

The Seattle Department of Transportation

## Madison Corridor BRT Study

# FINAL REPORT

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# PROJECT OVERVIEW



1

# INTRODUCTION

The Madison Street Bus Rapid Transit Study is a project of the Seattle Department of Transportation (SDOT). The purpose of the Study was to identify a Locally Preferred Alternative (LPA) for BRT service in the Madison corridor between the waterfront and 23rd Avenue or Martin Luther King Jr. Way. Service is proposed to begin in 2019. The Madison corridor was identified as a priority for implementation of high capacity transit in the 2012 Seattle Transit Master Plan (TMP). BRT was selected as the transit mode due to the steep grades in segments of the corridor, which preclude rail service. By improving travel times, reliability, frequency

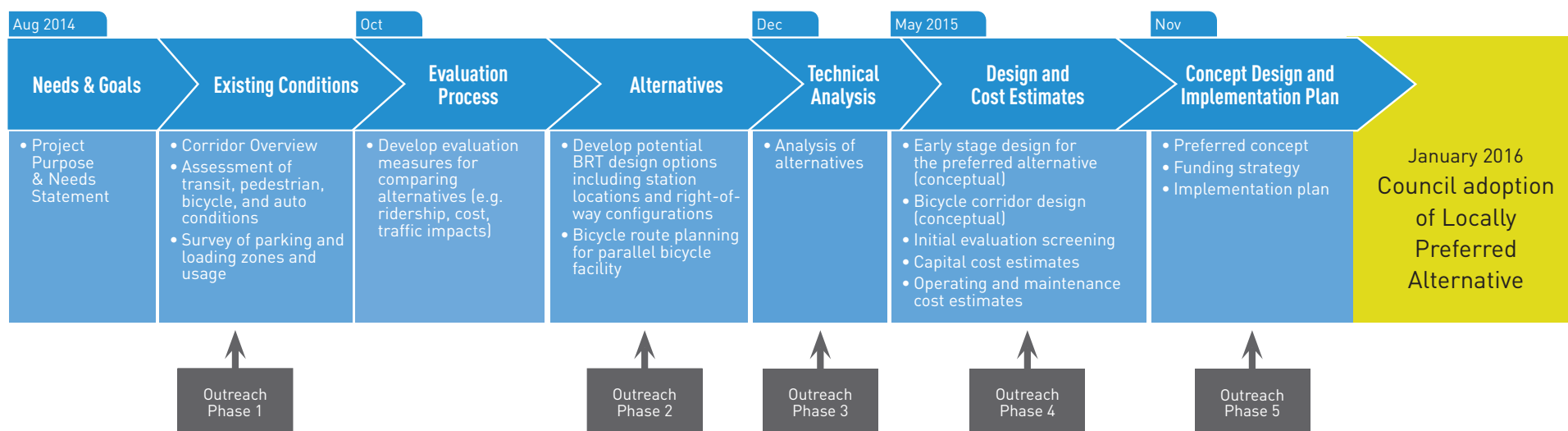
of service, passenger amenities and visibility, BRT is able to emulate many of the features and service characteristics of high-quality rail.

Madison Street cuts across the street grid at an angle, connecting downtown and First Hill and the residential neighborhoods to the east. It is a busy street for all users. The corridor is also rapidly growing, as the City has targeted it for dense, infill development. Transit service in the corridor currently consists primarily of Route 11 to the east (continuing downtown via the Pike/Pine corridor) and Route 12 to the west, from downtown to 19th Avenue.

This Study has developed and evaluated BRT alternatives that include transit facilities and operations, streetscape and pedestrian improvements, and an alternate bike facility. The study process has included ongoing community engagement, particularly at key decision points.

This report describes the LPA and the technical and outreach steps taken to arrive at an LPA recommendation.

FIGURE 1-1. MADISON CORRIDOR BRT STUDY

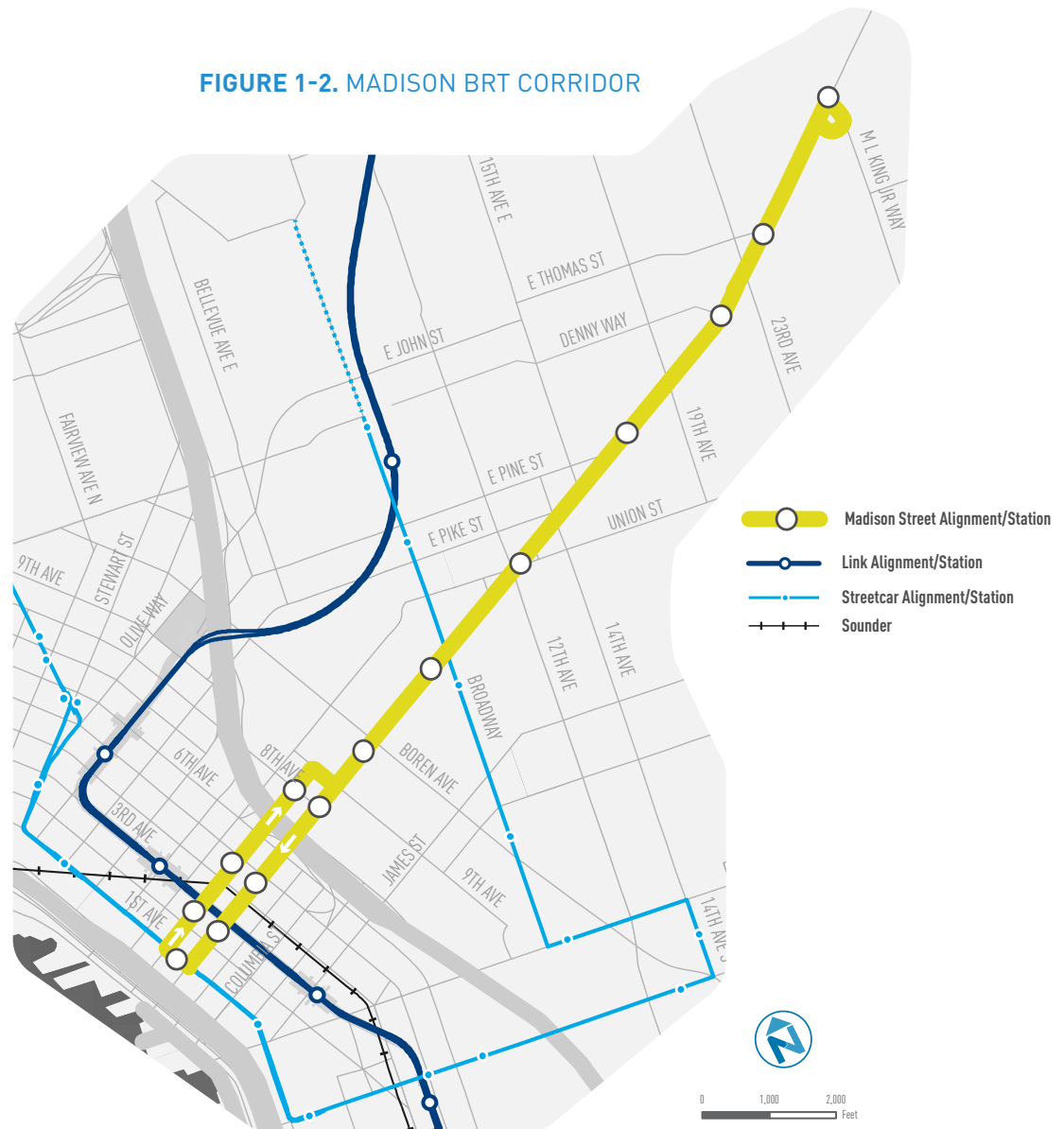


## CORRIDOR DESCRIPTION

As defined for this study, the Madison corridor extends from the waterfront – defined as between Alaskan Way, adjacent to the Colman Dock Washington State Ferries Terminal, and First Avenue – east-by-northeast to 23rd Avenue East or Martin Luther King Jr. Way. The study area includes Madison itself as well as adjacent segments of other streets.

Madison is unique among Seattle streets in two key ways. First, it is the only street in the Downtown/First Hill grid to continue east without changing direction, at an angle diagonal to the grid that exists in the rest of the city from Broadway east to Lake Washington. Second, Madison is the only street to extend from Elliot Bay east to Lake Washington. For both reasons, Madison is a major east-west route, connecting relatively low-density residential and neighborhood-oriented retail areas in the east (Madison Park and Madison Valley) to denser, more mixed-use districts in its central segments (the Central District, Capitol Hill and First Hill) and the office towers of Downtown to the west. Between Broadway, where the grids transition, and 22nd Avenue, where Madison turns due northeast, the street is oriented 32 degrees counterclockwise of east-west, resulting in a series of uniquely configured, complex intersections.

FIGURE 1-2. MADISON BRT CORRIDOR



The street is also characterized by steep grades, primarily in its westernmost segment between the waterfront, Downtown and the summit of First Hill. It is the steep grades in this segment that precluded consideration of a rail alternative as part of this study. Several regional medical centers are located atop First Hill, including Virginia Mason Hospital and Swedish Medical Center along Madison, as well as the campus of Seattle University.

In all, Madison Street runs 3.7 miles. Along the way, it connects to major north-south and east-west streets including Martin Luther King Jr., 23rd Avenue, 15th Avenue, Union Street, 12th Avenue, Broadway, Boren Avenue, and Downtown avenues from Sixth downhill to First. Similarly, transit service operating on Madison is able to connect to a number of routes running both north-south and east-west, including King County Metro Route 2 on Union and Route 48 on 23rd Avenue, or, alternately, to branch off of Madison onto north-south or east-west streets, as both Routes 11 and 12 currently do.

This configuration of streets and transit routes is reflected in the demand for travel within the corridor. Madison is classified by SDOT as a Principal Arterial, its current configuration provides up to four through travel lanes, plus turn lanes, and one-way AM peak-hour traffic volumes reach approximately 1,800 vehicles per hour westbound in the segment crossing

Interstate 5 (I-5). As of 2013-2014, meanwhile average weekday ridership on Route 11 was 3,200, and on Route 12 it was 3,500.

## POLICY FRAMEWORK

High-quality, high-capacity transit service in Seattle's busiest corridors is essential if the City is to maintain a high quality of life for residents, workers and visitors; if it is to remain competitive in the global economy; and if it is to achieve its ambitious goals for ecological sustainability, social equity, and public health.

Seattle has developed a series of transportation planning documents in support of these aims. They informed this project and include the following:

- Seattle Comprehensive Plan
- Seattle Transit Master Plan (2012) and Seattle Transit Plan (2005)
- Move Seattle
- Seattle Jobs Plan
- Climate Action Plan
- Bicycle Master Plan
- Pedestrian Master Plan
- Seattle Race and Social Justice Initiative (RSJI)
- Freight Master Plan (under development)

Further detail on the plans and projects described in this section can be found in the Detailed Evaluation Report.

## PUBLIC INVOLVEMENT

Public and stakeholder input was integral to decision-making at each stage of the alternatives evaluation. Outreach strategies included a series of stakeholder interviews, three public open houses, two rounds of neighborhood-based meetings and charrettes, several walking/biking tours of the corridor, two online surveys, and additional briefings with community leaders and organizations.

### Open House, Design Workshops and Surveys

Open houses and neighborhood meetings and design workshops were held in a range of locations to attract participation from a diverse array of stakeholders. Two web-based surveys soliciting input on project design priorities and options were also posted in January-February and April 2015. Feedback from these public involvement activities informed development of the alternatives. The events are described below.

#### Round 1

The first Madison BRT open house was held on September 30, 2014. The open house included a brief presentation with an overview of the study process and an

orientation to the open house. The event also included a series of stations with information about the study process, BRT, stakeholder input, existing conditions, and draft purpose and need statements. Finally, there was a corridor map where participants could identify and comment on specific locations in the corridor needing attention. Participants were offered multiple ways to comment, including written comment cards, writing on the map of the corridor, and sending a message to the project email account.

## Round 2

On November 19 and 20, 2014, design workshops were held in three key segment of the corridor: Downtown, First Hill, and Capitol Hill/Central District. Following the workshops, an open house was held for members of the public to comment on the outputs of the design workshops, suggest additional alternatives, and provide input on other aspects of project design and development.

In the design workshops, invited participants developed conceptual BRT designs with assistance from project team members. In so doing, they addressed design challenges including potential BRT alignments and station locations, connections to major destinations and other transit lines, right-of-way constraints, pedestrian and bicycle accommodations, and grades.

Participants at the open house, meanwhile, contributed a variety of comments on each corridor segment, as well as on specific topics included on the open house comment card, such as station amenities and the overall project.

## Round 4

From May 4-6, 2015, four meetings were held: invitation-based community meetings in the Downtown, First Hill and Capitol Hill/Central District segments of the corridor, and an open house for the entire corridor.

A second online survey was also made available between May 3 and June 1, 2015.

The primary purpose of the meetings was to share key findings from the technical analysis of project alternatives completed prior to the meetings, and to ask the public for input on major decision points in preparation for identification of a preferred alternative.

Formats were as follows:

- **Segment-based meetings:** A presentation was made, and

**FIGURE 1-3. MAY OPEN HOUSE ATTENDEES**



questions were taken both during and after the presentation.

- **Open house:** A similar presentation was made, but including a formal interactive polling exercise, with participants voting using clickers. Informational boards and “roll-plot” plan-view drawings of project alternatives were also on display, and staff and consultants were available to answer questions. Attendees submitted comments using comment

cards and post-it notes placed on roll-plot drawings.

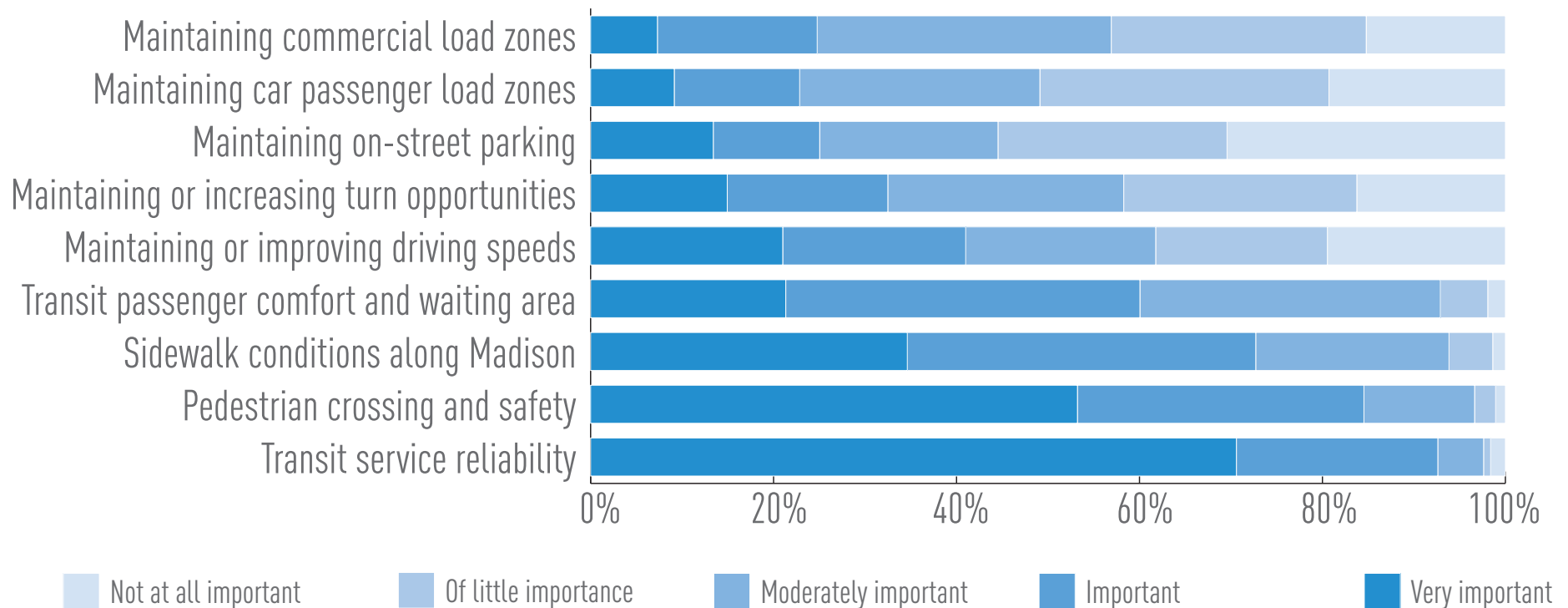
The purpose of the survey was to better understand the community’s preferences for transit service along Madison Street, and what features and characteristics the public would like to see included in the locally preferred alternative for the project now in development. Question topics included BRT features and amenities, major project design decision points including downtown

alignment options, station locations, terminus options, and preferred transit lane configuration, impacts on traffic and preferred bike facility configurations. The survey was completed by 414 respondents.

### Round 5

A fifth and final round of outreach was held in November 2015. This round consisted of a third corridor-wide open house, the purpose of which was to share the proposed LPA with members of the public.

**FIGURE 1-4. JANUARY SURVEY RESIDENT RESPONSES: IMPROVEMENT PRIORITIES**



# LOCALLY PREFERRED ALTERNATIVE



## LPA DECISION PROCESS

The Madison BRT Study is a local planning process that will 1) define the capital project and operations, and 2) position the City to pursue federal funding.

A management decision-making body was utilized within the Seattle Department of Transportation (SDOT) to advance key project decisions within the agency. This Project Steering Committee was comprised of Deputy Directors of SDOT Policy and Planning, Traffic Management, Transit and Mobility, Project Development, Major Projects, and Capital Projects and Roadway Structures divisions. The Steering Committee was responsible for approving key decisions and endorsing the final Locally Preferred Alternative (LPA) recommendation. In addition, key SDOT technical staff provided input and consultation throughout the planning process.

Approval of the LPA by the Mayor and Seattle City Council is required to advance the Project. The Council adopted the LPA in January 2016.

The Madison BRT Study also involved key agency partners including King County Metro Transit and Sound Transit.

## LPA PROJECT DESCRIPTION

The LPA is a key policy document that provides a description of the Madison BRT project. This section describes the roadway and transit capital improvements and operating characteristics of the recommended LPA. The following pages describe key elements of the recommended LPA for Madison BRT.

### Overview

The LPA combines elements of the alternatives studied, as well as new elements developed through the evaluation process. Specifically, it includes:

- A western terminal at 1st Avenue, shared with the Center City Connector
- Eastbound operation on Spring between 1st Avenue and 9th Avenue
- Stations near I-5 at both 5th Avenue and 8th Avenue
- Center-running transit-only lanes from 9th Avenue to 15th Avenue
- An eastern terminal at Martin Luther King, Jr. Way

## Alignment

The LPA corridor includes Madison Street between 1st Avenue and Lake Washington Boulevard as well as Spring Street between 1st Avenue and 9th Avenue and 1st Avenue and 9th Avenue between Madison and Spring. The downtown /First Hill loop would operate clockwise – westbound on Madison, northbound on 1st Avenue, eastbound on Spring and southbound on 9th Avenue.

## Stations

There would be a total of 21 stops, including the western terminal and 10 stops in each direction. From west to east (outbound from downtown), stations would be located at:

- **1st Avenue:** The Center City Connector (CCC) northbound stop between Madison and Spring. The platform would be shared by CCC streetcars and BRT vehicles, allowing for seamless transfers.

Then on both Madison and Spring at:

- **3rd Avenue:** On the far-side of 3rd Avenue in both directions, on the sidewalk. The stop on Spring would be on a bulbout extending from the sidewalk.
- **5th Avenue:** On the near-side of 5th Avenue in both directions. The Madison stop would be on a sidewalk extension, while the

Spring stop would be on an island between the BRT and travel lanes.

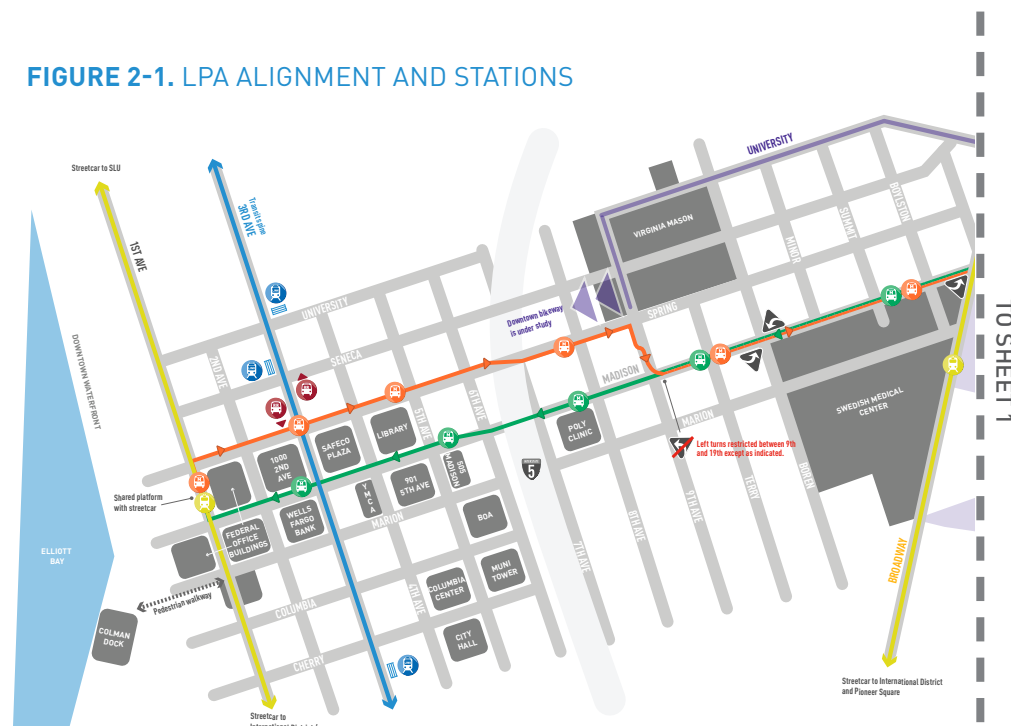
- **8th Avenue:** West of 8th Avenue. The Madison stop would be on an island between the BRT and travel lanes, while the Spring stop would be on a sidewalk extension.

Then on Madison at:

- **Terry:** On the east side of Terry, on a center median island.
- **Summit/Boylston:** Between Summit and Boylston, on a center median island.

- **12th Avenue/13th Avenue/Union:** Between 12th Avenue and 13th Avenue and northeast of Union, on a center median island.
- **17th Avenue:** Far-side in both directions.
- **22nd Avenue:** Far-side in both directions.
- **24th Avenue:** East of 24th Avenue, on sidewalk extensions.

FIGURE 2-1. LPA ALIGNMENT AND STATIONS



- **27th Avenue/Martin Luther King Jr. Way:** Near-side at MLK Jr. Way eastbound and far-side at 27th Avenue westbound.



Other than at 1st Avenue (where the already-planned streetcar stop would be used), there would be two basic types of station, each with a full suite of BRT station amenities including branded custom shelters, off-board fare payment machines, and real-time arrival and other forms of passenger information.

- **Sidewalk stations** would generally be on curb extensions, approximately 60 feet long,
- **Island stations** would be platforms in the center median of the street, generally bidirectional and at least 60 feet long, with longer stops at busier locations on First Hill and at 12th Avenue/Union. Island stops would be a minimum of nine feet wide.

## Transit Priority

Madison BRT will feature exclusive or semi-exclusive Transit Only Lanes (TOL) for much of its length. Exclusive running way for transit is a core component of the Project, providing a high level of operational reliability and a transit travel time that is highly competitive with auto travel.

The extent of the transit lanes was based on the 2012 Master Plan analysis and was updated as part of this study. The lanes will be a combination of fully exclusive center median lanes and side-running Business Access & Transit (BAT) lanes allowing auto

access to turn lanes, curb cuts and curbside parking.

- Center lanes will extend from 9th Avenue to 15th Avenue eastbound and from 15th Avenue to 6th Avenue westbound.
- BAT lanes will extend from 1st Avenue to 6th Avenue downtown.
- BAT lanes will extend from 15th Avenue to 18th Avenue.

In addition to running in exclusive transit lanes, Madison BRT will employ transit signal priority (TSP) treatments at most signalized corridor intersections. Signal priority will be used to hold lights green for approaching BRT vehicles and shorten red times for BRT vehicles stopped at intersections. Separate “queue jump” transit-only phases will be employed where BRT vehicles need to go in advance of auto-traffic, for example where transitioning from exclusive transit lanes to general-purpose lanes.

## Cross-Sections/ Roadway Configurations

Cross-sections will vary depending on right-of-way constraints as well as project design (e.g., center- vs. side-running lane segments).

Lane widths would also vary, but general-purpose lanes would be a minimum of 9 feet, 6 inches wide, while transit lanes would be

a minimum of 10 feet wide at stops, and 10 feet, 6 inches between stops. Both types of lanes would be wider in most places.

Combination through-turn or dedicated turn lanes would be provided where turns are permitted. On Madison between 6th Avenue and 15th Avenue, left turns would be prohibited except where noted in the segment descriptions below.

Sidewalks would generally be unchanged except at sidewalk stations and new corner bulbouts where they would be extended; at three locations (Boren, Broadway and Union) where they would be narrowed slightly to accommodate left-turn lanes; and on the south side of Madison between 12th Avenue and 13th Avenue, where the right-of-way would be reconfigured and a new 12-foot sidewalk constructed.

Intersection improvements for pedestrians and bicyclists are described in the following section, Pedestrian and Bicycle Improvements.

Following are basic cross-sections by segment:

- West of 6th Avenue, where BRT would operate westbound on Madison and eastbound on Spring in BAT lanes, the basic cross-section would consist of the BAT lane on the north side of the street (the right

side westbound on Madison, and the left side eastbound on Spring] accompanied by two general-purpose travel lanes in the same direction. On Madison, existing angled parking would be replaced by parallel parking, while on Spring, there would be a Protected Bicycle Lane or PBL on the south side of the street from 1st to 4th Avenues. BRT vehicles would operate in the northbound transit-only lane on 1st.

- Between 6th Avenue and 9th Avenue, BRT would operate westbound in a center lane on Madison and eastbound in general-purpose lanes on Spring. On Madison, there would be two general-purpose lanes increasing to three between 7th Avenue and 8th Avenue on the approach to I-5, and one eastbound general-purpose lane. On Spring there would be two eastbound general-purpose lanes, parallel parking on both sides, and a bicycle lane on the left side. On 9th Avenue, BRT would operate southbound in a center lane transitioning to a shared left-turn lane.
- Between 9th Avenue and 15th Avenue, the basic cross-section would consist of a center-running transit lane and general-purpose lane in each direction, with dedicated left-turn lanes at Boren, Broadway,

12th Avenue (eastbound only) and 14th Avenue (westbound via Pike). Left turns would be prohibited elsewhere. There would be no parking on Madison. Stations in this segment would be center-island platforms. At Terry, the platform would extend into the intersection, with left turns prohibited. At 12th Avenue/13th Avenue/Union, a number of changes would be made:

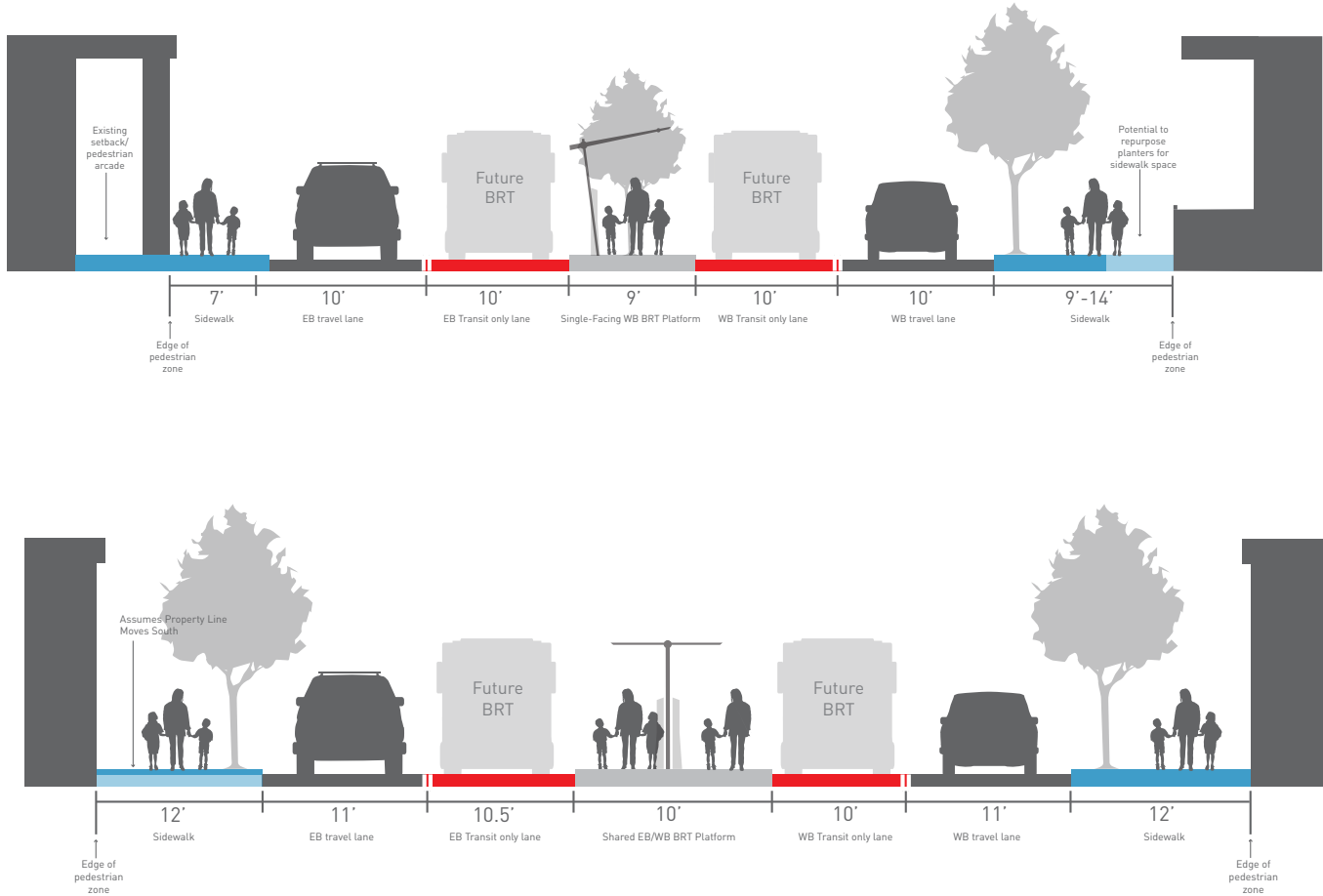
- » The existing triangular parcel on the south side of Madison would be reconfigured, requiring modifications to the property.
- » Union between 12th Avenue and 13th Avenue would be redesigned to accommodate protected bicycle lanes, and westbound traffic would be diverted to 13th Avenue.
- Between 15th Avenue and 17th Avenue, BRT would transition from center to BAT lanes. Westbound, there would be two general-purpose lanes, which BRT vehicles would use to merge from the BAT to center lane. Eastbound, the transit and general-purpose lanes would switch or change places just east of 15th Avenue, with BRT vehicles using a queue jump to go ahead of traffic.
- Between 17th Avenue and 18th Avenue, BRT vehicles would operate

in a BAT lane. At 18th Avenue, they would transition to a general-purpose lane. Parallel parking will be removed from 18th Avenue to 22nd Avenue to create an additional travel lane for BRT vehicles and general-purpose traffic. Left turns will be allowed at 19th Avenue.

- East of Denny/22nd Avenue, BRT would operate in general-purpose lanes. There would be a single general-purpose lane in each direction, plus parallel parking on both sides of the street. There would be an eastbound left-turn lane at 23rd Avenue. BRT vehicles would turn around at Martin Luther King, Jr. Way using the traffic island at MLK Jr. Way, Harrison and Arthur Place, and would layover there and on Madison at MLK Jr. Way.

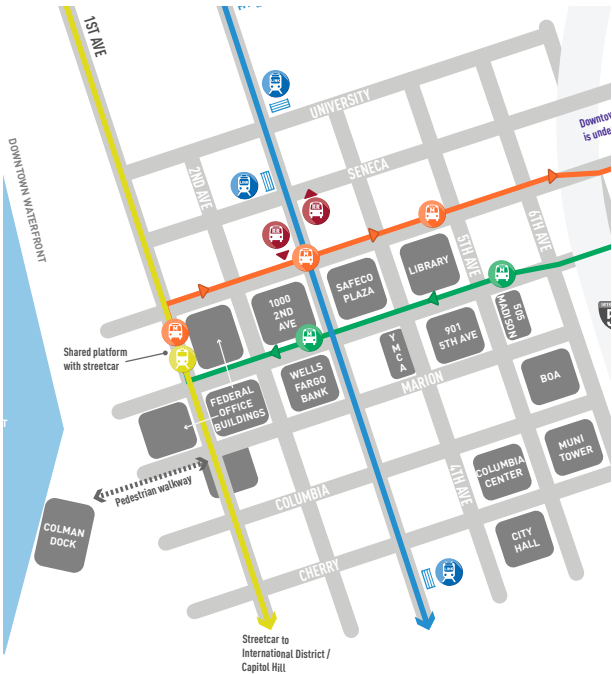
Two representative cross-sections showing the center island stations at Boylston and at 12th/Union are shown in Figure 2-2.

FIGURE 2-2. LPA CROSS-SECTIONS



Configurations of the western and eastern terminals at 1st and at Martin Luther King, Jr. Way are represented diagrammatically in Figure 2-3 below.

FIGURE 2-3. LPA TERMINALS



WESTERN TERMINAL



EASTERN TERMINAL

## Service Plan

The proposed daily span of service is:

- Monday through Saturday up to 20 hours (5 a.m. to 1 a.m.)
- Sundays/Holidays up to 17 hours (6 a.m. to 11 p.m.)

Proposed headways are:

- Every six minutes between 6 a.m. and 7 p.m. on weekdays
- Every 15 minutes during all other hours of operation

The LPA does not require any specific changes to King County Metro bus service currently operating in the corridor. The analysis assumes that BRT service replaces Route 12.

## Vehicle Technology

Madison BRT will be operated using 60-foot articulated low-floor buses with three doors on the right side of the vehicle and two on the left, allowing for loading and unloading using either side of the vehicle. Each vehicle will be custom-branded and may be equipped with on-board bicycle racks. Capital cost estimates assume purchase of eight of these vehicles, based on a projected peak fleet requirement of six, plus a 25 percent spare ratio.

These vehicles will be electrically powered, using either electric trolleybus (ETB) technology requiring overhead contact systems (OCS) or some combination of ETB/OCS and emerging battery-powered technology allowing for substantial “off-wire” operation. ETB infrastructure currently extends from 1st Avenue to 19th Avenue.

**FIGURE 2-4. CLEVELAND HEALTHLINE VEHICLE AT CENTER RUNNING STATION**



## Operations and Maintenance Facilities

It has been assumed that BRT vehicles could be accommodated at an existing King County Metro base used for storage and maintenance of ETB vehicles.

## Fare Collection/Policy

Madison BRT will employ a “proof-of-payment” policy based on off-board fare payment, all-door boarding and fare enforcement officers. Along with near-level boarding, POP will serve to greatly reduce dwell times.

The LPA assumes that Madison BRT will be fully integrated into the regional transit fare collection system. Central Puget Sound Transit agencies have developed a coordinated fare payment system. This partnership led to the 2009 launch of the ORCA (“One Regional Card for All”) card, which is a contactless, stored value smart card used for payment of public transport fares for eight separate transit providers in the Puget Sound area.

ORCA uses modern RDFI technology to store value on personal cards that function as an E-purse. ORCA-equipped stations and vehicles use an RDFI card reader on board or at the stop/station to track personal trips. Fare revenues are allocated using card data to the respective agencies providing recorded trips.

Further exploration of the fare payment options will be conducted during project development and will be a key element of the operations finance plan development.

## Transit, Pedestrian and Bicycle Connections

Madison BRT will provide enhanced east-west connectivity between downtown and the dense and rapidly developing mixed-use neighborhoods of First Hill, Capitol Hill and the Central District, with service extending to Madison Valley.

It will also provide key east-west connections between major north-south transit corridors including the Center City Connector/First Avenue Streetcar (with which it would share a platform, enabling seamless transfers), Link (via a roughly 400-foot walk to University Street Station), the 3rd Avenue transit spine, and the First Hill Streetcar on Broadway (again, via a walk of about 400 feet). Its western terminal would also be about 1,000 feet from the Colman Dock Washington State Ferries terminal.

Pedestrian and bicycle access are further described in a following section. However, Madison BRT will be highly accessible to pedestrians using the generally well-connected, gridded street network and complete sidewalk system within the corridor. All stations will be accessed at signalized intersections or marked mid-

block crossings and will be ADA-accessible. Protected bicycle lanes (PBLs) and greenways will run near and connect to the corridor.

## Pedestrian and Bicycle Improvements

The Project would include a number of improvements for pedestrians and bicyclists. In addition to the construction of corner-bulbous sidewalk extensions at a number of locations, the following major improvements would be made as part of or in relation to the Project:

- A parallel bicycle facility would be provided including:
  - » A protected bicycle lane (PBL) on Spring between 1st and 4th Avenues;
  - » A neighborhood greenway on 9th, University, and Union west of Broadway;
  - » A neighborhood greenway on Denny and Thomas between Broadway and Madison;
  - » A potential future PBL on Union between Madison and 27th; and
  - » A neighborhood greenway on 27th, Arthur and 29th, from Union to Madison.

- The intersection of 12th and Union would include an additional crosswalk and bicycle crossings. There would also be a wide crosswalk on Madison on the east side of the intersection enabling transitions between the bike facilities on Union to the east across Madison and 12th Avenues.
- At 24th, a short segment of two-way bicycle lane would be striped through

the intersection of 24th and John and improvements to the sidewalk on Madison west of the intersection would be included in order to facilitate through movements on the 24th Avenue Greenway.

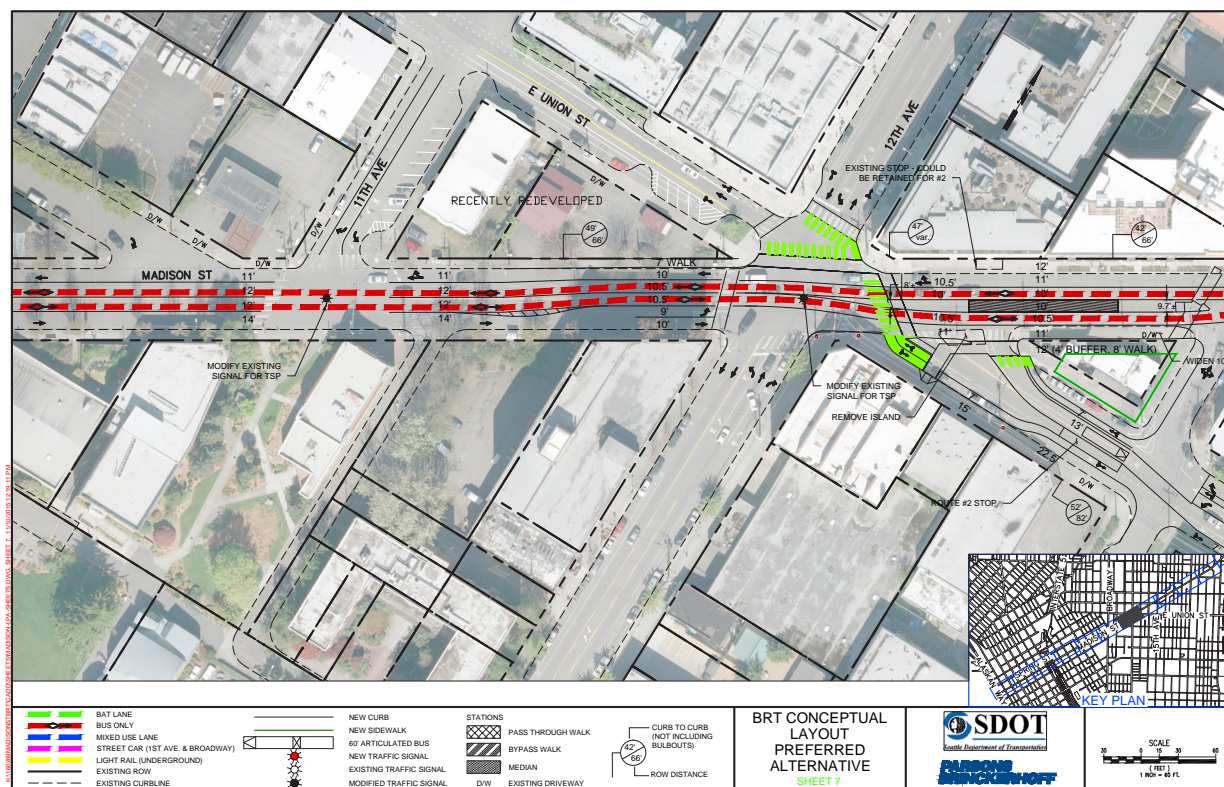
## Parking and Loading

As indicated by Figure 2-6, the draft LPA would remove approximately 173 total on-

street parking spaces between 1st Avenue and Martin Luther King, Jr. Way. Of this estimated total, 11 would be passenger or delivery loading spaces, 66 would be parking spaces that are available all day, and 96 would be spaces that are restricted during peak periods.

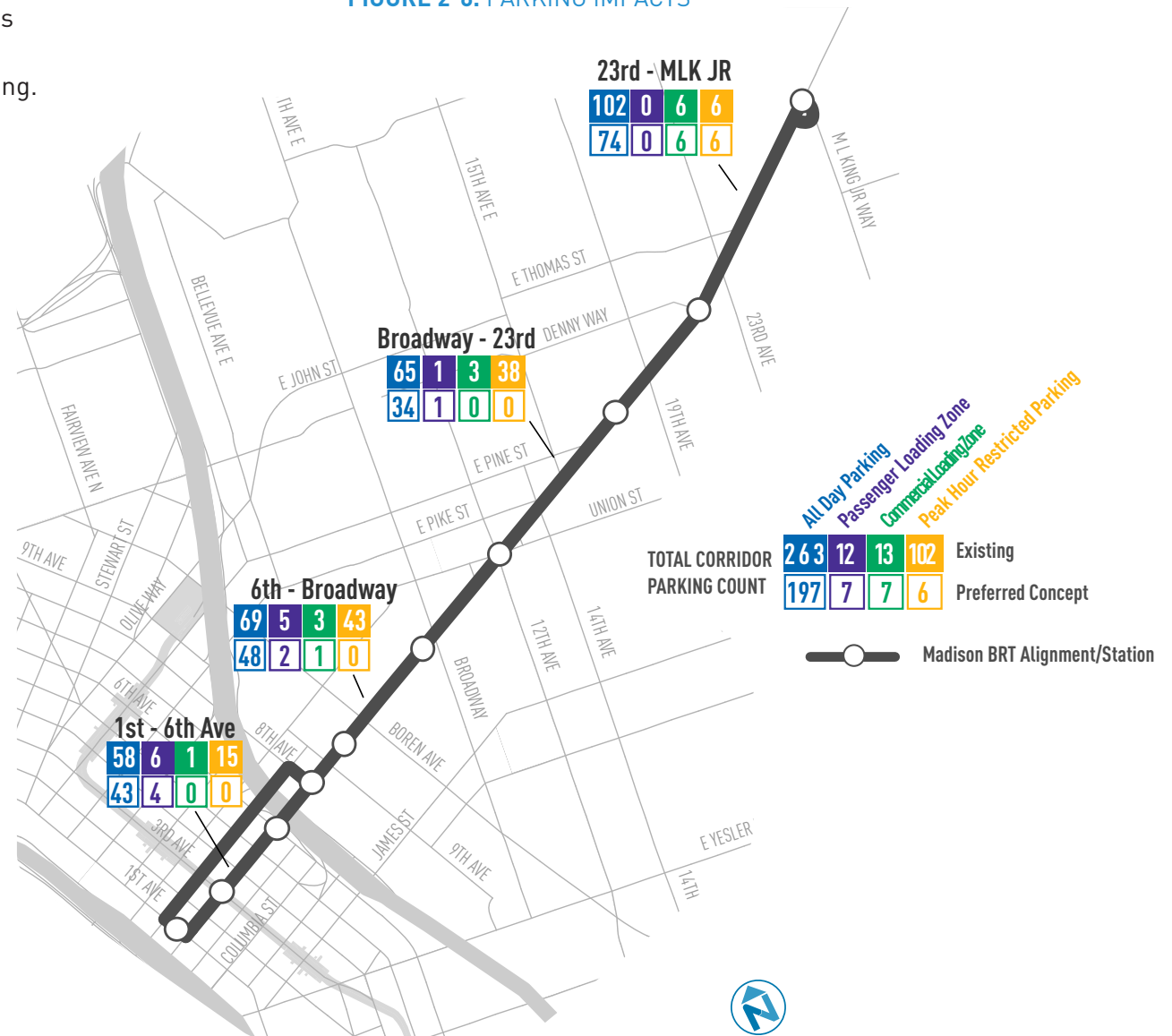
- Downtown, a total of 33 spaces would be removed on Madison and Spring, of which 15 would be all-day parking spaces, 15 would be peak-restricted spaces, and three would be loading spaces. Diagonal parking spaces on Madison would be partially replaced by parallel parking. Fourteen existing carpool spaces would be removed.
- On First Hill, a total of 69 spaces would be removed, 59 of them on Madison. Of these 69 spaces, 21 would be all-day parking spaces and five would be loading spaces. Forty-three, or 62 percent, would be peak-restricted spaces.
- Between Broadway and 23rd Avenue, near Capitol Hill and the Central District, a total of 43 spaces would be removed, of which two would be all-day parking spaces, three would be loading spaces, and 38 or 88 percent would be peak-restricted spaces.
- In Madison Valley, a total of 28 spaces would be removed, all of them all-day parking spaces.

FIGURE 2-5. 12TH AVENUE/UNION INTERSECTION DESIGN



A number of mitigation strategies will be evaluated in future phases to mitigate the impact of parking loss in the corridor. This could include conversion of short segments of select two-way streets into one-way streets with both angled and parallel parking.

FIGURE 2-6. PARKING IMPACTS



## LPA Capital Improvement Summary

Figure 2-7 provides a summary of transit capital improvements proposed as part of the LPA.

**FIGURE 2-7. TRANSIT CAPITAL IMPROVEMENTS**

Attribute	Amount
<b>Right-of-Way</b>	
Miles of Center Transit Only Lane (unidirectional)	1.98
Miles of Business Access and Transit (BAT) Lane (unidirectional)	1.14
<b>Stations</b>	
Island (bidirectional)	3
Island (unidirectional)	2
Sidewalk	13
<b>Fleet</b>	
BRT Vehicles	8
<b>Overhead Contact System</b>	
Miles of Overhead Wires (unidirectional)	2.37
Substations	1

## Capital Costs

The estimated capital cost for the LPA is \$122 million. This is a year-of-estimate (2015) cost. Consistent with FTA guidance on capital cost estimation, it includes estimated costs for:

- BRT Guideways/Lanes
- Stations
- Sitework and Special Conditions
- Systems (e.g. overhead contact systems)
- Right-of-Way
- Vehicles
- Professional Services

The estimate assumes partially colored concrete transit lanes and an extension of the existing OCS from 19th Avenue to Martin Luther King, Jr. Way, requiring an additional substation. Construction costs account for approximately \$62 million of the total, while right-of-way and vehicle purchases account for \$13 million and soft costs including project development and design account for \$28 million. These figures include FTA-mandated category-specific contingencies ranging from 15 to 40 percent. The FTA-required unallocated contingency of 20 percent adds another \$20 million to the project cost.

# EVALUATION FRAMEWORK

3



This chapter briefly describes the method used to evaluate project alternatives, including the project's Purpose and Need statement.

## PROJECT PURPOSE

The Madison Street Bus Rapid Transit (BRT) corridor is one of five High Capacity Transit (HCT) corridors identified for priority implementation in the City of Seattle's 2012 Transit Master Plan (TMP). The purpose of the Madison BRT project is to improve transit capacity, travel time, reliability, connectivity, comfort, visibility and legibility in the Madison corridor, while also making related improvements to pedestrian and bicycle access as well as the streetscape and public realm. In so doing, the project would improve overall mobility in a dense and rapidly developing corridor that spans diverse neighborhood districts from Center City to First Hill, Capitol Hill, the Central District, and east of the study area to the Madison Valley and Madison Park.

## PROJECT NEED

The Madison BRT project is based on the following needs:

- **Residents, employees, visitors, students, and shoppers all need frequent, reliable transit service.** Bus service can be slow, unreliable

and crowded during peak hours, and service could be more frequent.

- **People using transit in the corridor need to make east-west connections to major transit hubs.** Madison BRT would connect Colman Dock, RapidRide, Link, Downtown transit corridors, and the First Hill Streetcar, helping to form a network of frequent, high-capacity transit.
- **Intensifying land use necessitates a robust multi-modal transportation network for the Madison corridor.** The Madison corridor connects Downtown Seattle with dense and growing mixed-use neighborhoods. Large-scale infill development is occurring throughout the corridor and more is expected. The transit network and supporting non-motorized facilities are needed to accommodate this growth.
- **Pedestrian and bicycle improvements are needed to support the transit network and improve safety and comfort.** Pedestrian and bicycle volumes are high and growing, and the Pedestrian and Bicycle Master Plans identify needed improvements to support these modes.
- **Public realm improvements would help support the transit investment, livability, and economic**

**development.** The corridor could be made a more pleasant place to spend time by adding more green space, places to sit, and more comfortable and attractive bus stops.

- **Affordable access is needed to Center City jobs and the health, social services and educational facilities on First Hill.** Higher-quality transit service could ensure that employees, patients, visitors, students and staff have an affordable and convenient travel option.
- **Greenhouse Gas (GhG) emissions are on the rise.** Seattle's Climate Action Plan relies on high-capacity transit in major corridors, including Madison, to meet targets.

## DECISION POINTS

Following development of project alternatives and based in part on the Purpose and Need statement described in the previous section and public engagement process described in the previous chapter, an evaluation framework was developed focused on major decision points:

- **The basic configuration of bus lanes and stations and the design of the street in the central segment of the corridor.** Both center and side running alternatives were under

consideration in the central segment of the corridor, between 8th and 20th Avenues. The side and center running alternatives differed in where BRT lanes and stations would have been located: on each side, or in the center of the street. Under the side running alternative, the curb lanes would have been converted to bus lanes, and the station would have been on both sidewalks. Under the center running alternative, the center lanes would have been converted to bus lanes, and the station would have been in the street, either on an island between the bus lanes or on separate platforms to the right of the bus lanes, between the bus and traffic lanes. Regardless of alternative, stations would have been in the same general locations, at the same intersections.

- **The eastern terminal of the BRT corridor.** Under the alternatives, there were two options for the eastern terminus: 23rd Avenue or Martin Luther King Jr. Way. Some or all BRT vehicles could have turned around at these locations. If vehicles turned around at 23rd Avenue, they would have made a clockwise loop using 23rd and Olive, “laying over” at the end of the line on Olive just east of 20th.

If they continued to Martin Luther King Jr. Way, there would have been layover on Arthur Place between MLK Jr. Way and 29th Avenue.

- **The eastbound alignment of BRT downtown (westbound buses would be on Madison).** Downtown, BRT vehicles will travel west on Madison, as Route 12 does today. However, vehicles could have traveled east on either Marion or Spring. Under the alternatives, if vehicles used Marion, BRT buses would have connected back to Madison using 6th Avenue. If BRT used Spring, they would have connected back using 8th or 9th Avenues. BRT vehicles would use side running bus lanes and stations on either street.
- **The western or downtown/ waterfront terminal.** The western terminus, downtown near the waterfront, could have been in any of five locations: between Madison and Marion southbound on Western, between Madison and Marion southbound on 1st Avenue, or between Madison and Spring northbound on 1st Avenue, Western, or Alaskan Way. Vehicles were not planned to layover at the western terminal.
- **Where to locate a station between 3rd and Terry Avenues.** Under

the alternatives, BRT stations were proposed for 3rd Avenue and Terry Avenue—a half mile with no interim stops to serve major employment clusters. However, I-5 represents a major barrier between these two stations. A station on the downtown side would have been more accessible to downtown, but less accessible to First Hill – and vice versa.

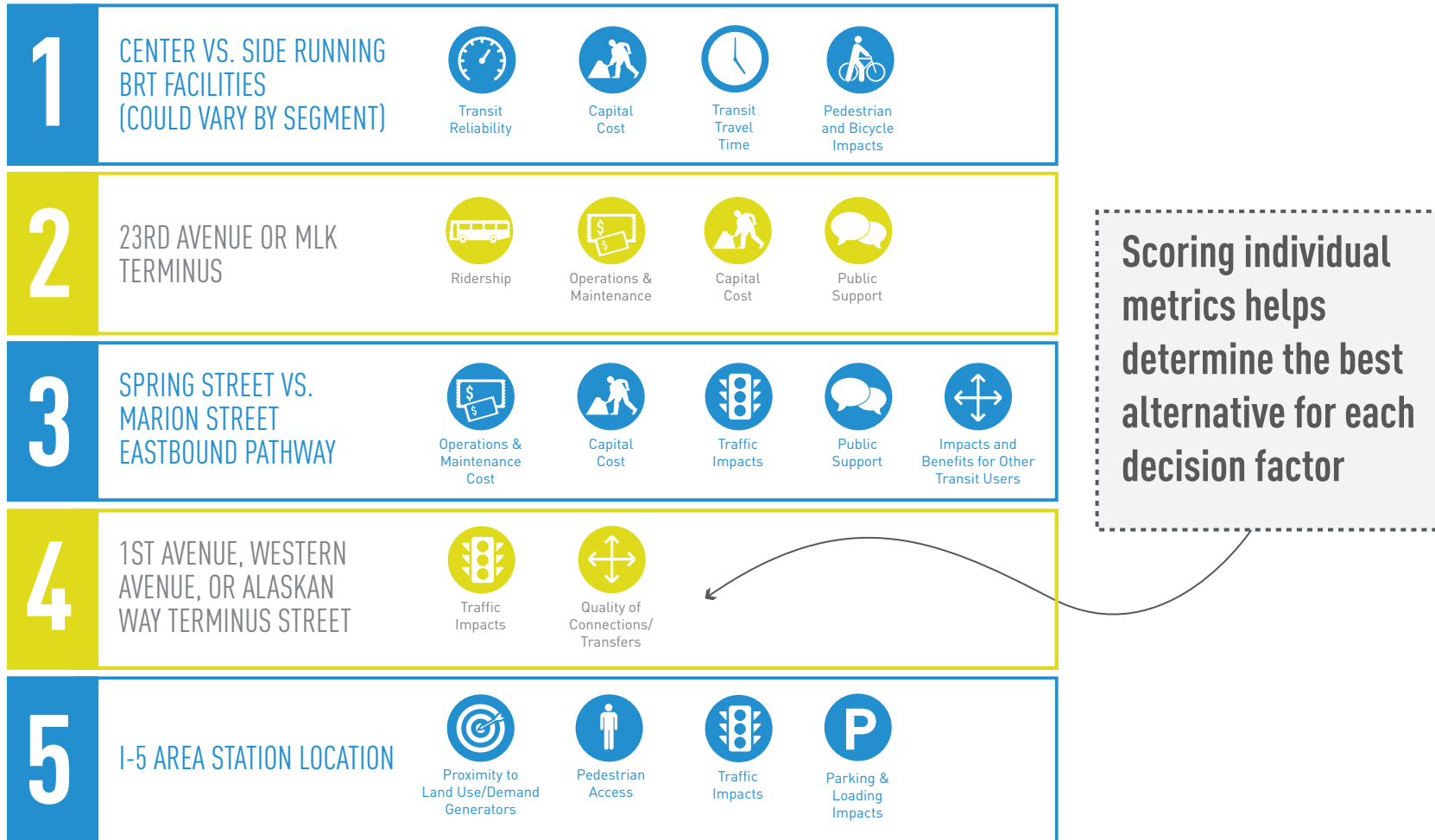
## METRICS

In order to conduct the evaluation, a number of performance measures were identified and associated with one or more of the decision points. These metrics were chosen on the basis of relevance, importance, and their ability to serve as differentiators between the alternatives. Results of the evaluation based on these metrics can be found in the following chapter.

FIGURE 3-1. EVALUATION FRAMEWORK

# HOW DO WE SHAPE THE BEST BRT ALTERNATIVE?

**5 Key Decision Factors** with established **Metrics** help us compare different options



# EVALUATION OF ALTERNATIVES



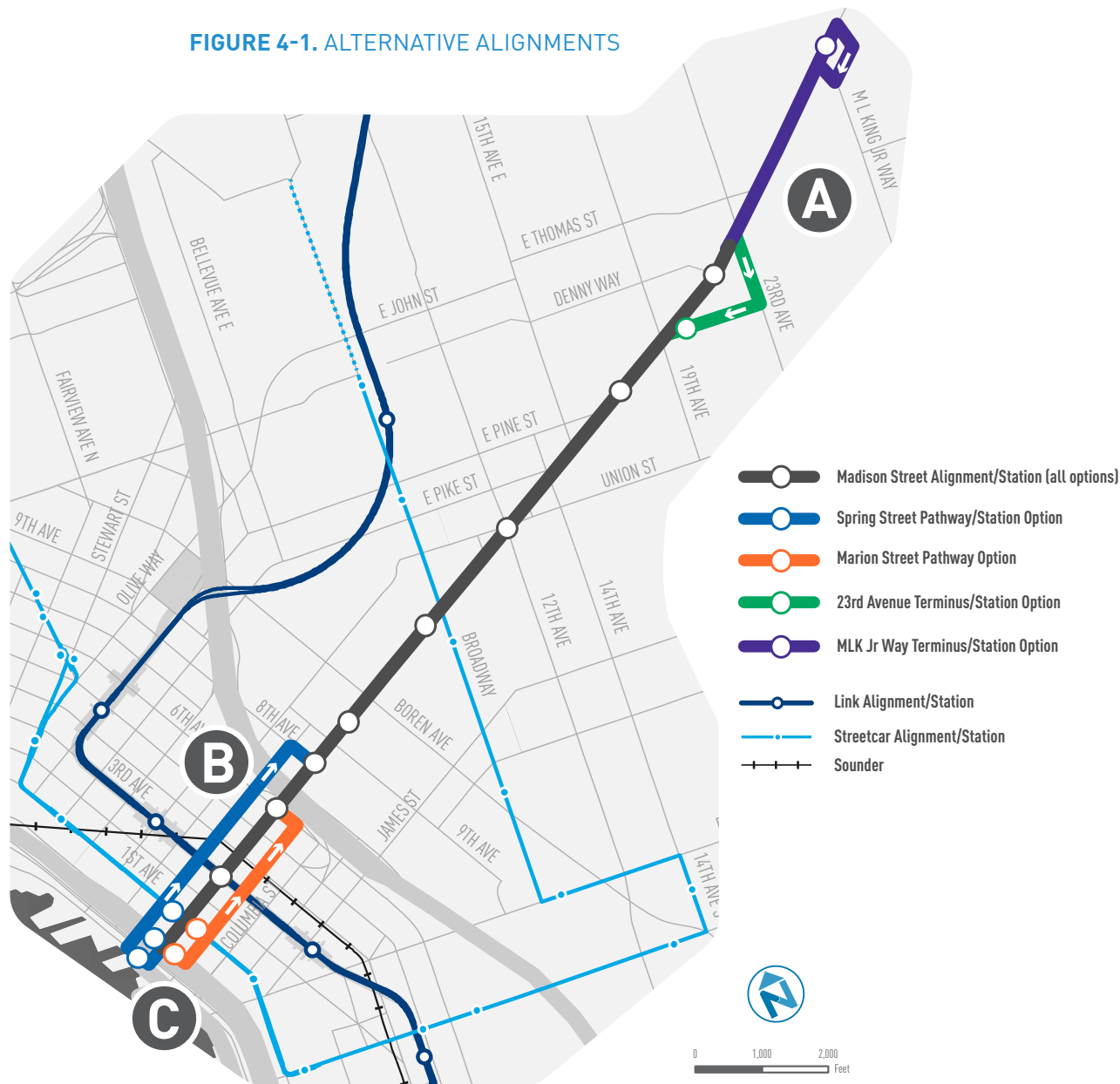
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This chapter summarizes the evaluation of project alternatives.

Alternative alignments are shown in Figure 4-1, including the eastern terminal options (labeled “A”), the downtown eastbound pathway options (“B”) and the western terminal options (“C”). The side vs. center running alternatives would have applied to the central segment between 8th and 20th avenues. I-5 station options are shown at 6th and 8th.

Renderings illustrating the basic configurations of side and center running alternatives are shown in Figure 4-2. Note that the center running alternative could have included median island platforms or unidirectional right-side island platforms.

**FIGURE 4-1. ALTERNATIVE ALIGNMENTS**



# SIDE VS. CENTER RUNNING ALTERNATIVES

## Transit Travel Times

Using a transportation operations model, analysis was conducted of transit travel times between 1st and 23rd Avenues (eastbound) and 20th and 1st Avenues (westbound) during the PM peak hour of 5 to 6 p.m. The modeling found that both the Center and Side Running alternatives would improve PM peak hour transit travel times by nearly 40 percent, with slightly greater improvement under the Center Running alternative.

## Transit Reliability

Analysis of transit travel time reliability was conducted in the core segment of the corridor, between 6th and 13th Avenues where traffic congestion, transit delay and loads aboard transit vehicles are all at or near their highest points. Today, the same transit trip in this relatively short segment may take as little as 7 minutes and as much as 14 minutes westbound during the PM peak (based on model results). Under both the center and side running alternatives, there was found to be little variability under either alternative – less than a minute – although performance of the Side Running Alternative would degrade as numbers of conflicts with pedestrians and right-turning vehicles increased.

FIGURE 4-2. SIDE AND CENTER RUNNING CROSS SECTIONS



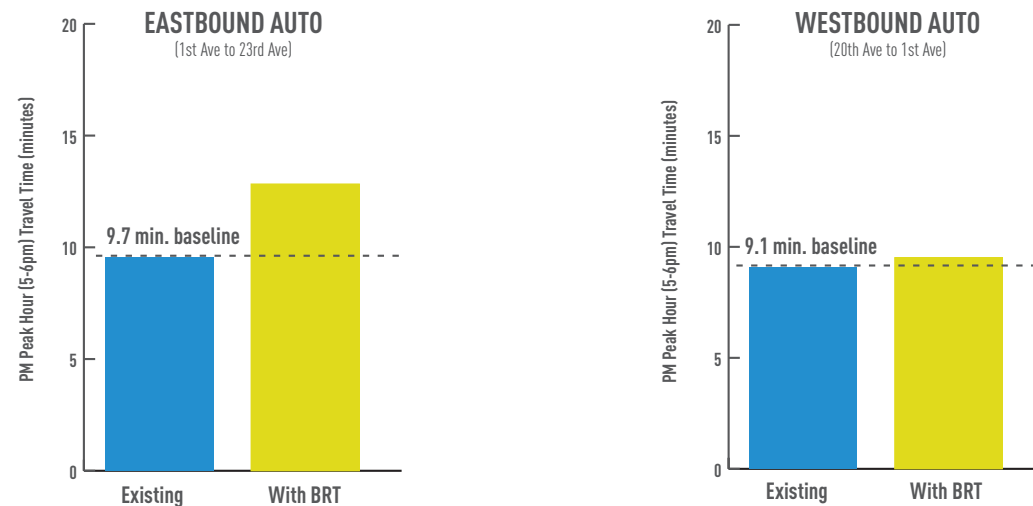
## Auto Travel Times

Using a travel model, analysis was conducted of auto travel times between 1st and 23rd Avenues (eastbound) and 20th and 1st Avenues (westbound) during the PM peak hour of 5 to 6 p.m. Impacts on traffic were found to vary significantly by segment, BRT alternative and direction. Overall, the side running alternative had fewer impacts, as it would have allowed left turns at most intersections, while the center running alternative would have allowed lefts between 8th and 20th only at select locations.

## Capital Costs

Capital costs for the project were estimated using Move Seattle estimates and the FTA Standard Cost Category (SCC) template. Estimated costs for the center and side running alternatives between Western and 23rd Avenue using the Marion downtown eastbound pathway are shown in Figure 4-3. As Figure 4-3 shows, capital costs for the center running alternative were projected to be approximately 22 percent higher than for the side running alternative. This is primarily because it would have required more extensive reconstruction of both the roadway and sidewalk around stations, including utility relocation.

**FIGURE 4-3. AUTO TRAVEL TIMES**



**FIGURE 4-4. SIDE VS. CENTER RUNNING ALTERNATIVES: CAPITAL COSTS**

Scenario	2015 Cost
Center Running	\$120M
Side Running	\$98M

## Conclusions

The center running alternative was found to provide greater benefits for transit, including greater improvements in travel times and reliability. Traffic impacts and capital costs were somewhat higher than for the side running alternative.

# WESTERN TERMINAL OPTIONS

## Traffic Impacts

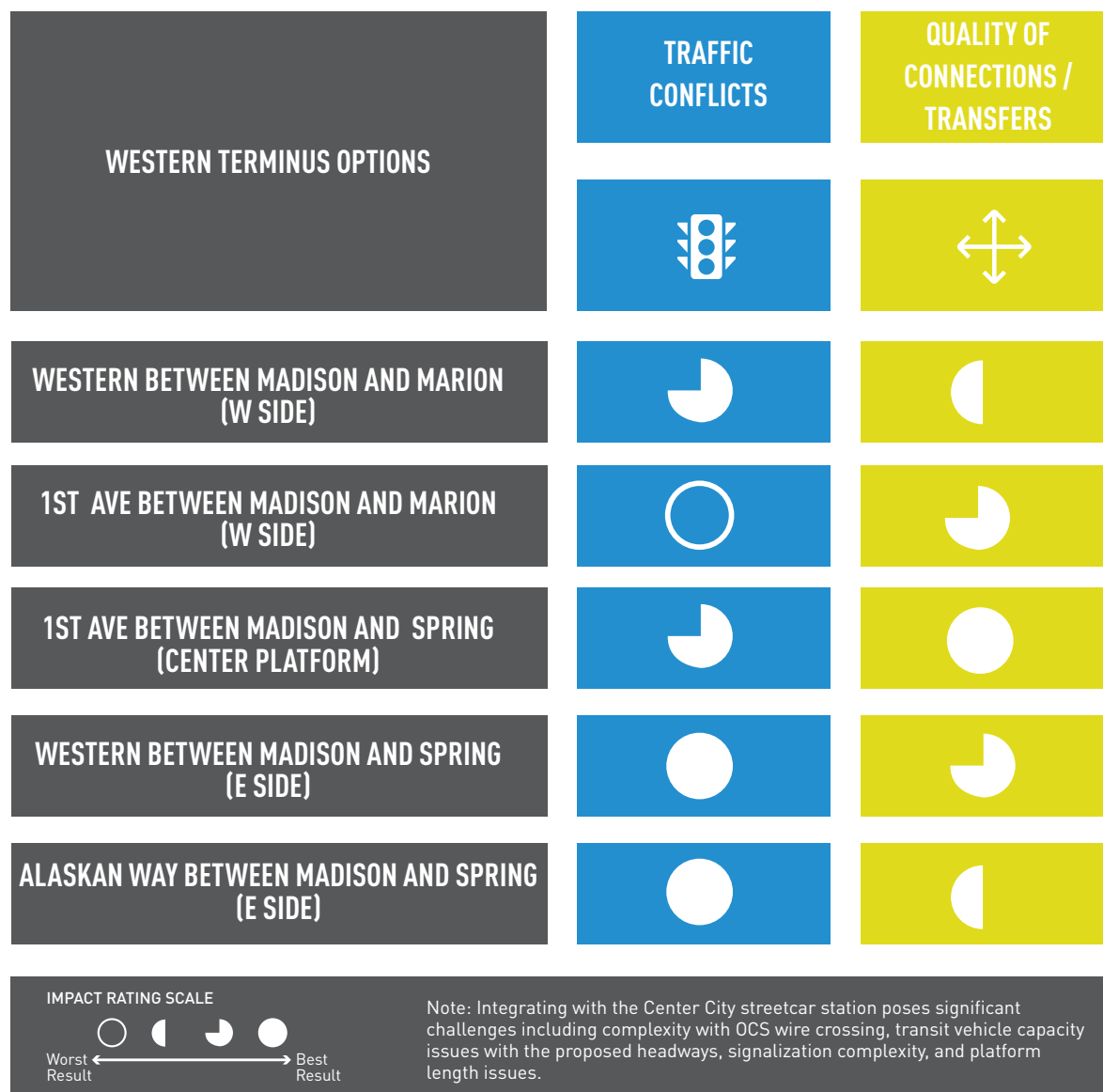
Impacts on traffic from terminals at Western (under either alternative) or Alaskan Way (under the Spring alternative) were found to be relatively minor, as there is relatively little traffic west of 1st Avenue that could be impacted by transit operations. Impacts from a terminal on 1st Avenue were found to vary by alternative. Under the Spring alternative, BRT vehicles could operate in the transit-only lanes already planned for the Center City Connector project. Under the Marion alternative, BRT vehicles would have stopped in the southbound traffic lane, impacting traffic.

Impacts on transit from traffic were also found to vary. Under the Marion alternative, BRT vehicles would have needed to make a series of left turns, from Madison to Western, then from Western to Marion. Under the Spring alternative, vehicles would have only needed to turn right, although they would have had to cross lanes of traffic to access the transit lane on the north side of Spring.

## Quality of Connections/Transfers

Western is relatively close to both Colman Dock and the future Center City Connector streetcar. Access to Colman Dock could be enhanced by a staircase connecting to the Colman Dock pedestrian bridge, which is planned to be reconstructed as part of the

**FIGURE 4-5.** WESTERN TERMINAL OPTIONS: TRAFFIC CONFLICTS AND QUALITY OF CONNECTIONS/TRANSFERS



Alaskan Way project. A 1st Avenue terminus would allow for same platform transfers to streetcars if coupled with the Spring alignment. Alaskan Way, meanwhile, is within sight of Colman Dock, but some distance from the 1st Avenue streetcar line.

## Conclusions

A 1st Avenue terminal coupled with the Spring Downtown Eastbound Pathway was deemed most desirable, as it would both allow for seamless transfers to streetcars and have little impact on traffic. It allows for a level, one-block walk to the Colman Dock pedestrian bridge.

## DOWNTOWN EASTBOUND PATHWAY ALTERNATIVES

### Operating and Maintenance Costs

There was found to be little to no annual difference in cost between the Marion and Spring alternatives. This is because the travel time differences between the alternatives were found to be so slight as to have no impact on numbers of vehicles required to operate service, limiting cost differences to relatively minor areas such as numbers of intersections with transit signal priority.

### Capital Costs

Use of Spring rather than Marion was found to increase project costs by approximately

\$5.8 million, or 5 to 6 percent. The difference in cost was largely based on additional overhead wires, transit lane costs and transit-priority signals.

## Traffic Impacts

While conversion of travel lanes to transit lanes can reduce traffic capacity, impacts on traffic vary, as left-turn restrictions and dedicated turn lanes can help keep through traffic flowing. Using a transportation operations model, analysis was conducted of auto travel times if BRT service were on Marion or Spring. As Figure 4-6 indicates, Spring was found to have a greater impact on auto travel times.

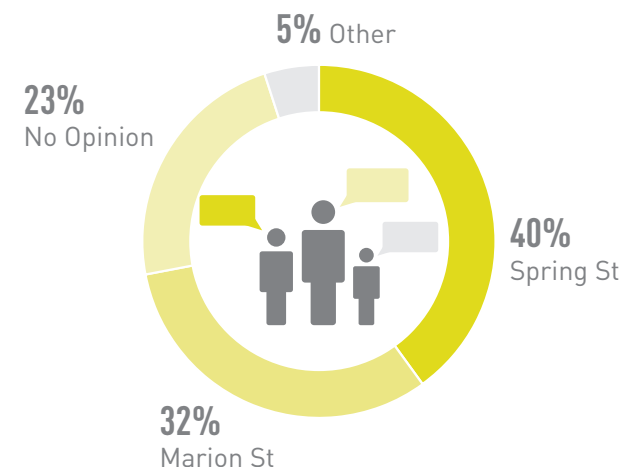
## Public Support

In January and February, an online survey was conducted in which participants were asked a number of questions about the BRT project. There were a total of 1,660 respondents. One of the questions asked was which western alignment respondents would prefer. As indicated by Figure 4-7, respondents to this question expressed a preference for the Spring alternative, with 40 percent selecting it vs. 32 percent for Marion. Spring was also preferred by corridor residents, 41 percent to 30 percent. Among non-residents, there was a slight preference for Marion (42 percent vs. 36 percent), although again, there were far fewer non-resident respondents.

**FIGURE 4-6.** DOWNTOWN EASTBOUND PATHWAY ALTERNATIVES: AUTO TRAVEL TIMES

Eastbound		
Scenario	Minutes	% Change
<b>Downtown (1st Ave-8th Ave), Eastbound</b>		
Spring	+1.87	+54%
Marion	+0.25	+7%

**FIGURE 4-7.** DOWNTOWN EASTBOUND PATHWAY ALTERNATIVES: PUBLIC SUPPORT



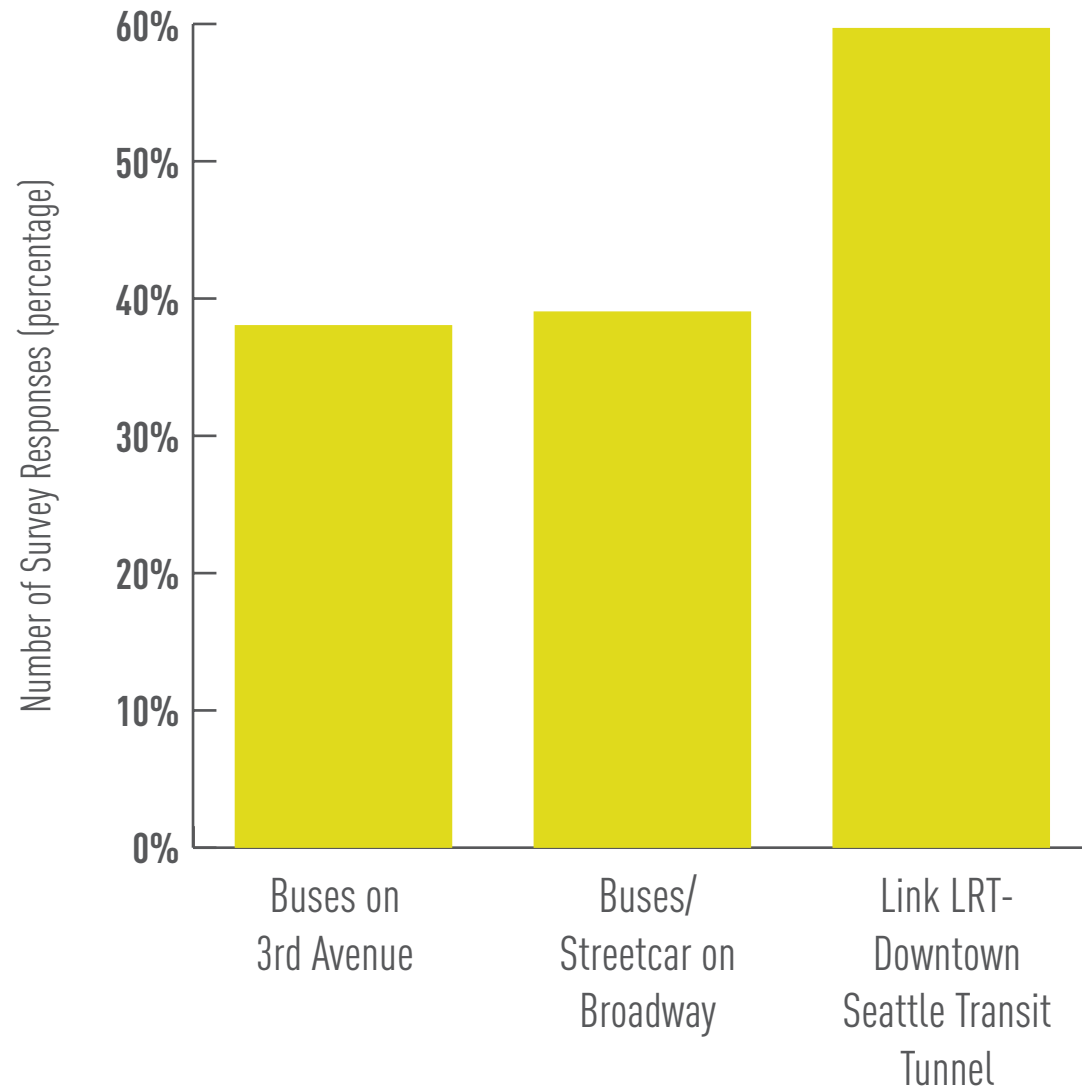
## Impacts and Benefits for Other Transit Users

The Spring alternative was found to provide greater connectivity, as an eastbound stop at 3rd Avenue would be one block or approximately 310 feet closer to a Link station entrance than an eastbound stop on Marion. The Marion alternative was found to provide greater connectivity to ferry service at Colman Dock, but there are fewer ferry riders than there are Link users – and Link ridership will only continue to grow as the system is expanded. Additionally, online survey respondents identified their top transfer points as the Downtown Seattle Transit Tunnel (DSTT) followed by the CCC Streetcar, multiple bus lines, and Washington State Ferries. However, the Spring alternative could eliminate service on Marion downtown.

## Conclusions

While it would be more expensive and would have a greater impact on traffic, a Spring Downtown Eastbound Pathway was found to provide greater benefits for transit, in terms of greater connectivity to Link. It also enjoyed more public support.

**FIGURE 4-8.** DOWNTOWN EASTBOUND PATHWAY ALTERNATIVES: SURVEY RESPONSES RE: HIGHEST PRIORITY TRANSFER POINTS

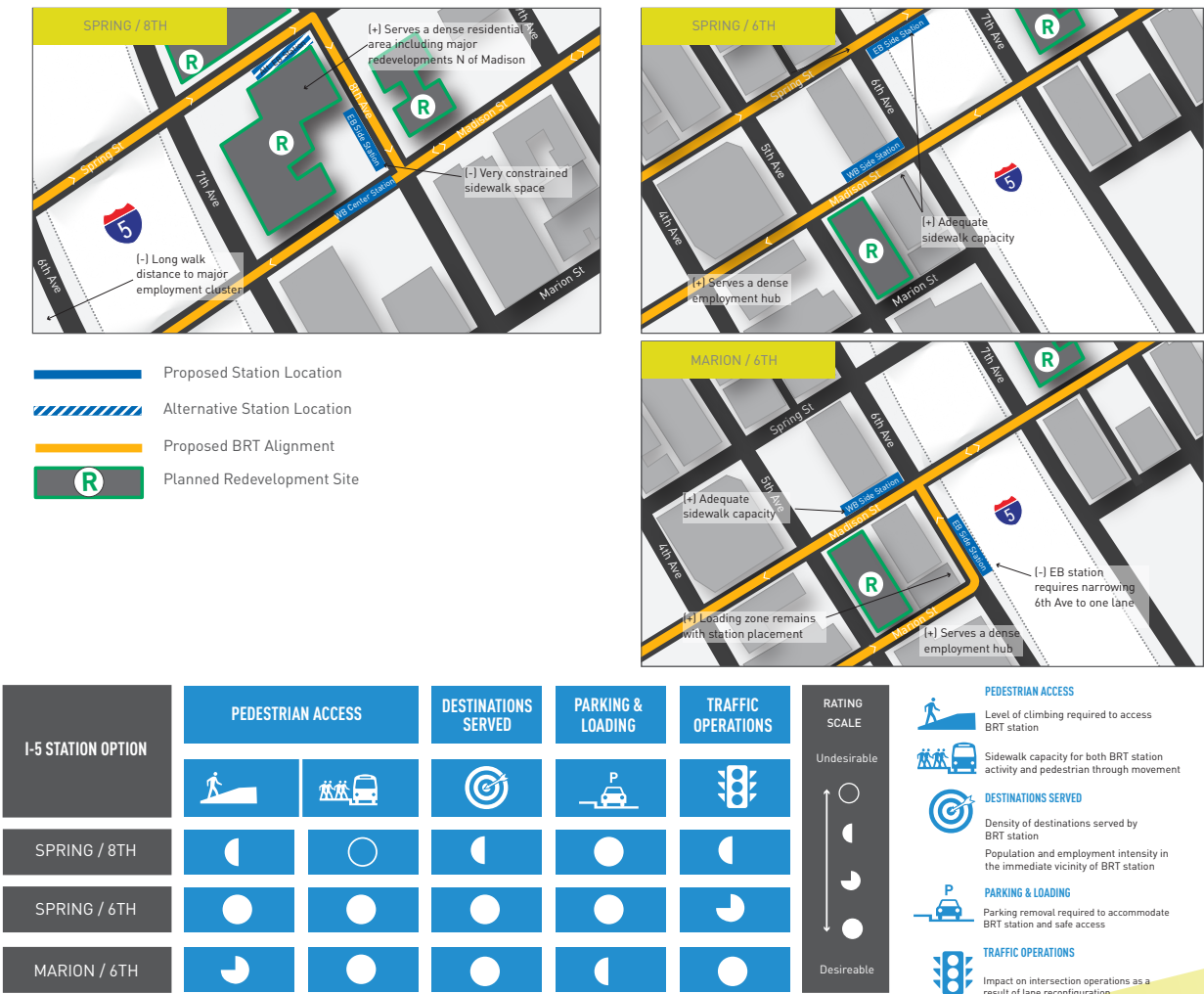


# I-5 STATION LOCATION OPTIONS

## Pedestrian Access, Destinations Served, Parking and Loading, and Traffic Operations

The evaluation of I-5 station location options is described in Figure 4-9. As the figure indicates, locations west of I-5 would provide gentler grades and greater access to other transit routes and destinations, while parking and traffic impacts would vary.

**FIGURE 4-9.** I-5 STATION LOCATION OPTIONS: PEDESTRIAN ACCESS, DESTINATIONS SERVED, PARKING AND LOADING, AND TRAFFIC OPERATIONS



## Stop Spacing

A mapping exercise conducted as part of the online survey found support for decreasing stop spacing in Downtown and First Hill to allow for a second downtown stop near 5th Avenue, as well as revised spacing in First Hill (8th/9th Avenue, Boren, and Broadway were all popular stops).

## Conclusions

Stations on both sides of I-5 would enjoy strong support and would have only a minor impact on running times.

## EASTERN TERMINAL OPTIONS

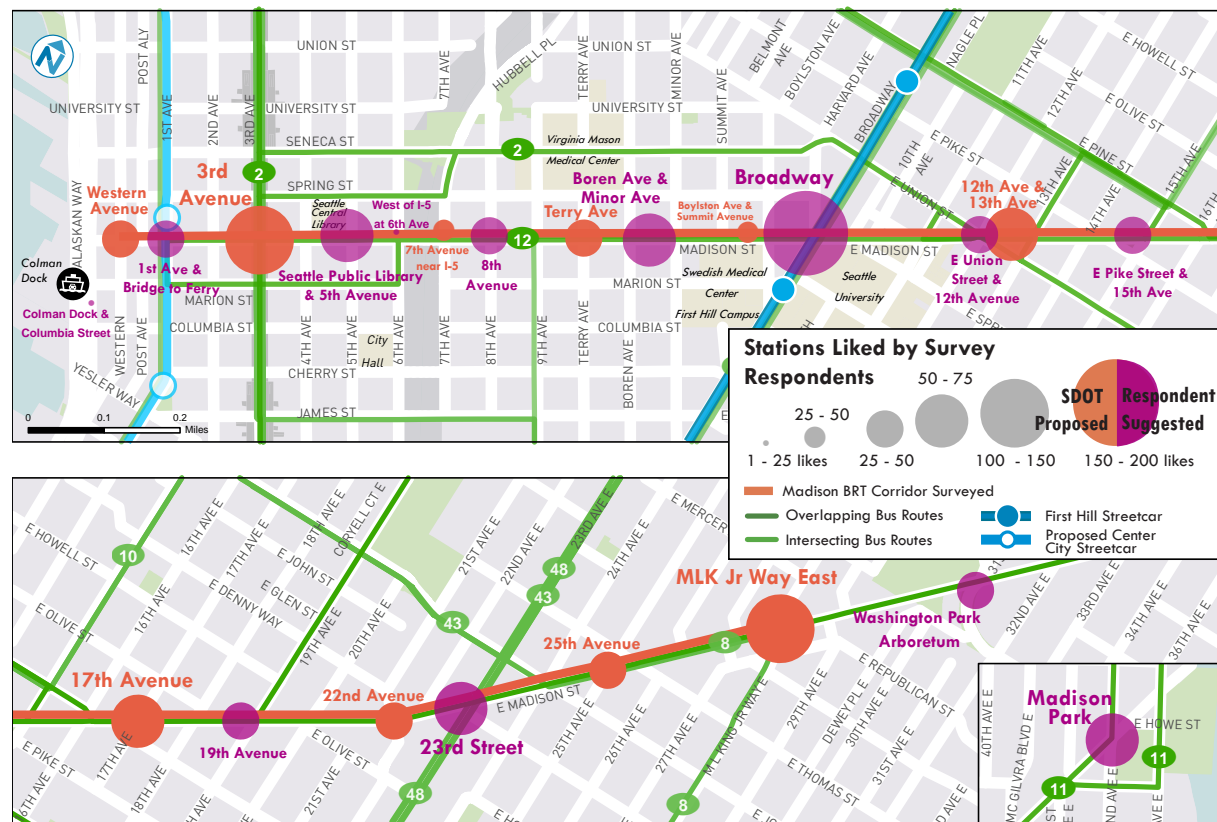
### Ridership

Ridership estimation conducted using the FTA Stops model found that extension from 23rd Avenue to Martin Luther King Jr. Way would increase BRT ridership by approximately 1,000 boardings per day.

### Operating and Maintenance Costs

Annual differences in cost between the 23rd Avenue and Martin Luther King Jr. Way alternatives were estimated to range from approximately \$40,000 to as much as \$340,000 more (in year 2015 dollars) for MLK Jr. Way. This was a factor of whether the extension would merely introduce additional station maintenance-related costs, which are relatively minor, or would require an

**FIGURE 4-10. I-5 STATION LOCATION OPTIONS:**  
SURVEY RESPONSES RE: STOPS AND STOP SPACING



additional vehicle in operation at times, which would incur greater cost.

## Capital Costs

Extension to Martin Luther King Jr. Way was found to increase project costs by approximately \$13.4 million, or 11 to 14 percent. The difference in cost was largely based on additional overhead wires, a power substation, and added stations.

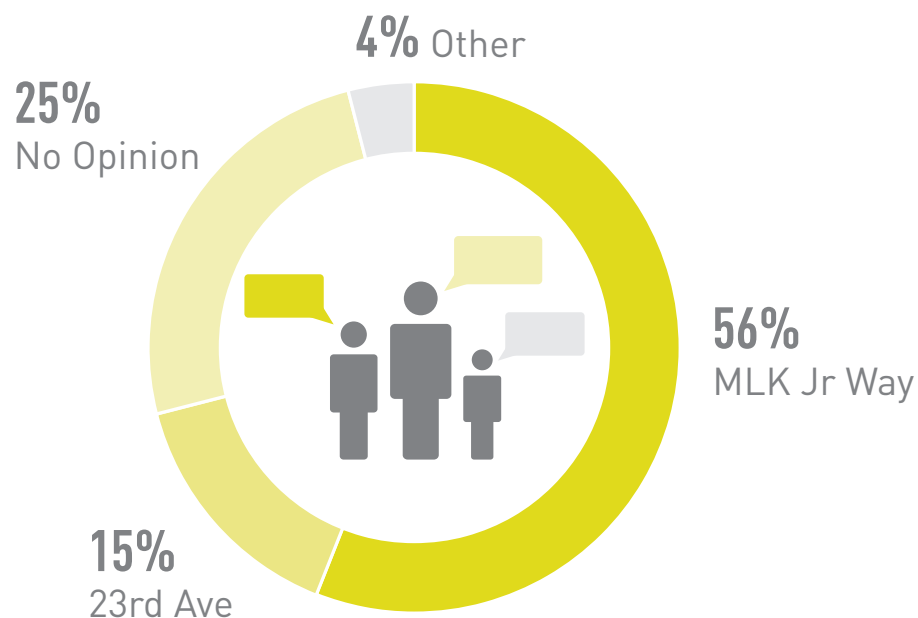
## Public Support

In January and February, an online survey was conducted in which participants were asked a number of questions about the BRT project. There were a total of 1,660 respondents. One of the questions asked was which eastern terminus respondents would prefer. Results are shown in Figure 4-10. As indicated by Figure 4-10, respondents to this question expressed a clear preference for the Martin Luther King Jr. Way alternative, with 56 percent selecting this alternative vs. just 15 percent for the 23rd Avenue alternative (25 percent had no opinion). This preference was shared by corridor residents and non-residents alike, although among nonresidents, a greater number of respondents (50 percent) had no opinion than those expressing a preference for MLK Jr. Way (32 percent). Non-residents, however, made up a relatively small share of the sample, just 265 of the 1,543 respondents to this question. Among the 1,278 residents who responded to the question, 61 percent preferred the MLK Jr. Way alternative.

## Conclusions

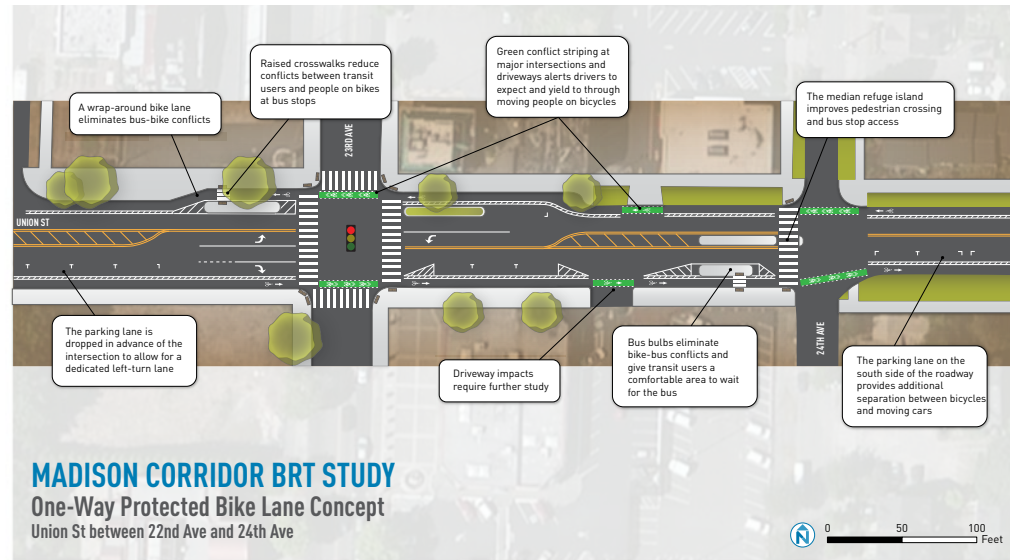
While a Martin Luther King, Jr. Way eastern terminal would be more expensive, it was found to generate significant additional ridership and to enjoy much greater public support.

**FIGURE 4-11. EASTERN TERMINAL OPTIONS: PUBLIC SUPPORT**





**FIGURE 4-13. PARALLEL BIKEWAY ALIGNMENT:  
ONE-WAY PROTECTED BIKE LANE CONCEPT**



**FIGURE 4-14. PARALLEL BIKEWAY ALIGNMENT OPTIONS BY SEGMENT**

	DOWNTOWN	FIRST HILL	EAST OF BROADWAY	
SEGMENT	<ul style="list-style-type: none"> <li>Spring Street 1st to 4th</li> <li>Additional routes TBD, per Center City Bike Network Project</li> </ul>	<ul style="list-style-type: none"> <li>University Street from 9th Avenue to Broadway</li> </ul>	<ul style="list-style-type: none"> <li>Phase 1: Denny/Thomas</li> </ul>	<ul style="list-style-type: none"> <li>Phase 2: Union Street from Broadway to 27th</li> <li>27th Avenue</li> </ul>
CONCEPTS	<ul style="list-style-type: none"> <li>Recommended design: Improve safety for existing Spring Street bike lane from 1st to 4th by upgrading existing bike lane to protected bike lane, as part of the Madison BRT project</li> <li>Additional routes downtown to be determined through the Center City Bike Network Project currently underway</li> </ul>	<ul style="list-style-type: none"> <li>Recommended design: Greenway treatments from 9th to Broadway</li> <li>Implementation in 2017, as part of BMP program</li> </ul>	<ul style="list-style-type: none"> <li>Recommended design: Greenway treatments from Broadway to 24th</li> <li>Implementation in 2019, as part of BMP program</li> <li>Madison BRT project will include pedestrian and bicycle crossing improvements at 24th &amp; Madison</li> </ul>	<ul style="list-style-type: none"> <li>Recommended design: Two one-way PBLs – safety key factor</li> <li>Madison BRT Project will include protected bike lanes on Union from 12th to 14th, where project will be changing the roadway design</li> <li>2015 next steps: Assess additional funding options</li> <li>If funding identified, advance a corridor design study</li> </ul>

# NEXT STEPS



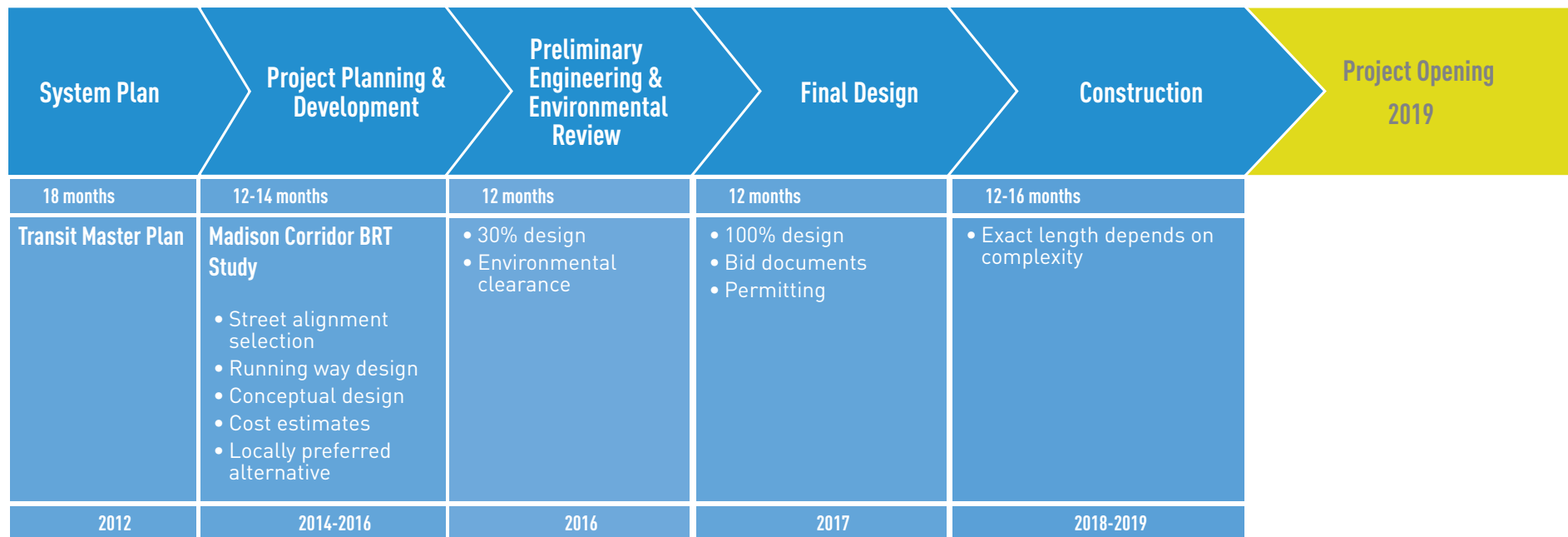
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The adoption by the Seattle City Council of a Locally Preferred Alternative is a critical step for the Madison BRT Project and represents completion of an important local planning phase. As part of the Madison BRT Study process, the City of Seattle has coordinated with the Federal Transit Administration (FTA). Once the City Council has adopted the Madison BRT LPA, SDOT plans to submit a formal request to FTA to enter into Project Development, which ensures next project phases are developed consistent with Federal

requirements to receive grant funding. City Council adoption of the LPA and the FTA's approval to enter Project Development will enable the City to commence preliminary engineering and required environmental analyses.

Figure 5-1 illustrates the progression of the Project from identification in the Transit Master Plan to construction and completion. The current identified year of opening is 2019.

**FIGURE 5-1. MADISON BRT PROJECT DEVELOPMENT TIMELINE**



The following are key next steps in advancement of the Madison BRT Project.

- **City Council Adoption of the LPA (Early 2016).** The Seattle City Council adopted the LPA in January 2016.
- **Entry into FTA Project Development (Early 2016).** After City Council approval of the LPA, the City of Seattle will submit a letter to the FTA requesting entry into Small Starts Project Development. Once FTA approves the City's request to advance into Project Development, the project sponsor has two years to complete the National Environmental Policy Act (NEPA) process and submit sufficient information on the cost, financial commitments, and project rating to qualify for a Project Construction Grant Agreement (PCGA).
- **Develop and refine finance plan (2015-2016).** FTA evaluates projects on the local capacity to finance and build the Project and the level of commitment for the local sources of funding. The project sponsor's financial commitment to the Project includes capital and operations. Formal financial commitments are not necessary to advance into Project Development. During Project Development, the project sponsor must produce formal commitments

of the local capital funds and funding for 20 years of operation for the system. The local sponsors commit to operate the Project for 20 years as part of the PCGA. Concurrent with environmental documentation and preliminary engineering and final design, the City will develop capital and operating plans that commit local funds to match federal capital grant funds and support service operations.

The City has begun to evaluate local capital and operating funding options. Capital financing scenarios assume that a portion of the Project cost will be funded through an FTA Small Starts grant, which provides grants up to \$75 million for transit projects with a total project cost not exceeding \$250 million. A number of local, regional, and state sources are being evaluated to provide local match.

- **Conduct 30% Design and Environmental Analysis (2016-2017).** In order to submit the FTA Small Starts Templates to receive federal grant funding to construct the Madison BRT project, SDOT is required to conduct federal and state environmental assessment according to NEPA regulations. This process is typically conducted in concert

with the next phase of project design, which will advance corridor designs to a 30% engineering level. An initial step in this process will be formal agreement with FTA regarding the class of action or type of NEPA evaluation required. Based on conversations with the FTA, the City expects that an Environmental Assessment or Documented Categorical Exclusion level of NEPA documentation will be appropriate for this project and that a full EIS will not be required. Once that formal decision has been made and documented, the Project will advance through required environmental analysis, documentation and public findings, and assuming all impacts can be mitigated, develop the documentation of a Finding of No Significant Impact (FONSI).

- **Submit the project for FTA Small Starts funding (September 2016).** The FTA Section 5309 Grant Program provides funding for transit capital projects on a competitive basis. The Madison Corridor BRT study fits into the Small Starts category under this program. Fifty percent of the FTA Small Starts Project rating is based on the strength of the City's capacity to finance and deliver the Project, while the remaining 50 percent is based on an

assessment against the following six criteria (each valued equally).

- » **Land Use.** Criterion includes existing density and zoned development capacity.
- » **Economic Development.** Criterion includes the potential for economic development to occur as part of the transit development. Project sponsors are allowed to submit economic development scenarios that project specific development for a mode investment like streetcar.
- » **Cost Effectiveness.** The criterion for cost effectiveness for Small Starts projects is the cost/ride for the federal share of the Project. To achieve a high rating, the cost per ride must be below \$1.00.
- » **Mobility Benefits.** Mobility benefits are determined by the number of people served or benefitted by the investment.
- » **Environmental Benefits.** Environmental benefits are determined by the use of the mode and the effectiveness in reducing environmental impacts. The benefits of the development are not included in this criterion which is limited to evaluating the mode being utilized.

» **Congestion Relief.** No rules or guidelines have been established as this criterion was added to MAP-21 late in the process and were not included in preliminary notice of the rule making. FTA intends to issue special guidance on this criterion.

- **Commence Preliminary Engineering and Final Design (2016-2017).** The City's 30% design team will be positioned to carry project engineering into final stages of design. The project schedule targets completion of that work in 2017 allowing for construction activities in 2018.
- **Project Construction (2018-2019).** Project construction would begin in 2018 and conclude in 2019. A plan for construction phasing and mitigation of impacts would be developed during the Preliminary Engineering and Environmental Assessment process.
- **Project Opening (2019).** Madison BRT opens for service.

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