Image from Nelson\Nygaard

3 CORRIDORS

Seattle has many important transit corridors that serve dense neighborhoods and job centers. In addition to these land use attributes, successful transit corridors have strong demand generators at their termini and operate over direct routes that allow high levels of speed and reliability. The Transit Master Plan (TMP) included an in-depth process to study travel for successful high- and medium-capacity transit service. The evaluation used measures grouped under five "accounts" including: Community, Economy, Environment and Human Health, Social Equity, and Efficiency. These measures were used to identify corridor capital investment priorities where SDOT will prioritize speed and reliability improvements. The TMP is consistent with King County Metro's 2011 Strategic Plan for Public Transportation, which calls for the agency to invest resources in corridors that have the highest potential to generate ridership, as well as to serve regional equity and environmental goals. The TMP also builds on King County Metro's RapidRide Bus Rapid Transit (BRT) program, recommending seven new BRT corridors for development under the RapidRide brand in Seattle. Other planned improvements are also reflected in this chapter, including those from various multimodal corridor studies and area plans, such as the Madison Corridor Bus Rapid Transit Study, the Route 44 Enhancements Study for NW Market and 45th Streets, the Roosevelt to Downtown High-Capacity Transit Study, and the Accessible Mt. Baker Plan.

A LONG-RANGE VISION FOR SEATTLE'S HIGH CAPACITY TRANSIT NETWORK

WHAT IS HIGH CAPACITY TRANSIT?

High capacity transit (HCT) refers to transit that delivers high levels of capacity, frequency, and design quality linked by effective transfer facilities. HCT consists of both rubber-tired (e.g., bus rapid transit or BRT) and rail modes (e.g., streetcar) and fills a need for service between Link light rail and local bus. A more detailed description of HCT for Seattle is provided on page 3-8.

WHY DOES SEATTLE NEED A LONG-RANGE VISION FOR HIGH CAPACITY TRANSIT?

The Transit Master Plan (TMP) articulates a long-range vision for a Seattle where most residents can walk or bike to high-quality, high-capacity transit and where a network of routes moves residents, visitors, and workers swiftly between major neighborhoods. The TMP is structured to help City staff and elected officials implement the vision and measure progress toward its achievement. A clear, long-range vision provides a tool to:

- Build consensus for action and priorities among local stakeholders and partner agencies
- Guide investment of limited resources to achieve the greatest benefit
- Develop a phased implementation approach for Seattle-focused HCT corridors that support the system of urban centers and villages set forth in the City's Comprehensive Plan
- Meet key City economic, environmental, equity, and livability goals, such as a significant reduction in greenhouse gas (GhG) emissions

WHAT WOULD IT TAKE TO REALIZE THE VISION IN 40 YEARS?

Realizing the vision will require sustained action by the City to:

- Develop local funding sources to support both transit operations and significant transit corridor capital investments
- Provide initiative, staff capacity, and funding support for leading design and construction of rail and BRT projects in priority citywide corridors
- Coordinate with Sound Transit (ST) to prioritize study and construction of HCT in western Seattle neighborhoods in the ST long-range mass transit plan
- Work with King County Metro Transit to develop BRT services in corridors that don't merit rail investment or where demand is high and interim rubber-tired solutions are required
- Continue to funnel growth to key urban centers and urban villages served by the long-range HCT network

LONG-RANGE HCT VISION: TARGETED TO SERVICE QUALITY

The long-range HCT network illustrated in Figure 3-1 goes beyond the existing regional vision for Link light rail and the Seattle Streetcar Network Concept for Center City neighborhoods. It defines a citywide network of BRT and rail corridors that will deliver transit service with high levels of capacity, frequency, design, and access quality linked by effective transfer facilities.

THE LONG-RANGE HCT VISION GUIDES

The Long-Range HCT Vision can help to guide Seattle's land use and transportation investments and policy decisions to ensure that they are supportive of the Transit Master Plan. The Vision guides the City to:

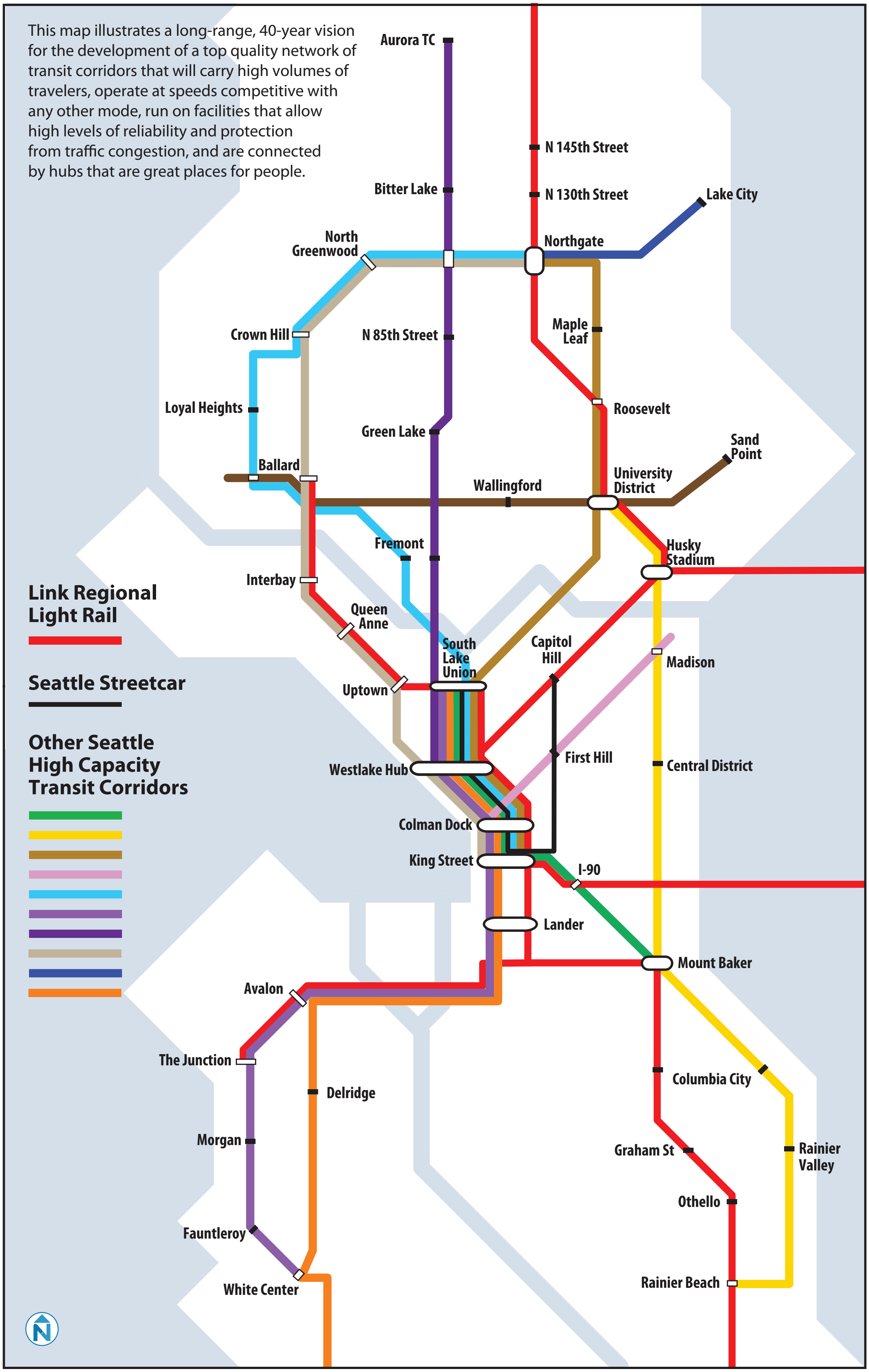
- **Coordinate with partner agencies:** The Vision communicates Seattle's priorities for transit corridor connections to regional transit agencies.
- **Phase and prioritize investments:** The Vision ensures that major transit capital investments in Seattle move the City toward a clear goal, even as investments are phased toward full system development.
- **Focus all development around transit-oriented neighborhood principles (see Chapter 5):** The Vision recognizes where growth is planned and guides transit investments to meet future needs.
- **Coordinate modal investments:** The Vision informs the City's other modal investments by implementing the Bicycle and Pedestrian Master Plans, coordinating with the City's Freight Master Plan priorities, and supporting seamless transfers where major transit facilities meet.

THE LONG-RANGE HCT VISION INSPIRES

The Vision is a means for Seattle to come together around building the transit system that will help the City attain its economic, environmental, equity, and human health goals. Moving Seattle toward its HCT Vision will do more than enhance mobility, it will deliver on other important City goals to be an economically vital, low-carbon city. Achievement of the HCT vision will inspire:

- **A new mobility paradigm where walking, bicycling, and taking transit are the most convenient ways to travel for most trips in the city:** Seamless connections to the regional transit system will make transit the best option for Seattleites accessing other Puget Sound communities and for workers and visitors traveling to Seattle.
- **Most new development designed and constructed based on transit-oriented neighborhood principles:** Pedestrian-friendly transit nodes are the focal point of neighborhood centers and community interaction.
- **Low-carbon neighborhoods centered around transit nodes:** Transit helps Seattle achieve emissions reduction goals and helps to shape development patterns that reduce the number and distance of driving trips.
- **A healthy, active lifestyle for Seattle residents of all ages:** Increased levels of walking, bicycling, and transit trips allow residents of all ages to incorporate physical activity into their daily routines.

FIGURE 3-1 SEATTLE LONG-RANGE HIGH CAPACITY TRANSIT VISION



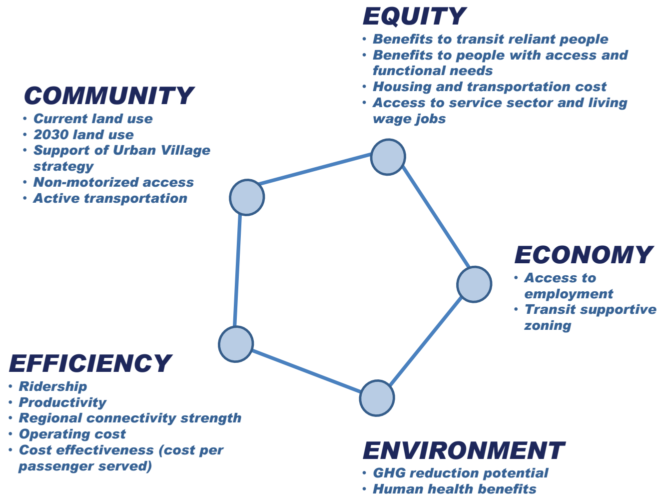
TRANSIT CORRIDOR EVALUATION PROCESS

It will take decades to achieve Seattle's long-range vision for transit. The TMP is a 20-year plan, designed to deliver near-term priorities for transit system investment. The TMP employed an outcome-based evaluation process to determine where and how to invest limited transit funding.

HOW THE TMP DETERMINED CORRIDOR INVESTMENT PRIORITIES

The TMP used an outcome-based process called multiple account evaluation (MAE) to identify capital and transit service investments that support the TMP goals. Figure 3-2 shows the evaluation accounts used to prioritize corridor investments. The MAE process provided a powerful tool to engage stakeholders in developing a set of corridor investment priorities. It also helped the City to make investment decisions in line with economic, environment, health, and community development goals. The evaluation led to the prioritization of corridors that are poised for high-capacity transit investments or significant investments in rubber-tired transit improvements. The MAE process identified a clear set of priorities for City transit investment that serve as a foundation for TMP recommendations.

FIGURE 3-2 ACCOUNTS USED IN MULTIPLE ACCOUNT EVALUATION PROCESS



PUBLIC AND STAKEHOLDER PARTICIPATION

Three key groups were instrumental in developing the TMP and the corridor evaluation process:

- **Transit Master Plan Advisory Group (TMPAG):** The TMPAG included 25 members appointed by the Mayor and City Council. The group met monthly and provided detailed input at every phase of the corridor evaluation process.
- **City/County/Regional Interagency Technical Advisory Team (ITAT):** The ITAT included technical staff from SDOT and a number of other City departments, the Seattle Planning Commission, King County Metro Transit and Roadway Division, Sound Transit, Puget Sound Regional Council, and Public Health – Seattle and King County.
- **City of Seattle Executive Steering Committee (ESC):** The ESC was an executive leadership team that provided high-level direction to the TMP technical team.

Image from Nelson\Nygaard

The project team also briefed the Seattle City Council, the Office of the Mayor, the Seattle Planning Commission, the Pedestrian Advisory Board, the Bicycle Advisory Board, the Freight Advisory Board, Seattle Center, Puget Sound Regional Council, and several neighborhood groups.

The public participated in developing the plan by participating in focus groups, completing an online survey that received over 12,000 responses, and providing comments at various stages of the planning process.

In a series of workshops, the ITAT and TMPAG helped to determine desired outcomes for the TMP. The most important outcomes identified by these groups—and supported through the public focus groups and the survey—were used to develop an evaluation framework for developing investment priorities. Both groups provided detailed input that influenced the evaluation measures used to prioritize corridors for transit investment.

Following release of the draft TMP Summary Report in September 2011, SDOT held a series of five public open houses in Seattle to share information about the report and provide the public with an opportunity to engage with the project team and provide feedback. In addition, SDOT and several other City departments held a meeting attended by over 160 people from historically underrepresented communities. The Summary Report was revised based on public as well as stakeholder and agency feedback.

In fall of 2015, two HCT corridors and five priority bus corridors were re-examined as BRT corridors branded as RapidRide. SDOT elevated these seven corridors to BRT levels of service and design in response to rapid growth of Seattle's urban centers and villages, and growing demand for high quality transit services that both serve existing and choice transit markets. Key 2012 TMP corridor evaluation measures were used to evaluate the RapidRide corridors.

The ESC was re-engaged and a series of King County Metro coordination meetings were facilitated to ensure BRT corridors (operated as the next generation of RapidRide services) met basic operating and capital assumptions.

CORRIDOR EVALUATION APPROACH AND STAGES

Corridors were evaluated against 16 criteria (a number of which had multiple sub-criteria) organized under the five evaluation accounts shown in Figure 3-2. The results were reviewed with the ITAT, TMPAG, and ESC at each stage, and their feedback was used to refine the analysis and methods.

Stage I: Screening For Demand Potential

The Stage I corridor evaluation analyzed transit corridors based on the Urban Village Transit Network (UVTN) to determine their potential to generate ridership. A detailed market analysis (see Chapter 2 of the TMP Briefing Book) also guided selection of initial corridor alternatives. Based on current and future land use and demographic characteristics, corridors least likely to deliver significant return on transit investments within the plan timeframe were screened out during this phase. The Stage I process narrowed the evaluation to a set of priority corridors.

Stage II: Multiple Account Evaluation

The Stage I corridors were evaluated against performance measures within each MAE account as illustrated in Figure 3-3. The measures were weighted for relative importance by ITAT, TMPAG, and ESC. The reviewers also assigned a weight to each account.

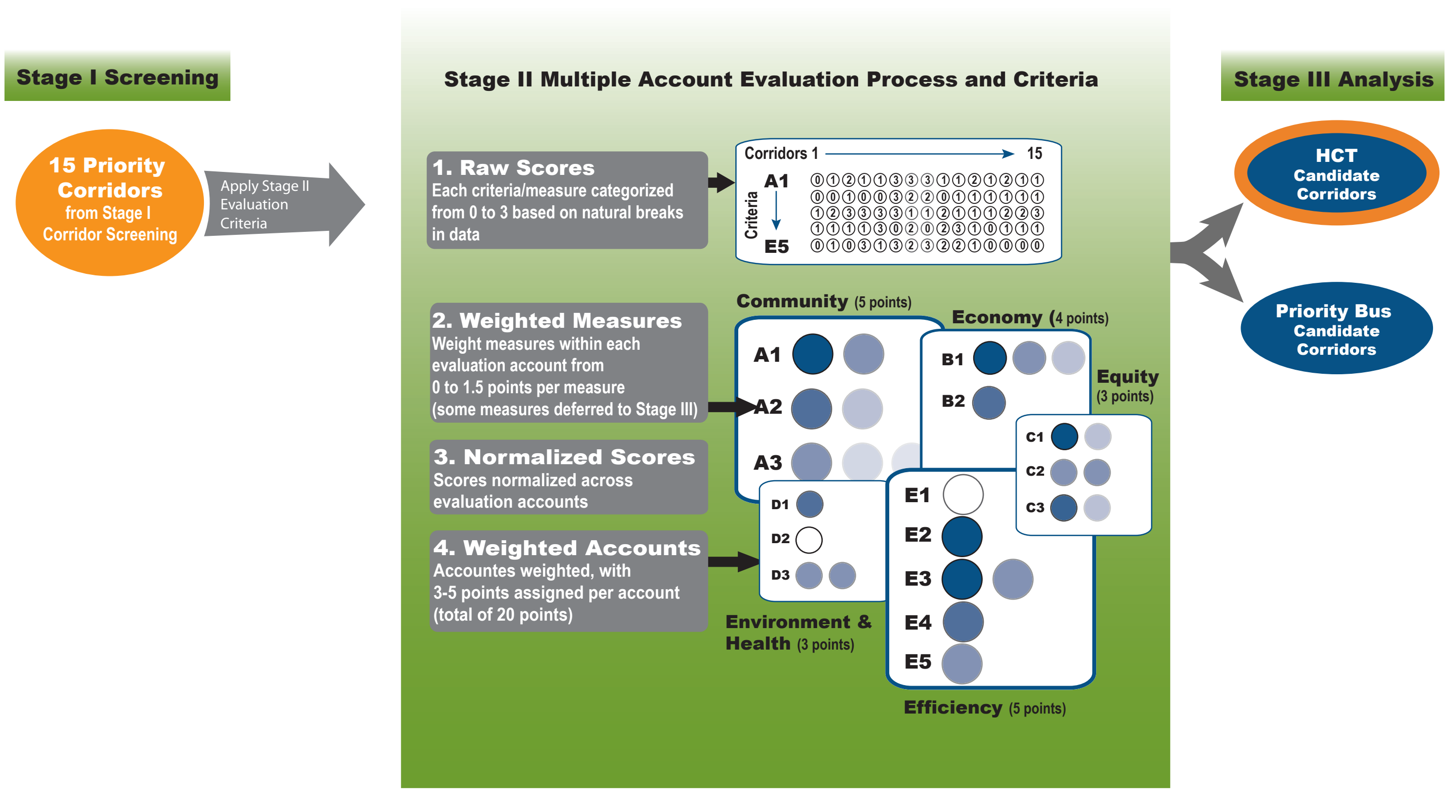
Stage III: High Capacity Corridor and Priority Bus Corridor Analyses

Based primarily on the Stage II evaluation, the corridors were prioritized into two tiers for more detailed analysis of potential transit investments:

- **High Capacity Transit (HCT) Candidate Corridors:** The top tier of corridors was evaluated for rail, bus rapid transit (BRT), and enhanced bus mode options and for more detailed alignment considerations. Operating plans and planning level capital cost estimates were developed for each of these corridors. Two original HCT corridors are now included in the RapidRide network.
- **Priority Bus Corridors:** The remaining corridors were evaluated for speed and reliability capital improvement opportunities and for service enhancements. In fall of 2015, five of the priority bus corridors were elevated to the RapidRide network.

Additional factors considered included the viability of the corridor for high-capacity transit (e.g., grade, availability of right-of-way) and potential overlap with current and planned Link light rail or other major transit investments.

FIGURE 3-3 MULTIPLE ACCOUNT EVALUATION PROCESS



PRIORITY INVESTMENTS IN THE FREQUENT TRANSIT NETWORK

WHAT IS THE FREQUENT TRANSIT NETWORK?

The Frequent Transit Network (FTN) is a vision for a network of transit corridors that connect the City's urban centers and villages with high-quality transit service within a short walk for most residents. This chapter identifies priorities for corridor capital investments, while Chapter 4 describes FTN service characteristics.

The FTN builds upon the city's Urban Village Transit Network (UVTN)—a service investment concept used in the 2005 Seattle Transit Plan. The UVTN provided a framework for measuring transit performance on important arterial corridors, but it gave limited direction for how the City should invest capital resources in operable, end-to-end transit corridors. The FTN replaces the UVTN by developing a program of coordinated transit corridor capital investments, with project-level detail on how to implement speed and reliability improvements. The TMP Briefing Book, page 4-16, provides a map of the UVTN, while pages 4-34 to 4-36 of the TMP Briefing Book illustrate UVTN performance measures.

Chapter 4 (Service) provides a detailed description of the service design principles, service levels, and performance characteristics of the Frequent Transit Network (FTN).

CONSISTENCY WITH KING COUNTY METRO'S TRANSIT VISION

Metro's long-range plan, to be completed in the summer of 2016, will present a shared vision for a future public transportation system that gets people where they want to go and helps the greater Seattle area thrive. The plan has been closely coordinated with Sound Transit and will describe an integrated network of transportation options in King County, the facilities and technology needed to support those services, and the financial requirements for building the system.

PRIORITY CORRIDOR CAPITAL INVESTMENTS: BUILDING THE FREQUENT TRANSIT NETWORK

Making capital investments in priority transit corridors that develop and enhance the FTN is a key focus of the TMP. Investments in the corridors identified through the TMP have the highest potential benefits to Seattle and its residents. Priority corridor investments in the FTN fall into two general categories summarized below and illustrated in Figure 3-4.

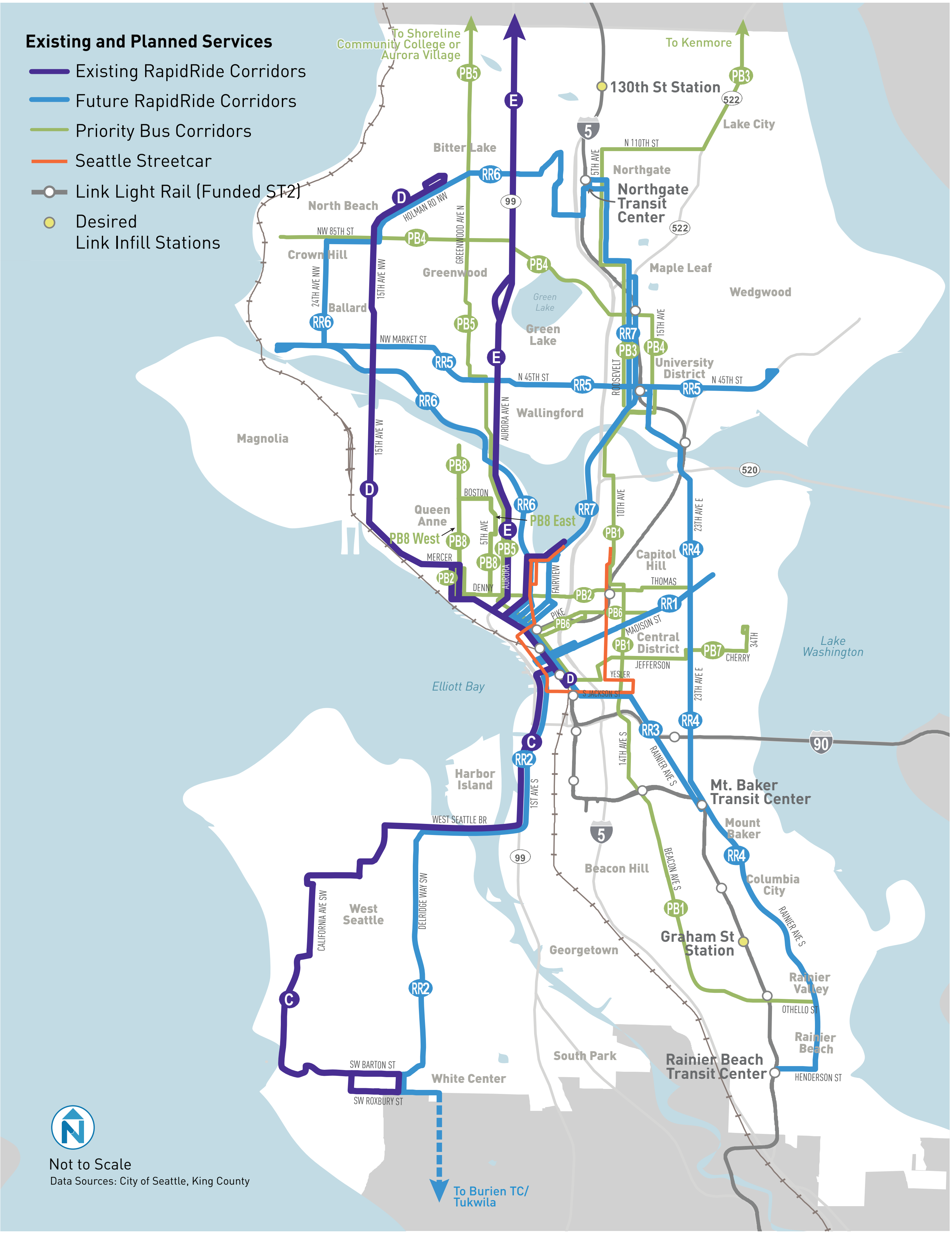
The following sections describe each category of corridors in detail.

- **High Capacity Transit Corridors:** These represent the top tier of citywide corridors that were evaluated for suitability for rapid streetcar and BRT modes.
- **Priority Bus Corridors:** The remaining citywide corridors were considered for transit priority and infrastructure improvements, assuming rubber-tired transit would continue to be the dominant mode. Those corridors that provide transit access through downtown include a focus on Center City circulation, broadly benefiting transit service operating in and through downtown, and serve critical connections between many of Seattle's densest neighborhoods.

In addition to these corridors investments, priority investments in the FTN include:

- **Support Link light rail**, which serves important regional connections but is not funded or developed by the City.
- **Eliminate or reduce impacts of traffic bottlenecks** where they impact transit operation (i.e., constrained arterials entering downtown, bridge entries, and freeway ramp locations).
- **Coordinate with neighboring jurisdictions** to ensure that transit speed and reliability improvements on Seattle streets are carried across city boundaries. This is particularly important in corridors where predominant travel demands are between northern, southern, or eastern Seattle neighborhoods and neighboring jurisdictions.

FIGURE 3-4 PRIORITY TRANSIT CORRIDORS FOR CAPITAL INVESTMENTS



HIGH CAPACITY TRANSIT CORRIDORS

Surface High Capacity Transit in Seattle

The Revised Code of Washington defines "high capacity transit" as follows:

> *"High capacity transportation system" means a system of public transportation services within an urbanized region operating principally on exclusive rights-of-way, and the supporting services and facilities necessary to implement such a system, including interim express services and high occupancy vehicle lanes, which taken as a whole, provides a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways.*

This definition was developed to govern the actions of agencies like Sound Transit, charged with developing regional transit systems designed to carry passengers between large urban centers. In these cases, a focus on the separation of transit from general purpose vehicles is of critical importance. In a dense urban city like Seattle, high capacity transit is needed in many corridors in addition to grade separated fixed-guideway service. Inevitably, these surface high-capacity lines will mix with general purpose traffic at times. However, there is much that can be done to provide high capacity transit features in an urban arterial street environment.

Seattle's surface HCT corridors use principles of HCT transit design to move high-volumes of passengers at competitive speeds, with high levels of reliability, and while delivering amenities and services expected when using a rail line.

For Seattle, surface HCT consists of both rail and rubber-tired transit modes that can provide residents with high-quality transit service, consistent with the design principles and FTN service levels (see Chapter 4). The HCT corridors identified in the TMP fill a key service need between Link light rail and local bus service. Seattle's surface HCT will be distinguished by the following factors:

- Provides locally-focused service for transit markets within the city of Seattle and surrounding areas. Link light rail focuses on regional connectivity and longer-distance trips; by design, it is more of an intercity commuter rail model of transit operation than an urban light rail service.
- Operates primarily on arterial streets using a combination of exclusive and shared right-of-way. Link light rail uses exclusive right-of-way with full or partial grade separation. The Center City Connector streetcar project will use dedicated transit lanes on 1st Avenue in downtown, but mix with traffic on other segments of the line.
- The Seattle HCT network aims to dedicate 50% of corridor right-of-way to transit in order to provide fast and reliable transit service and qualify BRT projects for FTA Small Starts funding.

SURFACE HIGH CAPACITY TRANSIT MODES

Seattle's surface HCT corridors have the potential to be served by multiple modes. However, steep topography or constrained rights-of-way limit the available mode options for some corridors. The TMP considers surface HCT modes, plus an enhanced bus service, for developing transit corridors in Seattle:

- **Rapid Streetcar** uses standard modern streetcar vehicles or longer articulated or coupled street-running vehicles and is envisioned to operate like the European street tram systems described in the call out on pages 3-10 and 3-11. Rapid streetcar achieves faster operating speed and greater reliability through longer spacing between stops and more extensive use of exclusive right-of-way than is typical of U.S. streetcar lines that emphasize Center City circulation. Rapid streetcar stations would be on-street and would be designed to include high volume shelters, real-time passenger information, level boarding, off-board fare payment, and enhanced station amenities. Rapid streetcar would have higher capacity trains, greater priority over traffic, and operate at higher speeds compared with a local streetcar circulator, such as the initial implementation of the South Lake Union streetcar. Current SDOT plans for the Center City Connector and transit lane improvements on Westlake will begin to transition Seattle Streetcar from a primarily mixed-traffic system to one that has significant priority over general purpose traffic.

DIFFERENTIATING LINK LIGHT RAIL FROM SEATTLE HCT

Much of the existing and planned Sound Transit Link light rail system has attributes of a rapid rail system (e.g., fully exclusive and grade-separated right of way and off-board fare payment), providing fast regional connections with limited stops. The segment of Central Link in Southeast Seattle that operates on MLK Jr Way is a notable exception since it operates in the street right-of-way and crosses intersections at grade, yet even here stop spacing is wide. The Link service design model compares to BART in the San Francisco Bay Area or SkyTrain in Vancouver, B.C. Light rail systems in places like Portland and San Diego share some similar features to Link, but operate on-street (both in mixed traffic and exclusive lanes) in the most urban areas of their service areas. The HCT or urban rail modes evaluated in the TMP would use a similar model, operating in existing street rights-of-way, with longer stop spacing, and a mix of priority treatments to gain advantage over traffic.

The San Diego Trolley (photo) and Portland MAX system operate on-street in the most urban parts of their service areas.

Image from Nelson\Nygaard

- **Local Streetcar** is the rail mode considered for extension of Seattle Streetcar north on Broadway and functions as an urban circulator. It has relatively short distances between stops and operates only in mixed or transit only lanes.
- **Bus Rapid Transit** is the mode considered for many of Seattle's HCT corridors. BRT combines a rubber-tired transit vehicle with the operating characteristics of rail, including longer stop spacing and use of exclusive right-of-way. BRT stations may include real-time passenger information, level boarding, off-board fare payment, and enhanced station amenities. BRT vehicles are often "branded" or stylized to distinguish them from buses providing local service, and they may have features such as multiple, wide doors on the left- or right-side of vehicles to increase boarding capacity. The initial deployment of King County Metro's RapidRide service falls into a "light" category of BRT service with less extensive priority features, but it does include branded, stylized vehicles and some well-developed station features. The City aims to make investments in future RapidRide corridors with greater levels of priority than the initial RapidRide deployment. BRT may be implemented using diesel electric hybrid or electric trolley buses. The TMP aims to meet minimum standards for runningway priority and other enhanced transit features based on the City's RapidRide Expansion Toolkit. A summary of the RapidRide Toolkit is provided on pages 3-14 to 3-15.
- **Enhanced Bus** assumes a more basic level of improvements and priority features for existing transit service, with increased hours of operation and frequency comparable to BRT, but generally operating in mixed traffic. As with BRT, diesel or electric trolley buses could be used.

The TMP Briefing Book, Section 6, provides a more in-depth discussion of transit modes.

The T3 tram line is one of four tram lines in Paris that exemplify the Rapid Streetcar mode. Typical of European street trams, it uses articulated, higher-capacity trains and exclusive right-of-way. Although Paris historically had an extensive network of street trams, predating its Metro system, its modern tram lines have all been constructed since the 1990s.

Image from Wikimedia Commons user Pline

The South Lake Union Streetcar is an example of the local streetcar mode.

Image from Nelson\Nygaard

Los Angeles MTA operates the Orange and Silver line Full BRT and BRT "Light" services, branded as "Metro Liner." Orange Line vehicles utilize exclusive right-of-way and receive priority at intersections. These services are designed to look and operate like Metro Rail services; the Orange line has exclusive off-board fare payment and all-door boarding, which is also planned for the Silver Line. The Silver line primarily runs along a freeway right-of-way while the Orange line utilizes an old rail right-of-way, which has implications for access and land use integration (discussed in Chapter 5).

Image from Los Angeles Metro Transportation Library and Archive

Los Angeles MTA offers a 26-route network of Metro Rapid bus service, distinguished by red and silver low-floor vehicles (left). Metro Rapid service is characterized by longer stop spacing, transit priority features, and clearly branded enhanced stations. It is differentiated from Metro Local service, which uses similar vehicles (right), but Metro Local buses are painted orange and are not exclusively low-floor vehicles.

Image from Los Angeles County MTA (left) and Flickr user LA Wad (right)

INTRODUCING THE RAPID STREETCAR MODE VIA EUROPEAN STREET TRAMS

Modern streetcar development in the United States is often characterized by low-speed urban circulators designed to make short connecting trips in dense urban districts. It is not surprising, then, that people's vision of "streetcars" is of a mode designed more like the South Lake union streetcar than the urban tram lines over which U.S. travelers to Europe marvel. The rapid streetcar mode considered in the TMP models the European street tram more than Portland Streetcar or the initial operating design for the South Lake Union Streetcar which have little priority over general purpose traffic.

Comparing Rapid Streetcar to Local Streetcar Circulators

"Rapid Streetcar" is a term coined to differentiate the high-capacity transit rail mode identified in the Seattle TMP from modern U.S. streetcar lines that typically serve downtown circulation, are low speed, and operate in mixed traffic with limited priority over general traffic. These lines consequently have short stop spacing and operate at relatively low average speeds.

Cities are attracted to the lower capital costs of building streetcar lines relative to light rail; lighter weight streetcar vehicles require less extensive street reinforcement and utility relocation. Although they operate at much lower speeds in urban environments, streetcar vehicles are capable of traveling at a comparable speed to light rail—44 miles per hour for vehicles manufactured by United Streetcar. Design features of Rapid Streetcar that differentiate it from local streetcar models include:

- Use of dedicated rights-of-way, where conditions allow
- Provision of high levels of traffic signal priority and other transit priority treatments to allow transit to bypass general purpose traffic in intersections and congested parts of the transit corridor where rail cars mix with traffic
- Use of larger or coupled vehicles to accommodate high passenger loads
- A higher level of station investment design and amenity development
- A higher level of investment in station access and wayfinding

These features produce a traveler experience that is more comparable to what Americans think of as urban light rail. The following European street tram examples are instructive as to the potential for Rapid Streetcar in Seattle.

European Street Trams as a Model for Seattle

Dozens of mid- and large-sized European cities have built new surface-running tram lines in the last decade; the mode has become popular due to its modest cost compared with subways and popularity with riders. These European trams provide context for the Rapid Streetcar mode identified for HCT corridors in the TMP. European trams that have longer spacing between stops and make use of exclusive right-of-way are able to attain higher average speeds than is typical of U.S. streetcar systems. Many lines carry large passenger volumes. Several examples of such tram lines or systems are described below.

*Nice**

The Nice T1 tram line uses Alstom Citadis 302 5-section trains that are about 100 feet long and hold up to 56 seated and 144 standing passengers. (The Citadis trains include versions with up to seven sections that are about 130 feet long and hold 70 seated and 230 standing passengers). The nearly 5.5 mile line, which opened in 2007, replaced four bus lines and carries about 90,000 passengers per day. Trains run from 5 a.m. to 2 a.m. seven days per week. During peak service hours of 8 a.m. to 9 p.m., Nice T1 trams run every five minutes on weekdays, every six minutes on Saturdays, and every 10 minutes on Sundays.

As illustrated in the photo, trams in Nice are visibly branded and operate in dense urban neighborhoods, including traveling through busy pedestrian plazas and crossing at-grade intersections with high volumes of pedestrians and cyclists. A strength of the European Street Tram/Rapid Streetcar model is that it puts transit where people are and want to be, breaking down the challenge of directing people to grade-separated stations that can be challenging to reach.

Lyon†

The modern tramway network in Lyon consists of four lines, all built since 2001, and complements the city's four-line metro system. The simple fact that a network of four lines covering 31 miles of the city was built in a 10 year time frame is instructive. The ability to contextually integrate tram lines into the existing urban fabric allows for relatively rapid development. The nine-mile T3 line, completed in 2006, initially used the 5-section Citadis train, although 7-section Citadis 402 trains have been ordered. The line runs at a maximum speed of 43 mph and averages 23 mph; some of the line operates in relatively low-density areas where higher speeds are attainable. An extension of the T4 line is planned. The Lyon tramway is designed to complement intercity and regional transit systems as well as the higher capacity Lyon Metro system. Following the completion of a four line metro system in the 1970s and 1980s, the city has transitioned to the development of a surface tramway system as the more cost effective way to serve mobility needs.

* Wikipedia, http://fr.wikipedia.org/wiki/Lignes_d%27azur; http://en.wikipedia.org/wiki/Tramway_de_Nice. Lignes d'Azur. http://www.lignesdazur.com/ftp/lignes_FR/tram%20horaires%20%2821%2004%20 10%29.pdf

† Wikipedia, http://en.wikipedia.org/wiki/Lyon_tramway

Applicability of the European Model to the U.S.

European trams operate the type of high-quality service—high frequency and high speed—that is proposed in the TMP. While U.S.-based streetcar manufacturers such as United Streetcar have not yet produced longer articulated or coupled vehicles, or expressed interest in doing so, they likely would be able to license designs from other manufacturers and produce the vehicles given sufficient demand. There are few existing U.S. examples of Rapid Streetcar lines, although portions of the Portland, San Diego, and San Francisco light rail systems operate in a similar fashion. Further, a number of cities are exploring streetcar development projects that cover longer distances and provide a much higher level of priority for streetcar vehicles.

T1 tram in Nice's Place Girabaldi, where the tram runs without overhead wires, using batteries for a short section.

Image from Wikimedia Commons user Myrbella

A train on Lyon's T2 tram line.

Image from Wikimedia Commons user Alain Caraco

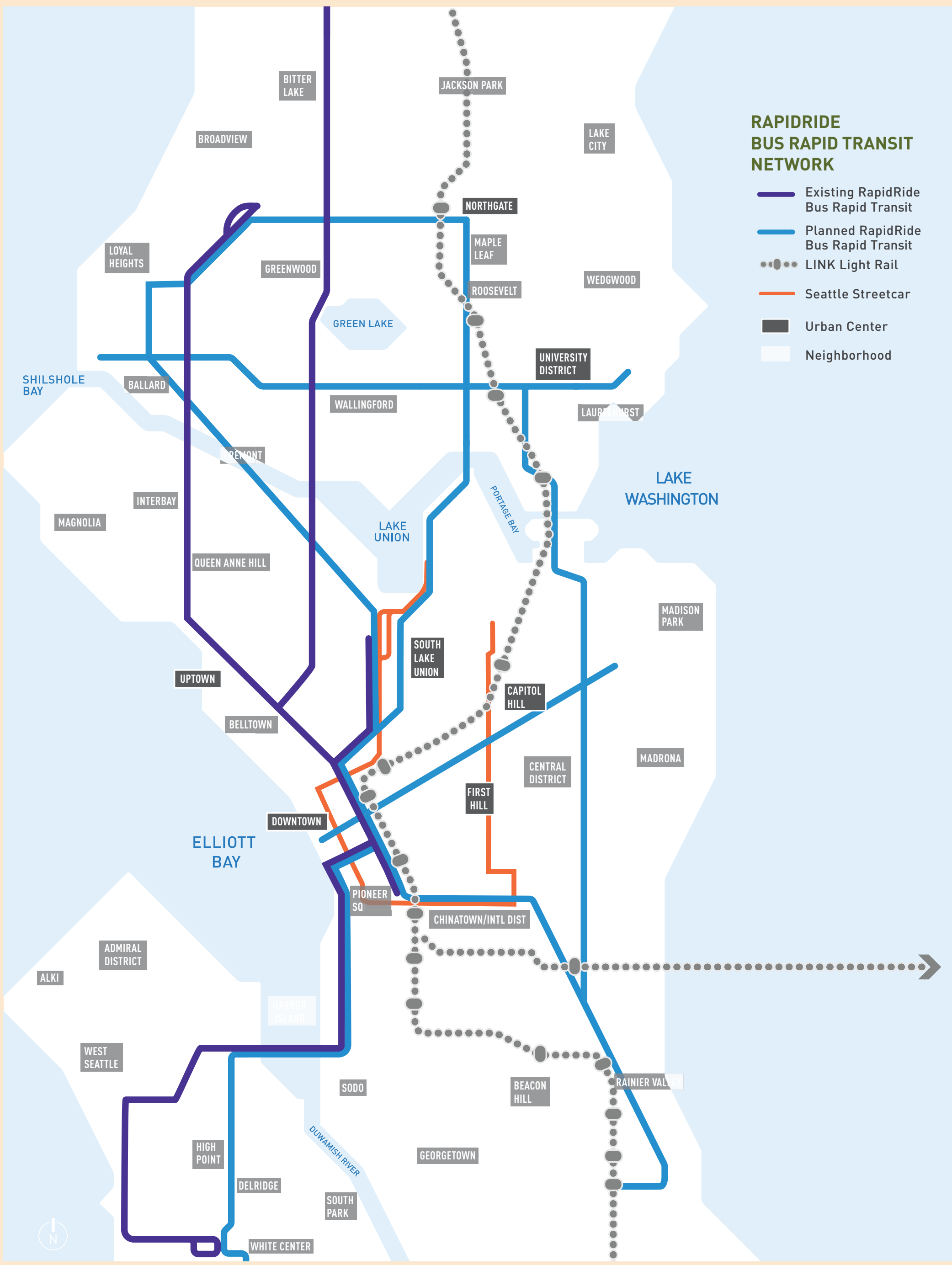
A NEW GENERATION OF RAPIDRIDE BUS RAPID TRANSIT IN SEATTLE

Bus Rapid Transit (BRT) is an enhanced, rail-like transit service that employs strategies aimed at improving transit travel speed, reliability, passenger comfort, and transit identity over traditional fixed-route bus service, including dedicated runningways, intersection priority features, enhanced stations, specialized vehicles, frequent transit service, off-board fare collection systems, and distinctly stylized branding.

BRT systems throughout North America employ a broad spectrum of these strategies based on available resources, corridor constraints, and desired benefits.

BRT systems are commonly differentiated by the range of strategies employed, falling into one of three primary categories: Full BRT, BRT "Light" and Enhanced Bus. Full BRT employs many or all of the enhanced characteristics, most notably an exclusive runningway, while BRT "Light" is typically less capital intensive, applying only targeted strategies like branding, vehicle and station upgrades, and some intersection treatments. The City intends to build on King County Metro's bus rapid transit program.

FIGURE 3-5 RAPIDRIDE BUS RAPID TRANSIT NETWORK



BRT is often considered successful when the following conditions are in place:

- **Transit supportive land use and high ridership demand:** Like other HCT modes, dense and mixed-use development with a diversity of local and regional destinations support BRT activity. Typically, dense, walkable neighborhoods are the most transit supportive.
- **Branding and marketing plan:** Coordinated branding and visibility programs market BRT service and all of its physical elements (vehicles, stations, signage etc.) as specialized service, separate from other local fixed route bus service.
- **Multimodal access:** High quality access to BRT is provided for all modes of travel including seamless transit connections between BRT and other transit services, convenient and safe bicycle and pedestrian paths and amenities.
- **Competitive with automobile travel:** Investments in transit speed and reliability ensure that BRT vehicles can bypass congested roadways and intersections while also directly accessing desired destinations.

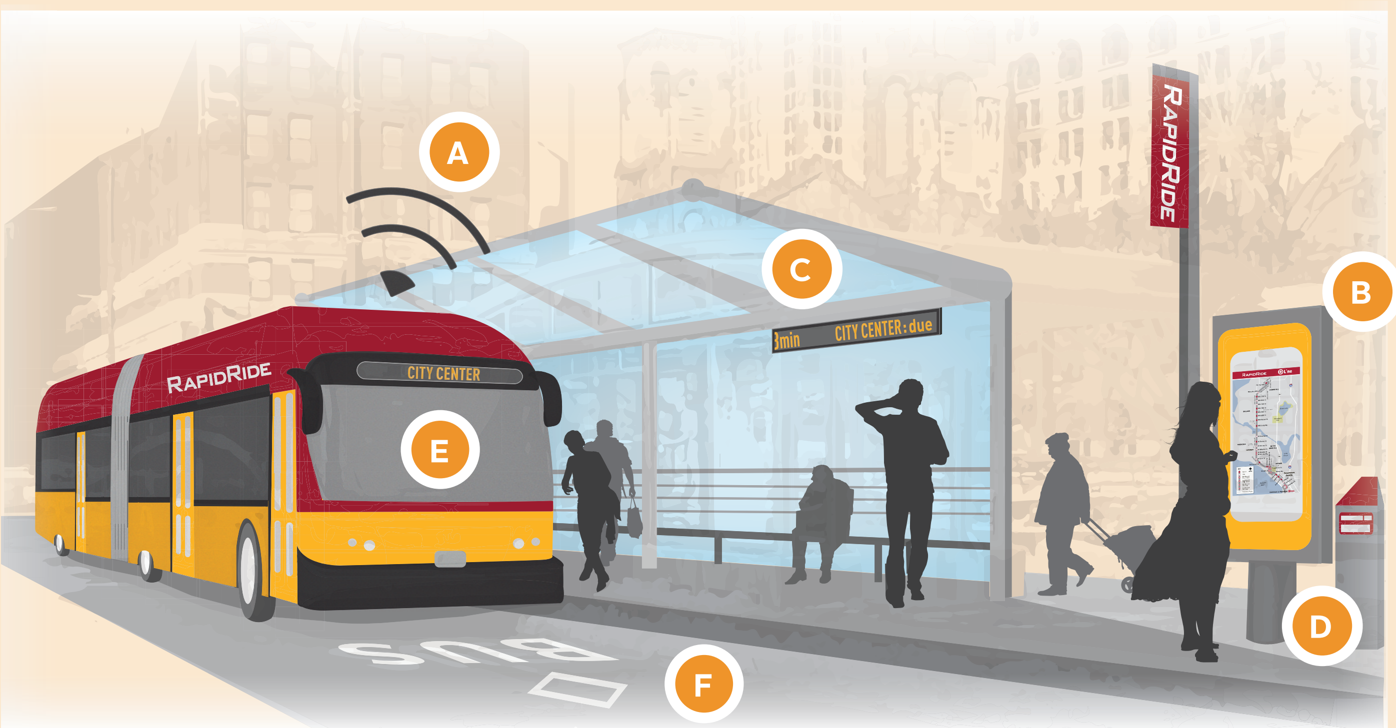
EmX in Eugene, OR operates along a dedicated center running transitway.

Source: Lane Transit District

Cleveland HealthLine along the bustling Euclid corridor serves as a critical mobility option and economic development tool.

Source: Nelson\Nygaard

ELEMENTS OF RAPIDRIDE BUS RAPID TRANSIT

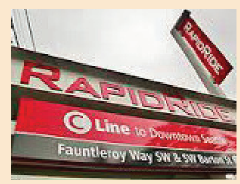


A TRANSIT SIGNAL PRIORITY

Intersection improvements including transit signal priority (TSP) allow buses to bypass congestion. TSP does so by giving buses earlier and/or longer green lights.

B RAPIDRIDE BRANDING

Unique designs make buses and stations more visible, raising awareness of RapidRide and increasing customer expectations for higher levels of service.



C ENHANCED STATIONS

RapidRide stations include raised platforms, off-board fare payment, real-time arrival information, larger shelters, and other passenger amenities.

D ENHANCED FARE COLLECTION SYSTEMS

Off-board fare collection using ticket vending machines, card readers, and other tools at stations allow passengers to load without waiting in line to pay their fares.

E SPECIALIZED VEHICLES

Custom buses provide more capacity, more doors, and lower floors for easier loading and unloading, and unique designs.

F DEDICATED RUNNING WAY

Bus-only lanes separate transit from traffic and are clearly marked to increase visibility.

PRIORITIZING TRANSIT

Dedicated runningway investments are a primary feature that distinguish RapidRide from other enhanced bus services. RapidRide service can operate in two basic types of dedicated runningway environments, providing vehicles priority over general purpose traffic: (1) transit only lanes and (2) business access transit (BAT) lanes. BAT lanes can be designed as curb lanes (i.e., running against the curb) or offset lanes (allowing on-street parking stalls with dwelling occurring via bus bulbouts). Dedicated and clearly delineated transit lanes reduce conflicts between autos and buses and reduce transit delay for RapidRide and other transit services that use the RapidRide corridor. BAT lanes allow for business, loading zone, and parking garage access as well as right turn lane queuing.

Surface treatments and markings in the transit lane help to prevent general purpose traffic from entering the lane illegally, minimize illegal parking and loading, and distinguish the high level of service provided by RapidRide. Red paint markings for transit only lanes, dashed red lane markings along BAT lanes, and other special markings such as double white stripes and "Don't block the box" markings both distinguish and delineate the RapidRide runningway from general purpose travel lanes. Red lane treatments also give RapidRide and other bus services a greater level of visibility, acting as wayfinding for high-quality bus service and communicating speed and reliability benefits.

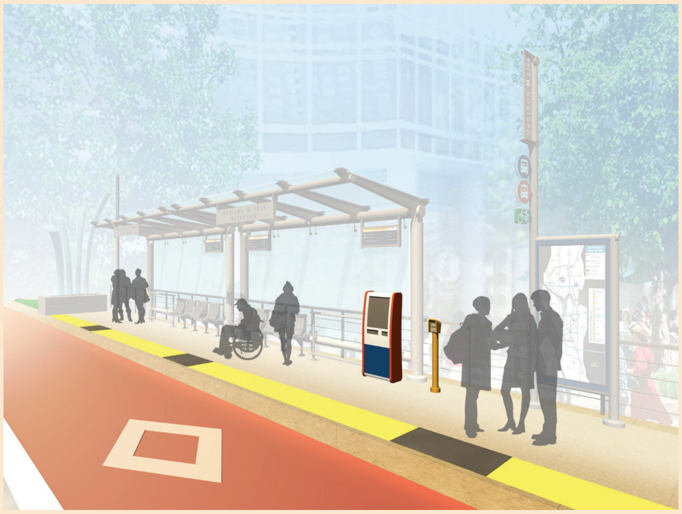
Dedicated red transit lanes are visible reminders of the speed, reliability, and level of priority that is expected of RapidRide corridors.

Source: SDOT

REDEFINING THE PASSENGER EXPERIENCE

RapidRide station and vehicle amenities are designed to optimize the passenger experience. Seattle's RapidRide stations are distinguished by providing a full suite of station features a customer would expect at a light rail or rapid transit station – from comfortable seating to weather protection to real-time information, so that passengers know exactly when the next bus will arrive. Each RapidRide station offers a base level of passenger amenity including benches, glass canopy shelters, RapidRide standalone marker/pylon, technology pylon (with real time information and system maps), off-board fare collection, pedestrian LED lighting, trash and recycling bins, and bike parking.

RapidRide offers several other features that both enhance the passenger experience and provide travel time savings for transit. All-door boarding and off-board fare payment improve the customer experience by reducing wait times to board, better distributing on-board loads, and reducing dwell time. Ticket vending machines allow patrons without ORCA cards or e-fare options to purchase tickets before boarding. Platform level boarding is an important way to reduce boarding time and keep buses running on schedule; enhance the transit experience for people using wheelchairs, scooters or mobility devices; and increase system accessibility, safety, and comfort. Level-boarding also eliminates the need for ramp deployment for people with strollers, mobility devices, or other wheeled devices.



RapidRide stations provide the comfort and amenities that one would expect at a Link or streetcar station.

Source: Nelson\Nygaard

SOUND TRANSIT HIGH CAPACITY SYSTEM DEVELOPMENT

In November 2016, Sound Transit (ST) plans to take an ST3 ballot measure to the voters of Puget Sound. ST3 would provide billions of dollars toward the next phase of expansion of the regional light rail, commuter rail, express bus, and high-capacity transit system. Projects to be included in the ST3 measure are being shaped by ST's long-range planning process, which includes detailed studies for a number of corridors.

ST3 will provide investment in key transit corridors and core capacity requirements to keep transit moving through Seattle's Center City. Seattle expects 28% growth of its population by 2040 and more than a million new residents are expected throughout the region in the same period. Many of those residents will travel to Seattle to work, shop, and play.

The City of Seattle has coordinated with and provided input to Sound Transit regarding its preferences for ST3 investment in Seattle. The following is a brief description of key projects that are considered in ST's planning process and are top priorities for SDOT and City of Seattle leadership (also illustrated in Figure 3-6). Ballard to Downtown and West Seattle to Downtown light rail lines are the City of Seattle's top priority ST3 projects.

Ballard to Downtown Light Rail

The 2012 Seattle Transit Master Plan identified a corridor between Ballard and Downtown the highest demand transit corridor in Seattle. The TMP recommendation led to a partnership study co-managed by Sound Transit and SDOT, which evaluated many alignment and mode alternatives. The City's preferred alignment would start in Ballard at NW Market and 15 Avenue NW, cross the Ship Canal on a new multimodal bridge, pass west of Queen Anne Hill through Interbay with stops near Dravus, Newton and the Expedia campus, enter a tunnel west of Uptown, run east to make subway station stops near Mercer and 1st Avenue, Harrison and 7th Avenue, and Westlake and Denny to serve Uptown and South Lake Union. The line could either terminate at Westlake with subgrade pedestrian connections to the existing station and/or enter a new downtown Seattle transit tunnel and continue south through Downtown.

West Seattle to Downtown Light Rail

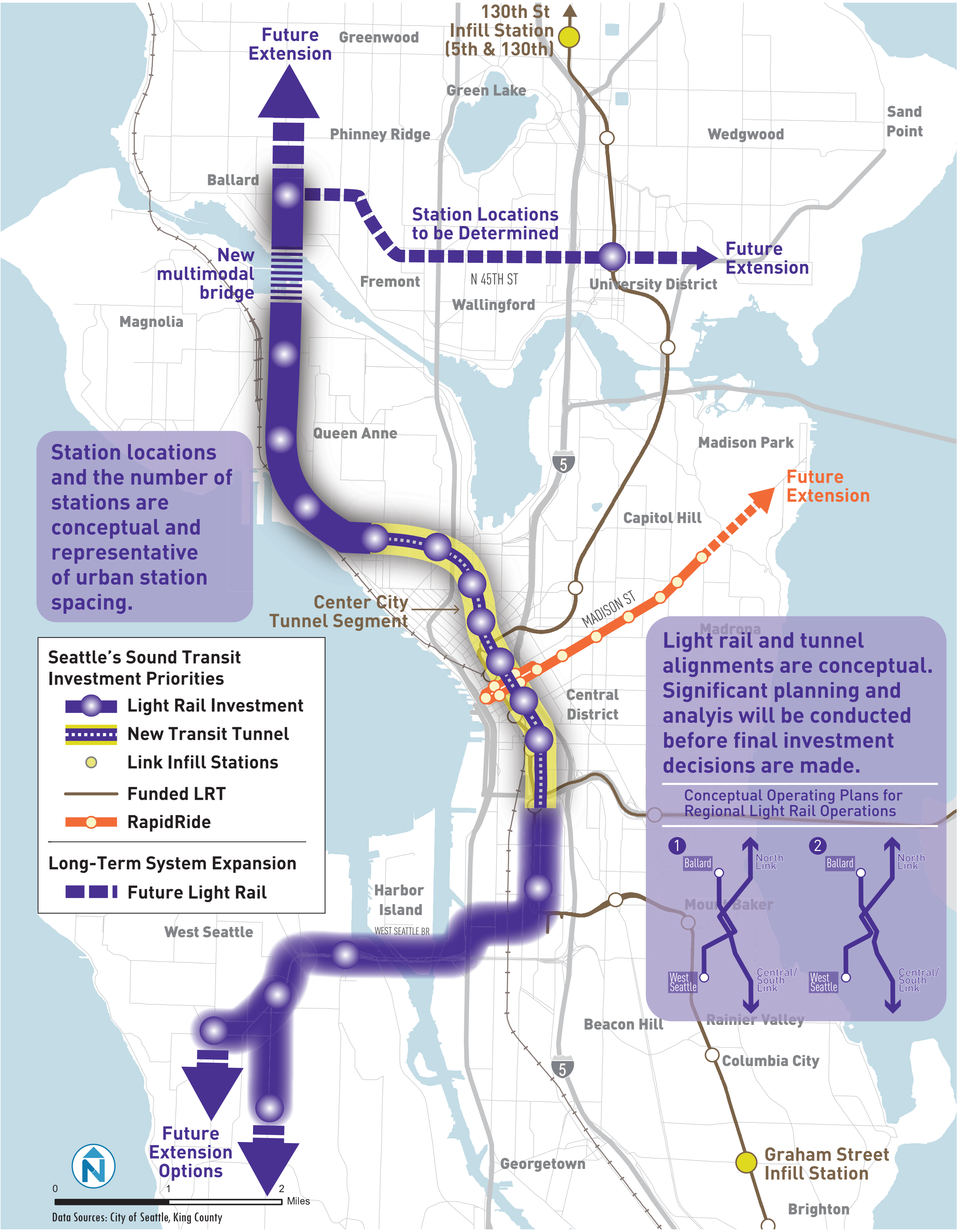
Another top priority light rail project is to connect West Seattle with Downtown. The City supports an initial line that travels between West Seattle and Downtown, connecting to the Alaska Junction or High Point, with the possibility for future phases to extend further south. This line would likely run on a combination of surface and elevated alignments.

Madison Bus Rapid Transit

The City believes the Madison Corridor BRT project is an important early investment project from ST3. This project, potentially operational by 2019, would provide important connections to the regional system with a small amount of ST funding relative to other Seattle/regional investments. During planning and design phases of ST's Central Link project (now operational) a decision was made to eliminate the First Hill station due to cost. At that time, a Madison BRT route was examined by ST as a possible mitigating solution to provide service to the First Hill and South Capitol Hill neighborhoods. These are among the densest residential neighborhoods in the City and are rich with jobs due to the location of two major medical centers and Seattle University. The City of Seattle plans to adopt a Locally Preferred Alternative for this project in December 2016 and proceed with preliminary design, engineering, and environmental clearances in 2016 and 2017.

A light rail line between Ballard and Downtown is the City of Seattle's top priority of ST3 investment.
Image from Nelson\Nygaard

FIGURE 3-6 SEATTLE'S SOUND TRANSIT INVESTMENT PRIORITIES



New Downtown Transit Tunnel

Sound Transit's examination of Ballard to Downtown and West Seattle light rail alignments has included options that run on surface streets. SDOT does not support surface street options due to highly constrained street capacity in the Center City, lower transit performance provided by surface running HCT, and the many competing demands for arterial street space. As such, the City of Seattle places investment in a new Downtown transit tunnel as a high priority ST3 investment. Early analysis suggests that a tunnel running east of the existing DSTT between 4th and 6th Avenues would be the optimal alignment. A new transit tunnel could be connected to the existing DSTT stations with subgrade pedestrian tunnels.

Ballard to University District Light Rail

Ballard and the University District are Seattle's two most rapidly growing Urban Village/Centers outside the Center City. SDOT's ability to add lane capacity dedicated to transit between the two Centers is challenged by very limited arterial street connections and narrow street rights-of-way. This corridor was studied by ST in their long-range plan development and is the next highest rail priority for the City of Seattle after the development of Ballard and West Seattle lines. The City of Seattle supports an initial line between Ballard and the U District Station with potential for a future extension toward Seattle Children's Hospital.

Infill Light Rail Stations

The City of Seattle's ST3 interests also include construction of two infill stations on currently operating or planned lines. These include Graham Street station on Central Link and 130th Street Station on Lynnwood Link.

A new Downtown Transit Tunnel aligned under 4th to 6th Avenues could provide subgrade pedestrian tunnel connections to existing Downtown Seattle Transit Tunnel stations, providing convenient connections between Central Link, Lynnwood Link, and a future Ballard to West Seattle light rail line.
Image from The Transit Politic

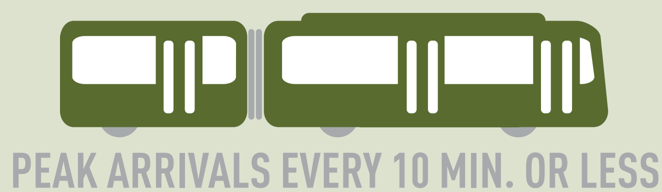
SEATTLE RAPIDRIDE NETWORK EXPANSION

King County Metro implemented RapidRide service and capital improvements in three Seattle corridors between 2010 and 2014. All corridors have been successful in attracting new riders to the system, with increases in weekday ridership as high as 75% over the baseline service. The City of Seattle, recognizing challenges in providing transit service to keep up with rapid growth, has determined that seven additional corridors should be elevated to BRT level of capital and service investment. It is logical to build from the successful RapidRide brand and program of investment. Together, Seattle Department of Transportation (SDOT) and King County Metro Transit are coordinating to plan seven new RapidRide corridors.

WHAT ARE SDOT'S GOALS FOR NEW RAPIDRIDE CORRIDORS?

SDOT is leading the capital planning of the RapidRide network expansion with the aim to deliver convenient, high-quality mobility that includes such attributes as:

- Ten minute or better frequency during peak periods and 12 minute or better frequency during the midday, so passengers don't have to wait to travel
- Twenty to 24 hour service everyday of the week to meet the diverse travel needs of Seattle, when they need it
- On-time service, with tools to identify and address delays quickly and keep transit moving reliably even during congested periods of the day
- A high level of passenger experience with functional, quality facilities at stops and stations, such as better-than-standard shelters, real-time information, off-board fare payment, and improved access
- Ability to get most places in Seattle with one transfer between a RapidRide line, Seattle Streetcar, and/or Link light rail

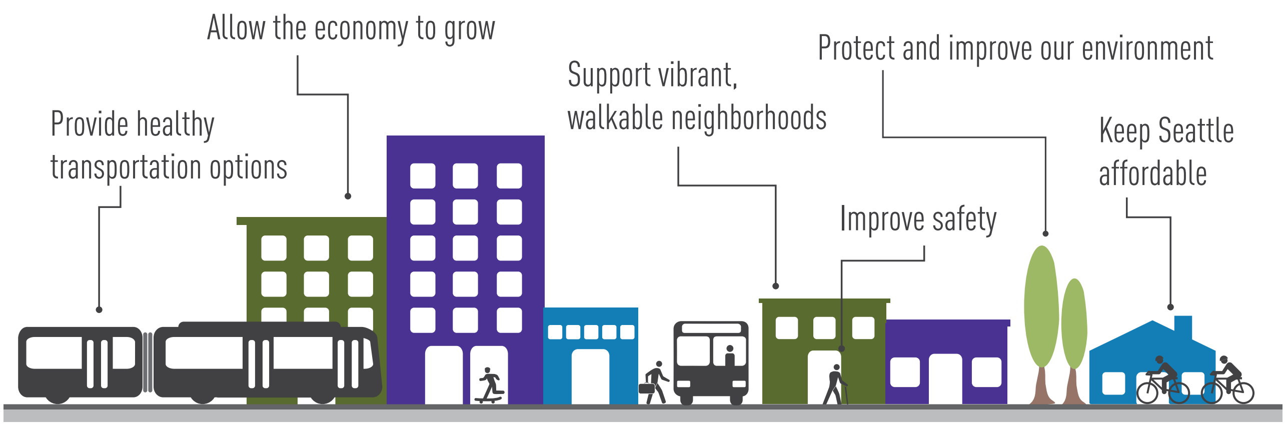


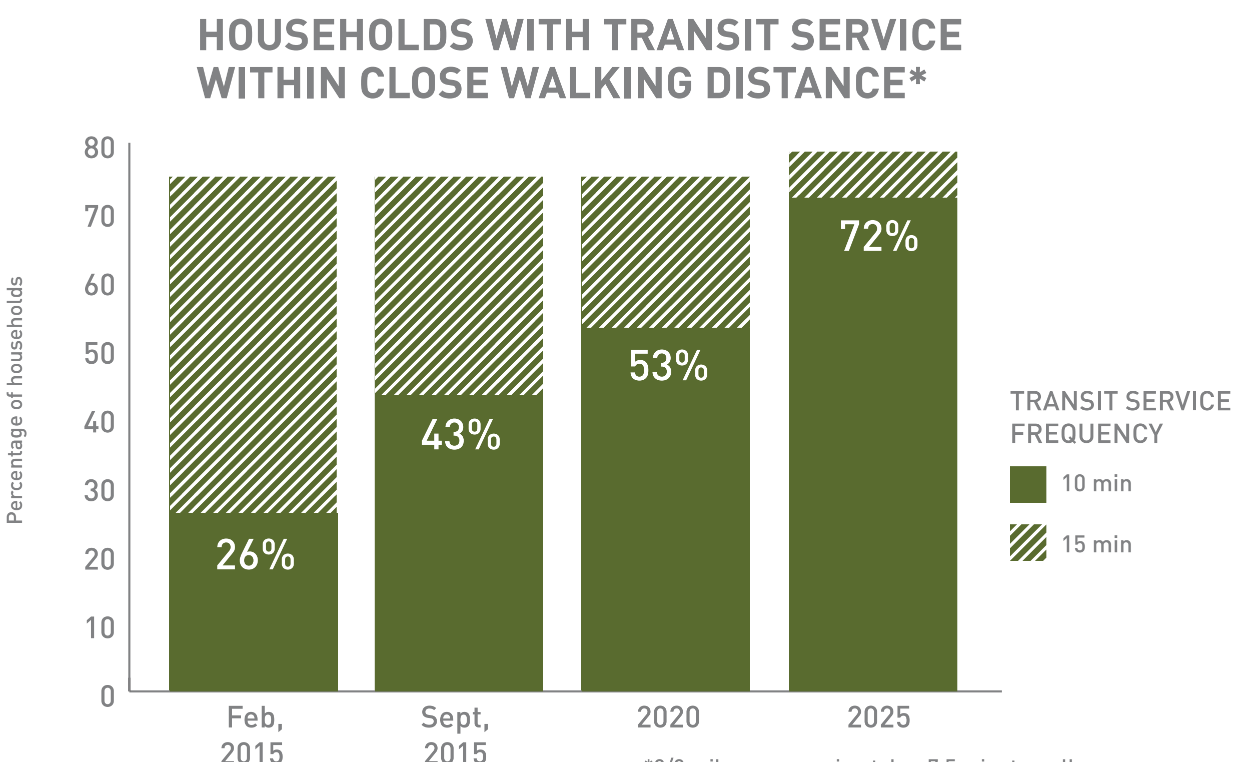
WHY EXPAND RAPIDRIDE?

- Seattle has been one of the nation's **fastest growing cities** for the last 2 years.
- **Population is increasing at approximately 18,000 people per year**, 77% faster than surrounding King County.
- **Seattle Center City and Urban Village job growth is strong**, with major employers growing operations or moving to the area.
- **Enhanced transit service and capacity is needed** to match Seattle's population and economic growth as there is limited opportunity to expand traffic lanes.
- **Transit mode share to downtown has topped 45% of all commuters.** Transit ridership in Seattle is at an all time high and many bus routes are overcrowded.
- **Ridership gains of 44%,** as of 2014, indicate that RapidRide lines have proven popular with riders compared to previous bus service.
- **RapidRide ridership increased an average of 8% during the first 5 months of 2015** compared to the same months in 2014, with an 18% increase on the E Line.

THE BENEFITS OF THE SEATTLE RAPIDRIDE NETWORK

- **Provides 72% of Seattle residents with 10-minute or better all-day transit service** within a 10-minute walk from their home by 2025
- Implements several coordinated corridors, in an efficient manner, by employing **unified design and standardizing fleet, stations, and operations,** in concert with FTA streamlined planning and environmental guidance
- **Links diverse and low-income neighborhoods** to downtown transit hubs, employment opportunities, and shopping districts
- **Utilizes existing fleet resources** in electric trolley bus corridors, implements dual door coaches in right-of-way constrained corridors, and implements level boarding and **fully accessible** connections for persons of all abilities
- **Provides an integrated transit network** by connecting with the expanding light rail, streetcar, bus, and bike share systems
- **Supports Sound Transit by connecting urban neighborhoods and job centers** to light rail stations





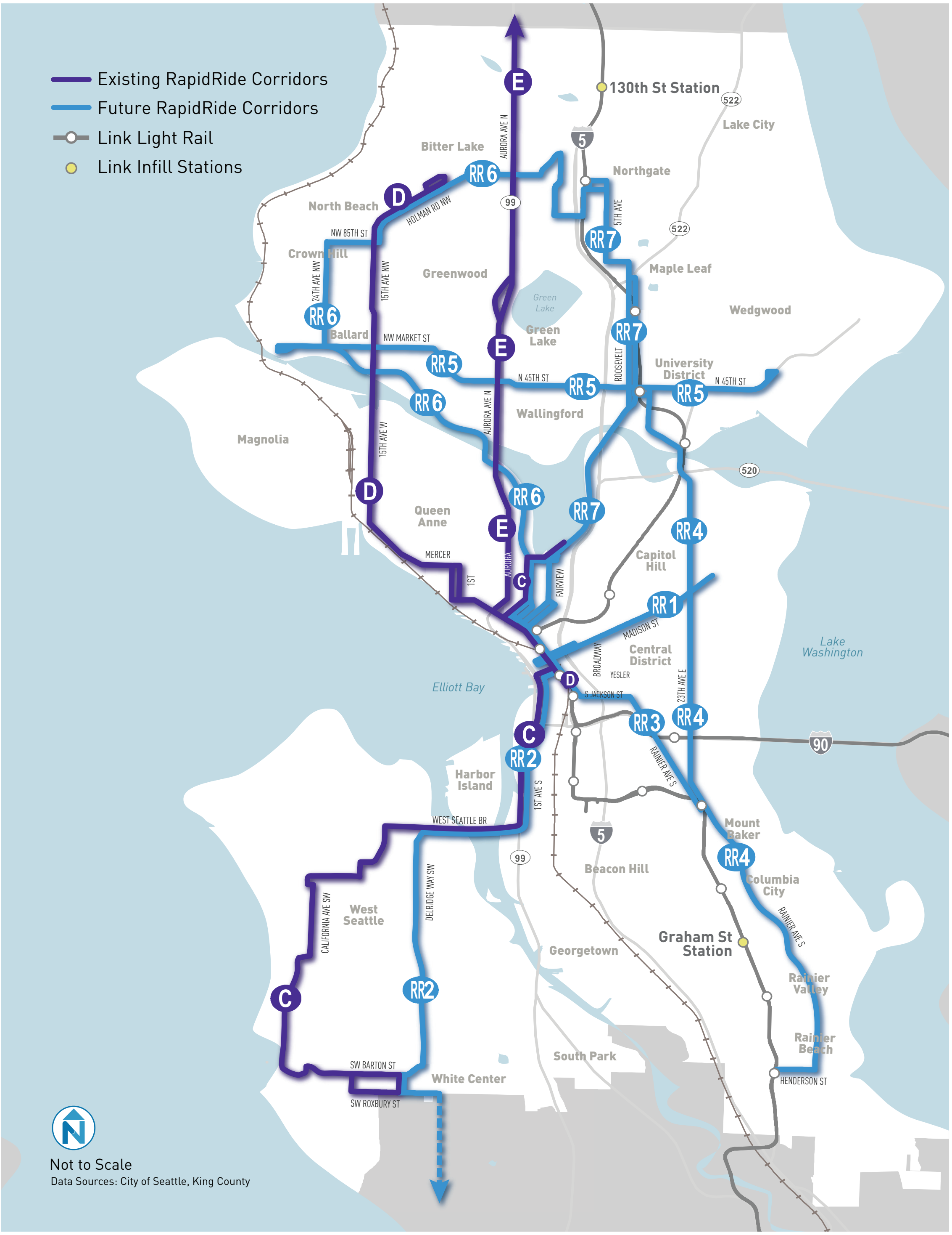
*3/8 mile, or approximately a 7.5 minute walk

THE RAPIDRIDE CORRIDORS

The ten corridors—three existing and seven proposed—that will shape Seattle's future RapidRide network are shown in Figure 3-7. Seattle's RapidRide corridors are:

- Central Area - First Hill - Downtown, via Madison (RapidRide Corridor 1)
- Burien TC – Downtown via Delridge Way (RapidRide Corridor 2)
- Mount Baker – Downtown via Rainier Avenue and Jackson Street (RapidRide Corridor 3)
- Rainier Valley – U-District via 23rd Avenue and Rainier Avenue (RapidRide Corridor 4)
- Ballard – U-District – Laurelhurst via Market Street and 45th (RapidRide Corridor 5)
- Northgate - Ballard - Fremont - South Lake Union – Downtown, via Westlake Avenue (RapidRide Corridor 6)
- Northgate - Roosevelt - University District - South Lake Union - Downtown, via Roosevelt Way/11th Avenue and Eastlake Avenue (RapidRide Corridor 7)

FIGURE 3-7 EXISTING AND PROPOSED RAPIDRIDE CORRIDORS



RAPIDRIDE NETWORK IMPLEMENTATION STRATEGIES

- **Strategy RR 0.1:** Develop strategy for forwarding corridor planning, design, engineering and environmental clearances in a time and cost efficient manner.
- **Strategy RR 0.2:** Conduct detailed evaluation of right-of-way design for each corridor segment as a next phase of study.
- **Strategy RR 0.3:** Ensure major development projects in the corridor consider station area placement, non-motorized connectivity, setback requirements, and street frontage design consistent with RapidRide station and running way needs.
- **Strategy RR 0.4:** Conduct outreach to corridor neighborhoods to discuss corridor design options and tradeoffs.
- **Strategy RR 0.5:** Develop street concept plans for RapidRide corridor segments likely to experience significant future development.
- **Strategy RR 0.6:** Develop coordinated federal and local funding plans for the network and individual corridors and work with regional partners and FTA to obtain grant funds for project construction.
- **Strategy RR 0.7:** Coordinate vehicle specifications and use of existing fleet resources with King County Metro's bus procurement staff.
- **Strategy RR 0.8:** Develop a 5-year action plan for RapidRide corridors as part of future Transit Master Plan updates to achieve silver or better ITDP BRT Standard scores. Achieving the preferred standards from Seattle's RapidRide Toolkit will aid in achieving silver BRT status.
- **Strategy RR 0.9:** Continue to coordinate closely with King County Metro (KCM) on design, engineering, operations, technology and project construction planning. Coordinate with Sound Transit on regional funding strategy for federal transit monies.
- **Strategy RR 0.10:** Evaluate and bundle multimodal improvements with the RapidRide corridor projects. Leverage planning, design, construction of several individual projects into a larger package for efficiency and minimization of construction impacts.
- **Strategy RR 0.11:** Develop a coordinated implementation and local funding plan for each RapidRide corridor.
- **Strategy RR 0.12:** Coordinate with KCM to develop service plans, fund and install OCS extensions (where necessary), and conduct public review process to implement new RapidRide corridors.

SEATTLE'S RAPIDRIDE SCORECARD

Seattle's RapidRide Network corridors will meet minimum standards for service, design, and access, ensuring a fast, reliable, and high quality passenger experience. Each RapidRide corridor sheet (presented on pages 3-26 through 3-53) include RapidRide element scorecards based on a select set of criteria. Each RapidRide corridor is scored based on its ability to meet or surpass key service and design elements that will deliver speed, reliability and a high-quality experience for customers accessing, waiting for, and riding a RapidRide vehicle. Only RapidRide elements that can be scored at a concept level are assessed (i.e., service, vehicle, and station design elements cannot be scored at this level of planning).

Implementation of these features is dependent on further analysis, design, and funding availability. Criteria and scoring methodologies are presented below.

FIGURE 3-8 RAPIDRIDE CRITERIA AND SCORING METHODOLOGIES

<table>
<tr><th>ELEMENT</th><th>CRITERION</th><th>TARGET</th><th>SCORING METRIC</th></tr>
<tr><td rowspan="3">The Elements</td><td>Dedicated Runningway</td><td>Mixed-traffic for no more than 50% of corridor acceptable with intersection enhancements to prioritize transit (e.g., bus bulbs, far-side stops or near-side stops with queue jump lanes, transit signal priority)</td><td>% of corridor with all-day dedicated runningway</td></tr>
<tr><td>Bus Lane Alignment</td><td>RapidRide corridors limit transitions between median- and side-running alignments along corridor extent</td><td>Yes/No</td></tr>
<tr><td>Intersection Treatments</td><td>Provide transit priority at congested intersections by providing queue jump lanes and/or signal priority treatments</td><td>% of signalized intersections with priority treatments</td></tr>
<tr><td rowspan="2">The Network</td><td>Intermodal Connections</td><td>Alignment provides connectivity to local and regional bus, planned Link light rail, and other modes of travel; the alignment is direct and easy for customers to understand</td><td># of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus</td></tr>
<tr><td>Stop Spacing</td><td>Maximum stop spacing is every 0.5 miles with no overlaid "local" service</td><td>Average stop spacing</td></tr>
<tr><td>The Stations</td><td>Full Rapid Ride Stations</td><td>Stations to be upgraded to a full featured RapidRide stations, offering a base level of passenger amenity</td><td># of stations being upgraded to full featured stations</td></tr>
<tr><td>The Connections</td><td>Move Seattle Walking and Biking Improvements</td><td>Safe, intuitive, and proximate paths are provided between RapidRide stations and local bus stops, Link light rail stations, Colman Dock, regional express routes, and Pronto Bike Share stations</td><td># of Move Seattle pedestrian/bicycle projects in corridor</td></tr>
</table>

SURFACE HCT AND BICYCLE INTEGRATION

The design of surface HCT corridors on urban streets requires addressing trade-offs between transit, motor vehicles, and people riding bicycles. Context-sensitive, block-by-block design will be required to ensure that high volumes of bicyclists along parts of these corridors can be safely accommodated.

Best Practices for Integrating Bicycles with BRT and Streetcar

Best practices for integrating bicycles with BRT or streetcar include:

- **Center running transitways** allow for median stops that minimize bicycle as well as pedestrian conflicts
- **A "Copenhagen left" turn** (jughandle) can be used to help cyclists cross tracks and other traffic; a bicycle-only signal can be implemented in conjunction with this type of turn
- **Separated facilities** such as protected bike lanes (Montreal, Vancouver B.C., and Washington D.C.) or parallel bikeways (The Netherlands)
- **Clearly delineated pedestrian and bicycle space,** such as "channelized" travel paths for each mode to help prevent conflicts
- **Warning signage** to alert cyclists, pedestrians, and transit passengers to potentially dangerous situations

Best practices for integrating bicycles with RapidRide include:

- **Floating bus stops** that wrap around passenger waiting facilities eliminate conflicts with transit vehicles and help manage bicycle speeds through intersections

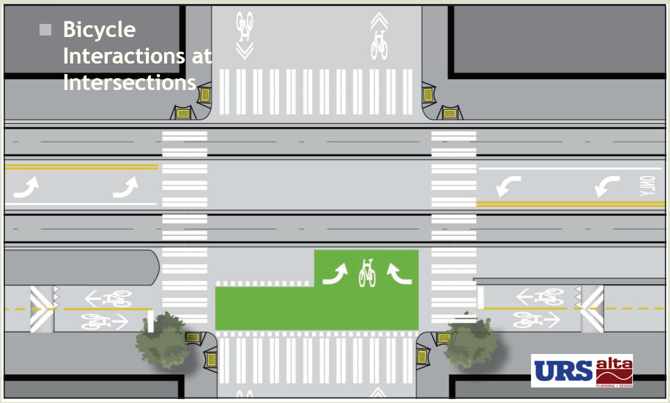
Best practices for integrating bicycles with streetcar include:

- **A left-side track and platform alignment** is optimal for reducing conflicts
  - If a right-side track alignment is used, provide adequate dedicated spaces for bicycles and place stations outside of the bicycle travel path
- **Crossings designed so that cyclists cross tracks at an angle near 90 degrees** to reduce risk of a tire catching in the track; use pavement markings to reinforce the intended crossing angle

Seattle First Hill Streetcar Bikeway Design

In Seattle, a two-way cycle track along Broadway (right) was constructed for the First Hill Streetcar, connecting First Hill, Capitol Hill, the International District, and Pioneer Square. The design includes bike boxes (shown in green) to facilitate safe turns.

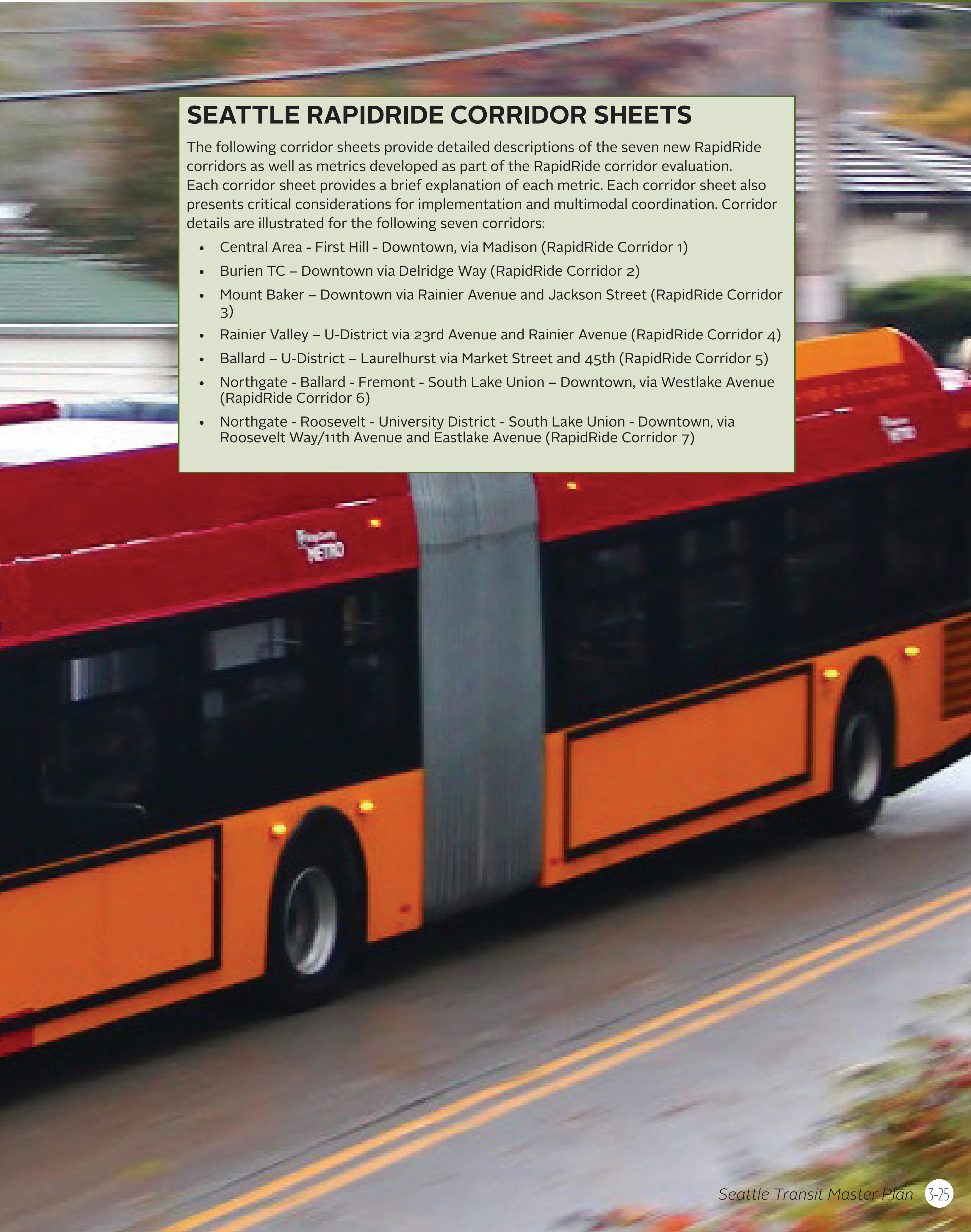
Source: Association of Pedestrian and Bicycle Professionals, "Integrating Bicycles with Streetcars" (Webinar), April 20, 2011.



A cycle track is the bicycle facility for the First Hill Streetcar project.

Source: URS; Alta Planning


WESTWOOD VILLAGE
RAPIDRIDE
6085



SEATTLE RAPIDRIDE CORRIDOR SHEETS

The following corridor sheets provide detailed descriptions of the seven new RapidRide corridors as well as metrics developed as part of the RapidRide corridor evaluation. Each corridor sheet provides a brief explanation of each metric. Each corridor sheet also presents critical considerations for implementation and multimodal coordination. Corridor details are illustrated for the following seven corridors:

- Central Area - First Hill - Downtown, via Madison (RapidRide Corridor 1)
- Burien TC – Downtown via Delridge Way (RapidRide Corridor 2)
- Mount Baker – Downtown via Rainier Avenue and Jackson Street (RapidRide Corridor 3)
- Rainier Valley – U-District via 23rd Avenue and Rainier Avenue (RapidRide Corridor 4)
- Ballard – U-District – Laurelhurst via Market Street and 45th (RapidRide Corridor 5)
- Northgate - Ballard - Fremont - South Lake Union – Downtown, via Westlake Avenue (RapidRide Corridor 6)
- Northgate - Roosevelt - University District - South Lake Union - Downtown, via Roosevelt Way/11th Avenue and Eastlake Avenue (RapidRide Corridor 7)

RapidRide Corridor 1

Central Area - First Hill - Downtown, via Madison Street

Key Characteristics

Length: 2.88 miles

Major Stations: 1st Avenue (shared with Center City Connector streetcar), Madison/Spring at 3rd Avenue, Terry Avenue, Summit/Boylston (Broadway Streetcar connection), 12th Avenue, 22nd Avenue, MLK Jr. Way

Average Stop Spacing: 0.26 miles

Key Connections

- Downtown Seattle Transit Tunnel
- 3rd Avenue Transit Spine
- Seattle Streetcar at 1st Avenue (planned) and Boylston/ Broadway
- RapidRide Corridor 4 at 23rd Avenue/Denny Way
- Colman Dock (via pedestrian connection)

Permitted Development:

Office Commercial: 1,600,122 sf
Retail: 108,248 sf
Residential: 1,162 units

Service Design

Alignment Alternatives: None (LPA determined)
Potential for Dual-Sided Vehicles: Yes, recommended

RapidRide Scorecard		
CRITERION	SCORING METRIC	SCORE
The Elements		
Dedicated Runningway (all-day)	*% of corridor*	62%
Bus Lane Alignment (limited transitions)	*Yes/No*	Yes
Intersection Treatments	*% of signalized intersections have transit priority treatments*	51%
The Network		
Intermodal Connections	*# of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus*	Link: **1** RapidRide: **2** Streetcar: **2** Colman Dock: **1** Local/regional bus: **12**
Stop Spacing	*Average stop spacing*	0.26 miles
The Stations		
Full-Feature Stations	*# of stations being upgraded to full featured stations*	18
The Connections		
Move Seattle Walking and Biking Improvements	*# of Move Seattle pedestrian/ bicycle projects in corridor*	10

LEGEND

HCT Corridors
- Corridor Alignment
- Alternative Alignment
- ST Link Light Rail / Stations
- Existing RapidRide Routes
- Seattle Streetcar / Stations

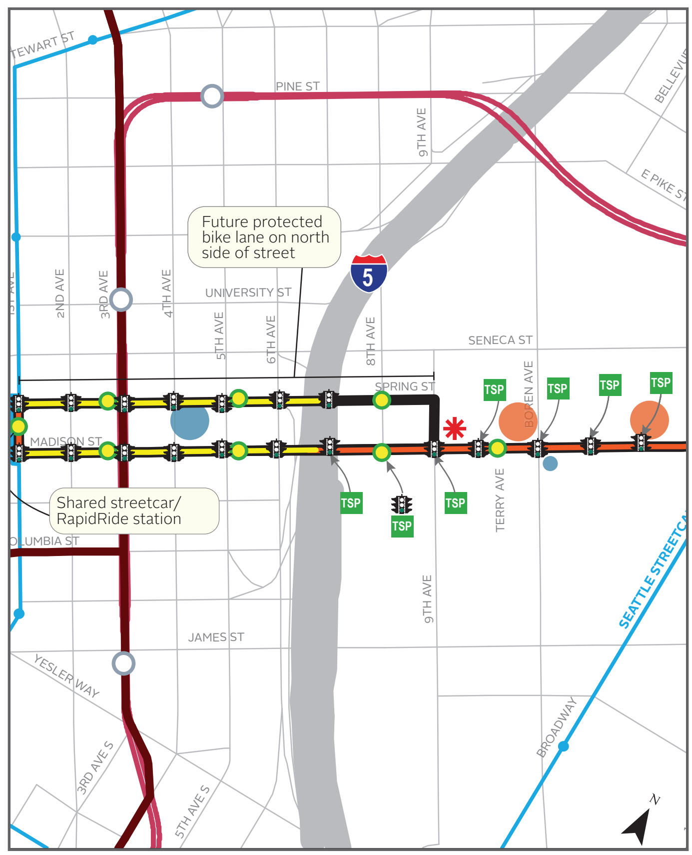
Potential Improvements
- BB Bus Bulbs
- TSP Transit Signal Priority
- Upgrade to Full Station
- FS Floating Bus Stop
- Queue Jump Lanes *(both directions, unless noted)*
- Layover Location *(requires study)*

Potential Right-of-way Treatments Pending Detailed Feasibility Analysis
- Transit Only Lane
- BAT Lane
- Peak BAT Lane
- Mixed Traffic

Future RapidRide Corridors
- Corridor 1: Madison
- Corridor 2: Delridge
- Corridor 3: Jackson/Rainier
- Corridor 4: 23rd/Rainier
- Corridor 5: Market/45th
- Corridor 6: Westlake - Ballard - Northgate
- Corridor 7: Roosevelt

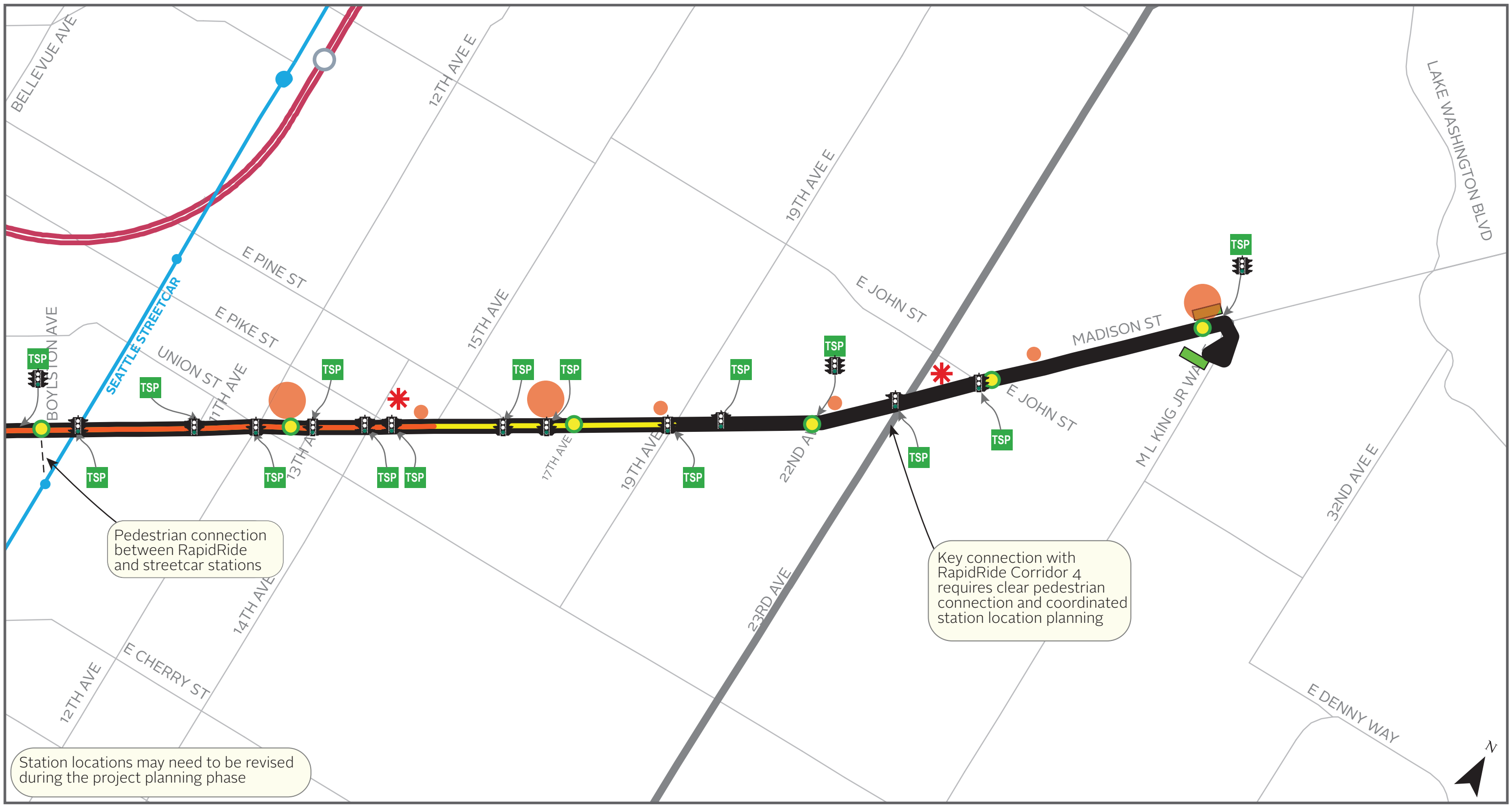
Existing Daily Boardings at High Ridership Stops
- 100 - 200
- 201 or more
- Inbound
- Outbound

Existing Signals
- SDOT Full Signal
- WSDOT Signal
- Half Signal
- Mid-Block Cross Walk



RapidRide Corridor 1:
Major updates to corridor capital project elements compared to the 2012 Transit Master Plan

- This corridor was labeled HCT Corridor 6 in the 2012 Transit Master Plan
- SDOT has completed a Concept Design Study for this corridor, including the development of 10% design plans. Many of the 2012 TMP concepts are include in the Preferred Concept developed in 2015, including BAT lanes on downtown streets.
- Median transit only lanes included in the 2015 Preferred Concept were not included in the 2012 TMP.
- The 2015 Preferred Concept also extends the project's eastern terminus to Martin Luther King Jr. Boulevard rather than 23rd Avenue.



Recommended RapidRide corridor improvements are conceptual in nature and will require future public outreach, technical analysis, and detailed design work.

RapidRide Corridor 1

Central Area - First Hill - Downtown, via Madison Street

Metric	Score	Details
Ridership *(Weekday riders [2035] and Net New Riders)*	**17,000** **(7,000 net new riders)**	**Ridership potential in 2035 is based on service improvements and projected land use changes:** Ridership was modeled using the Sound Transit ridership forecasting model.
Productivity	**172 riders/hour**	**Efficiency with which provided transit capacity is utilized. Productivity equals weekday ridership divided by weekday revenue hours:** A "revenue hour" includes time when a transit vehicle is available to carry passengers. It includes layover time, but excludes "deadhead" time such as when a bus travels to the start of a route. Weekday hours of revenue service calculated through development of corridor-specific operating plan.
RapidRide Initial Investment Level	**$98.0-$120.0M** **($34.0-$41.7M per mile)**	**Expected level of initial investment required to provide transit speed, reliability, passenger comfort, and access improvements in the corridor.** Based on initial planning level assessment conducted as part of the 2015 TMP update. Future analysis will identify the most cost-effective capital project elements and levels of investment appropriate to different right-of-way configurations and land use environments along the corridor. Higher level of investment may be possible based on potential additional local, regional, state and federal funding identified during detailed corridor planning and design process. Vehicles, major repaving, and sidewalk projects are included in cost range.
Cost/Rider	**$1.98**	**Value of investment over time, including cost of operation and annualized cost of capital investment, fleet replacement, and maintenance:** Annualized operating and capital cost per rider equals annual operating cost plus annualized capital costs divided by annual boarding rides. Operating cost adjusted for inflation by 2.4% annually. Infrastructure life held constant. Assumed vehicle life is 15 years for electric trolley bus.
O&M Cost	**$6.8M**	**Annual total cost to deliver service on the proposed line.** Annual operating cost based on the number of hours of revenue service, calculated through development of corridor-specific operating plan, multiplied by the 2015 operating cost for RapidRide. The 2015 operating costs are based on King County Metro operating cost factors and assumptions from the Madison Corridor BRT Study. Does not include cost reductions from repurposing of existing bus service hours.
Operating Cost/ New Ride	**$1.24**	**Operating cost to deliver a new boarding ride considering potential cost savings:** Calculated as planned weekday operating cost minus weekday operating cost savings, divided by the number of net new boarding rides projected for 2035. Analysis of cost savings is conceptual.
Travel Time Savings	**40%**	**In-vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations:** Projected 2035 corridor travel time with current road design - estimated travel times under each mode, alignment, and design.
GhG Savings	**514 MT CO2e**	**Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions:** Emissions savings from reduced VMT based on an assumed rate of displaced light duty vehicle trips per new transit rider, average trip length by corridor, average fuel economy, and resulting fuel savings. Emissions savings from net change in transit emissions equals planned service minus existing service (based on conceptual operating plans). Emissions factors applied based on known emission assumptions for electric trolley bus and diesel hybrid bus.

Note: All costs are in 2015 dollars.

IMPLEMENTATION STRATEGIES

- **Strategy RR 1.1:** Coordinate with the Center City Connector team to ensure integrated right-of-way operations and superior passenger experience at the 1st Avenue RapidRide Station to be shared with Seattle Streetcar.
- **Strategy RR 1.2:** Enhance pedestrian access and connectivity between the Boylston Avenue RapidRide Station and Broadway First Hill Streetcar Station.
- **Strategy RR 1.3:** Use the Terry and 12th Avenue RapidRide Station Areas as an opportunity to enhance the public realm, including pedestrian safety and streetscape enhancements and the potential for roadway reconfiguration to improve non-motorized access.
- **Strategy RR 1.4:** Coordinate with the RapidRide Corridor 4 (23rd/Rainier) project to design stations that would provide a safe, comfortable, and proximate transfer between the two intersecting RapidRide routes at Madison Street & 23rd Avenue.
- **Strategy RR 1.5:** Conduct preliminary engineering (PE) and prepare National Environmental Policy Act (NEPA) clearances necessary to allow project to apply for federal funding in 2016.
- **Strategy RR 1.6:** Engage King County Metro to evaluate a route extension east to MLK Jr. Way.
- **Strategy RR 1.7:** Advance Spring Street transit only lanes and floating bus stops/passenger islands as an early implementation item.

MULTIMODAL PROJECT COORDINATION

- **Strategy MMC 1.1:** Capitalize on station area improvements to enhance pedestrian facilities conditions and facilities across the roadway.
- **Strategy MMC 1.2:** Use Madison BRT project to provide enhanced pedestrian and bicycle crossings and improve safety, particularly at Union Street, 19th Street, and 24th Street intersections.
- **Strategy MMC 1.3:** Identify overlap and coordinate with Pedestrian Master Plan improvement projects along each corridor that have shared design elements with RapidRide such as enhanced intersection crossings, curb bulbs, and improved sidewalks.
- **Strategy MMC 1.4:** Replace sidewalks between 24th and 28th Avenues where current sidewalk conditions are very poor.
- **Strategy MMC 1.5:** Develop a street concept plan for the Madison Street corridor between MLK and 1st Avenue.
- **Strategy MMC 1.6:** Connect the 2nd & 4th Avenue protected bike lanes with a protected bicycle lane on the north side of Spring Street.
- **Strategy MMC 1.7:** Provide clear wayfinding to direct people walking and biking to RapidRide stations.
- **Strategy MMC 1.8:** Ensure neighborhood greenway crossings provide safe access across the corridor and to RapidRide stations at 8th and Union Avenues.
- **Strategy MMC 1.9:** Identify stations for bike share expansion to enable seamless transfers between RapidRide and bike share.

RapidRide Corridor 2

Burien TC – South Lake Union via Delridge Way

Key Characteristics

Length: 10.16 miles

Major Stations: South Lake Union stations along Westlake Avenue, 3rd Avenue Transit Spine stations, Columbia Street and Alaskan Way, Genesee Street, Barton Street/26th Avenue, Delridge Way/Roxbury Street

Average Stop Spacing: 0.56 miles

Key Connections

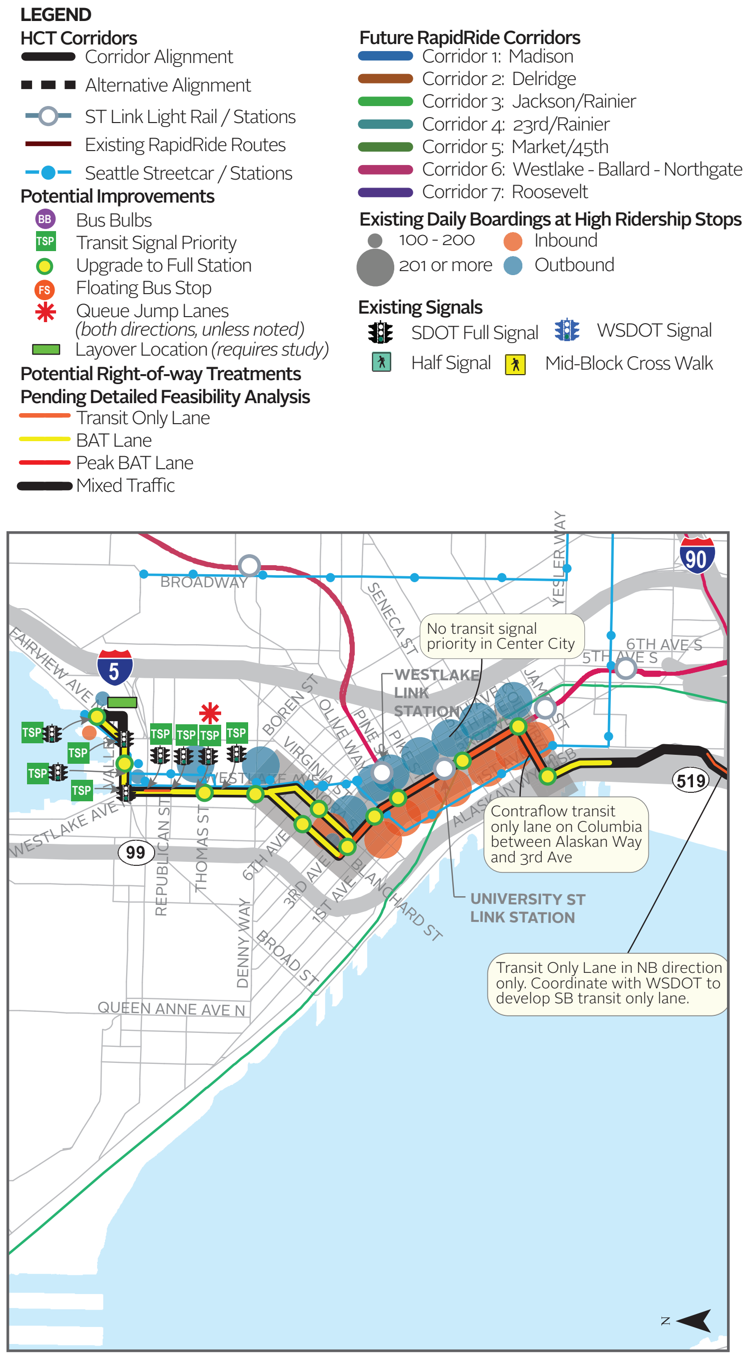
- Aloha terminus (RapidRide Corridors 3 and 7 connections)
- Downtown Seattle Transit Tunnel
- 3rd Avenue Transit Spine
- Seattle Streetcar connections along Westlake Avenue
- Colman Dock
- Spokane Street Park & Ride
- SW Genesee (Route 50/125 connection)
- Barton Street/26th Avenue (C Line connection)
- SW Delridge/Roxbury (several local route connections)

Permitted Development

Office Commercial: 10,468,932 sf
Retail: 1,434,795 sf
Residential: 13,855 units

Service Design

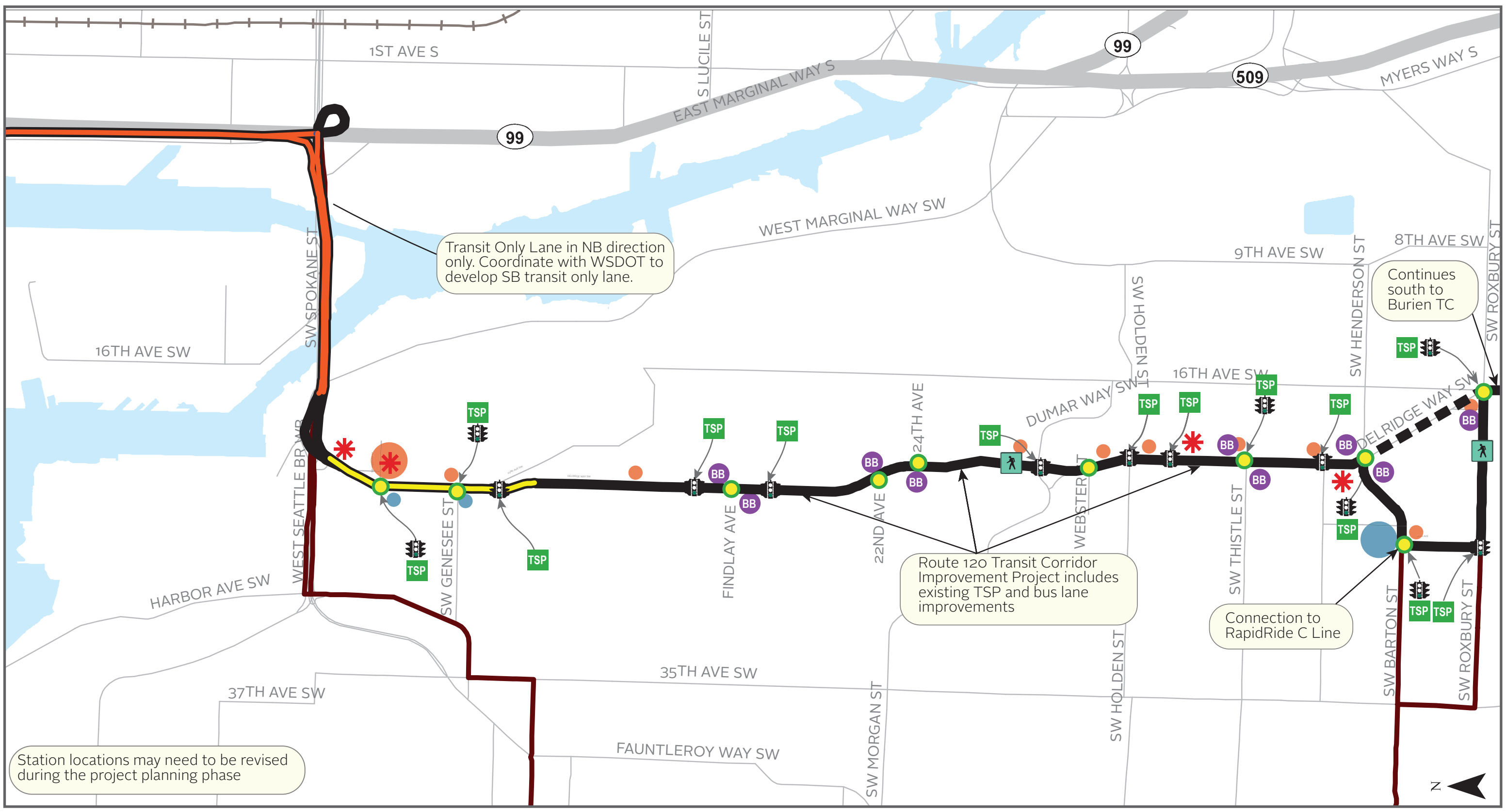
Alignment Alternatives: Direct connection along Delridge Way SW between SW Barton and Roxbury
Potential for Dual-Sided Vehicles: No



RapidRide Scorecard		
CRITERION	SCORING METRIC	SCORE
The Elements		
Dedicated Runningway (all-day)	% of corridor	30%
Bus Lane Alignment (limited transitions)	Yes/No	Yes
Intersection Treatments	% of signalized intersections have transit priority treatments	44%
The Network		
Intermodal Connections	# of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus	Link: 1 RapidRide: 7 Streetcar: 1 Colman Dock: 1 Local/regional bus: 10
Stop Spacing	Average stop spacing	0.56 miles
The Stations		
Full-Feature Stations	# of stations being upgraded to full featured stations	24
The Connections		
Move Seattle Walking and Biking Improvements	# of Move Seattle pedestrian/ bicycle projects in corridor	7

RapidRide Corridor 2:
Major updates to corridor capital project elements compared to the 2012 Transit Master Plan

- This corridor was labeled Priority Bus Corridor 2 in the 2012 Transit Master Plan
- Corridor is extended to South Lake Union including proposal to use new Westlake transit lanes
- Corridor alignment between Barton and Roxbury consistent with KCM Route 120 adjustment providing connection to RapidRide C Line at Westwood Village



Recommended RapidRide corridor improvements are conceptual in nature and will require future public outreach, technical analysis, and detailed design work.

RapidRide Corridor 2

Burien TC – South Lake Union via Delridge Way

Metric	Score	Details
Ridership *(Weekday riders [2035] and Net New Riders)*	**14,600** **(7,800 net new riders)**	**Ridership potential in 2035 is based on service improvements and projected land use changes:** Weekday riders (2035) estimated from Spring 2015 stop/route-level boardings assigned to each corridor. Net new weekday riders equal 2030 estimate of potential ridership minus current (2015) ridership estimate for the corridor.
Productivity	**66 riders/hour**	**Efficiency with which provided transit capacity is utilized. Productivity equals weekday ridership divided by weekday revenue hours:** A "revenue hour" includes time when a transit vehicle is available to carry passengers. It includes layover time, but excludes "deadhead" time such as when a bus travels to the start of a route. Weekday hours of revenue service calculated through development of corridor-specific operating plan.
RapidRide Initial Investment Level	**$38.0-$47.0M** **($3.7-$4.6M per mile)**	**Expected level of initial investment required to provide transit speed, reliability, passenger comfort, and access improvements in the corridor.** Based on initial planning level assessment conducted as part of the 2015 TMP update. Future analysis will identify the most cost-effective capital project elements and levels of investment appropriate to different right-of-way configurations and land use environments along the corridor. Higher level of investment may be possible based on potential additional local, regional, state and federal funding identified during detailed corridor planning and design process. Does not include vehicle costs.
Cost/Rider	**$3.43**	**Value of investment over time, including cost of operation and annualized cost of capital investment, fleet replacement, and maintenance:** Annualized operating and capital cost per rider equals annual operating cost plus annualized capital costs divided by annual boarding rides. Operating cost adjusted for inflation by 2.4% annually. Infrastructure life held constant. Assumed vehicle life is 12 years for diesel hybrid bus.
O&M Cost	**$14.4M**	**Annual total cost to deliver service on the proposed line.** Annual operating cost based on the number of hours of revenue service, calculated through development of corridor-specific operating plan, multiplied by the 2015 operating cost for RapidRide. The 2015 operating costs are based on King County Metro operating cost factors and assumptions from the Madison Corridor BRT Study. Does not include cost reductions from repurposing of existing bus service hours.
Operating Cost/ New Ride	**$3.03**	**Operating cost to deliver a new boarding ride considering potential cost savings:** Calculated as planned weekday operating cost minus weekday operating cost savings, divided by the number of net new boarding rides projected for 2035. Analysis of cost savings is conceptual.
Travel Time Savings	**14%**	**In-vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations:** Projected 2035 corridor travel time with current road design - estimated travel times under each mode, alignment, and design.
GhG Savings	**1,964 MT CO2e**	**Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions:** Emissions savings from reduced VMT based on an assumed rate of displaced light duty vehicle trips per new transit rider, average trip length by corridor, average fuel economy, and resulting fuel savings. Emissions savings from net change in transit emissions equals planned service minus existing service (based on conceptual operating plans). Emissions factors applied based on known emission assumptions for electric trolley bus and diesel hybrid bus.

Note: All costs are in 2015 dollars.

IMPLEMENTATION STRATEGIES

- **Strategy RR 2.1:** Work with WSDOT to address transit priority needs on state highway facilities, particularly a southbound transit only lane on SR-99 and a westbound transit only lane on the West Seattle Bridge.
- **Strategy RR 2.2:** Evaluate options with WSDOT for jointly improving freight/transit operations on state highway facilities.
- **Strategy RR 2.3:** Leverage recent King County Metro stop consolidation and transit investments along the Delridge corridor that were part of the 2012 Route 120 Transit Corridor Improvement project. Coordinate funding in the adopted State Transportation Package.
- **Strategy RR 2.4:** Coordinate with existing funding arrangements for corridor improvements.
- **Strategy RR 2.5:** Work with local stakeholders to evaluate transit speed and reliability tradeoffs between corridor on-street parking and Business Access and Transit (BAT) lanes.
- **Strategy RR 2.6:** Work with the Bicycle Advisory Board and other local stakeholders to evaluate separated bicycle facility options along Delridge Way SW between SW Oregon Street and SW Orchard Street.
- **Strategy RR 2.7:** Engage King County Metro to evaluate a route extension from City Center to South Lake Union via Westlake Avenue.
- **Strategy RR 2.8:** Investigate lane capacity issues on Westlake Avenue and layover options in South Lake Union that would allow for a route extension.
- **Strategy RR 2.9:** Evaluate feasibility of South Lake Union operations on Westlake, particularly transit lane capacity to accommodate Seattle Streetcar, Rapid Ride C-Line, RapidRide Corridor 6 (Northgate - Ballard - Fremont - South Lake Union – Downtown), and this line.

MULTIMODAL PROJECT COORDINATION

- **Strategy MMC 2.1:** Coordinate design of transit priority treatments with ongoing Bicycle Master Plan facility planning on Delridge Way SW between SW Oregon Street and SW Orchard Street and on 26th Avenue between SW Barton Street and SW Roxbury Street.
- **Strategy MMC 2.2:** Develop a street concept plan for the Delridge Way SW corridor between the West Seattle Bridge ramps and SW Roxbury Street.
- **Strategy MMC 2.3:** Ensure neighborhood greenway crossings provide safe access across the corridor and to proposed RapidRide stations.
- **Strategy MMC 2.4:** Provide clear wayfinding to direct people walking and biking to RapidRide stations.
- **Strategy MMC 2.5:** Identify overlap and coordinate with Pedestrian Master Plan improvement projects along each corridor that have shared design elements with RapidRide such as enhanced intersection crossings, curb bulbs, and improved sidewalks.
- **Strategy MMC 2.6:** Identify stations for bike share expansion to enable seamless transfers between RapidRide and bike share.

RapidRide Corridor 3

Mount Baker – South Lake Union via Rainier Avenue and Jackson Street

Key Characteristics

Length: 5.25 miles

Major Stations: South Lake Union stations on Fairview, 3rd Avenue Transit Spine stations, International District stations along Jackson Street, 23rd Avenue, Judkins Park, Mount Baker Transit Center

Average Stop Spacing: 0.26 miles

Key Connections

- Aloha terminus (RapidRide Corridors 2 and 7 connections)
- Downtown Seattle Transit Tunnel
- 3rd Avenue Transit Spine
- Seattle Streetcar connections along Jackson Street and at Westlake and 5th/7th
- King Street Station
- 23rd Avenue (RapidRide Corridor 4 connection)
- Rainier Freeway Station
- Mount Baker Link Station/Transit Center

Permitted Development:

Office Commercial: 9,459,932 sf
Retail: 1,404,480 sf
Residential: 15,248 units

Service Design

Alignment Alternatives: None
Potential for Dual-Sided Vehicles: Yes

RapidRide Scorecard

CRITERION	SCORING METRIC	SCORE
The Elements		
Dedicated Runningway (all-day)	*% of corridor*	**75%**
Bus Lane Alignment (limited transitions)	*Yes/No*	**Yes**
Intersection Treatments	*% of signalized intersections have transit priority treatments*	**40%**
The Network		
Intermodal Connections	*# of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus*	Link: **5** RapidRide: **8** Streetcar: **2** Local/regional bus: **8**
Stop Spacing	*Average stop spacing*	**.38 miles**
The Stations		
Full-Feature Stations	*# of stations being upgraded to full featured stations*	**18**
The Connections		
Move Seattle Walking and Biking Improvements	*# of Move Seattle pedestrian/ bicycle projects in corridor*	**7**

LEGEND

HCT Corridors
- Corridor Alignment
- Alternative Alignment
- ST Link Light Rail / Stations
- Existing RapidRide Routes
- Seattle Streetcar / Stations

Potential Improvements
- Bus Bulbs
- Transit Signal Priority
- Upgrade to Full Station
- Floating Bus Stop
- Queue Jump Lanes *(both directions, unless noted)*
- Layover Location *(requires study)*

Potential Right-of-way Treatments Pending Detailed Feasibility Analysis
- Transit Only Lane
- BAT Lane
- Peak BAT Lane
- Mixed Traffic

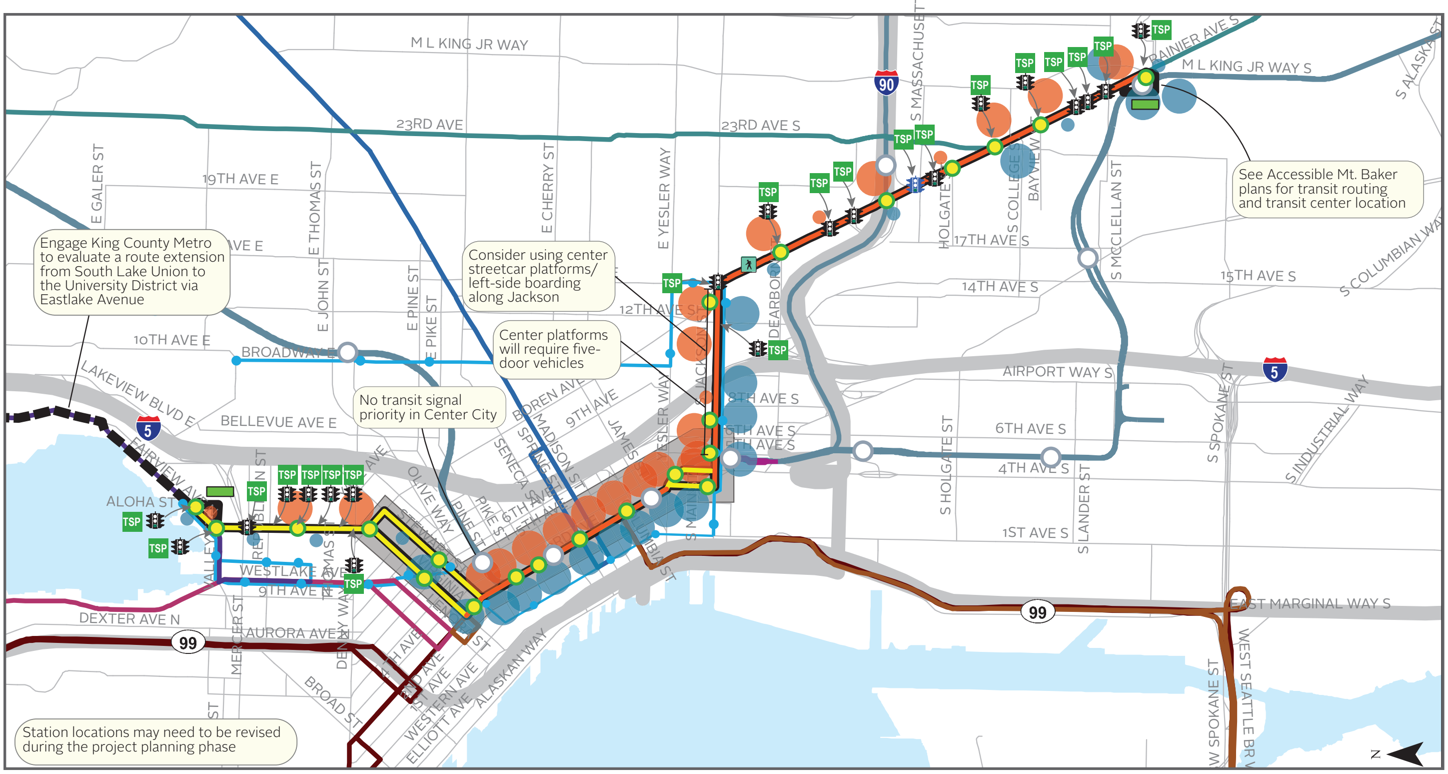
Future RapidRide Corridors
- Corridor 1: Madison
- Corridor 2: Delridge
- Corridor 3: Jackson/Rainier
- Corridor 4: 23rd/Rainier
- Corridor 5: Market/45th
- Corridor 6: Westlake - Ballard - Northgate
- Corridor 7: Roosevelt

Existing Daily Boardings at High Ridership Stops
- 100 - 200
- 201 or more
- Inbound
- Outbound

Existing Signals
- SDOT Full Signal
- WSDOT Signal
- Half Signal
- Mid-Block Cross Walk

RapidRide Corridor 3: Major updates to corridor capital project elements compared to the 2012 Transit Master Plan

- This corridor was labeled Priority Bus Corridor 4 in the 2012 Transit Master Plan
- Segment of Rainier Avenue between Roxbury and Massachusetts: 2015 TMP recommends consideration of median transit only lanes.
- Segment of Jackson from Rainier Avenue to 3rd Avenue: 2015 TMP recommends consideration of transit only operations for streetcar lane (currently shared with traffic).
- 2015 TMP recommends consideration of line extension north of Downtown via Stewart/Virginia and Fairview.



Recommended RapidRide corridor improvements are conceptual in nature and will require future public outreach, technical analysis, and detailed design work.

RapidRide Corridor 3

Mount Baker – South Lake Union via Rainier Avenue and Jackson St

Metric	Score	Details
Ridership *(Weekday riders [2035] and Net New Riders)*	**17,900** **(8,000 net new riders)**	**Ridership potential in 2035 is based on service improvements and projected land use changes:** Weekday riders (2035) estimated from Spring 2015 stop/route-level boardings assigned to each corridor. Net new weekday riders equal 2030 estimate of potential ridership minus current (2015) ridership estimate for the corridor.
Productivity	**107 riders/ hour**	**Efficiency with which provided transit capacity is utilized. Productivity equals weekday ridership divided by weekday revenue hours:** A "revenue hour" includes time when a transit vehicle is available to carry passengers. It includes layover time, but excludes "deadhead" time such as when a bus travels to the start of a route. Weekday hours of revenue service calculated through development of corridor-specific operating plan.
RapidRide Initial Investment Level	**\$19.0-\$23.0M** **(\$3.6-\$4.4M per mile)**	**Expected level of initial investment required to provide transit speed, reliability, passenger comfort, and access improvements in the corridor.** Based on initial planning level assessment conducted as part of the 2015 TMP update. Future analysis will identify the most cost-effective capital project elements and levels of investment appropriate to different right-of-way configurations and land use environments along the corridor. Higher level of investment may be possible based on potential additional local, regional, state and federal funding identified during detailed corridor planning and design process. Does not include vehicle costs.
Cost/Rider	**\$2.10**	**Value of investment over time, including cost of operation and annualized cost of capital investment, fleet replacement, and maintenance:** Annualized operating and capital cost per rider equals annual operating cost plus annualized capital costs divided by annual boarding rides. Operating cost adjusted for inflation by 2.4% annually. Infrastructure life held constant. Assumed vehicle life is 15 years for electric trolley bus.
O&M Cost	**\$11.1M**	**Annual total cost to deliver service on the proposed line.** Annual operating cost based on the number of hours of revenue service, calculated through development of corridor-specific operating plan, multiplied by the 2015 operating cost for RapidRide. The 2015 operating costs are based on King County Metro operating cost factors and assumptions from the Madison Corridor BRT Study. Does not include cost reductions from repurposing of existing bus service hours.
Operating Cost/ New Ride	**\$1.92**	**Operating cost to deliver a new boarding ride considering potential cost savings:** Calculated as planned weekday operating cost minus weekday operating cost savings, divided by the number of net new boarding rides projected for 2035. Analysis of cost savings is conceptual.
Travel Time Savings	**33%**	**In-vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations:** Projected 2035 corridor travel time with current road design - estimated travel times under each mode, alignment, and design.
GhG Savings	**1,073 MT CO2e**	**Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions:** Emissions savings from reduced VMT based on an assumed rate of displaced light duty vehicle trips per new transit rider, average trip length by corridor, average fuel economy, and resulting fuel savings. Emissions savings from net change in transit emissions equals planned service minus existing service (based on conceptual operating plans). Emissions factors applied based on known emission assumptions for electric trolley bus and diesel hybrid bus.

Note: All costs are in 2015 dollars.

IMPLEMENTATION STRATEGIES

- **Strategy RR 3.1:** Investigate layover opportunities in northern South Lake Union consistent with use of Fairview, including identification of overhead wire needs.
- **Strategy RR 3.2:** Engage King County Metro to evaluate a route extension from South Lake Union to the University District via Eastlake Avenue.
- **Strategy RR 3.3:** Evaluate tradeoffs of converting First Hill Streetcar running way on Jackson Street to center-running transit-only lanes to allow for shared RapidRide/streetcar operations and Japantown, Chinatown, and Little Saigon center-platform stations.
- **Strategy RR 3.4:** Leverage planned and recently constructed King County Metro transit investments along 23rd Avenue.
- **Strategy RR 3.5:** Evaluate feasibility of center-running transit-only lanes on Rainier Avenue including I-90 undercrossing opportunities and constraints.
- **Strategy RR 3.6:** Coordinate right-of-way and station designs with the RapidRide Corridor 4 project (Rainier Valley – U-District via 23rd Avenue and Rainier Ave).
- **Strategy RR 3.7:** Evaluate options for jointly improving freight/transit operations on the major truck street portion of Jackson Street between S Dearborn Street and MLK Jr. Way.
- **Strategy RR 3.8:** Engage King County Metro to evaluate a route restructuring for Route 7.
- **Strategy RR 3.9:** Coordinate station and level boarding opportunities at the Judkins Park East Link and RapidRide stations.

MULTIMODAL PROJECT COORDINATION

- **Strategy MMC 3.1:** Coordinate design of the southern route terminus routing and layover facility with the Accessible Mt. Baker study in order to 1) integrate the study's near-term recommended access and safety improvement projects and 2) ensure compatibility with the long-range integrated multimodal plan for the Mt. Baker Town Center.
- **Strategy MMC 3.2:** Work with Sound Transit to ensure safe, attractive, and convenient non-motorized connectivity between the Judkins Park East Link Station and RapidRide.
- **Strategy MMC 3.3:** Coordinate routing and station design with the Accessible Mt. Baker study in order to 1) integrate the study's near-term recommended access and safety improvement projects and 2) ensure compatibility with the long-range integrated multimodal plan for the Mt. Baker Town Center.
- **Strategy MMC 3.4:** Coordinate with Southeast Transportation Study to leverage mobility and safety improvement project recommendations along corridor.
- **Strategy MMC 3.5:** Develop a street concept plan for the Rainier Avenue corridor between Jackson Street and MLK, incorporating recommendations from the Accessible Mt. Baker study.
- **Strategy MMC 3.6:** Provide clear wayfinding to direct people walking and biking to RapidRide stations.
- **Strategy MMC 3.7:** Identify overlap and coordinate with Pedestrian Master Plan improvement projects along each corridor that have shared design elements with RapidRide such as enhanced intersection crossings, curb bulbs, and improved sidewalks.
- **Strategy MMC 3.8:** Work with WSDOT to implement urban interchange improvements at Rainier Avenue and I-90.

RapidRide Corridor 4

Rainier Valley – U-District via 23rd Avenue and Rainier Avenue

Key Characteristics

Length: 10.97 miles

Major Stations: Rainier Beach Transit Center, Mount Baker Transit Center, Judkins Park, Rainier/23rd Avenue, Madison/23rd Avenue, Boyer/Washington Arboretum, Montlake Freeway Station, NE Pacific/UW Medical Center, U-District Link Station

Average Stop Spacing: 0.38 miles

Key Connections

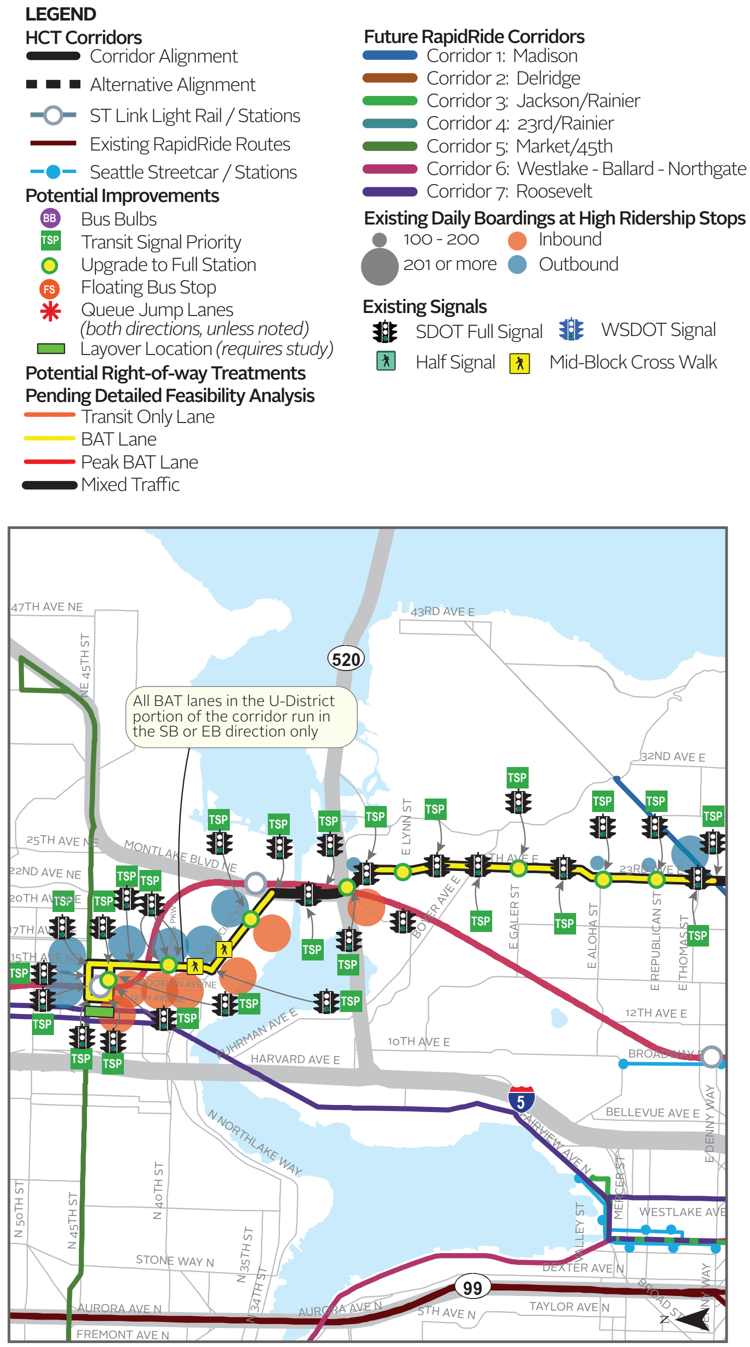
- Rainier Beach Link Station/Transit Center
- Mount Baker Link Station/Transit Center
- 23rd Avenue (RapidRide Corridor 3 connection)
- Rainier Freeway Station/Judkins Park Link Station
- Madison Street (RapidRide Corridor 1 connection)
- Montlake Freeway Station
- Husky Stadium Link Station (via NE Pacific)
- U-District Link Station/45th Street (RapidRide Corridor 1 connection)

Permitted Development:

Office Commercial: 67,843 sf
Retail: 235,194 sf
Residential: 4,290 units

Service Design

Alignment Alternatives: None
Potential for Dual-Sided Vehicles: Yes (short segment shared with RapidRide Corridor 3)

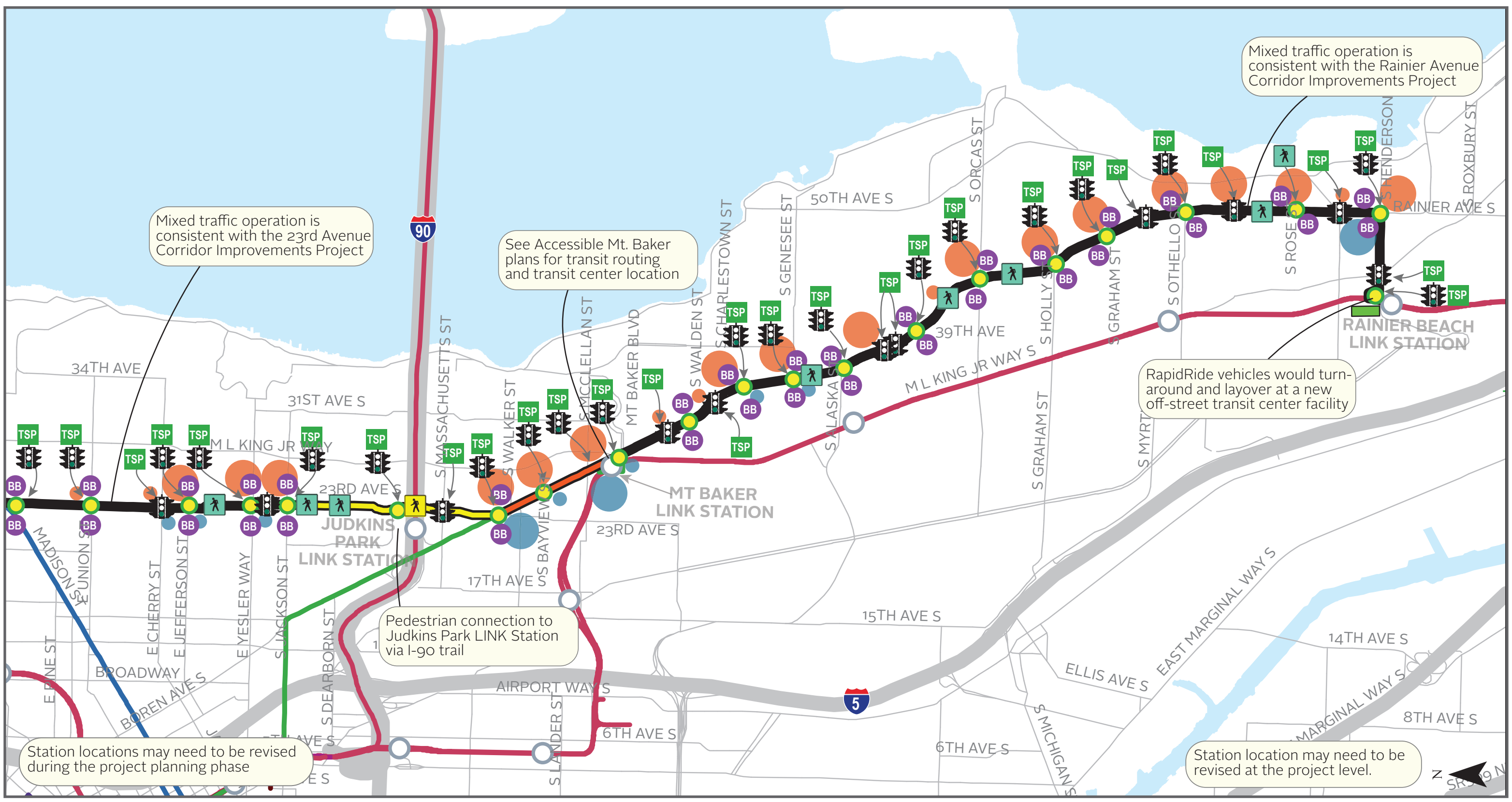


RapidRide Scorecard

CRITERION	SCORING METRIC	SCORE
The Elements		
Dedicated Runningway (all-day)	*% of corridor*	38%
Bus Lane Alignment (limited transitions)	*Yes/No*	Yes
Intersection Treatments	*% of signalized intersections have transit priority treatments*	86%
The Network		
Intermodal Connections	*# of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus*	Link: **5** RapidRide: **3** Local/regional bus: **13**
Stop Spacing	*Average stop spacing*	0.38 miles
The Stations		
Full-Feature Stations	*# of stations being upgraded to full featured stations*	53
The Connections		
Move Seattle Walking and Biking Improvements	*# of Move Seattle pedestrian/ bicycle projects in corridor*	31

RapidRide Corridor 4:
Major updates to corridor capital project elements compared to the 2012 Transit Master Plan

- This corridor was labeled Priority Bus Corridor 5 in the 2012 Transit Master Plan
- Segment between E. Thomas and N 45th Street: 2015 TMP recommends consideration of BAT lanes where feasible given ROW constraints and traffic operations.
- Segment of 23rd Avenue between S. Jackson and Rainier: 2015 TMP recommends consideration of BAT lanes.



Recommended RapidRide corridor improvements are conceptual in nature and will require future public outreach, technical analysis, and detailed design work.

RapidRide Corridor 4

Rainier Valley – U-District via 23rd Avenue and Rainier Avenue

Metric	Score	Details
Ridership *(Weekday riders [2035] and Net New Riders)*	**15,800** **(5,400 net new riders)**	**Ridership potential in 2035 is based on service improvements and projected land use changes:** Weekday riders (2035) estimated from Spring 2015 stop/route-level boardings assigned to each corridor. Net new weekday riders equal 2030 estimate of potential ridership minus current (2015) ridership estimate for the corridor.
Productivity	**58 riders/hour**	**Efficiency with which provided transit capacity is utilized. Productivity equals weekday ridership divided by weekday revenue hours:** A "revenue hour" includes time when a transit vehicle is available to carry passengers. It includes layover time, but excludes "deadhead" time such as when a bus travels to the start of a route. Weekday hours of revenue service calculated through development of corridor-specific operating plan.
RapidRide Initial Investment Level	**\$90.0-\$96.0M** **(\$8.7-\$8.8M per mile)**	**Expected level of initial investment required to provide transit speed, reliability, passenger comfort, and access improvements in the corridor.** Based on initial planning level assessment conducted as part of the 2015 TMP update. Future analysis will identify the most cost-effective capital project elements and levels of investment appropriate to different right-of-way configurations and land use environments along the corridor. Higher level of investment may be possible based on potential additional local, regional, state and federal funding identified during detailed corridor planning and design process. Does not include vehicle costs.
Cost/Rider	**\$4.33**	**Value of investment over time, including cost of operation and annualized cost of capital investment, fleet replacement, and maintenance:** Annualized operating and capital cost per rider equals annual operating cost plus annualized capital costs divided by annual boarding rides. Operating cost adjusted for inflation by 2.4% annually. Infrastructure life held constant. Assumed vehicle life is 15 years for electric trolley bus.
O&M Cost	**\$19.1M**	**Annual total cost to deliver service on the proposed line.** Annual operating cost based on the number of hours of revenue service, calculated through development of corridor-specific operating plan, multiplied by the 2015 operating cost for RapidRide. The 2015 operating costs are based on King County Metro operating cost factors and assumptions from the Madison Corridor BRT Study. Does not include cost reductions from repurposing of existing bus service hours.
Operating Cost/ New Ride	**\$3.72**	**Operating cost to deliver a new boarding ride considering potential cost savings:** Calculated as planned weekday operating cost minus weekday operating cost savings, divided by the number of net new boarding rides projected for 2035. Analysis of cost savings is conceptual.
Travel Time Savings	**24%**	**In-vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations:** Projected 2035 corridor travel time with current road design - estimated travel times under each mode, alignment, and design.
GhG Savings	**1,577 MT CO2e**	**Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions:** Emissions savings from reduced VMT based on an assumed rate of displaced light duty vehicle trips per new transit rider, average trip length by corridor, average fuel economy, and resulting fuel savings. Emissions savings from net change in transit emissions equals planned service minus existing service (based on conceptual operating plans). Emissions factors applied based on known emission assumptions for electric trolley bus and diesel hybrid bus.

Note: All costs are in 2015 dollars.

IMPLEMENTATION STRATEGIES

- **Strategy RR 4.1:** Consider local funding options for Rainier Beach Transit Center Project inclusive of new roadway, layover space, station area amenities, and operator comfort station that will serve the southern terminus of the RapidRide route.
- **Strategy RR 4.2:** Provide a convenient pedestrian and bicycle connection to University of Washington (Husky Stadium) Link Station.
- **Strategy RR 4.3:** Work with King County Metro to address layover potential on 12th Avenue and viable turnaround options that provide a connection to the U-District Link Station.
- **Strategy RR 4.4:** Coordinate with Madison BRT Project (RapidRide Corridor 1) to design stations and pedestrian connections that would provide a safe, comfortable, and proximate transfer between the two intersecting RapidRide routes at Madison Street & 23rd Avenue.
- **Strategy RR 4.5:** Evaluate options for jointly improving freight/transit operations on the major truck street portion of Rainier Avenue between S Dearborn Street and MLK Jr. Way.
- **Strategy RR 4.6:** Engage King County Metro to evaluate a route restructuring for Route 48.

MULTIMODAL PROJECT COORDINATION

- **Strategy MMC 4.1:** Coordinate with 23rd Avenue Corridor Improvements Project on feasible bus priority treatments following modification of 23rd Avenue from a four-lane street to a three-lane street between S Jackson Street and E John Street.
- **Strategy MMC 4.2:** Work with Sound Transit to ensure safe, attractive, and convenient non-motorized connectivity between the Judkins Park East Link Station and RapidRide.
- **Strategy MMC 4.3:** Coordinate routing and station design with the Accessible Mt. Baker study in order to 1) integrate the study's near-term recommended access and safety improvement projects and 2) ensure compatibility with the long-range integrated multimodal plan for the Mt. Baker Town Center.
- **Strategy MMC 4.4:** Coordinate with Rainier Avenue Safety Improvements Project to integrate and optimize RapidRide operations and facility design with approved roadway safety improvements between S Alaska Street and S Kenny Street.
- **Strategy MMC 4.5:** Coordinate with Southeast Transportation Study to leverage mobility and safety improvement project recommendations along corridor.
- **Strategy MMC 4.6:** Develop a street concept plan for the streets north of the 23rd Avenue Corridor Improvements Project.
- **Strategy MMC 4.7:** Ensure 21st Avenue and Rainier north/south neighborhood greenway crossings provide safe access across the corridor and to proposed RapidRide stations.
- **Strategy MMC 4.8:** Provide clear wayfinding to direct people walking and biking to RapidRide stations.
- **Strategy MMC 4.9:** Identify overlap and coordinate with Pedestrian Master Plan improvement projects along each corridor that have shared design elements with RapidRide such as enhanced intersection crossings, curb bulbs, and improved sidewalks.

RapidRide Corridor 5

Ballard – U-District – Laurelhurst via Market Street and 45th Street

Key Characteristics

Length: 6.27 miles

Major Stations: Market Street/24th Avenue, Market Street/15th Avenue, 45th Street/Walingford Avenue, 45th Street/Roosevelt Way, Brooklyn Avenue/U-District Link Station, Sand Point Way/40th Avenue

Average Stop Spacing: 0.39 miles

Key Connections

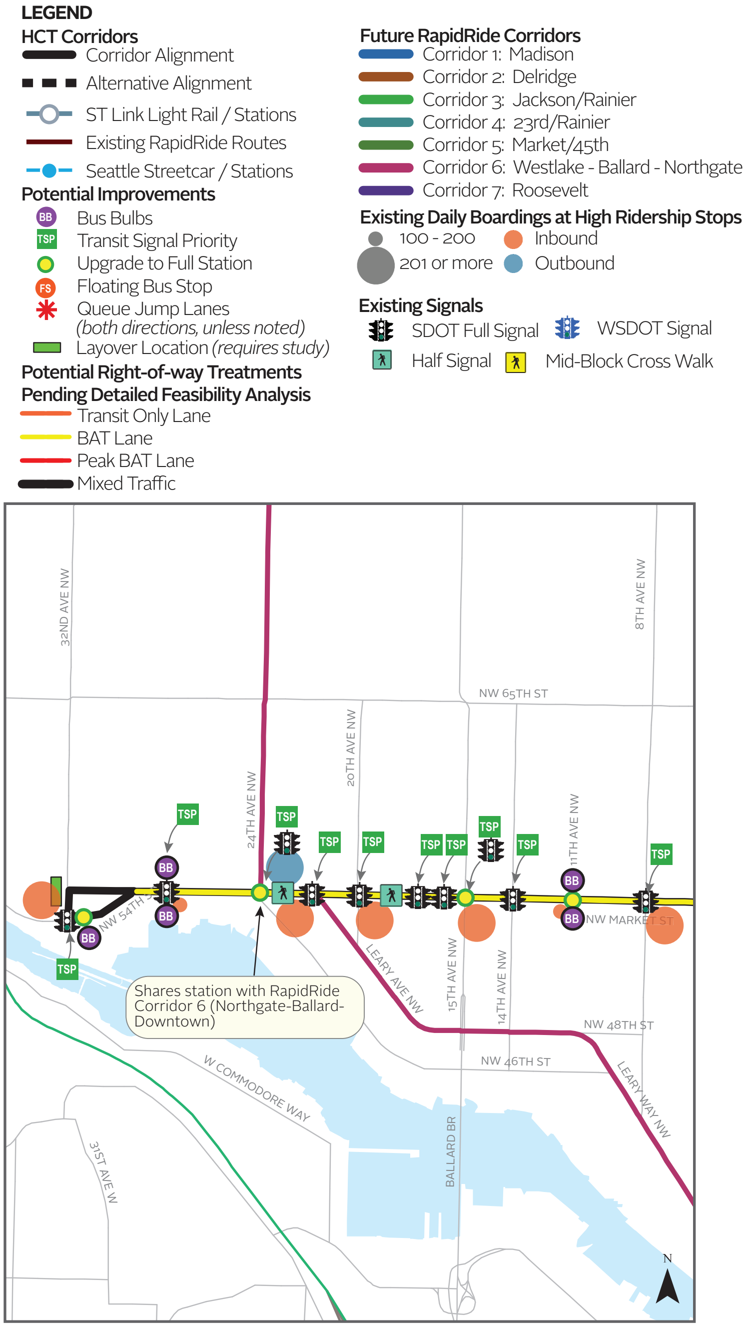
- Market Street/24th Avenue (RapidRide Corridor 6 connection)
- Market Street/15th Avenue (E Line connection)
- 46th Street/Aurora Avenue (D Line connection)
- I-5 at NE 45th Street Freeway Station
- 45th Street/Roosevelt Way (RapidRide Corridor 7 connection)
- Brooklyn Avenue (Connection to U-District Link Station and RapidRide Corridor 4)

Permitted Development:

Office Commercial: 823,258 sf
Retail: 445,160 sf
Residential: 3,703 units

Service Design

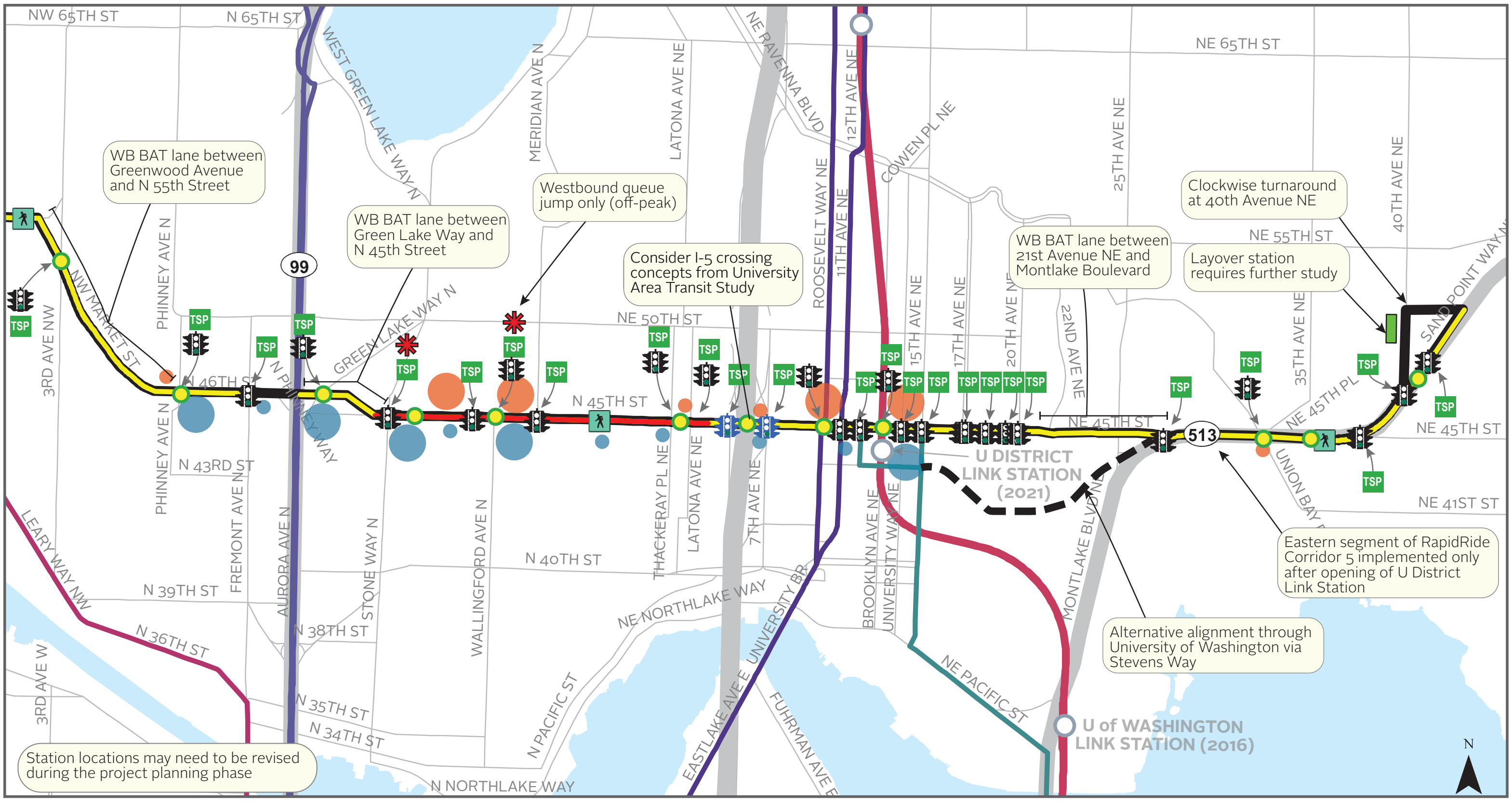
Alignment Alternatives: Potential routing through University of Washington via E Stevens Way
Potential for Dual-Sided Vehicles: No



RapidRide Scorecard		
CRITERION	SCORING METRIC	SCORE
The Elements		
Dedicated Runningway (all-day)	*% of corridor*	71%
Bus Lane Alignment (limited transitions)	*Yes/No*	Yes
Intersection Treatments	*% of signalized intersections have transit priority treatments*	84%
The Network		
Intermodal Connections	*# of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus*	Link: **1** RapidRide: **5** Local/regional bus: **11**
Stop Spacing	*Average stop spacing*	0.39 miles
The Stations		
Full-Feature Stations	*# of stations being upgraded to full featured stations*	31
The Connections		
Move Seattle Walking and Biking Improvements	*# of Move Seattle pedestrian/ bicycle projects in corridor*	14

RapidRide Corridor 5:
Major updates to corridor capital project elements compared to the 2012 Transit Master Plan

- This corridor was labeled Priority Bus Corridor 13 in the 2012 Transit Master Plan
- Segment of the corridor between 30th Avenue NW and 42nd Avenue NE: 2015 TMP recommends consideration of peak and all-day BAT lanes where feasible.
- Projects resulting from 2014-2015 SDOT NW Market/45th Street Project analysis and design are include in 2015 TMP. These improvements included transit speed and reliability enhancements and pedestrian improvements.



Recommended RapidRide corridor improvements are conceptual in nature and will require future public outreach, technical analysis, and detailed design work.

RapidRide Corridor 5

Ballard – U-District – Laurelhurst via Market Street and 45th St

Metric	Score	Details
Ridership *(Weekday riders [2035] and Net New Riders)*	**16,200** (6,900 net new riders)	**Ridership potential in 2035 is based on service improvements and projected land use changes:** Weekday riders (2035) estimated from Spring 2015 stop/route-level boardings assigned to each corridor. Net new weekday riders equal 2030 estimate of potential ridership minus current (2015) ridership estimate for the corridor.
Productivity	**81 riders/hour**	**Efficiency with which provided transit capacity is utilized. Productivity equals weekday ridership divided by weekday revenue hours:** A "revenue hour" includes time when a transit vehicle is available to carry passengers. It includes layover time, but excludes “deadhead” time such as when a bus travels to the start of a route. Weekday hours of revenue service calculated through development of corridor-specific operating plan.
RapidRide Initial Investment Level	**$30.0-$37.0M** ($4.8-$5.9M per mile)	**Expected level of initial investment required to provide transit speed, reliability, passenger comfort, and access improvements in the corridor.** Based on initial planning level assessment conducted as part of the 2015 TMP update. Future analysis will identify the most cost-effective capital project elements and levels of investment appropriate to different right-of-way configurations and land use environments along the corridor. Higher level of investment may be possible based on potential additional local, regional, state and federal funding identified during detailed corridor planning and design process. Vehicle costs not included.
Cost/Rider	**$2.80**	**Value of investment over time, including cost of operation and annualized cost of capital investment, fleet replacement, and maintenance:** Annualized operating and capital cost per rider equals annual operating cost plus annualized capital costs divided by annual boarding rides. Operating cost adjusted for inflation by 2.4% annually. Infrastructure life held constant. Assumed vehicle life is 15 years for electric trolley bus.
O&M Cost	**$13.6M**	**Annual total cost to deliver service on the proposed line.** Annual operating cost based on the number of hours of revenue service, calculated through development of corridor-specific operating plan, multiplied by the 2015 operating cost for RapidRide. The 2015 operating costs are based on King County Metro operating cost factors and assumptions from the Madison Corridor BRT Study. Does not include cost reductions from repurposing of existing bus service hours.
Operating Cost/ New Ride	**$2.57**	**Operating cost to deliver a new boarding ride considering potential cost savings:** Calculated as planned weekday operating cost minus weekday operating cost savings, divided by the number of net new boarding rides projected for 2035. Analysis of cost savings is conceptual.
Travel Time Savings	**19%**	**In-vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations:** Projected 2035 corridor travel time with current road design - estimated travel times under each mode, alignment, and design.
GhG Savings	**1,122 MT CO2e**	**Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions:** Emissions savings from reduced VMT based on an assumed rate of displaced light duty vehicle trips per new transit rider, average trip length by corridor, average fuel economy, and resulting fuel savings. Emissions savings from net change in transit emissions equals planned service minus existing service (based on conceptual operating plans). Emissions factors applied based on known emission assumptions for electric trolley bus and diesel hybrid bus.

Note: All costs are in 2015 dollars.

IMPLEMENTATION STRATEGIES

- **Strategy RR 5.1:** Explore additional eastern route terminus routing and layover options in the vicinity of Sand Point Way.
- **Strategy RR 5.2:** Evaluate feasibility of Business Access and Transit (BAT) lanes east of I-5.
- **Strategy RR 5.3:** Integrate spot improvements west of I-5 as recommended by Route 44 Enhancements Study.
- **Strategy RR 5.4:** Build off success of SDOT spot improvements constructed as part of the NW Market/NE 45th Street Transit Priority Corridor Improvement Project and continue to implement public realm elements of the project.
- **Strategy RR 5.5:** Work with corridor business stakeholders to evaluate tradeoffs between transit speed and reliability and on-street parking needs.
- **Strategy RR 5.6:** As a primary east-west route, ensure seamless connections to north/south RapidRide routes and future U-District Link Station.
- **Strategy RR 5.7:** Evaluate sidewalk width in station areas for potential right-of-way needs for ADA-compliant station design.
- **Strategy RR 5.8:** Engage King County Metro to evaluate a route extension east to Sand Point Way/NE 50th Street.
- **Strategy RR 5.9:** Coordinate with King County Metro and the University of Washington to evaluate potential campus routing options.

MULTIMODAL PROJECT COORDINATION

- **Strategy MMC 5.1:** Coordinate with WSDOT on Market Street/I-5 crossing improvements and access control that will enhance transit and non-motorized trips.
- **Strategy MMC 5.2:** Coordinate with Sand Point Way Safety Corridor project to integrate and optimize RapidRide operations and facility design with approved roadway safety improvements between Montlake Boulevard NE and 50th Street NE.
- **Strategy MMC 5.3:** Develop a street concept plan for the Sand Point Way, 45th Street, 46th Street, and Market Street corridor, considering previous work on the NW Market/NE 45th Street Transit Priority Corridor Improvement and Sand Point Way Safety Corridor projects.
- **Strategy MMC 5.4:** Ensure 46th Street and 17th Avenue neighborhood greenway connections provide safe access across the corridor and to proposed RapidRide stations.
- **Strategy MMC 5.5:** Provide clear wayfinding to direct people walking and biking to RapidRide stations.
- **Strategy MMC 5.6:** Identify overlap and coordinate with Pedestrian Master Plan improvement projects along each corridor that have shared design elements with RapidRide such as enhanced intersection crossings, curb bulbs, and improved sidewalks.

RapidRide Corridor 6

Northgate - Ballard - Fremont - South Lake Union – Downtown, via Westlake Avenue

Key Characteristics

Length: 13.15 miles

Major Stations: Jackson, 3rd Avenue stations, Westlake Avenue stations, Fremont Avenue/34th Street, Market Street/15th Avenue, Market Street/24th Avenue, Holman Road/15th Avenue, Northgate Link Station/Transit Center

Average Stop Spacing: 0.41 miles

Key Connections
- Downtown Seattle Transit Tunnel
- 3rd Avenue Transit Spine
- Seattle Streetcar at Jackson Street and Westlake Avenue
- Leary Avenue/15th Avenue (D Line connection)
- Market Street/24th Avenue (RapidRide Corridor 5 connection)
- 105th Street/Aurora Avenue (E Line Connection)
- Northgate Link Station/Transit Center

Permitted Development:
Office Commercial: 9,558,738 sf
Retail: 1,456,012 sf
Residential: 16,997 units

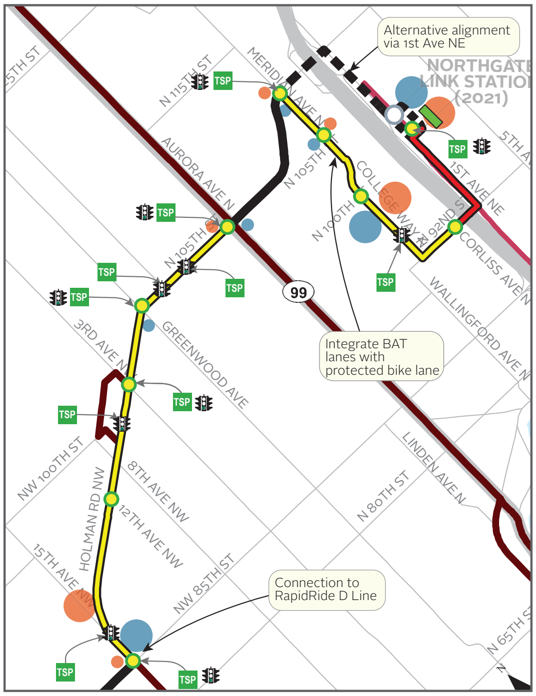
Service Design
Alignment Alternatives: Potential new bridge connection across the Ship Canal, immediately to the west of the Ballard Bridge
Potential for Dual-Sided Vehicles: No

RapidRide Scorecard

CRITERION	SCORING METRIC	SCORE
The Elements		
Dedicated Runningway (all-day)	*% of corridor*	**41%**
Bus Lane Alignment (limited transitions)	*Yes/No*	**Yes**
Intersection Treatments	*% of signalized intersections have transit priority treatments*	**55%**
The Network		
Intermodal Connections	*# of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus*	Link: **5** RapidRide: **9** Streetcar: **2** Local/regional bus: **11**
Stop Spacing	*Average stop spacing*	**0.41 miles**
The Stations		
Full-Feature Stations	*# of stations being upgraded to full featured stations*	**55**
The Connections		
Move Seattle Walking and Biking Improvements	*# of Move Seattle pedestrian/ bicycle projects in corridor*	**26**

RapidRide Corridor 6: Major updates to corridor capital project elements compared to the 2012 Transit Master Plan

- This corridor was labeled HCT Corridor 11 (Ballard – Fremont – Downtown) and a portion of Priority Bus Corridor 10 (Holman Road) in the 2012 Transit Master Plan
- The 2012 TMP recommended Rapid Streetcar as the preferred mode for this corridor; the 2015 TMP recommends RapidRide for this corridor.
- This corridor introduces a new segment along 24th Avenue NW between NW Market Street and N 85th Street. No dedicated transit lanes are called for in this segment; floating bus islands are recommended for consideration.
- Segment of the corridor on Holman Road between 15th Avenue NW and Aurora Avenue N recommended for consideration of BAT lanes.
- Segment of College Way between Northgate Way and N 92nd Avenue recommended for consideration of BAT lanes pending further analysis of right-of-way constraints and bicycle facility priorities.
- For the segments of the corridor between Ballard and South Lake Union, recommendations for right-of-way reallocation to transit lanes are similar to the 2012 TMP despite the change in recommended mode from rapid streetcar to RapidRide.



LEGEND

HCT Corridors
- Corridor Alignment
- Alternative Alignment
- ST Link Light Rail / Stations
- Existing RapidRide Routes
- Seattle Streetcar / Stations

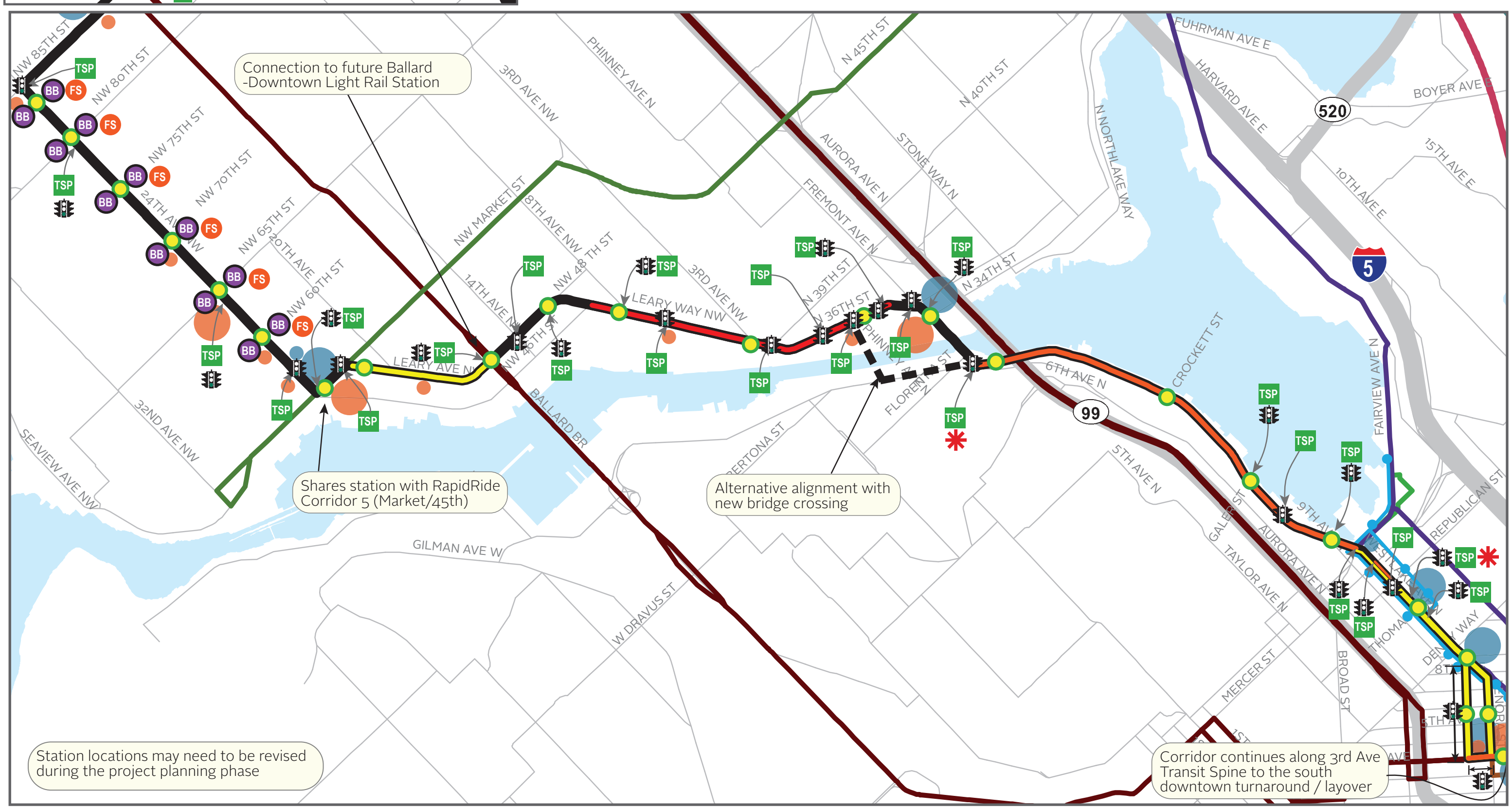
Potential Improvements
- BB Bus Bulbs
- TSP Transit Signal Priority
- Upgrade to Full Station
- FS Floating Bus Stop
- Queue Jump Lanes *(both directions, unless noted)*
- Layover Location *(requires study)*

Potential Right-of-way Treatments Pending Detailed Feasibility Analysis
- Transit Only Lane
- BAT Lane
- Peak BAT Lane
- Mixed Traffic

Future RapidRide Corridors
- Corridor 1: Madison
- Corridor 2: Delridge
- Corridor 3: Jackson/Rainier
- Corridor 4: 23rd/Rainier
- Corridor 5: Market/45th
- Corridor 6: Westlake - Ballard - Northgate
- Corridor 7: Roosevelt

Existing Daily Boardings at High Ridership Stops
- 100 - 200
- 201 or more
- Inbound
- Outbound

Existing Signals
- SDOT Full Signal
- WSDOT Signal
- Half Signal
- Mid-Block Cross Walk



Recommended RapidRide corridor improvements are conceptual in nature and will require future public outreach, technical analysis, and detailed design work.

RapidRide Corridor 6

Northgate - Ballard - Fremont - South Lake Union – Downtown, via Westlake Avenue

Metric	Score	Details
Ridership *(Weekday riders [2035] and Net New Riders)*	**24,400** **(9,000 net new riders)**	**Ridership potential in 2035 is based on service improvements and projected land use changes:** Weekday riders (2035) estimated from Spring 2015 stop/route-level boardings assigned to each corridor. Net new weekday riders equal 2030 estimate of potential ridership minus current (2015) ridership estimate for the corridor.
Productivity	**71 riders/hour**	**Efficiency with which provided transit capacity is utilized. Productivity equals weekday ridership divided by weekday revenue hours:** A "revenue hour" includes time when a transit vehicle is available to carry passengers. It includes layover time, but excludes "deadhead" time such as when a bus travels to the start of a route. Weekday hours of revenue service calculated through development of corridor-specific operating plan.
RapidRide Initial Investment Level	**$31.0-$38.0M** **($2.4-$2.9M per mile)**	**Expected level of initial investment required to provide transit speed, reliability, passenger comfort, and access improvements in the corridor.** Based on initial planning level assessment conducted as part of the 2015 TMP update. Future analysis will identify the most cost-effective capital project elements and levels of investment appropriate to different right-of-way configurations and land use environments along the corridor. Higher level of investment may be possible based on potential additional local, regional, state and federal funding identified during detailed corridor planning and design process. Vehicle costs no included.
Cost/Rider	**$3.25**	**Value of investment over time, including cost of operation and annualized cost of capital investment, fleet replacement, and maintenance:** Annualized operating and capital cost per rider equals annual operating cost plus annualized capital costs divided by annual boarding rides. Operating cost adjusted for inflation by 2.4% annually. Infrastructure life held constant. Assumed vehicle life is 12 years for diesel hybrid bus.
O&M Cost	**$24.2M**	**Annual total cost to deliver service on the proposed line.** Annual operating cost based on the number of hours of revenue service, calculated through development of corridor-specific operating plan, multiplied by the 2015 operating cost for RapidRide. The 2015 operating costs are based on King County Metro operating cost factors and assumptions from the Madison Corridor BRT Study. Does not include cost reductions from repurposing of existing bus service hours.
Operating Cost/ New Ride	**$3.06**	**Operating cost to deliver a new boarding ride considering potential cost savings:** Calculated as planned weekday operating cost minus weekday operating cost savings, divided by the number of net new boarding rides projected for 2035. Analysis of cost savings is conceptual.
Travel Time Savings	**17%**	**In-vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations:** Projected 2035 corridor travel time with current road design - estimated travel times under each mode, alignment, and design.
GhG Savings	**2,906 MT CO2e**	**Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions:** Emissions savings from reduced VMT based on an assumed rate of displaced light duty vehicle trips per new transit rider, average trip length by corridor, average fuel economy, and resulting fuel savings. Emissions savings from net change in transit emissions equals planned service minus existing service (based on conceptual operating plans). Emissions factors applied based on known emission assumptions for electric trolley bus and diesel hybrid bus.

Note: All costs are in 2015 dollars.

IMPLEMENTATION STRATEGIES

- **Strategy RR 6.1:** Evaluate South Lake Union operations on Westlake, particularly transit lane capacity to accommodate Seattle Streetcar, RapidRide C Line, proposed RapidRide Corridor 2 (current Route 120) and this route. This service should take priority over the Delridge extension to South Lake Union.
- **Strategy RR 6.2:** Study in detail options for crossing the Ship Canal, which could include various design and operational alternatives for use of the existing Fremont Bridge (likely first phase), rebuilding the existing Fremont Bridge to accommodate all modes, and the development of a new multimodal high-bridge to cross the Ship Canal (in the vicinity of 3rd Avenue W).
- **Strategy RR 6.3:** Evaluate options for jointly improving freight/transit operations on major truck streets corresponding to proposed RapidRide route alignment (Westlake Avenue N, N 36th Street, Leary Way NW, Holman Road NW, N 105th Street, and N Northgate Way).
- **Strategy RR 6.4:** Evaluate feasible routing options for crossing I-5 and optimal access to the Northgate Transit Center.
- **Strategy RR 6.5:** Consider phasing of transit priority treatments on a segment-by-segment approach based on right-of-way characteristics, traffic patterns, and ridership demand.
- **Strategy RR 6.6:** Evaluate feasibility of South Lake Union operations on Westlake, particularly transit lane capacity to accommodate Seattle Streetcar, Rapid Ride C-Line, RapidRide Corridor 2 (Burien TC – South Lake Union, via Delridge Way), and this line.

MULTIMODAL PROJECT COORDINATION

- **Strategy MMC 6.1:** Coordinate design of priority bus treatments on 1st Avenue NE with protected bicycle lane proposed between NE 92nd Street to Northgate Way.
- **Strategy MMC 6.2:** Coordinate design options along Westlake Avenue with the Westlake Cycle Track project.
- **Strategy MMC 6.3:** Evaluate options for a new multimodal bridge crossing of the Ship Canal east of the Fremont Bridge. A new bridge would ensure transit reliability but could also provide needed crossing options for pedestrians and people on bicycles.
- **Strategy MMC 6.4:** Ensure compatibility between existing protected bicycle lane and transit-only lane on Nickerson Street (as part of a new high bridge crossing).
- **Strategy MMC 6.5:** Optimize transfer and pedestrian experience at the junction of RapidRide Corridors 5 and 6 in the Ballard Hub Urban Village area.
- **Strategy MMC 6.6:** Coordinate with the Move Ballard study to integrate the multimodal transportation plan recommendations and access improvements into effective route and station design options in the Ballard Hub Urban Village.
- **Strategy MMC 6.7:** Develop a street concept plan for all streets in RapidRide Corridor 6.
- **Strategy MMC 6.8:** Ensure 100th, 90th, and 83rd Street neighborhood greenway connections provide safe access across the corridor and to proposed RapidRide stations.
- **Strategy MMC 6.9:** Provide clear wayfinding to direct people walking and biking to RapidRide stations.
- **Strategy MMC 6.10:** Identify overlap and coordinate with Pedestrian Master Plan improvement projects along each corridor that have shared design elements with RapidRide such as enhanced intersection crossings, curb bulbs, and improved sidewalks.
- **Strategy MMC 6.11:** Pilot a transit and freight only lane on Leary Avenue between 15th Avenue and Fremont Avenue.

RapidRide Corridor 7

Northgate - Roosevelt - University District - South Lake Union - Downtown, via Roosevelt Way/11th Avenue and Eastlake Avenue

Key Characteristics

Length: 8.74 miles

Major Stations: Northgate Link Station, Roosevelt Way/11th Avenue and 45th Street, Lynn Street, Republican Street, Fairview Avenue stations, 3rd Avenue stations, Jackson Street

Average Stop Spacing: 0.38 miles

Key Connections

- Downtown Seattle Transit Tunnel
- 3rd Avenue Transit Spine
- Seattle Streetcar and RapidRide Corridor 2/3 at Aloha Street
- Roosevelt Way/11th Avenue and 45th Street (RapidRide Corridor 4/5 and U-District Link Station connections)
- Northgate Link Station

Permitted Development:

Office Commercial: 9,814,304 sf
Retail: 1,529,741 sf
Residential: 21,018 units

Service Design

Alignment Alternatives: Access to 3rd Avenue via Westlake and Lenora/Blanchard; Connection to U-District Link Station via Brooklyn Ave
Potential for Dual-Sided Vehicles: Yes

RapidRide Scorecard		
CRITERION	SCORING METRIC	SCORE
The Elements		
Dedicated Runningway (all-day)	*% of corridor*	**49%**
Bus Lane Alignment (limited transitions)	*Yes/No*	**Yes**
Intersection Treatments	*% of signalized intersections have transit priority treatments*	**63%**
The Network		
Intermodal Connections	*# of connections to Link, RapidRide, Ferry, streetcar, and local/regional bus*	Link: **6** RapidRide: **9** Streetcar: **2** Local/regional bus: **11**
Stop Spacing	*Average stop spacing*	**0.38 miles**
The Stations		
Full-Feature Stations	*# of stations being upgraded to full featured stations*	**42**
The Connections		
Move Seattle Walking and Biking Improvements	*# of Move Seattle pedestrian/ bicycle projects in corridor*	**24**

LEGEND

HCT Corridors
- Corridor Alignment
- Alternative Alignment
- ST Link Light Rail / Stations
- Existing RapidRide Routes
- Seattle Streetcar / Stations

Potential Improvements
- BB Bus Bulbs
- TSP Transit Signal Priority
- Upgrade to Full Station
- FS Floating Bus Stop
- Queue Jump Lanes *(both directions, unless noted)*
- Layover Location *(requires study)*

Potential Right-of-way Treatments Pending Detailed Feasibility Analysis
- Transit Only Lane
- BAT Lane
- Peak BAT Lane
- Mixed Traffic

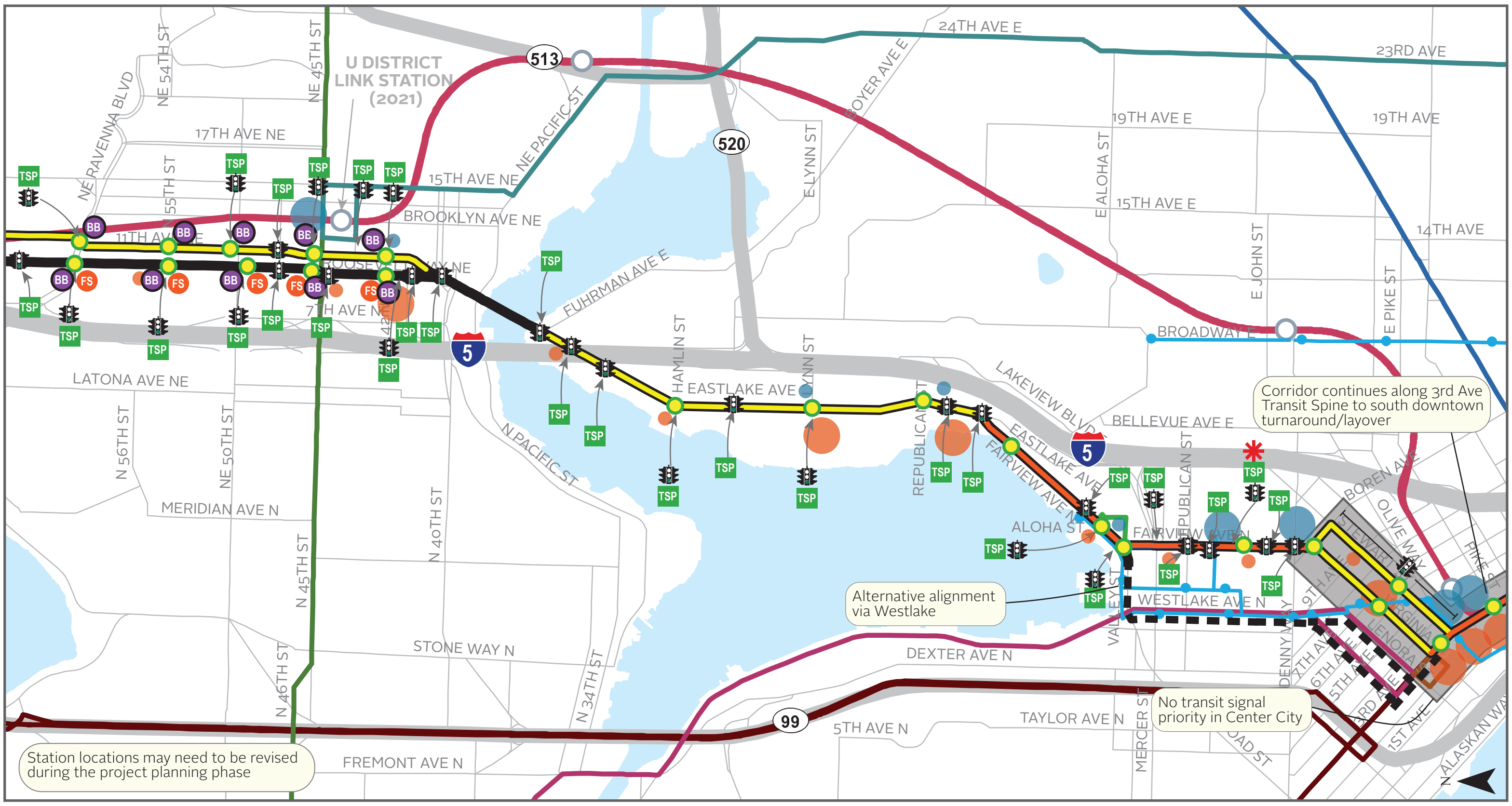
Future RapidRide Corridors
- Corridor 1: Madison
- Corridor 2: Delridge
- Corridor 3: Jackson/Rainier
- Corridor 4: 23rd/Rainier
- Corridor 5: Market/45th
- Corridor 6: Westlake - Ballard - Northgate
- Corridor 7: Roosevelt

Existing Daily Boardings at High Ridership Stops
- 100 - 200
- 201 or more
- Inbound
- Outbound

Existing Signals
- SDOT Full Signal
- WSDOT Signal
- Half Signal
- Mid-Block Cross Walk

RapidRide Corridor 7:
Major updates to corridor capital project elements compared to the 2012 Transit Master Plan

- This corridor was labeled HCT Corridor 8 in the 2012 Transit Master Plan
- 2012 Transit Master Plan recommended Rapid Streetcar for this corridor.
- For the segments of the corridor between the University District and South Lake Union, recommendations for right-of-way reallocation to transit lanes are similar to the 2012 TMP despite the change in recommended mode.
- The 2015 TMP recommends consideration of BAT lane treatments on Eastlake Avenue and Fairview Avenue south of the University Bridge. The 2012 TMP recommended streetcar operations shared with traffic.
- SDOT is completing a Concept Design study for this corridor in 2017 which will provide more refined recommendations for transit facility design and roadway cross sections.



Recommended RapidRide corridor improvements are conceptual in nature and will require future public outreach, technical analysis, and detailed design work.

RapidRide Corridor 7

Northgate - Roosevelt - University District - South Lake Union - Downtown

Metric	Score	Details
Ridership *(Weekday riders [2035] and Net New Riders)*	**16,000** **(9,200 net new riders)**	**Ridership potential in 2035 is based on service improvements and projected land use changes:** Weekday riders (2035) estimated from Spring 2015 stop/route-level boardings assigned to each corridor. Net new weekday riders equal 2030 estimate of potential ridership minus current (2015) ridership estimate for the corridor.
Productivity	**53 riders/hour**	**Efficiency with which provided transit capacity is utilized. Productivity equals weekday ridership divided by weekday revenue hours:** A "revenue hour" includes time when a transit vehicle is available to carry passengers. It includes layover time, but excludes “deadhead” time such as when a bus travels to the start of a route. Weekday hours of revenue service calculated through development of corridor-specific operating plan.
RapidRide Initial Investment Level	**\$28.0-\$34.0M** **(\$3.2-\$3.9M per mile)**	**Expected level of initial investment required to provide transit speed, reliability, passenger comfort, and access improvements in the corridor.** Based on initial planning level assessment conducted as part of the 2015 TMP update. Future analysis will identify the most cost-effective capital project elements and levels of investment appropriate to different right-of-way configurations and land use environments along the corridor. Higher level of investment may be possible based on potential additional local, regional, state and federal funding identified during detailed corridor planning and design process. Vehicle costs not included.
Cost/Rider	**\$4.17**	**Value of investment over time, including cost of operation and annualized cost of capital investment, fleet replacement, and maintenance:** Annualized operating and capital cost per rider equals annual operating cost plus annualized capital costs divided by annual boarding rides. Operating cost adjusted for inflation by 2.4% annually. Infrastructure life held constant. Assumed vehicle life is 15 years for electric trolley bus and 12 years for diesel hybrid bus.
O&M Cost	**\$20.8M**	**Annual total cost to deliver service on the proposed line.** Annual operating cost based on the number of hours of revenue service, calculated through development of corridor-specific operating plan, multiplied by the 2015 operating cost for RapidRide. The 2015 operating costs are based on King County Metro operating cost factors and assumptions from the Madison Corridor BRT Study.
Operating Cost/ New Ride	**\$4.00**	**Operating cost to deliver a new boarding ride considering potential cost savings:** Calculated as planned weekday operating cost minus weekday operating cost savings, divided by the number of net new boarding rides projected for 2035. Analysis of cost savings is conceptual.
Travel Time Savings	**23%**	**In-vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations:** Projected 2035 corridor travel time with current road design - estimated travel times under each mode, alignment, and design.
GhG Savings	**1,957 MT CO2e**	**Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions:** Emissions savings from reduced VMT based on an assumed rate of displaced light duty vehicle trips per new transit rider, average trip length by corridor, average fuel economy, and resulting fuel savings. Emissions savings from net change in transit emissions equals planned service minus existing service (based on conceptual operating plans). Emissions factors applied based on known emission assumptions for electric trolley bus and diesel hybrid bus.

Note: All costs are in 2015 dollars.

IMPLEMENTATION STRATEGIES

- **Strategy RR 7.1:** Evaluate tradeoffs between Fairview and Westlake alignments through Center City and South Lake Union, considering needs for overhead trolley wire and capacity constraints on Westlake Transit lanes created by use of Seattle Streetcar and one existing (RapidRide C Line Extension) and RapidRide Corridors 2 and 6 (current Route 40 and Route 120).
- **Strategy RR 7.2:** Examine feasibility of converting center-running shared streetcar/general purpose lanes on Fairview Avenue to transit-only lanes to allow for shared RapidRide/streetcar operations between Valley Street and Yale Avenue N.
- **Strategy RR 7.3:** Collaborate with King County Metro and Sound Transit to create high-quality connections between the RapidRide route and U-District Link Station on Brooklyn Avenue.
- **Strategy RR 7.4:** Consider phasing of transit priority treatments on a segment-by-segment approach based on right-of-way characteristics, traffic patterns, and ridership demand.
- **Strategy RR 7.5:** Consider routing and operating plan alternatives that connect the U-District to Mt. Baker via downtown.
- **Strategy RR 7.6:** Evaluate sidewalk width in station areas along 5th Avenue NE for potential right-of-way needs for ADA-compliant station design.
- **Strategy RR 7.7:** Engage King County Metro to evaluate a Route 70 extension to Northgate Transit Center for Route 7.

MULTIMODAL PROJECT COORDINATION

- **Strategy MMC 7.1:** Coordinate design of transit priority treatments with ongoing Bicycle Master Plan facility planning on Roosevelt Way between NE 40th Street and NE 65th Street.
- **Strategy MMC 7.2:** Coordinate with Roosevelt Neighborhood Streetscape Concept Plan to leverage complete streets improvements on Roosevelt Way.
- **Strategy MMC 7.3:** Coordinate with University District Urban Design Framework to ensure that transit priority element design is compatible with plan recommended design concepts for several key streets and updated design guidelines.
- **Strategy MMC 7.4:** Coordinate design of priority bus treatments on 1st Avenue NE with protected bicycle lane proposed between NE 92nd Street to Northgate Way.
- **Strategy MMC 7.5:** Provide clear wayfinding to direct people walking and biking to RapidRide stations.
- **Strategy MMC 7.6:** Identify overlap and coordinate with Pedestrian Master Plan improvement projects along each corridor that have shared design elements with RapidRide such as enhanced intersection crossings, curb bulbs, and improved sidewalks.

Fully featured RapidRide stations include shelters, benches, tech pylons with real time information, off-board payment validation, system maps, and branded signage.
Image from King County Metro

SEATTLE RAPIDRIDE IMPROVEMENTS

Between 2010 and 2014 King County Metro Transit rolled out six arterial BRT routes under the RapidRide brand. RapidRide is designed to provide a service backbone in heavily traveled transit corridors, creating transfer opportunities to conventional fixed-route Metro service, paratransit service, Link light rail, Sounder commuter rail, state and local ferries, and ST Express regional bus routes.

Three of the six RapidRide lines operate solely within the City of Seattle:

- **RapidRide C Line:** West Seattle to Downtown Seattle via West Seattle freeway.
  - Fully branded service started in September 2012.
  - Roadway elements include BAT lanes and bus bulbs.
- **RapidRide D Line:** Ballard to Uptown to Downtown Seattle along 15th Avenue NW.
  - Fully branded service started in September 2012.
  - Roadway elements include BAT lanes and bus bulbs.
- **RapidRide E Line:** Shoreline to Downtown Seattle via Aurora Avenue N.
  - Fully branded service started February 2014.
  - Roadway elements include BAT lanes and queue jump lanes.

Throughout the RapidRide system Metro has targeted ½ mile stop spacing to improve operating speeds and balance access needs by providing a faster, more reliable service.

Passenger facility improvements vary along the lines with three levels of station/stop improvements. These range from fully featured stations for locations with 150 or more daily boardings to basic stop improvements that include RapidRide signage, schedule, and basic furniture for low volume locations.

The RapidRide fleet consistent of New Flyer diesel electric hybrid vehicles with three boarding doors, low-floor design, three bike front loading racks, and branded livery.

RapidRide uses a "proof of payment" fare collection system, with random on-board fare inspection. There are 131 off-board ORCA readers; 122 on pylons or poles, and nine on downtown Seattle kiosks.

RapidRide lines C, D, and E use sixty foot articulated coaches with hybrid diesel-electric power.
Image from King County Metro

Improvement to Existing RapidRide Lines

The City of Seattle has supported Metro's RapidRide by making speed and reliability investments in the C, D, and E Line corridors. In 2015, SDOT invested local operating funds raised through Prop 1 (STBD) in additional frequency on busy RapidRide corridors.

As SDOT works with King County Metro Transit to implement new RapidRide lines in Seattle, shorter-term investments in existing corridors are needed and can provide significant benefits to the 35,000 daily passengers traveling in the three corridors.

High priority improvements to existing Seattle RapidRide lines include:

RapidRide C Line Enhancements

RapidRide C Line service from West Seattle to downtown has been among the biggest successes for the program when measured by ridership increases. Between 2012 and 2014 ridership increased 75% to over 8,000 weekday riders. West Seattle is also growing rapidly with numerous residential and mixed-use projects recently completed, underway, or in the pipeline along the RapidRide corridor.

SDOT has evaluated opportunities to improve speed, reliability, and passenger amenities along this route. Key potential improvements include:

- Extend off-board fare payment to 24/7 along the entire corridor
- Install delineators to separate bus lanes from general purpose travel lanes
- Add additional LED "Do not enter" signs to keep traffic out of bus lanes
- Extend bus lane hours to include reverse peaks
- Install transit signal priority at additional intersections, where feasible
- Install additional tech pylons to provide real time customer information

RapidRide Express for C Line during Peak Periods

RapidRide service provides faster travel times than a typical local bus route due to wider station spacing and other speed and reliability improvements. For passengers traveling from major boarding areas to downtown, service speeds could still be higher. Since the C Line has few very high boarding locations, it is a good candidate for express service. This proposal would develop a RapidRide brand express service that serves only the Fauntleroy Ferry Terminal, Morgan Junction, and Alaska Junction before running express to one downtown stop and serving South Lake Union along Westlake Avenue.

In concept, such a service could include:

- 10 Peak Direction Trips
- 960 new seats (plus 250 comfortable standing positions) per peak
- Six new RapidRide coaches (requires coordination with KCM)

RapidRide tech pylons provide real time information, system maps, and off-board ticket validation.
Image from Oran Viriyincy

All-Door/Off-Board Fare Payment

RapidRide has provided a test-bed for all-door boarding and off-board fare payment on bus services in Seattle. The combination of these two features can be very beneficial in reducing bus travel times and improving reliability. San Francisco's Muni implemented these features on bus services city-wide in 2012. A study completed two years post implementation showed the following results in San Francisco:

- 1.5 second (38%) reduction in dwell time per passenger boarding
- 2% average speed reduction on all bus routes
- Improved fare compliance

While not specific to RapidRide, SDOT is interested in implementing all-door boarding and off-board fare payment on its busiest corridors and eventually city-wide. A first phase of implementation could include the 3rd Avenue Transit Spine and the busy Pike/Pine Corridor. These improvements would require the addition of off-board ORCA readers and ticket vending machines to 15 unequipped stops on 3rd Avenue and on Pike Street (depending on ORCA reader availability).

All door boarding on Muni's 1BX Express line in San Francisco reduces dwell time at stops.
Image from SFMTA

ACCESSIBLE MT. BAKER

The Accessible Mt. Baker project introduces an integrated multimodal approach to implementing safety improvements and developing a long-term plan to improve transit access in the Mt. Baker Station area. The guiding principles of the Plan are to:

- **Improve access** to neighborhood destinations consistent with the neighborhood plan
- **Create a network** of streets, paths, and open space
- **Respect the existing** character and assets
- **Establish a neighborhood and regional destination**
- **Prioritize modes** in the station area:
  1. **Pedestrian and Bicycle:** Safety and comfort
  2. **Transit:** Reliable and frequent
  3. **Freight:** Access and reliability
  4. **Auto:** Calm and predictable
- **Ensure diverse voices** and traditionally underrepresented communities are heard and considered

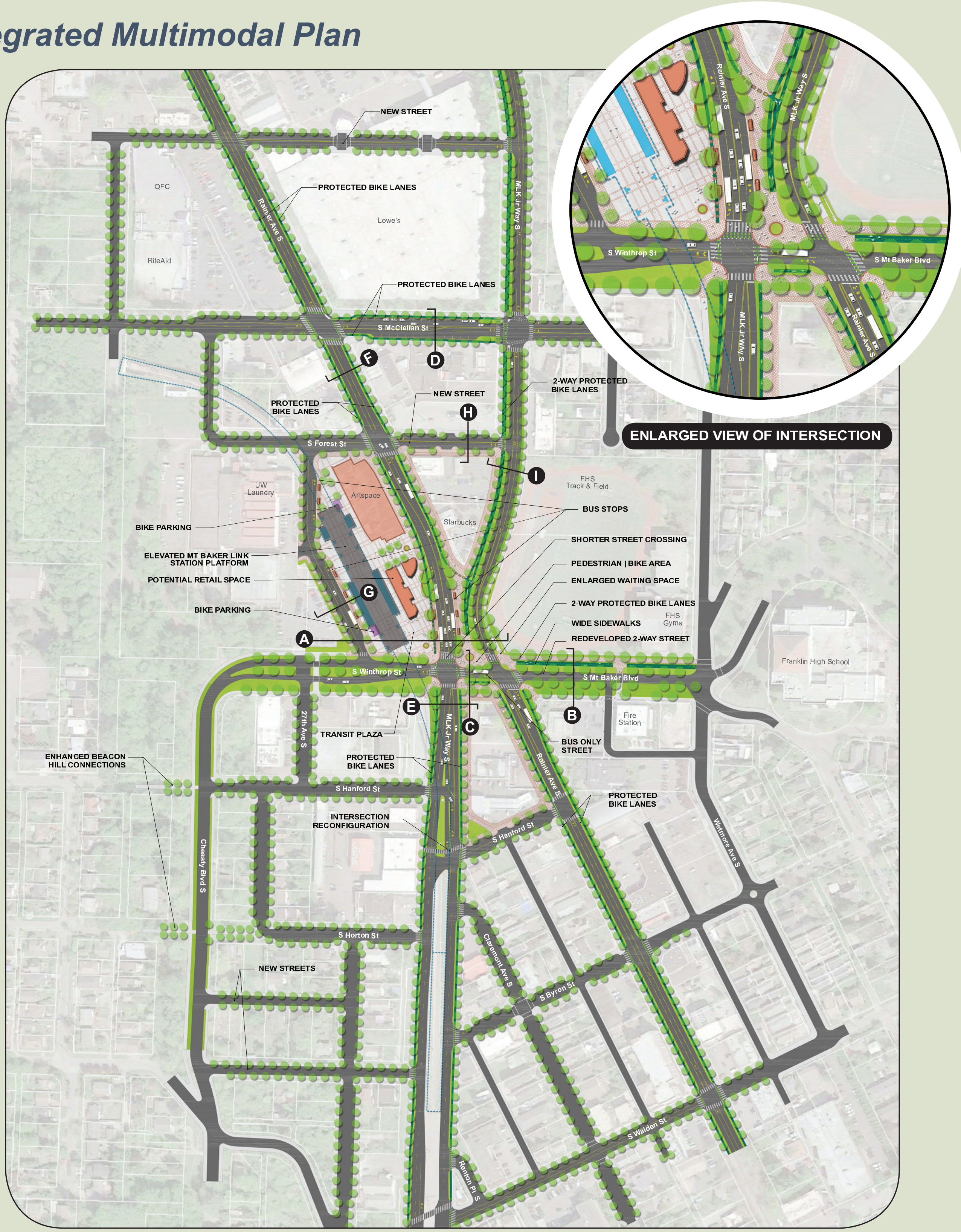
The Plan is realized by creating a new street network where the north segment of Rainier Avenue is aligned with the south segment of MLK Jr Way into a new north/south arterial and the north segment of MLK Jr Way is aligned with the south segment of Rainier Avenue. The existing five lane streets are narrowed to provide space for sidewalks, bike and transit facilities. This realignment provides for:

- Direct, spacious pedestrian crossings of Rainier/MLK
- Shorter crosswalks with more separation from cars
- ADA compliant sidewalks
- A new on-street bus transit center adjacent to the rail station
- A transit-only bypass through the reconnected Olmstead greenway
- A new bus loop using 27th Avenue around the west side of the rail station
- Public realm improvements (lighting & open space)
- A comprehensive protected bicycle network that compliments the Rainier N/S neighborhood greenway
- Intersection and signal improvements to improve traffic reliability
- Balancing peak traffic demands for freight and autos on the two new arterials

The new transit facilities at the Mt. Baker Station will serve the existing local bus lines, as well as RapidRide Corridor 3 and 4 (Rainier/Jackson and 23rd Avenue).

Accessible Mt. Baker

Integrated Multimodal Plan



The Accessible Mt. Baker Plan proposes changes to the street network to improve safety and mobility for all users. RapidRide corridor recommendations proposed in the TMP are consistent with the Accessible Mt. Baker Plan.

Image from SDOT

Investments in priority bus corridors provide faster travel speeds, a more comfortable wait, and easier connections to other transit lines.

Image from Nelson\Nygaard

PRIORITY BUS CORRIDORS

Priority bus corridors are corridors where existing transit ridership is high and planned growth will continue to drive transit ridership demand. These corridors merit speed and reliability improvements, but were not prioritized for RapidRide level investment either because: (1) ridership and levels of planned growth do not merit that level of investment, (2) right-of-way characteristics are not conducive to RapidRide investments, or (3) the corridors operate largely in the Center City where trip lengths are relatively short and right-of-way dedication is already in place or planned (i.e. 3rd Avenue and Pine Street).

Value of Investments in Speed and Reliability

Priority bus corridors are a cornerstone of Seattle's transit system. Investing in speed and reliability improvements and dramatically improved passenger amenities and facilities in these corridors yields not only direct benefits for passengers and transit operators, but complements HCT investments. Benefits include:

- **Travel time savings for riders:** Implementing corridor improvements that mitigate the impact of congestion on buses and make them more reliable leads to transit that is more competitive with the automobile and provides a heightened passenger experience on- and off-vehicle.
- **Reduced impacts of delay on transit operating and capital costs:** Travel time savings can improve transit's bottom line if the time savings avoid the need to add runs and purchase additional vehicles to keep up with delay caused by increased traffic congestion.
- **Improved access to local and regional HCT:** The bus network facilitates access to high capacity service in Seattle and connections to regional destinations. Bus corridor improvements are also investments in future potential HCT corridors.

Service Investments in Priority Bus Corridors

The Frequent Transit Network (see Chapter 4) describes the service characteristics to support capital investments in Priority Bus Corridors. Developing a Frequent Transit Network aligned with capital investments in Priority Bus Corridors will maximize the impact of the capital investments in the corridors. Key service attributes of the FTN include:

- **Convenience:** Frequent transit service, operating every 15 minutes or better, 18-24 hours per day, allows passengers to take a bus without consulting a schedule and enables choices to increase transit use and/or reduce dependence on a car.
- **Branding:** Marketing the frequent transit network as a distinct service offering ensures that passengers connect high service quality with all service elements, including routes, vehicles, stops, and printed and electronic transit information.
- **Legibility/Usability:** A branded FTN provides a high-quality core route system with wider coverage than rail and other high-capacity service.

Chapter 4 describes the service attributes of the FTN in more detail and also provides information about branding.

The TMP Briefing Book, pages 5-27 to 5-29, provides additional discussion and examples of branding elements, including frequent service networks in other cities.

INVESTMENT PHASING PRINCIPLES

Given limited resources for transit investments for the City and its partners, transit improvements will need to be implemented in phases. Principles for making investment phasing decisions include:

- **Leverage Current Projects:** Consider the ability for a corridor project to complement and/or enhance projects currently underway or planned by the City's partners, e.g., Link and RapidRide corridors.
- **Ridership Demand:** Invest where need is greatest. The corridor evaluation process provides detailed modeling of potential ridership and related benefits.
- **Anticipated Growth:** Invest in transit where the greatest growth is planned, allowing developers to make design and construction decisions based on the knowledge that the neighborhood will have high-quality, permanent transit infrastructure.
- **User Benefits:** Investments that lead to significant travel time benefits will attract the most new riders.
- **Grant Opportunities:** Include partnership and grant funding opportunities as important inputs when developing project implementation schedules.

These priorities are implicit in the TMP recommendations and should serve as guidelines as the TMP is used to make decisions about project priority.

BUS IMPACTS ON PAVEMENT


Image from SDOT

The weight and repetitious patterns of transit vehicles can cause significant wear on asphalt and Portland cement pavement. This is particularly true where bus routes are consistently heavily loaded (exceeding 150% of loaded capacity) and/or on streets that have thin pavement layers. A study* conducted by the University of Washington and the City of Seattle determined that a fully loaded Metro Breda bus (now retired dual-mode buses used in the Downtown Seattle Transit Tunnel) exceeded legal axle loads and would exert four times as much damage on pavement as a similar bus that met legal axle loads. However, these impacts accounted for less than a quarter of pavement damage on a given street. SDOT should consider the following to minimize impacts of transit on street pavement conditions:

- Coordinate with transit providers to ensure that bus acquisition standards meet legal axle loads and/or minimize pavement impacts
- Work with Metro to provide frequent service that better distributes passenger loads across buses in high demand corridors, thereby reducing pavement impacts
- Develop thick and durable pavement designs for FTN and high volume bus corridors
- Use Portland Cement Concrete (PCC) paving materials (or other highly durable materials) on transit streets or at high volume transit stops/stations
- On asphalt streets, install PCC pads at bus pullouts or curb stops that have high bus volumes

* Chinn, Esther and De Bolt, Peter. Washington State Transportation Commission, Heavy Vehicles vs. Urban Pavements, 1993.

PRIORITY BUS CORRIDORS

Figure 3-9 lists the priority bus corridors along with planned RapidRide service. The corridors are illustrated in Figure 3-10.

FIGURE 3-9 PRIORITY BUS CORRIDOR SUMMARY

Corridor	Description	Corridor Serves
PB1	Othello – U-District via Beacon Avenue and Broadway	University District Capitol Hill Central District Beacon Hill Rainier Beach
PB2	Lower Queen Anne– South Lake Union – Capitol Hill via Denny	Queen Anne Belltown South Lake Union Capitol Hill
PB3	Lake City – Northgate – U District	Lake City Northgate Roosevelt University District
PB4	Crown Hill – Greenlake – U District	Crown Hill/North Beach Greenlake University District
PB5	Phinney Ridge – Greenwood – Broadview	Broadview, Bitter Lake, and Greenwood Phinney Ridge and Fremont Queen Anne and Westlake South Lake Union Downtown
PB6	Pike/Pine	Center City
PB7	Jefferson/Yesler	Madrona, Central District Center City
PB8	Seattle Pacific University - Queen Anne - Seattle Center East/West	Queen Anne Center City

IMPLEMENTATION STRATEGIES

STRATEGY AREA: IMPLEMENTING PRIORITY BUS CORRIDOR IMPROVEMENTS

- **Strategy PBC 1:** Develop a coordinated approach to corridor development that integrates other modal plans (see more detailed recommendation in Mobility Corridors section of Chapter 5).
- **Strategy PBC 2:** Set targets to design and implement two to three corridors every two years starting in 2015.
- **Strategy PBC 3:** Target Corridor 6, Corridor 7, and Center City Priority Corridors as high priority corridors for development (see Figure 3-14).
- **Strategy PBC 4:** Focus next investments on high demand corridors that do not require major system restructuring (Corridors 2, 13, 14, 15).
- **Strategy PBC 5:** Share responsibility with Metro to continue to refine plans to reduce inefficiencies and reinvest operating funds to: 1) meet FTN service targets; 2) develop restructuring plans around North Link, RapidRide, and other higher capacity services; 3) refine TMP system design proposals; and 4) simplify downtown operations.
- **Strategy PBC 6:** Coordinate development of Priority Bus Corridor improvements with the Seattle Freight Master Plan and priority freight corridors.
- **Strategy PBC 7:** Coordinate development of Priority Bus Corridor improvements with the Seattle Bicycle Master Plan, including long-term network development and five year investment priorities.

FIGURE 3-10 PRIORITY BUS CORRIDORS

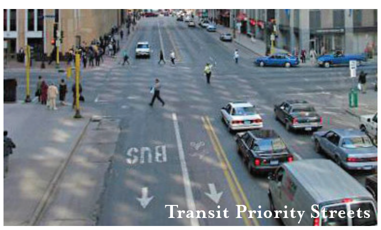
BUILDING TRANSIT CORRIDORS - A TOOLBOX

This section provides an overview of a toolbox of corridor treatments and interventions that was developed to guide capital improvements in RapidRide and priority bus corridors. The toolbox was used in a planning-level assessment of improvement options for each of the priority bus corridors. Estimated travel time improvements were incorporated into revised ridership estimates.


Transit Signal Priority


Queue Jump Lanes

BAT Lanes


Transit Priority Streets


Bus-Bike Treatments

All images from Nelson\Nygaard

Treatment	Definition	Constraints	Effectiveness[1]
Roadway Treatments			
Transit Signal Priority (TSP)	At traffic signals, buses communicate with the traffic signal system to provide a green signal indication to an approaching bus. Delay for buses may be reduced at intersections as a result.	Less effective when signals are operating at capacity.	Up to 10% reduction in signal delay.
Queue Jump Lanes	At signalized intersections, a bus is provided with a lane, adjacent to general-purpose traffic, and an advanced green signal indication to bypass congested areas. Buses "jump" the queue of waiting cars.	Lane must be as long as the typical queues. TSP makes these much more effective, particularly if there is no far-side receiving lane. May increase pedestrian crossing times.	5-25% reduction in travel times at a signal.
Dedicated Bus Lanes (Business Access and Transit or BAT Lanes)	A lane is reserved for exclusive use by buses. It may also be used for general-purpose traffic right-turn movements onto cross streets and for access to adjacent properties. This treatment would speed bus travel times.	Conflicts with right-turn and delivery vehicles. Strong opposition from businesses that may lose on-street parking.	5-25% reduction in travel times.
Dedicated Bus Median Lanes	A median lane is reserved for exclusive use by buses. This treatment speeds bus travel times.	Conflicts with left-turn vehicles. Signalization challenges.	5-25% reduction in travel times.
Contra-flow lanes	A contra-flow bus lane is a dedicated lane of an otherwise one way street reversed for buses and other mass transit. It is typically used to get around bottle-necks or access limited access facilities.	Loss of roadway capacity. Pedestrian safety considerations. Signalization challenges.	Varies based on access needs.
Transit Priority Streets	A street that is dedicated to transit or is designed primarily as a transit corridor. Leading examples include 3rd Avenue in Seattle, the Portland (OR) Transit Mall, and Nicollet Mall or Marquette/2nd in Minneapolis.	Loss of roadway capacity. Limited number of streets in geographically constrained areas.	Highly effective strategy for moving high volumes of buses in urban centers. Effectiveness peaks at 80-100 buses per hour per lane.
Limited or Time Prohibited General Purpose (GP) Turning Movements	GP turning movements are restricted at all times or during peak periods. May be implemented with queue jump or dedicated bus curb lanes.	Impacts on other roadways from diversion of GP traffic/turning movements.	Highly effective means to implement peak period queue jump lanes or transit only lanes.
Innovative Bus-Bike Treatments	Treatments to provide bicycles with safe routes along high-volume transit corridors, manage bicycle-transit vehicle interactions, and allow bicycles to share transit lanes. Examples include shared lane markings, colored pavement, and bicycle-only signals.	Highly contextual and must be considered within balance of person travel delay/benefit for specific street or corridor conditions.	Difficult to measure impacts on transit, but can reduce transit delay on busy bicycle corridors and improve bicycling experience.
Trolley Bus-Specific Treatments			
Electrification	Convert a diesel bus corridor to electric trolley buses by adding wire in missing segments.	Most cost-effective where overhead wire already exists on part of a route.	Effective in increasing use of zero-emissions electric fleet.
Enhanced Trolley Wire Switching	Allows an electric trolley bus to turn onto an alternative stretch of wire.	N/A	Effective in increasing use of zero-emissions electric fleet.
Trolley Passing Wire	Allows an electric trolley bus to pass coaches at terminals or stops.	N/A	Effective in increasing use of zero-emissions electric fleet.


Bus Bulb


Boarding Island

Off Board Fare Payment

Treatment	Definition	Constraints	Effectiveness[1]
Stop Treatments			
Curb Extensions/ Bus Bulbs/Boarding Platforms	Sidewalks are extended into the street so that buses would stop in the lane of traffic. This prevents buses from getting trapped by passing vehicles, unable to return to the flow of traffic. The delays from merging back into lane may be minimized as a result.	Only applicable where an on-street parking lane exists. Impacts to traffic flow must be taken into accounted.	Depends on traffic. Eight seconds per stop is the assumed.[2]
Boarding Islands	A transit access point constructed in a lane that allows buses to use the faster moving left-lane of a roadway. It also removes side friction caused by right-turning vehicles, parking maneuvers, and delivery vehicles.	Pedestrian safety and ADA access requirements. Effects on overall traffic due to taking an additional lane.	Varies based on access needs. At 5th & Jackson, it saves approximately one minute per run.
Level Boarding Platforms	A boarding platform that is level with the bus to enable easier and faster boarding, particularly for passengers with mobility impairments, using wheelchairs, or bringing a stroller on-board the bus.	Most applicable to RapidRide and rail systems where vehicle and platform design is standardized.	Varies depending on number of wheelchair and assisted boardings. Can provide significant time benefit.
Defined Platform Loading Locations	Defining the locations where doors will open allows passengers to wait in nearest proximity to their bus and can reduce dwell times.	May be most effective in a proof-of-payment system where passengers may board through any door.	Saves less than one second per boarding passenger.
Defined Bus Loading Positions	Defining the platform loading locations at a stop can reduce dwell times by allowing passengers to more quickly find/walk to their bus and ensure that a bus is correctly positioned to be able to depart before a bus in front of it.	Most effective with "platooned" bus arrivals (e.g., buses timed to leave a common origin point at the same time).	Effectiveness decreases as the number of loading locations at a stop increases.
Bus Stop Consolidation	Reducing the number of stops on a route, particularly where spacing is less than a stop every three blocks, can result in travel time savings.	ADA and elderly/disabled access. Grades must be accounted for in this.	2-20% of overall run time (4% in recent Line 28 consolidation), up to 75% of dwell time.
Off-Board Fare Payment	Fare payment typically delays the loading and unloading of buses, as only one door may be used. Off-board fare payment may speed boarding and allow use of all doors.	Capital and O&M expense of off-board payment machines. Passenger safety at night.	Saves one second per boarding passenger.
Vehicle Treatments			
Low-Floor, Wide-Door Vehicles	Low-floor vehicles (including in conjunction with level boarding platforms) allow passengers to board more quickly without climbing steps, particularly for passengers with mobility challenges. Wheelchair lifts on low-floor vehicles operate more quickly and with fewer mechanical problems. Wide-door vehicles allow large volumes of passengers boarding at a stop to enter and exit vehicles more efficiently.	Wide-door vehicles are most effective if implemented in conjunction with prepaid fare payment.	Varies depending on number of wheelchair and assisted boardings.
On-Vehicle Perimeter Seating	On heavily loaded routes, increases standing capacity, makes more efficient use of seating capacity, and allows passengers to exit the vehicle more quickly, reducing dwell times.	More appropriate for shorter-distance routes.	Varies with passenger loads.

Transit Toolbox Notes and Sources

1 The measures of effectiveness are derived from data found in the Transit Capacity Quality of Service Manual, unless a specific local measure is cited

2 King County Metro, Stop Spacing Program Description, 7/7/2011

BUS CORRIDOR PROJECT SUMMARY SHEETS

Potential improvements and recommendations are conceptual in nature. Implementation of priority bus corridors would require more detailed evaluation/analysis of current conditions, coordination between SDOT and partner agencies, and community involvement.

Corridor PB1: Othello – U-District via Beacon Ave, 12th Ave, and Broadway

Corridor Overview – Length 10.4 miles

- North-South transit corridor extending from the U-District to Rainier Beach, serving Capitol Hill, the Central District, and Beacon Hill with good connections to Link light rail

Key Connections

- University Link station
- Capitol Hill Link station
- Jackson Street: connections to RapidRide Corridor 3 (Jackson/Rainier) and other bus routes
- Beacon Hill Link station
- Othello Link station

Neighborhoods Served

- University District
- Capitol Hill
- Central District (West)
- Downtown (East)
- Beacon Hill
- Rainier Beach

Primary Routes and Potential Restructuring

- KCM Routes 36 and 49

Proposed Transit Improvements*

- TSP (requires fiber installation)
- Electrification on 12th Avenue
- Bus Bulbs
- Station Upgrades

Multimodal Projects

- SDOT is making safety and multimodal improvements on 12th Avenue at the Howell Street and Olive Street intersections; these projects include pedestrian bulb-outs on all corners necking down the right of way
- Further evaluation of bus operations on 12th Avenue vs. Broadway are needed

Implementation Considerations

- Evaluate turnaround and layover options at north and south ends of the corridor
- Creation of new transit street on 12th Avenue including electrification, TSP, and bus bulbs
- Electrification needed on NE 11th/Roosevelt N. of Campus Parkway
- Work with Sound Transit to ensure safe, attractive, and convenient connections at the 4 Link stations served by this corridor

Corridor Performance Evaluation

Ridership Potential

- Up to 11,100 weekday riders/3,900 net new riders

Productivity

- Up to 60 riders per hour

Capital Cost Estimate

- $20M ($1.9M/mile)

Travel Time Savings

- 15% over local bus

Net GHG Reduction

- 820 MT CO2e

**In addition to planned corridor improvements*

Corridor PB2: LowerQueen Anne – South Lake Union – Capitol Hill via Denny

Corridor Overview – Length 5.0 miles

- East-West transit corridor through Capitol Hill and South Lake Union extending north into Queen Anne

Key Connections

- D Line Connections to Interbay and Ballard
- North-south transfer opportunities along Denny Way
- Capitol Hill Link station and PB1 Corridor
- RapidRide Corridors 1 and 4 (23rd/Rainier and Madison, respectively) at 23rd Avenue

Neighborhoods Served

- Queen Anne
- Belltown
- South Lake Union
- Capitol Hill

Primary Routes and Potential Restructuring

- KCM Routes 8, 43, RapidRide D

Proposed Transit Improvements*

- TSP (requires fiber installation)
- Electrification
- Multimodal Projects
- Pedestrian enhancements are needed along and across Denny Way
- The Denny Way Streetscape Concept Plan provides guidance for pedestrian realm improvements along this busy corridor

Implementation Considerations

- Design solutions to limit impact of I-5 ramps are needed
- Conduct corridor study to analyze transit priority options for Denny Way
- Investigate electrification options on Denny Way and Elliott/15th Avenue
- As primary east-west route, ensure seamless connections to north/south RapidRide routes and Capitol Hill Link Station

Corridor Performance Evaluation

Ridership Potential

- Up to 14,700 weekday riders/4,200 net new riders

Productivity

- Up to 80 riders per hour

Capital Cost Estimate

- $40M ($7.7M/mile)

Travel Time Savings

- 22% over local bus

Net GHG Reduction

- 1,710 MT CO_2e

**In addition to planned corridor improvements*

Corridor PB3: Lake City – Northgate – U District

Corridor Overview – Length 7.7 miles

- North-south transit corridor from U District to Lake City, serving Roosevelt and Northgate (future) Link Stations via Northgate Way and 5th Avenue; additional routing options north of Seattle City limits

Key Connections

- Northgate Transit Center (future Link station)
- Roosevelt Link Station (future) and Priority Bus Corridor 4 at NE 65th Street
- University District (Link and bus)
- RapidRide Corridor 7 along 11th/Roosevelt

Neighborhoods Served

- Lake City
- Northgate
- Roosevelt
- University District

Primary Routes and Potential Restructuring

- KCM Routes 41, 66X (future 63), 67

Proposed Transit Improvements*

- TSP (fiber is only installed along Lake City Way)
- Bus bulbs
- Stop consolidation

Multimodal Projects

- Lake City Way is identified as a Seattle Vision Zero corridor and will be a target for future pedestrian safety investments
- The Lake City Way Traffic Safety Project is a WSDOT and City of Seattle partnership planning and designing corridor safety improvements for all modes; early projects are at the intersections of 24th Avenue NE, NE 110th Street, and NE 145th Street

Implementation Considerations

- Conduct further analysis of alignment options at Northgate Transit Center
- Conduct further analysis of alignment options along Lake City Way/80th Street/Roosevelt Way
- Identify funding to complete improvements outside of Seattle city limits
- Create high quality connections between the route and U-District Link Station on Brooklyn Avenue
- Evaluate sidewalk width in station areas along 5th Avenue NE for potential right-of-way needs for ADA-compliant station design
- Integrate route design/transit priority treatments with ongoing Bicycle Master Plan facility planning on Roosevelt Way between NE 40th Street and NE 65th Street

Corridor Performance Evaluation

Ridership Potential

- Up to 4,600 weekday riders/1,300 net new riders

Productivity

- Up to 40 riders per hour

Capital Cost Estimate

- $5M ($0.7M/mile)

Travel Time Savings

- 20% over local bus

Net GHG Reduction

- 200 MT CO_2e

In addition to planned corridor improvements

Corridor PB4: Crown Hill – Greenlake – U District

Corridor Overview – Length 6.6 miles

- This corridor corresponds to the northern portion of KCM Route 48, providing both east-west and north-south connectivity through northwest and northeast Seattle

Key Connections

- RapidRide D
- RapidRide E
- Priority Bus Corridor 5 (Greenwood)
- University District (Link and bus)

Neighborhoods Served

- Crown Hill / North Beach
- Greenwood
- Green Lake
- University District

Primary Routes and Potential Restructuring

- KCM Routes 48 (Northern Portion); served by route 45 following March 2016 service changes

Proposed Transit Improvements*

- TSP (fiber is not installed)
- Bub Bulbs
- Electrification

Multimodal Projects

- NE Ravenna Boulevard/Cowen Place NE between E Green Lake Way N and NE 62nd Street will be rechannelized as a protected bike lane

Implementation Considerations

- Evaluate electrification cost/benefit north of 50th Street
- Evaluate turnaround and layover options at east and west ends of the corridor
- Conduct traffic analysis east of I-5 to determine key congested intersections and priority bus treatment options
- Conduct study of routing options through Greenlake east of Aurora Avenue
- Coordinate with existing planned improvements south of 50th Street

Corridor Performance Evaluation

Ridership Potential

- Up to 7,400 weekday riders/1,100 net new riders

Productivity

- Up to 60 riders per hour

Capital Cost Estimate

- $57M ($8.6M/mile)

Travel Time Savings

- 19% over local bus

Net GHG Reduction

- 1,150 MT CO2e

In addition to planned corridor improvements

Corridor PB5: Phinney Ridge – Greenwood – Broadview

Corridor Overview – Length 9.1 miles

- North-South transit corridor connecting northwest Seattle to Eastlake, South Lake Union and downtown via Aurora, Fremont, Phinney, and Greenwood Avenues

Key Connections

- Shoreline Community College and/or Aurora Village TC
- RapidRide Corridor 6 at 105th Street
- Priority Bus Corridor 4 at 85th Street
- RapidRide Corridor 5 at 45th Street
- Westlake Hub

Neighborhoods Served

- Broadview, Bitter Lake, and Greenwood
- Phinney Ridge and Fremont
- Queen Anne and Westlake
- South Lake Union
- Downtown

Primary Routes and Potential Restructuring

- KCM Route 5

Proposed Transit Improvements*

- Bus Bulbs or In-Lane Island Stops
- TSP (fiber installation required)
- Stop Consolidation
- Station Upgrades

Multimodal Projects

- The Greenwood Avenue Transit and Pedestrian project will improve sidewalk and crossing conditions between 90th and 105th Streets; the project will also include stop consolidation and new in-lane bus islands

Implementation Considerations

- Investigate multiple termination options on north end
- Identify funding to complete improvements outside of Seattle city limits
- Consider queue jump options to provide transit priority on Fremont Bridge
- Coordinate design of transit priority treatments with ongoing Bicycle Master Plan facility planning on Phinney Avenue N

Corridor Performance Evaluation

Ridership Potential

- Up to 9,600 weekday riders/1,100 net new riders

Productivity

- Up to 60 riders per hour

Capital Cost Estimate

- $9.3M ($1.0M/mile)

Travel Time Savings

- 18% over local bus

Net GHG Reduction

- 420 MT CO_2e

In addition to planned corridor improvements

Corridor PB6: Pike/Pine (Center City)

Corridor Overview – Length 2.4 miles

- Primary east-west pedestrian and transit corridor linking downtown Seattle and the Westlake Transit Hub with Capitol Hill (as identified in City of Seattle Center City Access Strategy and Metro Transit Strategic Plan and Transit Blueprint)

Key Connections

- Westlake and Convention Place DSTT Stations
- Third Avenue Transit Spine
- First Hill Streetcar

Primary Routes and Potential Restructuring

- Key KCM Routes 10, 11, 14, 43, 49 (many others use segments of this corridor)
- Some of these routes turn between Pike/Pine and Third Avenue; these routes should be revised to operate common routings the length of Pike/Pine as far west as First Avenue

Completed Improvements

- Pike/Pine Transit Access Improvement Project (2009) included updated signal equipment with greater potential for transit signal priority, in-lane bus stops, and coordinated pedestrian improvements (bus stops have been consolidated and re-spaced for better service and operations)

Proposed Transit Improvements*

- Pine Street BAT Lane between 3rd Avenue and 9th Avenue

Multimodal Projects

- The Pike/Pine Renaissance Plan provides streetscape design considerations for the western end of this corridor
- SDOT is conducting a multimodal study for this corridor that will evaluate options for improving safety and mobility for all modes

Implementation Considerations

- Consider as early pilot corridor for off-board fare payment
- Continue to implement access and transit priority treatments to avoid transit delay at congested intersections or corridor segments
- Improve bus stop facilities with real-time schedule information, off-board fare payment equipment, and other amenities

Corridor Performance Evaluation

Ridership Potential

- Up to 7,000 weekday riders/1,100 net new riders

Productivity

- Up to 63 riders per hour

Capital Cost Estimate

- $13.6 ($5.7M/mile)

Travel Time Savings

- 14% over current bus operations

Net GHG Reduction

- 69 MT CO_2e

**In addition to planned corridor improvements*

Corridor PB7: Jefferson/Yesler (Center City)

Corridor Overview – Length 2.9 miles

- East-west bus corridor that provides important direct service to Downtown and First Hill from Harborview Medical Center, Yesler Terrace, and dense residential neighborhoods

Key Connections

- Pioneer Square DSST Station
- Third Avenue Transit Spine
- First Hill Streetcar

Primary Routes and Potential Restructuring

- KCM Routes 3 and 4
- Reroute service from James Street to Yesler Way west of 9th Avenue (reflected in map)
- Consider extending downtown portion of routes to new Central Waterfront Transit Station (shared with Madison BRT), providing connections to Colman Dock

Planned/Completed Improvements*

- Some bus stops have been consolidated and passenger facilities upgraded
- The City of Seattle is investing heavily in improved midday service in the corridor

Multimodal Investments

- 3rd Avenue Transit Corridor Improvements will enhance the pedestrian environment at the intersection of this corridor with the 3rd Avenue Transit Spine
- Pioneer Square Active Streets Strategy recommends a number of improvements for enhancing pedestrian safety, security and vibrancy of street life on the western end of this corridor; some strategies have been implemented

Implementation Considerations

- Electrification of Yesler Way (2nd to 9th) and 9th (Yesler to Jefferson) to reduce turning movements off of Third Avenue and to avoid freeway-related congestion on James Street
- Enhance pedestrian access, particularly around medical center and at key intersections
- Provide in-lane bus stops
- Provide transit signal priority with new interconnected traffic controllers and vehicle detection where needed
- Add transit-only lanes or peak period parking restrictions in congested segments of the corridor, particularly where I-5 ramps create peak period traffic congestion
- Improve bus stop facilities with real-time schedule information, off-board fare payment equipment, and other amenities

Corridor Performance Evaluation

Ridership Potential

- Up to 6,400 weekday riders/1,300 net new riders

Productivity

- Up to 54 riders per hour

Capital Cost Estimate

- $16.3 ($5.7M/mile)

Travel Time Savings

- 14% over current bus operations

Net GHG Reduction

- 94 MT CO2e

**In addition to planned corridor improvements*

Corridor PB8: Seattle Pacific University - Queen Anne - Seattle Center East/West

Corridor Overview – Length 4.9 miles

- Most direct bus corridor serving the main Seattle Center entrance on 5th Avenue N and dense, high ridership markets in Belltown, Denny Triangle, Uptown, and Queen Anne. Includes both Queen Anne avenue and 5th Avenue, Taylor pathways between Seattle Center/Uptown and Seattle Pacific University.

Key Connections

- Third Avenue Transit Spine
- Westlake DSTT station
- RapidRide D Line
- Corridor PB2: Queen Anne – South Lake Union – Capitol Hill via Denny

Primary Routes and Potential Restructuring

- KCM Routes 2, 3, 4, 13, and 16
- These routes should be consolidated to follow a single pathway to the south end of Downtown and serve the same downtown bus stops

Planned/Completed Improvements*

- Third Avenue Transit Spine has been designated transit-only during peak hours
- Some bus stops have been consolidated and passenger facilities upgraded
- City of Seattle investments help provide better weekday and evening frequency on Routes 3 and 4

Multimodal Improvements

- Mercer pedestrian and bicycle improvements implemented as part of the Mercer Corridor project enhance access to transit by foot and bicycle in this corridor
- 5th Avenue protected bike lane and pedestrian improvements along the corridor will improve pedestrian and bicycle access

Implementation Considerations

- Extend 3rd Avenue transit-only restrictions north to Denny Way
- Extend hours of 3rd Avenue transit-only restrictions
- Engage in comprehensive effort to improve the Third Avenue streetscape and pedestrian/bus rider experience
- Maintain a smooth 3rd Avenue street surface for a higher-quality bus experience
- Continue to implement access and transit priority treatments to avoid transit delay at congested intersections or segments
- Improve bus stop facilities with real-time schedule information, off-board fare payment equipment, and other amenities

Corridor Performance Evaluation

Ridership Potential

- Up to 10,900 weekday riders/2,900 net new riders

Productivity

- Up to 68 riders per hour

Capital Cost Estimate

- $28.0 ($5.7M/mile)

Travel Time Savings

- 14% over current bus operations

Net GHG Reduction

- 350 MT CO2e

*In addition to planned corridor improvements

Priority Bus Corridor Metrics and Methodology Notes

The following metrics were evaluated for each of the priority bus corridors.

- 2030 Weekday Ridership: Estimated from Fall 2009 stop/route-level boardings assigned to each corridor.
- Net New Riders:
  - 2030 estimate of potential ridership - current (2009) ridership estimate for the corridor
- Productivity: Efficiency with which provided transit capacity is utilized.
  - Productivity = weekday ridership / weekday revenue hours
  - Weekday hours of revenue service calculated through development of corridor specific operating plan
- Capital Costs: Cost to implement transit priority improvements, based on typical costs, including allowances for engineering and contingency costs. Does not include vehicle costs.
  - Capital Cost per Mile = total capital costs / corridor miles
- Travel Time Improvement: Estimated end-to-end time savings per identified capital or other efficiency improvement (including both potential and currently planned and funded improvements). Unit travel times savings was based on local SDOT or King County Metro experience. If local estimates were not available, industry-standard estimates were applied.
- Greenhouse Gas Reduction: Annual reduction in GhG equivalents from reduced VMT and net change in transit emissions (see HCT results for methodology details).

The conceptual operating plans developed to calculate these metrics assumed the following minimum headways over a service span of 5 a.m. to 1 a.m. (20 hours), which approximately correspond to RapidRide service levels. The operating plans were limited to the corridor as evaluated in the TMP and to service within Seattle.

Period	Weekday	Weekend
Peak	10	15
Off-Peak	15	15
Late Evening	30	30

Additional detail on methodology is provided in Appendix B.

CENTER CITY TRANSIT IMPROVEMENTS

CENTER CITY CONDITIONS AND CHALLENGES

When SDOT developed the Center City Circulation Report in 2003, the Center City area was growing despite a recession. The city was faced with challenges of accommodating many more jobs and residents with the existing and constrained set of transportation facilities. More than a decade later, much of the growth predicted has occurred, but transit service in key growth areas has been limited. As an example, South Lake Union has experienced tremendous growth, but few improvements in regional transit connectivity. The Denny Triangle, Downtown Commercial Core, South Downtown, and South Lake Union are experiencing unprecedented growth and are targeted for continued high levels of employment growth. Significant residential growth is occurring and expected to continue in Belltown, Denny Triangle, First Hill, and South Lake Union. Further, with rapid increases in housing prices in Seattle, more workers are commuting from beyond city boundaries.

Fast, frequent, and reliable transit is the linchpin to managing Center City growth and a rising demand for regional access to the Center City. Investments needed to manage these growth pressures are framed by some key realities:

- **Land Development:** The Center City is expected to take on roughly 50% of the city's total population and job growth over the next 20 years. This is both a challenge and an opportunity for transit development, since the level of growth demands a shift away from auto-oriented mobility. This simple reality is driven by geographic constraint.
- **Geography:** Seattle's center resembles an hourglass where both people and goods funnel through heavily-trafficked north-south corridors into a narrow downtown

core bounded by Puget Sound, Lake Washington, and I-5. Buses, trucks, ferry passengers, automobiles, bicyclists, and pedestrians must cross and enter the Center City at limited bridge and ferry terminal access points. Steep hills limit transit mode and vehicle options in the east-west direction.

- **Right-of-way constraints:** Approximately 700 local and regional buses travel in the north-south direction through downtown during a single commute peak hour. Bus operations in the Downtown Seattle Transit Tunnel will be increasingly constrained and terminated by 2020 as tunnel capacity is given over to rail operations. Dedicating surface right-of-way to transit requires balancing the needs of all modes, including motor vehicles, freight, and bicycles.
- **Transit service quality:** Buses are overloaded on a number of transit corridors despite frequent peak service. Travel times on cross-town bus routes and connections from inner-city neighborhoods are among those most impacted by congestion. The improving economy and new service investments by the Seattle Transportation Benefit District (Prop 1) have also led to increased service levels on many bus routes connecting Center City neighborhoods and the rest of the city.
- **Electric trolley bus network efficiency:** The existing infrastructure investment in a quiet, low-emission transit mode is a significant asset; however, expanding the system will require adding wire and restructuring service (including changes to route interlining).
- **Wayfinding:** The Center City transit network consists of a wide variety of transit modes, providers, and facilities. Rail modes include Link and the Seattle Streetcar. Diesel and trolley buses are operated by Metro, Sound Transit, and service providers from surrounding counties. Light rail, streetcar, and bus modes are vertically separated between surface streets and the Downtown Seattle Transit Tunnel. Transit legibility is challenging and must be addressed at a system level to optimize service investments in the Center City.

CENTER CITY KEY CAPITAL IMPROVEMENTS

Sound Transit is planning for its next major phase of regional high capacity transit system development. The ST3 Plan will go to regional voters in 2016 and, if approved, will fund major light rail extension projects in Seattle and around the region. Among the City's top priorities for ST investments are the Ballard to Downtown and West Seattle to Downtown light rail lines, which would serve Uptown/Lower Queen Anne, South Lake Union, Denny Triangle, and tie into all major Downtown Seattle Transit Tunnel stations with underground pedestrian tunnels. The new tunnel would also provide capacity for West Seattle light rail and possibly interim RapidRide service from South and West Seattle neighborhoods. A number of other important surface transit investments are needed to address more immediate transit demands. These include:

1. **Seattle Streetcar:** The Center City Connector project will link the South Lake Union and First Hill streetcar lines, creating a true Center City circulation network that has potential to carry 30,000 daily riders by 2035. This project plans to provide dedicated lanes for 85% of the alignment, elevating streetcar from a slow moving mode to a serious urban circulation tool.
2. **Westlake Transit Lane Improvements:** Reliability of the South Lake Union Streetcar has declined steadily as South Lake Union development has boomed. The streetcar shares Westlake Avenue with KCM Route 40 and soon RapidRide C Line service will also use this corridor. This project will provide transit lanes between Stewart and Valley. Customers along this corridor will have a bus or train arriving every three minutes during most of the day. Importantly, streetcar services will be far more reliable with limited exposure to traffic delays.
3. **Madison Bus Rapid Transit:** Madison BRT will be the first high capacity transit service to provide east-west service in downtown. Curb lanes are planned for Madison Street and Spring Street connecting to median running transit lanes east of 9th Avenue. The future RapidRide line will share a platform with Seattle Streetcar at its 1st Avenue terminus.
4. **3rd Avenue Transit Spine Enhancements:** 3rd Avenue is the most heavily used transit facility in the State of Washington. It is challenging to balance transit throughput with the demands of a downtown street. This project will implement improvements to the pedestrian realm, passenger waiting areas and information, and other key enhancements that will make 3rd Avenue a better place walk, catch the bus, and to do business.
5. **Electric Trolley Infrastructure:** With a virtually emissions free electric utility, electric powered transit in Seattle is the best solution for reducing carbon emissions. The City supports continuing to electrify high-frequency bus corridors. Key electrification projects included in the TMP are Denny Way between Uptown and Olive Way. The new wire between 1st and 3rd Avenues would also have the benefit of allowing more efficient routing of trolley routes from Queen Anne to downtown via the 3rd Avenue Transit Spine. It is also a city priority to add wire on Yesler between 2nd Avenue and 9th Avenue E, and on 9th Avenue from Yesler to Jefferson to reduce turning movements off of 3rd Avenue and improve connections to Harborview Medical Center.

FIGURE 3-11 CENTER CITY TRANSIT CAPITAL IMPROVEMENT PRIORITIES

CENTER CITY AND SOUTH LAKE UNION SERVICE IMPROVEMENTS

TMP recommendations for Center City transit investments are based on analysis and principles that make downtown transit easy to understand and use for both infrequent and regular riders, including:

- Operate routes on the same street in both directions. If this is not possible, operate service in a limited set of linear corridors. Limit turning movements from linear corridors to make transit service more predictable.
- Avoid running couplet service more than one block apart.
- Operate common service types and destinations on the same streets and/or at common stops. For example, regional service on 2nd and 4th Avenues, service to common sectors of the City (e.g., NW Seattle) stop on the same block, etc.
- Develop a strong, high-capacity Center City circulation system that connects all major multimodal hubs (Westlake, Colman Dock, and King Street/International District) to limit the need for regional bus throughput and increase the usability of regional high capacity transit.
- Extend services through downtown to meet service needs to expanding regional job centers, particularly in South Lake Union.
- Create high-frequency, high-quality connections in the east-west direction, connecting the dense urban neighborhoods of Capitol Hill and First Hill to Downtown and key north-south regional transit services.

Figure 3-12 illustrates key surface transit service improvements in the Center City, including:

- New Seattle Streetcar service through Downtown connecting the First Hill and South Lake Union Streetcar lines and providing five-minute headways from South Lake Union to the International District.
- Extensions of existing RapidRide lines including: (1) C Line extension to South Lake Union and (2) D Line extension to South Downtown.
- Enhanced service on Madison as part of the Madison Corridor Bus Rapid Transit project. This line will offer six-minute headways for 12 or more hours daily on Madison and Spring Street (eastbound) through Downtown.
- Extension of two high frequency bus lines that are proposed RapidRide corridors to South Lake Union: (1) RapidRide Corridor 2 (Delridge; current KCM Route 120) via Westlake and (2) RapidRide Corridor 3 (Rainier/Jackson; current segment of KCM Route 7) via Fairview.
- Continued service improvements on identified Center City Priority Bus Corridors (see Figure 3-10: PBC map)
- New service operating east-west between Uptown and South Lake Union on Harrison Street to be implemented once the SR 99 Tunnel is operational and the grid is restored.

FIGURE 3-12 CENTER CITY KEY SERVICE IMPROVEMENTS

CENTER CITY CONNECTOR STREETCAR

Since the 2012 adoption of the Seattle TMP, the City of Seattle has taken significant steps toward implementation of a top plan priority – connecting the South Lake Union and First Hill streetcar lines through downtown. The Center City Connector Streetcar will link Seattle's streetcar investments into a single, connected system.

The 1.2-mile Center City Connector project will provide mobility through the core of downtown, serving major event and visitor destinations, employment centers, a growing residential population, and areas of significant development. The project will provide affordable and convenient transportation access to employment, services, and housing located within Seattle's Center City and last-mile connections from regional transit services. The project also provides a critical linkage to leverage the existing South Lake Union Streetcar (operating since 2007) and First Hill Streetcar (currently in startup), creating a 5-mile system serving the broader Center City. Figure 3-13 shows that the Center City Connector allows Seattle Streetcar to effectively link 10 key Center City neighborhoods. The project is expected to increase streetcar system ridership by 14,400 daily trips and increase system ridership to nearly 22,000 daily trips in the year of opening.

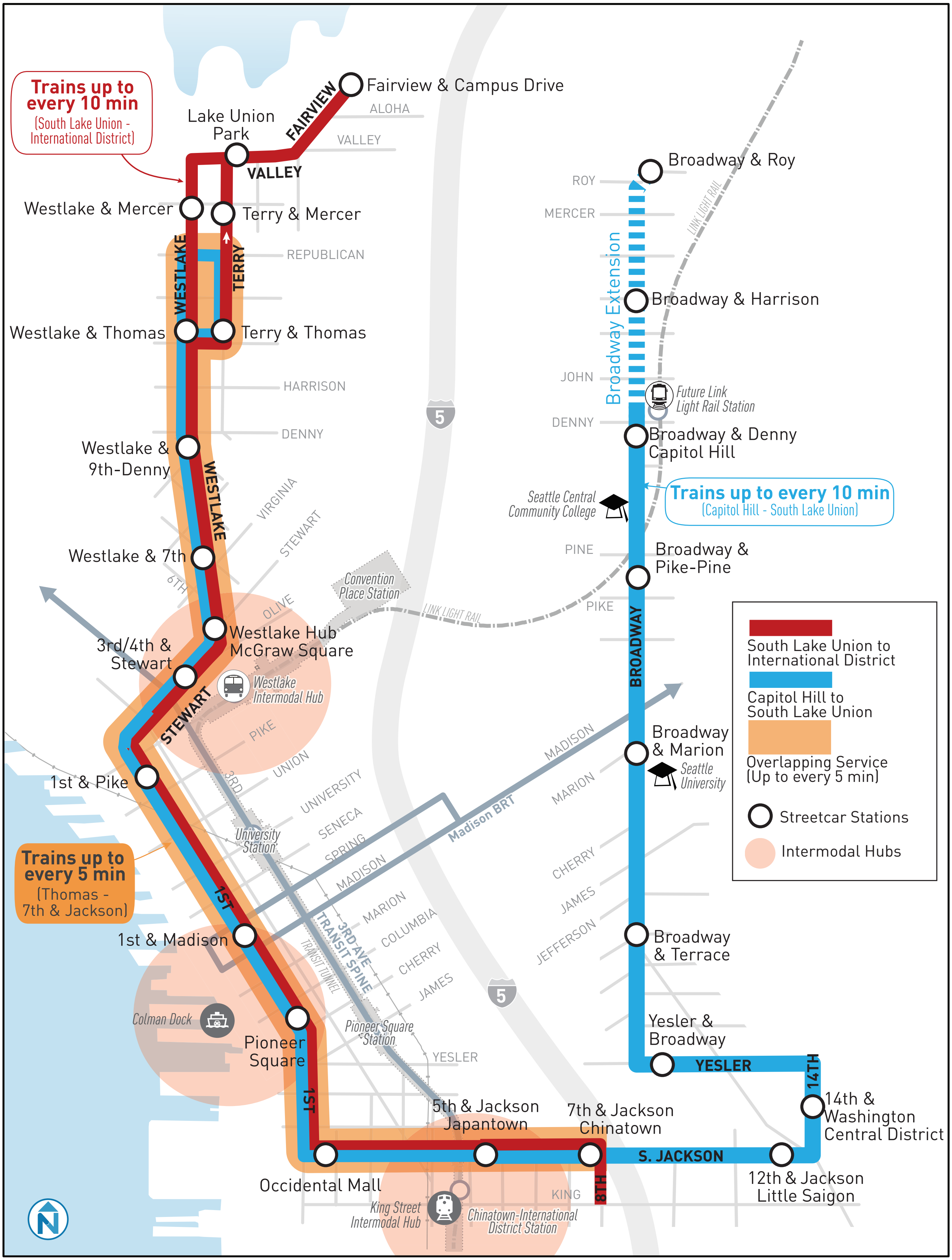
The Center City Connector will run along Stewart Street and 1st Avenue, between the Westlake Intermodal Hub and Jackson Street in the Pioneer Square neighborhood. Over 85% of the new track will operate in an exclusive transit lane, including all of the 1st Avenue alignment. The project includes a new turn-around track in the South Lake Union neighborhood (Republican Street between Westlake Avenue and Terry Avenue), four new streetcar stations, modifications to the Westlake and Occidental Stations, and expansion of the Seattle Streetcar fleet with seven additional vehicles and three replacement vehicles that can operate in off-wire segments.[1] It also includes expansion of the existing streetcar operation and maintenance facilities to accommodate the larger vehicle fleet.

With the Center City Connector, Seattle will be able to operate the City's streetcar lines as a unified system, maximizing the utility of previous transit investments with this short connection. The full streetcar system will provide service from 5:00 a.m. to 1:00 a.m. Monday through Saturday, and 6:00 a.m. to 11:00 p.m. on Sundays and holidays. The Center City Connector, along with a portion of the system between the Thomas Street Station in South Lake Union and the 7th Avenue Station in the International District, will operate with 5-minute headways between 6:00 a.m. and 8:00 p.m. on weekdays, and 8:00 a.m. to 8:00 p.m. on Saturdays and Sundays (with 7.5-minute headways at other times). Figure 3-14 illustrates that with this project in place, Seattle Streetcar will provide 5-minute headway service between South Lake Union and the International District including connections to the City's three Intermodal Hubs.

FIGURE 3-13 SEATTLE STREETCAR SYSTEM WITH CENTER CITY CONNECTOR

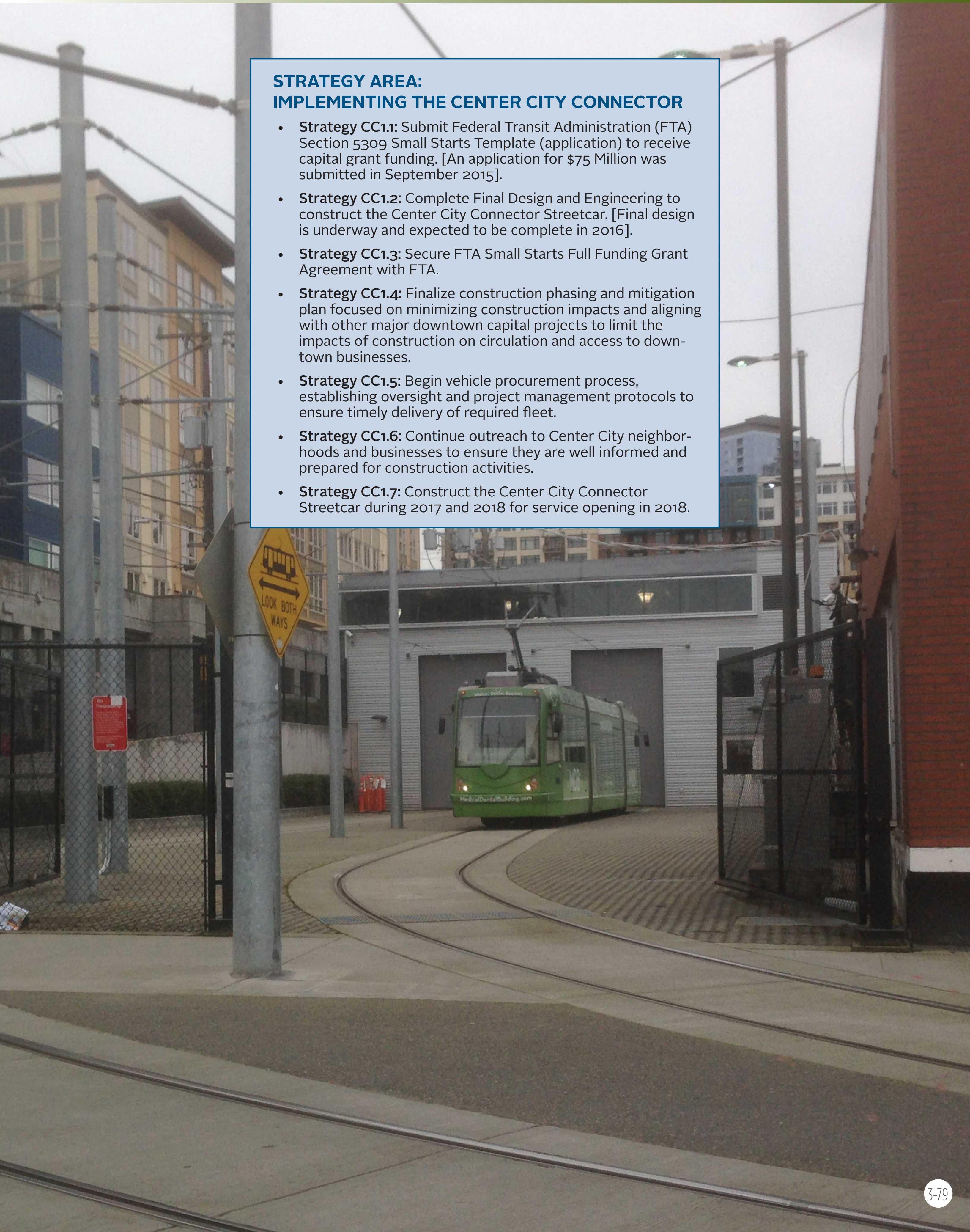
1 Streetcar vehicles serving the First Hill Streetcar and portions of the proposed alignment utilize on-board energy storage systems (OESS) to operate through wireless segments with no external power supply. The elimination of overhead wires in portions of the corridor reduces conflicts with existing wires for trolley buses and minimizes visual and aesthetic impacts.

FIGURE 3-14 STREETCAR SYSTEM OPERATING PLAN



STRATEGY AREA: IMPLEMENTING THE CENTER CITY CONNECTOR

- **Strategy CC1.1:** Submit Federal Transit Administration (FTA) Section 5309 Small Starts Template (application) to receive capital grant funding. [An application for $75 Million was submitted in September 2015].
- **Strategy CC1.2:** Complete Final Design and Engineering to construct the Center City Connector Streetcar. [Final design is underway and expected to be complete in 2016].
- **Strategy CC1.3:** Secure FTA Small Starts Full Funding Grant Agreement with FTA.
- **Strategy CC1.4:** Finalize construction phasing and mitigation plan focused on minimizing construction impacts and aligning with other major downtown capital projects to limit the impacts of construction on circulation and access to downtown businesses.
- **Strategy CC1.5:** Begin vehicle procurement process, establishing oversight and project management protocols to ensure timely delivery of required fleet.
- **Strategy CC1.6:** Continue outreach to Center City neighborhoods and businesses to ensure they are well informed and prepared for construction activities.
- **Strategy CC1.7:** Construct the Center City Connector Streetcar during 2017 and 2018 for service opening in 2018.



THIRD AVENUE TRANSIT SPINE

Third Avenue is downtown Seattle's most heavily used transit corridor. More than 2,500 buses travel the corridor every weekday and about 47,500 people board at bus stops on the corridor each day. Thousands of visitors, workers, shoppers and area residents also use 3rd Avenue daily.

Throughout much of the day, passenger queues to board buses on 3rd Avenue in the vicinity of Pike and Pine Streets are overwhelming to through pedestrians. To maintain a vital business environment and function effectively for transit passengers, the 3rd Avenue Transit Spine requires significant investment. Streetscape studies have been undertaken to revitalize the corridor, but a more complete, transit-focused study is needed. A well-developed coordinated set of improvements would elevate 3rd Avenue as a centerpiece of Seattle's public space, an effective circulation corridor for downtown transit passengers, a hub for city and regional transit customers, and a great place to work, shop, and enjoy the city. SDOT and King County Metro Transit are working in partnership to plan and design improvements to the 3rd Avenue transit spine. The project will lead to investments in transit amenities, improved lighting, enhanced landscaping, and artistic elements that will enrich the user experience along the street.

The following steps would help simplify transit routing through downtown and would facilitate (though not ensure) the shift of bus volumes from the Downtown Transit Tunnel to 3rd Avenue. They would need to be accompanied by strong branding and clear customer information and signage.

- Eliminate turns where feasible (between Stewart and Yesler) to create a linear transit spine. This configuration would allow downtown passengers to board with certainty that buses would not turn off of 3rd Avenue.
- Eliminate conflicts with pedestrians at the city's highest-volume pedestrian intersections.
- Route all north-south running rapid, frequent, and local buses serving Seattle on the Transit Spine to the extent possible; regional services would use 2nd and 4th Avenues as a north-south transit corridor.

STRATEGY AREA: IMPROVING THIRD AVENUE TRANSIT SPINE

- **Strategy CC2.1:** Conduct an integrated streetscape and operations study for the 3rd Avenue Transit Spine (Denny to Jackson). Study outcomes would include a 3rd Avenue Transit Spine that operates more effectively as a linear circulator in downtown, serves key city transit routes, and is reconstructed as a centerpiece of Seattle's downtown pedestrian environment. [SDOT and King County Metro have developed plans for 3rd Avenue Improvements and are in design phases with intent to complete Final Design in 2016].
- **Strategy CC2.2:** Improve transit user experience by providing dynamic transit information, improve waiting areas, provide new shelters and protection from rain and wind, and improve design of pedestrian through zones and transit passenger waiting areas.
- **Strategy CC2.3:** Upgrade pedestrian amenities, improve street lighting, enhance public realm treatments, and add public art features to this important pedestrian and transit corridor.
- **Strategy CC2.4:** Develop funding sources to complete improvements along the entire corridor from Jackson to Denny.
- **Strategy CC2.5:** Further restrict auto traffic on the 3rd Avenue Transit Spine during midday times and north of Stewart as required by increasing bus volumes.
- **Strategy CC2.6:** Implement strategic electric trolley wire projects to improve trolley bus routing and reduce the number of and/or impacts of turning movements on the 3rd Avenue Transit Spine in downtown Seattle.

PLANNING FOR LONG-TERM TRANSIT MOBILITY IN THE CENTER CITY

The City of Seattle and local and regional transit and business partners are planning a major study of downtown mobility, including transit operations and capital. The Center City Mobility Plan will provide direction for optimizing downtown transit operations and identifying capital improvements needed to ensure world class transit mobility in a rapidly growing downtown. Sound Transit and King County Metro Transit are key partners. Leaders from these agencies and SDOT will work with business partners to define a future for a vibrant, sustainable Center City. Undoubtedly, transit investment will be the foundation for success.

This effort will build on current 3rd Avenue Transit Corridor Improvements project outcomes, planning and design for the Center City Connector project, and other public and private planning efforts including the Seattle Comprehensive Plan Update.

STRATEGY AREA: ESTABLISHING LONG-TERM TRANSIT INFRASTRUCTURE IN THE CENTER CITY

- **Strategy CC3.1:** Work with King County Metro Transit and Sound Transit to establish schedule and service plan concepts from moving bus routes from the Downtown Seattle Transit Tunnel to Center City surface streets as required by increased light rail service operating in the DSTT.
- **Strategy CC3.2:** Include new north-to-south transit tunnel as part of Sound Transit 3 funding and capital improvement package. The extent and pathway of the tunnel will require further study, but optimally would provide subway operations for Sound Transit light rail from Ballard between Uptown, the western edge of South Lake Union, and Downtown. The City of Seattle should advocate for options that optimize use of a new tunnel, including evaluation of dual mode operations that could carry RapidRide service from West Seattle (prior to future West Seattle rail service).
- **Strategy CC3.3:** Develop a long-term plan with short-term implementing actions for surface street transit operations in the Center City. The plan should consider projected land use conditions, market needs, and other competing roadway needs. The plan should take a long-view approach, recognizing significant transit infrastructure and changes to bus operations may be needed to provide transit mobility and circulation needed to support Seattle's rapidly growing Center City.
- **Strategy CC3.4:** Work with transit providers to implement off-board fare payment on 3rd Avenue and throughout the Center City.
- **Strategy CC3.5:** Work with Metro and Sound Transit to improve passenger wayfinding and information on all major transit streets in the Center City.
- **Strategy CC3.6:** Upgrade downtown traffic signal systems to increase transit throughput on 3rd Avenue and all key Center City transit streets.
- **Strategy CC3.7:** Study opportunities for extension of the Seattle Streetcar or a RapidRide line, possible the Madison Line, from Downtown to Lower Queen Anne through Belltown via 1st Avenue.

TRANSIT ACCESS TO SOUTH LAKE UNION AND UPTOWN

The South Lake Union and Uptown neighborhoods will undergo a massive transformation in the next decade as the neighborhoods grow to accommodate 12,000 new residents and 24,000 new jobs. Several major infrastructure projects—the Alaskan Way Viaduct Replacement Project, the Mercer East Project, and the Mercer West Project— will change travel patterns in the area and provide a new pathway for transit in the east-west direction along Harrison Street.

Direct high-capacity transit service to these rapidly growing neighborhoods is limited. A Ballard to Downtown Seattle light rail line is a priority of the next major phase of Sound Transit construction, but it could be 10 to 15 years before such a project is operational. Seattle needs to provide more direct service to South Lake Union, provide reliable surface transit facilities to allow streetcars and buses to operate consistently and at competitive speeds, and work with transit agency partners to continually invest in more service.

The planned extension of West Seattle RapidRide (C Line) service to South Lake Union will be implemented in early 2016. The opening of the North Portal will also provide enhanced transit access to South Lake Union and Uptown from the North Aurora corridor. Three of the seven proposed RapidRide lines would pass through or terminate in South Lake Union. These projects are important short- to mid-term improvements, but with the scale of development in these neighborhoods, high-capacity transit improvements are needed and should be forwarded as regional priorities.

STRATEGY AREA: IMPROVING TRANSIT SERVICE TO SOUTH LAKE UNION AND UPTOWN

- **Strategy CC4.1:** Work with Sound Transit and regional partners to make Ballard to Downtown light rail a top priority for Sound Transit 3 investment.
- **Strategy CC4.2:** Develop transit lanes on Westlake between McGraw Square and Valley Street providing transit priority for local bus, RapidRide and Seattle Streetcar services. Transit operations in this corridor have become unreliable due to significant increases in general purpose traffic and pedestrian volumes in the area.
- **Strategy CC4.3:** Extend RapidRide C Line service from West Seattle into South Lake Union, using transit lane improvements on Westlake Avenue.
- **Strategy CC4.4:** Work with Metro, Sound Transit, and Community Transit to reroute regional bus services with high volumes of passengers bound for South Lake Union or north downtown through South Lake Union via Westlake and Fairview.
- **Strategy CC4.5:** Consider extending other transit services from south Seattle and the southern Metro region through downtown to South Lake Union. Proposed RapidRide routes serving the Rainier Corridor, Mt. Baker, and the Delridge corridor are strong candidates.
- **Strategy CC4.6:** Evaluate the viability of a South Lake Union/Uptown off-street transit center that could be constructed as part of an integrated development project and co-located with a future Sound Transit light rail station.
- **Strategy CC4.7:** Evaluate viability of transit lane improvements on Fairview to provide a priority transit pathway for Electric Trolley Bus routes serving the SLU market.
- **Strategy CC4.8:** Establish Harrison Street as an important east to west transit carrying street.
- **Strategy CC4.9:** Develop the future RapidRide Station on Aurora Avenue N (to be renamed 7th Avenue N) between Harrison and Thomas Streets as a hub for transit and improve pedestrian connections and street lighting between these locations and major employment centers.

ACCOMMODATING TRANSIT OPERATIONAL NEEDS IN THE CENTER CITY

Layover

Layover is the uncomely truth about bus operations. No matter the degree to which layover operations are made, more efficient, high-frequency services depend heavily on a ready supply of idle buses/operators to ensure reliable operations. Buses standing still are not all that attractive, nor are they human-scale, but they are a very necessary part of transit operations. The conundrum is how to accommodate bus layover in a way that meets urban design goals without locating them so far away from passenger activity areas that it increases operating costs or decreases reliability.

Layover locations should be at logical anchor points. For the Center City these anchor points will tend to be at the north and south fringes:

- North of downtown, in particular, special care must be given to ensure that the location of layover does not work to isolate South Lake Union from downtown, but instead to help transit integrate the two areas.
- In the south end of downtown, the best layover locations offer greater efficiency and connectivity by serving the King Street/International District multimodal hub rather than stopping just short of it in the northern parts of Pioneer Square.

Off-street layover can often be provided with creative design in mixed-use facilities. Potentially higher costs for developing such facilities are often worth the trade-off in terms of urban design benefits. Given the rate of property development in the Center City, the time is ripe for a careful analysis of such opportunities by SDOT, King County Metro, and Sound Transit.

On-street layover opportunities should be accommodated, but only where appropriate, such as through use of peak hour parking restrictions. The City should coordinate with Metro to identify and support low-impact opportunities for on-street layover. Usually this means no more than two buses at any one location. From an urban design perspective, a string of buses along a curb resembles a giant fence or barrier to the urban form and pedestrian environment and should be avoided.

Signal Systems

In the development of corridors for the Frequent Transit Network (discussed in depth in Chapter 4), extensive focus has been given to the implementation of aggressive transit signal priority. Along a corridor, this strategy is relatively straightforward. In the Center City, a number of factors make the addition of transit signal priority a far more complex undertaking, including:

- The presence of very high pedestrian volumes
- A grid of one way streets
- High peak hour turning volumes to access the freeway system
- The 3rd Avenue Transit Spine
- Regular major special events at the north and south edges of the Center City
- Uncertain traffic re-distribution patterns brought about by access points for SR 99

A signal system designed to offer transit priority in this environment needs to be adaptable to current traffic conditions, including high pedestrian volumes. Adaptive traffic control systems require extensive communication networks, centralized computing and communications resources, and staffing to watch the system. As a result, such a system to serve downtown will have a very high capital cost in the range of $10 million.

To date, adaptive systems have been considered for downtown, but not acted upon based on the relatively high cost and the concern of creating a less friendly pedestrian environment. Even so, the current system operates on a fixed-time basis and it may be possible to optimize signal timing for certain times of the day without increasing pedestrian delay, e.g., in the early hours of the AM peak. The potential benefits that might be derived from applying an adaptive signal system are not fully known, but it merits further consideration as a potential tool to improve transit performance in the margins—if it appears the benefits can outweigh the costs and the potential to increase pedestrian delay.

A string of buses parked along a curb is like a giant fence and acts as a barrier to street fronting building uses.

Image from Nelson\Nygaard

Signal system improvements that move buses more efficiently along the 3rd Avenue Transit Spine would benefit many passengers and could adjust to various traffic patterns at different times of day.

Image from Nelson\Nygaard

STRATEGY AREA: ACCOMMODATING TRANSIT OPERATIONS IN THE CENTER CITY

- **TOCC-1:** The City and Metro should jointly identify areas (not specific sites) where development of off-street layover facilities is needed, keeping in mind the balance between serving areas and operational efficiency.
- **TOCC-2:** The City should aggressively seek joint development opportunities to establish off-street layover.
- **TOCC-3:** The City and Metro should continue to work together to maintain an inventory of appropriate on-street layover locations.
- **TOCC-4:** The City should undertake a detailed study of implementing adaptive signal technology on the downtown signal system, including cost evaluation, benefits to transit, and potential to reduce pedestrian delay.

CONVENTIONAL VS. ADAPTIVE SIGNAL SYSTEMS

Conventional Signal Timing

- **Actuated-Uncoordinated "Free" Signal Timing:** Each intersection in a corridor responds to its own need with no regard to traffic operations at adjacent intersections. The traffic signal controller adjusts the amount of time served to each phase of the intersection based on the number of vehicles detected by detector loops or video detection at that intersection.
- **Coordinated Signal Timing with Time-of-Day Plans:** Signal timing along a corridor or within a network is coordinated between controllers based upon static signal timing plans. These plans are developed based on a sample of the average traffic volumes for particular times and days of the week. The time-of-day plans result in a common cycle length for a group of coordinated signals, offset starting points between adjacent signals, a sequence of phases, and an allocation of cycle time (splits) for each phase at each signal.

Adaptive Signal Timing

- **Adaptive Signal Timing:** Adaptive signal control systems continually refine the timings at every intersection within a corridor or network, cycle-by-cycle, as traffic conditions change. Adaptive systems monitor traffic conditions using vehicle detectors for all approaches, and often for all movements, of the intersections within the corridor. These systems adjust the signal timing based on the real-time traffic flow in the corridor.