Sound Transit On-Call A&E Services

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Task Order 84.00: Faregate Retrofit Pilot Design Study

Faregate Assessment Report

Final Report

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Contents

1 EXECUTIVE SUMMARY 1
2 INTRODUCTION 2
3 SOLUTION OVERVIEW 3
3.1 Recommended Faregate Solution 4
3.2 Potential Faregate Suppliers 4
4 CONCEPT OF OPERATIONS 6
4.1 Passenger-Facing Operations 6
4.2 Faregate Operations 7
4.3 Passenger Origin-Destination Use Case Scenarios 9
4.3.1 Origin: Station without Faregates Destination: Station without Faregates 9
4.3.2 Origin: Station without Faregates Destination: Station with Faregates 9
4.3.3 Origin: Station with Faregates Destination: Station with Faregates 13
4.3.4 Origin: Station with Faregates Destination: Station without Faregates 14
4.4 Special Event Crowd Management 14
4.5 Fare Compliance 15
4.6 Operations for Exiting Passengers with No Fare 15
4.7 Faregate Maintenance 17
4.8 Back-Office System Operations 18
4.9 Other Operations Services 18
5 BUSINESS RULES 18
6 TRANSIT GO TICKET MOBILE APPLICATION 20
7 FARE MEDIA REGISTRATION AND DISTRIBUTION 20
7.1 Youth Fares 20
7.1.1 Youth Accounts and ORCA Cards 21
7.1.2 Youth Accounts and Transit GO Ticket Mobile Application 22
7.2 Agency and Service Personnel 22
8 FAREGATE SPECIFICATIONS 22
8.1 Common Requirements 22
8.2 Standard Access Gate 24
8.3 Wide Access Gate 24
8.4 Conceptual Faregate Schematic 25
8.5 Faregate Operations During Communication Loss 25
8.5.1 Loss of Communications with Faregate BOS 26
8.5.2 Loss of Communications with ORCA BOS 26
8.5.3 Loss of All Communications 26
9 EMERGENCY EXIT DOOR 26
10 MAINTENANCE ACCESS GATE 27
11 TICKET VENDING MACHINE 27
11.1 Machine-Readable Tickets 27
11.2 Relocation and Installation 29
11.3 Alternative Low-Cost TVM 29
12 FARE INSPECTION TERMINAL SPECIFICATIONS 30

13 PASSENGER ASSISTANCE PHONE SPECIFICATIONS 30
14 PASSENGER SIGNAGE AND COMMUNICATIONS 30
15 FAREGATE BACK-OFFICE SYSTEM 31
16 FARE COLLECTION EQUIPMENT AND SYSTEM INTEGRATION 32
17 CONCEPTUAL SYSTEM ARCHITECTURE 33
18 STAFFING STRATEGY 34
18.1 Fare Engagement 34
18.2 Maintenance 34
18.2.1 Faregates 34
18.2.2 Ticket Vending Machines 35
18.3 Customer Service (Call Center) 35
19 CANDIDATE STATION SELECTION 36
20 BASIS OF DESIGN 36
20.1 Equipment Location Considerations 36
20.2 Equipment Quantity Methodology 37
20.3 NFPA 130, ADA, and Egress Requirements 37
20.4 Canopies and Rain Screens 38
20.5 Wayfinding Updates 38
20.6 Station Fencing 38
20.7 Power 39
20.7.1 Power Cabling 39
20.7.2 Power Demand 39
20.8 Network and Communications 39
20.8.1 Network Cabling 39
20.8.2 Network Demand 40
20.8.3 Fiber Cables and Converters 40
20.8.4 Cybersecurity and Data Security 40
20.9 Closed Circuit Cameras 40
20.10 Gate Installation 41
20.10.1 Introduction 41
20.10.2 Station Installation Sequence 41
20.10.3 Station Preparation Work 41
20.10.4 Passenger Messaging During Construction 42
20.10.5 Conduit and Cable Installation 42
20.10.6 High Barrier Gate Array Installation 43
20.10.7 Site Safety 44
20.10.8 First Day of Operations 44
20.10.9 Costing 45
21 STATION DESIGNS 45
21.1 Lynnwood City Center Station 45
21.1.1 Overview 45
21.1.2 Station Layout 45
21.1.3 Architectural Description 45
21.1.4 Faregate Quantity Estimate 47
21.1.5 Ticket Vending Machines 47
21.1.6 Passenger Assistance Phones 47

21.2 Northgate Station ... 47
21.2.1 Overview ... 47
21.2.2 Station Layout ... 48
21.2.3 Architectural Description ... 48
21.2.4 Faregate Quantity Estimate ... 50
21.2.5 Ticket Vending Machines ... 50
21.2.6 Passenger Assistance Phones ... 50
21.3 Roosevelt Station ... 50
21.3.1 Overview ... 50
21.3.2 Station Layout ... 50
21.3.3 Architectural Description ... 50
21.3.4 Faregate Quantity Estimate ... 51
21.3.5 Ticket Vending Machines ... 52
21.3.6 Passenger Assistance Phones ... 52
21.4 U District Station ... 52
21.4.1 Overview ... 52
21.4.2 Station Layout ... 52
21.4.3 Architectural Description ... 52
21.4.4 Faregate Quantity Estimate ... 55
21.4.5 Ticket Vending Machines ... 55
21.4.6 Passenger Assistance Phones ... 55
21.5 University of Washington Station ... 56
21.5.1 Overview ... 56
21.5.2 Station Layout ... 56
21.5.3 Architectural Description ... 56
21.5.4 Faregate Quantity Estimate ... 59
21.5.5 Ticket Vending Machines ... 59
21.5.6 Passenger Assistance Phones ... 59
21.6 Capitol Hill Station ... 59
21.6.1 Overview ... 59
21.6.2 Station Layout ... 59
21.6.3 Architectural Description ... 60
21.6.4 Faregate Quantity Estimate ... 61
21.6.5 Ticket Vending Machines ... 61
21.6.6 Passenger Assistance Phones ... 61
21.7 Westlake Station ... 61
21.7.1 Overview ... 61
21.7.2 Station Layout ... 62
21.7.3 Architectural Description ... 62
21.7.4 Faregate Quantity Estimate ... 65
21.7.5 Ticket Vending Machines ... 65
21.7.6 Passenger Assistance Phones ... 65
21.8 Symphony Station ... 66
21.8.1 Overview ... 66
21.8.2 Station Layout ... 66
21.8.3 Architectural Description ... 66
21.8.4 Faregate Quantity Estimate ... 67
21.8.5 Ticket Vending Machines ... 68
21.8.6 Passenger Assistance Phones ... 68

21.9 Pioneer Square Station ... 68
21.9.1 Overview ... 68
21.9.2 Station Layout ... 68
21.9.3 Architectural Description ... 68
21.9.4 Faregate Quantity Estimate ... 70
21.9.5 Ticket Vending Machines ... 70
21.9.6 Passenger Assistance Phones ... 70
21.10 International District / Chinatown Station ... 70
21.10.1 Overview ... 70
21.10.2 Station Layout ... 70
21.10.3 Architectural Description ... 70
21.10.4 Faregate Quantity Estimate ... 73
21.10.5 Ticket Vending Machines ... 73
21.10.6 Passenger Assistance Phones ... 73
21.11 SeaTac / Airport Station ... 73
21.11.1 Overview ... 73
21.11.2 Station Layout ... 73
21.11.3 Architectural Description ... 74
21.11.4 Faregate Quantity Estimate ... 76
21.11.5 Ticket Vending Machines ... 77
21.11.6 Passenger Assistance Phones ... 77
21.12 Federal Way Downtown Station ... 77
21.12.1 Overview ... 77
21.12.2 Station Layout ... 77
21.12.3 Architectural Description ... 77
21.12.4 Faregate Quantity Estimate ... 79
21.12.5 Ticket Vending Machines ... 80
21.12.6 Passenger Assistance Phones ... 80
21.13 Downtown Redmond Station ... 80
21.13.1 Overview ... 80
21.13.2 Station Layout ... 80
21.13.3 Architectural Description ... 80
21.13.4 Faregate Quantity Estimate ... 82
21.13.5 Ticket Vending Machines ... 82
21.13.6 Passenger Assistance Phones ... 82
21.14 Bellevue Downtown Station ... 83
21.14.1 Overview ... 83
21.14.2 Station Layout ... 83
21.14.3 Architectural Description ... 83
21.14.4 Faregate Quantity Estimate ... 84
21.14.5 Ticket Vending Machines ... 84
21.14.6 Passenger Assistance Phones ... 85
21.15 Station Design Summary ... 85
22 PILOT PROGRAM DISCONTINUATION ... 85
23 RETURN ON INVESTMENT ANALYSIS ... 86
23.1 Assumptions ... 86
23.1.1 General Assumptions ... 86
23.1.2 Scenarios and Station-Specific Assumptions ... 86

23.2 Demand Projections & Methodology 88
23.3 Incremental Revenue Projections 93
23.4 Cost Projections 95
23.5 Return on Investment Calculations 98
24 RECOMMENDED NEXT STEPS 102
24.1 Architectural Design 102
24.1.1 Life Safety and Code Compliance General Assumptions 102
24.1.2 Conceptual Design and Visualization 102
24.1.3 Development of 10% Plans 102
24.1.4 Future Stations 102
24.2 Staffing and Operations 103
24.3 Wayfinding Enhancements 103
24.4 Strategies for Expedited Deployment 103
24.4.1 Procurement Strategy 104
24.4.2 Organization 104
24.4.3 Project Schedule Controls 104
24.4.4 Risk Mitigation 104
24.4.5 Potential Critical Path Items 105
24.4.6 Faregate System Procurement 107
24.4.7 Post-Award Strategies 108
25 REPORT SUMMARY AND CONCLUSIONS 110
APPENDIX A. STATION DESIGN DRAWINGS 1
APPENDIX B. BASIS OF ESTIMATE REPORT 1

Acronyms and Abbreviations

Abbreviation	Definition
ADA	Americans with Disabilities Act
ASCE	American Society of Civil Engineers
BOS	Back-Office System
CCTV	Closed-Circuit Television
CSR	Customer Service Representative
EED	Emergency Exit Door
FIT	Fare Inspection Terminal
FMV	Fare Media Validator
MAG	Maintenance Access Gate
MVP	Minimum Viable Product
NFPA	National Fire Protection Association
ORCA	One Regional Card for All
PAP	Passenger Assistance Phone

PMO	Program Management Office
ROI	Return on Investment
SAG	Standard Access Gate
TVM	Ticket Vending Machine
WAG	Wide Access Gate
WV	Wayside Validator

Glossary of Terms

Term	Definition
Aisle	A single controlled passage lane within a faregate array through which passengers can traverse between the Paid and Unpaid Zones within a station.
Array	A group of faregates arranged together to form a controlled access point between paid and unpaid zones.
Back-Office System (BOS)	A centralized software platform that manages fare transactions, accounts, pricing rules, clearing and settlement, device management, reporting and configurations across the system. There will be separate BOS platforms for the INIT fare collection components and for the Faregate components.
Bankcard	A contactless credit or debit card (or mobile wallet) used for fare payment (i.e., open payments).
Fare Ambassador	Sound Transit staff deployed throughout the Link and Sounder transit systems to assist customers, educate on fare policy and verify fare compliance using a Fare Inspection Terminal.
Fare Inspection Terminal (FIT)	A handheld or portable device used by Fare Ambassadors to verify fares of passengers within the Fare-Paid Zone or on board Link and Sounder vehicles.
Fare Media (plural) / Fare Instrument (singular)	Any physical or digital instrument used by a passenger to pay or prove fare entitlement, including smartcards, bankcards, mobile wallets and tickets, QR codes and paper tickets.
Fare Media Validator (FMV)	A Validator module embedded within the faregate cabinet on both the paid and unpaid sides of the faregate array. The FMV logic determines whether to signal the Faregate to open based on the fare media presented.
Faregate	A physical access control device consisting of two cabinets and doors/barriers. The space between the cabinets varies depending on whether the unit is a Standard or Wide Access Gate and acts as the Aisle used by passengers to traverse between the Paid and Unpaid Zones.
Paid Side/Paid Zone	The area beyond the Faregate Array where passengers are assumed and required to have proof of payment. Fare Ambassadors are permitted to perform platform inspections within this area.
QR Code	A machine-readable code displayed on mobile devices or printed on paper that can be scanned to validate a passenger’s fare.
Smartcard	A contactless chip card that can be either a Bankcard (i.e., open-loop) or an ORCA Card, Sound Transit’s reloadable closed-loop fare media card, which can store transit passes as well as stored value.

Term	Definition
Ticket Vending Machine (TVM)	A physical device that acts as the primary sales channel of fare media. TVMs are present at all Link stations and will be installed within both the Paid and Unpaid Zones of gated stations.
Unpaid Side/Unpaid Zone	The area of a station that is outside of fare control where no fare is required (e.g., a station entrance).
Validator	A physical device or “reader” that implements Sound Transit’s fare policy and business rules to process contactless taps or scans, depending on the fare media presented, to allow passengers to pay their fare.
Wayfinding	Signage and visual cues that guide passengers through a station to the platform where boarding/alighting occurs. This includes directing passengers to use the fare collection equipment.
Wayside Validator (WV)	A standalone Validator currently in use at Sound Transit stations. In the future, WVs will be located at stations that lack Faregates.

1 EXECUTIVE SUMMARY

Sound Transit tasked WSP to assess the feasibility of installing faregates at several Link light rail stations. This report documents the comprehensive work WSP completed across a range of topics in three phases of work. The first phase focused on fact-finding included:

- Detailed Concept of Operations, covering numerous use cases and illustrating potential changes to operations that faregates may introduce
- Business rules and fare policies affected by faregate operations, and suggestions for new or modified policies to improve fare compliance and provide other benefits
- Implications on fare media technology and distribution, especially for youth fares and the region's mobile ticketing application
- Pro forma specifications for the faregates and other system elements, as well as descriptions of the modifications required to the existing Ticket Vending Machines required to support faregate operations
- Necessary systems integration with Sound Transit's existing fare collection solution and recommended strategies for working with the system's incumbent supplier
- A review of staffing levels for all affected organizations, including strategies to effectively expand and utilize staff.

With this first phase of the study establishing a foundational understanding of the project's potential scope and impacts on Sound Transit, the study moved into the design phase. This phase included:

- Selection of the candidate stations for design
- Development of the basis of design, which governs the design decisions for each of the candidate stations
- Detailed preliminary designs for each candidate station, depicting required infrastructure enhancements (such as fencing, canopies, rain screens, security gates, etc.), faregate and TVM quantities and locations, and other essential elements of the designs

The analysis then entered the third phase: the financial feasibility assessment. In this phase, WSP looked at a 10-year period (starting in 2030) to:

- Estimate the start-up and ongoing operating costs for affected operations identified in the first phase of the study, such as staffing and fare media
- Estimate the capital costs for infrastructure enhancements, power and data cabling, faregate, TVM, and other equipment, as well as other one-time costs such as systems integration with the incumbent fare collection system
- Predict the fare revenue increases that the faregate solution would generate, based on ridership projections, current fare compliance rates compared to projected compliance rates with faregates, and average fare collected per passenger
- Construct a sophisticated model to provide annual return on investment calculations for each of the 14 candidate stations and the project as a whole, for three distinct scenarios

The result of the study showed that in all three scenarios modeled, 13 of the 14 stations achieve satisfactory Returns on Investment. In one scenario, the project breaks even in less than two years, while the other two scenarios break even in less than three years.

With such compelling financial results, the report concludes with a series of recommendations to ensure project success, including means to mature the designs, how to sharpen the cost and revenue estimates, and the skills and roles needed to establish and properly staff the organization to manage such a complex project. In addition, the report provides numerous suggestions for next steps and how to expedite the procurement and deployment of the faregate solution.

Despite the highly positive results of the project's financial feasibility, the faregate project will also introduce numerous challenges. Among the more significant challenges, the report identifies:

- The need to equip all passengers and service personnel with machine-readable fare media. This means that all youth, currently eligible for free travel, must have a fare card or mobile ticketing app before the first faregate enters service. Likewise, maintenance staff, revenue service personnel (i.e., armored car personnel), law enforcement officers, and first responders should have the ability to enter and exit the stations with ease.
- Because only a subset of Link stations will have faregates, the system must enable passengers who arrive at gated stations from non-gated stations to exit the station, even if they started their trip with no valid fare. To address this need, the recommended design includes Ticket Vending Machines in the "fare-paid" zones.
- However, in some cases, passengers arriving at gated stations may not only have no valid fare, but no means to purchase a fare from a TVM in the "fare-paid" zone. These passengers will be "trapped" in the station and need some assistance to exit the station. The report recommends reassigning Fare Ambassadors from on-board fare engagement to station attendant duties, enabling them to assist "trapped" passengers. In situations where no Fare Ambassador is present, the report also recommends deploying Passenger Assistance Phones that will allow the passenger to request help from a Customer Service Representative (or equivalent), who will have the ability to remotely command a faregate to open.

Although these challenges may add to the cost or complexity of the faregate solution, the report provides suggestions to mitigate the issues.

Ultimately, WSP fully endorses the project, and encourages Sound Transit to move the project forward.

2 INTRODUCTION

Sound Transit has a long history of evaluating and evolving its fare compliance policies through equitable engagement. This Faregate Retrofit Pilot Design Study is the most recent step in this policy evolution that began with Sound Transit's 2009 implementation of an open, ungated system. In 2019, a Fare Compliance Program evaluation identified disproportionate impacts, leading to a 2021 Fare Engagement pilot program that included the introduction of Fare Ambassadors across the light rail system, shifting focus from enforcement to education, customer service and compliance. This program has continued to be built and evaluated since its inception.

In 2023, Sound Transit received positive results from its Faregate Retrofit Study, which showed significant return on investment for retrofitting top ridership light rail stations with faregates. Station design standards were subsequently updated for faregate retrofit compatibility.

In 2025, faregates were identified as a potential revenue generator as part of the Enterprise Initiative and strategic planning continued through a collaborative, interdepartmental effort. This update was presented to the Sound Transit Board of Directors in December 2025, and the Board responded with Motion No. M2025-64, directing the CEO on the findings of a Faregate Retrofit Implementation Study to inform future decisions regarding faregate deployment across the system in Q2 of 2026. This report contains the findings and recommendations from this Board-directed study, which was conducted by consultants from WSP in partnership with Sound Transit staff.

WSP evaluated existing stations on Lines 1 and 2 of the Sound Transit Link light rail transit system to determine which stations should receive faregates as part of a pilot to increase fare compliance and enhance station security. The process included:

1. Identifying and selecting candidate stations based on ridership, station design, special event considerations, and other factors.
2. Defining baseline functional and operational requirements to guide station designs.
3. Conducting thorough site surveys and developing preliminary designs for gating candidate stations.
4. Creating cost estimates to design, develop, test, deploy and operate faregates and related systems at the candidate stations.
5. Considering revenue and ridership history and projections, developing Return on Investment (ROI) models to measure the cost-effectiveness of the project as a whole and individually for each candidate station.
6. Producing a comprehensive report that makes detailed recommendations for the Faregate Retrofit Pilot Design Study (the project).

3 Solution Overview

The proposed solution consists of the following:

- At select stations, all Wayside Validators (WVs) will be removed and replaced with faregates, which will protect all platform entry points. The faregates will require presentation of valid fare media to enter the station and to exit the station. This “bi-directional” operation will ensure that passengers pay to depart at gated stations and will also ensure that passengers who arrive at gated stations on trips originating at ungated stations will also pay a fare.
- All faregates will be of the “High Barrier” swinging panel style, described in Section 3.1.
- The faregates will include Fare Media Validator (FMV) modules from Sound Transit’s incumbent fare system supplier, INIT. These modules, functionally identical to the modules in the existing stand-alone WVs, will accept ORCA cards, contactless bankcards, mobile wallets, and possibly paper tickets with printed QR codes.
- New or relocated Ticket Vending Machines (TVMs) in the fare-paid zone behind the faregate arrays will allow arriving passengers without a valid fare to purchase a ticket or add value to their ORCA account so they can exit the station. Passengers arriving without a valid fare but with a valid bankcard can use their bankcard at the faregate to exit the station.
- All existing TVMs will be modified to dispense machine-readable media for use on the faregate FMVs.
- A faregate Back-Office System (BOS) will monitor, manage, and configure the faregate system.
- The solution includes other new or modified devices, systems, services and fare policies as necessary and described in this report.

3.1 Recommended Faregate Solution

In seeking ways to improve revenue collection, Sound Transit commissioned Cambridge Systematics to explore the feasibility of employing faregates at some or all the agency's train stations. The resulting *Sound Transit Faregates Study*, submitted in December 2022, concluded that by deploying faregates at some or all its stations, Sound Transit could see a significant increase in fare revenues, with varying returns on investment depending on the quantity of stations equipped with faregates. The study identified several potential solutions for faregates, including turnstiles, rotary gates, bi-parting leaves and paddle gates.

The Americans with Disabilities Act (ADA) and the National Fire Protection Association (NFPA) standards exclude the use of any barrier mechanism, other than swinging doors or gates, for emergency egress. Because many of Sound Transit's busiest stations are underground or have other egress constraints, Sound Transit should only consider faregates with swinging doors for this project.

In the years since Cambridge Systematics submitted its report, fare collection equipment providers have introduced a new generation of faregates that have proven to be highly effective in increasing fare compliance. WSP recommends these "High Barrier Faregates" for use in Sound Transit's Link light rail system. As shown in Figure 3-1 through Figure 3-3, the gates have several important characteristics in common:

- Swinging door panels that are at least 5 feet high and extend to about 6-8 inches off the floor; these dimensions deter climbing over and under the barrier.
- Compact cabinet designs that are uniform for all gates, regardless of aisle width. Only the width of the panel changes to determine aisle width.
- Overhead channels for inter-cabinet power and data cabling, simplifying installation.
- High throughput of at least 30 passengers per minute.

3.2 Potential Faregate Suppliers

There are multiple fare gate suppliers. The High Barrier Faregates shown below are examples of these gates in revenue service:

- STraffic faregates (Figure 3-1) are in service at Bay Area Rapid Transit (BART) in San Francisco, Los Angeles County Metropolitan Transportation Authority (LACMTA) in Los Angeles, and Washington Metropolitan Area Transit Authority (WMATA) in Washington, DC. In addition, the Metropolitan Transportation Authority (MTA) in New York is evaluating the STraffic faregates as part of a demonstration program for the upcoming pilot test project.
- High Barrier Faregates are a recent addition to Cubic's product line (Figure 3-2) and are also part of the New York MTA demonstration program.
- Conduent faregates (Figure 3-3) are in service at Southeastern Pennsylvania Transportation Authority (SEPTA) in Philadelphia and NJ Transit in New Jersey. Conduent High Barrier Faregates are also deployed throughout the Paris Métro subway system and are part of the New York MTA demonstration program.

Figure 3-1 – STraffic High Barrier Faregates

Figure 3-2 – Cubic High Barrier Faregates

Figure 3-3 – Conduent High Barrier Faregates

4 CONCEPT OF OPERATIONS

4.1 Passenger-Facing Operations

To increase fare compliance, Sound Transit may install faregates at key stations on the Link light rail transit system. Because only a subset of stations will employ faregates, the faregates will be bi-directional to ensure that all passengers entering and exiting gated stations have paid a fare. Thus, the faregates will have FMV modules on both the entry and exit sides of the gates that require all entering and exiting passengers to present a valid fare to pass through the gate.

Accessible faregates will accommodate passengers in wheelchairs or who are reliant on other mobility assistance devices, pushing or pulling wheeled luggage, carrying a child or package, pushing a stroller or bicycle, and other common occurrences that require additional aisle width.

When a valid fare is presented to the faregate FMV, the faregate will open. The faregate will then track the person's progress through the aisle. The gates will remain open until the person, and their belongings, passes the "active zone," which is the space the swinging panels occupy as they move. While there is a "timeout" factor, which will close the gates in the rare instances where a person pays but never traverses the aisle, or when a person stands in the aisle for a protracted time, to accommodate slow-moving passengers, the gates remain open as long as necessary to allow safe passage through the aisle.

The faregates will increase fare compliance by identifying and making reasonable attempts to thwart fare evasion. The faregate barrier will be robust and designed to deter forced entry. Faregate operations, sensors and other features will deter common fare evasion methods, such as tailgating, where two or more people attempt to pass through the aisle by walking in close proximity after having paid only one fare.

Many passengers will arrive at gated stations on a trip that began at a station without faregates. Some of these passengers will have boarded the train without paying a fare, either intentionally or unintentionally. Passengers with a valid ORCA card, bankcard, or mobile wallet will be able to use that card or device to pay the fare to exit the station through the faregate. However, some arriving passengers will have no valid fare. To avoid “trapping” those passengers behind the faregate array, all gated station entry points will include at least one TVM on the fare-paid side of the faregate array. This will allow passengers without a valid fare to purchase a ticket or add value to their ORCA card account, allowing them to pay a fare to exit the station. See Section 4.6 for a discussion of possible operational scenarios to address “trapped” passengers and Section 14 for a description of signage to assist passengers in need of a valid fare.

At present, Sound Transit’s TVMs dispense paper tickets that are not machine-readable. To enable all passengers to enter and exit through the new faregates, all TVM-issued tickets must become machine-readable. If faregates are installed, Sound Transit’s existing fare system provider must upgrade all TVMs to dispense machine-readable tickets. See Section 11.1 for further discussion.

4.2 Faregate Operations

By default, faregates will operate in Full Bi-Directional mode, meaning the gate will be closed until it receives a signal from the FMV module to open from either direction. See Section 3.1 for a description of the recommended faregate design. The faregate will then verify that it is safe to open (i.e., there is no obstruction in the active zone, the space where the gate panels swing) and open the gate panels in the direction of the passenger’s motion. When the transiting passenger clears the active zone, the faregate will close the gate panels.

To inform passengers of the operational status of a faregate aisle, the overhead channel will include illuminated colored icons (e.g., ↓ for passage allowed and ✖ for passage not allowed). These icons will be on both sides of the channel, serving entry and exit directions, and will be visible from sufficient distance to guide passengers before they approach the aisle.

Faregates will connect to the Supervisory Control and Data Acquisition (SCADA) system or other device communications interfaces to receive notifications of station emergencies. Upon declaration of an emergency, the faregates will cease accepting fares and open in the exit direction. The faregates will remain in this state for the duration of the emergency. Upon cancellation of the emergency signal, the faregates will automatically resume normal operation.

In the event of power loss, the faregates will automatically open in the exit direction and remain open indefinitely until power is restored.

The faregate Back-Office System, or BOS (see Section 14), will monitor and provide remote control of faregate operations. Using the browser-based user interface to the BOS, authorized Sound Transit personnel will be able to configure each gate to alter its operation to any of the modes as shown in Table 4-1.

The BOS will support pre-programmed operational modes for each gate and array. The BOS can be configured to put pre-established operating modes in effect for specified periods for specified days. This will enable Sound Transit to optimize passenger flow during peak periods. For example, at outlying stations with heavy inbound travel, arrays could be configured so that all Standard Access Gates (SAGs) operate in Controlled Entry with No Exit mode, while the Wide Access Gates (WAGs) remain in Full Bi-Directional mode. In the afternoon, the configuration would be reversed, with all SAGs set to No Entry with Controlled Exit mode.

Table 4-1 – Faregate Operating Modes

Operating Mode	Entry Mode	Exit Mode	Overhead Gantry Symbol		FMV Passenger Display		Description
			Unpaid Side	Paid Side	Unpaid Side	Paid Side	
Full Bi-Directional	Controlled	Controlled	↓	↓	Tap Fare to Enter	Tap Fare to Exit	Controlled Entry (by presentation of a valid fare instrument) and Controlled Exit. This is the default operating condition.
Controlled Entry with No Exit	Controlled	Disabled	↓	✗	Tap Fare to Enter	No Exit	This mode may be used on some gates in an array to optimize passenger flow during peak travel periods.
No Entry with Controlled Exit	Disabled	Controlled	✗	↓	No Entry	Tap Fare to Exit	This mode may be used on some gates in an array to optimize passenger flow during peak travel periods. This mode may also be temporarily used on all gates in an array to limit access to platforms during special events.
Controlled Entry with Free Exit	Controlled	Free	↓	↓	Tap Fare to Enter	No Fare Required	As discussed in Section 4.6, this mode may be used during periods when no means are available for “trapped” passengers to receive assistance from on-site staff or CSRs. In “Free” mode, the faregate doors will open automatically in the direction of movement when the passenger enters the aisle. This would be the default operating mode if Sound Transit opts to not collect fares from passengers who board at non-gated stations.
Free Passage	Free	Free	↓	↓	No Fare Required	No Fare Required	In this mode, the faregate disables the FMV modules, and the gate panels remain open. Faregates will automatically enter this mode during emergencies and loss of power. Loss of power may extinguish gantry symbols and FMV Passenger Display.
No Passage	Disabled	Disabled	✗	✗	No Entry	No Exit	In this mode, the gate panels remain closed at all times. At locations where emergency egress is not an issue, Sound Transit may want to configure all gates in an array in this mode during overnight hours when trains are not running.
No Entry with Free Exit	Disabled	Free	✗	↓	No Entry	No Fare Required	As a safety measure, Sound Transit may want to configure all gates in an array (or only one WAG) to operate in this mode during overnight hours when trains are not running. This will enable any stragglers to exit the station but prevent re-entry.
Free Entry with Controlled Exit	Free	Controlled	↓	↓	No Fare Required	Tap Fare to Exit	No known use case for this configuration.
Free Entry with No Exit	Free	Disabled	↓	✗	No Fare Required	No Exit	No known use case for this configuration.

4.3 Passenger Origin-Destination Use Case Scenarios

The following diagrams illustrate several use cases demonstrating passenger interactions after Sound Transit deploys faregates. All sample use cases presented here assume a successful trip.

4.3.1 Origin: Station without Faregates Destination: Station without Faregates

Use Case #1

This use case is the same as current fare transactions. Passengers without fares use the TVMs to purchase fares or add value to their ORCA accounts. Those with valid media use the WVs prior to boarding. Upon alighting at their destination, no further action is required.

4.3.2 Origin: Station without Faregates Destination: Station with Faregates

Use Case #2: Passenger Purchases Ticket prior to Boarding

In this example, the passenger must purchase a ticket from the TVM prior to starting their trip.

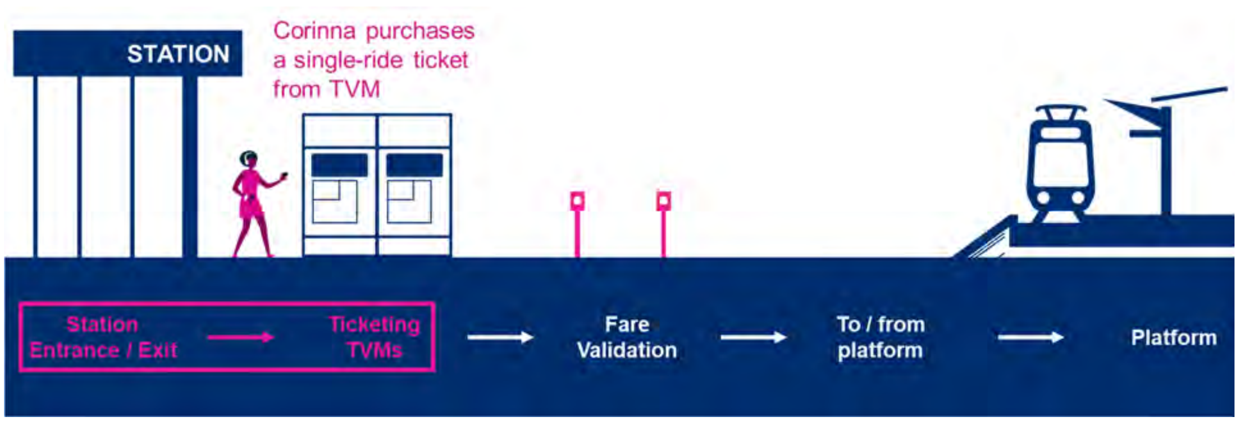

Figure 4-1 – Use Case #2: Passenger Purchases Ticket

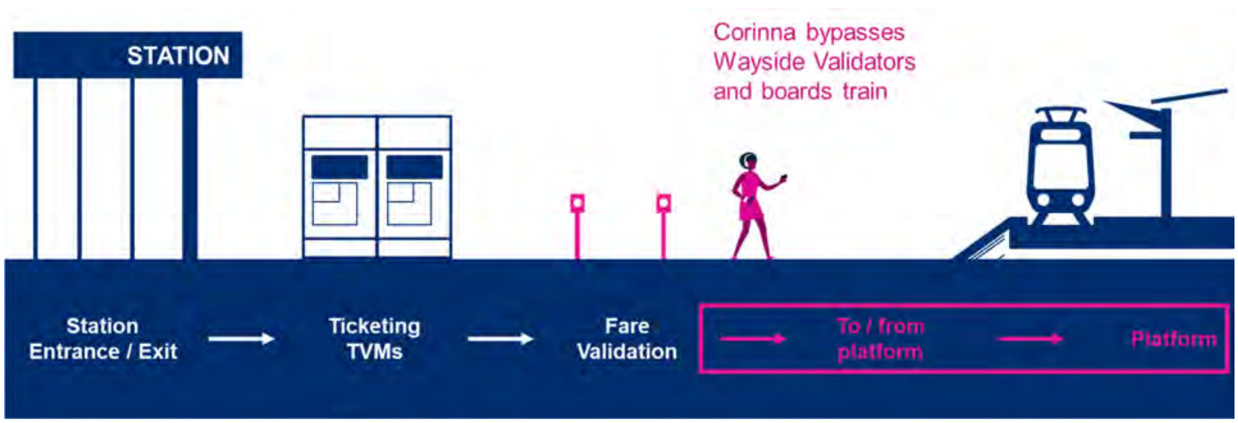

Figure 4-2 – Use Case #2: Passenger Boards Train

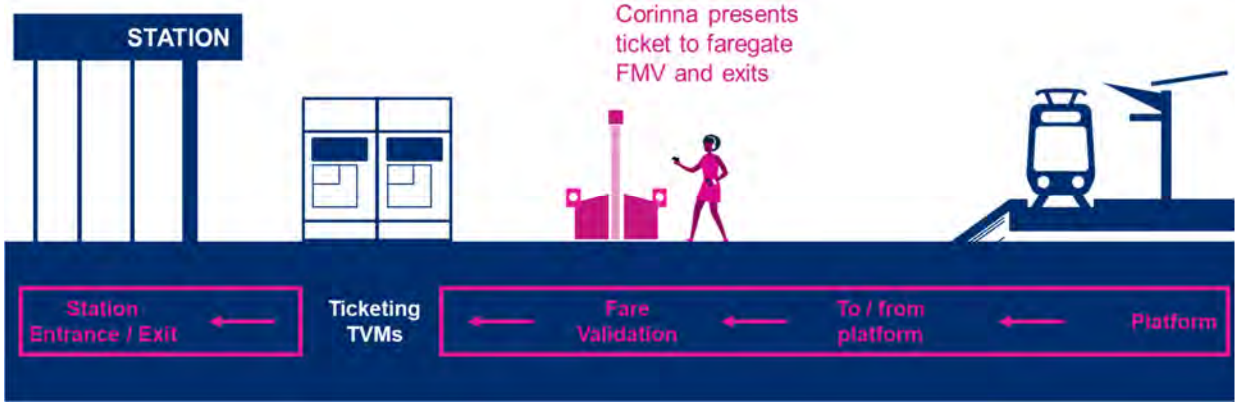

Figure 4-3 – Use Case #2: Passenger Arrives, Uses Ticket to Pass Through Faregate

Use Case #3: Passenger Boards without Valid Fare

In this example, the passenger has no valid fare and simply boards the train.

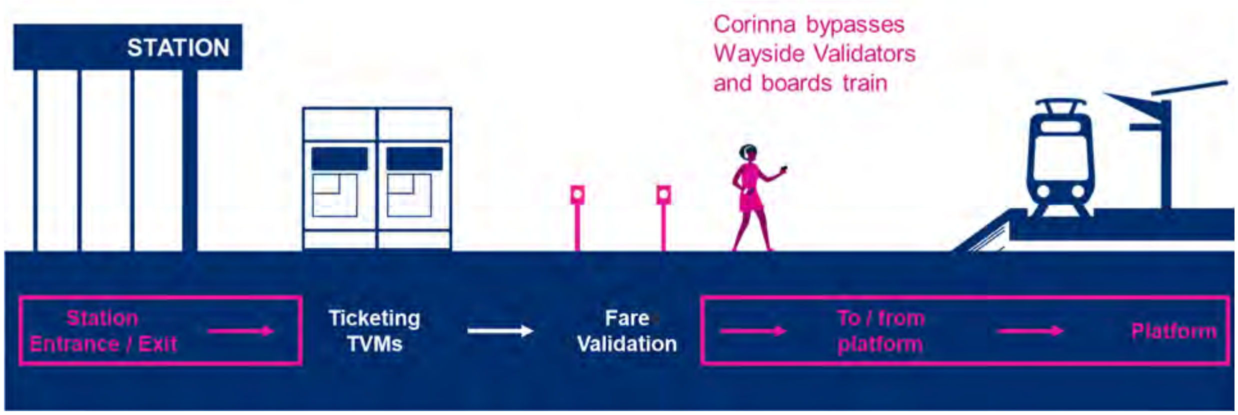

Figure 4-4 – Use Case #3: Passenger Boards Train without Valid Fare

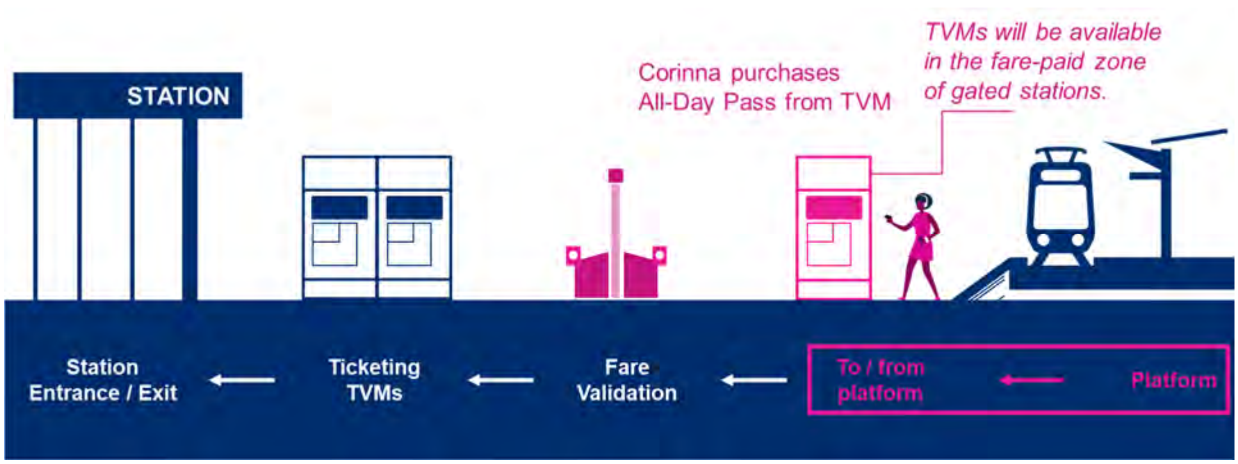

Figure 4-5 – Use Case #3: Passenger Arrives, Purchases Pass from Paid-Side TVM

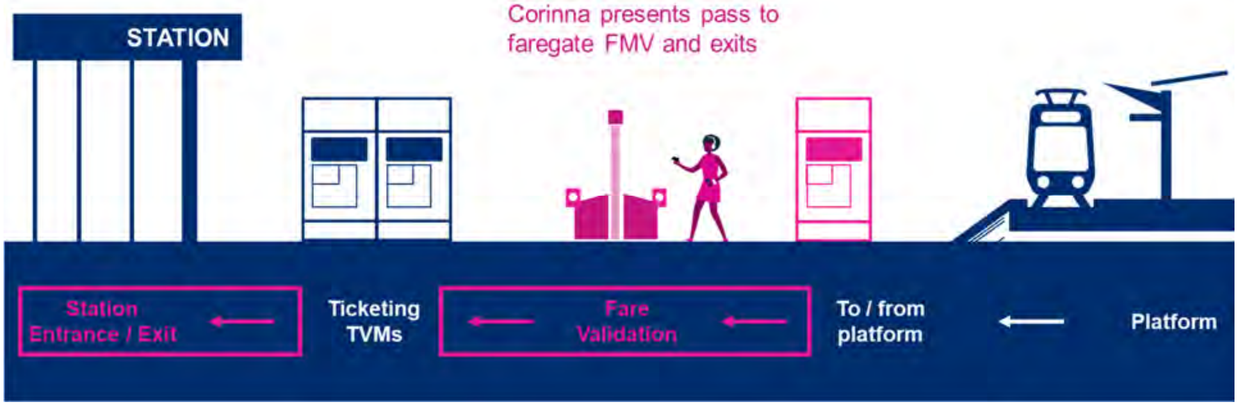

Figure 4-6 – Use Case #3: Passenger Uses Ticket to Pass Through Faregate

Use Case #4: Passenger with ORCA Card Bypasses Wayside Validators

In this example, the passenger has an ORCA card but simply boards the train.

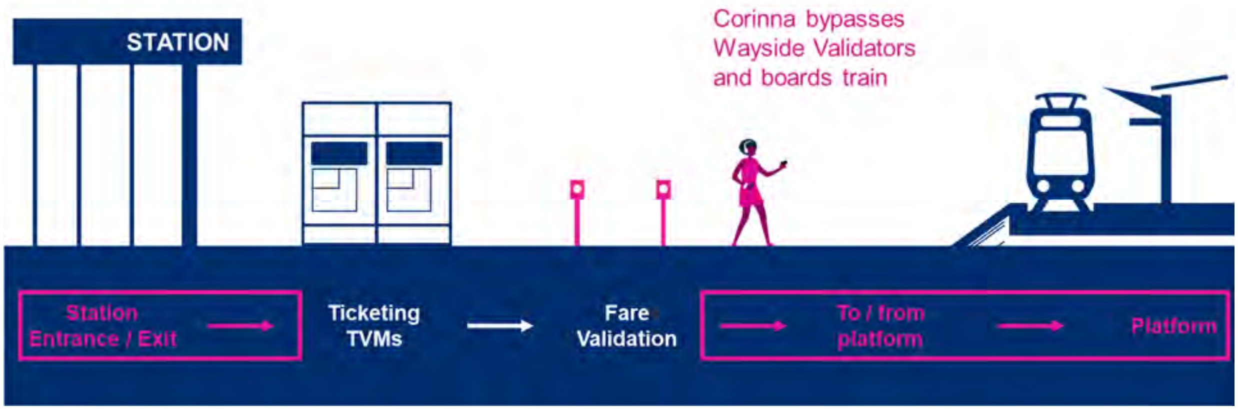

Figure 4-7 – Use Case #4: Passenger with Valid ORCA Card Boards Train without Using WV

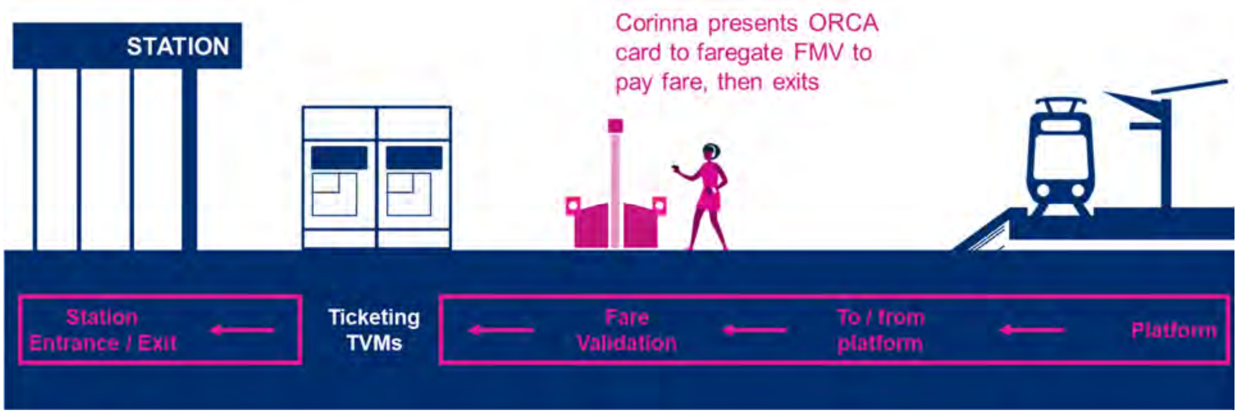

Figure 4-8 – Use Case #4: Passenger Arrives, Uses ORCA Card to Pay Fare

Use Case #5: Passenger Uses Contactless Bankcard at Wayside Validator

In this example, the passenger has a contactless bankcard and uses it to pay their fare prior to boarding the train.

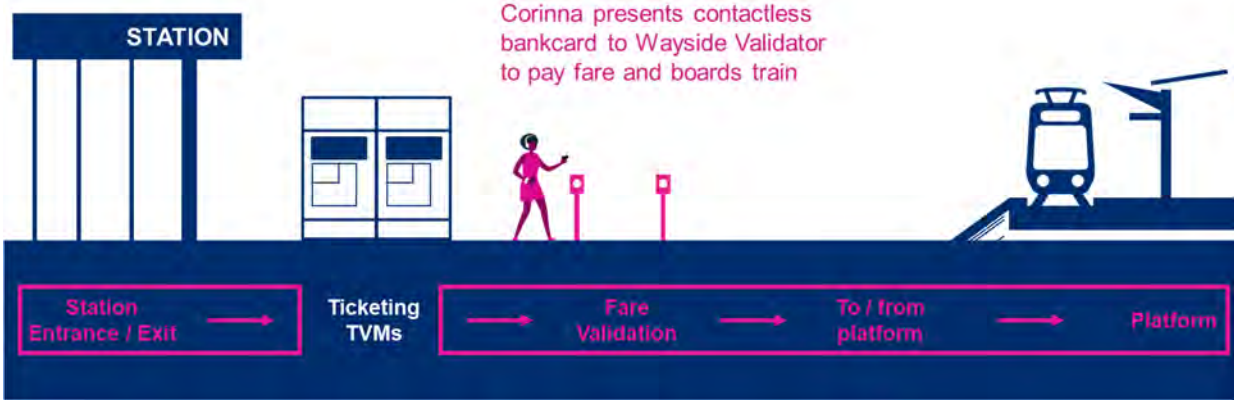

Figure 4-9 – Use Case #5: Passenger Uses Bankcard on Wayside Validator to Pay Fare

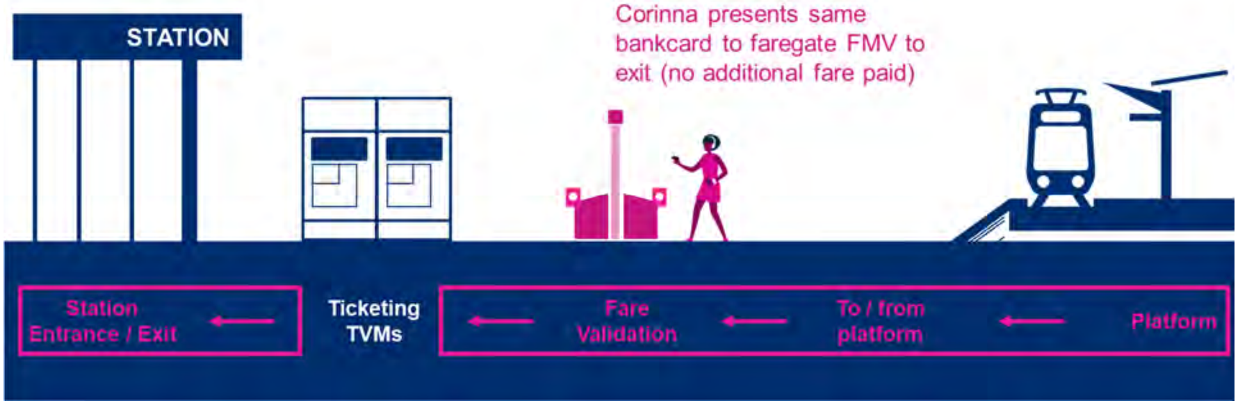

Figure 4-10 – Use Case #5: Passenger Arrives, Uses Bankcard to Pass Through Faregate

4.3.3 Origin: Station with Faregates Destination: Station with Faregates

Use Case #6: Passenger with Low-Balance ORCA Card

In this example, the passenger has an ORCA card, but the account has insufficient balance to pay a fare.

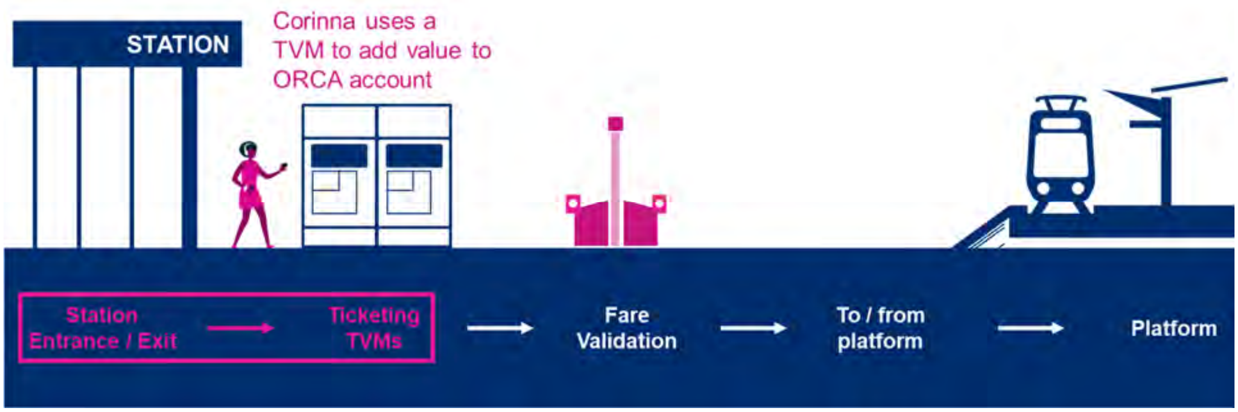

Figure 4-11 – Use Case #6: Passenger Uses TVM to Add Value to ORCA Account

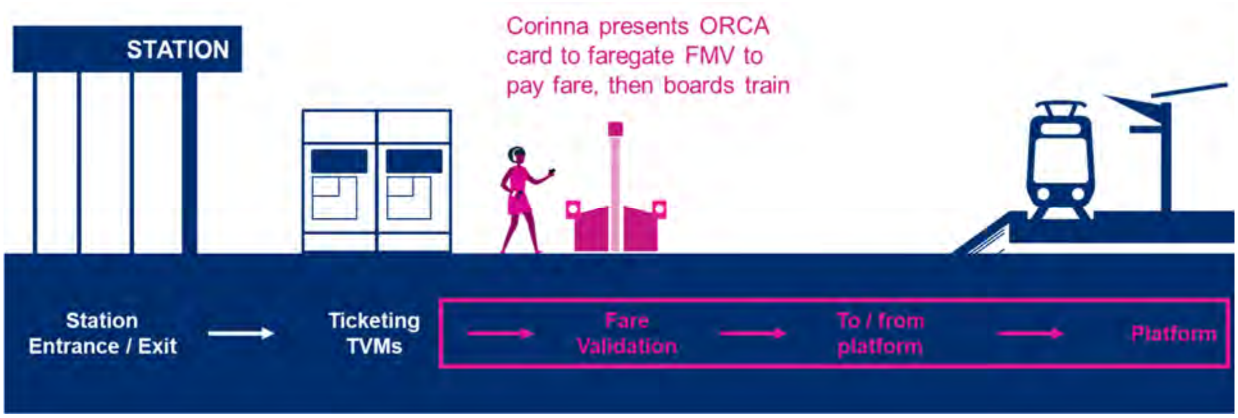

Figure 4-12 – Use Case #6: Passenger Uses ORCA Card at Faregate to Pay Fare

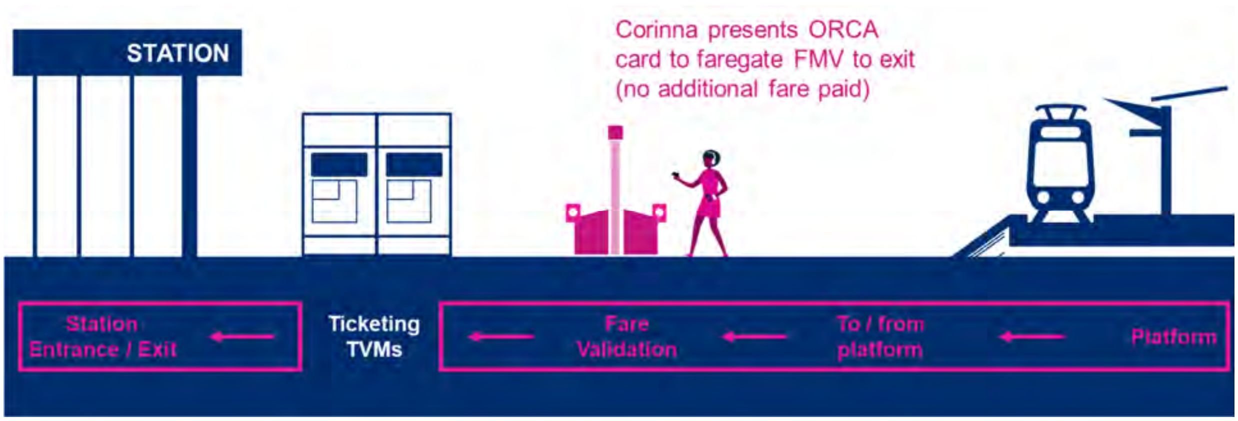

Figure 4-13 – Use Case #6: Passenger Arrives, Uses ORCA Card to Pass Through Faregate

4.3.4 Origin: Station with Faregates Destination: Station without Faregates

Use Case #7: Passenger with Any Valid Fare

In this example, the passenger has a valid fare instrument (e.g., ORCA card, contactless bankcard, mobile wallet, Transit GO Ticket mobile app, or TVM ticket) and uses it to pay at the faregate.

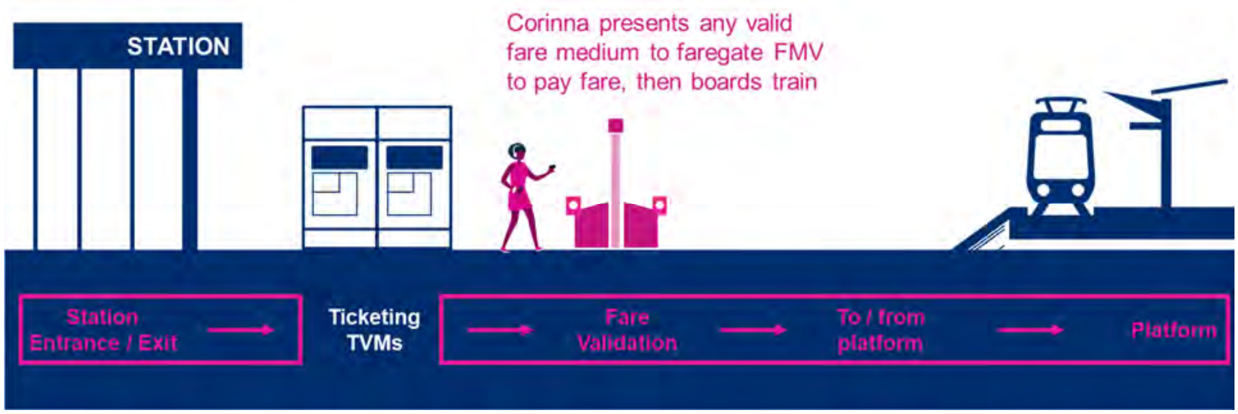

Figure 4-14 – Use Case #7: Passenger Pays Fare at Faregate

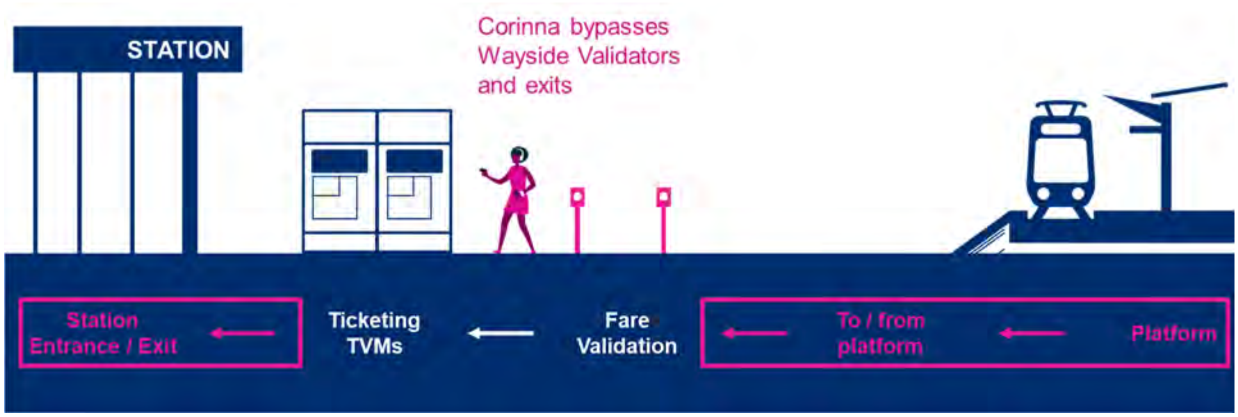

Figure 4-15 – Use Case #7: Passenger Arrives and Exits Station

4.4 Special Event Crowd Management

For special events, Sound Transit will be able to dispatch staff, equipped with tablets or smartphones, to use the BOS browser interface to control faregate operations at the station. At least two of the High Barrier gate suppliers discussed in Section 3.2 have demonstrated this feature using mobile devices, and Paris Métro has used the functionality for several years. Using the mobile device, on-site staff can prevent overcrowding on the platforms by temporarily placing all the station's faregates in No Entry with Controlled Exit mode. When overcrowding is no longer a concern, on-site staff will then use the mobile device to restore the station's faregate operations to Full Bi-Directional mode (i.e., Controlled Entry and Controlled Exit).

4.5 Fare Compliance

In recent years, Sound Transit has adopted fare policies that seek to encourage fare compliance through engagement rather than strict enforcement. Despite these efforts, Sound Transit's data shows fare compliance hovering around 61%, defined as the percentage of passengers who present a valid fare instrument upon request of a Fare Ambassador, excluding passengers eligible for free fares.

Unlike Fare Ambassadors, faregates are impersonal machines that can only function as programmed. Consequently, except in cases where a passenger actively circumvents the faregate, passage through a faregate will require a valid fare instrument, including passengers who are eligible for free fares. See Section 7.1 for the discussion of Youth Fares.

However, some Sound Transit fares are restricted to eligible passengers, such as reduced and free fares. Misuse of such concessions constitutes another form of non-compliance. Today, Fare Ambassadors can identify such misuse of non-full fare products and respond according to Sound Transit policies. For consistency with Fare Ambassador operations, the faregate system will also include features to support fare compliance at gated stations. Sound Transit will have the ability to configure the system to activate or deactivate these features at any time.

These configurable features will include:

- Sounding an alarm and illuminating an icon in the overhead channel upon detecting fare non-compliance. Detectable non-compliant activities include forced opening of the gate panels and tailgating, where a second passenger attempts to pass through the gate while closely following a paid passenger.
- Creating an event record upon detecting fare non-compliance and other anomalous behaviors and transmitting that information to the BOS. Reports from the Faregate BOS will identify patterns of fare non-compliance activity, enabling Sound Transit to target locations and times for concentrated fare engagement efforts or identify station design and operational challenges that may lead to non-compliance.
- Providing visual indication on the overhead channel each time a passenger uses a reduced or free fare to pass through the faregate. This will allow Fare Ambassadors to request verification that the passenger is eligible for the reduced or free fare.

4.6 Operations for Exiting Passengers with No Fare

If an exiting passenger has no valid fare and no means to purchase a fare, the faregates will prevent their exit, effectively "trapping" the passenger in the station's Fare-Paid Zone. Sound Transit must develop policies and methods to address this before deploying the faregates.

Passengers without a compatible fare payment method that need to exit a station through a faregate will require assistance. Because on-site personnel may not be present or visible, fare-paid sides of every faregate array should include a Passenger Assistance Phone (PAP) that connects automatically with a Sound Transit Customer Service Representative (CSR) or equivalent.[1] See Section 13 for PAP specifications.

Scenarios for serving exiting passengers without a compatible fare payment method include:

1. **Scenario 1.** Signage on the fare-paid side of the arrays will instruct passengers needing assistance to seek an on-site station attendant, a Fare Ambassador, Transit Security Officer, or other role, or use the PAP. Station attendants and CSRs will be on duty all hours that trains operate.

[1] Sound Transit is considering deploying additional PAPs in the unpaid zone to improve customer communications. Unpaid-zone PAPs are not required to support faregate operations, so the cost of any such PAPs is not included in this study.

If the passenger finds the station attendant, the station attendant will use an agency-issued ORCA card to open the faregate. If the passenger cannot find the station attendant and uses the PAP, the CSR will contact the station attendant and direct the attendant to the passenger.

2. **Scenario 2.** Signage on the paid side of the arrays will instruct passengers needing assistance to seek the on-site station attendant or use the PAP. Station attendants are on duty only for part of the service day, but CSRs are on duty all hours that trains operate. CSRs will have an application on their workstation that allows them to command an accessible Wide Access Gate (WAG) in each array to open in the exit direction for one passenger at a time. In addition, the CSRs will have access to closed-circuit television (CCTV) feeds showing the WAG at every array.

   If the passenger finds the station attendant, the station attendant will use an agency-issued ORCA card to open the faregate. If the passenger cannot find the station attendant and uses the PAP, and if the station attendant is on duty, the CSR will contact the station attendant and direct the attendant to the passenger. If the station attendant is not on duty, the CSR will direct the passenger to the array's WAG. Based on the passenger's self-description, when the CSR (observing the CCTV feed) sees the passenger approaching the WAG, the CSR will command the WAG to open in the exit direction.

3. **Scenario 3.** Signage on the paid side of the arrays will instruct passengers needing assistance to seek the on-site station attendant or use the PAP. Station attendants are on duty only for part of the service day, and CSRs will not be on duty during early morning and late evening hours (e.g., CSRs start at 6 a.m. and are not on duty after midnight). CSRs will have an application on their workstation that allows them to command the WAG in each array to open in the exit direction for one passenger at a time. In addition, the CSRs will have access to CCTV feeds showing the WAG at every array.

   During hours when CSRs are on duty, operations will be identical to Scenario 2. During operating hours when both station attendants and CSRs are not on duty, the BOS will automatically configure the WAG to operate in the Controlled Entry with Free Exit mode, and PAPs will be configured to play a recorded message that instructs passengers to use the WAG to exit.

   During hours when the CSRs are not on duty, Sound Transit may wish to transfer PAP calls to another service provider to offer assistance; these third-party CSRs would inform passengers that they may exit through the WAG.

4. **Scenario 4.** Signage on the paid side of the arrays will instruct passengers needing assistance to seek the on-site station attendant or use the PAP. Station attendants and CSRs will not be on duty all hours that trains operate, but CSRs will be on duty whenever station attendants are on duty. CSR coverage may also be greater than station attendants. CSRs will not have the ability to remotely command WAGs to open. During operating hours when station attendants are not on duty, the BOS will configure one WAG per array to operate in the Controlled Entry with Free Exit mode.

   During hours when both station attendants and CSRs are on duty, operations will be the same as Scenario 1. During hours when station attendants are not on duty, passengers may: freely exit through the WAG; if the passenger uses the PAP and CSRs are on duty, the CSR will instruct the passenger to exit through the WAG; or if the passenger uses the PAP and CSRs are not on duty, PAPs will be configured to play a recorded message that instructs passengers to use the WAG to exit.

Fare compliance policies and procedures should be consistent, regardless of whether fare non-compliance occurs on board a train or at a faregate. Today, when a Fare Ambassador discovers a fare non-compliant passenger on the train, the Fare Ambassador requests the person's identification and determines if that person is a repeat offender. First-time or infrequent offenders receive a warning, whereas repeat offenders can be removed from the train, trespassed, or possibly issued a formal citation. To perform these functions, Fare Ambassadors have portable Fare Inspection Terminals (FITs), which are ruggedized smartphones with a separate printer module.

To be consistent with existing fare engagement policies and procedures on light rail vehicles, Sound Transit should equip station attendants with the same or equivalent FITs currently used by Fare Ambassadors. Before allowing a “trapped” passenger to exit the station without paying a fare, the station attendant can request the passenger’s identification and determine whether the person is a repeat offender.

If the person is not a repeat offender, the station attendant will use the FIT to record the person’s identity in addition to the date, time and station where the person was allowed to exit without paying a fare.

The challenge Sound Transit faces is how to treat “trapped” passengers whom the station attendant determines to be a repeat offender, especially those who have no means to purchase a ticket at a TVM. Unlike on-board procedures, the only way to remove the offender from the property is through a faregate. Simply allowing repeat offenders to exit the station with impunity will only encourage further fare non-compliance. But if station attendants are not authorized to detain repeat offenders and issue citations, Sound Transit may have no choice but to allow repeat offenders to leave the station without penalty.

Nonetheless, identifying non-compliant passengers in person will likely provide a degree of deterrence. Scenarios described above that involve remote assistance of a CSR will likely produce few if any identities of non-compliant passengers, which could significantly diminish the effectiveness of the faregate solution during hours when no station attendants are on duty.

An important part of whichever solution Sound Transit selects for addressing the needs of “trapped” passengers will be thoroughly training Fare Ambassadors and CSRs in the policies and procedures that Sound Transit develops. The faregates are impersonal machines that will at times cause some passenger distress, perhaps especially to passengers with special needs. By providing the vital human touch that Sound Transit has previously cultivated, properly trained Fare Ambassadors and CSRs will mitigate those passenger concerns.

4.7 Faregate Maintenance

Sound Transit has no history of faregate maintenance. The existing collective bargaining agreement allows Sound Transit to consider two alternatives for faregate maintenance:

1. Outsource maintenance functions to the faregate supplier as part of an ongoing Operations & Maintenance (O&M) services contract.
2. Receive maintenance training from faregate supplier and expand Sound Transit maintenance staff to assume those duties.

If Sound Transit performs faregate maintenance, Sound Transit staff will monitor faregate operational status and dispatch technicians as needed to perform the following:

- Level 1 field maintenance, which includes preventive maintenance and corrective maintenance requiring no module replacement (e.g., reconnecting a loose cable or lubricating a bearing).
- Level 2 field maintenance, which includes replacing defective modules or components damaged by vandalism or normal wear.

Sound Transit staff will also perform limited Level 3 bench repairs, including replacing some subcomponents of defective modules (e.g., a defective circuit board, sensor or motor) and some rudimentary module overhauls. The Contractor will perform more comprehensive Level 3 repairs at its repair facility.

Because field technicians will carry spare modules and components, many of which will be too large to take on trains, each field technician will require a dedicated vehicle. With overlapping shifts, this may result in one vehicle per technician.

To ensure maintenance staff always has consistent system access and avoid interfering with passenger flow, maintenance staff ORCA cards will allow free passage through all faregates, including when the passage direction is disabled (i.e., the FMV Passenger Display shows “No Entry” or “No Exit”).

4.8 Back-Office System Operations

The faregates will require a centralized BOS to manage, monitor, configure and operate the faregates (See Section 14). All faregates will interface with the BOS, via APIs or other integration mechanisms, to exchange data such as event/alarm records, device status and health diagnostic manifests, gate configuration/operating mode, BOS-issued remote commands and passenger throughput data. The faregate supplier will be responsible for providing and hosting the BOS as part of an ongoing O&M services contract.

This BOS will be cloud-based platform with a modern browser-based user interface (UI) to enable Sound Transit staff to manage the faregate system remotely without the need for on-premises software installations. The UI will include real-time operational dashboards, device management views, reporting and analytics tools and configuration interfaces. The BOS will support multiple concurrent users and provide role-based access to tailor available functionality based on user responsibilities due to the presence of potentially sensitive data. All system updates, functions performed and messages exchanged between a faregate and the BOS will be auditable to track user actions.

4.9 Other Operations Services

The faregate supplier's Operations & Maintenance services contract should also cover:

- Software Support: the supplier should provide ongoing software support services to ensure the continuous, secure and up-to-date operation of all faregate and BOS software components.
- Technical Support: the supplier should provide technical support services to assist the agency in maintaining system availability and resolving operational issues.

5 Business Rules

Deploying faregates at key stations will require Sound Transit to review existing business rules and consider the following modifications or additions:

- All existing fare policies will remain in effect, but Sound Transit may wish to consider some new policies outlined below.
- All fare media (e.g., ORCA cards, TVM-dispensed tickets, open payment bankcards and mobile wallets, other pre-printed media, mobile ticketing apps) must be machine-readable.
- All passengers entering or exiting gated stations must have a valid fare instrument; that is, one card per passenger. In practice, this means that all passengers, including those who currently ride free, must possess their own fare instrument.[2]
  - Sound Transit should work with local schools and other institutions that serve Link riders who are 18 years old and under to develop procedures to dispense ORCA cards registered to passengers eligible for free fare. The account profile linked to the card must designate the user's eligibility for the Youth fare.
  - Accounts tied to ORCA cardholders eligible for free fare should continue to include the parameter in the user's profile that defines the date at which the user is no longer eligible for free fare (i.e., not later than the cardholder's 19th birthday). At that date, the cardholder's

[2] Note: The only known alternative to requiring all passengers to possess a fare instrument is to have a booth attendant on duty – for every faregate array and for all operating hours – to manually open a faregate to allow free-ride passengers to pass. All stations will have multiple arrays (as many as 6); coupled with the 20+ hours of daily service, the labor costs for booth attendants would be excessive. This alternative is not cost-effective and is thus not considered here.

account should automatically convert to adult fare, unless the cardholder is pre-authorized for a reduced fare upon turning 19.

— Sound Transit may want to implement a new business rule to accommodate visitors and residents who are under 19 and who do not attend local schools (e.g., homeschooled children or children under age 5). While TVMs could theoretically dispense tickets for free riders, enabling anyone under 19 to pass free through the faregates, such a policy would likely be severely abused. One possible policy would be to require a reduced fare for all riders under 19, unless they possess a Youth card, which would provide free travel. Because Sound Transit provides convenient ways to distribute the Youth cards to individuals not affiliated with local schools and institutions (see Section 7.1.1), such a policy would mostly affect visitors.

- Personal Care Attendants (PCAs) are also eligible for free fares while assisting a disabled passenger. Like those under 19, PCAs wishing to travel for free will require a properly registered ORCA card to pass through the faregates. To ensure that PCAs receive a free fare only while assisting a disabled passenger, the Back-Office System should verify that the transaction immediately preceding the PCA's card is properly registered to a disabled passenger. If the preceding transaction is not a disabled passenger, the PCA's account should be charged the PCA's default fare (i.e., adult or reduced fare).

- Policies that enable Sound Transit Fare Ambassadors to request proof of fare compliance while a passenger is in the fare-paid zone of the station (i.e., platform inspections) will remain in effect. In lieu of the existing floor tiles that designate the fare-paid zone, the faregate array will be the line of demarcation between the unpaid and fare-paid areas of the station.

- Although a passenger who exits a station through faregates is no longer in the station's fare-paid zone, if necessary, Sound Transit should adopt a policy (or amend an existing policy) that allows fare inspections on the unpaid side of the faregate arrays. If Sound Transit configures the faregates to indicate whenever a passenger exits using a reduced or free fare, Fare Ambassadors should have authority to verify that the passenger is eligible for the fare. Likewise, if the faregate detects and indicates an exiting passenger failed to pay a fare, Fare Ambassadors on the unpaid side of the array should be authorized to approach the passenger.

- Presently, Sound Transit charges $3.00 for a new ORCA card. This can be considered a "security deposit" that could support a policy that allows an account to go negative, perhaps by as much as $2.00. For example, if a passenger with a negative $2.00 balance throws the card away, Sound Transit would still net $1.00 in the process, an amount likely equal to the cost of procuring the card. In this example, Sound Transit could allow a passenger with as little as $1.00 in their account to start a trip, but faregates and fareboxes would reject an ORCA card with an account balance less than $1.00. Such a policy would greatly reduce transaction volume at the paid-side TVMs. Essentially, (in this example) this policy would mean that the only ORCA customers needing to use the paid-side TVMs would be those who started their trip at a non-gated station with less than $1.00 on their ORCA card account. Passengers starting their trip at a gated station with $1.00 or less on their ORCA would be denied entry, forcing them to replenish their account at the unpaid-side TVM before starting their trip.

- On trips where a passenger departs and arrives at stations with faregates, the passenger must use the same fare instrument at both stations. Otherwise, the fare system may charge the passenger twice for the trip, since both faregates will consider the transaction to constitute payment. For example, when a passenger uses a bankcard upon entering their departure station, the fare system will collect a fare from the user's bankcard account. If that passenger then uses a different bankcard or an ORCA card to exit the faregate at the arrival station, the fare system will conclude that the passenger departed from an ungated station without paying a fare and deduct a fare from the account associated with the second card. To reduce the frequency of these occurrences, Sound Transit should provide passenger education materials and install prominent signage on the paid side of the faregate arrays.

- To prevent multiple passengers using a single fare instrument, the faregates will be programmed to prohibit “passback,” where a single fare instrument is tapped more than once at a faregate or at multiple faregates in a single array.
- To encourage passengers to pay their fare before boarding the train at ungated stations, Sound Transit should consider a new policy that adds a small surcharge to tickets purchased from TVMs on the paid side of the faregate array. For example, a 50-cent surcharge for adult fares and a 25-cent surcharge for reduced fares. Because validators on the paid side of the faregates will also recognize when a passenger uses an ORCA or bankcard that had not been previously used at the departure station, the same small surcharge should apply to those transactions, too. This will apply the surcharge equitably to all passengers who boarded a train without paying.
- To minimize the impact on low-income passengers that the introduction of faregates may produce, Sound Transit should consider implementing a program where staff at Link stations can assist eligible passengers in applying for the ORCA LIFT card. Such a program would be most beneficial during the several months leading up to and after faregate deployment.

6 TRANSIT GO TICKET MOBILE APPLICATION

King County offers the Transit GO Ticket mobile application, which supports a wide variety of ticket types for the region’s transit services, including King County METRO, King County Water Taxi, Kitsap Transit, Seattle Streetcar, and Sound Transit.

The app does not appear to offer machine-readable capabilities, relying instead on displaying the ticket on the device screen for visual inspection. As discussed in Section 5, all fare media must be machine readable, so users of the Transit GO Ticket app must be able to use it to pass through the faregates. Sound Transit should thus explore ways to enhance the Transit GO Ticket app to be compatible with the faregates, which could include displaying a QR code and using the device’s Near Field Communications (NFC) interface for contactless validation.

Figure 6-1 – King County Mobile Ticketing Application Logo

7 FARE MEDIA REGISTRATION AND DISTRIBUTION

7.1 Youth Fares

Well in advance of the start of faregate revenue service, such as the start of the Pilot Test suggested in Section 24.4.7, Sound Transit should begin to implement procedures to establish and register accounts for all passengers eligible for youth fare. The user profiles associated with those accounts will establish free ride privileges to holders of the fare instrument registered to the account. The youth accounts should be usable on both ORCA cards and a mobile ticketing application. Each will require specific procedures.

7.1.1 Youth Accounts and ORCA Cards

Utilize MyORCA.com

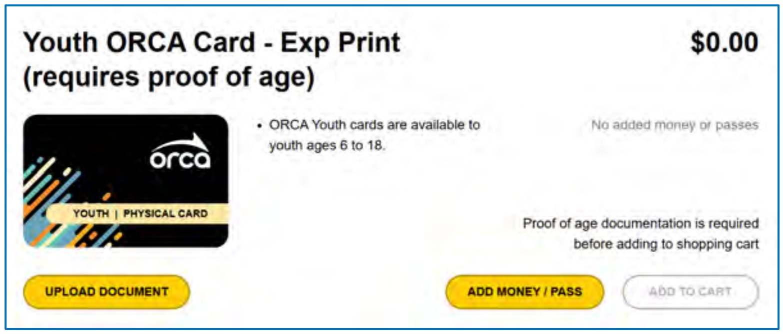

Figure 7-1 – Youth ORCA Card Application on MyORCA.com

The MyORCA.com website has an existing process for eligible youth to apply for an ORCA card that provides free ride privileges. The web portal requires the applicant to upload proof of age to enforce the age limitation codified in the business rules. See Figure 7-1.

While the MyORCA.com website has the procedures to create and register new accounts and to deliver cards, the number of Youth ORCA cards in circulation is very small. The introduction of faregates will cause a significant increase in demand for Youth ORCA cards, which could overwhelm the website's capacity, especially if eligible passengers wait until the last minute to apply. For this reason, it may be prudent to seek partnerships with local schools to assist in the registration and distribution process.

Partner with Local Schools

Because of the anticipated large number of Youth cards to distribute and register, Sound Transit should partner with schools and other organizations that interface with the region's youth in the administration of this program. While administration of this program may require partner schools to absorb some cost, Sound Transit's services are a cost-effective solution for school transportation, especially when compared to the operating costs school districts would bear if they had to provide bus service themselves.

Conceptually, this process could work as follows:

1. As a prerequisite to distributing fare media, Sound Transit will receive Youth card media from a supplier. The supplier will provide an electronic file containing the Unique ID, serial number, and all other pertinent information of the cards. Sound Transit will import this information into the fare media inventory database of the fare collection BOS provided by INIT.
2. The institution will log into their account on the institutional web portal and upload a text or Excel file (i.e., .CSV or .XLSX) containing a list of names and birthdates of their clients eligible for youth fare.
3. Sound Transit will import this list into the institution's database table and create an ORCA user account for every entry on the list. The user profiles for the new ORCA accounts will include the user's name and birthdate and set the account type to reflect eligibility for the youth fare.
4. Sound Transit will deliver the necessary quantity of ORCA cards to the institution.

5. To register and distribute a card, the institution's agent will:
   a. Using a smart phone or tablet equipped with an NFC interface, log onto the institution's account on the web portal and initiate the media distribution tool.
   b. Select the card recipient's name from the institution's list of clients and initiate the registration process.
   c. Retrieve a new ORCA card (or Youth card) from the inventory supplied by Sound Transit.
   d. Present the new card to the mobile device's NFC antenna. The device will read the card's Unique ID number and populate the web portal data field for the user's assigned card.
   e. Confirm the transaction is complete. The fare collection BOS will register the card by linking the card's Unique ID and associated serial number to the client's account profile.
   f. Deliver the card to the client.

7.1.2 Youth Accounts and Transit GO Ticket Mobile Application

While the app supports ticketing for Sound Transit's reduced fare programs, it may not support the free Youth fares. Because of the likely effectiveness of distributing Youth fare using a mobile app, if the app does not support free fares, Sound Transit should request modifications to the app to include the free fare option for those accounts that have been properly registered as eligible.

An additional benefit to using a mobile app for Youth fares is that compared to an ORCA card, students will be far less likely to loan out their smartphone to a friend or relative to enable them to get free rides for which they are not eligible.

7.2 Agency and Service Personnel

Prior to deploying the faregates, Sound Transit should establish procedures to distribute, register, and maintain ORCA cards and their associated accounts to provide station access for:

- Fare Ambassadors
- Sound Transit maintenance staff
- Sound Transit Security Officers and Transit Police
- Contracted security and facilities maintenance services personnel
- Municipal and County law enforcement officers
- Fire and Emergency Medical Services personnel
- Armored car service personnel to service TVMs
- Others as needed

8 FAREGATE SPECIFICATIONS

8.1 Common Requirements

All configurations of the faregates will satisfy the following requirements:

- Faregates will provide dual swinging panels for each aisle.
- The top of the swinging panels will be a minimum of 60 inches above the floor.
- The bottom of the swinging panels will be no more than 10 inches above the floor, per ADA Accessibility Guidelines Paragraph 404.2.10, Door and Gate Surfaces.

- Swinging panels will be constructed of tempered glass, or other suitably rugged clear material, and capable of withstanding a 300-pound weight suspended from the top outer edge of the panel without damage or deformation.
- Swinging panels will include permanent markings, such as etching, to enhance the visibility of the panel in the closed position.
- The end of every right-hand cabinet forming an aisle when traversing the aisle in both the entry and exit directions will include an integrated FMV, provided by INIT, for ORCA cards and open-loop payment media (i.e., contactless bankcards or mobile wallets). Thus, each faregate aisle will contain two integrated media validators, one for entry and one for exit. One of the Return on Investment scenarios models faregates that collect fares only on entry. This scenario does not include FMVs for exiting passengers. See Section 0.
- A faregate will consist of two cabinets mounted in parallel, constituting an aisle. Multiple aisles will constitute an array. Where an array consists of two or more aisles, the outer cabinets will have only one swinging panel and cabinets in the middle of the array will have swinging panels on both sides.
- If the mobile ticketing app displays QR codes (see Section 6) or the TVMs issue QR-coded paper tickets (see Section 11.1), each faregate FMV will incorporate an integrated barcode scanner. The integrated barcode scanner will provide a flat transparent surface onto which users will place their barcoded media face down for scanning.
- Upon presentation of a valid fare, faregate panels will open in the direction of passenger movement.
- Faregates will provide a rated throughput of no less than 30 passengers per minute.
- The timing, speed and force of panel movement will be configurable by authorized users of the Faregate BOS.
- Upon loss of power, faregates will automatically open their doors in the exit direction. Upon restoration of power, faregates will resume operation in no more than 60 seconds.
- As described in Section 8.5, faregates will continue to operate during times of communications loss.
- Upon receipt of an emergency notification, faregates will cease accepting fares and open in the exit direction. Upon cancellation of the emergency signal, faregates will resume normal operations in no more than 10 seconds.
- Faregates will include ADA-compliant controls, displays and audio feedback but will not include voice messaging.
- To simplify installation, faregates will include an overhead channel for inter-gate power and data cabling.
- The bottom of the overhead channel will be no less than 7 feet above the floor.
- Both sides of the overhead channel will include illuminated icons or other indicators visible from a distance. Some of these icons will inform passengers about the status of the aisle (e.g., a green arrow when the gate is operating in the passenger's direction, a red X when the aisle is closed and not permitting passage in the passenger's direction). If so configured, other icons will momentarily display to inform Sound Transit staff when a passenger uses a reduced or free fare, and when the faregate detects that a passenger passed through the aisle without paying a fare.
- If configured by Sound Transit, upon detection of passage without fare, the faregate will sound an alarm, display a prominent colored icon or other indicator on the overhead channel above the aisle and close the panels, unless doing so could cause injury.
- Faregates are assumed to be minimally tolerant of precipitation; therefore, faregates will require shelter from falling and wind-driven precipitation.

- All cabinets and components will be identical for all faregates, except that the width of the swinging panels will distinguish between SAGs and WAGs.
- Faregate cabinets will be constructed of stainless steel and approximately 8 inches wide and 6 feet long.
- The maximum height of installed faregate equipment, including the overhead channel, will be no more than 92 inches.

8.2 Standard Access Gate

The minimum clear aisle width of the SAG will be 18 inches, but procurement documents will state a preference for a slightly wider aisle of approximately 20 inches.

8.3 Wide Access Gate

WAGs will comply with ADA requirements and provide a minimum of 36 inches of clear aisle width. All faregate arrays will include at least one WAG. All station entries that provide wheelchair access will have at least two WAGs to ensure that the entry remains fully accessible in the event of a single WAG failure. For example, an array that serves an elevator will have two WAGs, but an array that serves only a stairway and/or an escalator may have only one WAG.

To improve ergonomics for passengers in wheelchairs, each WAG will include a secondary contactless reader antenna, connected to the associated FMV, mounted to the side of the right-hand cabinet, approximately 36 inches from the floor.

If the mobile ticketing app displays QR codes (See Section 6) or the TVMs issue QR-coded paper tickets (see Section 11.1), the WAG will also include a secondary QR code scanner, identical to the one mounted horizontally on the cabinet top surface, adjacent to the secondary contactless media antenna.

8.4 Conceptual Faregate Schematic

Figure 8-1 depicts a conceptual schematic from an overhead view of a two-aisle faregate array. Note that:

- The outer two faregate cabinets in the array have one moving panel each. All inner cabinets in an array will contain two moving panels.
- The FMVs for each aisle are on the right-hand cabinet when approaching the aisle from either direction.
- Each aisle has a single Faregate Controller that interfaces with both the entry and exit FMVs for the aisle, as well as the motors that move the gate panels. The FMVs will inform the Faregate Controller when a fare has been accepted. As part of the transaction, the FMVs will also inform the Faregate Controller about the passenger's fare category (e.g., adult, reduced, free).
- Upon receiving indication of fare payment from one of its FMVs, the Faregate Controller will instruct the two motors that control the gate's panels to open in the passenger's direction of motion, subject to appropriate signals from the Aisle Sensors. Upon traversing the aisle, based on sensor information, the Faregate Controller will instruct the two motors to close the panels.

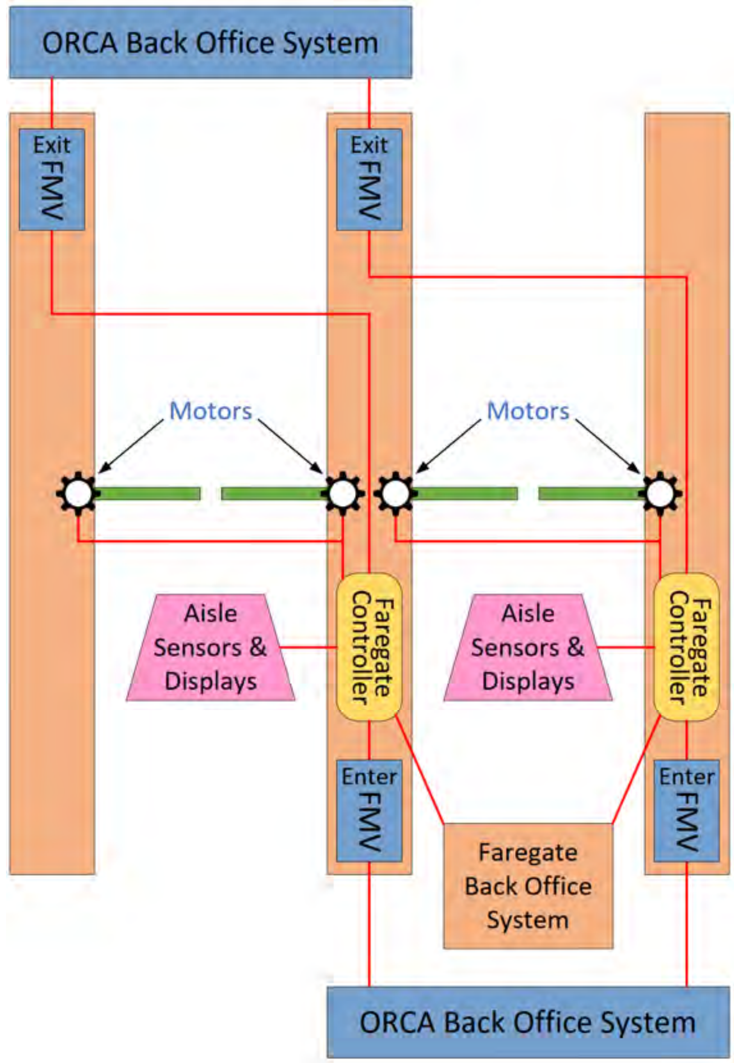

Figure 8-1 – Conceptual Faregate Schematic

- The FMVs communicate with the ORCA BOS to validate all fare transactions and to report the transaction results. The ORCA BOS also sends the FMVs lists of ORCA cards and contactless bankcards that are invalid, which are referred to as deny lists or the hotlist.
- The Faregate Controllers communicate with the Faregate BOS to report ridership data, event records, and to receive configuration and other operational instructions.

8.5 Faregate Operations During Communication Loss

As seen in Figure 8-1, each faregate communicates with both the Faregate BOS and the ORCA BOS. Thus, faregates must contend with two different methods of communications loss.

8.5.1 Loss of Communications with Faregate BOS

When the faregate loses communication with the Faregate BOS, the faregate can assume a variety of operating modes.

1. The faregates could continue to operate in the operating mode at the time of communication failure. (See Table 4-1) In some cases, this response may be inadvisable. For example, if the faregates remain in “No Entry with Controlled Exit” mode during special event operations, passengers would be blocked from entering the station until communications are restored.
2. Sound Transit could configure the faregates to return to the default operating mode whenever communications with the Faregate BOS are lost.
3. Sound Transit could configure the faregates to enter “Free Passage” mode whenever the Faregate Controller loses communication with the Faregate BOS. Such response to losing communicaton with the Faregate BOS may be unreasonable, since the faregates can operate safely while offline.

During loss of communication with the Faregate BOS, the Faregate Controller will record all passages through the aisle as well as any other events.

Upon restoration of communications with the Faregate BOS, the Faregate Controller will transmit all ridership and event records stored during the outage to the BOS. The BOS will then inform the faregate of the operating mode it should assume.

8.5.2 Loss of Communications with ORCA BOS

When the FMVs embedded in the faregates lose communication with the ORCA BOS, the FMVs will function in the same manner as the existing WVs act when they are offline. In most account-based fare collection systems, such as ORCA, offline validators continue to process any presented fare media and use internal logic and risk-mitigation lists to determine whether to accept a presented fare. Typically, the passenger is unaware that the validator is offline because the transaction proceeds normally. The FMVs will function in this manner when offline. However, Sound Transit can configure the faregates to enter other operating modes whenever the FMVs lose communication with the ORCA BOS.

The FMV will record all transactions performed while offline. Upon restoration of communications with the ORCA BOS, the FMV will transmit records of all transactions performed during the outage.

8.5.3 Loss of All Communications

If Sound Transit’s network fails or if there is a major internet outage, both the Faregate Controller and the FMVs will simultaneously lose communication with their respective Back-Office Systems. In such cases, the faregates and the FMVs will operate as discussed in Sections 8.5.1 and 8.5.2.

9 EMERGENCY EXIT DOOR

Emergency Exit Doors (EEDs) will provide additional exit-only capacity where needed to satisfy NFPA 130 egress requirements. Please note that the final station designs may require no EEDs.

There are two possible configurations for the EED:

- The EED will open manually in the exit direction from the paid side only via a “crash bar” mechanism but will be remotely monitored and locally alarmed.
- The EED will open in the exit direction only with the latch activated by remote control via solenoid or other electronically controlled mechanism. The mechanism will automatically trigger during power loss and declared emergency scenarios.

10 MAINTENANCE ACCESS GATE

At stations where maintenance equipment, such as scissor lifts, must access the paid side of the array, station fencing will include Maintenance Access Gates (MAGs) sufficiently large to accommodate the equipment.

- MAGs will be approximately 6 feet wide.
- MAGs may be composed of two swinging doors (i.e., French doors) or a single sliding panel (i.e., barn door).
- MAGs will be locked with keyed access on both sides, allowing only maintenance personnel to open the MAG from either side.

11 TICKET VENDING MACHINE

In general, each station or platform entry will have one TVM on the paid side to enable customers without a fare to purchase a ticket to exit the station through a faregate. Note that having only one TVM on the paid side will mean there is no redundancy for equipment failure. In such cases, passengers who arrive at a station without a valid fare will have to go to another station exit to use the TVM at that location, but some station platforms may have only a single exit. In the worst-case scenario, an unworking paid-side TVM may mean passengers without valid fares will be unable to exit the station.

TVMs on the unpaid side will remain, but at some stations the number of TVMs on the unpaid side may be reduced to provide equipment for the paid side. The resulting reduction in redundancy and transaction capacity may be unacceptable and require Sound Transit to relocate TVMs from stations with excess TVM capacity, deploy available spare TVMs, or purchase additional TVMs.

Hardware and software in all TVMs will remain identical, but paid-side TVMs may be configured to only sell machine-readable tickets as described in Section 11.1 and possibly add value to ORCA accounts. Sound Transit may also configure paid-side TVMs to include a modest surcharge on all transactions as discussed in Section 5.

11.1 Machine-Readable Tickets

All TVMs will require modifications to dispense machine-readable tickets so that passengers have an opportunity to purchase a single trip or round-trip/day pass ticket to either enter the station from the unpaid side or exit the station from the paid side.

Two alternative solutions are available:

1. Modify software in all TVMs to print a two-dimensional barcode (e.g., QR code). This solution would require minimal modifications of the TVMs, but all faregates would need to include a barcode scanner on both ends. If the mobile ticketing app discussed in Section 6 displays QR codes, the faregate will need to include QR code scanners. The ticket stock could be the same as used today; only the printed content would need to change to include the QR code. Because of its security features, this ticket stock costs approximately 2-3 cents per ticket. QR code tickets are susceptible to fraud; for example, a photo of a QR code ticket taken by a smart phone is easily shared by text message or a number of other popular social media apps. To mitigate this risk, the ORCA BOS would likely require enhancements to detect and deny excessive (i.e., fraudulent) use.
2. Modify hardware and software in all TVMs to print, encode and dispense disposable paper-based smartcard media that function similarly to the existing ORCA cards. This solution may require extensive hardware and software modifications to all TVMs but would not require a barcode scanner on the faregates. The unit price for disposable smartcards is 20-25 cents. Sound Transit

TVMs currently dispense 2.3 million tickets per year per Sound Transit, so the incremental fare media cost of this solution could be significant. Because paper smartcard media is highly secure, the ORCA BOS would need no enhancements to mitigate the risk of fraudulent use.

The ticket's printed barcode or encoded smartcard information will include all necessary data to enable the faregate media reader to determine the ticket's unique identification number (e.g., serial number), ticket type, expiration date/time and other data necessary to satisfy Sound Transit business rules.

Table 11-1 compares characteristics of the two alternative solutions for TVM machine-readable tickets.

Table 11-1 – TVM Machine-Readable Ticket Solution Comparison

Characteristic	Solution	
	QR Code Ticket	Paper Smartcard Media
Unit / Annual Media Cost (2.3 Million Tickets per Year)	2-3 cents $46,000-$69,000	20-25 cents $460,000-$575,000
Fare Media Fraud Risks and Mitigations	Easily photocopied. May require ORCA BOS enhancements to validate transactions and to detect and prevent fraud, depending on use cases. QR code data is encrypted so counterfeits are at most a minor risk.	Comparable security to existing ORCA cards. Minimal ORCA BOS enhancements needed for transaction processing.
Required TVM Modifications	Minimal software changes only. Other INIT projects have TVMs that issue QR-coded tickets.	Requires replacement or modification of all ticket printer modules and associated software.
TVM Modification Capital Cost (250 TVMs and Spare Modules)	None	Estimated $1,250,000
Supported Fare Policies	Best suited for short-term fare products such as single ride and round-trip, as well as multi-trip products. Period passes (e.g., day, month) that provide unlimited rides for a defined period are especially susceptible to fraud.	Technology supports any fare product in use. Due to fragile nature of the media, fare products that enable long-term use (e.g., reloadable stored value, monthly passes) are not recommended.
Required Faregate Modifications	Faregate FMVs should include barcode scanner hardware to support machine-readability of mobile ticketing. If so, QR code TVM tickets will not by themselves require faregate modifications other than FMV software.	FMV software only.
Faregate Modification Capital Cost (400 FMVs and Spares)	None	None
INIT Non-Recurring Engineering	TVM software modifications will be minor, as will associated testing. The ORCA BOS may require enhancements to support validation of single-ride, round-trip and other multi-trip tickets. If QR code tickets are used for unlimited ride passes, the ORCA BOS may require significant enhancement for fraud detection and prevention functions.	May require significant engineering to integrate new module to print and dispense paper smartcard media. The module must read the serial number of each smartcard ticket prior to dispensing. Effort to develop and test TVM software enhancements may be significant. Required ORCA BOS enhancements should be modest.
Pilot Project Operational Implications	Ideally suited for paid-side TVM application where most purchases will likely be for single-ride tickets needed to exit station. QR code tickets for existing period pass products will be subject to fraud.	Will support all existing TVM ticket types without increasing risk of fraud, but at likely greater capital and operating costs, and with likely greater effort required of INIT.

11.2 Relocation and Installation

It is anticipated that all TVMs on the paid side of the faregate arrays will be identical to TVMs already in service. Some stations will also require relocation of existing TVMs on the unpaid side of the faregate arrays.

Most stations will require new TVMs, purchased from INIT or pulled from spare inventory, on the unpaid side to retain transaction volume capacity and/or redundancy. See Table 21-29 for a summary of TVM quantities (i.e., existing, unpaid side, paid side, relocated and new).

11.3 Alternative Low-Cost TVM

Because the faregates will accept contactless bankcards for payment, passengers who need to purchase a fare to exit gated stations can simply use their bankcard at the faregate. Thus, the paid-side TVMs could be limited to accept coins and bills only. Moreover, the paid-side TVMs need not dispense new ORCA cards nor allow ORCA card holders to add value to their accounts prior to exiting the station. Arguably, any passenger wishing to purchase an ORCA card or wanting to add value to their account could have done so at their station of origin. See Section 5 for a suggested fare policy that will reduce the need for ORCA card holders to use paid-side TVMs.

Under these assumptions, for the paid-side TVMs, Sound Transit could consider purchasing compact vending machines that accept coins and bills only and dispense paper QR code tickets, potentially limited to adult and reduced fare single-ride tickets. Several suppliers provide such machines primarily as on-street multi-space parking machines, which have been deployed as TVMs where space is limited and functional requirements are modest. Most such applications are Bus Rapid Transit start-up systems. Depending on quantities and other required features, unit prices of these compact parking system-derived vending machines can be as low as about 25% of the price of typical full-function TVMs currently used by Sound Transit.

Coincidentally, the quantity of paid-side TVMs nearly equals the quantity of new TVMs required to support this preliminary design of the faregate pilot project. There are 32 paid-side TVMs and 31 new TVMs (see Table 21-29). If this coincidence holds and Sound Transit opts to use low-cost paid-side TVMs, the existing fleet of INIT TVMs can remain as unpaid-side TVMs, providing full ORCA card functionality as required, but with many relocations to accommodate the new station layouts.

While some of these compact machines are not as robust as the typical TVMs used in transit applications, all paid-side TVMs will be inside station enclosures, so their environmental tolerances will be more than sufficient.

It is possible to procure the low-cost compact TVMs from any qualified supplier. This would require a separate BOS to monitor and manage these devices and some integration work with INIT. If these TVMs only dispense single-ride QR code tickets, the extent of integration with INIT would be modest.

However, INIT recently introduced a compact TVM they call the VENDstation, with initial deployment for Orange County Transit Authority’s (OCTA) new streetcar system, scheduled for service in 2026. For OCTA, the compact TVM will accept cash, bankcards, and mobile wallets to dispense QR coded paper tickets, making it an ideal solution for a low-cost TVM for paid-side installations. (Although for paid-side TVMs, only cash payments are necessary.) Using these INIT devices for the paid-side TVMs would simplify procurement and avoid the integration effort, as well as potential complications of a separate BOS that would be required if another contractor supplied the compact TVMs.

For the purposes of this analysis, the Return on Investment calculations assume all new TVMs are the same as the existing TVMs.

12 FARE INSPECTION TERMINAL SPECIFICATIONS

The current FIT is a ruggedized smart phone with a Bluetooth thermal printer module supplied by INIT and primarily used by Fare Ambassadors in current operations. FITs are used to validate that passengers using an ORCA card or their contactless bankcard (or mobile wallet) have paid their fare by interfacing with the ORCA BOS to validate that a tap was performed within the last two hours prior to inspection. Any additional FITs required to equip station attendant personnel will be the same as those currently in use.

13 PASSENGER ASSISTANCE PHONE SPECIFICATIONS

PAPs will be wall-mounted devices that utilize Voice over Internet Protocol (VoIP) technology for voice communication to Sound Transit's call center. Figure 13-1 shows an example of a PAP. Each PAP will include the following:

- A "Request Help" or "Call" button or similar control to initiate communication
- A speaker and microphone protected by a stainless-steel grate or similar component
- A light to indicate that a call is in progress
- An ADA-compliant label for the "Request Help" or "Call" button
- A camera to enable the CSR to see real-time video of the caller

Figure 13-1 – Typical Passenger Assistance Phone

Pressing the "Request Help" or "Call" button will automatically connect the PAP with the next available CSR. The PAP speaker volume will be remotely configurable and sufficient to be heard in all ambient sound conditions at the station.

The PAP should be located on the paid side of the faregate array, near the faregate(s), and preferably close to the array's WAG.

14 PASSENGER SIGNAGE AND COMMUNICATIONS

Signage on fare-paid side of stations with faregates will inform passengers about fare operations and ways to receive help. Such signs may include:

- Fare Required to Exit
- For Help, Use Passenger Assistance Phone or See Fare Ambassador
- Use Ticket Vending Machine to Purchase Ticket or Add Value to ORCA Card

To deter unauthorized use of EEDs (see Section 9) and existing doors configured for emergency egress only, each door should include signage such as, "EMERGENCY EXIT ONLY – ALARM WILL SOUND."

At some stations, passengers may encounter elevators well before stairs or escalators leading to the same platform or mezzanine. To improve overall circulation and reduce crowding at the elevator entrances, clear directional signage is recommended. Signage should convey messaging such as: "PASSENGERS REQUIRING ELEVATOR ACCESS ONLY. ALL OTHER PASSENGERS PROCEED TO MEZZANINE LEVEL."

In addition:

- User interfaces on the faregates and PAPs will include raised letter and Braille symbols in compliance with ADA requirements.
- System maps on trains, websites and other customer-facing channels should clearly identify stations with faregates.
- Audio stop announcements on trains could include a reminder that the station requires fare to exit.
- Periodic audio announcements in gated stations could include instructions about how to seek help with the faregates.

Prior to faregate deployment, Sound Transit should conduct public outreach, especially with the disabled community, to develop additional signage and communications methods.

15 FAREGATE BACK-OFFICE SYSTEM

The faregate BOS will:

- Manage, configure, and monitor faregate status and operations
- Be cloud hosted with an availability of not less than 99.9%
- Provide a browser-based user interface
- Employ best practices, compatible with Sound Transit standards, for cybersecurity, user authentication and network security
- Not record fare transactions to avoid expanding Sound Transit's PCI scope
- Record (with station location and timestamp parameters):
  - Passenger counts (passage with fare)
  - Successful fare evasion (passage without fare)
  - Thwarted fare evasion attempts
  - Maintenance events
  - Emergency events
  - Power loss events
  - BOS communication loss events
- Control gate operation mode by modifiable configuration files and ad hoc commands from authorized users (see Section 4.2)
- Enable authorized users to remotely command a faregate to open
- Manage software downloads to faregates (excluding software for embedded FMV modules)
- Provide one or more dashboards depicting operational status of all faregates and active maintenance alarms
- Enable authorized maintenance staff to:
  - Observe the real-time operational status of a specific faregate and its constituent modules
  - Remotely perform faregate diagnostics

- Provide contractor-supplied reports for:
  - Passenger counts
  - Fare evasion history
  - Maintenance and operational event history
  - Operating mode configurations
  - Software version control
- Include a reporting system that:
  - Supports filtering and sorting by date, time of day, station, array, faregate, event type, and other salient characteristics
  - Enables authorized Sound Transit users to perform ad hoc queries, modify contractor-supplied reports, create new reports, and schedule reports and queries to run at defined intervals (e.g., daily, weekly, monthly)

16 FARE COLLECTION EQUIPMENT AND SYSTEM INTEGRATION

Cooperation from Sound Transit's incumbent fare system provider, INIT, is essential to the success of this project. The recommended solution requires INIT to provide the following:

- FMV modules for the faregates (two per faregate aisle plus spares). The faregate supplier will integrate these FMVs into the faregate cabinet, which will supply necessary power and communication interfaces. The FMV will communicate via separate network interface (i.e., a dedicated Ethernet connection) to INIT's fare collection BOS, the ORCA BOS, to conduct all ORCA and open payment transactions. The FMV and the Faregate Controller module will interface via a separate communications port. When the FMV confirms the validity of a presented fare instrument, the FMV will inform the Faregate Controller and the faregate will then open. The FMV will also inform the Faregate Controller when a passenger uses a reduced or free fare.
- ORCA BOS software and associated user interfaces to manage, monitor and configure the FMV modules in all faregates.
- Software interface protocols in support of faregate-to-FMV integration. The Faregate Controller will inform the FMV when to commence or cease acceptance of fares based on faregate operating modes. For example, if the Faregate BOS commands a faregate to begin No Entry with Controlled Exit mode, the Faregate Controller will command the FMV in the unpaid fare zone to cease operations and the FMV in the fare-paid zone to commence or continue operations as appropriate.
- If Sound Transit decides to have the Transit GO Ticket mobile app display QR codes or have the TVMs dispense QR code tickets, hardware and software to support QR code media issuance and usage transactions, INIT will provide:
  - Modified TVM software to print QR coded information on the tickets.
  - QR code scanner hardware (described in Section 8.1) for every FMV.
  - Modified software for the existing FITs to scan QR code media.
  - ORCA BOS software updates to support modified TVM functionality (including ticket configurability), QR code media transaction processing and associated database and report modifications.

- If Sound Transit decides to have the TVMs dispense tickets that are disposable smartcard media, hardware and software to support disposable smartcard media issuance and usage transactions, INIT will provide:
  - New or modified TVM hardware to print, encode and dispense disposable smartcard media and the associated modifications to the TVM software.
  - Associated firmware for the FMV and existing WVs to process disposable smartcard media usage transactions.
  - Modified software for the existing FITs to scan disposable smartcard media.
  - ORCA BOS software updates to support modified TVM functionality, disposable smartcard media transaction processing and associated database and report modifications.
- If necessary, enhancements to the institutional web portal to support widespread distribution and registration of Youth fare ORCA cards. See Section 6 for more information.
- Documentation, testing, software support and other services as required.

Because of the complexity of the effort required and to ensure that INIT performs the work at reasonable cost and schedule, Sound Transit should execute a sole-source contract with INIT for this work before commencing the procurement for the faregate pilot project.

17 Conceptual System Architecture

Figure 17-1 depicts a conceptual system architecture for the faregates and other elements with which the faregates must interface.

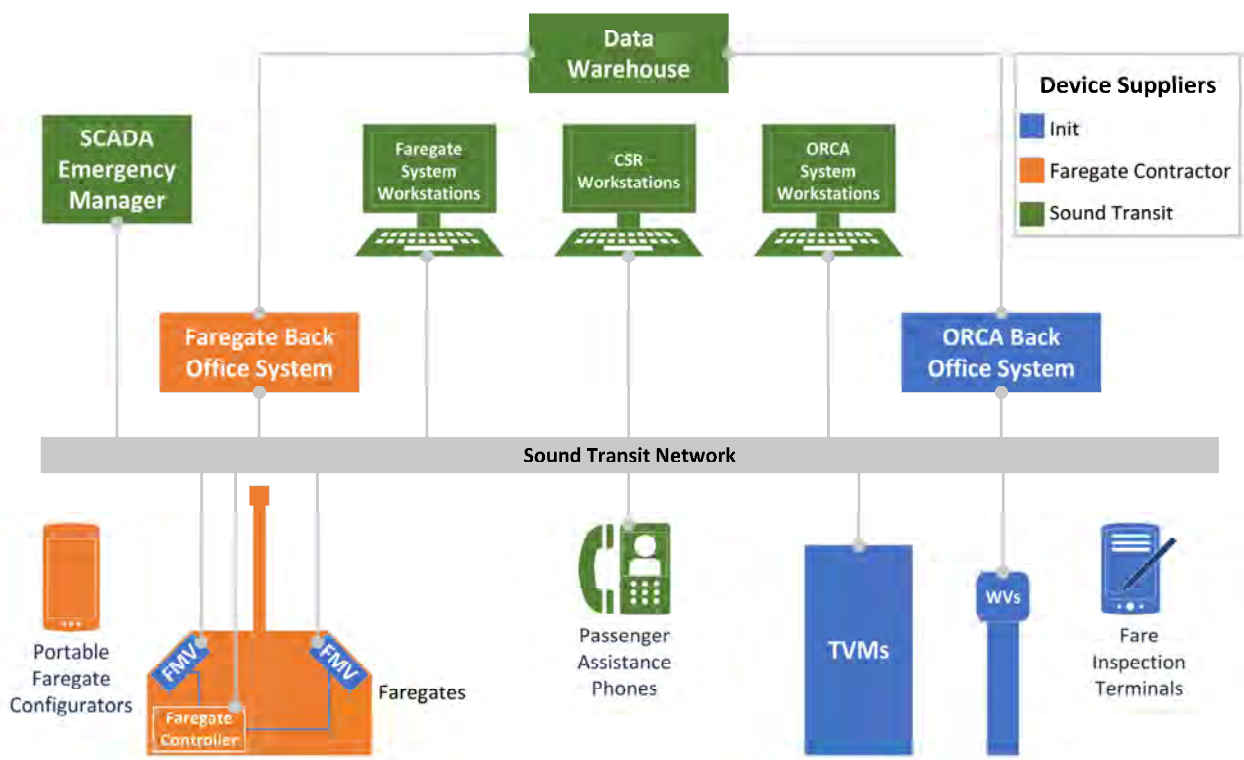

Figure 17-1 – Conceptual System Architecture Diagram

18 Staffing Strategy

18.1 Fare Engagement

According to 2025 ridership data, more than 81% of trips on the Link light rail involved at least one of the 14 stations earmarked for faregates. If Sound Transit equips all future Link stations with faregates, the percentage of trips involving faregates would likely increase. With 81% of trips requiring no fare engagement to ensure compliance, on-board engagement efforts would see diminishing returns. Consequently, after faregates are deployed, Sound Transit could significantly reduce staff assigned to on-board fare engagement and focus on-board efforts on only the portions of the Link light rail system that do not include gated stations. As shown in Figure 19-1, excluding the terminal stations, SeaTac / Airport, and Bellevue Downtown, those segments are:

- Line 1 and 2 stations north of Northgate.
- Line 1 stations south of International District / Chinatown.
- Line 2 stations east of International District / Chinatown.

The remaining Fare Ambassador staff could be assigned to station attendant duties. The number of Fare Ambassadors required to satisfy station attendant needs at the 14 gated stations will depend on the number of hours Sound Transit deems necessary for station attendant services. At most, assuming station attendants would cover 16 hours every weekday from 6 AM to 10 PM at all 14 stations, 40 Fare Ambassadors would be required for station attendant duties, based on Sound Transit staffing practices (1.4 full-time staff per 8-hour shift).

Sound Transit is targeting a total of 61 Fare Ambassadors on staff by the end of 2026. Assigning 40 Fare Ambassadors to station attendant duties would leave about 20 for other assignments. The remaining 20 Fare Ambassadors could provide on-board fare engagement on those segments of the system where the 19% of trips involving no gated station will be most common and provide coverage for one shift per weekend day for station attendant services at the 14 gated stations.

Redefining the Fare Ambassador's role to be in-station will enhance the effectiveness of the faregates while retaining the human touch that is a hallmark of Sound Transit's passenger-first philosophy. Retaining on-board fare engagement, albeit at a much lower level than at present, will also retain the benefits they provide to passengers when the Fare Ambassadors are performing duties other than fare engagement.

While it seems possible to provide all necessary Fare Ambassador services with the planned staff, this analysis assumes Fare Ambassador staffing will increase by five to ensure adequate coverage seven days per week.

18.2 Maintenance

18.2.1 Faregates

Figure 18-1 depicts a conceptual approach to staffing and scheduling of faregate maintenance services. Shaded cells indicated days when the indicated staff will be on duty. This concept provides:

- Seven days per week coverage, with an emphasis on weekdays.
- Response times necessary to ensure desired faregate availability.
- Sufficient staffing to accommodate vacations, sick days and other absences.
- Resources for routine preventive maintenance to sustain equipment reliability and appearance.

Figure 18-1 – Conceptual Maintenance Staffing and Schedule

Field Staff Role	#	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Hours
Morning Shift	3								6 a.m. – 3 p.m.
Mid-Day Shift	1								10 a.m. – 7 p.m.
Mid-Day Shift	1								10 a.m. – 7 p.m.
Afternoon Shift	3								2 p.m. – 11 p.m.
Floater / On-Call	1								As Needed
Floater / On-Call	1								As Needed
Office Staff Role									
Bench Technician	1								8 a.m. – 5 p.m.
Supervisor	1								8 a.m. – 5 p.m.
TOTAL	12								

Supervisory and bench repair staff may be shared from existing similar roles, such as staff involved in maintaining fareboxes, TVMs or other such electro-mechanical devices.

18.2.2 Ticket Vending Machines

This project entails the addition of TVMs in the fare-paid zones. The preliminary estimate calls for 32 paid-side TVMs. In general, these TVMs should experience far fewer transactions per day than the TVMs in the unpaid zone, so their frequency of service calls should be correspondingly lower. However, unlike the TVMs in the unpaid zone, there is only one TVM per paid zone, requiring faster repair response times to minimize downtime.

Consequently, it is recommended to add three TVM maintenance staff to service the additional TVMs.

18.3 Customer Service (Call Center)

As discussed in Section 4.6, PAPs will enable passengers “trapped” on the paid side of the faregate array to connect to a Sound Transit CSR at the agency’s call center. Providing this type of coverage will likely require longer hours of service at the call center, although the number of CSRs on duty during the early morning and late evening hours should be minimal because long-term call volume at those hours would be low. After the public becomes accustomed to the faregates, additional call volume due to the introduction of faregates will be modest because call volume will be physically constrained by the limited number of PAPs (see Table 21-29). It is estimated that the additional call center coverage will require two CSR Full Time Equivalents (FTE).

19 CANDIDATE STATION SELECTION

WSP assessed station ridership and available architectural drawings, in collaboration with Sound Transit, and selected 14 stations for site surveys. Those site surveys concluded that in general, all 14 stations are feasible candidates for faregate deployment. After consultation and analysis of site survey results and ridership information, WSP and Sound Transit selected 14 stations for preliminary design, based on a combination of factors, including:

- Ridership (both origin and destination).
- Complexity and estimated cost of station facility modifications required to accommodate faregates.
- Operational considerations such as ridership from special events and intermodal transfers.
- Effect on fare inspection operations.

The selected stations are highlighted in red in Figure 19-1.

Figure 19-1 – Faregate Candidate Stations

In addition to representing a significant portion of total Link ridership, these 14 stations also provide:

- An easily identifiable block of stations, simplifying the effort to inform the public.
- A contiguous string of nine stations that will make fare engagement more effective, since downtown passengers will not be able to walk a few blocks to a nearby station that has no faregates to avoid paying a fare.
- Coverage for the SeaTac / Airport Station, which is a focal point station for visitors and less frequent riders, many of whom may be unfamiliar with proof of payment fare operations and thus more likely to not pay a fare (some unintentionally).
- Coverage for the International District / Chinatown Station, which serves as the transfer point for the Sounder commuter rail service.
- Coverage for stations with high-volume special events, especially the University of Washington station, where faregates will provide improved control of crowds on the platforms
- Coverage for all three terminal stations

20 BASIS OF DESIGN

20.1 Equipment Location Considerations

WSP identified optimal locations for faregate arrays, based on station design, pedestrian flows and isolated access points, such as elevators. According to the Sound Transit Requirements Manual of 2024, surge zones must be maintained near entries and landings and at the base of stairs, escalators, TVMs and elevators. These surge zone requirements also apply to faregate arrays, and the zones must remain free of obstructions to accommodate large passenger surges. The proposed faregate array layouts comply with the surge zone requirements where practicable. However, at some stations surge zones may overlap, and exceptions, due to existing constraints, will need to be considered.

In developing faregate locations, WSP also sought to minimize passenger inconvenience. For example, one objective of the design is to ensure passengers may change travel direction without having to exit and then re-enter a station. The designs allow passengers at stations with dual platforms to transfer between platforms without having to exit one faregate array and then enter through another.

The designs also consider pedestrian behavior and attempt to minimize introduction of lengthy detours. While some station designs include closure of common pathways, even for pedestrians not using the trains, the designs seek to strike a balance between effective fare collection and pedestrian convenience.

20.2 Equipment Quantity Methodology

To determine the correct number of faregates, peak passenger demand, specific faregate throughput capacities faregates and compliance with NFPA 130 and emergency egress codes must all be considered. Because NFPA 130 emergency egress and evacuation requirements analysis will be performed at a later phase of the project, WSP based the initial quantity and the layout of faregates on qualitative and operational factors.

For each identified faregate location, best practices require a minimum of two faregates to eliminate single points of failure and to allow simultaneous bi-directional flow through the array. Thus, for a station with three separate access points each requiring a faregate array, the design basis calls for a minimum of six faregates, regardless of the passenger volume.

Although Sound Transit provided station-specific ridership information for both departing and arriving passengers, that information does not provide sufficient information about maximum peak departures and arrivals to enable data-driven analysis of the number of faregates required at a station. To determine the number of faregates required for any given array, the maximum number of passengers passing through the array at any time in both directions must be known. Available data from Sound Transit provides peak hour departures, but that information does not provide the maximum peak throughput (i.e., the peak of the peak). Existing data also does not provide how many passengers are arriving at the same time, nor does it identify distribution of passengers among each station’s multiple access points.

Because of this uncertainty, WSP estimated equipment quantities based on observations during peak ridership times, estimated capacity of station infrastructure (e.g., stairways and escalators) and clearly identifiable cases where additional capacity would be required for special events and other operational characteristics. For example, the University of Washington station experiences extreme passenger loads on game days, and the SeaTac / Airport station experiences significant demand during holiday travel season, as well as high off-peak usage.

20.3 NFPA 130, ADA, and Egress Requirements

The analysis of existing Sound Transit stations for compliance with NFPA 130 emergency egress and evacuation requirements will be performed at a later phase of the project.

Although Title 49, Construction of Transportation Facilities, incorporates the ADA Accessibility Guidelines, analysis of accessibility requirements is outside the scope of this project; however, accessibility considerations have been maintained to the extent practicable. Specifically, at least one ADA-accessible faregate has been provided within each faregate array to preserve the existing accessible route through each station and to avoid introducing new accessibility barriers.

WSP recommends High Barrier Faregates integrated with the fire alarm system via dry contact or power cut, ensuring gates open during emergencies (i.e., fail-safe). Gates must meet NFPA 130 evacuation width and flow requirements, open in the direction of exiting, display “exit” signage and remain unlocked in emergencies. Sound Transit should ensure future project teams address these requirements when selecting faregate systems.

20.4 Canopies and Rain Screens

WSP recommends canopies and rain screens at certain stations to protect the fare collection equipment from environmental exposure. The canopy design criteria include assumed overhang dimensions, water management and material durability. Stations in this analysis will include the following design elements related to canopies and rain screens:

- Overhangs – Canopies will extend approximately 10 feet in front of the faregate and/or TVM equipment to cover both the machine and the queuing passengers.
- Vertical side rain screens in the form of storefront glazed wall systems are included in the proposed station designs (see Section 21) to create a weather-shielded zone for the faregate equipment at certain stations, while maintaining their visibility.
- Water Management – Proper drainage will need to be considered by future design teams to prevent moisture from reaching the equipment or creating slip hazards. A minimum slope of 2% is recommended to ensure water sheds uniformly or drains to a system. Ice shields may be used to move ice and any snow accumulation away from the equipment or entry points.
- Material Durability – Canopy and rain screen materials should be selected for longevity and resistance to corrosion. Aluminum is preferred for its corrosion resistance and light weight, and because it withstands high humidity without rust. Steel with protective finishes is also recommended for larger structural spans. Framework must be of noncombustible materials. Designs must meet Authority Having Jurisdiction’s (AHJ) Building Code and American Society of Civil Engineers (ASCE) 7 standards for wind, snow and seismic loads specific to the site location.

20.5 Wayfinding Updates

Installation of the new faregates will require localized modifications to the existing wayfinding and tactile warning tile layout. These adjustments are necessary to ensure proper alignment with the proposed faregate configuration, maintain continuity of accessible paths and support intuitive passenger circulation through the fare-paid zone. In the fare-paid zone, wayfinding tile will assist in locating the paid-side TVMs, PAPs and the nearest WAG. Wayfinding tiles on the unpaid side of the faregate array will assist in locating the TVMs, the nearest WAG and perhaps the nearest PAP on the unpaid side, if applicable.

20.6 Station Fencing

Fencing at least 8 feet in height will be installed at the faregate arrays to protect the station from unauthorized access while maintaining visibility. Fencing must withstand high-traffic wear and corrosive environments. Recommended fencing materials include metal or aluminum. Materials considered in the fencing system selection should reduce maintenance, upkeep and repair, as well as have a thirty-to-fifty-year life cycle. Local ordinances and code requirements should be reviewed during design to determine if any fencing system requirements or restrictions apply. Fencing systems should also be reviewed by Sound Transit’s security management to ensure current security industry best practices are considered and applied.

20.7 Power

20.7.1 Power Cabling

Sound Transit currently operates an open system with no faregates. Converting selected stations to a closed-gate configuration will require the installation of new fare gates. Each gate must be supplied with 120-volt power on a dedicated 20-amp circuit.

To provide power to the gates, new electrical feeders will be routed from the fare collection power distribution panel located in the station's electrical room to each gate position. Depending on the gate manufacturer's specifications, either individual circuits for each gate or shared circuits serving up to five gates will be supported.

During the station site investigations, optimal gate locations were identified and incorporated into the existing as-built drawings (see Section 21). Engineering staff then performed cable "take-off" measurements to determine the required conduit and cable lengths from each gate location back to the electrical room, considering the planned routing path as well as any elevation changes or transitions through mezzanines. All power cabling will be installed in steel conduit in accordance with building and electrical standards, and the associated material quantities and lengths have been included in the ROI calculations.

20.7.2 Power Demand

During the station site investigations, each station's power supply room was assessed to confirm available panel capacity and to evaluate the feasibility of routing new power feeds from the fare collection power distribution panel to the proposed gate locations. All inspected power distribution panels had sufficient blank spaces to support the additional gate loads. New electrical breakers would need to be added. In several large, distributed stations, two dedicated fare-collection power rooms were present; both rooms were fully inspected. All power rooms and AFC panels were clean, dry, clearly labeled and in good overall condition. Based on these inspections, no additional subpanels, panel upgrades or electrical infrastructure enhancements will be required, and therefore no such costs were included in the ROI calculations. The cost of additional breakers for each power supply to a gate will be included in the cabling costs.

20.8 Network and Communications

20.8.1 Network Cabling

Each gate array, or group of gates, will require a dedicated network connection. This network drop will be routed from the station's communications room to the gate array location. As the communications room is typically adjacent to the station's power supply room, the network cable run is generally comparable in length to the power-cable routing. Whenever new power conduit is pulled, the network cabling should be installed concurrently to reduce labor and minimize station impacts.

For any network run exceeding 328 feet (100 meters), a fiber-optic cable will be required to ensure proper signal integrity and throughput. To ensure cabling standardization, fiber-optic cables will be used for all cable runs from the gate array to the comm room. Between gates in an array a CAT6 cable will be specified.

Each gate array will require only a single network connection to the station backbone. Within the primary gate of the array, a compact managed network switch will be installed. This switch will provide a local network segment for all gates and validators within that array. To maintain proper security and logical separation, validators operating on the same physical infrastructure should be isolated using virtual local area network configurations. Validator traffic must be virtual local area network-tagged or otherwise segmented for direct routing to the ORCA BOS.

20.8.2 Network Demand

During the station site investigations, each station's communications room was examined to assess available network capacity and infrastructure readiness. All communications rooms were equipped with multiple 19-inch equipment racks and were actively supporting existing Sound Transit network systems.

The incoming fare collection network cables could not be positively identified because each cable is labeled with an ID number rather than a descriptive label. However, both the fiber-optic and copper network switches in these rooms had unused ports available for new faregate connections.

Additionally, each station currently has a validator connected to the communications room via its own dedicated network port. These existing validator ports can be repurposed to support the new gate arrays, eliminating the need for additional switch hardware or expanded network capacity.

20.8.3 Fiber Cables and Converters

Within the station communications room, the existing fiber switch can terminate the fiber run and route traffic onto the trackside fiber backbone.

At the gate array, the primary gate will house a managed switch equipped with a Small Form-factor Pluggable (SFP) uplink port. The fiber drop will be terminated with Lucent Connectors (LC), which will be inserted into the appropriate SFP fiber transceiver module installed in the gate-array switch. This configuration provides a reliable, high-bandwidth uplink from the gate array to the station network while leveraging existing fiber infrastructure.

20.8.4 Cybersecurity and Data Security

Physical Security

The physical security of the network and communications infrastructure will be consistent with the existing fare collection system. The communications room is secure, with access controlled by the building access management system, and is continuously monitored via Closed-Circuit TV (CCTV) surveillance.

Network cabling running from the communications room to the faregates is protected within steel conduit. Cable access to each faregate cabinet is only possible from the floor entry point or from the ceiling. Faregate cabinets are secured with locks and equipped with audible alarms that activate if a cabinet door is opened without an authorized key. All cabinet access events are logged and reported to the Gate Management System (i.e., the Faregate BOS).

Network Security

As the existing INIT validators are being relocated from platform posts to faregates, the currently approved network security architecture will remain in place. The faregates themselves do not process or store financial data. All network communications are encrypted using Transport Layer Security (TLS) version 1.2 or higher.

20.9 Closed Circuit Cameras

For the purpose of this feasibility study, we assume that with some potential reorientation, the existing CCTV cameras will provide sufficient coverage for the faregates and relocated TVMs. A more detailed analysis of the CCTV coverage requirements should occur during future design phases.

20.10 Gate Installation

20.10.1 Introduction

Upgrading faregates at active stations has become a routine practice across the industry. Recent gate replacement projects have been successfully completed in San Francisco and Philadelphia, with a similar project scheduled to begin shortly in New York. Fare collection system providers have developed significant expertise in replacing legacy gates with new high barrier faregates at operational stations during service hours.

These installations are executed under carefully planned construction phasing to minimize operational impacts. Work is coordinated with agency operations, maintenance and customer service staff to ensure continuity of service. Passenger information systems are configured to provide real-time messaging, passenger assistance personnel are deployed as required and temporary passenger circulation patterns are implemented as needed. All changes to passenger flow are supported by clear, compliant wayfinding and signage to safely direct customers around active work zones.

20.10.2 Station Installation Sequence

This report identifies the stations recommended for upgrade based on projected passenger demand and the estimated cost of implementing high barrier faregates. As Sound Transit evaluates the ROI associated with each station, it is recommended that the implementation sequence begin with two low-impact stations. These initial installations would function as a pilot deployment, allowing installation procedures, system integration and operational issues to be validated and resolved with minimal service disruption.

Following successful completion of the pilot phase, construction should proceed at SeaTac / Airport Station and then advance northward up through Line 1. Sequencing the airport station early provides several technical and operational benefits: it establishes a gated entry point with high volumes of fare-inexperienced passengers, reduces downstream fare enforcement and customer-service impacts and mitigates the risk of passengers entering the system without valid fare media and attempting to exit at gated downtown stations. Additionally, airport stations typically have extended dwell times, higher staffing levels and more robust passenger information systems, providing greater resilience during early adoption of gated operations.

20.10.3 Station Preparation Work

Prior to the commencement of construction, each station should be prepared to the maximum extent practicable to minimize passenger impacts and reduce the risk of construction delays. A detailed site investigation should be conducted to identify and resolve potential unforeseen conditions. This investigation should include verification of existing conditions, clearances and constraints within the station.

Detailed conduit and cable routing paths from the electrical and communications rooms to the proposed faregate array locations will be identified. This effort should determine whether existing conduit, cabling and pathways serving current platform validators (i.e., WVs) can be reused or repurposed, or whether new infrastructure is required.

Construction logistics planning will be completed in advance and include staff access routes and equipment movement plans. These plans should define how construction personnel, tools, materials and gate equipment, including the new faregate assemblies, will be safely transported to each installation location without adversely impacting passenger circulation or station operations. At this stage, the sequence of faregate installations within the station should be developed to minimize passenger interference as each gate array is deployed.

Within the electrical room, the fare collection power distribution panel, available spare breakers and grounding provisions will be positively identified, labeled and reserved for the upgrade work. Existing electrical as-built drawings, load calculations and supporting documentation will be located, verified in the field and prepared for revision following installation of the new faregates.

The Sound Transit Network IT team will coordinate and manage all station network modifications. Network preparation will begin with the creation of a dedicated station VLAN for faregate communications, supporting secure connectivity between the high barrier faregates and their cloud-based back-office system (i.e., the Faregate BOS) via the station network routed to Sound Transit's datacenter(s) and out to the cloud. Within the communications room, network switch ports designated for the new high barrier faregates will be identified, configured and physically labeled to support installation, testing and long-term maintenance.

20.10.4 Passenger Messaging During Construction

Passenger communications should be led by Sound Transit and implemented through a coordinated, two-tiered messaging strategy.

The first tier should consist of external communications, including press releases and social media outreach. Messaging should be phased to align with project milestones. Initial communications should introduce the faregate upgrade program and its objectives, followed by targeted messaging emphasizing the requirement for passengers to carry valid fare media. Subsequent communications should explain how to use the new high barrier faregates. Ongoing updates should include the schedule of station upgrades and periodic progress reports to maintain public awareness and set expectations.

The second tier should focus on on-site station messaging and signage. See Figure 20-1, for example. Passengers should be clearly informed of upcoming and active construction work and any temporary changes to station operations. Signage should clearly indicate required passenger actions, revised entry and exit paths and safe routes around installation work zones. Clear, standardized instructional signage should also be provided to guide passengers in the proper use of the new faregates once installed. Messaging should be designed to support safe passenger circulation while minimizing confusion and operational impacts during construction.

Figure 20-1 – Passenger Signage at BART

20.10.5 Conduit and Cable Installation

Conduit installation for the faregate upgrade will be planned and coordinated in advance to support reliable power and communications connectivity while minimizing impacts to station operations. Existing conduit routes will be field-verified and reused where capacity and condition allow. New conduit will be installed only where required and routed to avoid conflicts with structural, architectural and MEP (i.e., mechanical, electrical and plumbing) systems while preventing the conduit being publicly visible.

All conduit will be metallic and suitable for the station environment, with rigid steel or intermediate metal conduit used in exposed or high-impact areas. Conduit will be securely supported, installed plumb and square and configured to minimize bends and pulling distances. Penetrations through walls, floors or fire-rated assemblies will be properly sleeved, sealed and firestopped in accordance with applicable codes and agency standards.

Conduit and cable installation must be completed and accepted before the faregate installation can start. The work should be protected to prevent passenger access or damage during construction. Pull boxes and junction boxes will remain accessible for maintenance. All conduit will be permanently labeled at termination points, and final routing will be documented in updated as-built drawings upon completion of the work.

20.10.6 High Barrier Gate Array Installation

During non-revenue hours, temporary work area fencing or boarding will be delivered and erected to secure the area where the new high barrier faregate array will be installed. The protected work zone will provide sufficient space to perform construction activities safely and efficiently while minimizing impacts to passenger circulation. Station signage and wayfinding will be installed concurrently to inform passengers of temporary changes and to guide them around the work area.

Once the area is secured, site preparation activities can commence. This will include removal of any existing fencing or equipment within the work zone. Power and data connections will be made available by removing conduit caps from floor penetrations or dropping cables from overhead pathways, depending on station-specific configurations. The floor area beneath the gate array will then be cleaned and prepared for layout.

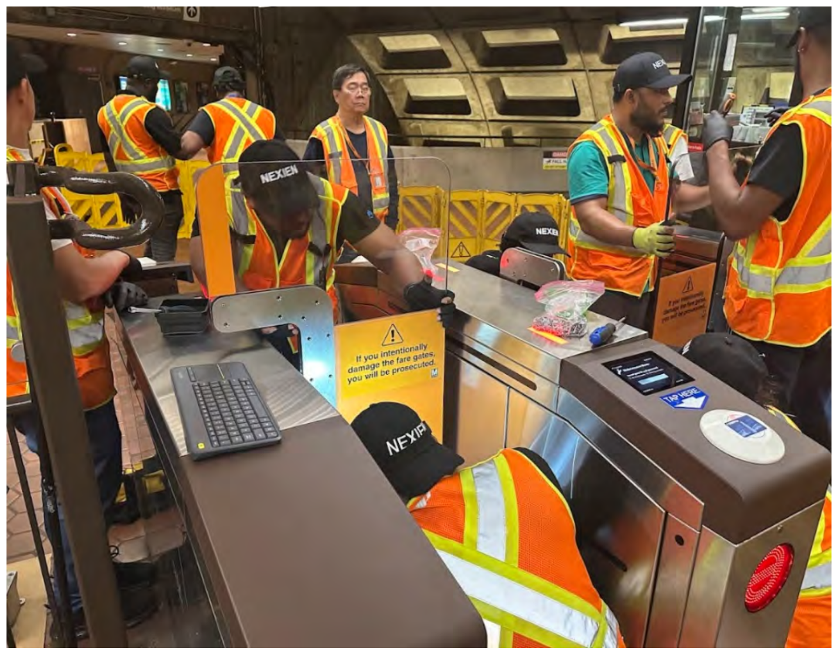

Figure 20-2 – Faregate Installation at WMATA

The gate array footprint will be set out on the station floor, and anchor bolt locations will be marked for each gate. Given that installations are performed on existing concrete with unknown substrate conditions, epoxy-set anchor bolts will be used. Drill templates will be utilized for each gate to ensure accurate bolt placement. Once drilled, epoxy anchors will be installed and allowed to fully cure in accordance with manufacturer requirements.

Following anchor installation, the high barrier gates will be positioned, mounted and torqued to the manufacturer's specified values. Power and network cables will be connected, and each gate will be energized. Manufacturer-required site installation tests and back-office communication tests will be performed with results documented. This sequence will be repeated for each gate within the array.

Upon completion of the full gate array, installation crews will demobilize, temporary screens and fencing will be removed and the work area returned to service before proceeding to the next gate array location. Based on installations observed in other transit systems, a typical station installation, which includes removal of legacy faregates, has a duration of approximately two weeks.

20.10.7 Site Safety

Safety is a significant factor for both passengers and installers. The works perimeter boarding should be solid and high enough to block line of sight. This ensures that construction workers are not being disturbed by passengers and passengers are protected from potential accidents. For example, a worker is using a powered cutting wheel to remove a legacy mounting bolt. A passenger stops to ask what he is doing, the worker loses focus and jams the grinder blade which then breaks, throwing broken grinder blade pieces into the workspace.

Figure 20-3 – Safe Working Fence Around Works Area at BART

20.10.8 First Day of Operations

Once all high barrier faregate arrays within a station have been installed and all TVM relocations completed, the commencement of gated station operations can be scheduled.

To transition the station to gated operation, temporary fencing will be installed during non-revenue hours in front of the permanent fence line (see Figure 20-4). This temporary barrier will allow construction crews to complete installation of the permanent security fencing required to fully secure the paid area of the station. Upon completion, the temporary fencing can be removed.

Figure 20-4 – Temporary Fencing at BART Gate Array

With the temporary boarding in place the station is gated, passengers will be required to obtain valid fare media and present it at the faregates to enter the system. During the initial week of operation, increased staffing levels will be required at the station to provide passenger assistance. This is necessary to address customer confusion and accommodate passengers who may not have been aware of prior press releases, social media outreach or construction-related station messaging introducing the new gated configuration.

20.10.9 Costing

Included in the cost estimating section of this report are the following:

- Conduit and cable installation based on similar installation work for the current Sound Transit WVs.
- Gate installation and final fencing of each station based on past contractor estimates.

21 STATION DESIGNS

The following sections summarize the faregate assessment of each of the 14 selected stations. Reference APPENDIX A for the Proposed Faregate Control Concept Design Drawings.

21.1 Lynnwood City Center Station

21.1.1 Overview

Lynnwood City Center Station is a light rail station located near 44th Avenue W and 200th Street SW in the City of Lynnwood, Washington. The station serves a growing suburban mixed-use district that includes retail, residential development, and regional transit facilities. Passenger access is provided through multiple entrances at the ground level. These entrances connect passengers to the platform level above.

21.1.2 Station Layout

Lynnwood City Center Station is a multi-level station consisting of a ground level and a platform level.

At the ground level, passengers enter the station through multiple entrances equipped with stairs, escalators, and elevators. This level functions as the primary circulation space within the station, connecting all entrances to the platform above.

21.1.3 Architectural Description

The proposed faregate control concept for Lynnwood City Center Station establishes a fully enclosed fare-paid zone at all ground-level circulation points serving access to the platform. Faregate arrays are provided at both the western and eastern ground level station entrances to control passenger movement from the unpaid circulation areas to the platform level.

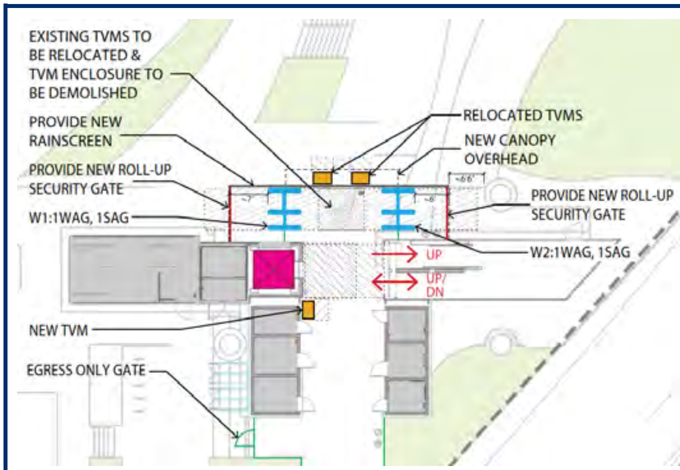

Figure 21-1 – Lynnwood City Center Station Faregate Arrays (W1 & W2)

At the western ground level station entrance, passenger access is provided through a primary entry point located on the north face of the building. This entrance currently contains an enclosure with two ticket vending machines. This existing structure is proposed to be demolished and the two existing TVMs will be relocated. Two faregate arrays, W1 and W2, are proposed to serve this entrance. Each array consists of one WAG and one SAG. See Figure 21-1.

To protect the faregate equipment and passengers from the elements, the design proposes a new overhead canopy with rain screens enclosing the faregate area. At the entrances to this covered area, two new roll-up security gates are proposed to allow the station to be secured during non-service hours. Due to existing site constraints, the proposed faregate sure zones for arrays W1 and W2 will overlap by approximately 8 feet, requiring an exception to the standard 15-foot surge zone requirement. On the unpaid side of the faregate arrays, under the proposed canopy, the two relocated TVMs from the demolished enclosure will be positioned to serve the unpaid passengers at this entrance. Once passengers pass through the faregate arrays, they may circulate to the platform level above via the existing stairway, escalator, and elevator. Within the paid circulation area, a new TVM is proposed to serve the paid area. Along the south side of this paid area, adjacent to the bicycle storage area, an 8-foot-tall security fence is proposed to maintain the fare-paid boundary. For egress purposes, an egress-only alarmed gate is proposed in this fence.

The eastern portion of the station includes two ground level entrances, located on the north and south faces of the building. At the north face entrance, a new faregate array (E1) is proposed. This array consists of two WAGs and two SAGs. See Figure 21-2.

Due to existing spatial constraints, the faregate array will be enclosed within a new canopy with rain screens on both sides. This enclosure provides weather protection while allowing the required 15-foot surge zone on the paid side of the array without overlapping the existing elevator and escalator surge zones. A new roll-up security gate is proposed at the end of the enclosure to allow the station to be secured during closed hours.

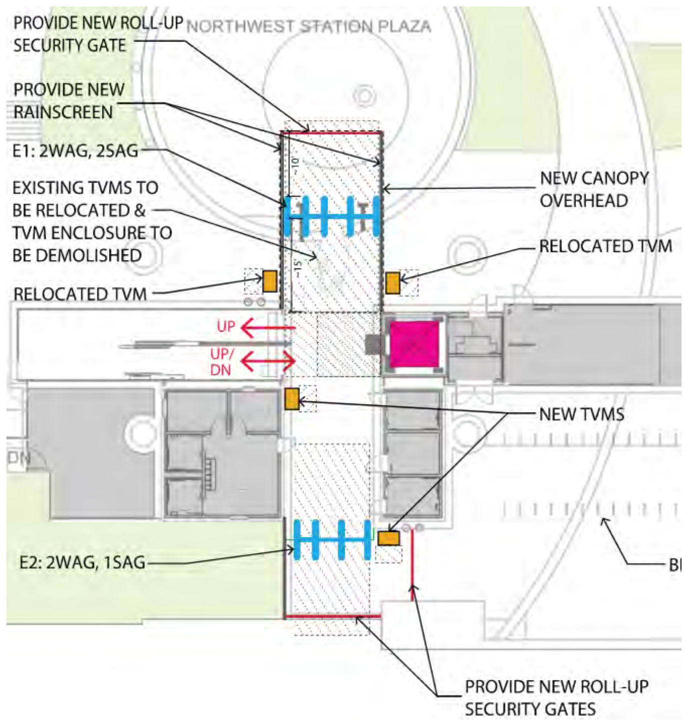

Figure 21-2 – Lynnwood City Center Station Faregate Arrays (E1 & E2)

This entrance currently contains a TVM enclosure with two machines. The enclosure will be demolished, and the two existing TVMs will be relocated to the unpaid area outside of the new faregate enclosure to serve unpaid passengers. On the south face entrance of the eastern building, opposite of faregate array E1, a second faregate array (E2) is proposed. This array consists of two WAGs and one SAG and serves passengers arriving from the adjacent parking garage and bicycle storage areas. See Figure 21-2. A new TVM is proposed on the unpaid side of the array to serve passengers entering from the South. Two new roll-up security gates are also proposed at this entrance to allow the station to be secured during non-service hours. Once passengers pass through faregate arrays E1 or E2, they may circulate to the platform level above via the existing elevator, stair, and escalator. A new TVM is proposed within this circulation area to serve the paid passengers.

21.1.4 Faregate Quantity Estimate

Table 21-1 – Lynnwood City Center Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Lynnwood City Center	W1	1	1
	W2	1	1
	E1	2	2
	E2	1	2
TOTAL		5	6

21.1.5 Ticket Vending Machines

Table 21-2 – Lynnwood City Center TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Lynnwood City Center	4	5	2	4	3

21.1.6 Passenger Assistance Phones

Lynwood City Center Station will require two PAPs, one for each paid zone.

21.2 Northgate Station

21.2.1 Overview

Northgate Station is an elevated light-rail station located along 1st Avenue NE in the Northgate neighborhood of Seattle. The station has direct connections to the Northgate Transit Center, multiple King County Metro bus routes, and the adjacent park-and-ride garage. A pedestrian bridge over I-5 provides access from the west, linking the station to North Seattle College and surrounding neighborhoods. Passenger access to the platform is provided through a mezzanine level beneath the platform, with multiple vertical circulation elements connecting the street level, mezzanine, and platform.

21.2.2 Station Layout

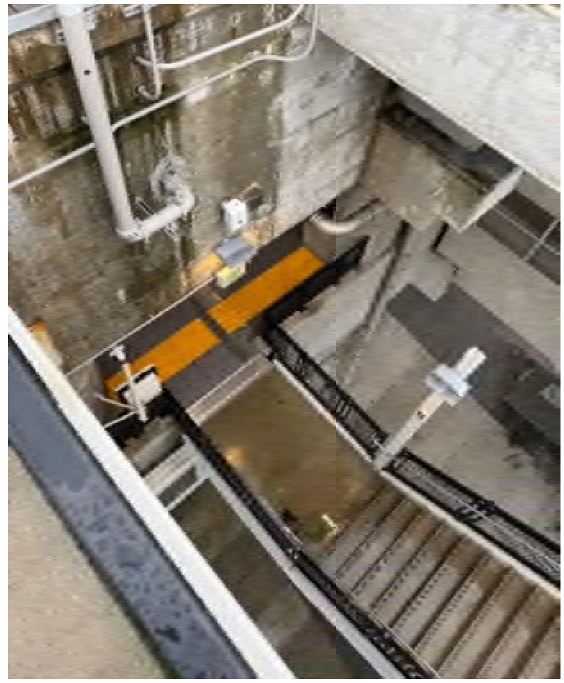

Figure 21-3 – Northgate Station Stair from Mezzanine to Platform

Northgate Station is a three-level elevated station consisting of a street level, mezzanine level, and platform level.

At the street level, passengers access the station from 1st Avenue NE, NE 103rd Street, and the adjacent Northgate Transit Center. Entrances connect to the mezzanine through stairs, escalators, and elevators. The surrounding area includes bus bays, passenger drop-off zones, and a parking garage, resulting in significant activity at street level.

The mezzanine, shown in Figure 21-3, is located directly beneath the elevated platform and serves as the primary access up to the platform through stairs, escalators, and elevators. This level includes passenger amenities such as restrooms and TVMs. The west side of the mezzanine also has a connection to the pedestrian bridge over I-5.

21.2.3 Architectural Description

The proposed fare control concept for Northgate Station establishes a fully enclosed fare-paid zone on the mezzanine level by installing faregates and 8-foot-tall security fencing at all circulation points up to the platform.

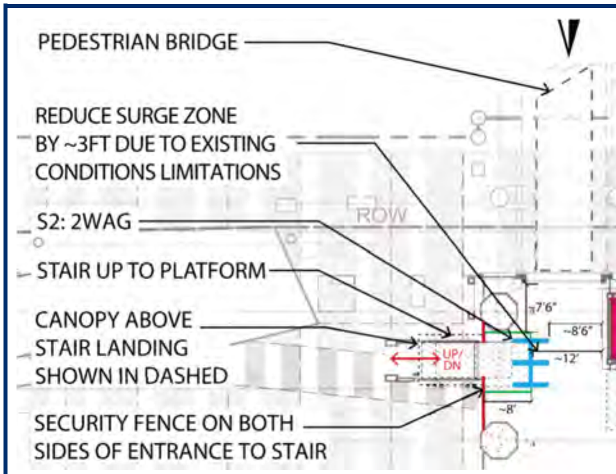

Figure 21-4 – Northgate Station Faregate Array (S2)

On the south portion of the mezzanine, passengers can enter the unpaid area through four access points: a stair from the ground level, the pedestrian bridge, a set of stairs and escalators from the southeast corner, and an elevator that terminates at the mezzanine. These access points all lead to a shared unpaid circulation area. Within this area, there are currently three TVMs; one of these machines will be relocated to the proposed paid side adjacent to the elevators leading to the platform.

The proposed design includes two faregate arrays to control access to the platform from the south mezzanine (S1 and S2). At the southernmost circulation point, adjacent to the pedestrian bridge, a stair leads directly to the platform. A faregate array (S2) is proposed at this location, consisting of two WAGs (see Figure 21-4). Due to limited space, a surge-zone exception will be required because the faregate surge zone overlaps the stair surge zone by approximately 10 feet. In the other direction, the clearance between the faregate array and the existing elevator wall will be approximately 12 feet, requiring an exception of roughly 3 feet.

Because the stairway is currently open to the elements (see Figure 21-3), a new canopy is proposed above the stair landing to protect the faregates and provide weather coverage for passengers. Additionally, the mezzanine railing adjacent to this stair will be replaced with an 8-foot-tall security fence installed between the existing columns to prevent climbing or bypassing the fare control boundary.

The remaining circulation from the south portion of the mezzanine includes an elevator and a set of escalators. A second faregate array (S1) is proposed here, consisting of two WAGs and two SAGs (see Figure 21-5). An 8-foot-tall security fence will enclose the array to maintain a continuous boundary. One relocated TVM will be placed within the paid area, allowing passengers to purchase fares before proceeding to the escalator or elevator to the platform. Passenger restrooms will also be within the fare-paid zone.

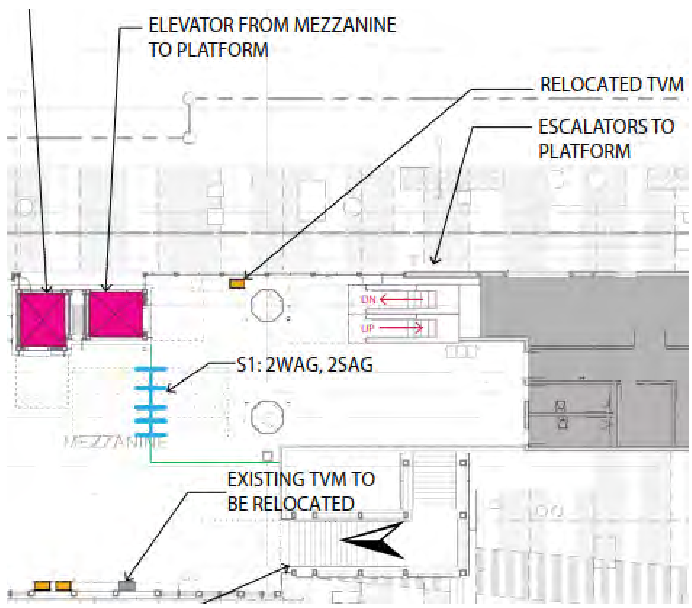

Figure 21-5 – Northgate Station Faregate Array (S1)

The north portion of the mezzanine (separate from the south portion) is accessible through a single entrance adjacent to the parking garage. From this entrance, passengers can reach the platform via an elevator or a combined stair/escalator.

A faregate array (N) is proposed in this area, consisting of two WAGs (see Figure 21-6). A typical 8-foot-tall fence will extend on both sides of the array. The array will be slightly offset into the mezzanine to allow the existing roll-up security gate to remain operational.

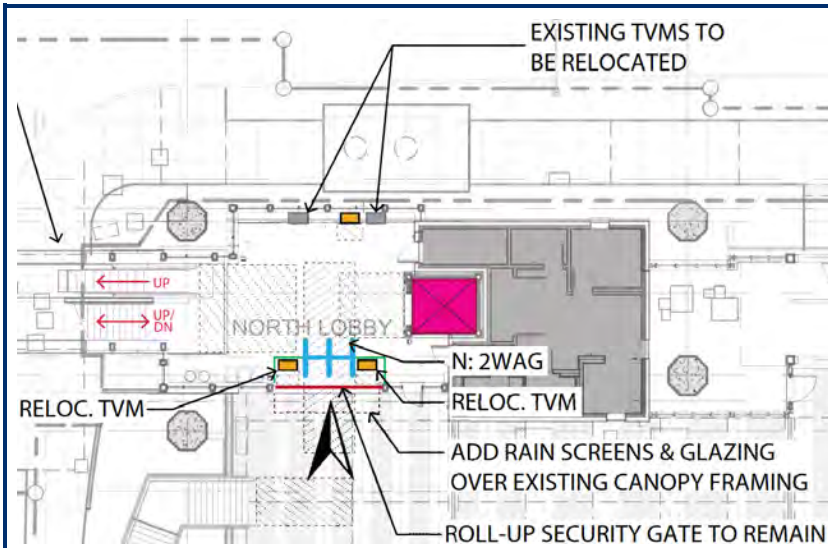

Figure 21-6 – Northgate Station Faregate Array (N)

Two of the existing TVMs will be relocated to the unpaid area adjacent to the faregate array, leaving one TVM in the paid area. To protect the faregates from weather exposure, rain screens and glazing are proposed over the existing canopy framing at the entrance. There will be a minor surge zone overlap of a few feet between the adjacent elevator and the proposed faregate array. Once past the faregate array, passengers may circulate to the platform via elevator or the stair/escalator.

21.2.4 Faregate Quantity Estimate

Table 21-3 – Northgate Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Northgate	S1	2	2
	S2	0	2
	N	0	2
TOTAL		2	6

21.2.5 Ticket Vending Machines

Table 21-4 – Northgate TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Northgate	6	4	2	3	0

21.2.6 Passenger Assistance Phones

Northgate Station will require three PAPs, one for the paid area of each faregate array.

21.3 Roosevelt Station

21.3.1 Overview

Roosevelt Station is an underground light rail station located beneath NE 65th Street and 12th Avenue NE, serving the Roosevelt neighborhood of Seattle. The station serves a dense residential and commercial area as well as nearby schools. Passenger access is provided through two street-level entrances. These entrances connect to a central mezzanine level, which distributes passengers to the platform below through multiple vertical circulation elements.

21.3.2 Station Layout

Roosevelt Station is a three-level underground station consisting of a street level, mezzanine level, and platform level.

At the street level, passengers enter the station through two separate entrance buildings located on NE 65th Street and NE 67th Street. Each entrance includes stairs, escalators, and elevators that connect directly to the mezzanine below.

The mezzanine spans the width of the station and serves as the primary circulation level. It connects both street-level entrances and provides access to the platform through stairs, escalators, and elevators. The mezzanine is currently an open, unpaid area with unrestricted movement between the two entrances and platform.

21.3.3 Architectural Description

The proposed fare control concept for Roosevelt Station establishes a fully enclosed fare-paid zone with each of the two entrance buildings by installing faregates and security fencing at the circulation points leading to the mezzanine and platform levels.

At the south entrance, located at NE 65th Street and 12th Avenue NE, passengers enter the unpaid area through the station lobby. A faregate array (S1) is proposed at this location, consisting of two WAGs and two SAGs (see Figure 21-7). An 8-foot-tall security fence will be installed on both sides of the array to maintain a continuous boundary.

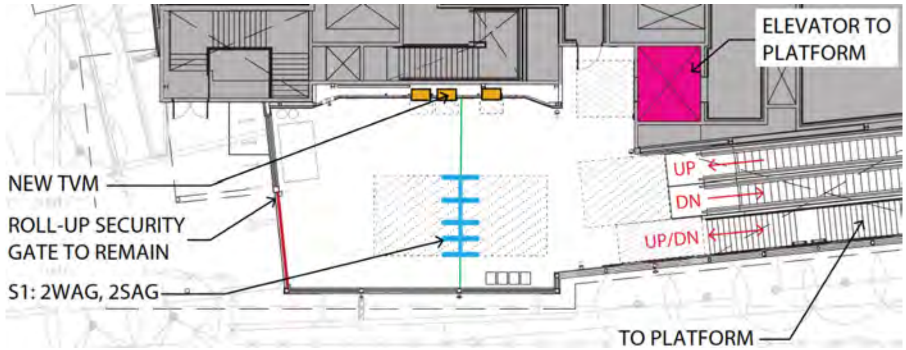

Figure 21-7 – Roosevelt Station Faregate Array (S1)

Two existing TVMs are located at this location; both will remain in place, with one positioned on the unpaid side of the faregate array and the other within the paid area. A new TVM will be added in the unpaid area for redundancy. This location includes a roll-up security gate that will remain. Past the faregate array, passengers can access the mezzanine and platform levels via elevator, stair, and escalator.

The north entrance, located at NE 67th Street and 12th Avenue NE, functions similarly to the south entrance but with a more constrained footprint. A faregate array (N1) is proposed at this location, consisting of two WAGs and two SAGs (see Figure 21-8). As with the south entrance, an 8-foot-tall security fence will be installed on both sides of the array.

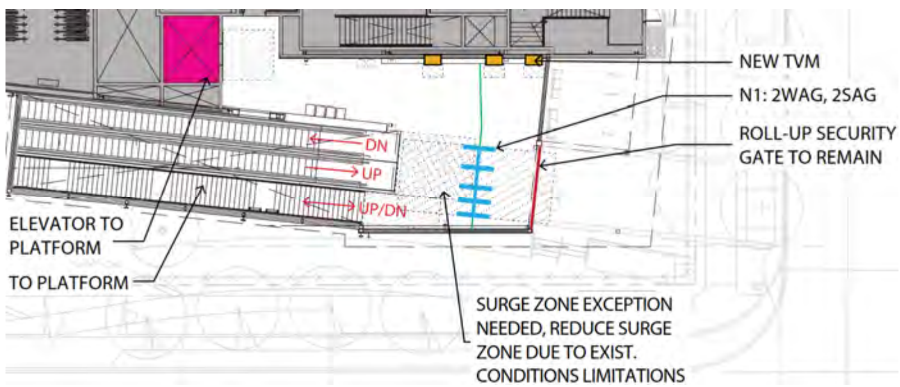

Figure 21-8 – Roosevelt Station Faregate Array (N1)

Two existing TVMs are located at this location; both will remain in place, with one positioned on the unpaid side of the faregate array and the other within the paid area. A new TVM will be added in the unpaid area for redundancy. The entrance also includes a roll-up security gate that will remain. Beyond the faregate array, passengers access the mezzanine and platform levels through a stair, escalator, and elevator. Due to the limited space within the north entrance, the proposed faregate array will result in a significant overlap of surge zones between the escalator and the faregates. The two surge zones will overlap almost entirely, with approximately 16 feet between them. A surge-zone exception will be required at this location to accommodate the existing conditions.

21.3.4 Faregate Quantity Estimate

Table 21-5 – Roosevelt Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Roosevelt	S1	2	2
	N1	2	2
TOTAL		4	4

21.3.5 Ticket Vending Machines

Table 21-6 – Roosevelt TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Roosevelt	4	4	2	0	2

21.3.6 Passenger Assistance Phones

Roosevelt Station will require two PAPs, one for the paid area of each faregate array.

21.4 U District Station

21.4.1 Overview

The U District Station is an underground light rail station located beneath Brooklyn Avenue NE in the University District neighborhood of Seattle. The station serves a dense, mixed-use area that includes the University of Washington campus. Passenger access is provided through two separate entrances located at NE 43rd Street and NE 45th Street. Each entrance connects to a shared mezzanine level that distributes passengers to the underground platform level through stairs, escalators, and elevators.

21.4.2 Station Layout

U District Station is a three-level underground station consisting of a street level, mezzanine level, and platform level.

At the street level, passengers enter the station through two entrances located at NE 43rd Street and NE 45th Street along Brooklyn Avenue NE. Each entrance includes stairs, escalators, and elevators that connect directly to the mezzanine below. The surrounding area includes high-density residential and university buildings, resulting in significant pedestrian activity.

The mezzanine spans the width of the station and serves as the primary circulation level. It connects both street-level entrances and provides access to the platform below. The mezzanine is currently an open unpaid area with unrestricted movement between the two entrances.

21.4.3 Architectural Description

The proposed faregate control concept for U District Station establishes a fully enclosed fare-paid zone by installing faregates and security fencing at all circulation points that provide direct access to the platform. Because both entrances include elevators that connect directly from the street level to the platform, faregate arrays are required at each street-level elevator, with a larger fare gate array located on the mezzanine to control access from the unpaid circulation.

At the south entrance, located at NE 43rd Street and Brooklyn Avenue NE, passengers may enter the station from either the 43rd Street side or the Brooklyn Avenue side. Each entrance is equipped with an existing roll-up security gate that will remain in place. Within the street level lobby, an elevator provides direct access to the platform.

To control this circulation path, a faregate array (S1) is proposed around the elevator, consisting of two WAGs (see Figure 21-9). An 8-foot-tall security fence will be installed on both sides of the array to maintain a continuous fare control boundary. The faregate surge zone will overlap the elevator surge zone by approximately 5 feet due to existing spatial constraints, requiring an exception to the standard 15-foot surge zone. This entrance also contains two existing TVMs, both of which will remain in place. Passengers who are not yet in the fare-paid zone will continue to circulate to the mezzanine level via the stairway and escalator, as the primary fare gate array for this entrance will be located on the mezzanine.

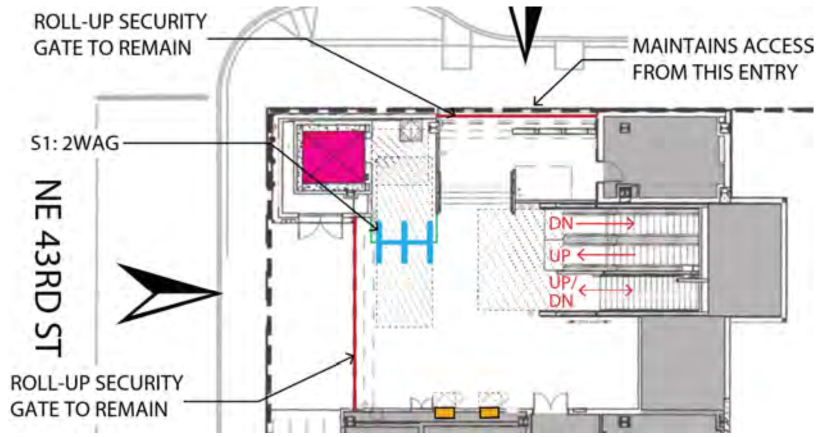

Figure 21-9 – U District Station Faregate Array (S1)

The north entrance, located around NE 45th Street and Brooklyn Avenue NE, follows a similar approach. This entrance has a single opening equipped with an existing roll-up security gate that will remain. Unpaid passengers may enter the station and travel to the mezzanine via the stairway, escalator, or elevator. As with the south entrance, the street level elevator provides direct access to the platform, requiring a faregate array (N1) around the elevator consisting of two WAGs (see Figure 21-10). An 8-foot-tall security fence will enclose the array.

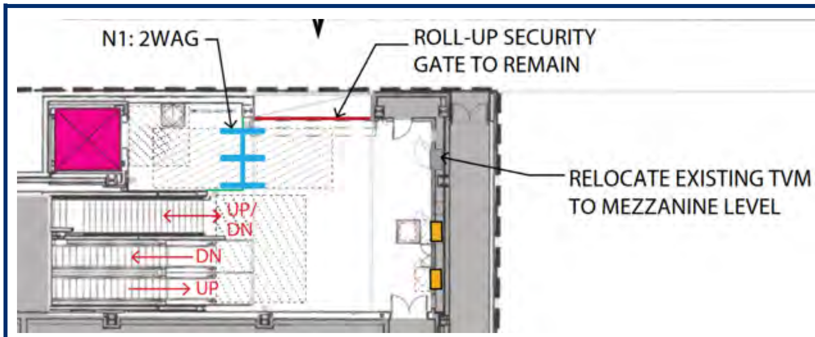

Figure 21-10 – U District Station Faregate Array (N1)

Three TVMs are currently located at this entrance; two will remain in place, and one will be relocated to the mezzanine level. A surge zone exception is needed at this array, because the faregate surge zone will overlap the elevator surge zone by approximately 6 feet at this location.

The paid zones of arrays S1 and N1 have insufficient space to install paid-side TVMs, and the elevators served by these arrays go directly to the station platform. To enable passengers using the elevators to purchase a fare (if necessary) to exit through Array S1 or N1, one new TVM will be installed on the platform outside of both elevators. See Figure 21-11 and Figure 21-12.

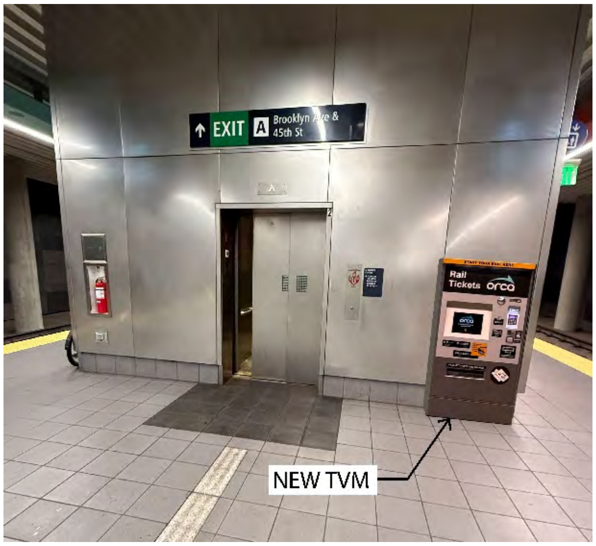

Figure 21-11 – U District Station Platform Level TVM at Exit A

Figure 21-12 – U District Station Platform Level TVM at Exit B

The mezzanine level is accessible to unpaid passengers from both entrance buildings and serves as the primary transition point to the platform. A faregate array (M1) is proposed on this level to control access to the stairs and escalators leading down to the platform (see Figure 21-13). This array consists of two WAGs and four SAGs.

Due to existing spatial constraints, a surge zone exception is needed at this location as the faregate surge zone will overlap the surge zone of an existing stairway to the platform by approximately 8 feet.

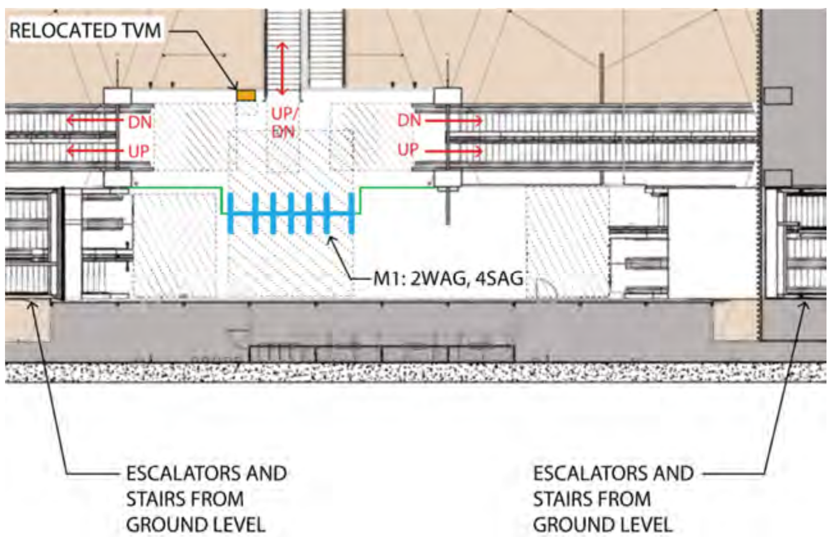

Figure 21-13 – U District Station Faregate Array (M1)

Beyond the faregate array, a relocated TVM from the north entrance will be positioned within the paid area. From this point, passengers may use the escalators or stairs to travel down to the platform.

WSP also studied an alternative scheme in which fare control would occur entirely at the street-level entrances rather than on the mezzanine. In this scheme, the Brooklyn Avenue NE entrance of the southern building would remain closed at all times, restricting access to a single controlled entry point (see Figure 21-14).

A faregate array consisting of two WAGs and two SAGs would be installed at the entrance before passengers access the elevator, escalator or stairway to the platform and mezzanine. One of the existing TVMs would be shifted slightly to allow one machine to serve the unpaid side and one to serve the paid side.

The north entrance would follow a similar approach, with a faregate array consisting of one WAG and three SAGs. One of the three existing TVMs would be relocated to the unpaid side, resulting in two machines on the unpaid side and one on the paid side.

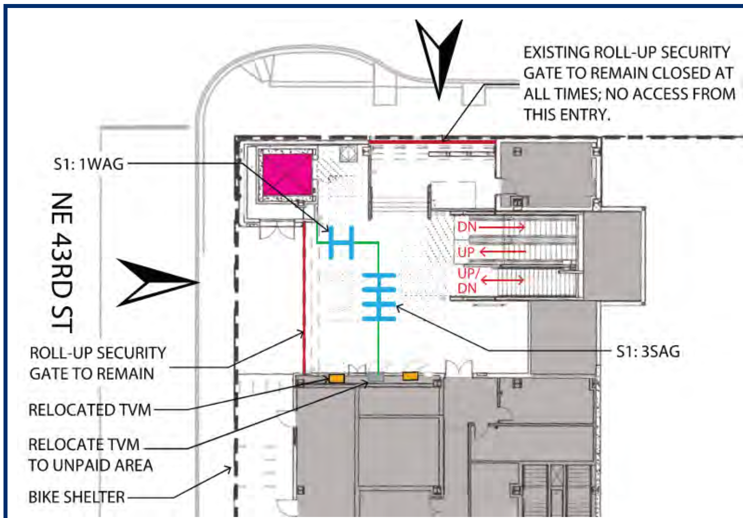

Figure 21-14 – U District Station Entry to Remain Closed in Alternative Scheme

With this alternative scheme, the mezzanine level would remain unchanged and would not require fare control elements. This design option was not carried forward as a potential station design because it would require permanently closing the Brooklyn Avenue NE entrance. Keeping both entrances open would maintain existing passenger circulation patterns and prevent the creation of dead-end areas within the station.

21.4.4 Faregate Quantity Estimate

Table 21-7 – U District Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
U District	S1	0	2
	N1	0	2
	M1	4	2
TOTAL		4	6

21.4.5 Ticket Vending Machines

Table 21-8 – U District TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
U District	5	4	3	1	2

21.4.6 Passenger Assistance Phones

U District Station will require three PAPs, one for the paid area of each faregate array.

21.5 University of Washington Station

21.5.1 Overview

University of Washington Station is an underground light rail station located near Husky Stadium at the southeast edge of the UW Campus. The station is surrounded by the university, athletic facilities, the Burke-Gilman Trail, and academic and medical buildings. Passenger access is provided through two primary levels: a surface level entrance plaza and an elevated pedestrian bridge that links the station to the UW campus across Montlake Boulevard. Both access points connect to a shared mezzanine level, which distributes passengers to the platform below.

21.5.2 Station Layout

University of Washington Station consists of a surface level, a pedestrian bridge level, a mezzanine level, and a platform level.

At the surface level, passengers enter the station from the plaza adjacent to Husky Stadium and the UW Medical Center. This level includes stairs, escalators, and elevators that connect directly to the mezzanine. It also provides access up to the pedestrian bridge via escalator, elevators, and stairs.

The pedestrian bridge level spans Montlake Boulevard and provides a direct connection from the UW Campus to the station. Passengers arriving from the bridge can access the station through stairs and elevators that descend to the mezzanine.

The mezzanine level serves as the primary circulation for the station. It connects from all entrance points and provides multiple circulation options to the platform via stairs, escalators, and elevators. The mezzanine is currently an open, unpaid area with unrestricted movement between the surface and bridge entrances.

21.5.3 Architectural Description

The proposed faregate control concept for University of Washington Station establishes a fully enclosed fare-paid zone by installing faregates and security fencing at all circulation points that provide access to the platform. Because the station includes multiple access points at both the surface level and the pedestrian bridge level, faregate arrays are required at locations where passengers reach the platform or mezzanine.

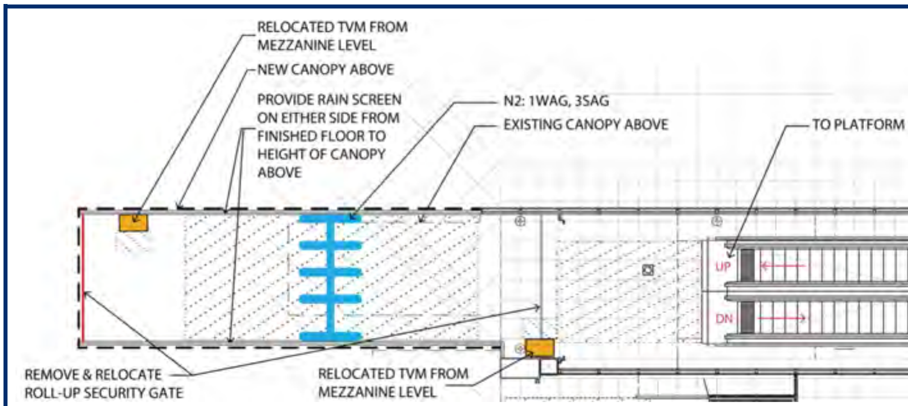

Figure 21-15 – University of Washington Station Faregate Array (N2)

At the surface level, the southernmost entrance is located adjacent to Montlake Boulevard NE. This entrance includes an escalator that connects directly to the mezzanine. A faregate array (N2) is proposed at this location, consisting of one WAG and three SAGs (see Figure 21-15).

To accommodate the array, the existing canopy structure (see Figure 21-16) overhead will be widened and extended. The design also proposes a rain screen on either side of the extended canopy, extending from the finished floor to the height of the canopy, to protect passengers and fare equipment from the elements. The existing roll-up security gate will be removed and reinstalled at the new end of the extended canopy.

Figure 21-16 – University of Washington Station Existing Canopy to be Widened and Extended

A TVM will be relocated from the mezzanine level to the unpaid area, and another relocated TVM will be positioned in the paid area beyond the array, allowing one machine to serve each side. Once past the faregates, passengers may circulate down the escalator to the mezzanine and platform. Adjacent to this entrance is a stairway and escalator that connect directly to the pedestrian bridge above.

The second surface level entrance is located beneath the pedestrian bridge near the elevators. A faregate array (N1) is proposed at this location, consisting of four SAGs and two WAGs (see Figure 21-17).

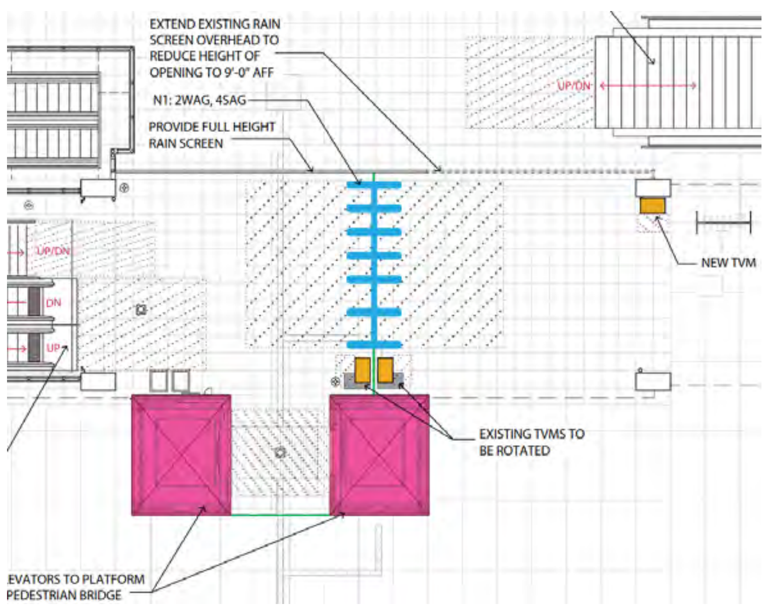

Figure 21-17 – University of Washington Station Faregate Array (N1)

Two existing TVMs near the elevators will be rotated 90 degrees so that one serves the unpaid area and one serves the paid area. A new TVM will be installed in the unpaid area to provide redundancy.

To protect the fare-paid zone and maintain a physical boundary, a full-height vertical side rain screen and an extension of the existing overhead rain screen will be installed to reduce the height of the opening to 9 feet above the finished floor (see Figure 21-18).The elevators at this entrance connect to the platform and the pedestrian bridge, and a stairway and escalator provide circulation to and from the mezzanine and platform. Security fencing will be installed between the elevators to maintain the fare-paid zone boundary.

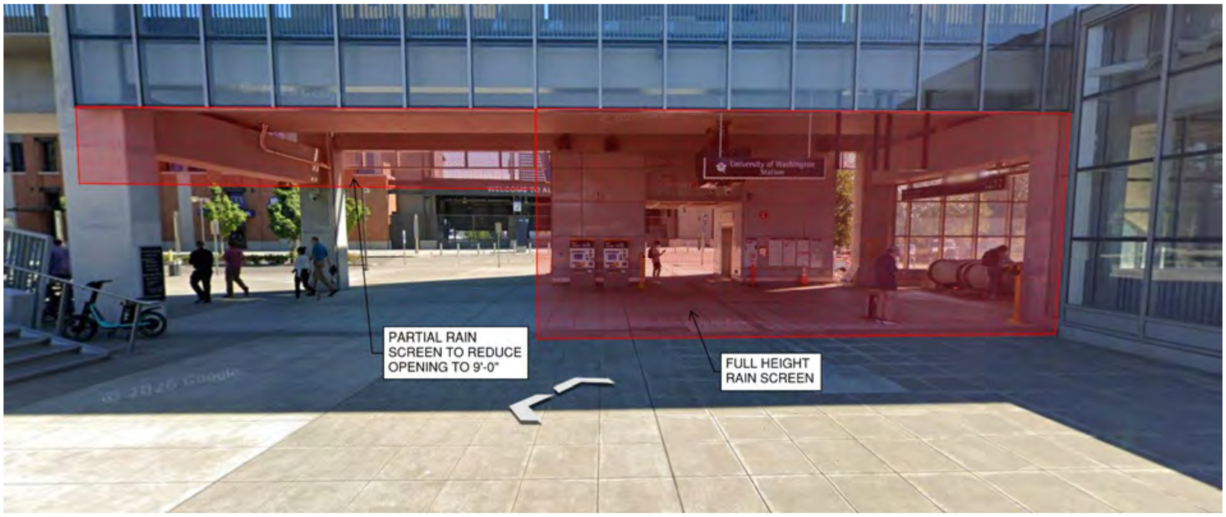

Figure 21-18 – University of Washington Station Rain Screen Modifications

At the pedestrian bridge level, passengers arriving from the UW campus access the station through two elevators that connect to the surface level, mezzanine, and platform. Because this circulation path provides direct access to the platform, a faregate array (referred to as the Bridge faregate array) is proposed at this location, see Figure 21-19. The array will consist of two WAGs and surrounding security fencing. Due to limited space on the bridge, the faregate surge zone will partially overlap the elevator surge zone by approximately 6 feet, requiring a surge zone exception to the typical 15-foot requirement.

Two TVMs are located on this level; one will remain in place in the unpaid area, and the other will be rotated 90 degrees to serve the paid area. At the south end of the pedestrian bridge, a stairway and escalator provide circulation down to the surface level.

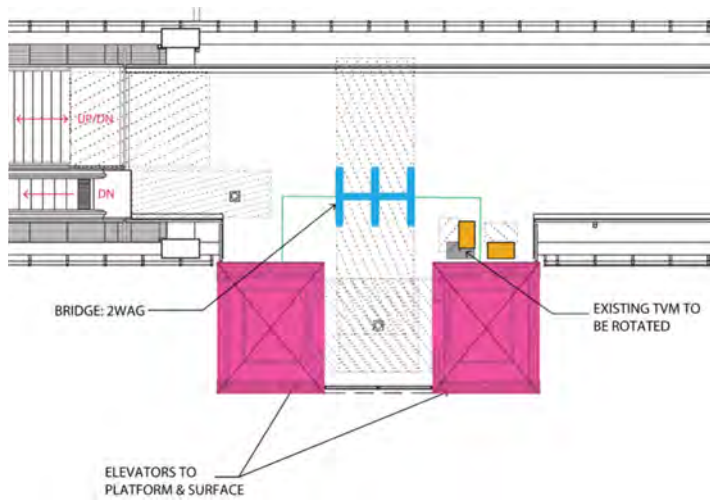

Figure 21-19 – University of Washington Station Faregate Array (Bridge)

21.5.4 Faregate Quantity Estimate

Table 21-9 – University of Washington Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
University of Washington	N1	4	2
	N2	3	1
	Bridge	0	2
TOTAL		7	5

21.5.5 Ticket Vending Machines

Table 21-10 – University of Washington TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
University of Washington	6	4	3	5	1

21.5.6 Passenger Assistance Phones

University of Washington Station will require three PAPs, one for the paid area of each faregate array.

21.6 Capitol Hill Station

21.6.1 Overview

Capitol Hill Station is an underground light rail station located beneath Broadway between E John Street and E Denny Way in the Capitol Hill neighborhood of Seattle. The station serves a dense urban district. Passenger access is provided through three separate entrances on the north, southwest, and southeast sides of the station.

21.6.2 Station Layout

Capitol Hill Station is a three-level underground station consisting of a street level, mezzanine level, and platform level.

At the street level, passengers enter the station through entrance buildings: the north entrance at the corner of E John Street and Broadway E, the southeast entrance at the corner of E Denny Way and Nagle Place, and the northwest entrance on the corner of E Denny Way and Broadway E. Each entrance includes stairs, escalators, and elevators that connect directly to the mezzanine below. The surrounding area includes dense mixed-use development and pedestrian-oriented streets, resulting in high ridership and foot traffic.

The mezzanine level spans the width of the station and serves as the primary circulation space. It connects all three street-level entrances and provides access to the platform through multiple vertical circulation points, including stairs, escalators, and elevators. It is currently an open, unpaid area with unrestricted movement between entrances.

21.6.3 Architectural Description

The proposed faregate control concept for Capitol Hill Station establishes a fully enclosed fare-paid zone by installing faregates and security fencing at each of the three entrance buildings.

The north entrance is located at the corner of E John Street and Broadway E. There is an existing roll-up security gate at the entrance that will remain. A faregate array (N1) is proposed within the station entrance, consisting of two WAGs and three SAGs (see Figure 21-20). Security fencing will be installed on both sides of the array to maintain the paid zone boundary.

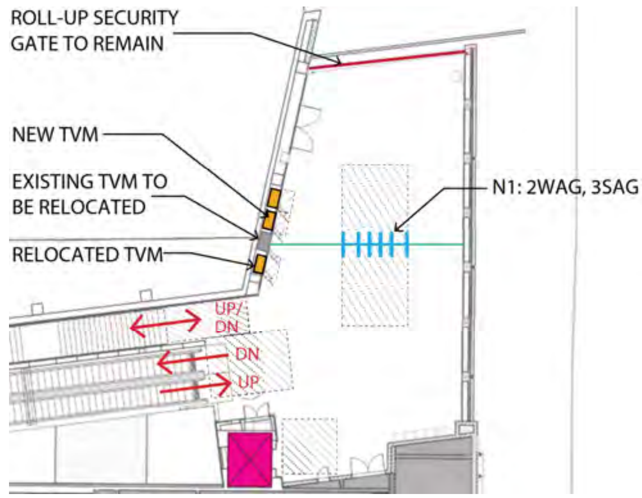

Figure 21-20 – Capitol Hill Station Faregate Array (N1)

Four alcoves for TVMs exist along the south wall of the entrance building. Two existing TVMs are installed in alcoves 1 and 3, numbered from west to east (from the top on the drawing). The TVM in alcove 1 will remain, while the TVM in alcove 3 will be relocated to alcove 4. A new TVM will be added to alcove 2. The faregate array will be positioned in a north-south orientation with the fence meeting the south wall centered on the now-vacant TVM alcove 3. The result is two TVMs on the unpaid side and one TVM on the paid side. Once past the faregates, passengers may access the mezzanine and platform via the existing elevator, stair, and escalator.

At the southeast entrance, located at the corner of E Denny Way and Nagle Place, the design follows a similar approach. The existing roll-up security gate at the entrance will remain. A faregate array (S2) is proposed at this location, consisting of two WAGs and two SAGs, with security fencing surrounding the array to maintain the fare-paid zone (see Figure 21-21). Due to existing spatial constraints, a surge zone exception to the 15-foot requirement is needed as the proposed faregate surge zone will overlap the landing surge zone of the existing stairway by approximately 4 feet.

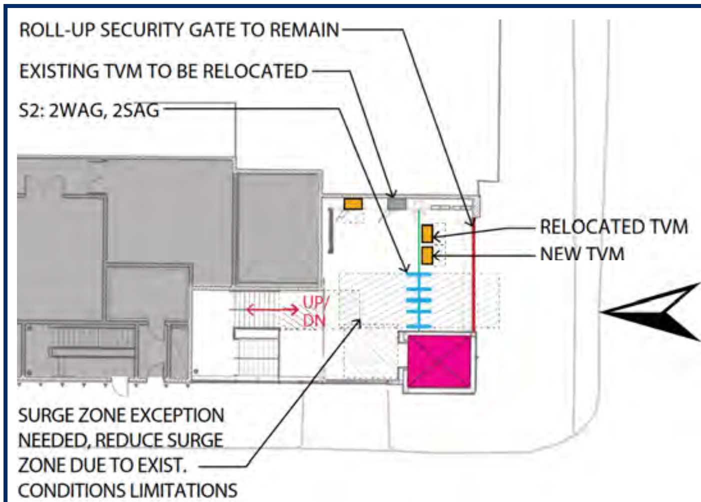

Figure 21-21 – Capitol Hill Station Faregate Array (S2)

Two TVMs are located in this entrance; one will remain in place to serve the paid side, and the machine closest to the entrance will be relocated to the unpaid side along the fence, facing the station entry. A new TVM will be added adjacent to the relocated TVM on the unpaid side.

At the southwest entrance located at the corner of E Denny Way and Broadway E, the design mirrors the overall station approach. The existing roll-up security gate at the entrance will remain. Because the southern façade of this entrance (adjacent to the bicycle parking area) is not fully enclosed, the design proposes adding a vertical rain screen along this side to protect the faregates and passengers from the elements.

A faregate array (S1) is proposed at this entrance, consisting of two WAGs and three SAGs (see Figure 21-22). Due to existing conditions and limited space, the faregate surge zones will significantly overlap the existing surge zones of the elevator, stair, and escalator, requiring an exception to the 15-foot surge zone requirement.

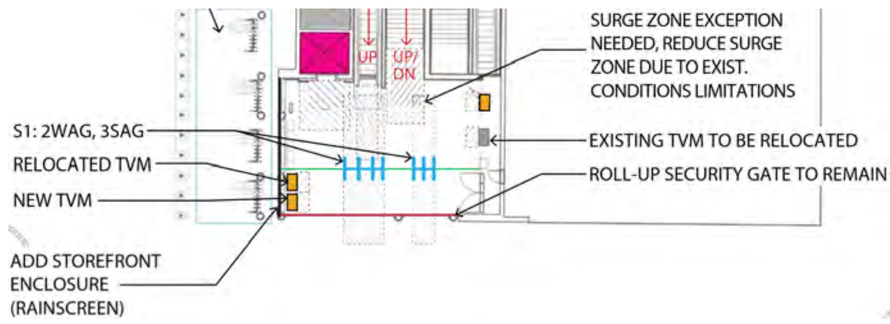

Figure 21-22 – Capitol Hill Station Faregate Array (S1)

Two TVMs are located at this entrance; one will remain to serve the paid side, and the other will be relocated to the unpaid side against the proposed rain screen. A new TVM will be added adjacent to the relocated TVM on the unpaid side for redundancy.

21.6.4 Faregate Quantity Estimate

Table 21-11 – Capitol Hill Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Capitol Hill	S1	3	2
	S2	2	2
	N1	3	2
TOTAL		8	6

21.6.5 Ticket Vending Machines

Table 21-12 – Capitol Hill TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Capitol Hill	6	6	3	3	3

21.6.6 Passenger Assistance Phones

Capitol Hill Station will require three PAPs, one for the paid area of each faregate array.

21.7 Westlake Station

21.7.1 Overview

Westlake Station is a high-ridership underground light rail station located beneath Pine Street in the center of Downtown Seattle. The station serves as a major transfer point, with access to the Seattle Center Monorail, South Lake Union Streetcar, and multiple King County Metro bus routes along 3rd and 4th Avenues. The mezzanine above the platform connects to several street-level entrances integrated into adjacent buildings, resulting in dispersed passenger entry points and complex circulation patterns.

21.7.2 Station Layout

Westlake Station is a three-level underground station consisting of a street level, a mezzanine level, and a platform level.

On the street level, passenger access is provided through multiple entrances along Pine Street, 3rd Avenue, 4th Avenue, and 5th Avenue. Entrances are integrated into adjacent buildings, such as Westlake Center, the Nordstrom block, and surrounding retail structures. Each entrance connects to the mezzanine via stairs, escalators, and elevators.

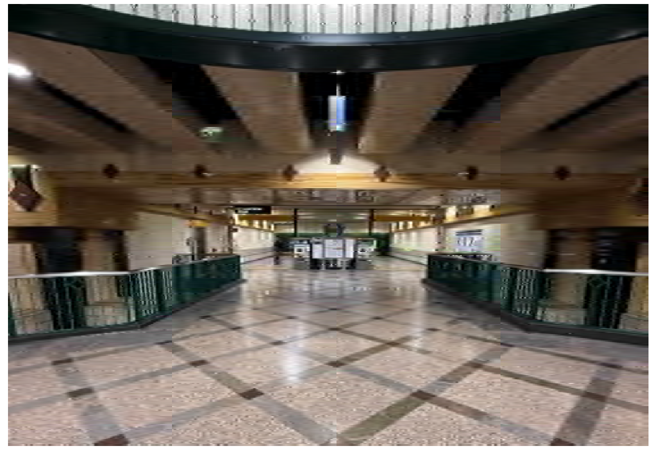

Figure 21-23 – Westlake Station Mezzanine Level

The mezzanine, shown in Figure 21-23, spans the length of the station and serves as the primary circulation level. The mezzanine connects all street-level entrances and provides access to the platform through elevators, stairs, and escalators. The mezzanine is currently an open, unpaid area with unrestricted movement between entrances and the platform.

21.7.3 Architectural Description

The proposed faregate control concept for Westlake Station establishes a fully enclosed fare-paid zone on the mezzanine level by installing faregates and 8-foot-tall security fencing at all circulation points connecting from street level or the monorail. The design will ensure that all passengers entering the platform level must pass through a controlled access point.

Of the 14 stations identified for faregates, Westlake Station is the most complex, requiring more arrays than any other station. For clarity, Figure 21-24 provides an overview of the entire mezzanine.

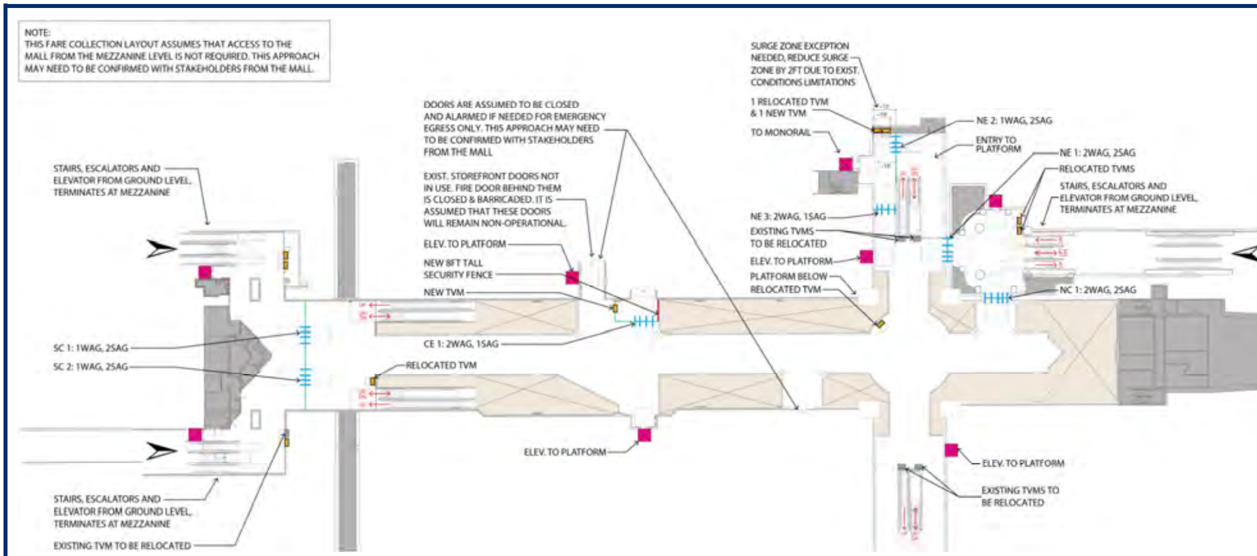

Figure 21-24 – Westlake Station Mezzanine Plan View

Two faregate arrays (SC1 and SC2) will be located at the south end of the mezzanine to control access from the stairs, escalators, and elevators arriving at the mezzanine from the street level. Faregate array

SC1 will consist of one WAG and two SAGs. Faregate array SC2 will also consist of one WAG and two SAGs (see Figure 21-25). An 8-foot-tall security fence will continue the remaining width of the mezzanine to maintain a continuous secure boundary and prevent bypassing or climbing over adjacent railings. There are presently four TVMs in this area. Three TVMs will remain in place, while one will be moved to the fare-paid zone next to a stairway or escalator leading to the platform.

At the center of the mezzanine level, the two elevators that connect directly to the platform will remain within the proposed fare-paid zone and will not require faregate arrays. This area is already contained by the proposed fare-paid boundary.

A small faregate array (CE1) with two WAGs and one SAG is proposed to be added at the entrance doors leading to the Nordstrom Rack store, Figure 21-26. To maintain a continuous secure boundary, the adjacent handrail will be extended vertically to 8 feet. A new TVM is proposed in this area to serve the unpaid passengers entering through array CE1.

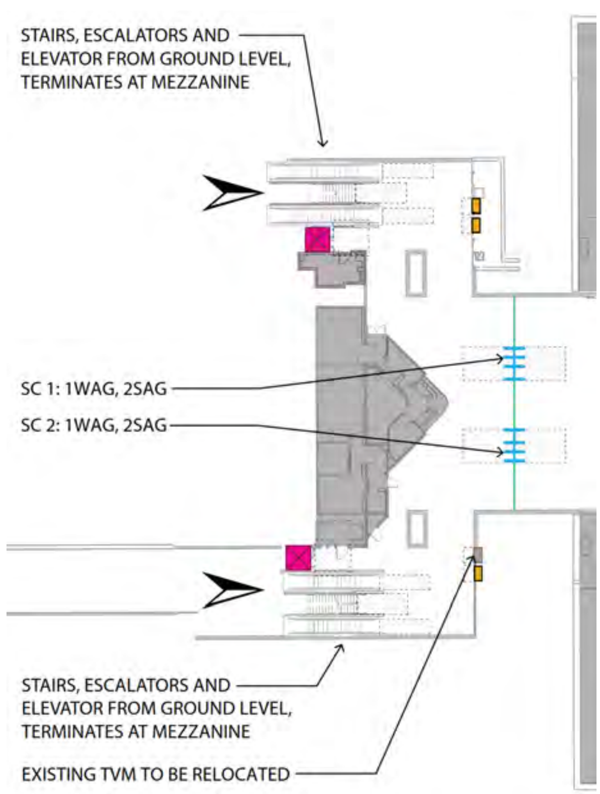

Figure 21-25 – Westlake Station Faregate Arrays (SC1 & SC2)

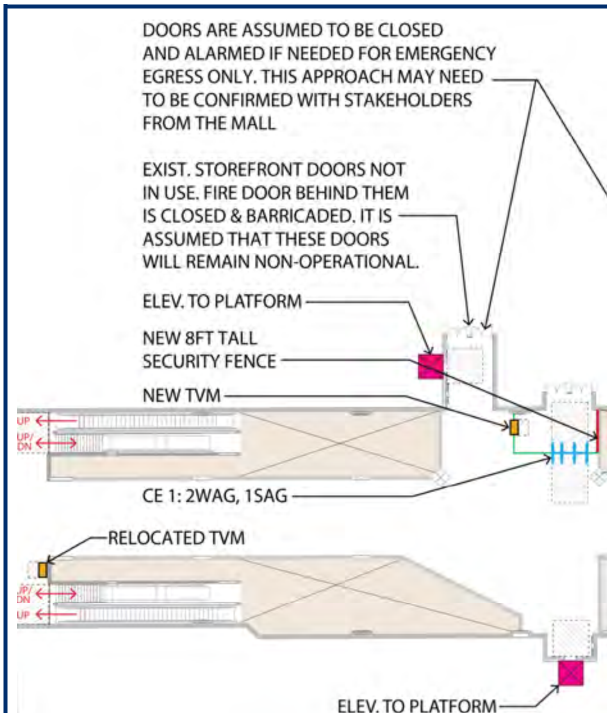

Figure 21-26 – Westlake Station Faregate Array (CE1)

Figure 21-27 shows the active doors where faregate array CE1 is proposed to be installed. The existing storefront doors to the south of faregate array CE1 are not in use. The fire door behind them is closed and barricaded. It is assumed that these doors will remain non-operational; therefore, no faregate array is proposed at this location.

Additionally, the entrance to Nordstrom Rack on the east side of the Mezzanine is assumed to be closed and alarmed if needed for emergency egress only.

This approach may need to be confirmed with stakeholders from the mall. Figure 21-28 shows the closed entrance.

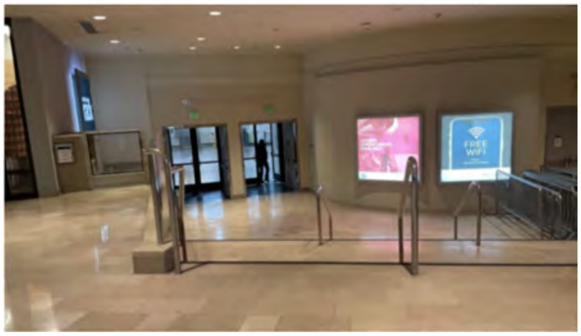

Figure 21-27 – Active Doors from Inside the Nordstrom Rack Store

Figure 21-28 – Closed Nordstrom Entrance on East side of Mezzanine

In the northwest portion of the mezzanine, there is a dedicated elevator that serves passengers arriving from the Seattle Center Monorail. Two faregate arrays (NE2 and NE3) are proposed around the monorail elevator landing area. Array NE2 consists of one WAG and two SAGs, whereas array NE3 includes two WAGs and one SAG (see Figure 21-29).

The two faregate arrays at this location will allow passengers to circulate in both directions around the existing stairway and escalator, preventing any dead-end circulation paths. A relocated TVM will be installed in the unpaid area before the arrays, as well as a new TVM to provide redundancy. Additionally, faregate array NE2 will require an exception to the 15-foot surge zone requirement for the faregates. Due to existing conditions, the surge area adjacent to the monorail connection is approximately 13 feet.

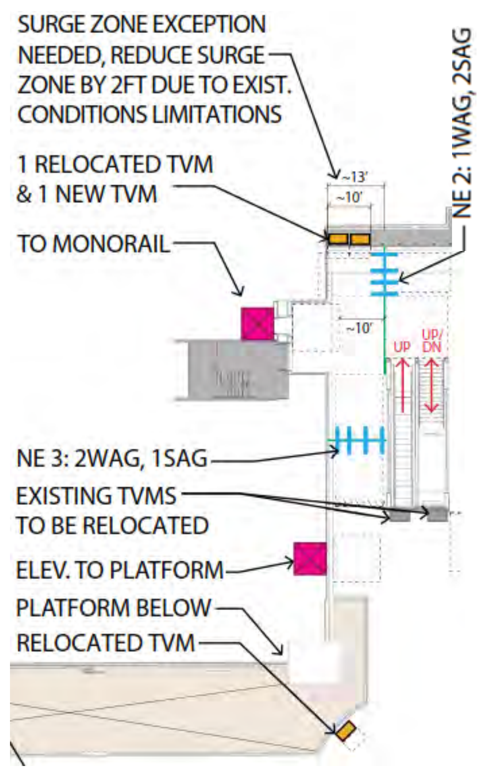

Figure 21-29 – Westlake Station Faregate Arrays (NE2 & NE3)

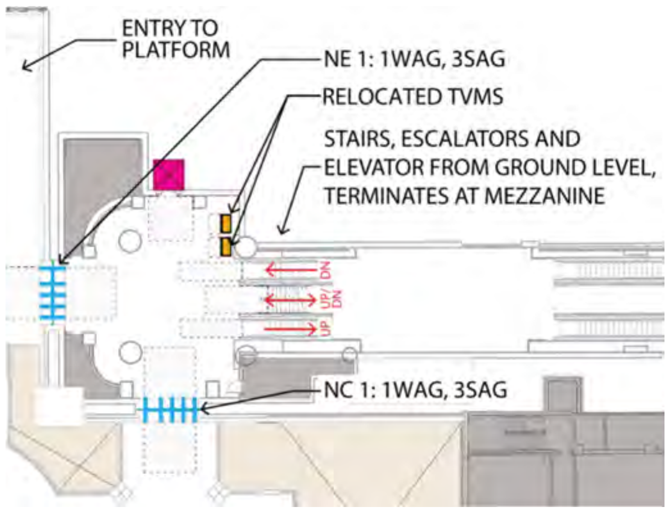

Figure 21-30 – Westlake Station Faregate Arrays (NE1 & NC1)

The northwest portion of the mezzanine handles pedestrian traffic from the street-level entrances and internal building connections. Two faregate arrays will be provided to control pedestrian traffic flows, NE1 and NC1, each with one WAG and three SAGs (see Figure 21-30). Two relocated TVMs will be installed in the unpaid area at this location to serve passengers before entering the station mezzanine.

To allow for TVMs in the unpaid areas, the following existing machines will be relocated: two machines in the northwest area of the mezzanine, two machines in the northeast area of the mezzanine, and one of the existing machines in the southeast portion of the mezzanine. This will result in three TVMs in the unpaid area before faregate arrays SC1 & SC2, two relocated TVMs in the unpaid area before faregate arrays NE1 & NC1, one relocated TVM in the unpaid area before faregate arrays NE2 & NE3, and two relocated TVMs in the mezzanine paid area.

21.7.4 Faregate Quantity Estimate

Table 21-13 – Westlake Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Westlake	SC1	2	1
	SC2	2	1
	CE1	1	2
	NE1	2	2
	NE2	2	1
	NE3	1	2
	NC1	2	2
TOTAL		12	11

21.7.5 Ticket Vending Machines

Table 21-14 – Westlake TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Westlake	8	8	2	5	2

21.7.6 Passenger Assistance Phones

Westlake Station will require six PAPs. Faregate arrays NE2 and NE3 both protect the same paid area, so a single PAP will serve both arrays. The other arrays will each require a PAP.

21.8 Symphony Station

21.8.1 Overview

Symphony Station is an underground light rail station located beneath 3rd Avenue between University Street and Union Street in Downtown Seattle. The station serves a dense cultural and commercial district, surrounded by Benaroya Hall, the Seattle Art Museum, office towers, and residential development. Passenger access is provided through multiple street-level entrances along 2nd Avenue, 3rd Avenue, and University Street. Each entrance connects to a shared mezzanine level that distributes passengers to the platform below.

21.8.2 Station Layout

Symphony Station is a three-level underground station consisting of a street level, mezzanine level, and platform level.

At the street level, passengers enter the station through several entrances along 2nd Avenue, 3rd Avenue, and University Street. Each entrance connects down to the mezzanine level below.

The mezzanine level spans the width of the station and serves as the primary circulation level. It connects all street-level entrances and provides access to the platform through stairs, escalators, and elevators. The mezzanine is currently an open unpaid area with unrestricted movement between entrances.

21.8.3 Architectural Description

The proposed faregate control concept for Symphony Station establishes a fully enclosed fare-paid zone by installing faregates and security fencing at each of the four entrances into the mezzanine level. Because all entrances provide direct access to the mezzanine, and the mezzanine connects directly to the platform, each entry will require a faregate array to maintain a consistent fare-paid boundary throughout the station.

On the north side of the mezzanine, there are two entrances. The first entrance is a ramp connection to the University Street and 2nd Avenue. To control passenger flow from this entrance into the mezzanine, a faregate array (N1) is proposed, consisting of two WAGs and one SAG, with security fencing on both sides of the array (see Figure 21-31). Because the mezzanine overlooks the platform below with an existing glass railing, the railing in this area will be extended to 8 feet in height to maintain a continuous boundary before entering the fare-paid zone.

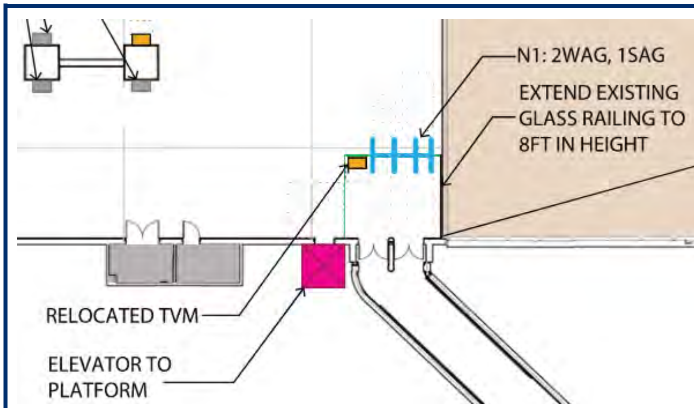

Figure 21-31 – Symphony Station Faregate Array (N1)

The northern portion of the mezzanine contains four existing TVMs; one will remain in place, and the other three will be relocated to the unpaid areas at each entrance (one adjacent to the N1 array and two before the N2 array).

The second entrance on the north side of the mezzanine is accessed via stairway and escalator from University Street and 3rd Avenue. A faregate array (N2) is proposed at the base of the stairway and escalator, consisting of two WAGs and one SAG, with security fencing on either side (see Figure 21-32). Once passengers pass through the faregates, they may travel down to the platform via the existing elevators, stairs, or escalators.

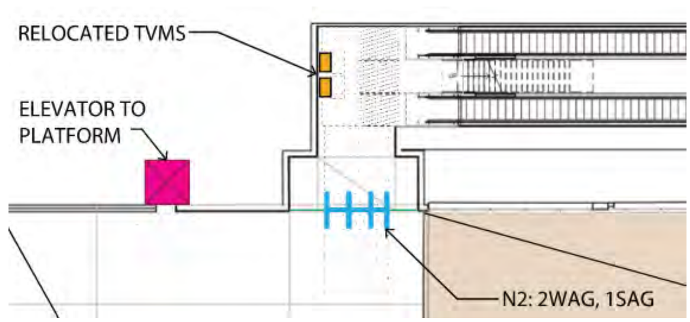

Figure 21-32 – Symphony Station Faregate Array (N2)

On the south side of the mezzanine, there are two entrances from Seneca Street and 3rd Avenue. One entrance includes an escalator that descends from the surface level, while the other entrance includes an elevator and stairway. A faregate array is proposed at each entrance (S1 and S2), with each array consisting of two WAGs and one SAG, surrounded by security fencing to maintain the fare-paid zone (see Figure 21-33).

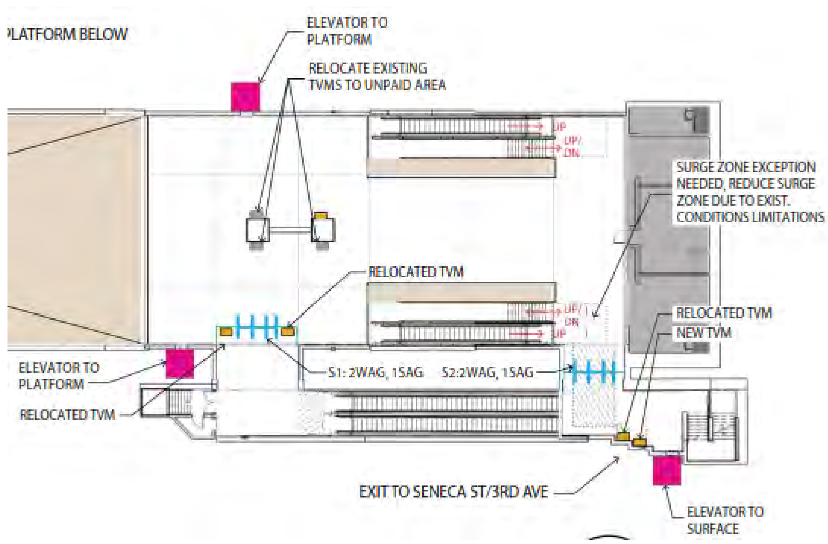

Figure 21-33 – Symphony Station Faregate Arrays (S1 & S2)

The southern portion of the mezzanine contains four existing TVMs; one will remain in the paid area, three will be relocated to the unpaid side (two adjacent to the S1 array and one in the entry near the S2 array). One new TVM will be installed in the entry near the S2 array, providing redundancy.

At both southern entrances, the proposed faregate surge zones overlap the existing escalator surge zones due to existing spatial constraints. Once past the faregates, passengers may travel down to the platform via elevators, stairs, or escalators.

21.8.4 Faregate Quantity Estimate

Table 21-15 – Symphony Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Symphony	S1	1	2
	S2	1	2
	N1	1	2
	N2	1	2
TOTAL		4	8

21.8.5 Ticket Vending Machines

Table 21-16 – Symphony TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Symphony	8	7	2	6	1

21.8.6 Passenger Assistance Phones

Symphony Station will require two PAPs, one for the paid area of each mezzanine.

21.9 Pioneer Square Station

21.9.1 Overview

Pioneer Square Station is an underground light rail station located beneath 3rd Avenue between James Street and Yesler Way in Downtown Seattle. The station is near City Hall, the King County Courthouse, office towers, and historic Pioneer Square. Passenger access is provided through multiple street-level entrances along 3rd Avenue and 2nd Avenue, each connecting to a shared mezzanine level. The mezzanine spans the length of the station and is divided into a north and south portion, with an open view to the platform between them. From the mezzanine, passengers access the platform below.

21.9.2 Station Layout

Pioneer Square is a three-level underground station consisting of street, mezzanine, and platform levels.

At the street level, passengers enter the station through several buildings and escalator portals located along 3rd Avenue and 2nd Avenue. Each entrance includes stairs, escalators, and in some locations elevators that connect directly to the mezzanine.

The mezzanine level is divided into a north and south portion, separated by an open area that overlooks the platform below. Each mezzanine portion connects to its own set of street-level entrances. The mezzanine provides access to the platform through stairs, escalators, and elevators. The entire mezzanine is currently an open, unpaid area with unrestricted movement between entrances.

21.9.3 Architectural Description

The proposed faregate control concept for Pioneer Square establishes a fully enclosed fare-paid zone by installing faregates and security fencing at each of the entrances into the mezzanine level. The mezzanine is divided into a north and south portion, with an open area in between that overlooks the platform. Because all entrances connect directly to the mezzanine, and the mezzanine provides direct access to the platform, each entry will require a faregate array to maintain a continuous fare-paid boundary throughout the station.

On the north portion of the mezzanine, there are two entrances from the street level. The first entrance, located in the northeast corner, includes an escalator, stair, and elevator that travel from the street level down to the mezzanine.

A faregate array (N1) is proposed at this entrance, consisting of two WAGs and three SAGs, with security fencing on both sides of the array (see Figure 21-34). To maintain a consistent 8-foot-tall boundary around the unpaid area, the existing railing that overlooks the escalator will be extended up to 8 feet in height.

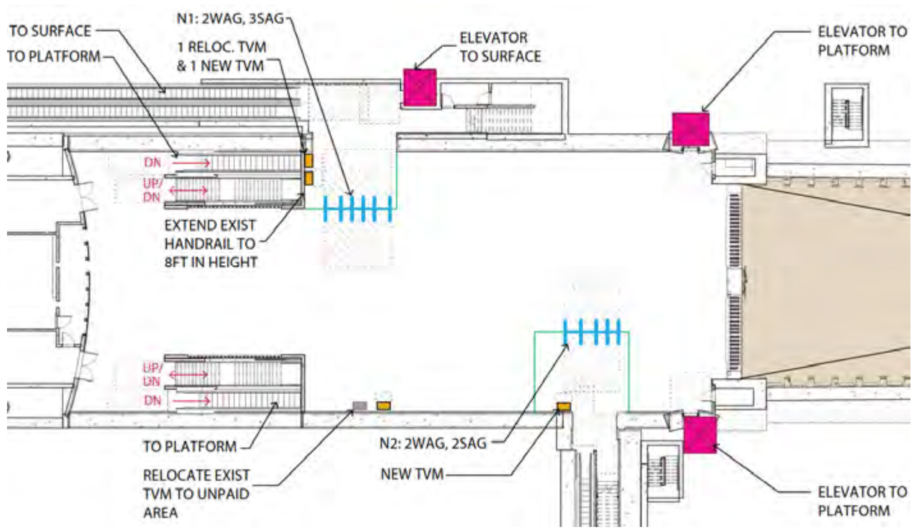

Figure 21-34 – Pioneer Square Station Faregate Arrays (N1 & N2)

The second entrance on the north portion includes a stairway and escalator from the street level. A faregate array (N2) is proposed at this location, consisting of two WAGs and two SAGs, with security fencing on either side of the array to maintain the fare-paid zone (see Figure 21-34).

The northern mezzanine currently contains two existing TVMs. One machine will be relocated to the unpaid area near array N1, adjacent to a new TVM. Passenger volume at array N2 is expected to be less, so only one new TVM is provided in that array's unpaid area. (Additional space is provided for a second TVM if future transaction volume warrants.) One TVM will remain in the paid mezzanine.

On the south portion of the mezzanine, there is one entrance from the street level. This entrance includes a stairway, escalator, and elevator that connect from the surface down to the mezzanine. A faregate array (S1W) is proposed at this entrance, consisting of two WAGs and three SAGs, with security fencing on either side of the array (see Figure 21-35).

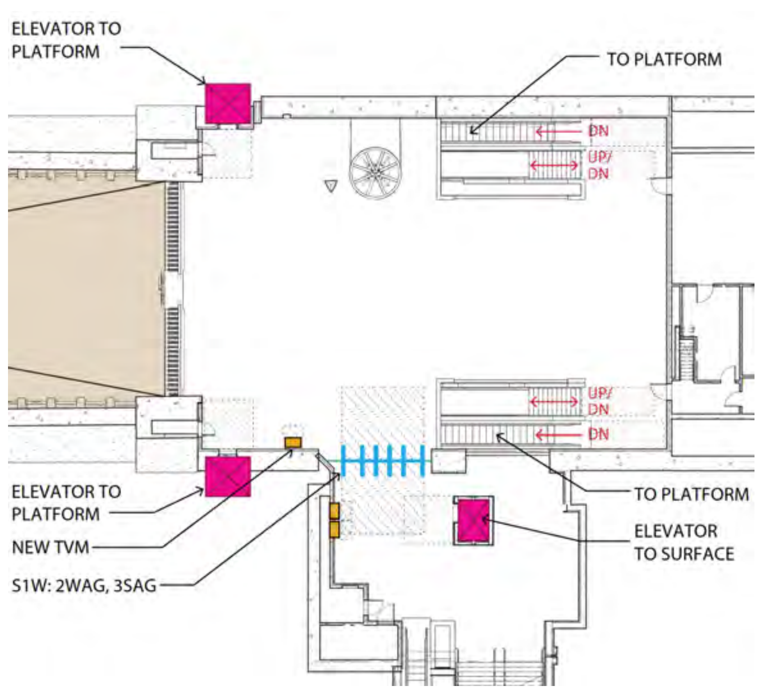

Figure 21-35 – Pioneer Square Station Faregate Array (S1W)

The southern mezzanine contains two existing TVMs; which will remain in place to serve unpaid passengers before the faregates. A new TVM will be installed in the paid area after the array. Once past the faregates, passengers may travel down to the platform via the existing elevators, stairs, and escalators.

21.9.4 Faregate Quantity Estimate

Table 21-17 – Pioneer Square Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Pioneer Square	S1W	3	2
	N1	3	2
	N2	2	2
TOTAL		8	6

21.9.5 Ticket Vending Machines

Table 21-18 – Pioneer Square TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Pioneer Square	4	5	2	1	3

21.9.6 Passenger Assistance Phones

Pioneer Square Station will require two PAPs, one for the paid area of each mezzanine.

21.10 International District / Chinatown Station

21.10.1 Overview

International District / Chinatown Station is an underground light rail station located beneath 5th Avenue S, between S Jackson Street and S King Street, in Seattle's historic Chinatown-International District. The station provides direct connections to King Street Station, Sounder commuter rail, Amtrak, multiple bus routes, and serves nearby Lumen Field and T-Mobile Park stadiums. Additionally, IDS will be the transfer station for passengers switching between Line 1 (Lynnwood/SeaTac) and Line 2 (Redmond/Bellevue). Passenger access is provided through two primary street-level entrances along S Jackson Street and 5th Avenue S, each containing stairs, escalators, and elevators that descend directly to the platform level. International District / Chinatown Station differs from the other stations, as it does not include a separate mezzanine level; circulation from the street leads directly to the train platforms.

21.10.2 Station Layout

International District / Chinatown Station is a two-level underground station consisting of a street level and a platform level.

At the street level, passengers enter the station through two primary entrances: one located along S Jackson Street and one along 5th Avenue S. Each entrance includes stairs, escalators, and elevators that descend to the platform below.

21.10.3 Architectural Description

The proposed faregate control concept for International District / Chinatown Station establishes a fully enclosed fare-paid zone by installing faregates, security fencing, rain screens, and new canopy structures at both entrances. Because each entrance provides direct access to the platform level below, faregate arrays will be required at both locations to maintain a continuous fare-paid boundary throughout the station.

At the southern entrance structure (see Figure 21-36), the existing configuration is an open shelter that provides partial overhead coverage and is not fully enclosed. The proposed design encloses the structure to create a defined entry point and controlled circulation path. The primary entrance will be located between the two existing elevators.

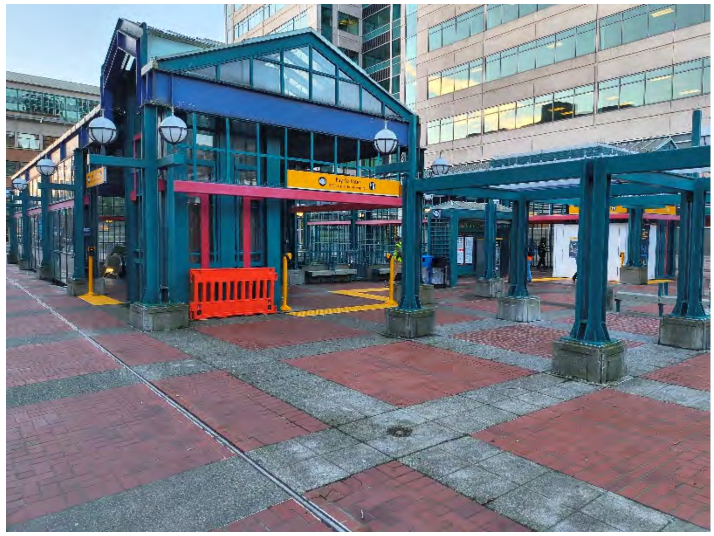

Figure 21-36 – International District / Chinatown Station Southern Entrance Structure

At this location, two faregate arrays (S1W and S1E) are proposed, each consisting of one WAG and two SAGs (see Figure 21-37). A security fence will be installed on both sides of the arrays, as well as along the perimeter of the structure. The fence will span between the existing structural columns and fully enclose the shelter to maintain the fare-paid boundary.

To protect the faregates and passengers from the elements, a row of three new columns will be added to support a new canopy overhead. In addition, new rain screens will be installed between the columns on both sides of the entrance. At the end of the southern entrance, a new roll-up security gate will be installed for station closure.

To the east of the southern entrance, beneath the new canopy, an existing TVM will be relocated from its current enclosure, which will be demolished. This relocated machine and an adjacent new TVM will serve unpaid passengers before they enter the faregates. Within the paid area, a new TVM will be installed in place of an existing bench, which will be removed to accommodate the new equipment.

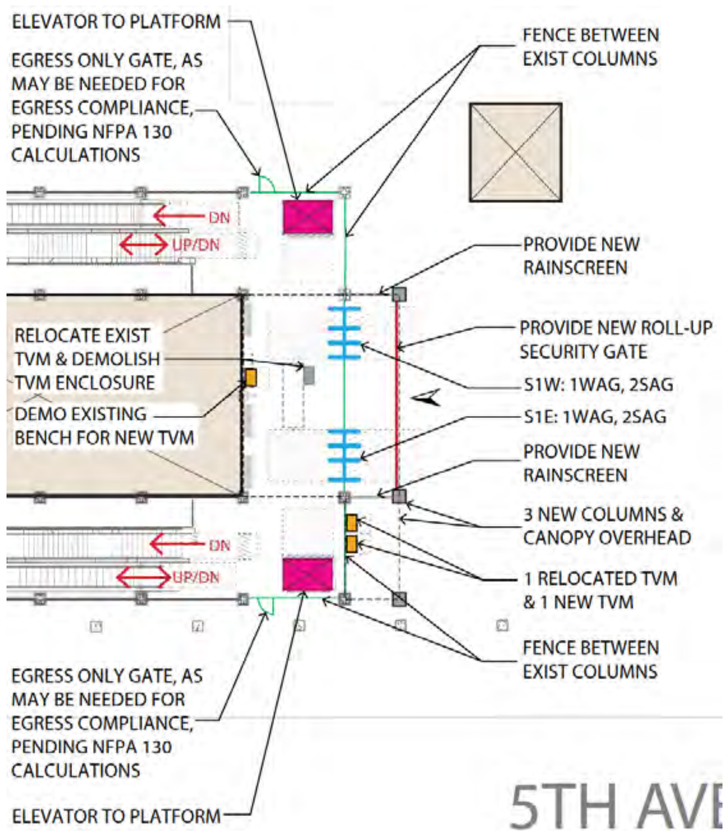

Figure 21-37 – International District / Chinatown Station Faregate Arrays (S1W & S1E)

After passing through either faregate array, passengers may proceed east or west to access the stairs, escalators, and elevators that lead to the platform level. The fully fenced and rain-screened enclosure may include egress-only alarmed gates on the east and west sides, if future NFPA 130 calculations (by a future design team) show they are needed.

At the northern entrance structure (Figure 21-38), located at the corner of 5th Avenue S and S Jackson Street, the design approach mirrors the southern entrance. The main entry point will be centered within the shelter, with two faregate arrays positioned on either side (see Figure 21-39). The array along the South Jackson Street side (N1) will consist of two WAGs and three SAGs. Security fencing will be installed around the perimeter of the shelter and faregate arrays to create a fully enclosed fare-paid zone.

Figure 21-38– International District / Chinatown Station Northern Entrance Structure

To protect the N1 array, two new columns will be added to support a new canopy overhead, providing weather protection for passengers and fare equipment. Rain screens will be installed between the new and existing columns on both sides of the entrance. A new roll-up security gate will be added at the end of the entrance for station closure.

The existing TVM will be shifted several feet so it remains in the unpaid area beneath the sheltered portion of the structure. To provide redundancy, a new TVM will be added on the opposite side of the entrance.

On the opposite side of the shelter, a smaller faregate array (N2) is proposed, consisting of two WAGs. This array will be protected by a similar configuration of new columns, canopy, and rain screens. Once passengers pass through either faregate array, they may proceed east or west to access the stairs, escalators, and elevators that lead to the platform level below.

A new TVM is proposed within this area to serve the paid passengers. As with the southern entrance, the enclosure may require egress-only alarmed gates on the east and west sides, pending NFPA 130 calculations by a future design team.

New canopy structures will require more in-depth structural analysis, given the age and condition of the supporting deck.

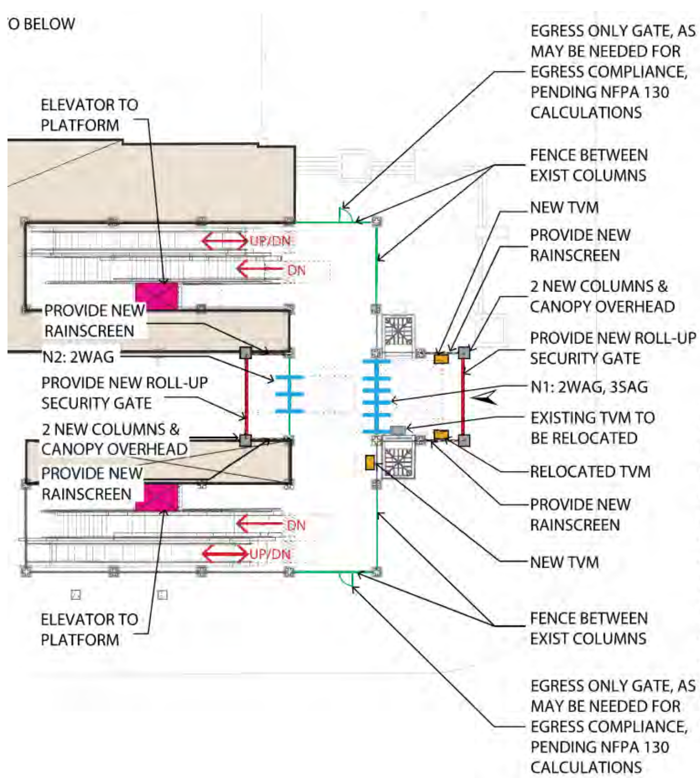

Figure 21-39 – International District / Chinatown Station Faregate Arrays (N1 & N2)

21.10.4 Faregate Quantity Estimate

Table 21-19 – International District / Chinatown Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
International District / Chinatown	S1W	2	1
	S1E	2	1
	N1	3	2
	N2	0	2
TOTAL		7	6

21.10.5 Ticket Vending Machines

Table 21-20 – International District / Chinatown TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
International District / Chinatown	2	4	2	2	4

21.10.6 Passenger Assistance Phones

International District / Chinatown Station will require two PAPs. The two south faregate arrays (S1W and S1E) can share a single PAP because collectively they will both protect the same paid zone. Likewise, the two north faregate arrays (N1 and N2) can share a single PAP because collectively they will both protect the same paid zone.

21.11 SeaTac / Airport Station

21.11.1 Overview

SeaTac / Airport Station is an elevated light rail station located along International Boulevard, directly serving Seattle-Tacoma International Airport. The station connects air travelers, airport employees, and local transit riders to the Link system. Passenger access is provided through two pedestrian bridges: one connecting to the airport terminal via the parking garage and one connecting to International Boulevard, the surrounding hotels, and existing street-level bus stop. Both bridges lead into a shared mezzanine level, which distributes passengers to the platform above. Importantly, many pedestrians traverse both bridges without using Link, so the mezzanine must remain available as a free passage between the bridges.

21.11.2 Station Layout

SeaTac / Airport Station is a three-level elevated station consisting of a street level, mezzanine level, and platform level.

From the street level, passengers access the station via an elevated pedestrian bridge that connects to the mezzanine. The mezzanine level is the primary circulation space for the station. It receives passengers from two pedestrian bridges: one from the airport terminal and one from International Boulevard. The mezzanine includes TVMs, flight information displays, and seating. From the mezzanine, passengers can access the platform via stairs, escalators, and elevators. The mezzanine is currently an open, unpaid area with unrestricted movement between both pedestrian bridges and the platform.

21.11.3 Architectural Description

The proposed faregate control concept for SeaTac / Airport Station establishes a fully enclosed fare-paid zone around all circulation points that provide access to the platform. Because the mezzanine receives passengers from two separate pedestrian bridges – one from the airport terminal and one from International Boulevard – the design allows passengers to move freely across the mezzanine between the two bridges without passing through a faregate. Faregates will instead be concentrated around the stairs, escalators, and elevators that lead up to the platform, ensuring that only passengers intending to board Link trains enter the fare-paid zone.

The placement of the security fences creates a clear, continuous corridor that enables pedestrians to bypass the paid zone entirely while traveling between the two pedestrian bridges, including those walking directly to or from the airport terminal. The enclosure will utilize transparent materials to maintain visibility and reduce sense of confinement for passengers moving through the mezzanine.

Figure 21-40 provides a plan view of all proposed fare collection equipment at the SeaTac / Airport station, showing unimpeded passage between the two pedestrian bridges.

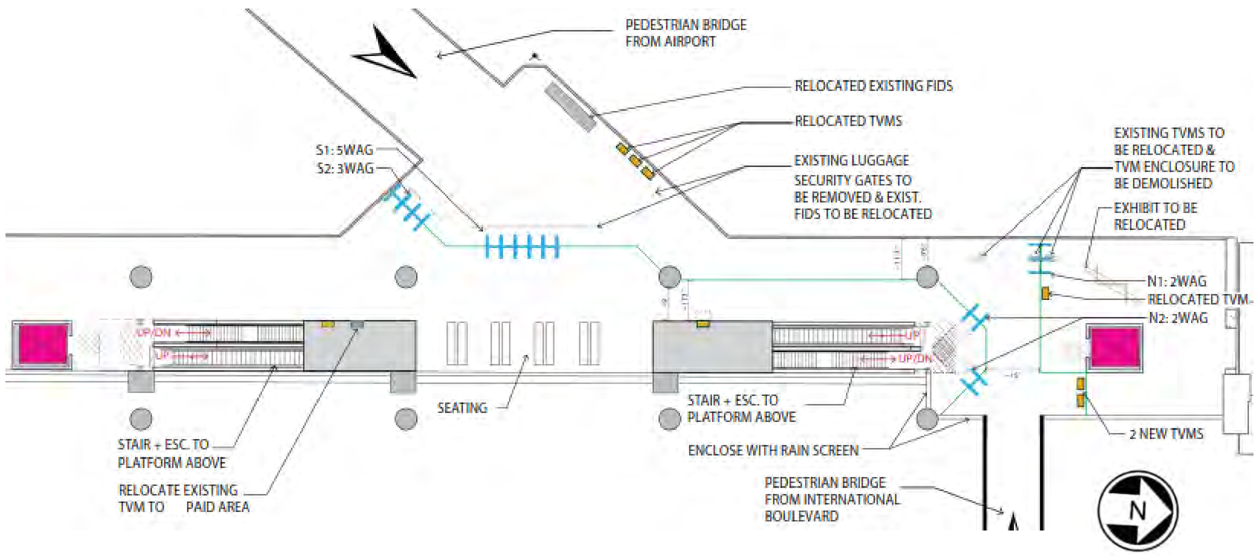

Figure 21-40 – SeaTac / Airport Station Plan View

On the north side of the mezzanine, adjacent to the pedestrian bridge from International Boulevard, a faregate array (N2) is proposed, see Figure 21-41. This array will consist of two WAGs to accommodate passengers traveling with luggage.

Two new TVMs will be in the unpaid area to serve passengers traveling from the international boulevard pedestrian bridge.

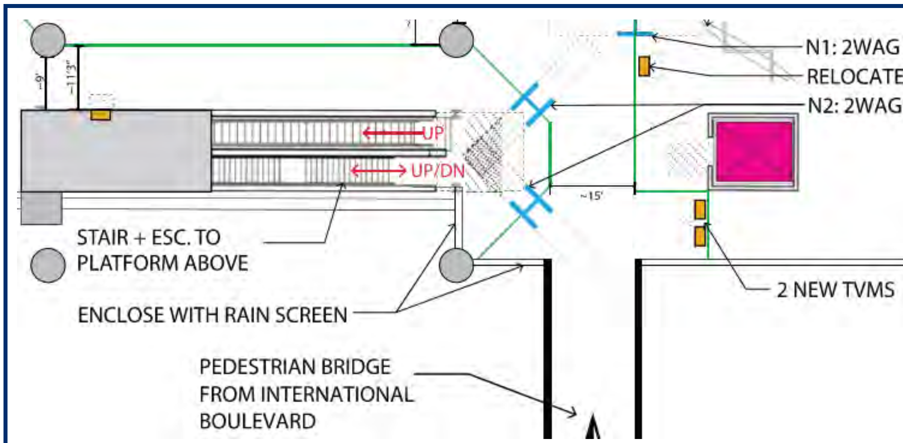

Figure 21-41 – SeaTac / Airport Station Faregate Array (N2)

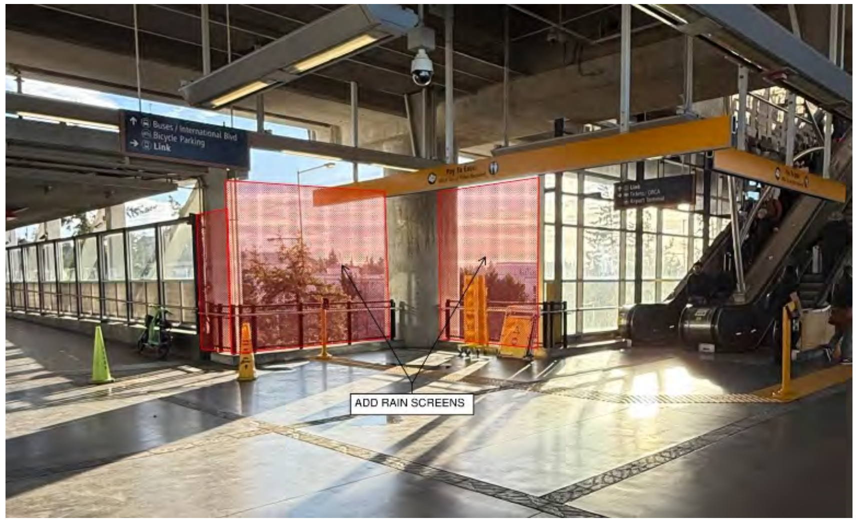

Figure 21-42 – SeaTac / Airport Station Proposed Rain Screens

Rain screens will be added at the corner of the mezzanine where the existing railing is currently open to the exterior, providing weather protection for faregates and passengers (Figure 21-42).

Once past the N2 array, passengers may proceed to the nearby stairway and escalators that lead to the platform above. It is important to note that the surge zones for the proposed faregate array N2 will significantly overlap the surge zones for the stair and escalator to the platform. A surge zone exception is needed at this location.

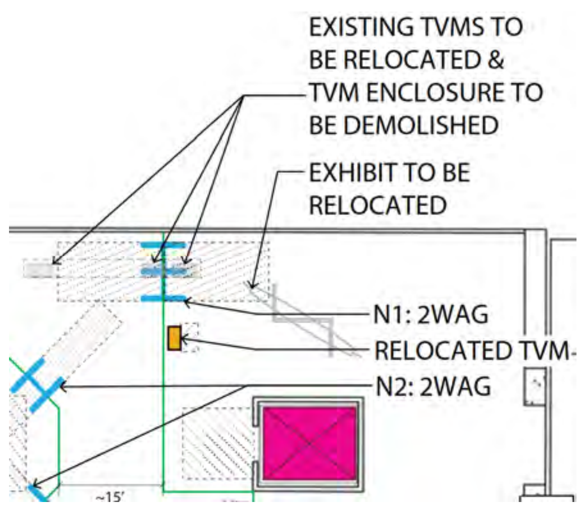

Figure 21-43 – SeaTac / Airport Station Faregate Array (N1)

On the north end of the mezzanine, across from the proposed N2 faregate array, there is a stairway and elevator that provide access to the platform. A faregate array (N1) is proposed to maintain a fare-paid zone around this circulation to the platform, see Figure 21-43. The array will consist of two WAGs. Security fencing will be installed around the array to maintain a clear separation between the paid and unpaid areas, maintaining a clear path of travel across the mezzanine for the passengers traveling to and from the pedestrian bridges.

Additionally, there will be a relocated TVM located in the paid area of faregate array N1.

On the southwest side of the mezzanine, adjacent to the pedestrian bridge from the airport terminal, two faregate arrays are proposed. The first array (S1) will consist of five WAGs, and the second array (S2) will consist of three WAGs (see Figure 21-44). These arrays will control access to the two sets of escalators and elevators that lead to the platform. Security fencing will be installed around each array to establish a continuous fare-paid boundary. This configuration accommodates high passenger volumes and provides sufficient capacity for travelers arriving from the airport with luggage.

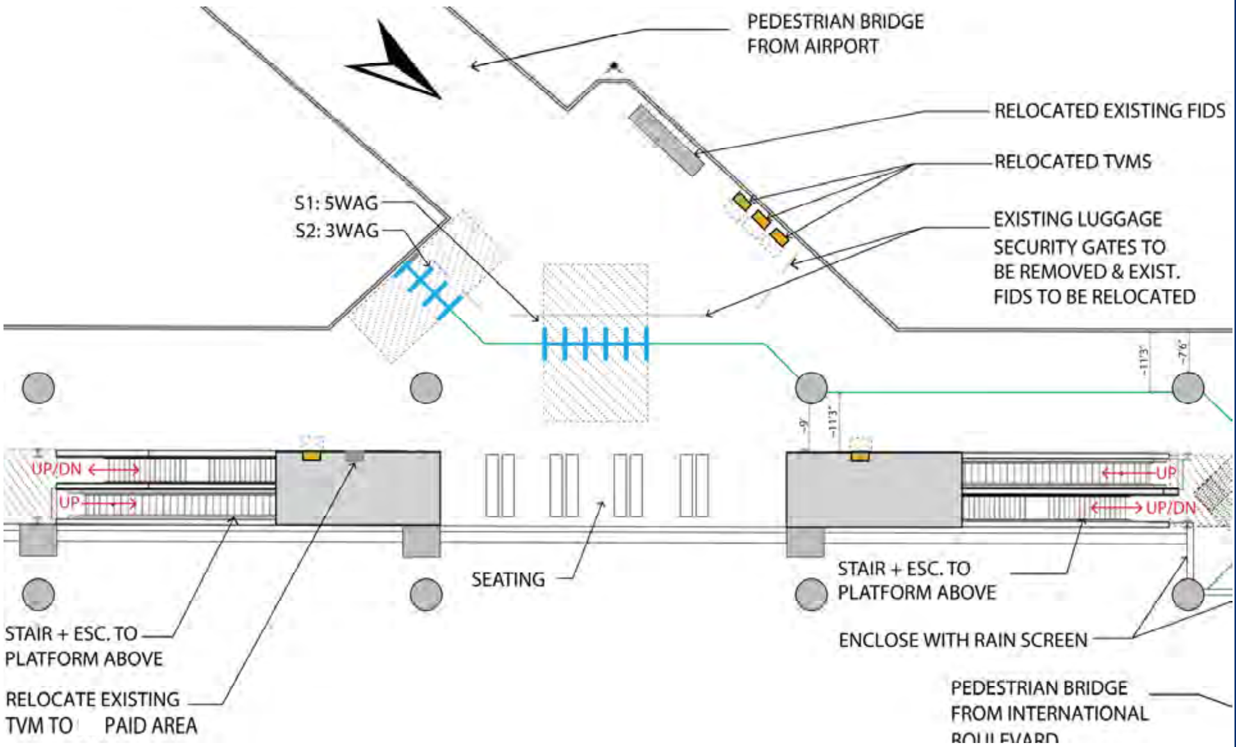

Figure 21-44 – SeaTac / Airport Station Faregate Arrays (S1 & S2)

The mezzanine currently contains three TVMs housed within an enclosure. The enclosure will be demolished, and all three machines will be relocated to the area adjacent to the airport pedestrian bridge entrance, ensuring they remain accessible to unpaid passengers. In the center of the mezzanine, the existing luggage security gates will be removed, and the flight information displays will be relocated to the wall near the airport pedestrian bridge, adjacent to the relocated TVMs. Additionally, an existing art exhibit located near the northern elevator will be relocated to allow for the installation of the proposed security fencing.

Once passengers pass through any of the faregate arrays, they may circulate to the platform above via the existing stairs, escalators, and elevators. Three existing TVMs within this paid area will remain in place to serve the paid passengers.

21.11.4 Faregate Quantity Estimate

Table 21-21 – SeaTac / Airport Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
SeaTac / Airport	S1	0	5
	S2	0	3
	N1	0	2
	N2	0	2
TOTAL		0	12

21.11.5 Ticket Vending Machines

Table 21-22 – SeaTac / Airport TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
SeaTac / Airport	6	5	3	4	2

21.11.6 Passenger Assistance Phones

SeaTac / Airport Station will require two PAPs. Faregate arrays S1, S2, and N2 will protect the same paid area, so a single PAP will serve all three arrays. The remaining array (N1) will require an additional PAP.

21.12 Federal Way Downtown Station

21.12.1 Overview

Federal Way Downtown Station is a light rail station located in the downtown of the City of Federal Way, Washington. The station serves a civic and commercial district that includes municipal facilities, retail spaces, and nearby residential development. The station also supports regional transit connections and pedestrian access from the surrounding downtown area.

21.12.2 Station Layout

Federal Way Downtown Station is a multi-level station consisting of a ground level and a platform level.

At the ground level, passengers enter the station through multiple entrances along 23rd Avenue S and S 319th Street. Both entrance buildings are equipped with stairs, escalators, and elevators that circulate passengers to the platform level above.

21.12.3 Architectural Description

The proposed faregate control concept for Federal Way Downtown Station establishes a fully enclosed fare-paid zone at all ground level entrances that provide access to the platform. Faregate arrays are installed within both the north and south entrance buildings to control passenger movement from the unpaid circulation areas to the platform level above.

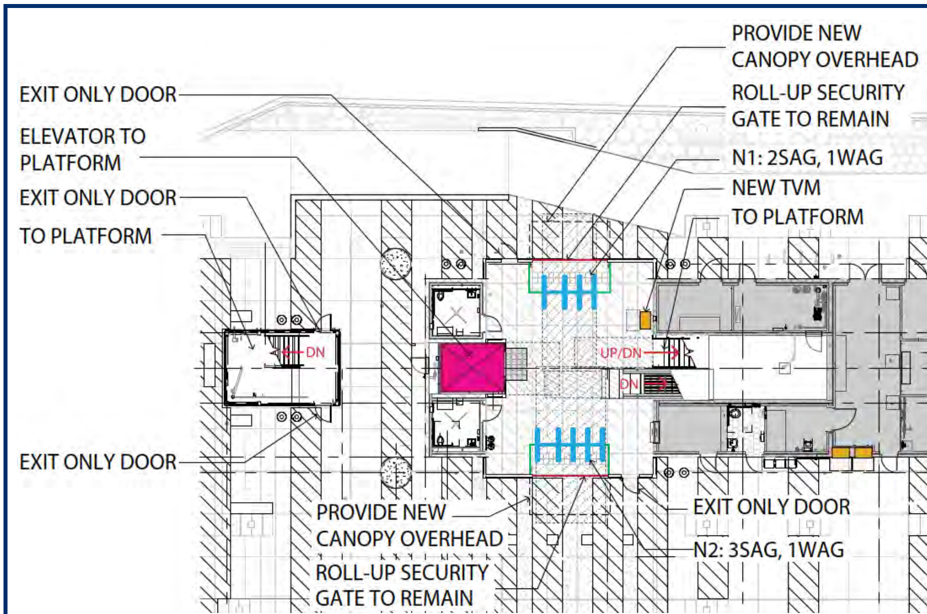

Figure 21-45 – Federal Way Downtown Station Faregate Arrays (N1 & N2)

The north entrance building includes two ground level entrances, located on the east and west faces of the structure. At the east entrance, a faregate array (N1) is proposed. This array consists of one WAG and two SAGs. See Figure 21-45. An 8-foot-tall security fence is provided on both sides of the array to maintain the fare-paid boundary. To protect the faregate equipment from the elements, a new overhead canopy is proposed, providing approximately 10 feet of clearance before the faregates. An existing door is located to the north of the entrance will be repurposed to function as an alarmed exit only door. The existing roll-up security gate at this entrance will remain in place to allow the station to be secured during non-service hours.

Opposite the east entrance, the west entrance will be served by a faregate array (N2) consisting of one WAG and three SAGs. See Figure 21-45. As with array N1, an 8-foot-tall security fence is provided on both sides of the array, and a new canopy is proposed overhead to protect the faregate equipment. A door located to the south of the entrance will function as an exit-only door. The existing roll-up security gate at this entrance will remain in place to secure the station during closed hours.

Once passengers pass through faregate arrays N1 or N2, they may circulate to the platform level above via the existing stairway, escalator, and elevator. Due to existing conditions and limited space within this circulation area, the proposed faregate surge zones will partially overlap with the surge zones associated with the elevator and stair/escalator, requiring an exception to the standard 15 foot surge zone requirement.

In addition, a new TVM is proposed within the paid circulation area to serve paid passengers. On the exterior of the north entrance building, two existing TVMs are embedded within the building façade. These machines will remain in place to serve unpaid passengers prior to entering the station. Additionally, an egress stairway located to the north of the building will function exclusively as an emergency egress. The door to this egress-only stairway should be alarmed to prevent unauthorized use.

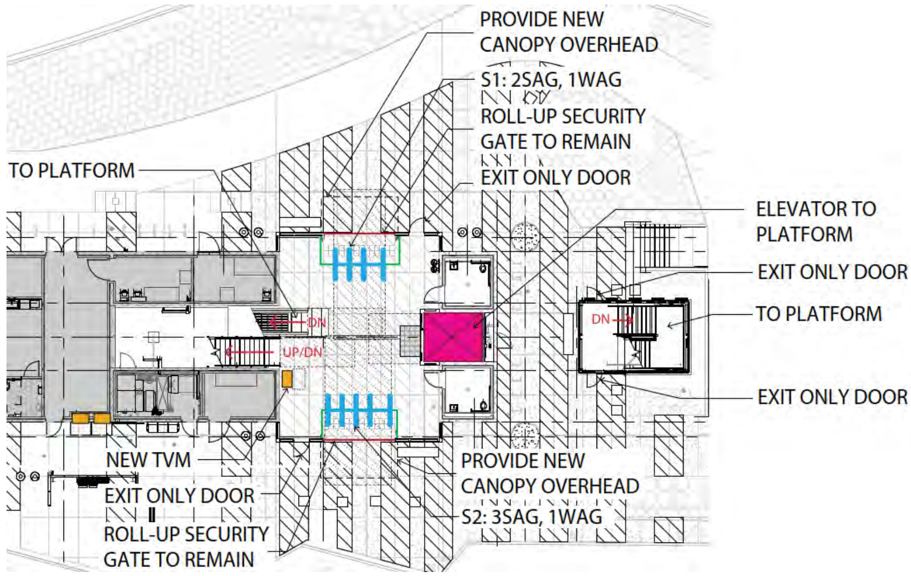

Figure 21-46 – Federal Way Downtown Station Faregate Arrays (S1 & S2)

The south entrance building is similar in configuration to the north entrance building and includes two ground-level entrances on the east and west faces. At the east entrance, a faregate array (S1) is proposed consisting of one WAG and two SAGs. See Figure 21-46. An 8-foot-tall security fence will continue on both sides of the array to define the fare-paid boundary. A new overhead canopy is proposed to protect the faregate equipment from the elements. An existing door located to the south of the entrance will be repurposed to function as an alarmed exit-only door. The existing roll-up security gate will remain in place to allow the station to be secured during non-service hours.

At the west entrance, a faregate array (S2) is proposed consisting of one WAG and three SAGs. See Figure 21-46. An 8-foot-tall security fence will continue on both sides of the array, and a new overhead canopy is proposed, consistent with the other entrances at the station. A door located to the north of the entrance will function as an exit-only door. The existing roll-up security gate at this entrance will also remain in place.

Similar to the north entrance, two existing TVMs embedded into the exterior of the south entrance building façade will remain in place to serve unpaid passengers prior to entering the station. Once passengers pass through faregate arrays S1 or S2, they enter a circulation area equipped with an elevator, stair, and escalator. Due to existing space constraints, the proposed faregate array surge zones will partially overlap the zones for the existing elevator and stair/escalator, requiring a surge zone exception. A new TVM is proposed within the paid circulation area to serve fare-paid passengers. At the south end of the station, an existing stairway from the platform to the surface will function exclusively as an emergency egress. The door to this egress-only stair should be alarmed to prevent unauthorized use.

21.12.4 Faregate Quantity Estimate

Table 21-23 – Federal Way Downtown Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Federal Way Downtown	N1	2	1
	N2	3	1
	S1	2	1
	S2	3	1
TOTAL		10	4

21.12.5 Ticket Vending Machines

Table 21-24 – Federal Way Downtown TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Federal Way Downtown	4	4	2	0	2

21.12.6 Passenger Assistance Phones

Federal Way Downtown Station will require two PAPs, one for each paid zone.

21.13 Downtown Redmond Station

21.13.1 Overview

Downtown Redmond Station is a light rail station located in downtown Redmond, Washington near NE 76th Street and Cleveland Street. The station serves Redmond's growing urban core, including nearby residential development, retail spaces, office buildings, and civic amenities. Passenger access is provided through multiple ground level entrances that connect the station to the surrounding street network, bicycle facilities and adjacent development.

21.13.2 Station Layout

Downtown Redmond Station is a multi-level station consisting of a ground level and a platform level. At the ground level, passengers enter the station through multiple entrances located along NE 76th Street and Cleveland Street. These entrances include circulation elements leading up to the platform above.

21.13.3 Architectural Description

The proposed faregate control concept for Downtown Redmond Station establishes a fully enclosed fare-paid zone at all ground level entrances that provide access to the platform. Faregate arrays are proposed within both the west and east entrance buildings to control passenger movement from unpaid circulation areas to the platform level.

The western entrance building is located at the corner of NE 76th Street and 166th Avenue NE and includes two ground level entrances on the west and east faces of the building. At the west entrance of the building, a faregate array (W1) is proposed consisting of two WAGs and three SAGs. See Figure 21-47. An 8-foot-tall security fence is proposed on both sides of the array to maintain the fare paid boundary.

A new TVM is proposed on the exterior of the building, prior to the faregate array, to serve unpaid passengers departing from this location.

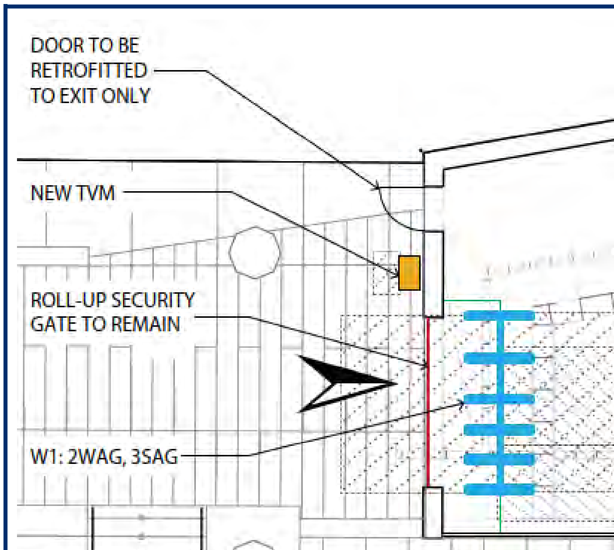

Figure 21-47 – Downtown Redmond Station Faregate Array (W1)

An existing roll-up security gate at this entrance will remain in place to allow the station to be secured during non-service hours. A canopy is not required at this entrance, because existing overhead coverage provides adequate protection for the proposed faregate equipment. A door located to the north of this entrance will be retrofitted to function as an alarmed exit-only door. Due to spatial constraints within the building, the proposed faregate array surge zone will completely overlap with the surge zone associated with the stair and escalator serving the platform. As a result, an exception to the standard 15-foot surge zone requirement will be needed at this location.

At the east entrance of the western lobby, a faregate array (W2) is proposed consisting of two WAGs and two SAGs. See Figure 21-48. An 8-foot-tall security fence is proposed on both sides of the array to maintain the fare-paid zone. The existing roll-up security gate at this entrance will remain to allow the station to be secured during closed hours.

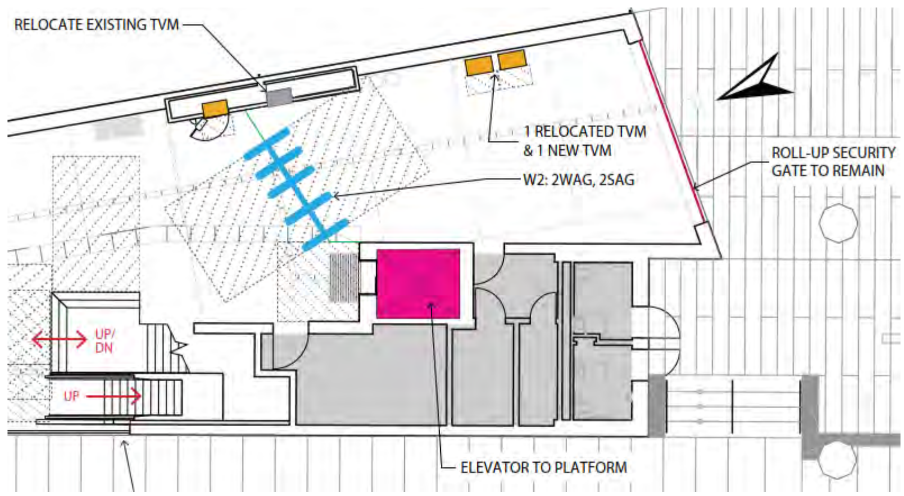

Figure 21-48 – Downtown Redmond Station Faregate Array (W2)

On the unpaid side of the faregate array, one new TVM is proposed, along with the relocation of one existing TVM from the current enclosure, resulting in two TVMs serving unpaid passengers. Because both arrays W1 (Figure 21-47) and W2 secure the same paid zone, only the single TVM in the paid zone adjacent to array W2 is required.

Once passengers pass through faregate arrays W1 or W2, they may circulate to the platform level above via the existing elevator, stair, and escalator. The remaining existing TVM within the enclosure will remain in place to serve passengers in the paid area.

The eastern lobby building includes two ground level entrances, located on the west and south faces of the structure. At the west entrance, a faregate array (E1) is proposed consisting of two WAGs and three SAGs. See Figure 21-49.

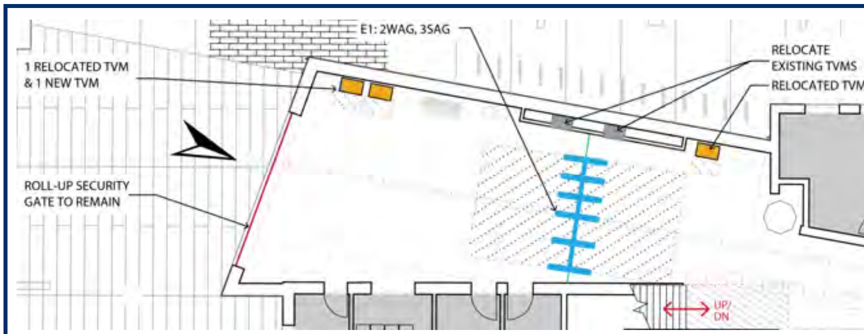

Figure 21-49 – Downtown Redmond Station Faregate Array (E1)

Both TVMs from the existing enclosure located along the north wall of the building will be removed and both existing TVMs will be relocated. One of the relocated TVMs will be positioned on the unpaid side of the faregate array, and the second will be relocated to the north wall within the paid area, allowing one machine to serve each side of the fare-paid boundary. To provide redundancy in the unpaid area, an additional new TVM is proposed adjacent to the relocated machine, resulting in two TVMs serving unpaid passengers.

An existing roll-up security gate at this entrance will remain in place to allow the station to be secured during non-service hours. A small southern entrance is located along NE 76th Street. A faregate array (E2) is proposed at this location consisting of two WAGs and one SAG, aligned within the existing doorway. See Figure 21-50.

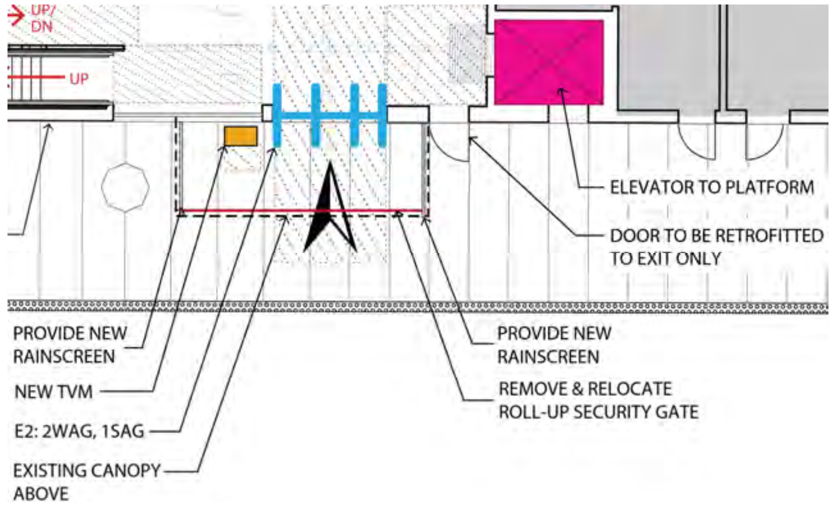

Figure 21-50 – Downtown Redmond Station Faregate Array (E2)

The existing canopy at this entrance will provide partial protection for the faregate equipment; however, to ensure full weather protection new rain screens are proposed on both sides of the canopy. As part of this modification, the existing roll up security gate will be removed from the doorway and relocated to the end of the canopy and rain screen enclosure.

Within the enclosed area, a new TVM is proposed adjacent to the doorway to serve the unpaid passengers at this entrance. An existing door located to the east of the entrance will be retrofitted to function as an alarmed exit-only door.

Once passengers pass through faregate arrays E1 or E2, they may circulate to the platform level above via the existing stairway, escalator, and elevator located within the lobby.

21.13.4 Faregate Quantity Estimate

Table 21-25 – Downtown Redmond Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Downtown Redmond	W1	3	2
	W2	2	2
	E1	3	2
	E2	1	2
TOTAL		9	8

21.13.5 Ticket Vending Machines

Table 21-26 – Downtown Redmond TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Downtown Redmond	4	6	2	3	4

21.13.6 Passenger Assistance Phones

Downtown Redmond Station will require two PAPs, one for each paid zone.

21.14 Bellevue Downtown Station

21.14.1 Overview

Downtown Bellevue Station is a light rail station located in the heart of downtown Bellevue, Washington near NE 6th Street and 112th Avenue NE. The station serves a dense urban environment characterized by high-rise office buildings, residential development, retail spaces, and major employment centers. Passenger access is provided through entrances on 110 Ave NE and 112th Ave NE.

21.14.2 Station Layout

Downtown Bellevue Station is a multiple-level underground station consisting of a surface level and a platform level.

At the street level, passengers enter the station through 110th Ave NE and 112th Ave NE. These entrances include circulation elements that lead to the platform level.

21.14.3 Architectural Description

The proposed faregate control concept for Downtown Bellevue Station establishes a fully enclosed fare-paid zone at the station entrances.

The west entrance to Downtown Bellevue Station is located along 110th Ave NE and is currently configured as an open, covered entry where passengers descend to the platform through existing vertical circulation elements.

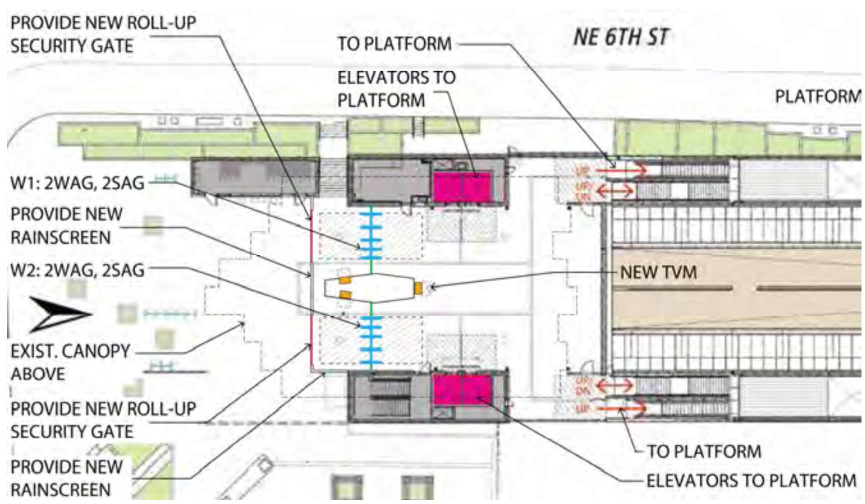

Figure 21-51 – Bellevue Downtown Station Faregate Arrays (W1 & W2)

To establish a fare-paid zone at this location, the design proposes the installation of new rain screen walls extending upward to the height of the existing canopy, fully enclosing the entrance while maintaining weather protection. Two openings will be provided within the rain screen enclosure to accommodate passenger circulation on either side of the existing central TVM enclosure. Each opening will be served by a faregate array. Faregate arrays W1 and W2 are proposed, each consisting of two WAGs and two SAGs. See Figure 21-51.

An 8-foot-tall security fence will be installed on both sides of each array to maintain a continuous fare-paid boundary. Within the rain screen openings, two new roll-up security gates are proposed, allowing the station to be fully secured during non-service hours.

The existing TVM enclosure located at the center of the entrance will remain in place. This configuration allows one TVM to serve each unpaid circulation path prior to the array. Beyond the faregate arrays, one new TVM is proposed to be installed adjacent to the TVM enclosure within the paid area to serve fare-paid passengers. Once past faregate arrays W1 or W2, passengers may circulate to the platform level below via existing elevators, stairs, and escalators.

The east entrance is located at the corner of NE 6th Street and 112th Avenue NE. At this location, two faregate arrays are proposed to control passenger access to the platform. Faregate arrays E1 and E2 are proposed at the existing entrance openings, each consisting of one WAG and one SAG. See Figure 21-52.

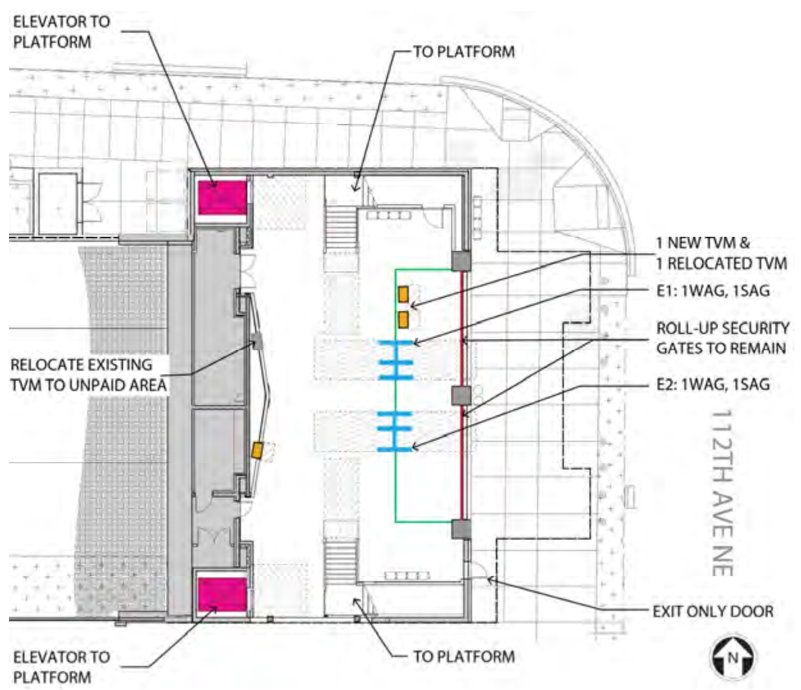

Figure 21-52 – Bellevue Downtown Station Faregate Arrays (E1 & E2)

An 8-foot-tall security fence will be installed on both sides of the array to establish a fare-paid boundary. Existing roll-up security gates at both entrance openings will remain in place and continue to secure the station during non-service hours.

Within the unpaid area before the faregate arrays, one existing TVM currently located within the paid area will be relocated to the unpaid side. In addition, one new TVM is proposed, resulting in two TVMs serving unpaid passengers prior to fare payment. To the south of the entrance area, an existing door will be retrofitted to function as an alarmed exit-only door. Once passengers pass through faregate arrays E1 or E2, they may circulate to the platform level above via the existing stairs and elevators. The remaining TVM within the enclosure will remain in place to serve passengers within the paid area.

21.14.4 Faregate Quantity Estimate

Table 21-27 – Bellevue Downtown Faregate Quantity Estimate

Station	Array	Standard Access Gates	Wide Access Gates
Bellevue Downtown	W1	2	2
	W2	2	2
	E1	1	1
	E2	1	1
TOTAL		6	6

21.14.5 Ticket Vending Machines

Table 21-28 – Bellevue Downtown TVMs

Station	Existing TVMs	TVMs After Faregate Deployment			
		Unpaid Side	Paid Side	Relocated	New
Bellevue Downtown	4	4	2	1	2

21.14.6 Passenger Assistance Phones

Bellevue Downtown Station will require two PAPs, one for each paid zone.

21.15 Station Design Summary

Table 21-29 summarizes faregate, TVM, and PAP quantity estimates for all stations described in the previous sections.

Table 21-29 – Station Design Summary

Station	SAGs	WAGs	TVMs				PAPs
			Unpaid	Paid	Moved	New	
Lynwood City Center	5	6	5	2	4	3	2
Northgate	2	6	4	2	3	0	3
Roosevelt	4	4	4	2	0	2	2
U District	4	6	4	3	1	2	3
University of Washington	7	5	4	3	5	1	3
Capitol Hill	8	6	6	3	3	3	3
Westlake	14	9	8	2	5	2	6
Symphony	4	8	7	2	6	1	2
Pioneer Square	8	6	5	2	1	3	2
International District / Chinatown	7	6	4	2	2	4	2
SeaTac / Airport	0	12	5	3	4	2	2
Federal Way Downtown	10	4	4	2	0	2	2
Downtown Redmond	9	8	6	2	3	4	2
Bellevue Downtown	6	6	4	2	1	2	2
TOTAL	88	92	70	32	38	31	36

22 Pilot Program Discontinuation

If Sound Transit deploys the faregate system but later decides to discontinue its use, the agency may opt for one of the following:

1. Remove all faregates and associated fencing, reinstall the stand-alone WVs, restore the wayfinding tiles and possibly relocate or remove the paid-side TVMs. Sound Transit may retain, remove or simply deactivate some or all PAPs. This will restore the stations to nearly the same condition prior to the faregate pilot project. For example, some conduit and electrical and data cabling installed for the project may remain in place.

2. Retain all faregate equipment and fencing but configure the faregates to always remain open. Deactivate the FMVs on the fare-paid side of the gates but continue use of the embedded FMVs on the unpaid side in lieu of reinstalling the stand-alone WVs. In this scenario, the faregates are no longer barriers to entry or exit but provide the necessary fare media validation functions for passengers entering the station. Additionally, Sound Transit could reactivate the faregates for crowd control at affected stations during special events.

3. Retain only the faregates at stations where crowd control is needed and restore the remaining stations as described for alternative 1 above.

23 RETURN ON INVESTMENT ANALYSIS

The ROI analysis evaluates the financial performance of the faregates installed at the 14 trial stations identified in Section 19 by comparing the net revenue generated to the total costs incurred for implementation and operations.

While a traditional ROI analysis measures the overall financial performance of a project by comparing the total profits generated to the total costs incurred over the project's lifecycle, the ROI analysis conducted for this exercise is based solely on the additional revenue directly attributable to the project.[3] Rather than evaluating all other resulting revenue increases and/or cost savings, this approach isolates the direct marginal revenue increase due to the investment, which can produce a more conservative or narrowly focused measure of financial return.[4]

This analysis also presents another metric to inform the timing of the ROI. A payback year is defined as the year in which cumulative benefits equal or exceed cumulative costs, meaning the project has fully recovered its initial investment. Traditional payback calculations consider all monetized benefits, similar to a traditional ROI analysis. When payback is calculated using incremental revenue, however, the payback year reflects only the point at which incremental revenue alone offsets project costs.

23.1 Assumptions

23.1.1 General Assumptions

The analysis employs several general assumptions, including:

- All costs are expressed in 2026 dollars (2026$),
- Faregate operation is assumed to begin in 2030,
- Analysis period corresponds to 10 years (2030-2039).

Further, the analysis excludes information pertaining to any potential faregate vendor contract terms and conditions and does not incorporate possible pricing structures, revenue sharing, maintenance agreements, service-level agreements or lifecycle replacement obligations. All assumptions are independent of specific vendor contractual agreements. Actual financial outcomes may vary depending on the specific contractual structure negotiated by Sound Transit.

The results of the analysis are presented in undiscounted values as the timing of the project is variable and the intention of the ROI is simplicity. While the analysis assumes faregate operations to begin in 2030, Sound Transit may choose to install and operate sooner or later than the assumed analysis start year.

23.1.2 Scenarios and Station-Specific Assumptions

Scenario 1 – High Ridership, Fares Collected from Exiting Passengers

In this scenario, we calculate ROI assuming high ridership and a solution where faregates require passengers to present a fare when entering and exiting the station. This solution requires all equipment as shown in the station designs and summarized in Table 21-29.

[3] ROI is traditionally measured in percentage point. For example, a 10% ROI suggests that for every dollar invested, 10 cents is earned.

[4] Examples of other indirect revenue increase and/or cost savings may result from reduce need of fare validation or enforcement personnel, reduce conflicts between transit staff and passengers, increase in perceived system security, and others.

In addition to the equipment discussed in Section 18, the faregate pilot project will require Full Time Equivalent (FTE) staffing for faregate maintenance as well as additional Fare Ambassadors, CSRs and TVM maintenance staff.

For this scenario's ROI calculations, maintenance FTE staff will be assigned to stations according to the quantity of new faregates and TVMs included in the station designs. PAPs will require minimal maintenance and are not included in the maintenance staff apportionment calculations.

Fare Ambassador and CSR staffing needs are independent of the equipment quantities, so those FTEs will be distributed equally to each station. Table 23-1 depicts the FTE allocations.

Table 23-1 – Equipment & FTE Allocations per Station – Scenarios 1 & 2

Station	Faregates	New TVMs	New Devices	Share of New Devices	Maintenance FTE	Ambassador FTE	Customer Service FTE	Total FTE
Lynnwood City Center	11	3	14	6.64%	1.00	0.36	0.14	1.50
Northgate	8	0	8	3.79%	0.57	0.36	0.14	1.07
Roosevelt	8	2	10	4.74%	0.71	0.36	0.14	1.21
U District	10	2	12	5.69%	0.79	0.36	0.14	1.29
University of Washington	12	1	13	6.16%	0.93	0.36	0.14	1.43
Capitol Hill	14	3	17	8.06%	1.21	0.36	0.14	1.71
Westlake	23	2	25	11.85%	1.79	0.36	0.14	2.29
Symphony	12	1	13	6.16%	0.93	0.36	0.14	1.43
Pioneer Square	14	3	17	8.06%	1.21	0.36	0.14	1.71
International District / Chinatown	13	4	17	8.06%	1.21	0.36	0.14	1.71
SeaTac / Airport	12	2	14	6.64%	1.00	0.36	0.14	1.50
Federal Way Downtown	14	2	16	7.58%	1.14	0.36	0.14	1.64
Downtown Redmond	17	4	21	9.95%	1.50	0.36	0.14	2.00
Bellevue Downtown	12	2	14	6.64%	1.00	0.36	0.14	1.50
TOTAL	**180**	**31**	**211**	**100%**	**15**	**5**	**2**	**22**

Scenario 2 – Low Ridership, Fares Collected from Exiting Passengers

Scenario 2 assumes the same functionality and equipment as Scenario 1, but with lower ridership projections. Therefore, the station-specific FTE allocations for this scenario are the same as Scenario 1.

Scenario 3 – Low Ridership, No Fares Collected from Exiting Passengers

Scenario 3 assumes low ridership but without the requirement for passengers to present a fare when exiting the station. This solution, therefore, requires no paid-side TVMs, eliminating the need for new TVMs, and hence reduces the maintenance FTE total by 3 (see Section 18.2.2). In addition, because no passengers will be "trapped" on the paid side, there will be no need for PAPs or to augment the Fare Ambassador staffing. However, this scenario also removes the possibility of recovering fares from passengers who arrive at gated stations from an ungated station, offsetting the capital and operating cost savings. Table 23-2 shows the FTE allocation for this scenario.

Table 23-2 – Equipment & FTE Allocations per Station – Scenario 3

Station	Faregates	New TVMs	New Devices	Share of New Devices	Maintenance FTE	Ambassador FTE	Customer Service FTE	Total FTE
Lynnwood City Center	11	N/A	11	6.1%	0.73	N/A	N/A	0.73
Northgate	8	N/A	8	4.4%	0.53	N/A	N/A	0.53
Roosevelt	8	N/A	8	4.4%	0.53	N/A	N/A	0.53
U District	10	N/A	10	5.6%	0.67	N/A	N/A	0.67
University of Washington	12	N/A	12	6.7%	0.80	N/A	N/A	0.80
Capitol Hill	14	N/A	14	7.8%	0.93	N/A	N/A	0.93
Westlake	23	N/A	23	12.8%	1.53	N/A	N/A	1.53
Symphony	12	N/A	12	6.7%	0.80	N/A	N/A	0.80
Pioneer Square	14	N/A	14	7.8%	0.93	N/A	N/A	0.93
International District / Chinatown	13	N/A	13	7.2%	0.87	N/A	N/A	0.87
SeaTac / Airport	12	N/A	12	6.7%	0.80	N/A	N/A	0.80
Federal Way Downtown	14	N/A	14	7.8%	0.93	N/A	N/A	0.93
Downtown Redmond	17	N/A	17	9.4%	1.13	N/A	N/A	1.13
Bellevue Downtown	12	N/A	12	6.7%	0.80	N/A	N/A	0.80
TOTAL	**180**	**N/A**	**180**	**100%**	**12**	**N/A**	**N/A**	**12**

23.2 Demand Projections & Methodology

This section details the demand projections for Sound Transit’s Link light rail trips as well as the methodology for calculating anticipated revenue and costs associated with the implementation of faregates at the 14 stations detailed in Section 19.

The anticipated trips at each station for the analysis period were calculated using forecasted data from the ST3 System Plan Ridership Update for low and high ridership and model years 2030, 2032, 2034, 2036, 2038 and 2040.[5] The input data on total trips used for each trial station is organized in Table 23-3 through Table 23-6, capturing all trips that pass through the installed faregates for low and high ridership scenarios. Trips that board and alight at non-gated stations are not relevant to the analysis as these trips do not impact the incremental revenue collected and thus were not assessed.

[5] Contract RTA/RP 0185-21, Task Order 3-012.

Table 23-3 – Total Trips (Low Ridership) – Boarded (Gated), Alighted (Any), Millions

Station	2030	2032	2034	2036	2038	2040
Lynnwood City Center	2.8	2.9	3.0	3.0	2.2	2.3
Northgate	3.0	3.0	3.1	3.1	3.3	3.1
Roosevelt	1.6	1.6	1.7	1.7	1.7	1.8
U District	4.2	4.3	4.3	4.3	4.5	4.5
University of Washington	3.1	3.1	3.1	3.2	3.3	3.3
Capitol Hill	4.9	5.0	5.0	5.1	5.3	5.2
Westlake	10.3	10.4	10.5	10.8	11.4	6.8
Symphony	6.1	6.2	6.2	6.3	6.7	6.1
Pioneer Square	3.1	3.1	3.1	3.2	3.3	2.7
International District / Chinatown	5.2	5.3	5.4	5.0	5.2	4.5
SeaTac / Airport	4.4	4.4	4.5	4.8	5.0	5.2
Federal Way Downtown	1.9	1.9	1.9	1.7	1.8	1.9
Downtown Redmond	0.4	0.4	0.4	0.4	0.5	0.5
Bellevue Downtown	2.0	2.1	2.2	2.2	2.5	2.6
TOTAL	**53.0**	**53.7**	**54.3**	**54.8**	**57.0**	**50.4**

Note: Decreases in ridership in 2040 account for the future Sound Transit line extensions and service expansions.
Source: Sound Transit System Performance Tracker – Ridership; Contract RTA/RP 0185-21, Task Order 3-012 ST3 System Plan Ridership Update for Years 2030, 2032, 2034, 2036, 2038, 2040

Table 23-4 – Total Trips (High Ridership) – Boarded (Gated), Alighted (Any), Millions

Station	2030	2032	2034	2036	2038	2040
Lynnwood City Center	3.5	4.2	5.0	5.7	4.1	4.2
Northgate	3.3	3.8	4.2	4.7	5.0	4.8
Roosevelt	1.8	2.0	2.2	2.4	2.5	2.6
U District	4.7	5.1	5.6	6.0	6.3	6.3
University of Washington	3.4	3.7	4.1	4.4	4.6	4.6
Capitol Hill	5.4	6.1	6.7	7.3	7.7	7.4
Westlake	11.7	13.6	15.6	17.9	18.9	11.0
Symphony	7.0	8.2	9.1	10.4	11.0	9.8
Pioneer Square	3.5	4.0	4.4	5.0	5.2	4.3
International District / Chinatown	6.2	7.5	8.8	8.5	8.8	7.7
SeaTac / Airport	5.0	5.5	6.0	6.9	7.2	7.4
Federal Way Downtown	2.3	2.6	2.9	2.9	3.0	3.1
Downtown Redmond	0.5	0.6	0.7	0.8	0.8	0.9
Bellevue Downtown	2.5	3.1	3.7	4.4	4.9	5.0
TOTAL	**60.7**	**69.9**	**79.0**	**87.2**	**90.2**	**79.1**

Note: Decreases in ridership in 2040 account for the future Sound Transit line extensions and service expansions.
Source: Sound Transit System Performance Tracker – Ridership; Contract RTA/RP 0185-21, Task Order 3-012 ST3 System Plan Ridership Update for Years 2030, 2032, 2034, 2036, 2038, 2040

Table 23-5 – Total Trips (Low Ridership) – Boarded (Non-Gated), Alighted (Gated), Millions

Station	2030	2032	2034	2036	2038	2040
Lynnwood City Center	0.5	0.5	0.5	0.5	0.7	0.8
Northgate	0.6	0.6	0.6	0.7	0.8	0.9
Roosevelt	0.2	0.2	0.2	0.2	0.3	0.4
U District	0.7	0.7	0.7	0.8	1.0	1.1
University of Washington	1.0	1.0	1.0	1.1	1.3	1.4
Capitol Hill	0.8	0.8	0.8	0.9	1.0	1.3
Westlake	3.6	3.7	3.7	4.2	4.8	2.5
Symphony	3.1	3.2	3.1	3.4	3.8	3.5
Pioneer Square	1.4	1.4	1.4	1.5	1.7	1.3
International District / Chinatown	1.5	1.5	1.5	1.6	1.8	1.4
SeaTac / Airport	0.8	0.8	0.8	1.1	1.2	1.8
Federal Way Downtown	0.9	0.9	0.9	0.9	1.0	1.4
Downtown Redmond	0.2	0.2	0.2	0.2	0.2	0.2
Bellevue Downtown	0.8	0.8	0.8	0.9	1.0	1.2
TOTAL	**16.0**	**16.3**	**16.4**	**17.9**	**20.6**	**19.1**

Note: Decreases in ridership in 2040 account for the future Sound Transit line extensions and service expansions.
Source: Sound Transit System Performance Tracker – Ridership; Contract RTA/RP 0185-21, Task Order 3-012 ST3 System Plan Ridership Update for Years 2030, 2032, 2034, 2036, 2038, 2040

Table 23-6 – Total Trips (High Ridership) – Boarded at (Non-Gated), Alighted (Gated), Millions

Station	2030	2032	2034	2036	2038	2040
Lynnwood City Center	0.5	0.7	0.8	0.9	1.2	1.4
Northgate	0.7	0.8	0.9	1.0	1.4	1.5
Roosevelt	0.2	0.3	0.3	0.3	0.4	0.6
U District	0.8	0.9	1.0	1.3	1.7	1.7
University of Washington	1.1	1.2	1.2	1.4	1.7	1.9
Capitol Hill	0.9	1.0	1.1	1.3	1.5	1.9
Westlake	4.1	4.7	5.2	7.2	8.5	4.1
Symphony	3.6	4.1	4.6	5.5	6.3	5.7
Pioneer Square	1.6	1.8	2.0	2.3	2.7	2.1
International District / Chinatown	1.7	2.1	2.3	2.7	3.0	2.4
SeaTac / Airport	0.9	1.0	1.1	1.6	1.7	2.6
Federal Way Downtown	1.0	1.2	1.3	1.5	1.6	2.4
Downtown Redmond	0.2	0.2	0.3	0.3	0.3	0.4
Bellevue Downtown	0.9	1.2	1.4	1.7	2.0	2.2
TOTAL	**18.2**	**21.0**	**23.5**	**29.1**	**33.9**	**30.8**

Note: Decreases in ridership in 2040 account for the future Sound Transit line extensions and service expansions.
Source: Sound Transit System Performance Tracker – Ridership; Contract RTA/RP 0185-21, Task Order 3-012 ST3 System Plan Ridership Update for Years 2030, 2032, 2034, 2036, 2038, 2040

The ridership data was used to interpolate for years missing from the analysis period. Linear interpolation was used in the absence of more details on ridership patterns. The total trips expected per year from 2030 through 2039 for each scenario are documented in Table 23-7 (sum of trips from Table 23-4 and Table 23-6), Table 23-8 (sum of trips from Table 23-3 and Table 23-5), and Table 23-9 (sum of trips from Table 23-3). The total trip data was used to calculate additional fare revenue collected from each station, further detailed in Section 23.3

Table 23-7 – Total Trips – Scenario 1, Millions

Station	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	4.0	4.4	4.9	5.3	5.7	6.1	6.5	5.9	5.3	5.4
Northgate	4.0	4.3	4.6	4.9	5.2	5.5	5.8	6.1	6.4	6.3
Roosevelt	2.0	2.1	2.3	2.4	2.5	2.6	2.8	2.9	3.0	3.1
U District	5.5	5.8	6.0	6.3	6.6	7.0	7.4	7.7	8.1	8.0
University of Washington	4.5	4.7	4.9	5.1	5.3	5.6	5.8	6.1	6.3	6.3
Capitol Hill	6.3	6.7	7.1	7.4	7.8	8.2	8.6	8.9	9.2	9.2
Westlake	15.7	17.0	18.3	19.6	20.8	22.9	25.1	26.3	27.4	21.3
Symphony	10.6	11.5	12.3	13.0	13.7	14.8	15.9	16.6	17.3	16.4
Pioneer Square	5.0	5.4	5.8	6.1	6.4	6.9	7.3	7.6	7.9	7.2
International District / Chinatown	7.9	8.7	9.5	10.3	11.1	11.1	11.1	11.5	11.8	11.0
SeaTac / Airport	5.9	6.2	6.5	6.8	7.0	7.7	8.4	8.7	8.9	9.4
Federal Way Downtown	3.3	3.5	3.8	4.0	4.3	4.3	4.3	4.5	4.6	5.1
Downtown Redmond	0.7	0.7	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.2
Bellevue Downtown	3.5	3.9	4.3	4.7	5.2	5.6	6.1	6.5	6.8	7.0
TOTAL	**78.9**	**84.9**	**91.0**	**96.7**	**102.5**	**109.4**	**116.3**	**120.2**	**124.1**	**117.0**

Note: Year 1 is defined as 2030.
Source: Sound Transit System Performance Tracker – Ridership; Contract RTA/RP 0185-21, Task Order 3-012 ST3 System Plan Ridership Update for Years 2030, 2032, 2034, 2036, 2038, 2040

Table 23-8 – Total Trips – Scenario 2, Millions

Station	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	3.3	3.3	3.4	3.4	3.4	3.5	3.5	3.2	2.9	3.0
Northgate	3.6	3.6	3.6	3.7	3.7	3.7	3.8	3.9	4.1	4.1
Roosevelt	1.8	1.8	1.8	1.9	1.9	1.9	1.9	2.0	2.0	2.1
U District	4.9	5.0	5.0	5.0	5.0	5.1	5.2	5.4	5.6	5.6
University of Washington	4.1	4.1	4.1	4.1	4.1	4.2	4.3	4.4	4.6	4.6
Capitol Hill	5.7	5.7	5.8	5.8	5.8	5.9	6.0	6.1	6.3	6.4
Westlake	13.9	14.0	14.1	14.1	14.1	14.6	15.0	15.6	16.3	12.7
Symphony	9.3	9.3	9.4	9.3	9.3	9.5	9.7	10.1	10.5	10.0
Pioneer Square	4.4	4.5	4.5	4.5	4.5	4.6	4.6	4.8	5.0	4.5
International District / Chinatown	6.7	6.7	6.8	6.9	6.9	6.7	6.6	6.8	7.0	6.4
SeaTac / Airport	5.2	5.2	5.2	5.3	5.3	5.6	6.0	6.1	6.3	6.6
Federal Way Downtown	2.8	2.8	2.8	2.8	2.9	2.8	2.7	2.8	2.8	3.1
Downtown Redmond	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Bellevue Downtown	2.8	2.9	2.9	3.0	3.0	3.1	3.1	3.3	3.5	3.7
TOTAL	**69.0**	**69.5**	**70.0**	**70.3**	**70.7**	**71.7**	**72.8**	**75.2**	**77.6**	**73.6**

Note: Year 1 is defined as 2030.
Source: Sound Transit System Performance Tracker – Ridership; Contract RTA/RP 0185-21, Task Order 3-012 ST3 System Plan Ridership Update for Years 2030, 2032, 2034, 2036, 2038, 2040

Table 23-9 – Total Trips – Scenario 3, Millions

Station	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	2.8	2.9	2.9	2.9	3.0	3.0	3.0	2.6	2.2	2.3
Northgate	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.2	3.3	3.2
Roosevelt	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.8
U District	4.2	4.3	4.3	4.3	4.3	4.3	4.3	4.4	4.5	4.5
University of Washington	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.3	3.3
Capitol Hill	4.9	4.9	5.0	5.0	5.0	5.1	5.1	5.2	5.3	5.3
Westlake	10.3	10.3	10.4	10.4	10.5	10.6	10.8	11.1	11.4	9.1
Symphony	6.1	6.2	6.2	6.2	6.2	6.3	6.3	6.5	6.7	6.4
Pioneer Square	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.3	3.3	3.0
International District / Chinatown	5.2	5.2	5.3	5.3	5.4	5.2	5.0	5.1	5.2	4.8
SeaTac / Airport	4.4	4.4	4.4	4.4	4.5	4.6	4.8	4.9	5.0	5.1
Federal Way Downtown	1.9	1.9	1.9	1.9	1.9	1.8	1.7	1.8	1.8	1.9
Downtown Redmond	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
Bellevue Downtown	2.0	2.1	2.1	2.1	2.2	2.2	2.2	2.4	2.5	2.6
TOTAL	**53.0**	**53.4**	**53.7**	**54.0**	**54.3**	**54.5**	**54.8**	**55.9**	**57.0**	**53.7**

Note: Year 1 is defined as 2030.
Source: Sound Transit System Performance Tracker – Ridership; Contract RTA/RP 0185-21, Task Order 3-012 ST3 System Plan Ridership Update for Years 2030, 2032, 2034, 2036, 2038, 2040

23.3 Incremental Revenue Projections

To calculate the amount of additional fare revenue collected in the three scenarios assessed, an increased collection rate was calculated based on current and future conditions.

The current fare collection rate that Sound Transit estimated is approximately 62%, meaning that around 6 out of 10 riders are paying fares to ride on the Link light rail. Sound Transit estimates 6% of trips are Youth fares or free for eligible individuals, therefore the maximum fare collection rate for trips is 94%. WSP estimates that the implementation of faregates enables 95% of fares to be collected, yielding an increase to 89% in fare collection rate at gated stations from approximately 62% for current conditions. The increased revenue generated from faregates is expected to be 27% of fares collected from future trips. To calculate the anticipated additional revenue generated from the implementation of faregates, several assumptions were used as shown in Table 23-10.

Table 23-10 – Revenue Calculation Assumptions

Variable	Unit	Value	Source
Current Fare Collection Rate	percent	62%	Sound Transit
Youth Fare Rate	percent	6%	Sound Transit
Faregate Fare Capture Rate	percent	95%	WSP Assumption
Faregate Station Fare Collection Rate	percent	89%	Calculated
Increased Collection Rate	percent	27%	Calculated

The average fare collected per year was calculated based on 2025 Link revenue, ridership and average fare compliance. For 2025, at $50.9 million generated in revenue from 37.6 million riders and a 62% average fare compliance, the average fare is estimated to be $2.18. Based on forecasted revenue and ridership data also provided by Sound Transit, WSP calculated the anticipated growth in fares to be 3.8% based on an anticipated $0.25 increase in adult fares every four years. Table 23-11 presents the average fare calculated for each year of analysis based on the assumptions mentioned.

Table 23-11 – Average Fare Assumptions

Variable	Unit	Value	Source
2025 Average Fare Collected from Fare Payers	dollar	$2.18	Sound Transit
Fare Increase	percent	3.8%	Calculated
Fare Increase Frequency	year	4	Sound Transit
Average Fare Year 1-3	dollar	$2.26	Calculated
Average Fare Year 4-7	dollar	$2.35	Calculated
Average Fare Year 8-10	dollar	$2.44	Calculated

The increased revenue per scenario was calculated in Table 23-12, Table 23-13, and Table 23-14. The trips per station were multiplied by the applicable average fare to get the total fare collected at each station. The total fares collected per year were then multiplied by the increased collection rate of 27% to get the increased revenue per station per year.

Table 23-12 – Increased Revenue – Scenario 1, Millions of 2026 Dollars

Stations	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	$2.5	$2.7	$3.0	$3.4	$3.7	$3.9	$4.2	$3.9	$3.5	$3.6
Northgate	$2.4	$2.6	$2.8	$3.1	$3.3	$3.5	$3.7	$4.1	$4.3	$4.2
Roosevelt	$1.2	$1.3	$1.4	$1.5	$1.6	$1.7	$1.8	$1.9	$2.0	$2.1
U District	$3.4	$3.6	$3.7	$4.0	$4.2	$4.5	$4.7	$5.1	$5.4	$5.3
University of Washington	$2.8	$2.9	$3.0	$3.3	$3.4	$3.6	$3.7	$4.0	$4.2	$4.2
Capitol Hill	$3.9	$4.1	$4.4	$4.8	$5.0	$5.3	$5.5	$5.9	$6.1	$6.2
Westlake	$9.7	$10.5	$11.3	$12.5	$13.3	$14.7	$16.1	$17.5	$18.3	$14.2
Symphony	$6.6	$7.1	$7.6	$8.3	$8.8	$9.5	$10.2	$11.1	$11.5	$10.9
Pioneer Square	$3.1	$3.3	$3.6	$3.9	$4.1	$4.4	$4.7	$5.1	$5.3	$4.8
International District / Chinatown	$4.9	$5.4	$5.9	$6.6	$7.1	$7.1	$7.2	$7.6	$7.8	$7.3
SeaTac / Airport	$3.7	$3.8	$4.0	$4.3	$4.5	$5.0	$5.4	$5.8	$5.9	$6.3
Federal Way Downtown	$2.0	$2.2	$2.3	$2.6	$2.7	$2.8	$2.8	$3.0	$3.1	$3.4
Downtown Redmond	$0.4	$0.5	$0.5	$0.6	$0.6	$0.6	$0.7	$0.7	$0.8	$0.8
Bellevue Downtown	$2.1	$2.4	$2.7	$3.0	$3.3	$3.6	$3.9	$4.3	$4.6	$4.7
TOTAL	**$48.8**	**$52.5**	**$56.2**	**$62.1**	**$65.8**	**$70.2**	**$74.6**	**$80.1**	**$82.7**	**$77.9**

Source: WSP Analysis

Table 23-13 – Increased Revenue – Scenario 2, Millions of 2026 Dollars

Station	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	$2.0	$2.1	$2.1	$2.2	$2.2	$2.2	$2.3	$2.1	$1.9	$2.0
Northgate	$2.2	$2.2	$2.3	$2.4	$2.4	$2.4	$2.4	$2.6	$2.8	$2.7
Roosevelt	$1.1	$1.1	$1.1	$1.2	$1.2	$1.2	$1.2	$1.3	$1.3	$1.4
U District	$3.1	$3.1	$3.1	$3.2	$3.2	$3.3	$3.3	$3.6	$3.7	$3.7
University of Washington	$2.5	$2.5	$2.5	$2.6	$2.7	$2.7	$2.7	$2.9	$3.0	$3.1
Capitol Hill	$3.5	$3.5	$3.6	$3.7	$3.8	$3.8	$3.8	$4.1	$4.2	$4.2
Westlake	$8.6	$8.6	$8.7	$9.1	$9.1	$9.3	$9.6	$10.4	$10.8	$8.5
Symphony	$5.7	$5.8	$5.8	$6.0	$6.0	$6.1	$6.2	$6.7	$7.0	$6.7
Pioneer Square	$2.7	$2.8	$2.8	$2.9	$2.9	$2.9	$3.0	$3.2	$3.3	$3.0
International District / Chinatown	$4.1	$4.2	$4.2	$4.4	$4.4	$4.3	$4.2	$4.5	$4.6	$4.3
SeaTac / Airport	$3.2	$3.2	$3.2	$3.4	$3.4	$3.6	$3.8	$4.1	$4.2	$4.4
Federal Way Downtown	$1.7	$1.7	$1.7	$1.8	$1.8	$1.8	$1.7	$1.8	$1.9	$2.1
Downtown Redmond	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.5
Bellevue Downtown	$1.7	$1.8	$1.8	$1.9	$1.9	$2.0	$2.0	$2.2	$2.4	$2.5
TOTAL	**$42.7**	**$43.0**	**$43.3**	**$45.1**	**$45.3**	**$46.0**	**$46.7**	**$50.1**	**$51.7**	**$49.0**

Source: WSP Analysis

Table 23-14 – Increased Revenue – Scenario 3, Millions of 2026 Dollars

Station	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	$1.8	$1.8	$1.8	$1.9	$1.9	$1.9	$1.9	$1.7	$1.5	$1.5
Northgate	$1.8	$1.9	$1.9	$2.0	$2.0	$2.0	$2.0	$2.1	$2.2	$2.1
Roosevelt	$1.0	$1.0	$1.0	$1.1	$1.1	$1.1	$1.1	$1.1	$1.2	$1.2
U District	$2.6	$2.6	$2.6	$2.7	$2.8	$2.8	$2.8	$3.0	$3.0	$3.0
University of Washington	$1.9	$1.9	$1.9	$2.0	$2.0	$2.0	$2.0	$2.2	$2.2	$2.2
Capitol Hill	$3.0	$3.0	$3.1	$3.2	$3.2	$3.2	$3.3	$3.5	$3.6	$3.5
Westlake	$6.3	$6.4	$6.4	$6.7	$6.7	$6.8	$6.9	$7.4	$7.6	$6.1
Symphony	$3.8	$3.8	$3.8	$4.0	$4.0	$4.0	$4.1	$4.3	$4.5	$4.3
Pioneer Square	$1.9	$1.9	$1.9	$2.0	$2.0	$2.0	$2.0	$2.2	$2.2	$2.0
International District / Chinatown	$3.2	$3.2	$3.3	$3.4	$3.5	$3.3	$3.2	$3.4	$3.5	$3.2
SeaTac / Airport	$2.7	$2.7	$2.7	$2.9	$2.9	$3.0	$3.1	$3.3	$3.4	$3.4
Federal Way Downtown	$1.2	$1.2	$1.2	$1.2	$1.3	$1.2	$1.1	$1.2	$1.2	$1.2
Downtown Redmond	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Bellevue Downtown	$1.3	$1.3	$1.3	$1.4	$1.4	$1.4	$1.4	$1.6	$1.7	$1.7
TOTAL	**$32.8**	**$33.0**	**$33.2**	**$34.6**	**$34.8**	**$35.0**	**$35.2**	**$37.2**	**$38.0**	**$35.8**

Source: WSP Analysis

23.4 Cost Projections

The costs considered in the analysis are largely broken down into capital, operations and maintenance (O&M) and FTE costs.

Capital costs consist of project costs associated with faregate system installation and preliminary software costs. Project costs are based on the faregates design proposed at each station and the scenario assessed. Detailed breakdown of project costs can be found in APPENDIX B. Scenarios 1 and 2 share the same project costs as the equipment necessary to collect fares from exiting passengers is similar. Scenario 3's project costs reflect decreased need for fare equipment, such as TVMs and PAPs, as fares are not collected from exiting passengers.

Based on the project cost estimates, the most expensive station to retrofit with faregates may be Lynnwood City Center Station while Roosevelt Station may be the least expensive. Project costs are expected to be incurred prior to the analysis period during construction but are included in the ROI analysis as a cumulative cost in addition to O&M and labor costs incurred during operations. Software costs are anticipated to be approximately $1.5 million to employ INIT and gate software. In the absence of a detailed breakdown cost by station, software costs per station were estimated by dividing the total software cost by the number of faregates and allocating costs by the number of faregates at each, as broken down in Section 23.1.2. The capital cost estimates by station are listed in Table 23-15.

Table 23-15 – Capital Costs by Station, Millions of 2026 Dollars

Stations	Project Costs – Scenarios 1 & 2	Project Costs – Scenario 3	Software Costs – Scenarios 1, 2, 3
Lynnwood City Center	$10.9	$10.1	$0.09
Northgate	$3.7	$3.5	$0.07
Roosevelt	$3.3	$2.7	$0.07
U District	$3.4	$3.2	$0.08
University of Washington	$7.2	$6.9	$0.10
Capitol Hill	$5.4	$4.6	$0.12
Westlake	$9.3	$8.4	$0.19
Symphony	$5.4	$5.0	$0.10
Pioneer Square	$5.7	$4.9	$0.12
International District / Chinatown	$8.3	$7.2	$0.11
SeaTac / Airport	$6.1	$5.5	$0.10
Federal Way Downtown	$5.0	$4.5	$0.12
Downtown Redmond	$6.9	$5.9	$0.14
Bellevue Downtown	$6.1	$5.5	$0.10
TOTAL	**$86.7**	**$77.8**	**$1.5**

Source: KAMP Engineering, WSP

Assumptions used to calculate O&M and FTE labor costs are detailed in Table 23-16. O&M costs associated with faregates are broken into faregate equipment maintenance and TVM equipment maintenance. Faregate equipment maintenance includes the hardware and software maintenance costs. For the purposes of this analysis, annual faregate equipment maintenance costs are limited to $1.0 million, assuming $0.5 million for INIT software and $0.5 million for gate software maintenance incurred annually across the faregate system. In the absence of a detailed breakdown cost by station, faregate equipment maintenance costs per station were estimated by dividing the total costs by the number of faregates and allocating costs per station by the number of faregates at each, as broken down in Table 23-16. Annual TVM equipment maintenance is anticipated to be $100,000, representative of an increase in backend costs across all installed TVMs. The TVM equipment maintenance costs per station were estimated similarly to the faregate equipment maintenance costs. However, the O&M costs associated with TVMs were calculated based on the total number of TVMs moved or newly installed to capture the incremental increase in O&M costs due to new equipment. TVM equipment maintenance costs were not included in the O&M costs for stations in Scenario 3, as no new TVMs will be installed.

The fully burdened rate of employing an FTE for Sound Transit was estimated to be $104,000. This annual salary was multiplied by the number of FTE at the stations, also detailed in Section 23.1.2 per station.

Table 23-16 – Cost Calculation Assumptions

Variable	Unit	Value	Source
Annual Faregate Equipment Maintenance Costs	2026$/year	$1,000,000	WSP
Total Faregates Installed at 14 Stations	value	180	WSP
Annual Faregate Equipment Maintenance Costs per Faregate	2026$/year/faregate	$5,556	Calculated
Annual TVM Equipment Maintenance Costs	2026$/year	$100,000	WSP
Total TVMs Moved or Newly Installed at 14 Trial Stations	value	69	WSP
Annual TVM Equipment Maintenance Costs per TVM	2026$/year/TVM	$1,449	WSP
Annual Full-Time Equivalent Cost	2026$/year	$104,000	Sound Transit

The combined annual O&M and FTE costs per station per year by scenario are shown in Table 23-17 and Table 23-18.

Table 23-17 – O&M and FTE Labor Costs – Scenarios 1 & 2, Millions of 2026 Dollars

Station	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Northgate	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Roosevelt	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
U District	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
University of Washington	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Capitol Hill	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Westlake	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4
Symphony	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Pioneer Square	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
International District / Chinatown	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
SeaTac / Airport	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Federal Way Downtown	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Downtown Redmond	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Bellevue Downtown	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
TOTAL	**$3.4**	**$3.4**	**$3.4**	**$3.4**	**$3.4**	**$3.4**	**$3.4**	**$3.4**	**$3.4**	**$3.4**

Source: WSP Analysis

Table 23-18 – O&M and FTE Labor Costs – Scenario 3, Millions of 2026 Dollars

Station	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Northgate	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Roosevelt	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
U District	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
University of Washington	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Capitol Hill	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Westlake	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Symphony	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Pioneer Square	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
International District / Chinatown	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
SeaTac / Airport	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Federal Way Downtown	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Downtown Redmond	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Bellevue Downtown	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
TOTAL	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**

Source: WSP Analysis

Additional costs incurred from faregate implementation, such as fare evasion citation collection costs or repair and rehabilitation costs, were not captured in the absence of detailed data.

23.5 Return on Investment Calculations

Based on the revenue and cost projections following the implementation of faregates at the 14 trial stations, Table 23-19 and Table 23-20 show the ROI projections by station and by year. The ROI percentages are based on cumulative costs and revenues during the analysis period.

Table 23-19 – Return on Investment by Station by Year – Scenario 1

Stations	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	-78%	-54%	-30%	-2%	26%	55%	86%	113%	136%	159%
Northgate	-37%	25%	87%	152%	216%	280%	344%	410%	477%	539%
Roosevelt	-64%	-30%	3%	36%	69%	101%	132%	164%	195%	225%
U District	-8%	80%	163%	246%	326%	405%	483%	563%	641%	714%
University of Washington	-63%	-26%	10%	47%	83%	120%	156%	194%	232%	269%
Capitol Hill	-33%	32%	96%	160%	223%	285%	346%	408%	468%	525%
Westlake	-2%	97%	196%	300%	404%	513%	626%	744%	861%	941%
Symphony	16%	131%	247%	366%	484%	604%	727%	853%	979%	1089%
Pioneer Square	-49%	1%	51%	102%	153%	203%	254%	306%	358%	400%
International District / Chinatown	-43%	16%	77%	142%	209%	273%	334%	396%	458%	511%
SeaTac / Airport	-43%	13%	67%	123%	177%	234%	294%	354%	413%	473%
Federal Way Downtown	-62%	-25%	11%	49%	86%	121%	154%	187%	219%	253%
Downtown Redmond	-94%	-89%	-83%	-77%	-71%	-65%	-58%	-52%	-46%	-39%
Bellevue Downtown	-67%	-32%	4%	44%	84%	126%	169%	215%	261%	307%
TOTAL	**-47%**	**7%**	**60%**	**116%**	**172%**	**228%**	**284%**	**343%**	**400%**	**450%**

Source: WSP Analysis

Table 23-20 – Return on Investment by Station by Year – Scenario 2

Stations	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	-82%	-64%	-47%	-30%	-13%	4%	20%	34%	47%	59%
Northgate	-43%	10%	59%	107%	153%	195%	235%	277%	318%	357%
Roosevelt	-68%	-39%	-12%	14%	37%	59%	80%	100%	121%	140%
U District	-17%	58%	127%	192%	252%	308%	360%	414%	466%	515%
University of Washington	-66%	-35%	-5%	25%	53%	80%	107%	134%	161%	187%
Capitol Hill	-40%	16%	67%	117%	163%	206%	247%	288%	328%	366%
Westlake	-13%	68%	143%	217%	286%	353%	419%	486%	553%	598%
Symphony	1%	95%	182%	267%	345%	420%	492%	566%	640%	705%
Pioneer Square	-55%	-14%	25%	62%	96%	129%	160%	191%	223%	248%
International District / Chinatown	-52%	-7%	36%	79%	121%	158%	193%	229%	265%	295%
SeaTac / Airport	-50%	-3%	40%	83%	124%	165%	206%	248%	288%	330%
Federal Way Downtown	-68%	-38%	-11%	15%	39%	61%	80%	100%	119%	138%
Downtown Redmond	-95%	-91%	-86%	-82%	-78%	-75%	-71%	-68%	-64%	-61%
Bellevue Downtown	-73%	-47%	-23%	1%	24%	46%	67%	90%	113%	137%
TOTAL	**-53%**	**-10%**	**31%**	**71%**	**109%**	**145%**	**179%**	**214%**	**249%**	**279%**

Source: WSP Analysis

Table 23-21 – Return on Investment by Station by Year – Scenario 3

Stations	Year									
	1	2	3	4	5	6	7	8	9	10
Lynnwood City Center	-83%	-66%	-50%	-33%	-16%	0%	17%	31%	42%	54%
Northgate	-50%	-2%	44%	90%	134%	176%	216%	258%	300%	338%
Roosevelt	-66%	-33%	-3%	27%	55%	82%	107%	133%	158%	183%
U District	-22%	50%	117%	183%	245%	303%	358%	414%	469%	519%
University of Washington	-73%	-47%	-22%	3%	27%	50%	72%	96%	119%	141%
Capitol Hill	-38%	19%	73%	127%	177%	225%	270%	316%	361%	402%
Westlake	-29%	39%	102%	165%	225%	282%	337%	393%	448%	487%
Symphony	-28%	41%	106%	170%	231%	290%	346%	405%	462%	514%
Pioneer Square	-64%	-29%	3%	35%	64%	93%	120%	148%	175%	198%
International District / Chinatown	-57%	-16%	24%	65%	104%	140%	173%	208%	241%	271%
SeaTac / Airport	-52%	-7%	36%	79%	120%	161%	202%	244%	285%	325%
Federal Way Downtown	-76%	-53%	-31%	-11%	9%	27%	42%	57%	73%	87%
Downtown Redmond	-96%	-92%	-88%	-85%	-82%	-78%	-75%	-72%	-69%	-66%
Bellevue Downtown	-78%	-57%	-36%	-16%	4%	23%	42%	62%	83%	103%
TOTAL	**-60%**	**-21%**	**15%**	**51%**	**86%**	**119%**	**151%**	**184%**	**215%**	**244%**

Source: WSP Analysis

The payback year by station and ridership forecast are shown in Table 23-22. Across all scenarios, all station investments into faregates are expected to be paid back by Year 6 except for Downtown Redmond. If faregates are implemented across all 14 trial stations, Sound Transit can expect to see investments paid back by Year 3 for all three scenarios.

Table 23-22 – Payback Year by Station

Stations	Scenario 1	Scenario 2	Scenario 3
Lynnwood City Center	Year 5	Year 6	Year 6
Northgate	Year 2	Year 2	Year 3
Roosevelt	Year 3	Year 4	Year 4
U District	Year 2	Year 2	Year 2
University of Washington	Year 3	Year 4	Year 4
Capitol Hill	Year 2	Year 2	Year 2
Westlake	Year 2	Year 2	Year 2
Symphony	Year 1	Year 1	Year 2
Pioneer Square	Year 2	Year 3	Year 3
International District / Chinatown	Year 2	Year 3	Year 3
SeaTac / Airport	Year 2	Year 3	Year 3
Federal Way Downtown	Year 3	Year 4	Year 5
Downtown Redmond	N/A	N/A	N/A
Bellevue Downtown	Year 3	Year 4	Year 5
14 TRIAL STATIONS	**Year 2**	**Year 3**	**Year 3**

As shown in Figure 23-1, if Sound Transit implements faregates in all 14 stations, Sound Transit can expect to see 450%, 279%, and 244% ROI at the end of the analysis period in Year 10 for Scenario 1, 2 and 3, respectively. Within three years of operations (two years in Scenario 1), the faregates are expected to generate enough revenue to break even from initial capital and early O&M costs.

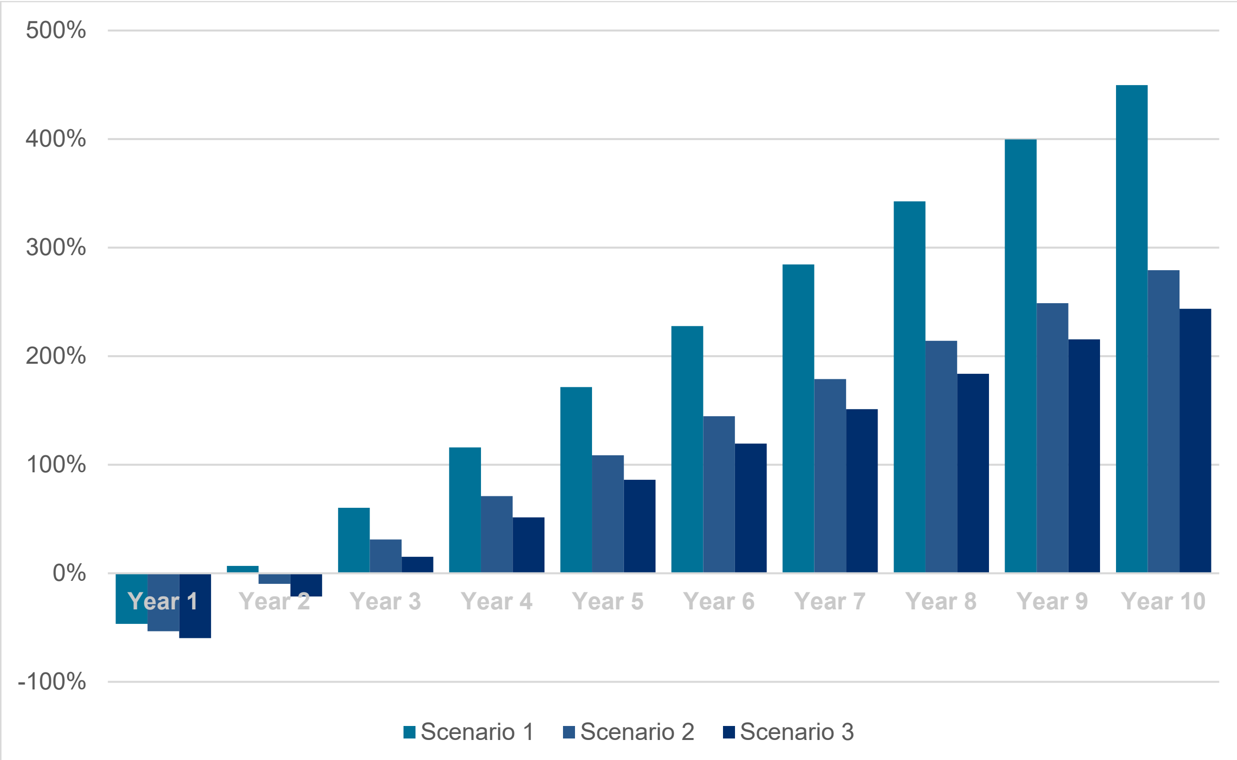

Figure 23-1: Return on Investment by Year for 14 Stations

Of the 14 stations in this study, Downtown Redmond station stands out. Because of that station's extensive capital modifications and modest ridership projections, for all three Scenarios, this station never reaches break-even. Moreover, because there are no plans to expand Line 2 further north, the station's ridership projections are unlikely to appreciably change beyond the 2040 limit of this study. If this project moves forward, Sound Transit should consider eliminating Downtown Redmond from the project, perhaps in favor of another station. By removing Downtown Redmond or replacing it with a station that achieves break-even, the project's total ROI will improve.

As mentioned in this report, the Stadium station may be considered a viable alternative. Although it is at-grade, Stadium has only one entry point, one which appears suitable for faregate installation. The station would likely require only minimal infrastructure enhancements, resulting in a rapid return on investment, and the faregates would provide much-needed help in managing crowds at the station during special events. Moreover, if Stadium station is selected for the project, it would also be an ideal candidate for the Pilot Test.

24 RECOMMENDED NEXT STEPS

24.1 Architectural Design

The following tasks are recommended to advance architectural design:

The next phase of work will focus on evaluating emergency exit requirements, developing architectural concepts for canopies and rain protection structures and beginning early design development and documentation. These activities will establish a strong foundation for subsequent design stages and ensure compliance with all applicable regulations.

24.1.1 Life Safety and Code Compliance General Assumptions

NFPA 130 calculations will be performed for each station to confirm adherence to essential life safety requirements. This analysis plays a critical role in ensuring regulatory compliance and will guide decisions regarding the placement and configuration of exit gates and other safety features.

24.1.2 Conceptual Design and Visualization

Concept-level design will be developed for station canopies and shelters to establish a consistent architectural look and feel. These concepts will be limited to visual and architectural intent only and will not include structural systems, lighting or other detailed technical elements.

Visualizations will also be prepared to illustrate faregates and associated fencing. These graphics will support stakeholder understanding of gate placement, fencing extents and passenger flow without advancing into detailed engineering.

24.1.3 Development of 10% Plans

The 10% design plans will be prepared for each station to document early design intent as well as support coordination and planning-related activities. These plans will include:

- Shelter and canopy design concepts (architectural only)
- Faregate and fencing visualizations
- Faregate installation plans
- TVM installation plans
- Additional security fencing specifications and locations
- Location of all PAPs

Collectively, these deliverables will provide a clear framework for advancing design, coordinating with stakeholders and preparing for subsequent project phases.

24.1.4 Future Stations

WSP recommends that all future stations should include provisions for faregates, including canopies and protective rain shields, and other associated elements, such as power and data conduits, paid-side TVMs and PAPs. While accommodating faregates at these stations may add unneeded cost if faregates are not deployed at those stations, the savings could be substantial compared to retrofitting them if Sound Transit later decides to implement faregates at the new stations.

Because of its significant special event ridership, Sound Transit should also consider evaluating the feasibility of adding faregates to the at-grade Stadium station as previously mentioned in section 23.5. Preliminary assessment of that station indicates that it could accommodate faregates, but further analysis may be required to assess how best to manage crowds on the pathways leading to the station during special events.

24.2 Staffing and Operations

As the project design progresses in the next phase, it is recommended that Sound Transit solidify operational objectives for Fare Ambassadors, maintenance staff, and call center CSRs. With better clarity of objectives, staffing plans should then be refined further.

24.3 Wayfinding Enhancements

In recent years, Bluetooth Low Energy (BLE) technology has proven its versatility by functioning as the foundation for many innovative solutions, including enhanced wayfinding assistance for the visually impaired. BLE technology offers superior wayfinding capabilities for many common use cases in comparison with GPS, which includes functioning underground where GPS signals cannot penetrate, in buildings that can shield GPS signals and in downtown locations where tall buildings can obstruct GPS signals.

By installing multiple Bluetooth beacons within Link stations, a wayfinding app on a passenger's mobile device can triangulate their precise location and guide them to within a few feet of any destination. Bluetooth wayfinding apps allow the users to specify their destination, such as the nearest TVM, PAP or accessible faregate within a station. Wayfinding tiles should remain and be modified to support the faregate deployment, as discussed in Section 24.4.5, but BLE wayfinding could provide a significantly improved experience for the visually impaired. When the wayfinding app gets the user within range of their desired destination, the wayfinding tiles could guide them the rest of the way. The wayfinding app does not need to be limited to just identifying the devices deployed as part of the faregate pilot. After traversing the faregate aisle, the wayfinding app could direct the passenger to the elevator, escalator or stairs to reach the platform. This could be part of a larger, Seattle-wide initiative, which allows visually impaired citizens to navigate throughout the city as well as inside major facilities such as government office buildings or hospitals where GPS wayfinding is infeasible or unreliable.

To further expand on the concept, rather than rely solely on the wayfinding tiles to lead a passenger the remaining distance to the desired device, the targeted device could emit distinctive "chirps" for a configurable period (e.g., 10 seconds). As the passenger reaches a predefined range, their smartphone would be paired with the device via the wayfinding app. Alternatively the wayfinding app might utilize the mobile device's cellular data to connect to a server and eventually to the station network to trigger the chirp response from the device. Any such technological solution would likely require research and design efforts from potential suppliers but could be accommodated in parallel with the faregates if Sound Transit initiates such a study soon.

Ultimately, the solution may need to be multi-faceted, with a combination of tactile pathways and one or more technologies.

24.4 Strategies for Expedited Deployment

The faregate pilot project will be complex and likely require three years or more between Board approval to commence the project and final implementation. However, because the faregates will provide valuable operational and financial benefits to Sound Transit, it is in the agency's best interest to seek ways to expedite the project to allow both the agency and its passengers to experience those benefits as quickly as practicable.

The subsequent sections outline potential strategies and suggestions, in no particular order of significance.

24.4.1 Procurement Strategy

As the incumbent supplier of the ORCA fare collection system, INIT's involvement in the faregate project is mandatory, which provides Sound Transit the opportunity to assess two procurement alternatives:

- A sole-source contract with INIT acting as Systems Integrator (SI)
- A separate procurement for faregates with the faregate contractor acting as Systems Integrator and a sole-source contract with INIT to provide only the necessary components and integration services as needed

While having INIT act as Systems Integrator may appear to offer the potential for a faster procurement, there is no guarantee that negotiations to award INIT the systems integrator role would be any faster than a competitive procurement. Moreover, INIT's ability to perform as Systems Integrator may be limited by their apparent resource constraints demonstrated not only on the ORCA project, but on other ongoing projects as well. Sound Transit should conduct a thorough assessment of both alternatives for their possible benefits and risks to the overall project schedule.

24.4.2 Organization

Due to the magnitude of the scope and quantity of activities pertaining to this project, it is imperative that Sound Transit establish a nimble organizational structure to shepherd the project from its outset to its conclusion. Any delays in setting up this organization will yield cascading effects on the project schedule; thus, the first strategy to expedite faregate deployment is establishment of an effective organization structure.

Of all the elements and systems that are integral to modern transit agencies, fare collection is unique in that nearly every department within the agency is a stakeholder to some degree. As a result, the ultimate success of the project will require that all affected organizations have a voice in the project's design and contribute to its completion. Doing so will foster an atmosphere of cooperation and ensure agency-wide advocacy for the project.

WSP recommends that as soon as the Board authorization for the project is received, Sound Transit should establish a Program Management Office (PMO) with representation from all departments, augmented as necessary with subject matter experts (SME), project schedulers, engineers, architects, cost managers, risk management experts, public outreach, accessibility design, corporate/institutional liaisons and other specialists as necessary. Sound Transit should equip the PMO with a comprehensive suite of tools to manage the program, especially those that will provide document, task and schedule controls.

24.4.3 Project Schedule Controls

Of special importance during the initial program start-up phase is the implementation of a comprehensive resource-loaded project schedule and a robust process to maintain its accuracy and completeness. A properly designed and managed schedule will be single most important tool of the PMO. It is therefore essential that the PMO includes highly skilled schedulers to develop and maintain the project schedule from the outset of the project.

24.4.4 Risk Mitigation

Every project faces risks from multiple fronts. Some risks are unavoidable. Many risks are entirely predictable and preventable. Each risk carries with it a range of project implications ranging from mere nuisances to catastrophic failures. The likelihood of project success is often linked to the awareness and diligence of its management team to constantly search for hidden risks and be attentive to identified risks. Reliance on luck to avoid the consequences of unseen (or worse, acknowledged) risks is not conducive to successful outcomes. Therefore, another key strategy to expedite a project is to circumvent preventable delays, and have mitigation plans prepared in advance to address the consequences when a risk inevitably becomes reality. The optimal method to achieve this objective is to include expert staff dedicated to risk management and mitigation as a key component to the PMO.

24.4.5 Potential Critical Path Items

Several items will require early, if not immediate, attention to ensure the project progresses as expected. Delays in completing these tasks are likely to result in corresponding delays to the project itself. Many of the following items may require additional information or time before work can begin, but it is not too early to begin planning and preparing for the work.

- *Faregate system functional requirements definition*: Any contract to supply the faregate system must clearly convey the requirements the contractor will be expected to satisfy. Before developing the technical specifications and scope of work documentation for the RFP (or sole-source negotiations), Sound Transit, with the assistance of SMEs, must develop a comprehensive set of functional and non-functional requirements clearly describing the agency's needs without being needlessly proscriptive of how a contractor must satisfy the requirements. Defining some requirements may require further study, such as an alternatives analysis for machine-readable ticket solutions described in Section 11.1 and the low-cost TVM alternative for paid-side TVMs, described in Section 11.3.

- *Machine-readable mobile ticketing*: The Transit GO Ticket mobile app may not presently support machine-readable tickets. If so, users of the app will be unable to pass through the faregates without the necessary software updates. The solution will either be an enhanced Transit GO Ticket app or development of an entirely new app. Sound Transit should address this issue with the app provider, King County Metro, before the first faregates enter revenue service.

- *Youth fare cards/Mobile app*: The faregates will require all passengers to have machine-readable fares. As discussed in Section 7.1, this will require passengers who ride free to possess a valid fare instrument (e.g., a fare card or mobile app). Assuming Sound Transit will work with local schools to distribute new fare cards and register the associated accounts for such cards and mobile apps, WSP recommends that Sound Transit be prepared to commence that program at the start of the school year preceding the first planned faregate activation. Doing so will likely provide sufficient time to maximize the number of students who are equipped to enjoy their free fares while traveling through gated stations.

- *INIT sole-source contract*: For the faregate solution to work, INIT must provide critical elements, specifically the FMVs to be embedded in the faregates and TVM enhancements required to dispense machine-readable tickets. In addition, INIT's cooperation and participation in the integration and testing of the FMV modules into the faregates will also be essential. To ensure INIT performs the required work in a timely manner and for a reasonable price, Sound Transit should develop and execute the sole-source contract prior issuing the RFP for the faregate system. This assumes Sound Transit engages a faregate Systems Integrator in a competitive RFP process. If Sound Transit opts to negotiate a sole-source contract with INIT as the Systems Integrator, the magnitude of that contract will expand considerably.

- *INIT integration development, FMV production, TVM enhancements*: The timeliness of INIT's contributions to the project will be pivotal to maintaining the project schedule. Without INIT's FMV modules and associated software interfaces, the project will grind to a halt at the acceptance testing stage. Sound Transit should plan to manage the INIT sole-source contract with special attention and diligence, by assigning sufficient and qualified staff to oversee the vendor's work.

- *Infrastructure improvements*: Every one of the 14 stations will require some degree of infrastructure work, such as fencing, rain screens, canopies and support pillars. The civil engineering, construction activities and infrastructure improvements will be entirely separate from the faregate system contract. But the construction work is intricately intertwined with the faregate deployment schedule. All infrastructure work must be completed at a station before the installation of any faregates can commence.

  To mitigate the risk of delays, Sound Transit should consider dividing the work into multiple bundles or packages of two or more stations to enable multiple local construction firms to participate. Although awarding multiple construction contracts would increase the PMO's workload, using a "divide and conquer" approach could significantly streamline the construction phase by allowing parallel activities and avoiding potential resource constraints resulting from the award of all construction work to only one or two firms. Sound Transit should prioritize determining the procurement strategy so the contract documents can be ready for bidding as soon as the design work is completed.

- *Wayfinding assistance design and implementation*: Sound Transit has done an admirable job of designing and installing tactile wayfinding tiles in the stations to assist the visually impaired in their journeys through the stations. The installation of the faregates, significant number of TVMs that will be relocated or newly added and the introduction of the PAPs, most existing wayfinding tiles will have to be replaced. Due to the variety of devices involved, new tactile paths may have to split into forks as the paths must now direct passengers to each station entry's WAG (from both paid and unpaid sides), the TVMs on the unpaid side, the paid-side TVM, and the PAP. Not all users will need to use a TVM or a PAP, but all will need to pass through the faregates, and the wayfinding tiles must accommodate all possible use cases. So, when the user encounters the tactile path, they may not know which direction to turn to follow it to the WAG, TVM or PAP. Since each station is unique, there can be no simple rule such as "TVMs are on the right of the faregates" or "PAPs are on the left side of the paid-side TVM." This added complication in the wayfinding path may confuse visually impaired passengers.

Addressing these challenges may require analysis of several alternatives and extensive outreach to the disabled community. Similar to the infrastructure enhancements, the wayfinding solution should be implemented at a station prior to faregate installation. Sound Transit should explore potential solutions as quickly as possible. See Section 24.3 for further discussion on possible wayfinding enhancements.

- *Electrical systems preparation (conduit, cabling, power)*: For the conduit, data cables and electrical wiring, Sound Transit can opt for one or more stand-alone electrical services contracts or have the construction contractor(s) team with qualified electrical subcontractors. Sound Transit should determine the procurement strategy soon, so that contract documents can be ready for bidding as soon as design work is completed. The objective should be to provide stations that are "plug and play" for the faregate systems contractor.

- *IT/network architecture design and implementation*: Sound Transit's IT Department should lead this effort. As with other required station improvements, the network systems must be completed before faregate installation at a station begins. Coordination with other station tasks will be imperative.

- *Historically sensitive site design approvals*: Because of its landmark status, the International District / Chinatown station requires additional reviews and approvals pertaining to infrastructure changes required to accommodate the planned faregate and TVM installations. Other stations may have similar requirements. These reviews could add significant time to the permitting process. Infrastructure design work for those stations should be prioritized so that applications to respective historical landmark commissions can be made as early as possible to avoid delaying faregate deployment. Any actions that could streamline the process, such as notifying the oversight agencies that requests for review and approval are forthcoming, should be performed as soon as possible.

- *Installation, deployment and transition planning:* Although the transition stage, which includes installation and other preparatory prerequisites to system activation, is considered one of the last major milestones, the transition process must be defined up front so that all transition requirements can be incorporated into the scope of work for the faregate systems integrator. Failure to define the transition fully can risk significant delays and costly change orders.

- *Business rules and fare policies*: This report suggests several business rules and fare policies that Sound Transit should consider. While there is no urgency to implement any new policies, which are usually subject to public review and Board approval, the faregate systems contract must describe all potential fare policies the new faregate system must accommodate. Under an expedited schedule, the RFP documents could be published in six to nine months. Because of the potential complexities and ramifications of new rules and policies, Sound Transit should begin a separate effort to define all current and potential rules and policies to ensure that the RFP documents accurately describe the agency's current and future needs.

24.4.6 Faregate System Procurement

- *Industry Familiarization*: The high barrier faregate is a new class of faregate. Suppliers continue to innovate and upgrade their offerings, but competitive procurements must avoid specifying proprietary designs. A specification that includes proprietary designs will either result in fewer proposals, or protests and requests for deletion of the problematic requirements. To avoid this issue, the published requirements should reflect the capabilities currently available as well as those under development across the industry.

Thus, before finalizing the RFP technical specifications, Sound Transit should invite potential suppliers to Seattle to make presentations and provide demonstrations of their high barrier faregates. Such engagements can be mutually beneficial; Sound Transit could learn much about the capabilities, features and performance characteristics of the suppliers' solutions, and the suppliers could learn more about Sound Transit's unique needs and challenges. The result is a fair and competitive procurement process with fewer question-and-answer iterations during the proposal development phase, which often require RFP amendments. Ultimately, this means fewer extensions of the proposal due date.

- *Establish a Minimum Viable Product to support a phased deployment approach)*: Complex fare collection specifications typically enumerate every technical requirement to enable both the agency and the contractor to understand the scope of work and assist in managing the contract. To do so, the proposal documents usually include a Requirements Traceability Matrix (RTM) form that lists every requirement individually. For each requirement, the proposer must clearly state on the RTM form their commitment to comply with the requirement or their intention to deviate or not comply. The RTM becomes part of the contract documents, solidifying proposer responses as concrete contractual obligations. Based on recent industry experience, the technical requirements for this project will number in the thousands.

Requirements will vary in significance and importance to Sound Transit. To satisfy many of the less important requirements, the contractor may have to invest significant development time and effort. In such cases, it makes little sense to delay the project for non-essential features. When developing the technical specifications, Sound Transit should categorize the importance/priority of each requirement. This will allow Sound Transit to define the basic elements of the solution that must be in place for the initial deployment, known as the Minimum Viable Product (MVP). When the initial deployment is complete, subsequent iterative software releases can gradually add the less-important features.

Depending on the number and content of features deferred to future software releases, this MVP-first approach can substantially reduce the time required to develop, test and deploy the first release of software. Perhaps equally important, reducing the feature content and complexity of the initial release will likely reduce the quantity and severity of software errors, allowing for a smoother rollout.

- *Minimize bespoke requirements*: Every fare collection project is unique, so some customization is unavoidable. To the extent possible, the specifications should seek to allow the suppliers to propose their existing solutions. Where customization is required, the specifications should focus on describing what Sound Transit needs, not on defining how the supplier should satisfy those needs. By letting the supplier design the custom aspects of the solution, they will be more able to leverage existing designs rather than developing a completely new solution. This approach not only reduces the cost of the project, but also the time required to design, develop and test custom features.

- *Consider issuing an RFI in advance of the RFP*: Typically, the technical specification is in final draft form for several weeks while it is under internal review prior to finalization and publication as part of the RFP. The procurement schedule and the quality of the RFP could benefit by allowing the prospective bidders an opportunity to review the final draft specifications and provide feedback as part of a formal Request for Information (RFI). Depending on Sound Transit procurement regulations, the responses to the RFI may not be public information until after the systems integrator is under contract. This allows the potential proposers to provide candid comments and detailed questions. Often, during the RFP process, proposers are unwilling to provide candid comments and ask detailed questions to avoid revealing sensitive information to competitors. The RFI process often provides an environment that shields the proposers from such concerns. By timing the RFI process to coincide with the last few weeks prior to RFP publication, Sound Transit will have time to enhance the RFP documents with little if any delay in the RFP schedule. Additionally, the RFI process could reduce the number of proposer questions and RFP amendments, expediting the procurement timeline.

- *Structure evaluation process for speed while reducing risk of protest*: As in other cases, reducing the risk of delay can be an effective means to expedite a project. Although post-selection protests are rare, they can upend a project. The proposal evaluation criteria, methods, and final selection process should be carefully constructed to minimize the risk of protest. Many agencies have taken the "best value" approach to an extreme by subjectively defining all evaluation criteria. No numerical scoring is used. Instead, every criterion is assessed using terms such as Unacceptable, Acceptable, Meets Requirements, or Exceeds Requirements. No weighting factors are used, only (at most) a rank ordering of importance. The eventual selection is then "holistic," where the collective factors for each proposal are considered subjectively as a whole. Evaluation criteria and methods such as this make protests based on the final selection difficult to uphold.

There are several other ways to derail a procurement, however. These are typically associated with the agency's behavior during the post-RFP period or with the structure of the procurement process itself. Sound Transit's procurement department should be heavily involved in the development of the specifications, terms and conditions, and all other documents that will be developed or modified for this procurement.

24.4.7 Post-Award Strategies

Streamline design reviews: The design review phase can consist of 50 or more design documents, submitted for agency review over the course of two or three review stages (e.g., Conceptual, Preliminary, Final). The level of effort required to complete the design review phase is often substantial because some documents are often subject to review in multiple stages. In addition, there can be many dependencies (i.e., prerequisites) between documents that can create a sequential "chain" of approvals among documents. Moreover, conventional fare collection projects mandate that all design documents must be approved for a design stage before the next stage can begin. Too often, such rigid adherence to sequential processes can halt all progress for just a single document. Consequently, it is not uncommon for the design review phase of complex fare collection projects to take a year, sometimes more.

To expedite the project, Sound Transit should adopt the same "agile" approach to design reviews that has proven to be so productive in the software development industry. Instead of giving the same level of attention to every component of the solution, Sound Transit should meet with the systems integrator to identify aspects of the solution that are mature and service-proven, which will thus require only cursory review. Then, the process should enable the systems integrator to prioritize the elements of the solution for review, based on which elements the contractor deems most important to progress the project to the next phase, development. Almost by definition, the contractor should declare all requirements necessary for the Minimum Viable Product as highest priority.

Many elements can be reviewed in parallel, but the contractor will be able to prioritize reviews for those elements which will optimize the project schedule. While each element may be subject to Conceptual, Preliminary, and Final design reviews, each element can proceed on its own schedule through the design review stages. Activity through the entire design review phase will be constant, without the typical lulls between stages, and without the risk that only a handful of documents awaiting approval could halt all progress.

This approach means that the design review phase will consist of a continuum of document submittals, reviews, and meetings, rather than the conventional approach of two or three tranches of document submittals, followed by three to six weeks of agency reviews and comments for each set of submittals, concluding with five or more days of meetings for each tranche of documents, followed by several more weeks of modifications to the previous tranche of documents. It also allows the contractor to commence development on any element of the system as soon as it completes design review, without having to wait for approval of all design elements, especially those that have no bearing on the approved element.

In addition, the “agile” design review approach enables more efficient use of subject matter resources, because only those qualified to review an element will be involved in the cycle of submittals, reviews, and meetings that will occur. However, a project of this complexity, which will include a faregate systems supplier and INIT, effectively two fare collection projects in tandem, will require a major resource commitment from Sound Transit. If Sound Transit cannot provide timely feedback for the submittals, the project will face potential delays or the prospect of design approvals by default. But a properly structured, staffed, and managed design review phase that is designed for efficiency and productivity has the potential to dramatically reduce the time required to approve the design.

- *Optimize Factory Acceptance Testing*: Many elements of the faregate solution may be mature with a solid track record of performance. If these elements are public-facing or are considered mission-critical, they should be subjected to comprehensive factory acceptance testing. But if the risk of defects on these proven elements is low, Sound Transit should balance the risks of minimal testing against the benefits of potentially expediting the project.

Sound Transit should also consider designing the factory acceptance test regimen to prioritize feature tests according to the requirements prioritization defined in the technical specifications and the Requirements Traceability Matrix and the Minimum Viable Product (see Section 24.4.6) – especially those features and requirements that cause the contractor to expend significant development effort.

By reducing testing effort on elements that are mature, or non-critical, and devoting special attention to those elements that are critical and unproven, the factory acceptance test phase will likely be more effective at revealing defects and more time efficient.

- *Expedite design approval for long-lead items*: Because many key subcomponents will be manufactured overseas, supply chains may be subject to disruption. At the outset of the design review phase, Sound Transit should request the contractor to identify any hardware components or subcomponents that have long lead times. To the extent practical, those hardware designs should be expedited to enable the contractor to quickly place orders to avoid delays.

- *Pilot Test / Incremental station activation*: It may seem redundant, but to reduce risk, this faregate pilot project’s first deployment should be for the purposes of a Pilot Test. By their nature, Pilot Tests provide an early but limited trial run of the system. The Pilot Test requires that the faregate BOS is fully functional (at least at the MVP level) and that all other systems and procedures are ready for revenue service, such as Youth fare media distribution and TVM issuance of machine-readable media. The controlled public exposure will provide vital feedback and performance metrics; the test will also allow Sound Transit to debug new procedures and operations and verify the completeness and accuracy of system reports, all under controlled conditions.

Ideally, the Pilot Test would occur at two or more stations with comparatively low ridership, straightforward installation, and minimal infrastructure improvements. Roosevelt and Northgate appear to be excellent candidates for the Pilot Test. The infrastructure improvements, electrical systems modifications, and any other station-specific activities for the selected Pilot Test stations would receive top priority. When the Pilot Test station preparations are complete, the contractor can commence installing the faregates, and Sound Transit, or a subcontractor, can relocate existing or install new TVMs and install the PAPs.

For this type of project, the Pilot Test should run for about four to six weeks, which should provide sufficient experience to identify any issues that may require resolution before other stations are activated. If the test reveals critical issues, Sound Transit should consider extending the Pilot Test until the contractor, or other responsible party, resolve the issues.

At the non-Pilot Test stations, preparations and even equipment installation should occur in parallel with preparations at the Pilot Test station, as well as during the Pilot Test itself. However, Sound Transit should not activate faregates at any non-Pilot Test stations until successful completion of the Pilot Test, including the resolution of any critical defects identified during the test.

After completion of the Pilot Test, Sound Transit should activate faregates at non-Pilot Test stations as soon as they are installed and commissioned.

Selecting the “lowest hanging fruit” for the Pilot Test stations will minimize the time required to get the first faregates into service. Thereafter, activating the rest of the stations incrementally will not only minimize project complexity and risk, but will also allow Sound Transit and its passengers to reap the benefits of the faregates more quickly.

25 REPORT SUMMARY AND CONCLUSIONS

The project is financially viable with Return on Investment achieved in less than three years for all three scenarios. Among many other characteristics, to succeed, the project will require:

— Extensive coordination among all Sound Transit departments
— Thorough up-front planning
— A Program Management Office that is properly staffed, organized, and equipped
— Comprehensive review of fare policies and business rules
— Implementation of numerous new operational procedures
— Carefully orchestrated passenger education and outreach

The “pay on entry only” operation mode (Scenario 3) offers measurably lower ROI than the low-ridership “bi-directional” equivalent (Scenarios 1 & 2). A similar result would likely occur in a high-ridership assessment of the “pay on entry only” operating mode, resulting in strong but lower ROI than Scenario 1. This suggests that collecting fares for passengers entering and exiting gated stations provides financial benefits, but with greater operational complexity and some passenger frustration and confusion. Negative passenger reactions can be mitigated by effective public information campaigns prior to faregate deployment. Any remaining such reactions should fade quickly as passengers grow accustomed to the faregates. These results present Sound Transit with a decision: whether to maximize revenues or sacrifice some revenue gains in favor of a lower impact on the passenger experience.

While the “free exit” approach may appear to be an acceptable compromise, it would establish the precedent for all future expansion. This report recommends that future stations be designed to accommodate faregates from the outset. Doing so would eliminate the costly station retrofits required for this pilot project, resulting in per-station ROI that would almost certainly be measured in months, not years.

If all future stations include faregates from the outset, the percentage of trips involving faregates at the origin station will increase, which will correspondingly produce a reduction in the potential number of “trapped” passengers. Trapped passengers are those who start their trip at a non-gated station without a valid fare and arrive at a gated station without the ability to purchase a fare to exit. As Sound Transit deploys faregates to more stations, more trips will start at gated stations. Each such trip requires a valid fare, so those passengers cannot be “trapped” if they arrive at another gated station. Thus, the problem that Scenario 3 seeks to address will become less significant over time.

In addition, the choice between bi-directional and “pay on entry only” operation is fundamentally an equity issue. In the “pay on entry only” mode, faregates will require all passengers who start their trips at gated stations to pay a fare, but passengers who start their trips at non-gated stations will be able to avoid paying a fare, except on those minority of their trips where they encounter a Fare Ambassador. For example, a passenger who departs Star Lake, a non-gated station, and arrives as Westlake, a gated station, would be able to make the 50-minute trip without paying. In contrast, a person making the two-minute trip from Symphony, a gated station, to Westlake would always have to pay. Such inequities would quickly become widespread knowledge via social media and other similar channels of information.

Finally, paying one’s fare – and not paying one’s fare – is in many respects contagious. People are more willing to pay their fare if they feel that everyone else is doing so. Conversely, people are less willing to pay their fare if they observe widespread non-payment. Bi-directional faregates will simply make it harder for people to ride without paying. This will reinforce people’s willingness to pay because they will see for themselves that most of their fellow passengers are paying, too. As suggested in this report, the introduction of faregates will require extensive passenger outreach and preparation, regardless of the mode of operation. But with a comprehensive public campaign in advance of faregate deployment, Sound Transit's passengers will be well-equipped for the changes that faregates will bring. Because of its superior return on investment, the additional long-term benefits resulting from future system expansion, equity considerations, and its generally positive effects on fare compliance, WSP recommends adoption of "bi-directional" faregate operations.

The primary result of this analysis is a compelling case for deploying faregates. The strength of the financial assessment suggests the project merits further study, which would provide:

— Refined station designs, including satisfaction of NFPA exit capacity requirements, leading to more accurate construction cost estimates

— A clearer picture of the likely solution, leading to more accurate capital and operating cost estimates

— Enhanced Return on Investment models

— Better understanding of the procedures required to support faregate operations

— Development of initial project milestones and a project schedule

— Opportunities to conduct formal public outreach (e.g., focus groups) to gauge public reaction and to identify topics of interest and concern to Sound Transit's passengers and other outside stakeholders

— Additional recommendations for project organization, strategic planning, and other steps to ensure project success

With such follow-up information, Sound Transit will be equipped to more completely define the preferred solution for faregate deployment, and as a result make informed decisions regarding the project's – and the agency's – future. WSP recommends that Sound Transit take this next step.