ESSB 6392: Design Refinements and Transit Connections Workgroup | **Appendix A: White papers**

Turning, Queuing, and Channelization

Introduction

How was turning, queuing, and channelization addressed in the preferred alternative?

Lane channelization and turn pocket storage lengths were identified in the preferred alternative based on initial information available from the SDEIS. However, storage lengths and channelization were not analyzed in detail for the preferred alternative, as they were developed to fit within the environmental and operational effects evaluated in the SDEIS. Further analysis was requested to address the channelization and storage lengths as originally defined in the preferred alternative.

What issues are we trying to resolve?

As part of the design refinements associated with ESSB 6392, the project team sought confirmation that the number of lanes shown in the preferred alternative was necessary based on traffic forecasts and operations. In comment letters on the SDEIS, the Seattle City Council and Mayor expressed a desire for WSDOT to reduce the width of the corridor and associated roadways wherever possible in order to limit environmental impacts of the project. These comments echo those heard from many community members as well, asking that the project team eliminate any unneeded lanes. Specific areas studied included:

- Reducing the westbound off-ramp to a single lane.
- Reducing the number of turn lanes needed at the intersections of 24th Avenue and East Lake Washington Boulevard, and Montlake Boulevard and Lake Washington Boulevard.
- Reducing the number of lanes on Montlake Boulevard through the interchange.

Addressing the problem

How will we identify possible solutions?

Traffic modeling performed for the year 2030 (PM peak hour) identified potential modifications to channelization that could reduce the project footprint while maintaining safety, transit reliability, pedestrian connectivity, and limiting adverse effects on the SR 520 corridor. VISSIM was used for traffic modeling.

Recommendations

What did we consider?

The following design modifications were considered:

- Converting the westbound SR 520 off-ramp to a single lane from SR 520 to Montlake Boulevard.

- Converting the westbound SR 520 off-ramp to a single lane from SR 520 and expanding to two lanes west of Foster Island.
- Closing the southbound left turn from 24th Avenue East onto East Lake Washington Boulevard.
- Reducing the number of lanes on East Lake Washington Boulevard between 24th Avenue East and Montlake Boulevard.
- Reducing the number of lanes through the SR 520/Montlake interchange.

What are the options presented for TCT consideration?

Converting the westbound off-ramp to a single lane from SR 520 to Montlake Boulevard. The transportation team modeled a single lane off-ramp and carried the configuration through to the Montlake Boulevard intersection. This conversion would reduce the footprint of the preferred alternative, however the simulation model showed that traffic congestion would extend from the Montlake Boulevard intersection back onto the SR 520 corridor and across the floating bridge. This condition would introduce safety concerns for the SR 520 corridor as well as substantial delays for the traveling public.

Converting the westbound off-ramp to a single lane from SR 520 and expanding to two lanes west of Foster Island. This option reduced the footprint of the preferred alternative on Foster Island while still maintaining necessary lane alignments at the intersections of Montlake Boulevard and 24th Avenue East. In combination with the direct-access ramp, the traffic volume exiting at the combined Lake Washington Boulevard and Montlake interchange ramps would operate within State standards. On the western edge of Foster Island, the ramp expands to two lanes to keep traffic congestion from Montlake Bridge openings from adversely affecting the SR 520 mainline traffic operations. Exhibit 1 illustrates the recommended single lane off-ramp configuration. The orange shaded area represents the reduction in roadway width compared to the published preferred alternative footprint.

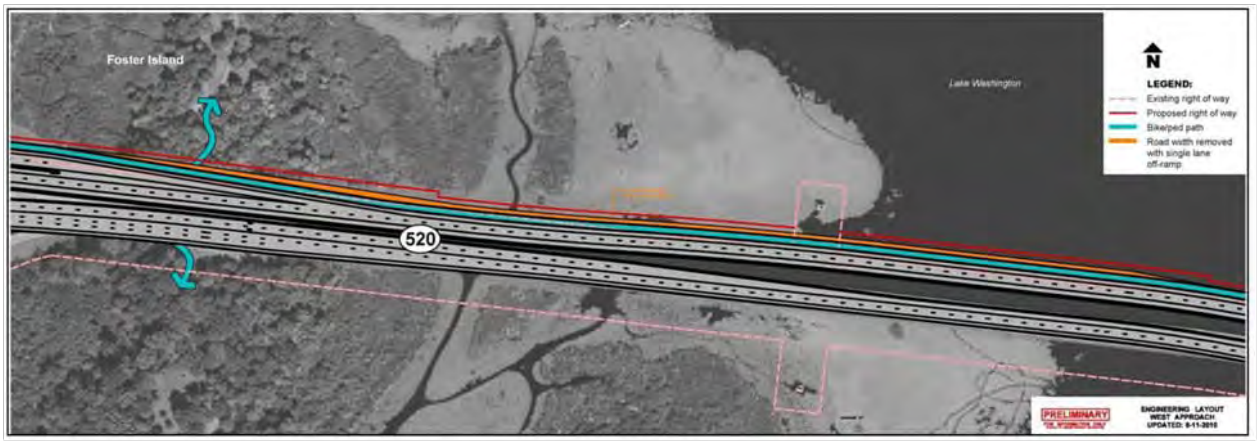


Exhibit 1. Westbound SR 520 single lane off-ramp.

Closing the southbound left turn from 24th Avenue East to East Lake Washington Boulevard. Effects of this option on local traffic operations were estimated using preliminary traffic forecasts from the SDEIS traffic data. Approximately 480 vehicles per hour are estimated to turn left from 24th Avenue East to East Lake Washington Boulevard during the PM peak.
If the southbound left turn movement was restricted, traffic would turn right onto Lake Washington Boulevard and then turn left onto Montlake Boulevard. The Montlake Boulevard/Lake Washington Boulevard intersection operates with a volume to capacity ratio of nearly 1.0, so the intersection could not accommodate any additional traffic. Adding traffic volume to the westbound left without adding new lanes would result in a volume to capacity ratio over 1.2, with 20% more cars at the intersection than could be accommodated at the traffic signal. Substantial congestion would result along Lake Washington Boulevard and on Montlake Boulevard, with transit travel times along Montlake Boulevard similar to a No Build configuration (~ 45 minutes) instead of the 7 minutes estimated in the preferred alternative configuration.

To accommodate the added traffic volumes, an additional westbound left turn lane (from Lake Washington Boulevard onto Montlake Boulevard) and northbound through lane (on Montlake Boulevard) would be required. The northbound through lane would be needed to provide added capacity for the movement that is in conflict with the westbound left turn. With these lane additions, the volume to capacity ratio is near that in the preferred alternative. An additional 12 feet of width would be required along Lake Washington Boulevard between 24th Avenue and Montlake Boulevard, and along Montlake Boulevard between East McGraw Street and East Hamlin Street.

Reducing the number of lanes on Lake Washington Boulevard between 24th Avenue and Montlake Boulevard. Assumptions for lane configurations and storage lengths on Lake Washington Boulevard between 24th Avenue and Montlake Boulevard are described below and shown in Exhibit 2.

Current traffic operations during the PM peak hour at the Montlake Boulevard/Lake Washington Boulevard intersection are rated at a level of service (LOS) E. In 2030, background traffic volume is expected to increase by about 25 percent, independent of the SR 520 project, resulting in traffic operations of LOS F. When an intersection operates at LOS F it is in failure: vehicles must wait through more than one signal cycle before traveling through the intersection. This also typically indicates severe congestion along the primary corridors.

The preferred alternative would change traffic patterns with the closure of the eastbound Lake Washington Boulevard ramps. Traffic from areas south (Madison Park and Leschi) would access SR 520 using the Montlake Boulevard intersection, resulting in an increase of 300 vehicles per hour through the Montlake Boulevard intersection during the PM peak.

- Westbound thru traffic accounts for 200 vehicles per hour northbound along Lake Washington Boulevard.
- Northbound left turns account for 100 vehicles per hour northbound along Montlake.

To improve transit reliability and travel times on Montlake Boulevard and to minimize traffic congestion along Lake Washington Boulevard, the Montlake Boulevard/Lake Washington Boulevard intersection would be reconfigured to include the following:

- Second northbound left turn lane.
- Eastbound approach lane.
- Westbound approach lane.

The westbound approach lane would extend from 24th Avenue to Montlake Boulevard. It would also taper out to include a left, left/through, and right turn lane at the Montlake Boulevard intersection. This westbound approach would operate at LOS E: even with the added lane, traffic backs up to the 24th Street intersection. The westbound through lane would operate at almost 5% over capacity. Still, this configuration would result in improved traffic operations through the Montlake Boulevard interchange compared to a No Build scenario.

An eastbound left turn lane was also shown in the preferred alternative at the 24th Avenue/Lake Washington Boulevard intersection. This left turn pocket would provide a turn lane for HOV traffic destined for the direct-access ramps to eastbound SR 520. It would also be available for traffic destined to the park north of SR 520. The opposing through movement volume of 610 vehicles per hour would limit opportunities for traffic turning left out of a shared lane, which could result in traffic congestion extending back to the Montlake Boulevard intersection.

Exhibit 2. Lake Washington Boulevard between 24th Avenue and Montlake Boulevard.

Reducing the number of lanes on Montlake Boulevard through the SR 520 interchange. Further evaluation of the lane configuration through the SR 520 interchange proposed in the preferred alternative did not result in any modifications. During discussions the TCT recommended that northbound right turn access be prohibited to the direct-access ramps, and instead all access to the direct-access ramps would be via Lake Washington Boulevard to 24th Avenue. Approximately 100 vehicles per hour would use that route.

Final TCT recommendation

The TCT recommended a number of turning, queuing, and channelization refinements. The recommendations are:

- Modify the westbound off-ramp to be one-lane from the floating bridge to west of Foster Island, expanding into two lanes from west of Foster Island to the Montlake intersection.
- Allow the left turn movement from 24th Avenue to eastbound Lake Washington Boulevard. Continued coordination between the City of Seattle, WSDOT, and the Arboretum and Botanical Garden Committee will be necessary to determine if time of day restrictions for the turning movement could be considered in the future.
- Improve the geometry of the transit/HOV direct-access ramps at the east edge of the Montlake lid to provide a transition between freeway design and local design.
- Provide 11-foot general-purpose lanes and 12-foot transit/HOV lanes on city streets and the westbound off-ramp on top of the Montlake lid.
- Maintain the width of the Portage Bay Bridge described in the preferred alternative, including the planted median.
- Prevent the right turn movement to the direct-access ramps from northbound Montlake Boulevard.

Bicycle and Pedestrian Connections and Amenities

Introduction

This white paper presents the recommendations for bicycle and pedestrian connections and improvements associated with the SR 520 project within the City of Seattle. These recommendations include opportunities to enhance connections from the new SR 520 regional bike and pedestrian path (SR 520 path) to ensure its integration with other regional facilities as well as with the existing and planned City of Seattle bicycle and pedestrian networks.

Bicycle and pedestrian mobility was considered in both the Montlake and the Capitol Hill/Roanoke Park areas. The Montlake neighborhood is the intersection of the proposed SR 520 path, City of Seattle designated routes, and the Burke Gilman Trail. The Technical Coordination Team (TCT) studied options for connecting these systems through both on-street and off-street facilities for bikes and pedestrians. The TCT also examined opportunities to improve existing bicycle and pedestrian connections at the E Roanoke Street/I-5 overcrossing and across the lid at 10th Avenue. Several recommendations were identified, and these should be considered by WSDOT and the City of Seattle as the Historic District negotiations (Section 106 process) proceeds.

How were bicycle and pedestrian connections and amenities addressed in the preferred alternative?

The preferred alternative design connects the new SR 520 path to existing bicycle and pedestrian facilities in the Montlake area and enhances bicycle and pedestrian connections in the Roanoke/North Capitol Hill area.

The preferred alternative includes the following elements:

- New regional path along the north side of the floating bridge.
- Grade-separated connection under Montlake Boulevard to the Bill Dawson Trail.
- Reconstruction of the Bill Dawson trail within the SR 520 right-of-way.
- Path along Lake Washington under SR 520 connecting to the Arboretum.
- Improved connection along 24th Avenue East between Shelby Street and Lake Washington Boulevard.
- Widened sidewalk across the second bascule bridge for use as a shared use path.
- Grade-separated crossing of Montlake Boulevard in the vicinity of Husky Stadium.
- Path on the Delmar lid over SR 520.
- Path on the south side of the Roanoke Street bridge over I-5, accompanied by either a new bridge or widening of the existing bridge.

What comments were received?

Comments received during the SDEIS comment period included requests to design bicycle and pedestrian facilities to promote pedestrian, bicycle, and transit use with safe connections for local users.

Suggestions were also made to promote connections to the designated bike routes near the SR 520 corridor.

What issues are we trying to resolve?

Refinements made to the bicycle and pedestrian facilities identified in the preferred alternative were intended to:

- Enhance regional and local connections and corridors in the project area.
- Increase mobility and safety for bicycles and pedestrians.
- Propose improvements to pedestrian and bicycle facilities and amenities, where possible.

Design considerations include the following:

- The Shelby-Hamlin neighborhood with the Canal Reserve and the Roanoke neighborhood are potential historic districts that are covered under Section 106 regulations. Any modifications to streets or landscapes in these districts must address Section 106 constraints.
- The Arboretum and East Montlake Park are parks that are covered by Sections 6(f) and 4(f). Any modifications to these parks beyond those already proposed by the preferred alternative must address Sections 4(f) and 6(f) constraints.
- Lake Washington Boulevard is eligible for listing in the National Register of Historic Places, and Section 4(f) applies to the boulevard as a component of the Montlake Historic District.
- Non-motorized crossings may impact the effectiveness of traffic operations in some locations. Additionally, pedestrian and bicycle crossings must be designed and located with full accessibility in mind.

Addressing the problem

How did we identify possible solutions?

A bicycle/pedestrian subgroup identified bicycle and pedestrian "desire lines," mapped bicycle/pedestrian route options, evaluated the advantages and disadvantages of each route, and established an objective process for selecting the preferred routes. The subgroup was composed of representatives from the Seattle Bicycle Advisory Board, Seattle Pedestrian Advisory Board, Seattle Design Commission, SDOT planners, and urban designers from the SR 520 project team. Route options proposed by the subgroup were presented to the TCT, who endorsed the subgroup's recommendations.

As part of the process, the subgroup developed evaluation criteria to qualitatively assess route characteristics before identifying the preferred routes. The highest priority criteria were safety, connectivity, and capacity.

Safety. All routes have clear signage for wayfinding, indicating decision and/or hazard points; good visibility ahead and outwards from the path; good path conditions; and the absence of

impediments or sudden changes. Points of potential bicycle, pedestrian, and vehicle conflict are eliminated or mitigated with safety features such as signalization and appropriate facilities.

Connectivity. Path users have more than one choice for reaching their destination, each route is without obstacles and barriers, and other bike-pedestrian trails and paths in the system can be reached. The goal of high connectivity is that a cyclist or pedestrian can reach any destination seamlessly without confusion, dismounting or excessive travel in a non-direct route.

Capacity. The network of bicycle and pedestrian paths can accommodate current and future non-motorized traffic volumes. This network comprises a variety of routes that distributes users over a wide area rather than compressing a mixture of user types into a confined area, ensuring that the needs and abilities of all user groups (experienced cyclists, casual cyclists, children, seniors, walkers, and runners, for example) have been addressed. A high capacity network includes efficient multimodal exchange and provisions for future growth.

Recommendations

What did we consider?

The subgroup began with the SR 520 I-5 to Medina preferred alternative as the starting point for their discussion, with the assumption that the preferred alternative would connect to designated primary bike routes in the city. Other assumptions were that the direct route from the second bascule bridge to the Burke Gilman Trail and the point of connection in the Arboretum would be resolved through separate design processes. These assumptions about points of connection established the study area boundary.

The primary goals of the subgroup were to:

- Make a regional connection between the new SR 520 path, across the Montlake Cut, and to the Burke Gilman Trail and the UW campus.
- Retain the local connection between the SR 520 path and Montlake Playfield via the Bill Dawson Trail.
- Create a new connection between the Waterfront Trail and the Arboretum as designated in the Arboretum Master Plan.
- Enhance connections to the north and south through on-street and off-street routes.

The subgroup did not discuss the I-5 crossing at Roanoke Street in great detail, as the design of the intersection is still under development. The City of Seattle will work with the consulting parties through the Section 106 process to identify issues and options for the 10th Avenue East/Roanoke Street channelization, which will influence the layout of an integrated path network in this area.

What are the options presented for TCT consideration?

The subgroup developed a network of primary and secondary bike-pedestrian routes that met the goals listed above (see exhibit 1). A primary route connects to a major destination, such as the University of Washington or the Burke Gilman Trail, or to a major city route. A secondary route is an important link between two primary routes. The options presented to the TCT are briefly described below.

Route 1, Regional Connection. Connects the Seattle terminus of the SR 520 path to the University of Washington and the Burke Gilman Trail. At 24th Avenue where the proposed SR 520 path connects with Seattle streets, two options are recommended for further evaluation:

1. Connect 24th Avenue East on the north side of 520 to a two-way bike boulevard on Shelby Street that would connect to Montlake Boulevard, and/or
2. Widen the sidewalks along Montlake Boulevard between Shelby and Hamlin Streets to at least 10-feet wide. This option could connect the SR 520 path to the second bascule bridge using either the SR 520 corridor and Montlake Boulevard or 24th Avenue and the Shelby/Hamlin one-way couplets.

For either option, an 18' wide path on the east side of the second bascule bridge is recommended. Connections to the Burke Gilman Trail would be provided by wide sidewalks, a bridge over Montlake Boulevard, and a bridge over Pacific Place. These improvements are described in detail in the Montlake Triangle Charrette white paper. Signage and wayfinding should be included to promote the use of this route for the majority of cyclists.

Route 2, Dawson to Downtown. Connects the SR 520 regional path to the Bill Dawson Trail via a tunnel under Montlake Boulevard. Route 2 completes a local connection to Seattle-designated bike routes to Downtown Seattle and Eastlake. The proposal includes ramps on both sides of Montlake Boulevard for bike and pedestrian access between Montlake Boulevard and the Bill Dawson Trail as well as a connection to the SR 520 regional path.

Route 3, Arboretum. A new path that connects the Waterfront Trail along the south side of the Montlake Cut to the Arboretum. The connection (Arboretum Loop Trail Extension) between East Montlake Park and the Arboretum would pass under SR 520 along the shoreline. Currently, no existing path network in the Arboretum—other than Lake Washington Boulevard—would connect to this trail extension, though a separate process is underway that will identify potential opportunities for trail connections.

Route 4, Montlake Boulevard. Improvements to on-street and off-street routes along the west side of Montlake Boulevard. Sidewalk widening between the existing bascule bridge and Roanoke Street would improve the bike and pedestrian access on this side of the roadway. In-street bike use remains challenging due to the turning movements and drop lanes associated with the interchange, but on-street improvements will be evaluated for inclusion in the final design.

Route 5, Transit Link. A suite of recommendations for improving crosswalks in the Montlake Boulevard and Lake Washington Boulevard East intersection. These improvements will enhance the safety of the bicycle/pedestrian crossings between the transit stops and the surrounding neighborhoods, the University of Washington, and recreational facilities on and near the Montlake lid.

Route 6, Montlake Bypass. A cyclist route on 24th Avenue East that connects the University of Washington and Montlake neighborhoods. It is designated as a bike boulevard in the Seattle Bicycle Master Plan. The 24th Avenue East route allows cyclists to avoid 23rd Avenue East and facilitates north-south travel through the Montlake neighborhood.

Route 7, Roanoke Park/North Capitol Hill. A suite of improvements near the 10th and Delmar lid and Roanoke Street. Improvements may include a bike-pedestrian path on the new 10th and Delmar lid, a path connecting the lid to Harvard Avenue and Broadway Street East, the addition of bicycle and pedestrian facilities (either via a separate bridge or widening of the existing bridge) to the south side of the Roanoke Street bridge over I-5, on-street bike lanes on Delmar Drive East, and pedestrian crossings at the intersections in the neighborhood. The City of Seattle will lead the outreach process for bicycle and pedestrian enhancements near I-5 and non-motorized paths on and to/from the 10th and Delmar lid.

Final TCT recommendation

The TCT recommended implementing components of the Montlake bicycle-pedestrian network included in the preferred alternative. They also supported the City of Seattle's anticipated process to identify additional components that may be added to the network in the future.

SR 520 project elements

The preferred alternative includes several components of the recommended Montlake bike-pedestrian network. These include:

Route 1. A minimum 14-foot wide shared use path between SR 520 and the Burke Gilman Trail, including an 18-foot path on the second bascule bridge. The project is assuming the implementation of the Rainier Vista Land Bridge project and a bicycle and pedestrian overcorssing of Montlake Boulevard to provide a connections between the east side of Montlake Boulevard and the Burke Gilman Trail.

Route 2. Connection to an enhanced Bill Dawson Trail via a bicycle/pedestrian-only tunnel under Montlake Boulevard.

Route 3. Arboretum Loop Trail Extension: a new recreational path under SR 520 connecting the Waterfront Trail to the Arboretum.

Route 5. Montlake Boulevard and Lake Washington Boulevard East intersection crossing improvements, jointly developed with City of Seattle.

Route 6. 24th Avenue East across the Montlake lid.

Recommendations to City of Seattle

Several of the recommendations should include input from the City of Seattle and could include community outreach in order to reach decisions for the bike-pedestrian network. These include:

Route 1. Recommend either the Shelby Street two-way bike lanes or Montlake Boulevard sidewalk widening to connect the SR 520 path to the Burke Gilman Trail.

Route 4. Recommend whether sidewalk widening or on-street improvements should be included on the east and west sides of Montlake Boulevard.

Route 7. Conduct further study evaluating additional pedestrian and bicycle crossings and pathways (incluidng in-street bike lanes) as well as traffic operations in the Roanoke Park/North Capitol Hill area.

Moving the recommendations forward

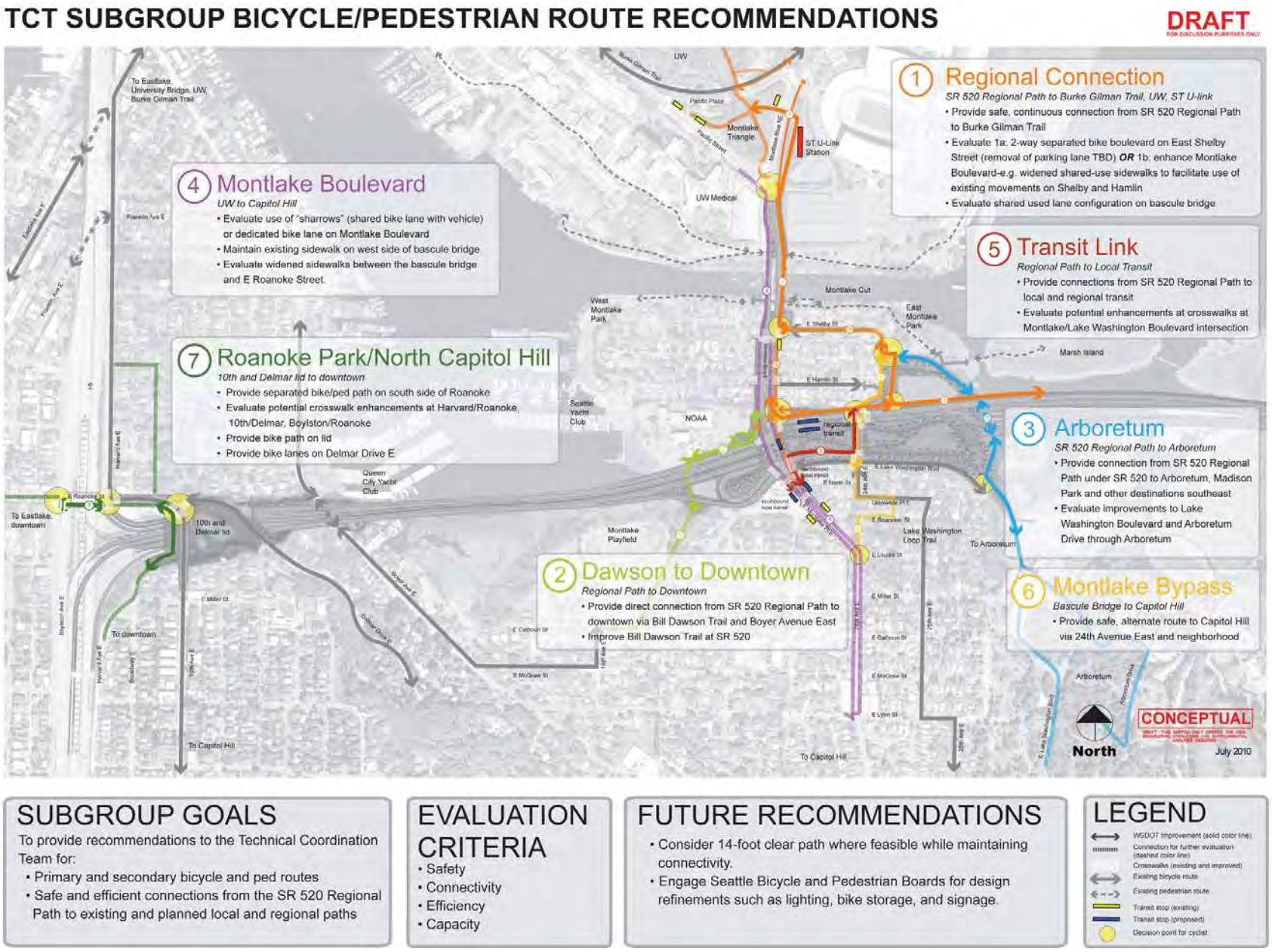
WSDOT is currently working with the Arboretum and Botanical Garden Committee (ABGC) to address a number of bike-pedestrian concerns, including continuation of the Arboretum trail system.

WSDOT will continue to include the Seattle Bicycle Advisory Board and Seattle Pedestrian Advisory Board in decision-informing discussions about bicycle and pedestrian designs and inclusion of amenities. As the SR 520 project moves toward construction, WSDOT will develop a process to work with the boards to identify and refine construction routing options.

WSDOT will also work with the boards and the Seattle Design Commission (SDC) to develop an aesthetic vision and goals for Seattle urban design and streetscapes within the project area. This collaboration will be accompanied by a public process, and WSDOT would document the results of both as a set of urban design guidelines that would inform and direct the final design details for the bike and pedestrian routes.

City of Seattle will inform WSDOT of the results of conversations with the Montlake, Roanoke/Portage Bay, and North Capitol Hill neighborhoods regarding path design and connectivity. The project would take no actions that would preclude future City of Seattle actions.

Exhibit 1. TCT bicycle/pedestrian route recommendations.



Arboretum: Traffic Calming

Introduction

How was traffic calming in the Arboretum addressed in the preferred alternative?

As part of ESSB 6392, both the Washington State Department of Transportation (WSDOT) and the Seattle Department of Transportation (SDOT) have been working with the Arboretum and Botanical Garden Committee (ABGC) to develop measures than can be implemented to reduce speed and "calm" traffic travelling through the Arboretum. While traffic calming along Lake Washington Boulevard in the Arboretum is not directly addressed in the preferred alternative for the SR 520 I-5 to Medina project, SDOT has developed a traffic calming plan that improves the environment for pedestrians and bicyclists in the Arboretum.

What comments were received?

WSDOT and SDOT received comments from ABGC expressing concern about the speed of vehicular traffic through the Arboretum and potential risks to the safety of pedestrians and bicycles in the park. ABGC identified specific focus areas along Lake Washington Boulevard where pedestrian activity is highest, and SDOT identified segments along the corridor where the speed of vehicles is greatest. ABGC also has concerns regarding the aesthetic impact of traffic calming features in the park. ABGC is interested in moving forward with implementation of a traffic calming plan in the Arboretum in the near term, prior to construction of the SR 520 I-5 to Medina project.

Addressing the problem

How did we identify possible solutions?

SDOT worked with the Seattle Parks Department and ABGC to review pedestrian conditions and develop recommendations for pedestrian and traffic calming improvements on Lake Washington Boulevard between East Madison Street and Foster Island Road.

Review of the existing conditions included analyzing available data regarding traffic speeds through the Arboretum, field observations (including a walking tour with ABGC representatives), and feedback received from ABGC regarding current and future pedestrian conditions on the corridor.

Knowledge of the existing conditions informed SDOT's development of a preliminary traffic calming plan along Lake Washington Boulevard, which was presented to ABGC on August 18, 2010 for comment. As part of the ESSB 6392 work group and mitigation processes, SDOT and WSDOT are meeting regularly with ABGC to finalize details of the traffic calming plan, among other SR 520-related refinements.

Recommendations

What did we consider?

A comprehensive suite of measures were considered to aid in calming traffic through the Arboretum,

with a focus on elements that improve safety conditions for pedestrian and bicycles and are effective in reducing vehicle speed.

SDOT and WSDOT are currently working with ABGC to finalize the details of the traffic calming plan for Lake Washington Boulevard. Below is a table that contains a preliminary list and description of the proposed elements. This list may be refined as discussions with ABGC continue.

Item	Location	Purpose
Pedestrian Improvements		
Marked Crosswalk	North of Interlaken Drive	Provide visibility at high usage pedestrian area
Marked Crosswalk	At Arboretum Drive	Provide visibility at high usage pedestrian area
Traffic Calming Improvements		
Radar Speed Sign	Southbound, south of Foster Island Road	Educate drivers; reduce southbound speeds through Arboretum
Radar Speed Sign	Northbound, north of E Madison Street	Educate drivers; reduce northbound speeds through Arboretum, particularly approaching high pedestrian activity area
Raised Crosswalk	North of Interlaken Drive at new marked crosswalk	Provide traffic calming; improve pedestrian visibility at new crosswalk proposed above
Speed Cushions (2)	TBD	Reduce vehicular speeds on corridor
Landscaped Curb Bulb	Southeast corner, Lake Wash Boulevard at Foster Island Road	Reduce northbound vehicle speed, particularly for turning traffic approaching intersection, to increase pedestrian safety; provide southbound “gateway” into Arboretum
Sign Improvements	Minor improvements to existing traffic signs	Improve clarity and message of existing traffic warnings on the corridor

In discussions with ABGC on August 18, 2010, the committee recommended that SDOT also implement a pedestrian-activated signal at Arboretum Drive and mark a crosswalk on Interlaken Drive. ABGC would also like SDOT to investigate the possibility of improving the intersection of Foster Island Road and Lake Washington Boulevard. Additional comments from ABGC will be incorporated into the traffic calming plan as work continues throughout fall 2010.

Final TCT recommendation

The Technical Coordination Team (TCT) supports the coordination efforts that have been made thus far between SDOT, WSDOT, and ABGC to identify proposed traffic calming strategies in the Arboretum. Elements of a preliminary traffic calming plan along Lake Washington Boulevard have been presented to the TCT on several occasions; the TCT recommends that SDOT finalize the proposal for a traffic calming plan with ABGC. Proposed elements of the plan include marked crosswalks, radar speed signs, speed cushions, sign improvements, landscaped curb bulbs, and raised crosswalks.

Arboretum: Traffic Management

Introduction

How was traffic management in the Arboretum addressed in the preferred alternative?

As part of ESSB 6392, both the Washington State Department of Transportation (WSDOT) and the Seattle Department of Transportation (SDOT) have been working with the Arboretum and Botanical Garden Committee (ABGC) to evaluate measures that would reduce the total number of automobile trips along Lake Washington Boulevard through the Arboretum. While traffic management in the Arboretum is not directly addressed in the preferred alternative for the SR 520 I-5 to Medina project, efforts are underway to evaluate options that may reduce traffic in the Arboretum and to develop a comprehensive traffic management plan for the Arboretum.

What comments were received?

WSDOT and SDOT received comments from ABGC stating their desire to reduce the volume of vehicular traffic travelling through the Arboretum, specifically traffic using the Arboretum to access SR 520. ABGC feels strongly that Lake Washington Boulevard should not function as a typical City arterial, but rather as a park boulevard. Lake Washington Boulevard has a dual City of Seattle roadway classification, as both a minor arterial and a park boulevard.

ABGC supports a traffic management approach that strongly discourages, or prohibits, "non-local" traffic from using Lake Washington Boulevard to access SR 520. Though the Preferred Alternative removes the ramps that currently connect directly to and from Lake Washington Boulevard, traffic may still access SR 520 via Lake Washington Boulevard by continuing to the Montlake interchange. Additionally, vehicles exiting SR 520 still have the option of accessing Lake Washington Boulevard via 24th Avenue.

Addressing the problem

How did we identify possible solutions?

Before identifying possible solutions to traffic management, the Technical Coordination Team established a preliminary list of goals for traffic management and traffic calming in the Arboretum. WSDOT and SDOT presented these goals to ABGC and conducted several brainstorming sessions to refine the list of goals. The goals fall into four categories: managing traffic, increasing safety, increasing visitor use, and maintaining the character of the Arboretum. On August 18, ABGC confirmed the following list of goals:

- Reduce the total number of vehicle trips through the Arboretum.
- Reduce vehicle speeds through the Arboretum.
- Increase vehicle, bicycle, and pedestrian safety.
- Increase bicycle and pedestrian use in the Arboretum.
- Increase visitor use in the park.

- Maintain existing character of the Arboretum.
- Reduce vehicle-generated noise on Lake Washington Boulevard in the Arboretum area.
- Reduce pollution and improve air quality.
- Reduce queue lengths in the Arboretum.

To inform the evaluation of traffic management techniques, WSDOT provided the following information to ABGC and SDOT. Historical average daily trip (ADT) data available from the City of Seattle for 23rd Avenue and Lake Washington Boulevard was charted for the years 1996 to 2008. There was no data for the year 2007, so that has been estimated for the chart shown in exhibit 1. This chart illustrates a substantial decrease in traffic on Lake Washington Boulevard in 2006 that was accompanied by an increase in traffic on 23rd Avenue. The current traffic volume on Lake Washington Boulevard through the Arboretum is approximately 18,000 ADT. Approximately 50% of these trips are vehicles that cross Lake Washington via SR 520 and 10% are accessing SR 520 westbound to I-5. The remaining 40%, or about 7,000 vehicles, are local trips not accessing SR 520.

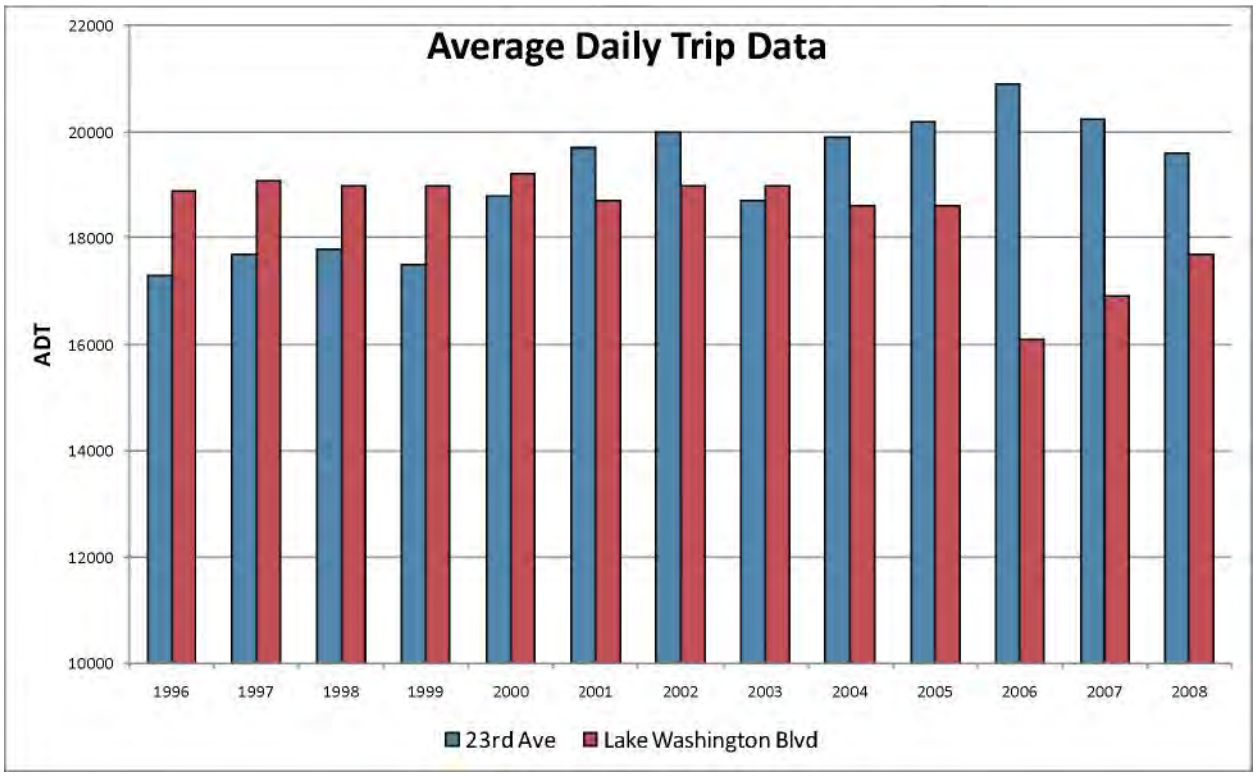


Exhibit 1. Average daily trip data for Lake Washington Boulevard and 23rd Avenue

In 2030, under the "No Build" scenario, ADT are estimated to increase to 22,500 (25%) due to population and employment growth in the area. With construction of the preferred alternative, ADT in 2030 are estimated at 20,000, which would be a 10-15% reduction over the No Build scenario.

In 2010, WSDOT conducted a license plate survey of traffic using the Lake Washington Boulevard ramps to SR 520. Review of the survey results and turning movement data illustrate that over 90% of traffic using the Lake Washington Boulevard ramps in the morning originates from the neighborhoods near the Arboretum,

with only 5 to 10% of the traffic associated with downtown Seattle. During the morning commute, 50% of vehicles using the eastbound on-ramp to SR 520 originate from neighborhoods south of Madison Park, with the next highest use (25%) from the Madison Park neighborhood.

During the evening commute the results are similar; however, the number of trips to/from downtown Seattle increase compared to the morning commute. The traffic between the SR 520 corridor and downtown Seattle increases by approximately 40 vehicles per hour (total in both directions). During the evening commute period, 50 to 65% of vehicles using the SR 520 ramps are associated with areas south of Madison Park and directly to/from Madison Park.

Recommendations

What did we consider?

WSDOT and SDOT are currently evaluating a comprehensive suite of traffic management measures intended to reduce traffic through the Arboretum, with a focus on elements that discourage vehicles from using Lake Washington Boulevard as a means to access SR 520. Below is a preliminary list of options for evaluation that has been developed in collaboration with ABGC.

Traffic management options to be considered:

- Intersection control modifications (including signal timing at Madison/23rd Avenue).
- Occupancy minimums.
- Time-based restrictions (both time of day and day of week).
- Turning restrictions.
- Signing revisions.
- Tolling.

Details regarding and evaluation of the above will be refined through continued coordination with ABGC.

Peak hour turning movement restrictions were evaluated for the intersection of 24th Ave and Lake Washington Boulevard. Effects of this option on local traffic operations were estimated using preliminary traffic forecasts from the SDEIS traffic data. Approximately 480 vehicles per hour are estimated to turn left from 24th Avenue East to East Lake Washington Boulevard during the PM peak.

If the southbound left turn movement was restricted, traffic would turn right onto Lake Washington Boulevard and then turn left onto Montlake Boulevard. The Montlake Boulevard/Lake Washington Boulevard intersection operates with a volume to capacity ratio of nearly 1.0, so the intersection could not accommodate any additional traffic. Adding traffic volume to the westbound left without adding new lanes would result in a volume to capacity ratio over 1.2, with 20% more cars at the intersection than could be accommodated at the traffic signal. Substantial congestion would result along Lake Washington Boulevard and on Montlake Boulevard, with transit travel times along Montlake Boulevard

similar to a No Build configuration (~ 45 minutes) instead of the 7 minutes estimated in the preferred alternative configuration.

To accommodate the added traffic volumes, an additional westbound left turn lane (from Lake Washington Boulevard onto Montlake Boulevard) and northbound through lane (on Montlake Boulevard) would be required. The northbound through lane would be needed to provide added capacity for the movement that is in conflict with the westbound left turn. With these lane additions, the volume to capacity ratio is near that in the Preferred Alternative. An additional 12 feet of width would be required along Lake Washington Boulevard between 24th Avenue and Montlake Boulevard, and along Montlake Boulevard between East McGraw Street and East Hamlin Street.

The workgroup recommends maintaining the left turn movement between 24th Avenue and Lake Washington Boulevard for the following reasons:

- Even with the left turn open, traffic through the Arboretum would be less than a No Build configuration.
- Widening Montlake Boulevard and Lake Washington Boulevard would introduce more affects on adjacent property.
- Further traffic management strategies could be pursued to achieve lower traffic volumes through the Arboretum.
    - Continued coordination between the City of Seattle, WSDOT, and the Arboretum and Botanical Garden Committee will be necessary to determine if time of day restrictions for the turning movement could be considered in the future.

WSDOT and SDOT support ABGC in developing traffic management strategies that reduce traffic in the Arboretum. The questions of how traffic is diverted, where diverted traffic might go, and what impacts could (if any) result from the removal of traffic from Lake Washington Boulevard will continue to be evaluated.

Final TCT recommendation

The Technical Coordination Team (TCT) supports the coordination efforts that have been made thus far between WSDOT, SDOT, and ABGC to identify traffic management strategies for the Arboretum. The TCT supports ABGC's goal to reduce traffic in the Arboretum, but is particularly concerned about adverse impacts to transit speed and reliability on 23rd Avenue and Montlake Boulevard. It is the recommendation of the TCT that WSDOT, SDOT, and ABGC continue to coordinate on the evaluation of traffic management options that will form the basis of a comprehensive traffic management plan for the Arboretum, including the TCT recommendation to maintain the left turn movement on the edge of the Montlake lid from 24th Avenue to eastbound Lake Washington Boulevard.

Neighborhood Traffic Management

Introduction

How was neighborhood traffic management addressed in the preferred alternative?

The SR 520 I-5 to Medina preferred alternative removed the existing Lake Washington Boulevard ramps, which changes the way that vehicles will travel to and from the SR 520 corridor. Traffic modeling predicts these changes will not result in significant changes to city streets, but there are still concerns from neighborhood groups about potential adverse impacts due to increased traffic volumes.

Addressing the problem

What comments did we receive?

Comments on the SDEIS from the Seattle City Council, the Mayor of Seattle, and community members indicated a desire for additional analysis regarding traffic impacts of the preferred alternative on City of Seattle streets. The City's elected officials and the public identified a number of streets for further evaluation.

How did we identify possible solutions?

The Seattle Department of Transportation (SDOT) developed a series of recommendations related to neighborhood traffic management and presented them to the Technical Coordination Team (TCT) for consideration.

Recommendations

What did we consider?

SDOT developed several process recommendations for moving forward with neighborhood traffic management. Given the timing of the ESSB 6392 workgroup effort relative to the Final Environmental Impact Statement (FEIS) and design efforts, the development of concrete neighborhood traffic management opportunities is premature.

Final TCT recommendation

The TCT supported the following recommendations:

- Evaluate potential traffic management opportunities on local streets after the FEIS is published.
- Allow the SR 520 project to move forward with the current forecast assumptions for City of Seattle arterials.
- Coordinate with existing and planned SDOT efforts and private development efforts related to traffic management in the project area.

- Develop an intelligent transportation system (ITS) plan for Montlake Boulevard and 23rd Avenue.
- Establish a schedule for ownership and implementation of traffic management opportunities in the first quarter of 2012. This schedule will provide time for review of updated traffic modeling included in the FEIS and will allow early evaluation of the impacts of tolling the SR 520 corridor on local traffic patterns.

Second Bascule Bridge Phasing

Introduction

How was phasing of the second bascule bridge addressed in the preferred alternative?

The SR 520 I-5 to Medina preferred alternative included a second bascule bridge across the Montlake Cut to the east of the existing bascule bridge. This second bascule bridge will improve traffic operations on Montlake Boulevard, increasing speed and reliability of both local and regional bus service. The new bridge also features an 18-foot pedestrian/bicycle path on the east side, as recommended by the ESSB 6392 Workgroup. In order to construct the second bascule bridge, WSDOT must acquire two residential properties at the corner of Montlake Boulevard and Shelby Street.

What comments were received?

The SDEIS proposed a construction timeline for the bascule bridge of 2016 to 2018. The Seattle City Council expressed concern about the timing of and need for the second bascule bridge, particularly in the context of impacts to adjacent property owners. The Council asked WSDOT to consider transportation demand management and other traffic management measures that might postpone the need for the bridge.

Addressing the problem

How did we identify possible solutions?

A subgroup of the Technical Coordination Team (TCT) was formed to identify approaches to phase construction of the second bascule bridge. The subgroup included participants from WSDOT, SDOT, and the Seattle City Council. The subgroup reviewed interim channelization plans for the corridor as well as a VISSIM model that illustrated the preferred alternative without the second bascule bridge. Due, in part, to this information, the subgroup recognized the need for the second bascule bridge and began to explore “triggers” that would more clearly signal the need to construct the bridge.

Recommendations

What did we consider?

The subgroup recognized that transit service reliability on Montlake Boulevard is poor today and that traffic operations will degrade in the future if traffic volumes increase as forecast. The subgroup acknowledged the difficulties of predicting changes in traffic volumes along this corridor after tolling begins on SR 520 in 2011. In addition, the volume of pedestrians and bicyclists crossing the Montlake Cut is expected to increase with the completion of the regional path across SR 520 in 2014 and the opening of the University Link UW station at Husky Stadium in 2016.

The subgroup brainstormed ideas related to the phasing of the second bascule bridge, which fell into two main categories:

1. Level of service measures that could trigger construction of the bridge.
2. Interim traffic management opportunities that may delay the onset of the triggers.

Level of service measures considered by the subgroup included:

- Transit travel times for both local and regional bus service.
- Pedestrian and bicycle levels of service across the Montlake Cut.
- General purpose travel times between Pacific Street and SR 520.
- Queue lengths on Montlake Boulevard north of the Montlake Cut.
- Cumulative passenger delay for transit riders.

Interim traffic management opportunities considered by the subgroup included:

- Implementing an intelligent transportation systems (ITS) program on Montlake Boulevard north of 45th Street.
- Installing transit priority treatments to key intersections on Montlake Boulevard.
- Extending the existing transit queue jumps.

Ultimately, the subgroup agreed to recommend two triggers to TCT: one related to transit travel times, and one related to pedestrian and bicycle levels of service across the Montlake Cut. The subgroup determined that these triggers best related to the core purposes for building the second bascule bridge and would be relatively easy to monitor over time. The subgroup also recommended moving forward with interim traffic management opportunities, as funding allows.

The subgroup presented these recommendations to TCT and led a discussion about phasing in general and triggers specifically. TCT recommended adding a third trigger related to SR 520 operations to ensure that traffic does not back up onto SR 520 from Montlake Boulevard. Additionally, TCT members expressed interest in helping to set the specific trigger thresholds and recommended that a committee be established to complete this work.

In addition to recommendations about phasing the bridge, the subgroup developed a recommended interim channelization for Montlake Boulevard for the period following construction of the floating bridge and west approach but prior to construction of the second bascule bridge. Two options for interim channelization were considered:

- Restriping the existing bascule bridge with an HOV lane in each direction (1 general purpose and 1 HOV lane in each direction).
- Maintaining the current striping on the existing bascule bridge (2 general purpose lanes in each direction).

After reviewing a VISSIM model showing the existing bridge with an HOV lane in each direction and exploring the challenges related to channelizing HOV lanes in the corridor with such a configuration, the subgroup determined that this option would have significant negative impacts on traffic and transit

operations along Montlake Boulevard and SR 520.

The second option for interim channelization maintains the current striping on the existing bascule bridge and implements transit priority treatments at Shelby Street (northbound) and Pacific Street (southbound) to ensure reliable transit operations (see exhibit 1). Additionally, the HOV receiving lane on northbound Montlake Boulevard plays a significant role in ensuring regional transit reliability for vehicles exiting SR 520 via the direct access ramps. Following discussion of both options, TCT concurred with the subgroup's recommendation to maintain the current striping and implement transit priority treatments.

Final TCT recommendation

The TCT recommends the following, based on the work of the subgroup and subsequent discussion:

- Include the second bascule bridge in the SR 520 FEIS.
- Establish three separate metrics to trigger the construction of the second bascule bridge. These triggers should be related to transit travel time, pedestrian and bicycle levels of service, and SR 520 operations.
- Identify opportunities for traffic management that may delay the onset of these triggers.
- Establish a committee that includes WSDOT, SDOT, Seattle City Council, King County Metro, Sound Transit, and University of Washington to identify the exact triggers/metrics and the next steps for implementation in the measurement of these triggers/metrics.
- Prior to construction of the second bascule bridge, maintain the channelization and striping across the existing bridge and implement transit priority treatments.

Exhibit 1. Channelization without the second bascule bridge.

Corridor Management Plan

Introduction

This white paper is a brief introduction to WSDOT's approach to managing urban freeway corridors such as SR 520, HOV lane performance standards and monitoring efforts, and the future of each as part of the new SR 520 corridor.

How was a corridor management plan addressed in the preferred alternative?

The SR 520 I-5 to Medina preferred alternative includes a variety of corridor management strategies, all designed to reduce collisions and congestion.

In ESSB 6392, the Washington State Legislature mandated the tolling authority to set a variable schedule of toll rates on SR 520, intended to maintain travel time, speed, and reliability on the SR 520 corridor and generate the necessary revenue for the project. The Legislature also mandated that high occupancy vehicle (HOV) lanes on SR 520 will require a minimum occupancy of three-plus persons. The Legislature further asked WSDOT to report when average transit speeds in the two HOV lanes fall below 45 miles per hour at least 10 percent of the time during peak hours.

What comments were received?

Comments from the Seattle City Council supported the Legislature's mandate, requesting development and implementation of "a corridor management plan that includes minimum performance standards for transit/HOV and general purpose lanes with triggers for mandatory actions to maintain those standards." The Seattle City Council requested that if minimum performance standards are not met in the transit/HOV lanes, mandatory triggers should be in place to increase the minimum number of passengers per vehicle in the HOV lanes, or consider conversion of the HOV lanes to transit-only lanes. The Council also recommended that performance management standards be developed for general purpose lanes on SR 520, including the potential use of variable tolling along the entire corridor to allow increasing toll rates to achieve specific performance standards for general purpose lanes as well as transit/HOV lanes.

Addressing the problem

How will we identify possible solutions?

WSDOT developed corridor management recommendations based on existing strategies for managing urban freeways. These strategies were presented to the Technical Coordination Team (TCT) for discussion.

Recommendations

What did we consider?

WSDOT deploys a variety of strategies to manage urban freeways with the goals of reducing collisions and congestion both in the general purpose lanes and HOV lanes. The intensity with which these strategies are deployed increases with the level of traffic demand on each facility so that WSDOT can increase the system "up time" (i.e., maintain travel speeds and avoid collisions). Today on the SR 520 corridor, WSDOT deploys the full suite of strategies, with the newest strategies of variable speed limits and lane control coming on-line in the latter part of 2010.

What are the options presented for TCT consideration?

Incident Response Teams. One of the longest running strategies deployed on SR 520 is WSDOT's Incident Response Teams (IRT). IRT service reduces the time lanes are blocked due to motorists running out of gas or having a flat tire, or due to collisions. This effort began in the 1980s with tow trucks stationed at the ends of the floating bridge during the peak rush hours and has since expanded, both with regard to the miles of SR 520 covered and the duration of coverage. WSDOT now has roving vehicles throughout most of the day covering SR 520 from I-5 to SR 202 and this service is expected to continue on the new SR 520 corridor.

Intelligent Transportation Systems. Another long-running set of strategies deployed on SR 520 are ramp meters, message signs, and cameras, collectively known as Intelligent Transportation Systems (ITS). These devices help maintain travel speeds by smoothing out merges at on-ramps and managing traffic demand by providing information to the public about lane blockages or congested conditions. This information helps the public make more-informed travel decisions and reduces the vehicle traffic demand on SR 520. The next evolution in ITS deployment on SR 520 will be the introduction of variable speed limits and lane control signs, currently branded as Smarter Highways. Together these applications will reduce the frequency and duration of collisions, which in turn will help maintain travel speeds. All of these traffic management applications will continue to be deployed on the new SR 520 corridor.

Electronic tolling. In Spring 2011 electronic tolling will begin on the SR 520 floating bridge. WSDOT secured funding for the toll systems through the USDOT's Urban Partnership program. Per that agreement with USDOT, WSDOT is to implement "variable pricing (based on the level of demand) on all through lanes of SR 520 between I-5 and I-405 and, to the extent necessary to maintain free flow traffic in the through-lanes, on all collectors and distributors for SR 520 between I-5 and I-405." The definition of free flow has been defined by USDOT to mean "speeds at or above 45 miles per hour at least 90 percent of the time during peak hours and generate funding without significantly altering the performance of nearby facilities". As stated in ESSB 6392, tolls are to be implemented on the floating bridge and rates are to be set with a variable schedule to maintain travel speeds and reliability while also generating revenue for the bridge replacement project.

The Transportation Commission is the toll setting authority for the state and they are currently in the process of establishing the initial toll rates schedule. Per ESSB 6392, the commission will, at least annually, review the performance of the corridor with tolls as well as the revenue generated and adjust toll rates as necessary to meet the legislative requirements. At this time, the commission's rate setting action is for tolls on the floating bridge only; implementation of tolls elsewhere on the SR 520 corridor would require additional legislative action.

With the start of tolling in 2011, WSDOT will be monitoring traffic flows on SR 520 and other freeways and local roads, transit travel times and ridership, user feedback, etc., to understand how the system is performing and whether any adjustments are appropriate. WSDOT will be reporting frequently to the legislature, the Transportation Commission, interested local jurisdictions, and the public about system performance. In addition, USDOT will be conducting its own study of before and after conditions as part of the Urban Partnership Agreement.

HOV lane performance standards. WSDOT has an established HOV lane performance standard to ensure the freeway HOV system helps provide reliable travel time and dependability for transit users, vanpoolers, and carpoolers. The established performance standard is that a driver in an HOV lane should be able to maintain an average speed of 45 mph or greater at least 90% of the time during the morning and afternoon peak hours. WSDOT monitors speed and reliability of the HOV system, by corridor, throughout the year and reports on it at least annually in WSDOT's Gray Notebook of performance reporting (see http://www.wsdot.wa.gov/Accountability/GrayNotebook).

The Seattle City Council recommended a performance standard of 45 mph at least 95% of the time, which is higher than the currently established standard and the standard referenced in ESSB 6392. WSDOT recommends continuing with the current performance standard of 45 mph at least 90% of the time as it is the one used for all other corridors in the state and matches federal policy.

The Seattle City Council also recommended that mandatory triggers be established by the Legislature to (a) raise the occupancy requirement or (b) convert transit/HOV lanes to transit-only lanes in order to meet the performance standard. WSDOT recommends against specific mandatory triggers because any changes to the HOV lanes on SR 520 must necessarily be considered in the context of the effect on general purpose travel lanes, tolling operations, and the rest of the regional freeway system. Additionally, the cause of subpar lane performance may be temporary in nature (for example construction on a related roadway) or the best remedy may be actions other than raising the occupancy requirement (for example further increasing incident response or increasing violation enforcement).

Transportation Demand Management (TDM). WSDOT employs additional strategies that increase the carrying capacity of the corridor during its busiest times. These strategies consist of enabling greater use of carpooling and transit, shifting trips outside of rush hours, shifting trips to a non-motorized mode, or eliminating the need for a trip altogether. Examples include

RideshareOnline, public vanpool programs and Growth and Transportation Efficiency Centers (GTECs). WSDOT partners with local governments, transit agencies, and businesses throughout the region to implement these existing strategies, as well as implementing emerging strategies such as flexible carpooling (sometimes known as "slugging") that will be pilot tested on the SR 520 corridor.

Final TCT recommendation

The TCT supports WSDOT's strategies for traffic management in the new SR 520 corridor. These strategies, including continuous HOV lanes from I-5 to SR 202, variable tolling, continued use of traffic management applications such as ramp meters, variable speed limits, and lane control, as well as companion incident response services and enforcement, should result in a corridor that is well positioned to meet the established HOV lane performance standards and corridor performance expectations expressed by the legislature and Seattle City Council. Additional legislation concerning corridor management, beyond what is currently included in ESSB 6392 for HOV lane occupancy, HOV lane performance and variable toll rates, is not recommended for further action.

Roadway Operations: Portage Bay Bridge Managed Shoulder

Introduction

How were Portage Bay Bridge managed shoulder operations addressed in the preferred alternative?

The preferred alternative defined a westbound managed shoulder lane across Portage Bay Bridge, from the Montlake Boulevard/SR 520 interchange to the I-5/SR 520 interchange. This lane provides the same benefit as an auxiliary lane while minimizing the width of Portage Bay Bridge.

What comments were received?

Through the mediation process, the SR 520 program transportation team identified the need for a westbound auxiliary lane between the Montlake Boulevard/SR 520 interchange and the I-5/SR 520 interchange across the Portage Bay Bridge. This auxiliary lane is needed to provide capacity for safe merging of traffic across Portage Bay Bridge and to ensure traffic operations are not severely congested during peak periods. Without the auxiliary lane, congestion would extend back from the Portage Bay Bridge onto the local street system and adversely affect transit travel times, speed, and reliability.

Many SDEIS comments requested narrowing the width of the Portage Bay Bridge. In an effort to address these concerns about width while ensuring the design does not adversely affect traffic operations, the preferred alternative defined a westbound managed shoulder lane across Portage Bay Bridge. This lane provides the same benefit as an auxiliary lane while minimizing the width of Portage Bay Bridge.

In response to comments received on the work plan for the ESSB 6392 Design Refinements and Transit Connections Workgroup, this white paper explains the function of the westbound managed shoulder lane.

Addressing the problem

What did we consider?

The westbound shoulder of the Portage Bay Bridge, beginning at the Montlake on-ramp and extending to the Harvard off-ramp, would operate as a lane open to traffic entering and exiting SR 520 during peak hours. When operational, the lane would include a 12-foot traffic lane with a 2-foot shoulder. In off-peak hours, the lane would be a 14-foot wide shoulder closed to traffic. Exhibit 1 represents the layout of the lane in plan view.

Exhibit 1 - Portage Bay Bridge with a shoulder auxiliary lane

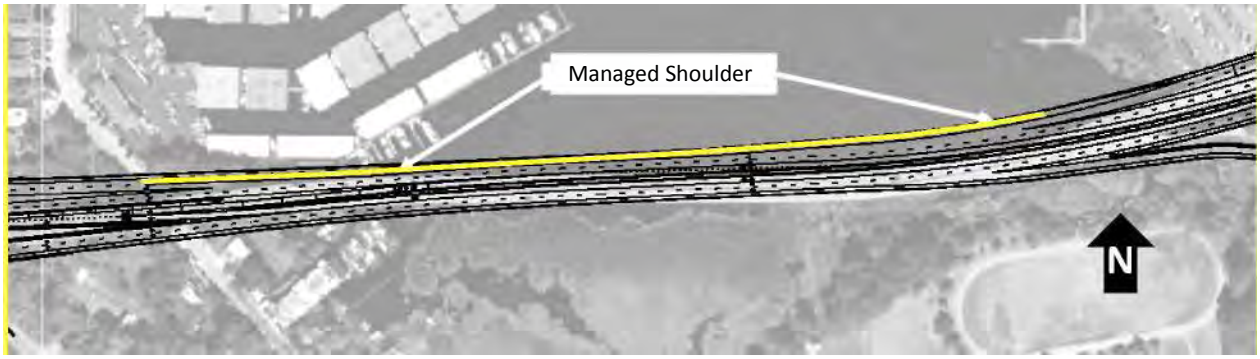
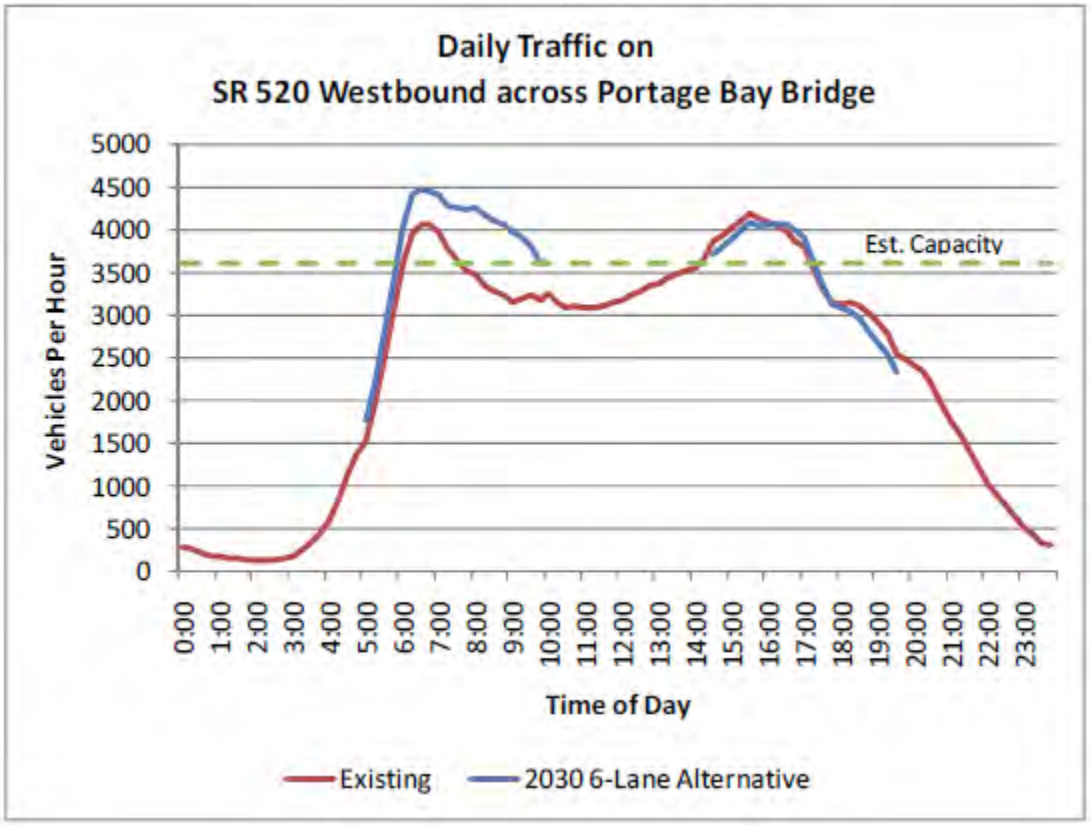


Exhibit 2 depicts traffic volumes for SR 520 westbound across Portage Bay Bridge in the year 2030 with the preferred alternative. The auxiliary lane would be in operation whenever demand exceeds capacity, and Exhibit 2 illustrates possible time periods when the managed shoulder auxiliary lane would be operational. Staff at WSDOT's Northwest Region Traffic Systems Management Center would review traffic operations on the Portage Bay Bridge to determine when to open the managed shoulder lane to traffic. This may occur dynamically based on real-time operating conditions. Active traffic management (ATM) signs would be used to designate if the lane is open (green arrow) or closed (red x).

Exhibit 2 -Daily traffic volumes across Portage Bay Bridge westbound SR 520



What are the options presented for TCT consideration?

Two options were considered: 1) no auxiliary lane and 2) provide an auxiliary lane.

Operations analysis was performed to determine how the two options would operate. Results illustrated in Exhibit 3 show that without an auxiliary lane on the westbound Portage Bay Bridge, traffic congestion would affect drivers on SR 520 and on Montlake Boulevard. This would adversely affect transit travel times and reliability. Transit travel times without an auxiliary lane were 55% greater than if the auxiliary lane is included in the design.

Final TCT recommendation

The Technical Coordination Team (TCT) recommends the westbound managed shoulder be included as described in the preferred alternative. This shoulder provides the function of an auxiliary lane by using the westbound shoulder to maintain acceptable traffic operations during the peak commute periods, special events, and for accident management. It also allows for a narrower footprint for the Portage Bay Bridge and maintains traffic operations on both the freeway and local system when needed to help relieve congestion.

Exhibit 3 – Year 2030 6-Lane Alternative, Traffic Operations with and without a Westbound SR 520 auxiliary lane

Roadway Operations: I-5 Express Lanes

Introduction

How were the operations of the I-5 express lanes addressed in the preferred alternative?

This document addresses the transit/HOV direct access ramp connection between SR 520 and the I-5 interchange included in the SR 520 I-5 to Medina preferred alternative. A direct access ramp will connect from the westbound SR 520 transit/HOV lane to the southbound I-5 express lanes during the morning periods of express lane operations. During the evening period of express lane operations, the direct access ramp will connect northbound I-5 express lanes to the eastbound SR 520 transit/HOV lane. The addition of a direct access on/off-ramp just south of the SR 520 interchange is necessary for this configuration, and would require design modifications to the express lanes. The preferred alternative will reduce the express lanes by one lane width just north of the I-5/SR 520 interchange to provide space for the single new transit/HOV direct access ramp to/from SR 520.

What comments were received?

The express ramp connection was included as part of all options evaluated in the SDEIS and was included an element in the preferred alternative. The project team received comments on the SDEIS that requested additional information on the operations of the I-5 express lanes with the project, in part to determine if the value added by the express ramp connection is enough to warrant construction. Comments on the SDEIS also included a desire to provide for additional on/off access to the express lanes north of 520 and to modify I-5 to ensure safe merging from SR 520 to the I-5 Mercer Street exit.

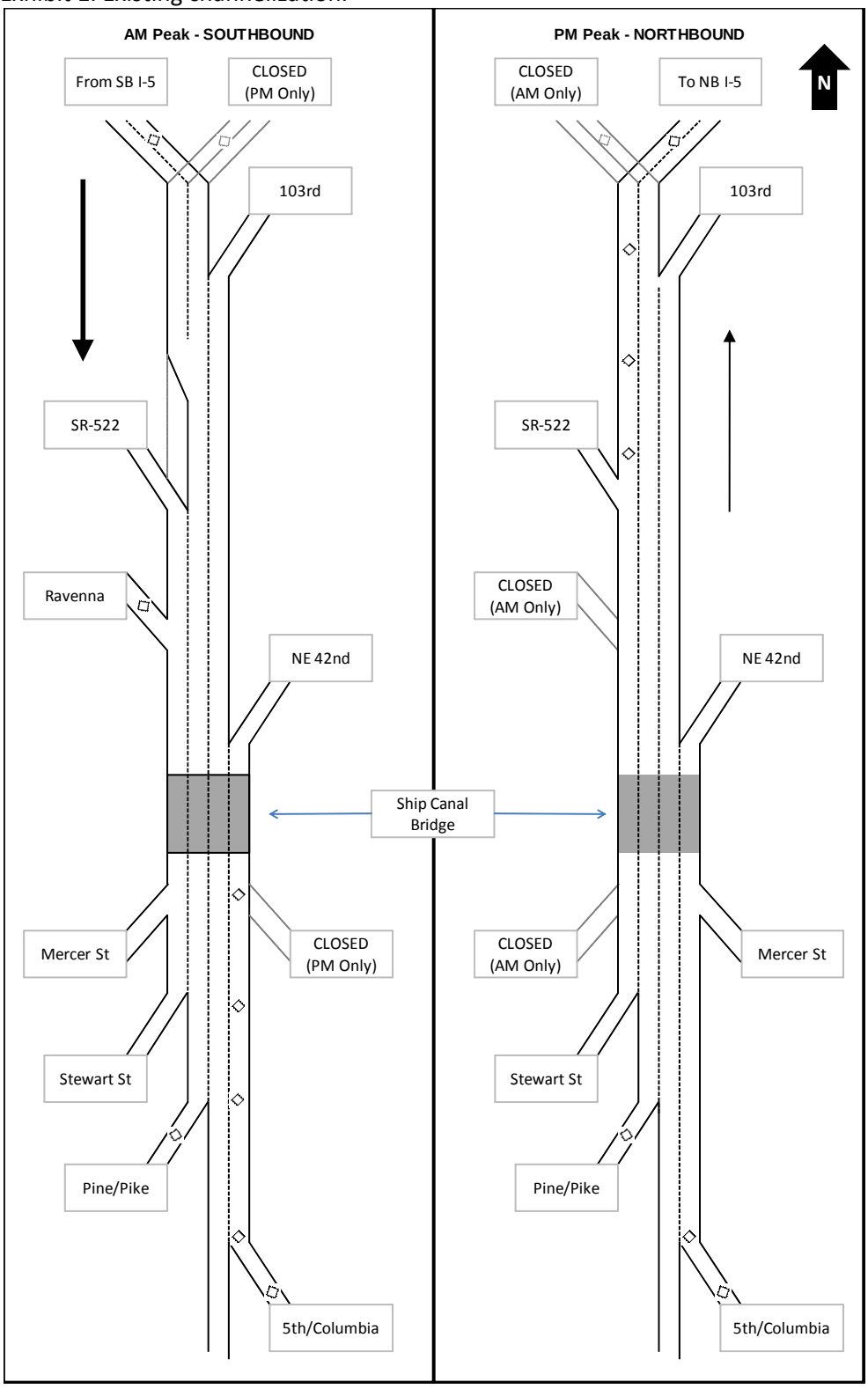
What issues are we trying to resolve?

The following summarizes the operations of the I-5 express lanes today, and in the year 2030 with the No Build and 6-Lane alternative. The operations referenced in this document are from the SDEIS analysis. The data reported for the 6-Lane alternative is Option A with the Lake Washington Boulevard ramps open (Option A+ through the Legislative Workgroup). For the purposes of this white paper, this option is most similar through the I-5 interchange to the preferred alternative as it is currently defined. I-5 express lane analysis will be updated for the preferred alternative and will be included in the Transportation discipline report of the FEIS.

<u>Existing conditions</u>

The reversible express lanes on I-5 operate southbound in the morning and northbound in the afternoon. The limits of the express lanes are between the Northgate area and downtown Seattle. The existing express lane congestion points are at the exit points where the roadway narrows to one general purpose lane (northbound at Northgate and southbound through downtown) or where traffic from intersection signals at Mercer Street and Stewart Street back onto the express lane system. Congestion also occurs in both directions near the SR 522 ramp. Exhibit 1 depicts the existing channelization for the express lanes.

Exhibit 1. Existing channelization.



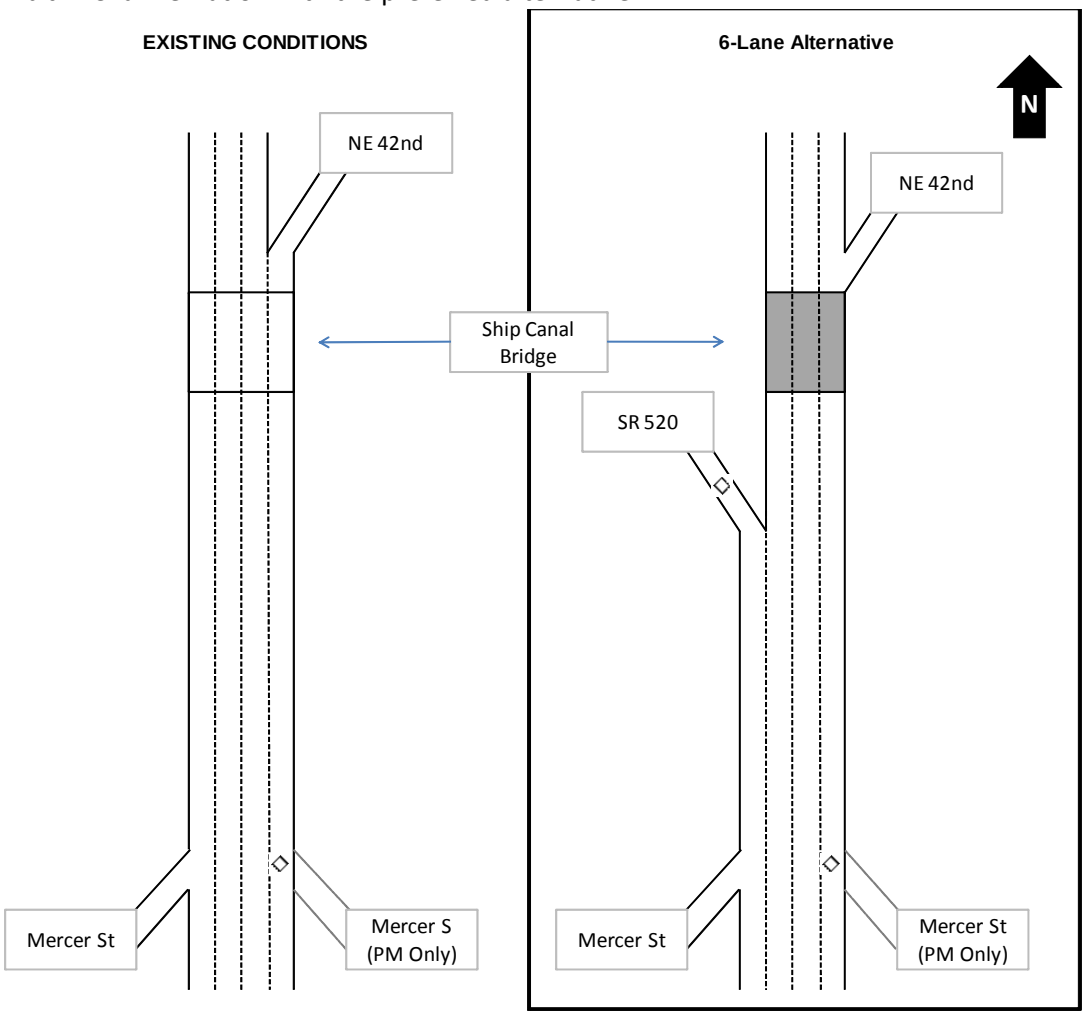
Year 2030 No Build alternative

By 2030, traffic volumes are expected to increase on the express lanes by about 10 percent in the morning and over 25 percent in the evening peak, resulting in increased congestion at the existing bottlenecks. This increase in traffic demand is expected due to projected increases in employment and population in the region by 2030, based on growth projections identified by the Puget Sound Regional Council.

Year 2030 with the project

The preferred alternative includes an HOV/transit ramp connection between SR 520 and the I-5 express lanes. The design would reduce the number of lanes from four to three in the express lanes across the Ship Canal Bridge to provide space for a single new HOV/transit ramp to/from SR 520. To accommodate the ramp, the 42nd Street NE ramp would be converted to a merge southbound or diverge northbound.

Exhibit 2. Channelization with the preferred alternative.



Southbound. In 2030, the 42nd Street NE ramp is expected to carry 260 vehicles per hour during the AM peak hour. This is a low volume for an interstate ramp and vehicles can reasonably merge to the express lanes if there is available capacity. Due to upstream congestion that would occur as described in the No Build, the maximum traffic volume approaching the three lane section of the Ship Canal Bridge is expected to be about 5,200 vehicles per hour. The three lane section of the Ship Canal can accommodate about 6,600 vehicles per hour, so this section of the express lanes could accommodate another 1,400 vehicles each hour before reaching capacity.

The SR 520/I-5 direct access ramp included in the project would add between 200 to 400 buses and carpools per hour in the AM commute period. Since the operational issues for the I-5 express lanes are in the lane that terminates at the I-5 mainline and not in the lanes that serve HOV/transit traffic, the transit traffic exiting to downtown would benefit from the direct access ramp connection.

Some of the traffic entering the express lanes from SR 520 would be destined for the I-5 mainline south of downtown Seattle. This would increase traffic pressure to an already congested lane as vehicles exit the express lanes back onto I-5 mainline at the southern end. Congestion could last up to an hour longer compared to the No Build alternative and extend just north of the SR 520 interchange at the peak.

Northbound. In 2030, the 42nd Street NE ramp is expected to carry 660 vehicles per hour during the PM peak hour. The express lane volume across the Ship Canal Bridge is expected to peak in the afternoon at 5,600 vehicles per hour (compared to a capacity of 6,600 vehicles per hour).

Northbound operations with the preferred alternative are similar to No Build, because volume increases due to the project would only occur south of the Ship Canal Bridge. In the northbound express lanes, congestion occurs at the north end of the corridor. As a result, the preferred alternative would provide buses with a direct connection from the I-5 express lanes into the SR 520 center HOV/transit lane. This connection would avoid congestion on the I-5 mainline and would benefit transit travel time and reliability.

Addressing the problem

How will we identify possible solutions?

This white paper provides additional information about how the express lanes would operate with the new connection from SR 520. No problems have been identified for resolution.

Recommendations

What did we consider?

For the I-5 express lane connection to/from the south, we have considered the option that was developed and drafted in the DEIS and SDEIS process. We have ensured that the SR 520/I-5 interchange

design has not precluded future actions that might include the addition of a direct access ramp between the SR 520 corridor and the express lanes to the north.

Final TCT recommendation

The Technical Coordination Team (TCT) recommends implementing the SR 520/I-5 interchange design developed in the preferred alternative. A single-lane, reversible direct-access ramp will connect from the westbound SR 520 transit/HOV lane to the southbound I-5 express lanes during the morning period of express lane operations. During the evening period, the direct-access ramp will connect northbound I-5 express lanes to the eastbound SR 520 transit/HOV lane. The preferred alternative will reduce the I-5 express lanes by one lane width just north of the I-5/SR 520 interchange to provide space for the new reversible transit/HOV direct-access ramp.

Transit Priority and HOV Lanes

Introduction

How were transit priority and HOV lanes addressed in the preferred alternative?

The SR 520 I-5 to Medina project's preferred alternative included arterial transit/HOV lanes on Montlake Boulevard between the SR 520 corridor and the Pacific Street intersection. However, the preferred alternative did not describe lane location details or descriptions of where the transit/HOV lanes ended. It was assumed that those two details would be resolved through the Technical Coordination Team (TCT) meetings, which included transit and transportation experts from SDOT, King County Metro, Sound Transit and WSDOT. The preferred alternative also described the addition of transit signal priority to the Montlake interchange area, in an effort to improve transit reliability. The specific locations where transit signal priority would be implemented were also assumed to be determined by the TCT.

Addressing the problem

How did we identify possible solutions?

A subgroup of the TCT was formed to identify approaches to enhance transit reliability on the Montlake corridor. The subgroup included participants from the SDOT, King County Metro, Sound Transit, WSDOT, and one external transit expert to provide an unbiased perspective for consideration. This subgroup focused their efforts on providing additional detail for Transit/HOV lane placement and transit signal priority, but also considered other design refinements that might improve transit reliability.

Through a series of meetings, the subgroup developed a list of goals, boundaries and measures for use in developing their recommendations. The subgroup used the current project assumption for HOV occupancy of three or more (3+) people on the arterials and the freeway. Though final occupancy requirements are not set by project staff, the subgroup assumed a 3+ occupancy requirement by the year 2030 is reasonable. Transit elements considered by the subgroup included:

- HOV lane location
- HOV lane termini
- Transit signal priority
- Queue jumps
- Bus stop locations

Recommendations

What did we consider?

The primary objective of the first subgroup meeting was to develop a list of goals, measures and boundaries to be used in the subgroup's development and assessment of transit design refinements. The list included:

Goals

- Improve transit speed and reliability between Roanoke Street and the Montlake multimodal center without adversely affecting traffic operations on SR 520.
- Minimize right of way impacts.
- Optimize walking distances and minimize delays for transit transfers.
- Accommodate potential future transit stop locations and capacity requirements.

Measures

- Right of way effects.
- Travel time.
- Delay/level of service.
- Queue lengths.
- Bus zone capacity.
- Pedestrian use of bus stops.

Boundaries

- No changes to the right of way identified in the SDEIS on Montlake Boulevard between the westbound off-ramp intersection and the second drawbridge.
- No widening of Montlake Boulevard south of Roanoke Street.
- No widening of Montlake Boulevard north of Pacific Street (an added southbound HOV/transit lane on Montlake Boulevard north of Pacific Street was discussed and could be implemented as a separate project at a later time—the SR 520 project improvements would not preclude this from happening since there will be three continuous southbound lanes on Montlake Boulevard south of Pacific Street).

The various options considered by the subgroup were evaluated using these defined goals, boundaries, and measures. Some additional preliminary transportation analysis was completed to support the evaluation process, work that supplemented previous analyses completed for the SDEIS and the Legislative Workgroup process.

The subgroup discussed the complexities of the Montlake interchange area and the transit service operations. On Montlake Boulevard, local bus service competes for traffic signal time with regional bus service leaving or entering SR 520. The Montlake Boulevard corridor is also a primary urban arterial, serving over 60,000 vehicles per day crossing the Montlake cut. These high traffic volumes and competition between local and regional transit service, coupled with the constraint of not widening the roadway through the area, mean that options are limited for adjusting signal timing in any one direction without impacting the other.

The subgroup also discussed the challenges with serving bus stops northbound on Montlake Boulevard

between SR 520 and Pacific Street. Bus stops located in the outside lanes north of the SR 520 interchange would require buses to then cross over two lanes to turn left onto Pacific Street for access to the Montlake multi-modal station. This turning movement is made by approximately 300 bus trips operating on Montlake Boulevard each day. The subgroup recommended minimizing these complex arterial weaves by limiting the number of buses that would need to make a stop in that roadway section.

When considering signal timing, the subgroup recognized that any options resulting in additional delay for traffic south of Roanoke Street or northwest of Pacific Place would also cause additional delay for buses. Local bus trips make up nearly 65% of the bus trips that cross the Montlake drawbridge, with local buses traveling in the same lanes as the general purpose traffic on Montlake Boulevard.

After discussing these goals and measures, the subgroup identified a number of transit design refinement options, and identified which options would provide improved transit reliability. The evaluation measures were assessed at a qualitative level based on traffic operations information available from the SR 520 program transportation team. A quantitative analysis to evaluate selected options will be conducted for the preferred alternative and documented in the Transportation Discipline Report of the Final Environmental Impact Statement. A summary of the options and evaluation follow.

<u>Transit/HOV lane location and termini</u>

The subgroup first determined the transit/HOV lane location and then discussed the length of the lane. The termination point of the transit/HOV lane is only described in the option that was selected to move forward as a recommendation to the Workgroup.

Inside transit/HOV lane both northbound and southbound. An inside lane is the left most through lane in the direction of travel.

- A southbound Montlake Boulevard inside transit/HOV lane was not determined to be a functional solution for the buses leaving Pacific Street. Those buses travel in the outside arterial transit/HOV lane on Pacific Street and would need to cross two lanes to use an inside transit/HOV lane. Because the majority of bus passengers traveling southbound are using local bus service (i.e., buses that need to stay in the outside lane), an inside transit/HOV lane would not serve the majority of the riders.
- A northbound Montlake Boulevard transit/HOV lane located on the inside would align the buses turning right from the SR 520 westbound direct access ramps directly into the transit/HOV lane. This alignment would provide SR 520 buses with a bypass lane for any northbound backups resulting from traffic congestion and Montlake drawbridge openings. The inside transit/HOV lane placement also directs the buses into the right-most left turn lane at the Montlake Boulevard/Pacific Street intersection, from which they can easily access the Montlake multi-modal station on Pacific Street. There are approximately 300 daily bus trips that make that left turn.

Outside transit/HOV lane both northbound and southbound. An outside lane is the right most through lane in the direction of travel.

- An outside southbound transit/HOV lane on Montlake Boulevard would provide a seamless connection from the existing outside arterial transit/HOV lane on Pacific Street. The outside southbound transit/HOV lane would also allow all buses to bypass congestion created by a Montlake drawbridge opening. Buses destined for SR 520 would have enough space and open roadway to change lanes after Shelby Street from the outside transit/HOV lane to the direct access ramp left turn, because it is anticipated that southbound congestion on Montlake Boulevard will be substantially reduced as a result of the improvements being made on the SR 520 corridor. Those design improvements include a two-lane on-ramp to eastbound SR 520, a new transit/HOV direct access on-ramp to eastbound SR 520, a two-lane westbound on-ramp and improved on-ramp merge lengths onto the freeway.
- A northbound outside transit/HOV lane on Montlake Boulevard would not be functional for buses coming from SR 520. The SR 520 buses will exit the freeway from the westbound direct access ramp, which is south of the general purpose ramp. All three lanes are dedicated right-turn lanes. A bus right turn from the direct access ramp into an outside northbound lane would be a very difficult movement; buses would need to cross over three lanes to drive a short distance in the transit/HOV lane and then cross back to turn left onto Pacific Street. Local buses would also need to exit the transit/HOV lane early to turn left onto Pacific Street.

Inside transit/HOV lane northbound and outside transit/HOV lane southbound. The subgroup recommended that an outside southbound transit/HOV lane and an inside northbound transit/HOV lane would provide the most reliable service for passengers along the Montlake Boulevard corridor.

- The northbound transit/HOV lane limits reach from the direct access ramps at SR 520 across the Montlake drawbridge. The limits were set to ensure easy access between the SR 520 direct access ramps and the Montlake Boulevard corridor for northbound traffic. The lane could not continue to the intersection of Montlake Boulevard and Pacific Street because of turning movement capacity constraints at the intersection.
- Continuing the outside transit/HOV lane in the southbound direction from Pacific Street on to Montlake Boulevard to Hamlin Street allows for continuity of the transit/HOV movements. This enhances transit/HOV operations and allows buses to bypass congestion resulting from drawbridge openings.

<u>Transit signal priority locations</u>

Current traffic operations analysis for the preferred alternative shows that the congestion along

Montlake Boulevard would not warrant transit signal priority after improvements by the SR 520 project are implemented. Traffic operations improvements from the SR 520 I-5 to Medina project result in reduced congestion on the Montlake Boulevard corridor, and therefore less of a need for transit signal priority. However, transit agency and City of Seattle staff understand that at times there could be congestion levels that warrant the use of signal priority, such as during major University of Washington events (e.g., football games, commencement ceremonies, or other unique events on campus), special events in Seattle or necessary Montlake Bridge opening events (e.g., opening day of boating season). To ensure transit operates reliably during these periods of high activity, the subgroup recommended that WSDOT provide all signal controllers installed as part of the project with the ability to accept transit signal priority. This design refinement would allow the City of Seattle and the transit agencies to manage transit service and traffic operations as conditions change into the future and on a daily basis. As the City, transit agencies, and WSDOT implement transit signal priority strategies, they will continue to evaluate whether they result in adverse effects to SR 520 mainline traffic or to bus service outside of the HOV/transit lane limits.

The following locations were considered for transit signal priority:

- Montlake Boulevard/Pacific Street
- Montlake Boulevard/Shelby Street
- Montlake Boulevard/Hamlin Street
- Montlake Boulevard/westbound ramps
- 24th Avenue/westbound ramps

The level of operations at the eastbound ramp intersection did not warrant the consideration of transit signal priority. The subgroup discussed the function of transit signal priority and its affect on intersections that operate at level of service F. The subgroup determined that if signal time was reallocated to provide bus priority, it would cause severe congestion in other directions and could adversely affect other transit services and traffic operations on the SR 520 corridor. The potential for these effects did not meet the goals or boundaries defined by the subgroup.

Queue jump locations

Queue jumps were discussed at the following locations:

- Northbound Montlake Boulevard at Lake Washington Boulevard
- Northbound Montlake Boulevard at westbound ramps
- Southbound Montlake Boulevard at Shelby Street

All of the potential queue jump locations were determined to not meet the goals set by the subgroup, particularly the goal for right-of-way impacts. Installing queue jumps would require additional right-of-way to implement. Queue jumps at the ramp intersections would also result in adverse effects on SR 520 traffic operations because additional signal time would be required for the queue jump.

Bus stop locations

The subgroup discussed potential bus stop locations; a separate white paper will present those conversations.

Final TCT recommendation

The TCT supported the following recommendations based on the work of the subgroup.

- Transit/HOV lane location on Montlake Boulevard
  - Inside transit/HOV lane northbound
    - Transit/HOV lane limits between westbound off-ramp and the northern end of the Montlake drawbridge
  - Outside transit/HOV lane southbound
    - Transit/HOV lane limits between Pacific Street and Shelby intersection

- Transit signal priority
  Traffic signal equipment installed along Montlake Boulevard will be compatible with future hardware installation for transit signal priority at the following intersections:
  - Montlake Boulevard/Pacific Street
  - Montlake Boulevard/Shelby Street Montlake Boulevard/Hamlin Street
  - Montlake Boulevard/westbound ramps
  - 24th Avenue/westbound ramps

- Transit queue jumps
  Additional right-of-way would be required to provide transit/HOV queue jumps on freeway on-ramps, which would result in additional right-of-way impacts. In an effort to respect the historical nature of the community, the addition of transit/HOV queue jump lanes was not recommended.

Transit Connections: Bus Stop Locations

Introduction

The 2008 High Capacity Transit (HCT) plan identified a vision for developing a multimodal center that ensures coordination of bus and light rail services in the vicinity of the Montlake Triangle and Montlake Interchange. The vision outlines the importance of pedestrian and bicycle movements, fast and reliable transit services, connection between local, bus rapid transit, and light rail service, and maintaining the open character and accessibility of the area.

Analysis of ridership projections from the 2008 HCT planning effort indicate most riders traveling to the Montlake Triangle area are going directly to or from the UW campus. When the Montlake Triangle area is the end of the light rail line, approximately 60% of transit customers will be destined for the UW campus and Medical Center, another 20% will transfer between buses and 20% will transfer from bus to light rail at the Sound Transit UW station. Less than 1% are expected to walk to the light rail station from the neighborhoods south of the Montlake Cut.

Figure 1 (Dec 2008). Projections of transit rider and pedestrian destinations in the Montlake Triangle area, prior to the extension of light rail to Northgate.

To address the removal of the existing Montlake freeway station, the HCT plan identified options for future transit connections for local and regional service in the Montlake Triangle area. The HCT plan recommended relocating and expanding bus stops at the Montlake Triangle to provide key transit connections for riders traveling between north Seattle, the UW campus, and the eastside communities of Bellevue, Kirkland, and Redmond. The plan identified necessary operating investments and capital

costs, including service hours, bus fleet requirements, transit stops with adequate capacity for layover storage and bus bays to accommodate higher volumes of buses at peak periods.

Bus stop locations in this area need to accommodate transfers between services as well as rider origins and destinations. In the Montlake Triangle area, riders may be transferring between buses or between buses and light rail, though a majority of transit users will be destined for the UW campus or the Medical Center and UW Health Sciences facilities. Along Montlake Boulevard at the SR 520 interchange, transfers may occur between local bus service and the regional bus service at SR 520, while also serving residents in the Montlake neighborhood and, currently, some riders accessing the UW campus from the freeway station by foot or bicycle. In addition to this transfer activity, nearly 6,000 riders each day are traveling through the Montlake Triangle in both directions to destinations to the north, to the Eastside and to communities south of SR 520.

Key considerations in the evaluation of bus stop locations were to:

- Improve transit speed and reliability between E. Roanoke Street and the Montlake Triangle area without significantly adversely affecting traffic operations on SR 520.
- Minimize any increased right-of-way needs beyond what the I-5 to Medina SR 520 Preferred Alternative currently requires.
- Optimize walking distances to key destinations on the UW campus and the UW station.
- Accommodate potential future transit stop locations and capacity requirements.
- Accommodate current and proposed local and regional bus transit service.
- Accommodate the ESSB 6392 definition of "effective transit connections" to be distances less than 1,200 feet between surface transit stops and the UW station.

How were bus stop locations addressed in the preferred alternative?

The preferred alternative suggested bus stop locations on the westbound and eastbound HOV direct-access ramps; however, the preferred alternative did not specify bus stop locations on Montlake Boulevard or in the Montlake Triangle area. The 2008 HCT plan recommended the creation of a multimodal transit hub in the Montlake Triangle area, and suggested an expanded bus stop on NE Pacific Street between NE Pacific Place and the existing taxi/patient drop-off/pick-up location.

Addressing the problem

How did we identify possible solutions?

WSDOT, Sound Transit, King County Metro, the City of Seattle, and UW all have plans, projects, or services that affect transit rider and pedestrian access in the Montlake area. A subgroup of the Technical Coordination Team (TCT) members with transit expertise met regularly to discuss key planning and design principles that would influence proposed bus stop locations. In evaluating options for stop locations, the subgroup considered a range of qualitative and quantitative data, including: the 2008 SR 520 HCT plan; projections for future transit ridership; route planning; design and construction plans; and *Complete Streets* considerations including City of Seattle plans and projections for future transit, bicycle and pedestrian infrastructure and connections. The subgroup identified eight potential locations for bus stop locations in the Montlake Triangle, three options for Montlake Boulevard stops near the

interchange (two northbound, one southbound), and three bus stop options at the HOV direct-access ramps on the Montlake lid.

The TCT subgroup developed the following criteria to consider potential bus stop locations:

- Montlake Triangle stops
  - *Ridership origin/destination*. Will the location provide transit riders destined for the area with the shortest average walk to and from their destination?
  - *Traffic operations.* Will the location result in a positive or adverse effect on traffic operations in the localized area?
  - *Travel times.* Will the location have an effect on the average total travel time for transit riders (bus trip plus walk to/from the destination), including those who are not destined for the Triangle area?
  - *Compatibility with UW station and Husky Stadium plans.* Will the location and associated operations support or impinge upon current projects and planning?
  - *Adequate bus/stop space.* Is there an appropriate amount of space for the facility?
  - *Constructability.* Does the location have special considerations or requirements for design and construction?
  - *Layover.* Would the option allow for current and future use of adequate curb space for bus layover?

- Montlake interchange stops
  - *Ridership origin/destination.* Does the location of the Montlake interchange stops provide a convenient transfer point between local bus service on Montlake Boulevard and regional bus service on SR 520? It is assumed the surrounding neighborhoods will continue to be served by local bus routes and stops, and that many bus riders will continue to transfer in the Montlake interchange area between SR 520 service to the east and local service to the south.

- Direct-access transit/HOV ramp stops
  - *Transit operations.* Is the location as close as possible to Montlake Boulevard bus stops and pedestrian and bicycle facilities, while avoiding significant delays to HOV traffic?

What options are presented for TCT consideration?

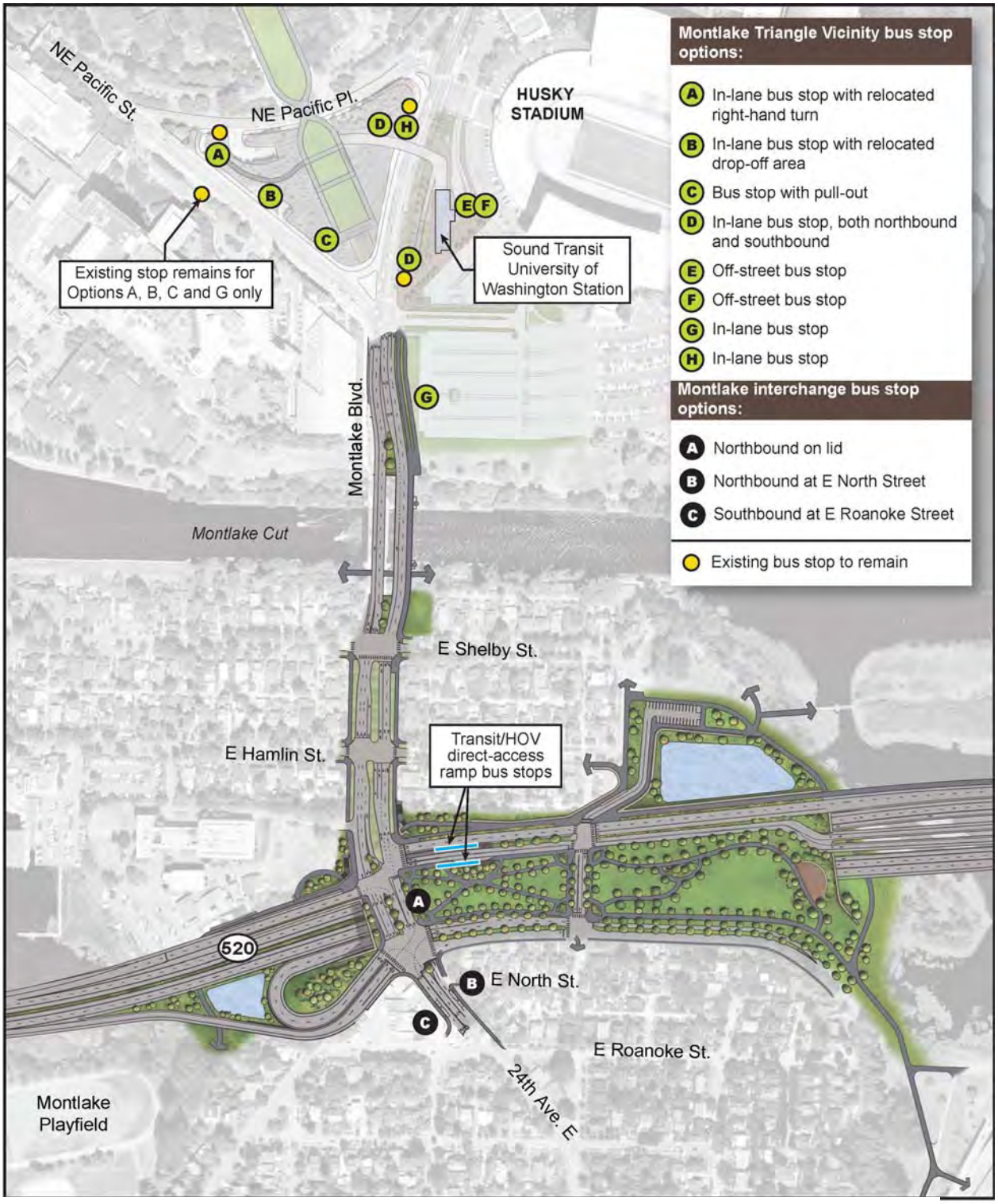


Figure 2 (September 2010). Montlake Triangle and Montlake interchange vicinity bus stop locations

Bus stop location options at the Montlake Triangle

To help evaluate the effectiveness of transit connections for bus riders and pedestrians in the Montlake Triangle, each transit stop option includes the following supporting documentation: the bus stop location for each option considered; approximate siting of the required 220 feet bus bay at each stop; bus circulation routes; estimated pedestrian walk times to specific destinations identified below; the distance between proposed bus stops; the estimated transit travel time along these routes; the total daily person delay for riders traveling through the area and qualitative analysis on potential traffic impacts.

Pedestrian walk times and distances

Pedestrian walk times were calculated between each of the transit stop options and three destinations: 1) the Medical Center T-wing pedestrian bridge at the Burke Gilman Trail, 2) UW main campus/Burke Gilman Trail, on Rainier Vista over NE Pacific Place, and 3) UW station elevators at Montlake Boulevard. The walk times assume a walk speed of 4 ft/sec, and include the average delay experienced at signals. The delay a pedestrian would typically experience at a signal assumes a random arrival with some pedestrians experiencing no delay (arriving when a walk sign is on) and some pedestrians experiencing the greatest delay (arriving as the walk sign turns off). The time included in the analysis is the average of all pedestrians as calculated by the SR 520 VISSIM model.

Traffic operations

Several of the stops require intersection modifications to provide the movement necessary for bus operations. Traffic operations were evaluated for each bus stop location to determine the average delay at signals and estimate the effect on local traffic and bus operations due to the intersection modifications.

Transit travel times

For each of the transit stop options, bus transit travel time was calculated between the Montlake Cut and the NE Pacific Street/NE Pacific Place intersection. Similar to the pedestrian travel time, the transit travel time includes the route, the delay experienced at signals, and a dwell time of 30 seconds at transit stops. Travel times are reported as absolute, not in addition to existing travel times today. Travel times assume speeds of 25 mph on the arterials and 15 mph when travelling through the UW parking lot.

Total daily person delay while riding transit

Total daily person delay is the estimated amount of additional time that transit passengers will spend en route to their destinations based on different Montlake Triangle routings. Added travel time impacts the convenience and desirability of using transit. Nearly 6,000 riders per day, in both directions, are traveling through the Montlake Triangle to points north, to the Eastside and to communities south of SR 520. Options A, B and C all assume no appreciable routing change through the Montlake Triangle and are assumed equal to baseline conditions. The difference between the transit travel times of Options D, E, F, G, and H and the baseline travel times was assumed to be the transit delay for each transit vehicle trip through the Triangle. This delay was multiplied by the current daily directional ridership through the Montlake Triangle to calculate the total daily person delay.

Option A

Westbound NE Pacific Street, nearside NE Pacific Place. This option reflects recommendations from the SR 520 HCT plan, which suggested relocating the northbound bus stop on NE Pacific Street just to the south of its existing location. This option maintains the existing taxi staging area, but relocates the right turn lane between NE Pacific Street and NE Pacific Place to provide the required 220 feet for a pull-out. The existing southbound bus stop on NE Pacific Street would be relocated slightly to the east and would also require 220 feet for an in-lane stop. North-to-westbound buses would maintain the existing route after crossing the Montlake Cut (north on Montlake Boulevard, then left on NE Pacific Street). Eastbound buses on NE Pacific Street would also use the existing route between NE Pacific Street and the Montlake Cut.

Pedestrian Walk Times

	Northbound	
To	Distance	Time
1	566 ft	2 min 45 sec
2	555 ft	2 min 19 sec
3	948 ft	3 min 57 sec
	Southbound	
To	Distance	Time
1	740 ft	3 min 52 sec
2	790 ft	4 min 5 sec
3	1010 ft	5 min 13 sec

Transit Travel Times

Northbound	1 min 24 sec
Southbound	1 min 42 sec

Option A Travel Times - Person delay while riding transit

(Option A assumed to have no travel delay compared to existing condition)

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	0 min	0 hr
SB	6,000	0 min	0 hr

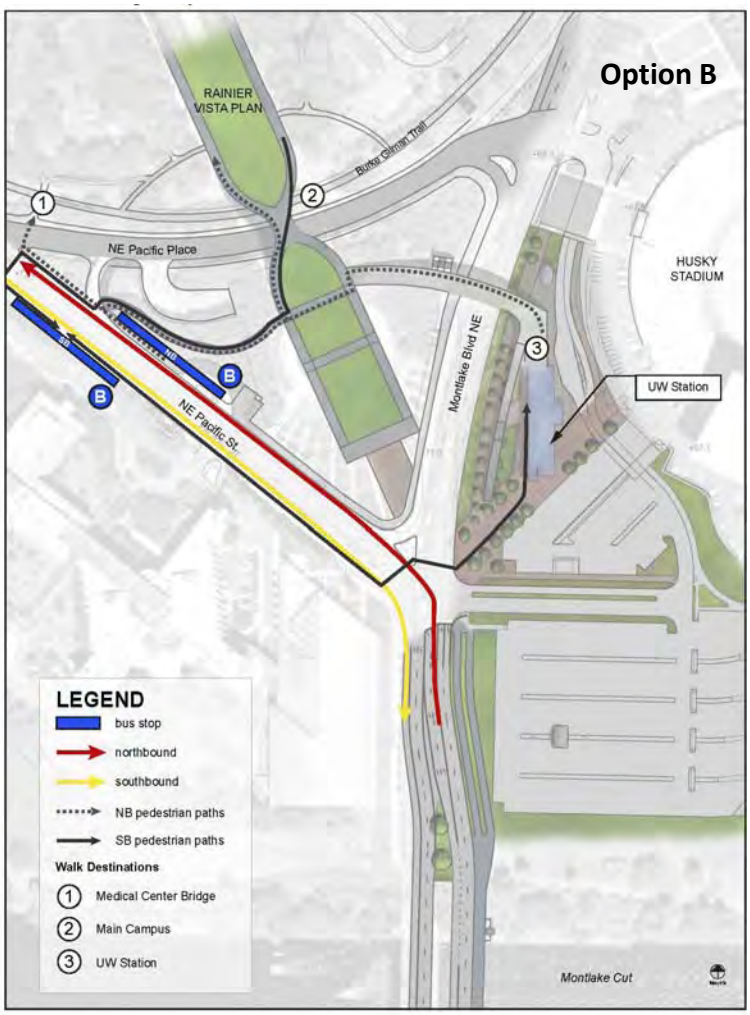
Benefits: These bus stop locations will result in minimal to no adverse effects on traffic operations and travel times over the existing condition. For the minority of riders who transfer at this location, this option may improve transit connectivity between bus-rail and bus-bus via new pedestrian pathways and shorter existing pathways. This bus stop option serves the majority of projected transit riders by providing similar distances and walking travel times as currently experienced today. Riders destined for the UW campus or UW Health Medical Center experience relatively short walk distances and multiple pathways. For the 20% of transit riders who transfer between bus and rail at the Triangle, the walking distance between these bus stops and the UW station is approximately 1,000 feet.

Challenges: The right turn lane from westbound NE Pacific Street to NE Pacific Place would be relocated for this option to accommodate the 220-foot bus bay. Further evaluation would be required to reduce the potential turning movement conflicts at this location.

Option B

Westbound NE Pacific Street, at current taxi pull-out. This option relocates the bus stop on westbound Pacific Street to the existing taxi/shuttle bus pullout directly across from the UW Medical Center, requiring relocation or elimination of the taxi/shuttle staging area. This in-lane bus stop would require 220 feet for buses to serve the stop. The existing bus stop on NE Pacific Street in the eastbound direction would also be relocated slightly to the east.

North-to-westbound buses would maintain the existing route after crossing the Montlake Cut (north on Montlake Boulevard, then left on NE Pacific Street). East-to-southbound buses on NE Pacific Street would also use the existing route between NE Pacific Street and the Montlake Cut.



Pedestrian Walk Times

	Northbound	
To	Distance	Time
1	660 ft	3 min 8 sec
2	535 ft	2 min 14 sec
3	926 ft	3 min 52 sec
	Southbound	
To	Distance	Time
1	740 ft	3 min 52 sec
2	790 ft	4 min 5 sec
3	1010 ft	5 min 13 sec

Transit Travel Times

Northbound	1 min 24 sec
Southbound	1 min 42 sec

Option B Travel Times - Person delay while riding transit

(Option B assumed to have no travel delay compared to existing condition)

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	0 min	0 hr
SB	6,000	0 min	0 hr

Benefits: Relocation of bus stops in this option will have little to no effect on intersection operations or transit travel times over the existing condition. Similar to Option A, riders making bus-rail or bus-bus transfers will be offered slightly better connectivity between stops via new and improved pedestrian pathways and route choices. This option serves the majority of projected transit riders with similar and efficient walking travel times. For the 20% of transit riders transferring between bus and rail at the Triangle, the walking distance between these bus stops and the UW station is approximately 930 feet and 1,000 feet, for northbound and southbound buses respectively. This option does not require modification of the right turn lane from Pacific Street to Pacific Place.

Challenges: The existing taxi/shuttle pull-out would be relocated or eliminated, an option that needs to be further evaluated by the University of Washington. Additional analysis is also needed on a potential crosswalk at this location that would provide a faster connection for riders walking to and from the UW Medical Center.

Option C

Westbound NE Pacific Street, near south corner of Triangle. This option would move the stop closer to the southern corner of the Montlake Triangle, just west of the intersection of Montlake Boulevard and NE Pacific Street. The pull-out stop in the westbound direction would require 220-feet and would remove buses from the traveled roadway to minimize impacts to traffic operations at the adjacent Montlake Boulevard/NE Pacific Street intersection. The existing bus stop on NE Pacific Street in the eastbound direction would also be relocated slightly to the east.

North-to-westbound buses would maintain their existing route crossing the Montlake Cut (north on Montlake Boulevard, then left on NE Pacific Street). Eastbound buses on NE Pacific Street would also travel the existing route between NE Pacific Place and the Montlake Cut.

Pedestrian Walk Times

	Northbound	
To	Distance	Time
1	960 ft	4 min 23 sec
2	425 ft	1 min 46 sec
3	813 ft	3 min 25 sec
	Southbound	
To	Distance	Time
1	740 ft	3 min 52 sec
2	790 ft	4 min 5 sec
3	1010 ft	5 min 13 sec

Transit Travel Times

Northbound	1 min 24 sec
Southbound	1 min 42 sec

Option C Travel Times - Person delay while riding transit
(Option C assumed to have no travel delay compared to existing condition)

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	0 min	0 hr
SB	6,000	0 min	0 hr

Benefits: These bus stop locations result in minimal to no effect on traffic operations or transit travel times over the existing condition. Similar to Options A and B, riders making bus-rail or bus-bus transfers will be offered slightly better connectivity between stops via new pedestrian pathways, route choices, and improved pedestrian pathways. Option C serves the majority of projected transit riders with similar and efficient walking travel times. Riders destined for the UW campus or UW Medical Center experience relatively short walk distances and multiple pathways for travel. Option C is somewhat further from the UW Medical Center than A and B. Adequate space exists for a two-bay bus pullout; however the underground Triangle garage limits the width of the sidewalk/ bus stop area at this stop location.

Challenges: The Triangle garage structure may limit the ability to construct a pull-out and bus stop or may require design modifications. Delay to through transit passengers resulting from buses merging into general purpose traffic after serving the pull-out bus stop was not calculated, but would add travel time to transit trips.

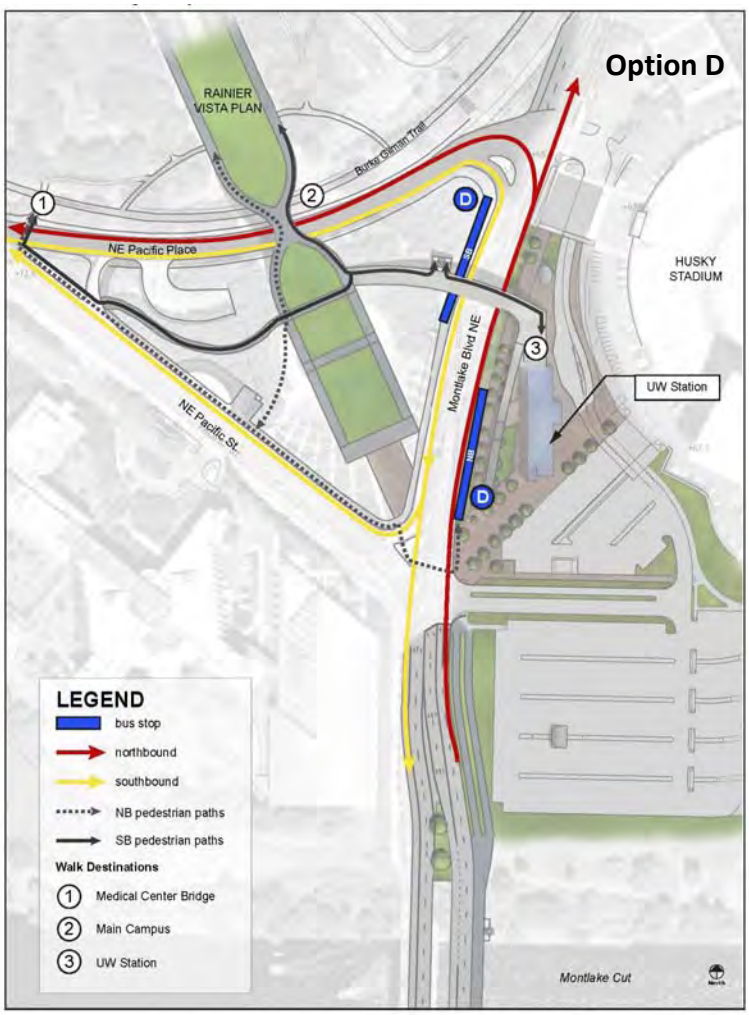
Option D

North and southbound stops on Montlake Boulevard adjacent to the UW station. These stops currently exist. The northbound stop is just north of Montlake Boulevard and NE Pacific Street and the southbound stop is located just south of the Montlake Boulevard and NE Pacific Place intersection. The northbound stop is in the current plans for the Sound Transit UW station project. The southbound stop is included in the current Montlake Triangle Improvement Plan. Both stops are currently served by the Route 243, which has three morning trips and two evening trips. Increasing the number of bus routes serving the northbound and southbound stops would require expanding these stops to accommodate 220-foot in-lane stops.

Northbound Montlake Boulevard buses would remain in the outside lane after crossing the Montlake Cut to the existing bus stop near the UW station, then continue north towards University Village and beyond. North-to-westbound buses would also remain in the outside lane after crossing the Cut to the existing stop, then change lanes to turn left at the traffic signal at NE Pacific Place, then continue west to NE Pacific Street. Eastbound buses on NE Pacific Street would turn left onto NE Pacific Place and turn right on Montlake Boulevard to the southbound bus stop. Buses headed south on Montlake Boulevard would change lanes and continue through the Montlake Boulevard/NE Pacific Street intersection. Buses exiting layover at NE Pacific Place would remain in the outside lane and turn right on NE Pacific Street for routes destined west of NE Pacific Place.

Option D includes an additional turn lane to allow for the northbound movement from Montlake Boulevard to Pacific Place, and would require signal modifications to provide green time for this movement. This additional movement causes the intersection to degrade in operations and would be 16% over capacity, resulting in significant congestion approaching the intersection. The typical queue for the two northbound lanes on Montlake Boulevard approaching Pacific Place would extend past Pacific Street. As a result, northbound transit trips that stop on Montlake Boulevard near the rail station would need to merge across two lanes of queued vehicle traffic to access the northbound left at Pacific Place. A mid-block transit signal queue jump and bus pull out could be installed to allow buses to make that crossing; however, it is likely that additional congestion would result from the added signal and irregular timing associated with bus arrival. Another option would be the addition of a northbound through lane at the Montlake/Pacific Place intersection that would improve operations and reduce congestion.

Southbound transit trips would experience additional congestion as they are routed through the southbound through movement of the Montlake/Pacific Street intersection. Today those southbound trips are able to use a queue jump that exists from Pacific Street to Montlake Boulevard. This southbound transit movement could be improved by providing a transit only through lane on Montlake Boulevard through the Pacific Street intersection that would connect into the HOV lane starting near the Montlake cut. With this change, the southbound route would still have over a 2 minute travel time.



Pedestrian Walk Times

	Northbound	
To	**Distance**	**Time**
1	1470 ft	7 min 15 sec
2	825 ft	3 min 26 sec
3	255 ft	1 min 4 sec
	Southbound	
To	**Distance**	**Time**
1	1200 ft	5 min 0 sec
2	380 ft	1 min 35 sec
3	390 ft	1 min 38 sec

Transit Travel Times

Northbound	4 min 6 sec
Southbound	3 min 8 sec

Option D Travel Times - Person delay while riding transit

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	2 min 31 sec	251 hr 40 min
SB	6,000	1 min 32 sec	153 hr 20 min

Benefits: Bus riders transferring to UW station or going to the UW athletic complex would have more direct access.

Challenges: Bus riders destined for the UW campus or Medical Center would experience increased travel time of 3-4 minutes, compared to current conditions. Transit service would be re-routed to accommodate this stop location, resulting a delay of 1 ½ -3 minutes for local transit riders traveling through the Montlake Triangle area compared to existing conditions. As described above, an in-lane stop at this location would have impacts on traffic operations on Montlake Boulevard that would affect general purpose traffic as well as bus operations. The left turn movement at the NE Pacific Street/NE Pacific Place intersection would impact traffic operations on Montlake Boulevard. Because the intersections of NE Pacific Street/NE Pacific Place on Montlake Boulevard are closely spaced, it is likely that buses would have difficulty changing lanes across Montlake to turn left onto NE Pacific Place. Southbound buses could not use the HOV lane and queue jump at the NE Pacific Place/Montlake Boulevard, resulting in impacts to bus travel times and traffic operations. Transit could not use

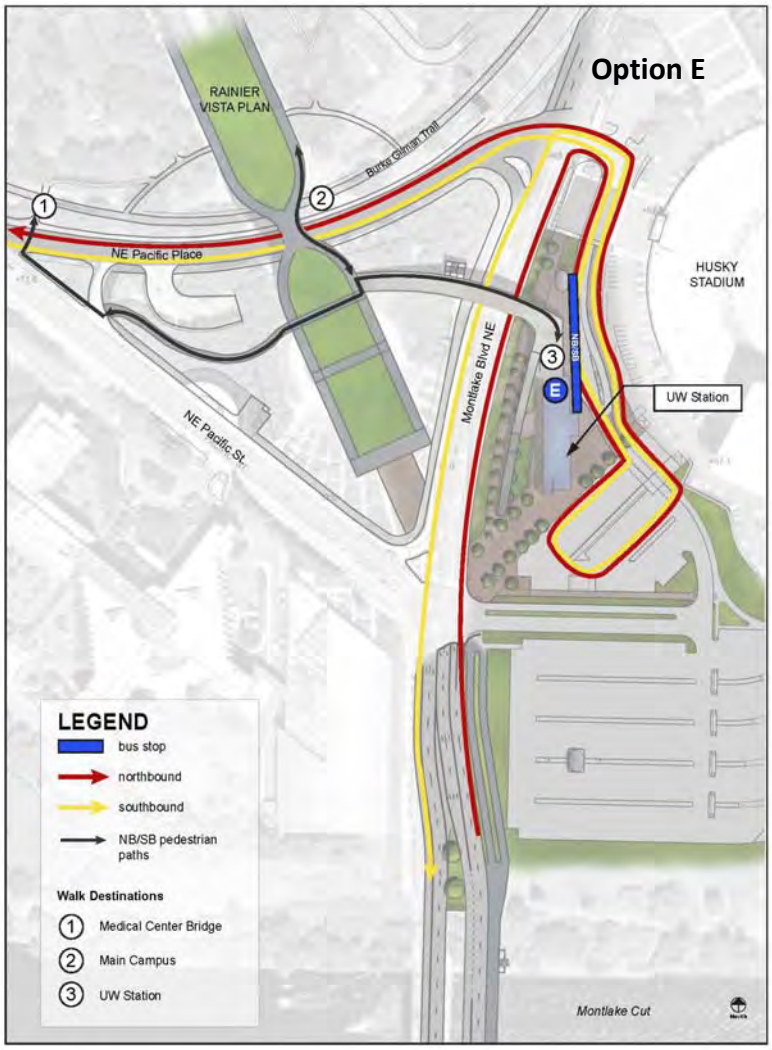
inside HOV lanes planned for northbound Montlake Boulevard or the transit/HOV lane configuration would need to be re-evaluated to have the lane serve this stop.

Option E

UW station at NE Pacific Place/Montlake Boulevard. Buses would enter and exit via the Montlake Boulevard/NE Pacific Place intersection. Buses could make a stop adjacent to or near the UW station. This option would require the construction of a transit center to accommodate northbound and southbound buses.

Option E includes signal and capacity modifications at the Montlake Boulevard/Pacific Place intersection. A westbound through lane would need to be provided to allow buses to exit the UW station lot. Adding the westbound movement at the intersection would cause the intersection to operate at 9 percent over capacity. Traffic traveling northbound at the intersection would back up past Pacific Street. The northbound transit trip travel time would increase to 5 minutes and 25 seconds. This includes about twice the distance to travel plus additional delay to travel through the Montlake Boulevard/Pacific Place intersection. Delays for general purpose traffic would increase compared to Option A, B, or C.

The southbound transit trip would increase to 6 minutes and 28 seconds due to the increased travel distance and intersection delay along Montlake Boulevard at Pacific Street and Pacific Place. Southbound transit trips for Option E would be routed through the congested southbound through movement at Montlake/Pacific Street similar to Option D, rather than access the transit/HOV queue jump from Pacific Street to Montlake Boulevard. This could be improved by providing a transit only through lane on Montlake Boulevard through the Pacific Street intersection that would connect into the HOV lane starting near the Montlake cut. With this change, the southbound route would still have over a 5 minute travel time.



Pedestrian Walk Times

	Northbound	
To	Distance	Time
1	1515 ft	6 min 42 sec
2	620 ft	2 min 35 sec
3	At stop	At stop
	Southbound	
To	Distance	Time
1	1515 ft	6 min 42 sec
2	620 ft	2 min 35 sec
3	At stop	At stop

Transit Travel Times

Northbound	5 min 26 sec
Southbound	6 min 28 sec

Option E Travel Times - Person delay while riding transit

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	3 min 25 sec	341 hr 40 min
SB	6,000	5 min 06 sec	510 hr 0 min

Benefits: Bus riders transferring to the UW station or going to UW athletic complex would have direct access. This is an off-street bus stop and limits impacts to traffic operations along Montlake Boulevard.

Challenges: Bus riders heading to UW campus or the UW Medical Center would experience increased walk times of approximately 2-4 minutes compared to existing conditions. Transit riders traveling through the Montlake Triangle area would experience longer travel times, a delay of 4-5 minutes compared to existing conditions. Traffic operations at Montlake Boulevard/NE Pacific Place would be impacted as described above due to the added signal phase required for the westbound exit from the stadium area. Transit operations during special events would require temporary on-street bus stops. Service to this location would require additional infrastructure, including construction of a transit center, and if trolley buses were to serve this off-street location, additional trolley wire. Bus circulation through the UW parking area may be difficult to accommodate due to physical

constraints near the parking facilities, bus movement, and potential conflicts or delays with other vehicles accessing the parking lots. Transit could not use inside HOV lanes planned for northbound Montlake Boulevard or the transit/HOV lane configuration would need to be re-evaluated to have the lane serve this stop.

Option F

Transit circulation/drop-off through Stadium parking lot: As in Option E, bus stops would be located adjacent to the UW station within the Husky Stadium parking lot. Buses would enter the area at the intersection of NE Pacific Place and Montlake Boulevard, stop adjacent to the UW station, then exit at the intersection of NE Pacific Street and Montlake Boulevard. This option would require the construction of a transit center to accommodate northbound and southbound buses at this location.

Option F includes signal and capacity modifications at the Montlake Boulevard/Pacific Street intersection. A westbound through and a left turn lane would need to be provided to allow buses to exit the UW station lot. The Montlake Boulevard/Pacific Street intersection would degrade to a LOS F, and would be 48% over capacity even with the recommended lane additions. This results in an 82% increase in delay for all vehicles travelling through the Montlake Boulevard/Pacific Street intersection. Congestion levels this high would likely cause queues that extend through adjacent intersections, which would affect transit trips beyond the travel time captured in the table below.

Northbound transit trips would be required to travel through the Montlake Boulevard/Pacific Street intersection twice, resulting in a travel time that exceeds 8 minutes. Southbound routes would travel through this intersection as well and would experience travel times over 3 ½ minutes.

Pedestrian Walk Times

	Northbound	
To	**Distance**	**Time**
1	1515 ft	6 min 42 sec
2	620 ft	2 min 35 sec
3	At stop	At stop
	Southbound	
To	**Distance**	**Time**
1	1515 ft	6 min 42 sec
2	620 ft	2 min 35 sec
3	At stop	At stop

Transit Travel Times

Northbound	8 min 50 sec
Southbound	3 min 38 sec

Option F Travel Times - Person delay while riding transit

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	3 min 34 sec	356 hr 40 min
SB	6,000	2 min 11 sec	218 hr 20 min

Benefits: Bus riders transferring to UW station or going to UW athletic complex would have direct access. This is an off-street bus stop and limits impacts to traffic operations along Montlake Boulevard.

Challenges: Bus riders heading to the UW campus or UW Medical Center would have to cross Montlake Boulevard and/or NE Pacific Street, resulting in longer walk times of approximately 2-4 minutes compared to existing conditions. Transit riders traveling through the Montlake Triangle area would also experience longer travel times, a delay of 2-7 minutes or more compared to existing conditions. The Montlake Boulevard/Pacific Street intersection would operate at well over capacity, impacting all traffic travelling through the intersection. Service to this location would require additional infrastructure, including construction of a transit center, and if trolley buses were to serve this off-street location, additional trolley wire. Bus circulation through the UW parking area may be difficult to accommodate due to physical constraints near

the parking facilities, bus movement, and potential conflicts or delays with other vehicles accessing the parking lots. Transit operations during special events would require temporary on-street bus stops. If all bus service inbound to the Triangle area used this stop, a longer signal for westbound movement at Montlake Boulevard/NE Pacific Street would be required to allow buses to move through the intersection. Any additional signal time at this location would result in substantial congestion on Montlake Boulevard and NE Pacific Street. Transit could not use inside HOV lanes planned for northbound Montlake Boulevard or the transit/HOV lane configuration would need to be re-evaluated to have the lane serve this stop.

Option G

Northbound on Montlake Boulevard, south of Stadium parking entrance. This northbound stop would be located just south of the E-12 parking lot and Husky Stadium access road. Bus riders would be required to cross the Husky Stadium access road to reach the UW station, assuming that local and regional bus transit riders are seeking a transfer to light rail destined north or south of the UW campus.

Option G includes signal and channelization modifications at the Montlake Boulevard/Pacific Street intersection. To provide a right side bus stop on Montlake south of Pacific Street and allow buses to travel northbound on Pacific Street, a bus-only signal phase would need to be provided. Adding this phase to the signal operations would result in substantial congestion that would extend back through the SR 520 interchange area, affecting local buses south of the SR 520 interchange. Without additional simulation analysis for the peak period, the level of travel time effect could not be quantified. To achieve the transit travel times shown in the table, an HOV bypass lane would need to be constructed for the length of the general purpose congestion.

The Montlake Boulevard/Pacific Street intersection is forecasted to operate at LOS F in the No Build condition. The additional green time for signal movement results in a 79% increase in delay per vehicle. Southbound transit trips would operate similarly as Options A, B, or C because they would use the existing HOV/transit lane on Pacific Street.

Pedestrian Walk Times

	Northbound	
To	**Distance**	**Time**
1	1520 ft	7 min 43 sec
2	1040 ft	4 min 36 sec
3	455 ft	2 min 10 sec
	Southbound	
To	**Distance**	**Time**
1	740 ft	3 min 52 sec
2	790 ft	4 min 5 sec
3	1010 ft	5 min 13 sec

Transit Travel Times

Northbound	3 min 39 sec
Southbound	1 min 42 sec

Option G Travel Times - Person delay while riding transit

(SB Option G assumed to have no travel delay compared to existing condition)

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	1 min 29 sec	148 hr 20 min
SB	6,000	0 min	0 hr

Benefits: This stop location would benefit riders transferring to light rail and does not impact plans for Husky Stadium expansion.

Challenges: Bus riders heading to the UW campus or the UW Medical Center would have to cross Montlake Boulevard and/or NE Pacific Street, resulting in approximately 2-5 minutes of additional walk time compared to existing conditions. Transit riders traveling through the Montlake Triangle area would experience travel time delay of 2 minutes or more, compared to existing conditions. General purpose traffic would be impacted by the traffic signal modifications as discussed above. Northbound Option G requires a transit priority signal for left turn movement onto NE Pacific Street from the bus stop. During the green light, buses would remain at the stop until the next signal phase because a bus could not complete a left turn in front of traffic on northbound Montlake Boulevard. Transit could not use

inside HOV lanes planned for northbound Montlake Boulevard or the transit/HOV lane configuration would need to be re-evaluated to have the lane serve this stop.

Option H

Montlake Triangle clockwise bus circulation. Bus stops H1 and H2 exist today. Northbound buses could be routed around the Montlake Triangle, turning left from Montlake Boulevard to NE Pacific Street followed by a right turn onto NE Pacific Place. Southbound buses would turn left from NE Pacific Street to Pacific Place. Both buses would make a right turn onto Montlake Boulevard and serve a southbound stop near the Montlake Boulevard/Pacific Place intersection, providing a connection to the Montlake Boulevard overcrossing to the UW station. Buses continuing northbound would turn right onto Montlake Boulevard from this stop and right onto NE Pacific Street, and continue to 15th Ave NE. Buses continuing southbound would turn right onto Montlake Boulevard and continue south toward SR 520.

The northbound H2 location is currently served by three daily trips by the Route 243 and a bus stop at this location is in the current plans for the Sound Transit UW station project and the current Montlake Triangle Improvement Plan. Increasing the number of bus routes serving the northbound and southbound stops would require creating 220-foot in-lane stops.

Option H uses existing signal phases and intersection channelization. Northbound transit trips are assumed to stop three times: twice at the stop on Pacific Street, and once on Montlake between Pacific Street and Pacific Place. The route is lengthened by circling the Triangle, resulting in a travel time of over 4 minutes.

The southbound routes are also lengthened by circling the northern section of the Triangle as described in Option D. Southbound transit trips would be routed through the congested southbound through movement at Montlake Boulevard/Pacific Street rather than access the transit/HOV queue jump from Pacific Street to Montlake Boulevard. This could be improved by providing a transit only through lane on Montlake Boulevard through the Pacific Street intersection that would connect into the HOV lane starting near the Montlake cut. With this change, the southbound route would still have over a 2 minute travel time.

Pedestrian Walk Times

	Northbound H_1 (NW corner)	
To	**Distance**	**Time**
1	660 ft	3 min 8 sec
2	535 ft	2 min 14 sec
3	926 ft	3 min 52 sec
	Northbound H_2 (NE corner)	
To	**Distance**	**Time**
1	1200 ft	5 min 0 sec
2	380 ft	1 min 35 sec
3	390 ft	1 min 38 sec
	Southbound (NE corner)	
To	**Distance**	**Time**
1	1200 ft	5 min 0 sec
2	380 ft	1 min 35 sec
3	390 ft	1 min 38 sec

Option H Travel Times - Person delay while riding transit

	Estimated through passengers	Travel time delay per passenger	Total daily person delay
NB	6,000	2 min 10 sec	216 hr 40 min
SB	6,000	1 min 30 sec	150 hr 0 min

Transit Travel Times

Northbound	4 min 6 sec
Southbound	3 min 11 sec

Benefits: Riders bound for UW campus would experience relatively short walk times. Bus riders transferring to UW station or going to the UW athletic complex would have more direct access from the southbound stop. Traffic improvements along NE Pacific Street are slightly improved as this option removes the existing southbound in-lane bus stop.

Challenges: Transit riders traveling through the Montlake Triangle area would experience a travel delay of approximately 1 ½ -3 minutes, compared to existing conditions. Transit operations are impacted, as buses would stop three times during the loop to accommodate riders boarding and alighting at the NE Pacific Street stop. This would potentially create confusion for riders trying to board buses as they travel northbound: they may be uncertain if

they will have to travel through the bus circulation prior to reaching their destination. Southbound buses could not use the HOV lane and queue jump at the NE Pacific Place/Montlake Boulevard intersection, resulting in impacts to bus travel times and traffic operations.

Summary

The following tables provide a summary of distances, walk times, transit travel times, and person delays in the Montlake Triangle area.

Pedestrian walk times and distances

The majority of bus riders and pedestrians (60%) will be destined for the UW campus or Medical Center. As shown in the two charts below, while Options D, E, F, and H offer the shortest walk distance and walk time to the UW station, only 20% of riders are headed to this destination. Options D, E, F, and G would significantly increase the walk distance to UW campus and Health Sciences facilities compared to current conditions and to Options A, B, and C.

Figure 3 (September 2010). Overview of pedestrian walk times (minutes) from northbound stop locations.

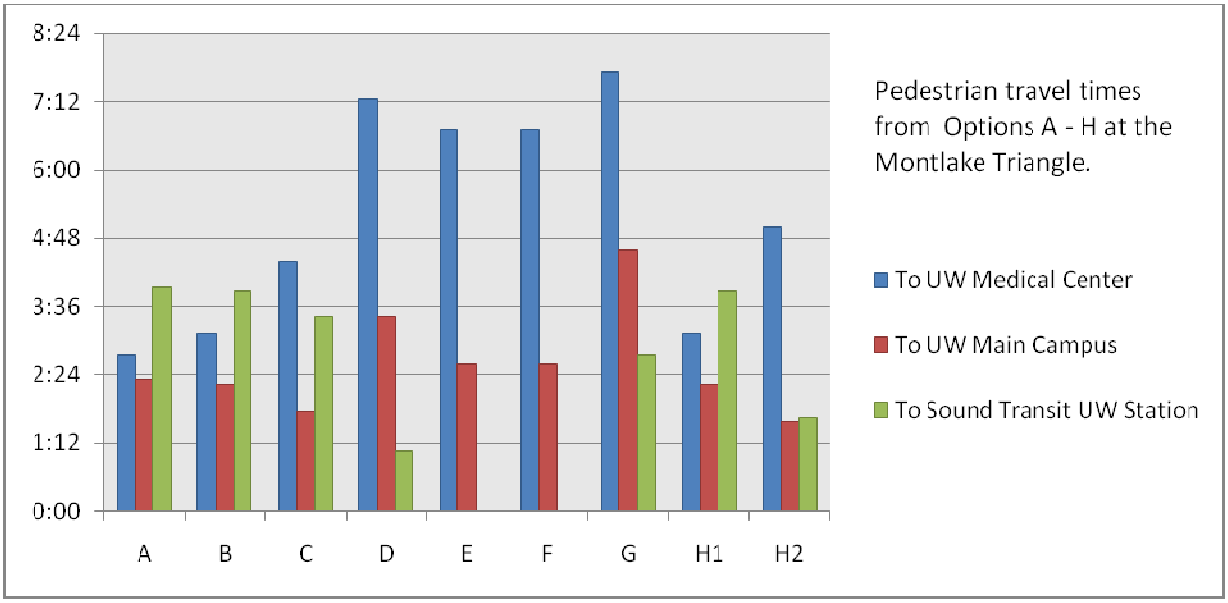
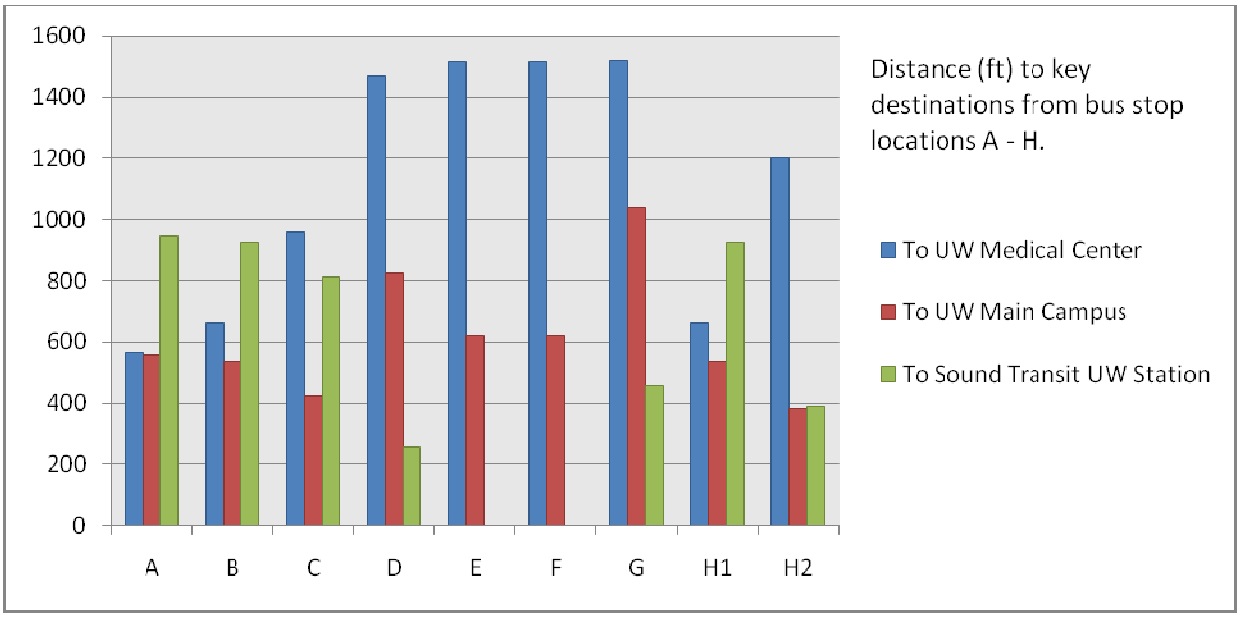


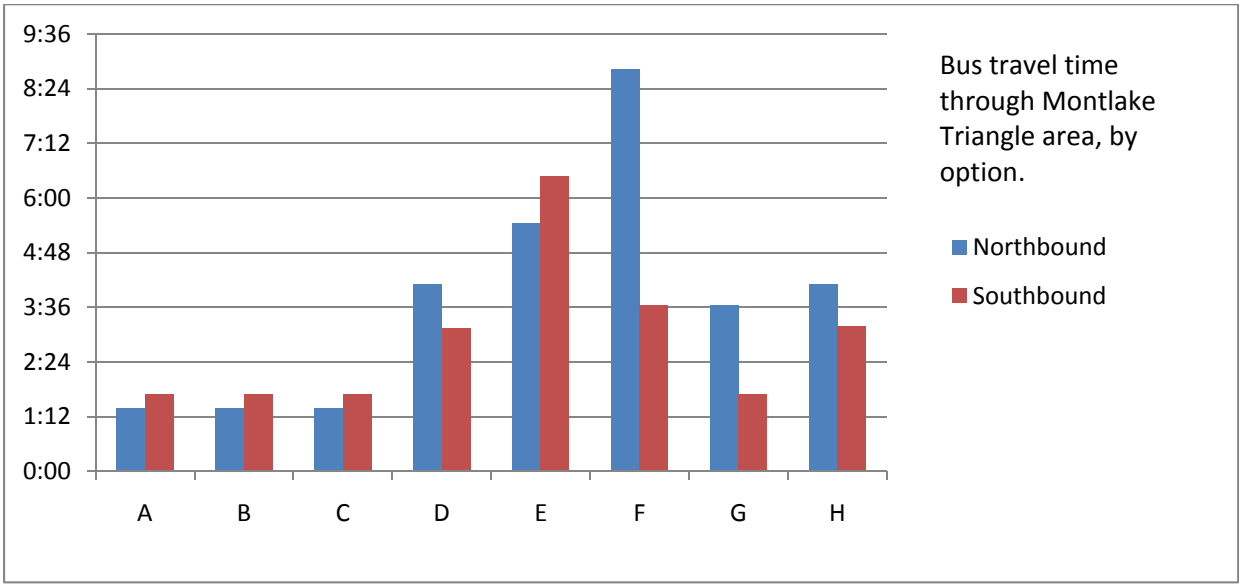
Figure 4 (September 2010). Overview of walking distances (feet) from northbound stop locations



Transit travel times

Options D, E, F, G, and H also increase the transit travel times for riders continuing through the area, relative to Options A, B, and C. This delay is especially pronounced for Options E and F, as buses are routed off-street through the existing Husky Stadium parking lot to the UW station entrance.

Figure 5 (September 2010). Overview of transit travel times (minutes)

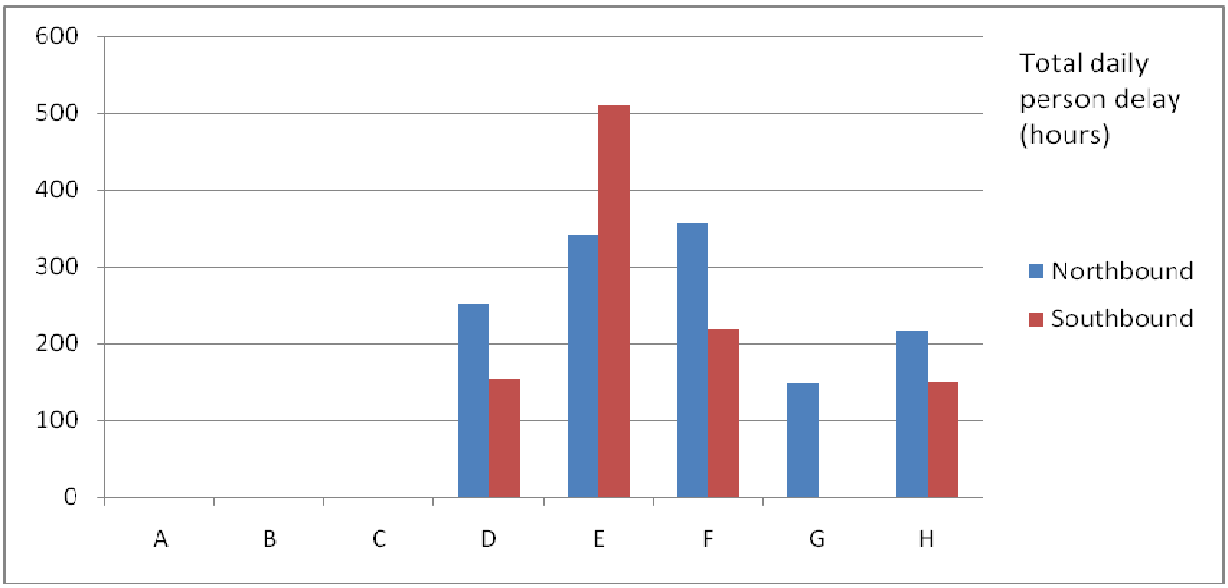


Total daily person delay

Options A, B, and C all assume no appreciable routing change through the Montlake Triangle and are therefore assumed equal to baseline conditions, resulting in no additional travel time delay for riders. Options E and F cause the most delay because they require all transit service to

detour off Montlake Boulevard and into the Husky Stadium parking lot to service the Sound Transit UW station. This results in a delay of 200-500 hours daily for each direction, equating to a delay of 2-5 minutes per rider. Options D and H add 150-250 hours daily to through passengers in each direction who must now ride around the Triangle, past the Northeast corner, before continuing northwestward on NE Pacific Street or south on Montlake Boulevard.

Figure 6 (September 2010). Overview of total daily person delay (hours)



Note: Options A, B, C, and southbound G are assumed to have no travel delay compared to baseline conditions today.

Traffic operations

Traffic operations for Options A, B, and C are not changed from the existing conditions or the planned improvements from the SR 520 project and the UW station project. Options D, E, F, G, and H would have added traffic impacts along Montlake Boulevard, NE Pacific Street, and NE Pacific Place, including:

- In-lane stops on Montlake Boulevard for Options D and G northbound could cause traffic delays.
- Option D requires a northbound left turn from Montlake Boulevard to NE Pacific Place, resulting in traffic, roadway, and sidewalk impacts on Montlake Boulevard.
- Options E and F require bus circulation through the Husky Stadium parking lot that would require close coordination with the UW station and Husky Stadium projects. Operations during special events would require on-street bus stops.
- Option F would require a longer signal for the westbound movement on Montlake Boulevard/ NE Pacific Street.
- Northbound Option G requires a transit priority signal for left turn movement onto NE Pacific Street from the stop. During the green light, buses would have to remain at the stop until the next signal phase, because a bus could not complete a left turn in front of northbound Montlake traffic.
- Option H requires buses to stop twice around the Montlake Triangle loop.

Recommendations for the Montlake Triangle stops

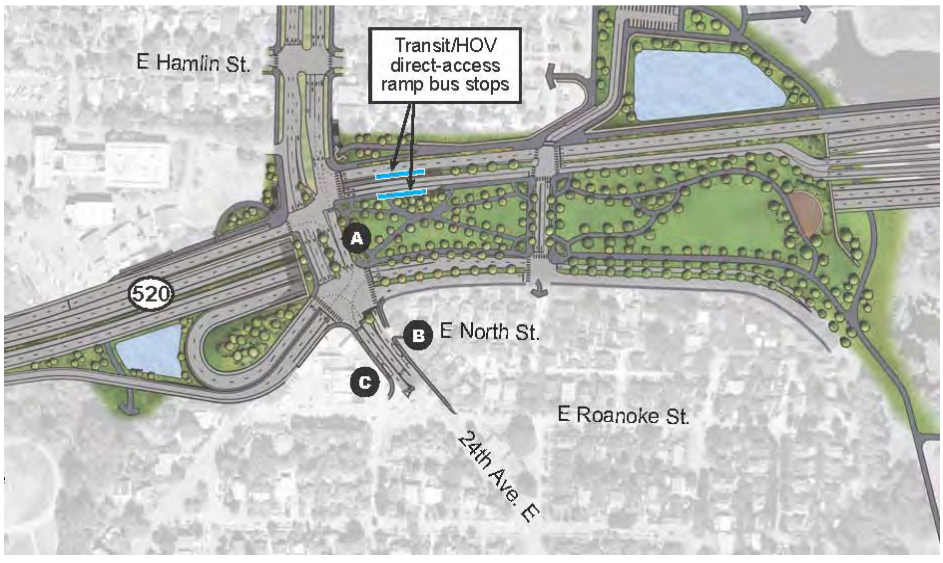
Bus stop Options A, B, and C are recommended for further evaluation and inclusion for short term improvements at the Montlake Triangle area. This evaluation should include ridership estimates that include the light rail extension to Northgate, the associated reorientation of local bus service that will accompany the extension, and should include average pedestrian walking times in the overall travel time. Each stop location offers the majority of transit riders the shortest walk distance to/from destinations on the UW campus and UW Medical Center, similar to what is currently experienced today. Transit riders transferring from bus-to-bus or bus-to-light rail are served by walk distances of 950-1010 feet, and walk times between 4 and 5 minutes. Riders transferring at this location will have improved connectivity via new pedestrian pathways and a new bridge over Montlake Boulevard connecting the Triangle to the UW station. To improve the walk time for the southbound stop next to the UW Medical Center, an additional crosswalk at the existing access signal should be evaluated. There is no significant impact to traffic operations or added travel time for riders with these options.

Bus stop Options D through H are not recommended for further consideration at this time. These options offer some benefits and could be implemented as continued transit planning efforts identify additional service and bus stop needs to address transit riders and pedestrian. Options D through H are not precluded by the initial implementation of Options A, B, or C. However additional infrastructure and traffic operations improvements are required to provide service at these locations. Northbound stops for Options D and G would require improvements to the existing stops such as 220-foot bus bays, additional sidewalk and curb space, and platforms. Options E and F would require construction of a transit center to serve all northbound and southbound routes in this area. Options D, E, F, and G would require signal and channelization changes to maintain traffic level of service and transit speed and reliability.

<u>Bus stop location options for the Montlake interchange</u>

The preferred alternative design provides an opportunity to consider consolidating and relocating bus stops on the Montlake lid and along Montlake Boulevard. Using local and regional transit ridership projections, the subgroup evaluated options for bus stop locations at the Montlake interchange.

Figure 7 (August 2010). Bus stop location options at the Montlake interchange.



Stop A: Northbound—locate a bus stop on the Montlake lid.

Benefits: This option benefits transit riders by reducing the walk distance between the regional and local transit stops. This allows riders to use these stops as a transfer point between local and regional buses, replicating the function of the Montlake Freeway station, which is removed as part of the Preferred Alternative. This option also provides general purpose traffic with two lanes for passing stopped buses.

Challenges: This option reduces the green space on the lid to accommodate the pull-out. This option requires a transit receiving lane further north of the lid, along the east edge of Montlake Boulevard to Hamlin Street.

Considerations: The stop on Montlake Boulevard at East Roanoke would need further evaluation and a public process to determine if it could be consolidated with the Montlake lid stop. Transit signal priority could be considered in the future upon continued review of traffic operations at this location.

Stop B: Northbound—locate an in-lane bus stop on East Montlake Place East at East North Street.

Benefits: This option decreases walk distance compared to the existing northbound stop location at Roanoke Street.

Challenges: Riders accessing regional buses would need to cross Lake Washington Boulevard and would experience increased walk time as compared to Stop A.

Stop C: Southbound—locate an in-lane bus stop on East Montlake Place East adjacent to the Hop-In Grocery.

Additional stop locations were considered on the lid but were not considered safe alternatives. The ESSB 6392 process eliminated the “slip ramps” or “free right turn lanes” at this location, which resulted in the removal of all traffic islands from the design. Today, the traffic islands act as a refuge for transit riders for access to buses. Removing the islands eliminates the space for a bus stop at this location.

Benefits: This option decreases the walk distance between the regional and local transit stops compared to the existing southbound stop location at Roanoke Street .

Challenges: The intersection of East Roanoke Street and East Montlake Place East will require reconstruction to provide the necessary curb space while maintaining business access. This stop also needs further evaluation to identify and resolve any potential transit operational issues.

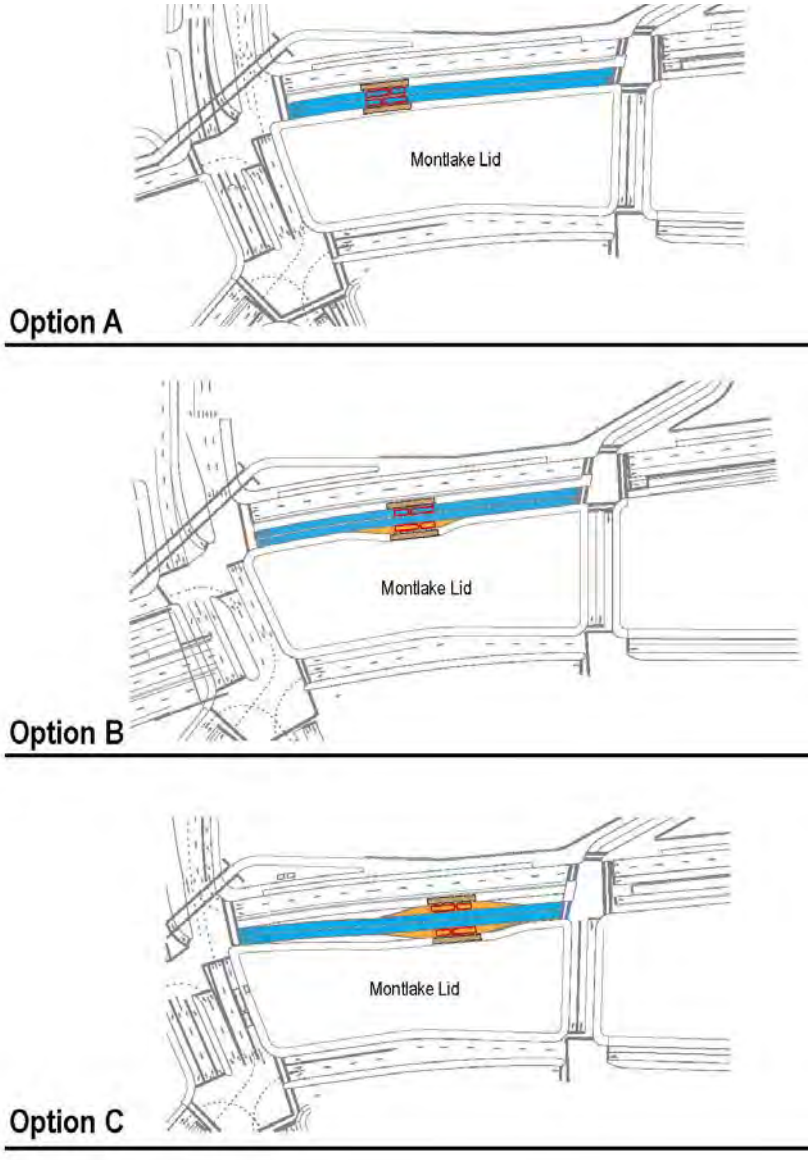
Recommendations for the Montlake interchange stops

A northbound bus pull out located on the Montlake lid (Stop A) and the southbound stop located adjacent to the Hop-In Grocery (Stop C), are recommended. These locations provide the most effective service for planned transit routes. The locations are also closest to the proposed bus stops on the direct-access ramps, facilitating easy transfers between local and regional bus transit service for riders.

Bus stop options for the direct-access transit/HOV ramps

The graphic below shows the three options for bus stop configurations on the eastbound and westbound direct-access ramps at the Montlake Boulevard and SR 520 interchange.

Figure 8 (August 2010). Bus pull-out options at the direct-access ramps.



Option A

This option has no pull outs. Buses stop in-lane on both the eastbound and westbound ramp.

Benefits: Buses are not required to re-enter traffic, which facilitates bus movement off the ramp and through the interchange. This option has the least impact to green space on the lid.

Challenges: The in-lane stop in the eastbound direction may cause back-ups as vehicles queue on Montlake Boulevard, waiting to complete the left turn movement onto the ramp. This could cause a bus to miss the green movement and have to wait through another signal cycle.

Option B

This option has a pull out on the eastbound ramp and an in-lane stop on the westbound ramp.

Benefits: The pull out in the eastbound direction reduces the potential for congestion backing onto Montlake Boulevard. Buses in the eastbound pull out would have an opportunity to reenter traffic when the cycle turns red for the southbound left from Montlake Boulevard to the direct-access ramp. The in-lane stop in the westbound direction will cause minimal delay. This option has some reduction of the green space on the lid.

Challenges: Appropriate pavement delineation will be required to ensure delayed westbound vehicles do not move in front of a stopped bus, creating potential bus-vehicle conflicts.

Option C

This option has pull outs on both the eastbound and westbound ramp.

Benefits: This option removes buses from the ramps reducing any additional delays to HOV's using the direct-access ramps.

Challenges: This option has the most reduction of the green space on the lid. In the westbound direction, additional delay may be incurred as the bus may need to wait to reenter traffic.

Recommendations for the direct-access transit/HOV ramp stops

Traffic operations analysis shows that pull outs are not required in both directions. Option B, with a pull out on the eastbound ramp and an in-lane stop on the westbound ramp, is recommended by the TCT. This option reduces the potential for congestion on Montlake Boulevard while only having a small reduction to the green space on the lid. These stops will be evaluated further in the design process to determine what potential improvements can be made to the passenger waiting environment.

Final TCT recommendations

The TCT recommended bus stop locations in three areas: the Montlake Triangle, the Montlake interchange, and the direct-access transit/HOV ramp.

Montlake Triangle stops

- Bus stop Options A, B, and C are recommended for further evaluation and inclusion for short term improvements at the Triangle area.
  - Each stop location offers the majority of transit riders the shortest walk distance to/from destinations on the UW campus and UW Health Sciences facilities.
  - Transit riders transferring from bus-to-bus or bus-to-light rail are served by walk distances of 1,010 feet or less.
- Options D through H could be implemented as continued transit planning efforts identify additional service and bus stop needs to address transit riders and pedestrians.

  - Options D through H are not precluded by the initial implementation of Options A, B, or C; however additional infrastructure and capital investments are required to provide service at these locations.
  - Options D, G, and H would require improvements to the existing stops such as 220-foot busy bays, additional sidewalk and curb space, and platforms.
  - Options D through H may have traffic impacts that affect general-purpose and transit traffic.
  - Options E and F would require construction of a transit center to serve all northbound and southbound routes in this area.

Montlake interchange stops

- A northbound bus stop and receiving lane located on the Montlake Lid (Stop A) and the southbound stop located adjacent to the Hop-In Grocery (Stop C), are recommended. These locations provide the most effective service for planned transit routes, and are closest to proposed bus stops on the direct-access ramps.

Direct-access transit/HOV ramp stops

- A pull out is recommended on the eastbound direct-access transit/HOV ramp, and an in-lane stop is recommended on the westbound ramp (Option B).

Light Rail Transit Accommodation

Introduction

How is light rail transit accommodation addressed in the preferred alternative?

The Washington State Department of Transportation received significant comment during the SDEIS public comment period regarding the ability of the SR 520 corridor, as analyzed in the SDEIS, to accommodate light rail transit (LRT). It must be noted that the SR 520 I-5 to Medina Bridge Replacement and HOV Project scope does not specifically include light rail transit as a mode choice. Therefore, full build out of LRT in the corridor would require modifications to the current project scope or provided as a future project. The approach in the preferred alternative has been to incorporate specific design features of the replacement bridge and approaches that support future conversion to light rail while minimizing reconstruction of the highway infrastructure. It is clear that there will be a need for construction and additional costs to add light rail to the SR 520 corridor, but the costs and risks associated with such an addition have been minimized by the design elements included in the preferred alternative. WSDOT designers have remained within the boundaries of the project scope for the preferred alternative, yet there has been a concerted effort to accommodate future light rail transit.

WSDOT designers are incorporating light rail options under several future bridge configurations. The design is such that LRT can be brought to the corridor both as a substitute for the HOV lanes (4 general purpose lanes plus 2-way LRT) and as an addition to the bridge described in the preferred alternative (4 general purpose lanes plus 2 HOV lanes plus 2-way LRT). Without a specific LRT alignment and service plan for the SR 520 corridor, the multiple design options accommodate a number of potential configurations.

What comments were received?

Many comments were received in the comment period, but most were well represented by comments provided by both the Mayor and City Council of Seattle. In summary from the Mayor's comments:

"…the A+ plan would make future conversion to light rail very difficult, if not impossible. This conclusion suggests that the A+ design does not live up to state laws, RCW 47.01.410, which mandates that the SR-520 bridge be designed to accommodate future light rail."

The comments went on to point out three specific issues with the design described in the SDEIS.

1) The pontoons must be designed with additional flotation and stability necessary to support the weight and dynamic loading of light rail. The project should include and bear the cost of the necessary additional pontoons.
2) There must be a "gap" between the eastbound and westbound lanes as the west approach reaches Foster Island to allow light rail to leave the center alignment on SR 520 to connect to Husky Stadium.
3) Adequate width must be maintained on the floating bridge to allow space for light rail infrastructure and operations, including emergency evacuation.

In summary, from the City Council's comments:

"We, therefore, recommend that the design for the SR 520 corridor accomplish the following in order to meet the legislative requirement to accommodate light rail:

1) *Design substantial element of the corridor, such as overpasses of highway portions, such that they would not have to be demolished and rebuilt in order to construct light rail.*
2) *Include the recommended gap between the eastbound and westbound lanes in the Arboretum area.*
3) *Have a design plan that includes light rail on the current 115-foot wide bridge corridor and/or that permits adding additional width without demolishing or re-building the bridge deck.*
4) *Ensure that the pontoons are designed so that the additional stabilization pontoons can be added without major disruption of the corridor or significant modification of the existing pontoons."*

Addressing the problem

How will we identify possible solutions?

The issues brought forth in the comment periods were directed, for the most part, to the design team for the SR 520 Project as most of the issues concern the details of the design for the bridge and approaches.

Recommendations

What did we consider?

The SR 520 design team considered how to add LRT to the corridor through replacing the HOV lanes with LRT, in a 4 general purpose lane + 2-way LRT configuration. The design team also considered how to add LRT to the corridor if future transit ridership demand indicated a need for both bus transit service operating in HOV lanes and 2-way LRT service, resulting in a 4 general purpose lane + 2 HOV lane + 2-way LRT configuration.

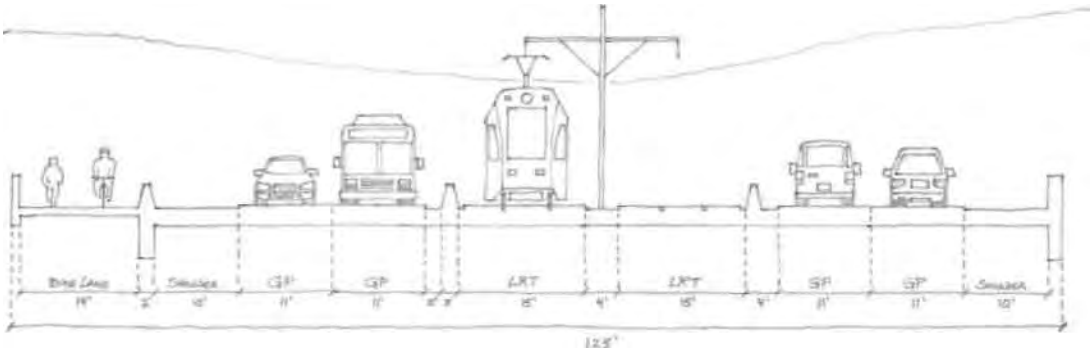
What options were presented for TCT consideration?

Using details of the report commissioned by the Mayor's office on LRT accommodation, below is a summary of how each issue has been addressed.

<u>Bridge deck - roadway structure</u>

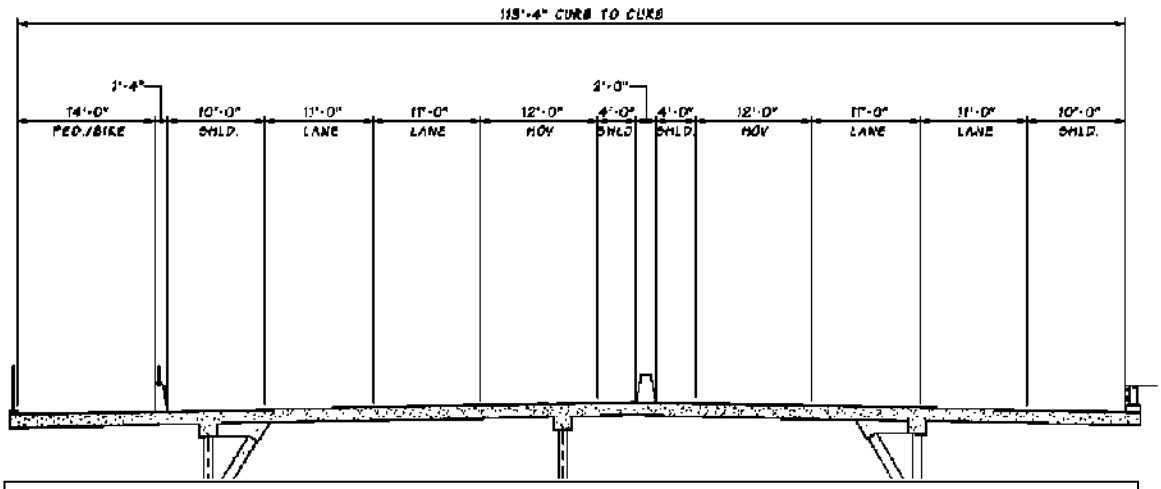
SDEIS: The report found that the roadway structure currently under design accommodates future LRT by including structural elements and stray current protection for LRT. The question that was raised was the potential need for a wider roadway structure. The report found that it could be necessary to widen the bridge deck up to ten feet, from 115 feet up to 125 feet, to support conversion to light rail. This was based on a combination of engineering factors

provided by Sound Transit and an assumption that the shoulder widths were at a minimum width that was acceptable to FHWA.

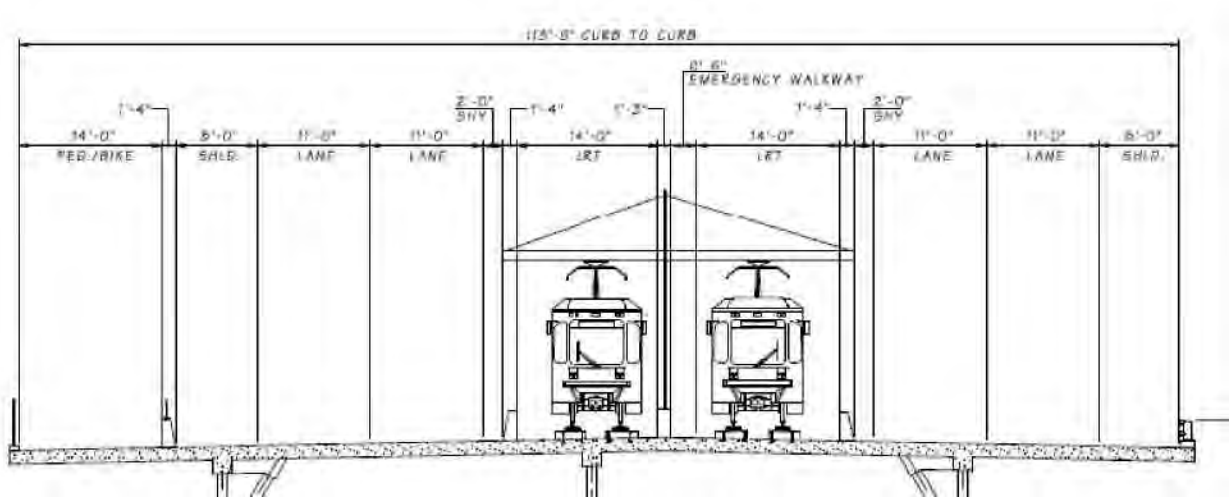


Mid-span cross section - Seattle Mayor's Report on LRT Accommodation, showing wider cross-section.

Preferred alternative resolution: In subsequent work on the design, WSDOT found that by reducing shoulder widths on the bridge deck and assuming LRT operation in a smaller design envelope (34.3 feet compared to 38 feet from outside of barrier to outside of barrier), LRT could be accommodated within a 115-foot roadway section.



Bridge mid-span cross section preferred alternative (WSDOT).



Bridge mid span cross section showing preferred alternative with HOV lanes converted to LRT, 4 GP lanes plus two LRT tracks with narrowed shoulders (WSDOT).

If light rail is added to the preferred alternative design with the 4 general purpose lanes plus 2 HOV lanes plus 2-way LRT configuration, widening of the bridge deck will be required. The outside of the bridge deck would be widened approximately 17-feet on each side. In addition, similar to the 4 general purpose lanes plus 2-way LRT configuration, the center portion of the roadway would be converted to LRT. Similar widening would also be required on the transition spans and along some segments of the approach spans.

Pontoons

SDEIS: The pontoons for the bridge as designed in the SDEIS, are capable of supporting a six-lane roadway section. The number of pontoons was insufficient to carry the six-lane roadway structure plus the added load and stability requirements necessary to accommodate LRT.

To support a six-lane structure the design includes a single string of longitudinal pontoons and supplementary stability pontoons, or "flankers," to be attached at periodic intervals to the longitudinal pontoons. The "flankers" are designed to provide the floatation and stability needed for a 6 lane roadway. With the addition of the LRT to the bridge, more flankers are needed to provide floatation and stability to accommodate the added weight and dynamic load.

Preferred alternative resolution: To support the additional loading of LRT, an additional 30 "flanker" pontoons would need to be added to the bridge. It should be noted that the technology and method for attaching these "flankers" is well known as the first phase of the six-lane bridge requires 14 "flanker" pontoons, and is the same pontoon joining process as used for all current floating bridge pontoons.

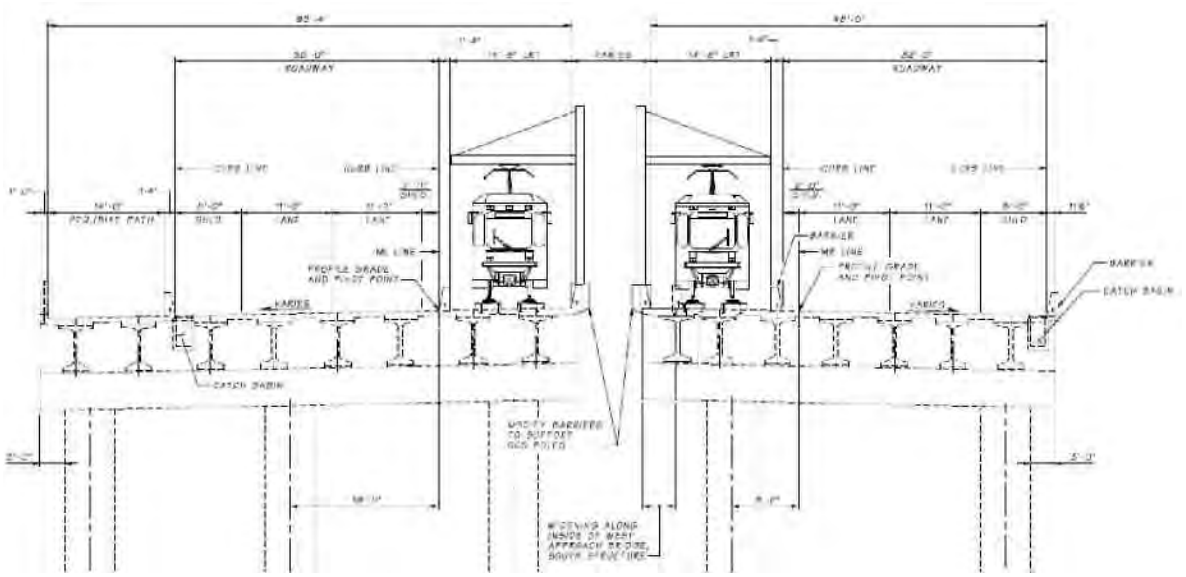
As currently defined, the project scope does not include the construction or installation of the additional 30 “flanker” pontoons necessary to support light rail. While far short of the cost of an entirely new bridge for LRT, environmental approval and the cost of the additional “flanker” pontoons would need to be part adding LRT to the SR 520 corridor.

Approaches

SDEIS: The design of the bridge approaches will require future widening and reconstruction of the structure to add light rail transit to the corridor. Similar to the floating bridge segment, the approach structures would be widened and the center portion of the bridge converted to LRT. Conversion to LRT may include demolition of the center portion to place LRT at a different profile, depending on the chosen route.

Preferred alternative resolution: The design of the east approach remains essentially the same. Current design for the Evergreen Point Transit station could accommodate LRT in the center position in the station taking the place of bus operations. Other LRT alignments which would require design and construction of a new station are also possible. The current station design would need to be adapted to provide good connectivity between buses and light rail. This station concept, likely a bi-level station, is not included in the preferred alternative. It should also be noted that some reduction of shoulder widths, consistent with reduced shoulders on the bridge, would be necessary on the east approach in the eastbound lanes to accommodate LRT if the HOV lanes are converted.

The design of the west approach has been modified to include the ability for light rail to leave the SR 520 alignment just to the east of Foster Island or approaching the Montlake Lid. This was achieved by widening the gap between eastbound and westbound lanes. Note that accommodating light rail in the west approach does require the addition of about 4 feet to the width of the structure of the eastbound lanes, as well as some widening of the bridge approach sections near the floating bridge where the gap is not provided. The structure foundation will support the 4-feet of additional width. The costs for this widening are not included in the SR 520 project for two reasons. First, there is a need to provide the narrowest structure possible to minimize adverse environmental impacts in this sensitive area. Second, the additional width cannot be justified for this project as light rail is not included as part of the project scope, only the accommodation for future light rail.



West approach east of Foster Island cross section showing preferred alternative with HOV lanes converted to LRT (showing 4 foot structural addition).

Westside shore connections

SDEIS: Light rail alignments considered in the Mayor's report as a response to the SDEIS assume a connection with the University Link station at Husky Stadium. An SR 520 light rail alignment would be designed to allow connectivity between the SR 520 light rail line and what will then be the existing U-Link light rail line. Four different options were proposed in the report for crossing the Montlake Cut:

- High-level fixed bridge
- Low-level bascule bridge
- Tunnel
- At-grade on Montlake with the second Montlake bascule bridge

Preferred alternative resolution: All four options remain open with the preferred alternative, but some of the details have been further clarified and two of the options have been enhanced. The high level bridge and tunnel options are clarified in that provisions have been made in the preferred alternative for LRT to leave the SR 520 alignment just east of Foster Island. The rail alignment, whether elevated or dropping to a tunnel, would be carried to the north of the SR 520 alignment and onto Foster Island. This has significant environmental implications. These impacts would be assessed in the environmental process related to an SR 520 light rail project. The advantage of these crossing alternatives is that the point of departure is now more clearly defined by the preferred alternative.

The low-level bascule bridge and the at-grade alternatives have been enhanced by the preferred

alternative. In both cases, assuming the 4 general purpose lane plus 2-way LRT configuration, the departure point from the SR 520 alignment has been accommodated as part of the project. The departure point could utilize the HOV/transit direct access ramps to Montlake Boulevard. These ramps have been designed with curvature and grade criteria that are compatible with light rail design and could be converted to light rail use. However, the exact track layout and necessary width of the running ways has not been designed specifically to accommodate either of these two alternatives. If either of these crossing alternatives moves forward, additional design work is necessary to determine that the ramps can, in fact, be directly converted to LRT, or that any necessary modifications to the structure have been identified.

The fourth alternative crosses the Montlake Cut on the second Montlake bascule bridge. The design of that bridge has included accommodation of light rail with some structural modifications as one of the considerations. It is anticipated that light rail would be in mixed traffic on Montlake Boulevard and on the bridge. The details of the channelization and lane configuration between the SR 520 Montlake lid and Husky Stadium have not been considered or designed. For the bascule bridge deck, the design has not encompassed the need to accommodate flush mounted light rail tracks to facilitate a shared roadway surface with motor vehicles. Stray current protection design and adequate clearance for the overhead catenary system (OCS) are also features that must be considered in the design if this crossing alternative is preferred.

What are the benefits and challenges of each recommendation?

The refinements made to the preferred alternative have accomplished two important aspects of a future potential light rail transit system added to SR 520. First, the design reduces the need for future structural modifications to accommodate LRT, and has identified the need to adapt specific aspects of the bridge for potential future LRT service. While the level of detail cannot be provided in this paper, it is worth noting that many of the lessons learned from adapting the I-90 bridge to light rail have been applied to this project, so that if the region were to decide to move forward with LRT on SR 520, many of the unknowns of I-90 are well known for SR 520. Specific design considerations have been incorporated to facilitate a more straightforward adaptation.

Second, while the costs are not specifically identified, the structural tasks necessary to add light rail have been identified and simplified.

The challenge implicit in these recommendations is two-fold. First, some of the environmental issues associated with adding light rail to the SR 520 corridor are now in much sharper focus, and some issues, such as construction on Foster Island and crossing the Montlake Cut, have serious implications for the feasibility of future LRT. Second, there is a clearer understanding of what adding LRT to the SR 520 corridor might cost. Costs to add “flanker” pontoons, widen the west approach, potentially re-design and re-construct the Evergreen Point station, and provide a crossing of the Montlake Cut could now be estimated. The environmental issues and cost implications will be important factors in any future decision process.

Final TCT recommendation

The preferred alternative incorporates specific design features on the replacement floating bridge and approaches that support future conversion to light rail while minimizing reconstruction of the highway infrastructure. The TCT endorses the work of the SR 520 design team to ensure compatibility of the corridor with potential future light rail service. Specifically, the project can accommodate future light rail in two different configurations with some capital investment, and maintain four options for connecting light rail to the UW station at Husky Stadium.

Noise Reduction Strategies

Introduction

How was noise reduction addressed in the preferred alternative?

Throughout the state, WSDOT is working hard to manage traffic noise along highways in accordance with federal and state noise mitigation policies. In the preferred alternative for the SR 520 I-5 to Medina project, WSDOT committed to providing noise reduction features along the highway and identified other noise mitigation strategies in the SDEIS. The noise reduction features identified in the preferred alternative include a speed reduction to 45 mph on the Portage Bay Bridge, raising the profile of the West Approach, and implementation of innovative noise reduction methods along the corridor, including:

- Four-foot high traffic barriers with absorptive material from I-5 to the west approach of the floating bridge.
- Quieter concrete pavement along the SR 520 mainline the full length of the project, including the floating bridge.
- Acoustically absorptive materials around the Montlake lid portals.
- Bridge expansion joint encapsulation with absorptive material.

Since early 2000 when work on the SR 520 Bridge Replacement and HOV project EIS began, discussions have included the length and location of freeway lids. The preferred alternative includes two freeway lids—one at 10th Avenue and Delmar and one at the Montlake interchange. Though the primary objective for including these lids in the project is to reconnect adjacent neighborhood communities divided by the existing highway, the lids may also provide noise reduction benefits for those properties abutting the lid as well.

What comments were received?

Noise generated by users of SR 520 has been a major concern for people living along the highway for many years. During the review of the SDEIS, WSDOT received a number of comments that reiterated concerns about noise and requested the project include additional noise reduction strategies. A number of additional noise management features were added to the preferred alternative to respond to these concerns.

Addressing the problem

How did we identify possible solutions?

In addition to reviewing current, proven technologies, WSDOT investigated several innovative noise management methods being used or tested in other states and countries. In 2008, WSDOT hired an Expert Review Panel (ERP) of internationally renowned acousticians to evaluate potential noise

reduction methods for the project. In addition to noise walls, the ERP recommended considering:

- Quieter concrete pavement technologies.
- Acoustically absorptive materials.
- Quieter ventilation fans.
- Transparent/translucent barriers.
- Bridge expansion joint encapsulation.
- Traffic speed reductions.

WSDOT evaluated all of the ERP recommendations for feasibility and ultimately identified the noise management features included within the preferred alternative.

Recommendations

What did we consider?

WSDOT considered a host of noise management methods, including implementing several test projects to evaluate initial and long term effectiveness of various pavement types. These noise reduction options were evaluated for both reasonableness and feasibility, criteria required by FHWA for designation as noise mitigation and eligibility for federal funding.

Following this careful process, WSDOT recommends using the following design features to reduce noise:

Continue to follow the required FHWA/WSDOT process for consideration of noise mitigation. This process generally refers to use of proven technology such as noise walls and barriers, in specific, qualified locations. Many comments on the SDEIS expressed strong negative opinions about the aesthetic effects of noise walls, although a small number of comments expressed support of walls. Decisions on whether walls are included in the project are made according to the 2006 *WSDOT Traffic Noise Analysis and Abatement Policy and Procedures.* As part of this policy, WSDOT consults with affected first-line property owners to determine whether or not they want walls to be built at their property line. WSDOT traffic noise policy is based on the Federal Regulation 23CFR772.

Four-foot traffic barriers with absorptive material from I- 5 to the West Approach of the floating bridge. Four-foot traffic barriers can be considered noise mitigation at qualified locations, similar to noise walls. In addition, the use of absorptive materials is likely to reduce noise levels below that of standard concrete. The additional noise reduction from these traffic barriers may allow for shorter noise walls in some areas.

Quieter concrete pavement along the SR 520 mainline the full length of the project, including the floating bridge. Quieter concrete pavement tests in other states have shown promise for reduced noise. However, given the unproven and innovative nature of this method, WSDOT cannot guarantee specific noise reduction amounts or acoustic longevity of the noise performance until quieter concrete pavement has been tested and implemented in Washington.

As an additional concern, the cost to maintain pavement surface conditions is currently unknown. Still, WSDOT recognizes the benefits this treatment may provide based on tests performed in other states and therefore plans to implement quieter concrete pavement as part of the project and monitor the effectiveness.

Acoustically absorptive materials around the Montlake lid portals. Use of these materials near lid portals would have similar benefit to their use on traffic barriers. WSDOT is currently testing absorptive materials on several noise walls (on I-5, I-405 and SR 18) and around bridge joints on the Tacoma Narrows Bridge. Preliminary results have been promising, although some maintenance challenges have been identified.

Bridge expansion joint encapsulation to reduce noise transmission through bridge joints. A WSDOT study of bridge expansion joint encapsulation on the Tacoma Narrows Bridge is underway, including monitoring for effect and longevity. Preliminary results for longevity are promising, as are results from similar features on Interstate 90. The SR 520 project is an ideal corridor for implementing this innovative noise reduction strategy.

Speed limit reduction on the Portage Bay Bridge. Though speed limit reductions are a proven tool for reducing traffic noise, this strategy must be balanced with the desire to maintain relatively high speeds within some highway corridors. While most segments of SR 520 are considered a high speed corridor, WSDOT responded to concerns about maintaining the residential neighborhood character surrounding the Portage Bay Bridge by agreeing to reduce posted speed limits on the bridge from 60 to 45 mph. Vehicles traveling at highway speeds at the Montlake interchange will make a safe and logical transition through this lower speed area as they approach I-5.

Raising the profile on the west approach across Foster Island. Based on updated noise analysis in support of the Final Environmental Impact Statement, WSDOT identified that raising the profile of the west approach—as identified in the preferred alternative—reduced noise through the Arboretum.

Final TCT recommendation

The Technical Coordination Team recommended that WSDOT move forward with noise management strategies as identified in the SDEIS for the preferred alternative, including:

- Continue to follow the required FHWA/WSDOT process for considering noise mitigation.
- Four-foot high traffic barriers with acoustically absorptive material from I-5 to the west approach of the floating bridge.
- Quieter concrete pavement along the SR 520 mainline the full length of the project, including the floating bridge.
- Acoustically absorptive materials around lid portals.
- Bridge expansion joint encapsulation to reduce noise transmission through bridge joints.
- Speed limit reduction on the Portage Bay Bridge.

Health Impact Assessment

Introduction

How was the Health Impact Assessment addressed in the preferred alternative?

In 2007, Senate Bill 6099 directed that a health impact assessment be prepared for the SR 520 project. To fulfill that legislation, the SR 520 Health Impact Assessment (HIA) was prepared by Public Health - Seattle & King County and the Puget Sound Clean Air Agency with support from WSDOT, and published in September 2008.

The HIA recommends elements for creating healthy communities in the SR 520 corridor, including landscaped lids and green spaces, transit improvements, pedestrian and bicycling amenities, design improvements and noise reduction strategies. The HIA also encourages selection of the project alternative that can most effectively and efficiently incorporate all recommended features into its design.

Specific HIA recommendations include the following four categories:

- Construction period management.
    - Reduce construction-related pollution.
    - Increase traffic management.
    - Provide for construction noise control.

- Transit, bicycling and walking.
    - Increase and improve transit service to meet increased demand, attract more riders and reduce air pollution.
    - Install connected walking and bicycling facilities throughout the corridor.
    - Create a common wayfinding system in the corridor.
    - Provide safe mobility on pedestrian and bicycling paths, and at transit stops and transfer points.

- Landscaped lids and green spaces.
    - Include three landscaped freeway lids (at Interstate 5, 10th Avenue and Delmar Drive East, and Montlake Boulevard).
    - Use landscaping materials throughout the SR 520 corridor, along adjacent rails and roadways and at transit stops.
    - Improve and preserve the integrity of the Washington Park Arboretum, and the ability of visitors to enjoy it and other green spaces and natural areas.
    - Preserve access to the waterfront for water related activities.

- Design features.
    - Reduce noise throughout the corridor.
    - Add to the adjacent communities' visual character with art and design.
    - Utilize innovative storm water management practices along the SR 520 corridor to reduce vehicular pollution from entering lake Washington.

The preferred alternative for the SR 520 I-5 to Medina project incorporates many of the types of design features recommended by the SR 520 Health Impact Assessment.

What comments were received?

During the SDEIS public comment period, the Seattle City Council commented that the SR 520 project should implement the HIA recommendations.

What issues are we trying to resolve?

Since the beginning of the project in 2000, the SR 520 project has included many of the concepts outlined in the HIA. Most notably, the project has included extensive bicycle and pedestrian facilities, landscaped lids, transit facilities, noise mitigation, and stormwater treatment. In 2010, the west side portion of the project is moving from conceptual design toward final design, including refining the project definition of the preferred alternative for the FEIS. As the project adds design details and definitions, these details should follow the intent of the issues outlined in the HIA.

Addressing the problem

How will we identify possible solutions?

As design of the preferred alternative continues, WSDOT is meeting regularly with the Seattle DOT, King County Metro, Sound Transit, the Arboretum and Botanical Garden Committee (ABGC) and other stakeholders to collectively identify detailed solutions for a number of HIA-related issues. In addition, comments gathered through the EIS process and public outreach activities are evaluated for inclusion in the project.

How will we reach agreement?

The preferred alternative design identified additional or improved solutions for more of the HIA recommendations. New and improved solutions to HIA recommendations continue to be identified and developed as part of ongoing work efforts with the City of Seattle, King County, other agencies and interested stakeholders. Among these efforts are the Technical Coordination Team (TCT) collaboration process, coordination with the ABGC to improve and preserve the integrity of the Arboretum, the NEPA process and compliance with Section 106 of the National Historic Preservation Act.

Recommendation

What did we consider?

WSDOT considered three SDEIS design options and subsequently developed the preferred alternative based on public and agency comments, HIA recommendations, and extensive coordination with various stakeholders.

What are the options presented for TCT consideration?

WSDOT recommends the following features in the preferred alternative to specifically address HIA recommendations. Ongoing design review of the preferred alternative will provide opportunities to add to or refine these features in the future. Current recommendations include:

Transit, bicycling and walking

- New direct-access transit/HOV ramps to/from the east to transit stops on the Montlake lid.
- Transit/HOV lanes on Montlake Boulevard and a second bascule bridge to improve transit mobility between SR 520, the University of Washington, and the U-Link station.
- Creation of space between the west approach bridges and on the floating bridge to accommodate potential future light rail and provide an improved environment for plants and aquatic species.
- Improved connections for pedestrian and bicycle facilities. For example:
    - A new regional bike/pedestrian trail connecting Bellevue to the Burke Gilman trail including proposed grade separated crossings over Montlake Boulevard and Pacific Place between the Sound Transit UW station and Rainier Vista on the University of Washington campus.
    - A new trail east of the Montlake lid directly connecting the Ship Canal Waterside Trail to the Washington Park Arboretum trail system as planned within the Arboretum Master Plan. Improved on-street bike lanes.
- Traffic bulbs and improved pedestrian crossings at key local street intersections, and other design features to calm traffic and help provide a safer environment to enhance mobility for pedestrians and bicyclists.

Landscaped lids and green spaces

- Landscaped freeway lids at 10th and Delmar and the Montlake Interchange are included in the west side portion of the project (three lids are included in the east portion of the project). Although the I-5 lid has been eliminated, the Montlake lid was expanded is now nearly 1500 feet in length.
- Widened bridge over I-5 at Roanoke Street East with landscaping or other enhancements to separate bike/pedestrian users from I-5.
- Corridor landscaping that will blend with the natural environment, with additional

landscaping on the expanded Montlake lid creating passive-use and open green space reconnecting the existing neighborhood, as well as new urban design features of Lake Washington Boulevard.

Design features

- Use of narrowed lanes and shoulders on SR 520 to reduce the sensitive area impact.
- Narrower Portage Bay Bridge including a managed shoulder for traffic use during peak traffic periods.
- Removal of existing Lake Washington Boulevard ramps, improving the area's visual quality and restoring native wetlands.
- Reduced height of the floating bridge to minimize visual effects to neighborhoods.
- A strong commitment to use innovative noise reduction strategies, in addition to following the standard FHWA/WSDOT process for consideration of noise mitigation. The preferred alternative now includes:
    - Four-foot traffic barriers with absorptive material from I-5 to the west approach of the floating bridge.
    - Quieter concrete pavement surface treatments along the SR 520 mainline the full length of the project, including the floating bridge.
    - Acoustically absorptive materials around the Montlake lid portals.
    - Bridge expansion joint encapsulation.
    - Speed limit reduction on the Portage Bay Bridge.
- Use of 'natural setting', green-build and low impact development stormwater ponds, and a commitment to innovative stormwater management strategies, especially on the floating bridge.
- Close coordination with the Arboretum and Botanical Garden Committee to develop plans for traffic calming and overall traffic management within the Arboretum, while ensuring visitors can continue to access and enjoy the Arboretum.

Final TCT recommendation

The TCT supports addressing recommendations from the 2008 HIA by incorporating design features identified in the preferred alternative, including enhancing transit, bicycling, and walking facilities; providing landscaped lids and green spaces; and employing noise reduction strategies.

Urban Design and Streetscape

Introduction

How were urban design and streetscape concerns addressed in the preferred alternative?

Drawing upon stakeholder input from both the Design Advisory Group (DAG) and mediation processes (2008), the SR 520 Urban Design team developed a series of design priorities for the SR 520 corridor, including proposed roadway and lid improvements in preparation of the preferred alternative. The team developed a vision statement that stresses corridor unity by defining the desire to create "...a coherent and graceful facility that reflects a harmonious relationship with the surrounding landscape, structures, and other elements of the corridor." Conceptual design for the preferred alternative included providing Americans with Disability Act (ADA) access, reconnecting separated neighborhoods through the use of lids, urban and historic aesthetics, preservation and enhancement of green and open spaces, access management, and mobility improvements through a variety of transportation mode choices and routes.

What comments were received?

Through preliminary public outreach efforts, the SR 520 Urban Design team heard a desire for specific features and functions at the Montlake interchange, Washington Park Arboretum and the I-5/Roanoke area. These elements included issues of safety, aesthetics, circulation, wayfinding, and directed programming requests.

As summarized in the Westside Urban Design Memorandum, these desires included:

- Creation of passive park and recreation space.
- Development of paths that logically and seamlessly connect to existing City of Seattle trail and open space networks, such as Washington Park Arboretum.
- Connections *to* and reconnections *of* neighborhoods.
- Creation of coherent, safe and easy bicycle and pedestrian connections.
- Emphasis on the use of vegetation over structure (e.g., green buffers versus fencing).
- Preservation and framing of views of visual resources such as Lake Union, downtown Seattle, Lake Washington, the Olympic and Cascade Mountains, the Arboretum, and Mt. Rainier, through the creation of belvederes, plazas and other public viewing areas.
- Use of lighting which emphasizes safety, directs lighting downward onto paths, and avoids "sky-shine".
- Design of "gardenesque" landscaping for interest and in keeping with neighborhood sensibility.
- Implementation of traffic calming measures via visual cues.
- Application of Olmsted principles and style to landscape and architectural designs where appropriate.

Comments received during the comment period of the SDEIS requested the project include features that add a "human scale" to the project, reflecting the complex needs of city streets. Specific features such as pedestrian lighting, pedestrian and bicycle facilities, and landscaping should be well integrated into the project. The project should adhere to concepts from the original Olmsted plan and in particular, design Lake Washington Boulevard and Montlake Boulevard in accordance with the Olmsted concepts. Particular attention should be given to the Arboretum, both toward minimizing impacts as well as the project design adjacent to, or within the park. Comments also recommended developing urban design guiding principles for use in integrating the project into the urban areas within Seattle, and to work closely on the project development with the Seattle Design Commission and the City of Seattle Office of Arts and Cultural Affairs.

Addressing the problem

How did we identify possible solutions?

The SR 520 Urban Design team developed recommendations based on previous work processes and public outreach efforts in the project area. These efforts include:

- Past stakeholder input from DAG and mediation.
- Work group recommendations.
- Design precedents, historic context and professional expertise.
- Information gained via extensive public outreach to Seattle neighborhoods, bicycle and pedestrian advocates, stewards of the Washington Park Arboretum, the University of Washington, and City of Seattle representatives.

In particular, the SR 520 Urban Design team focused on resolving issues that affect the FEIS footprint for the preferred alternative. Comments, recommendations, and suggestions from these earlier efforts were synthesized into comprehensive recommendations for Technical Coordination Team (TCT) consideration.

What are the options presented for TCT consideration?

The SR 520 Urban Design team developed a series of options for consideration by the TCT. These options included: providing paths at the Montlake lid, E. Roanoke Street I-5 crossing, and 10th and Delmar lid; providing opportunities for viewing visual resources; and ensuring the durability, relevance, beauty, context and maintenance of landscapes. Following is additional detail for each of the options.

- Provide paths at the Montlake lid which:
  - Are in scale and style with the surrounding Montlake neighborhood, Arboretum and Olmsted boulevards.
  - Accommodate diverse users and modes (e.g., cyclists, pedestrians, and elderly users).
  - Buffer users from the street edge (e.g., planting strips and other aesthetic physical buffers).

  - Connect users to locations both on the lid (e.g., transit stops, bicycle lockers, comfort stations, view points, plazas) and to the existing network of local and regional open spaces and paths/trails, including the Arboretum Waterfront Trail, the Lake Washington Loop Trail, East Montlake Park, UW open space, UW main campus, and Sound Transit's University Link UW station.
  - Are safe and legible (wayfinding).

- Provide paths at the E. Roanoke Street enhanced I-5 overcrossing and the 10th and Delmar lid which:
  - Are in scale and style with surrounding neighborhoods and parks.
  - Accommodate diverse users.
  - Connect users to north Capitol Hill, downtown Seattle and the University District.

- Provide opportunities for viewing visual resources at:
  - Montlake Bascule Bridge – 18-foot wide bicycle and pedestrian path with viewing space mid-span.
  - E. Roanoke Street enhanced crossing – improved bicycle and pedestrian access with possible belvedere/viewing areas to downtown Seattle.
  - 10th and Delmar lid – incorporation and preservation of the Bagley Viewpoint with raised viewing plaza at east edge of lid.
  - Montlake lid – raised viewing area to Washington Park Arboretum and Lake Washington at east edge of lid.

- Ensure durability, relevance, beauty, context and maintenance of landscapes by:
  - Selecting native vegetation (low maintenance, climate-appropriate) and/or vegetation in keeping with City of Seattle standards and historic context.
  - Not placing vegetation in areas where maintenance is difficult or impossible (e.g., Portage Bay Bridge).
  - Preserving mature tree canopy at 10th and Delmar lid where possible.
  - Preserving and/or enhancing Canal Preserve planting.
  - Connecting or augmenting Olmsted boulevard aesthetic and Arboretum collections/aesthetic through planting plans that respect Arboretum master plan, Olmsted precedents and City of Seattle standards.

Final TCT recommendation

The TCT supports collaboration between WSDOT, the Seattle Design Commission (SDC), City of Seattle, UW Architectural Commission, ABGC, Seattle Bicycle Advisory Board, Seattle Pedestrian Advisory Board, and Seattle neighborhoods to expand and refine an aesthetic vision, establish goals, and suggest design treatments for urban design and streetscapes within the project area. This collaboration would include identifying the existing urban amenities that will remain after construction of SR 520, and co-developing

a community engagement process for refining the goals and principles. It would ultimately result in a set of urban design guidelines that would inform and direct final design and construction of SR 520.

A SDC subcommittee would partner with WSDOT to review draft guidelines for visual, architectural and lid portal areas. Following general consensus from the subcommittee, the guidelines would be presented to the full SDC for review and general consensus, as well as City of Seattle review. Development of the urban design guidelines for SR 520 is expected to begin in the winter of 2010/2011.

Montlake Triangle Charrette

Introduction

How was the Montlake Triangle addressed in the preferred alternative?

Bounded by Montlake Boulevard, Pacific Place, and Pacific Street, the Montlake Triangle is the southeastern entry to the University of Washington campus. The Triangle is also a unique urban design element of the Rainier Vista view shed. Looking southeast from Drumheller Fountain on the main campus, Mt. Rainier is framed within the boundaries of the Vista. At the southeastern entrance to campus, the Montlake Triangle is the beginning of the Vista that frames views of the campus and fountain.

Preservation of the Rainier Vista has been a priority for the University of Washington, with emphasis in recent years to reinforce its importance and to reemphasize its contribution to the UW campus and surrounding landscape. In recent years, discussions have included ensuring preservation of the Rainier Vista while accommodating proposed transportation improvement projects in the vicinity of the Montlake Triangle, including the UWs own Rainier Vista Land Bridge project connecting the main campus and the Burke Gilman Trail to the Montlake Triangle.

In response to ESSB 6099, WSDOT, Sound Transit, and King County Metro worked in cooperation with the University of Washington to prepare the 2008 SR 520 High Capacity Transit plan. This plan recommended developing the Montlake Triangle into a multimodal transit hub, and the Montlake Triangle Charrette was established to meet the first milestone of the study: define the first phase of Montlake Multimodal Center improvements. The Montlake Triangle area provides important connections to local and regional services, including access to the University of Washington campus, the UW Medical Center, and Husky Stadium; Sound Transit and King County Metro bus transit service; multi-modal access to SR 520; connections for pedestrians and bicycles to regional trails; and access to future Sound Transit University Link (U-Link) light rail service. Several Triangle-area projects are in the planning and design or construction phases, and the SR 520 project provides an opportunity to leverage existing plans and projects to maximize investment in the area. The SR 520 I-5 to Medina preferred alternative identified a placeholder to address enhanced pedestrian and bicycle connectivity in the Triangle area, while ensuring connectivity of the future regional path provided by the SR 520 project.

What issue are we trying to resolve?

Sound Transit designed a pedestrian overpass that connects the UW light rail station to the University of Washington campus and the Burke Gilman Trail by providing a grade-separated pedestrian crossing across Montlake Boulevard and Pacific Place. As the University of Washington's Rainier Vista Land Bridge project moved forward, Sound Transit's pedestrian overcrossing design was re-examined. A proposal was developed to couple UWs Rainier Vista Land Bridge project with a Montlake Boulevard mid-block pedestrian crossing to connect the campus and the UW station.

The SR 520 I-5 to Medina preferred alternative was also developed considering the UW's proposed Rainier Vista Land Bridge project. In the preferred alternative, the proposed land bridge across Montlake Boulevard provided a connection to campus, coupled with the Rainier Vista Land Bridge project. The primary objective of the preferred alternative land bridge was to provide a regional connection for bicycle and pedestrian users coming from SR 520 and other surrounding Seattle neighborhoods. This land bridge concept was essentially a placeholder until a group could be formed to study options for the Montlake Triangle area in more detail. The Montlake Triangle Charrette was formed to evaluate opportunities in the Montlake Triangle area to enhance regional pedestrian and bicycle connectivity and provide access for transit users going to and from the UW station, while respecting design and construction schedules for the Sound Transit UW station and University of Washington Rainier Vista Land Bridge projects.

As described below, neither the original Sound Transit design nor the University of Washington's Rainier Vista Land Bridge project would improve the regional bicycle connections between SR 520 and the Burke Gilman Trail. Both projects also relied on an at-grade crossing of Montlake Boulevard to provide a link between the UW station and the University of Washington Medical Center. The recommended plan described below resolves these issues.

Addressing the problem

How did we identify possible solutions?

The Montlake Triangle Charrette (MTC) included representatives from WSDOT, SDOT, Seattle City Council, University of Washington, King County Metro, Sound Transit, and the Seattle Design Commission. The group met weekly for five weeks in June 2010, a schedule constrained by the need to maintain adopted project schedules of the University of Washington and Sound Transit projects.

MTC members developed an evaluation filter to screen proposed designs for the Montlake Triangle area. The filter identified design features that were "must haves" for the charrette participants, including elements such as bicycle/pedestrian connectivity and safety, function of the Montlake Triangle area during events at Husky Stadium and Hec Edmonson Pavilion, coordination with the Rainier Vista Land Bridge design, and connection to the Sound Transit UW station currently under construction.

In addition to the five Montlake Triangle charrettes, a subgroup of urban planners and designers met to brainstorm possible solutions that responded to the conceptual ideas identified in the larger group. At each charrette, the design subgroup presented options for consideration and discussion. After group discussion, the charrette participants eliminated options from further consideration and identified refinements to the remaining options. In the end, this iterative process led to one option that was recommended for further study.

Recommendations

What did we consider?

The MTC considered a range of options for the Montlake area, including several designs for undercrossings, overcrossings, and at-grade crossing enhancements.

Undercrossing options

The undercrossing, or tunnel, options considered varied in depth, connection to the UW station, and connection to the surface of the Montlake Triangle. MTC participants identified the best undercrossing option to be a short, direct tunnel from the mezzanine level of the Sound Transit UW station to the southeast tip of the Triangle (south of the Triangle Garage), with elevators to the surface.

Benefits of this undercrossing included a direct pedestrian connection from the University of Washington to the UW station, while providing a grade-separated crossing for light rail passengers, separating the majority of pedestrians from bicyclists, and facilitating an efficient connection between bus and rail. However, the undercrossing option does not provide an enhanced connection for regional bicycle and pedestrian users going to/from the University or the Burke Gilman Trail from the SR 520 regional trail and surrounding Seattle neighborhoods. Without this regional connection, the undercrossing option does not provide adequate enhanced regional benefit to non-transit users.

Overcrossing options

Overcrossing options varied in the width of the structure, ranging from a wide land-bridge (accommodating bicycle/pedestrian users and incorporating edge landscaping) to a narrow pedestrian-only bridge. MTC participants considered where the overcrossing should “land” on the west side of Montlake Boulevard, discussing benefits of landing in the Triangle or on upper campus (as in the original Sound Transit pedestrian overcrossing design). A variety of ramp designs were also presented to provide bicycle and ADA access to the overcrossing. Over several meetings, MTC participants discussed the optimal combination of each of these elements. In the end, the group recommended an overcrossing width of 30-34 feet, landing on the Montlake Triangle, with a short, straight ramp to the west of the UW station.

Benefits of the selected overcrossing include a direct pedestrian connection from the UW station over Montlake Boulevard to the Montlake Triangle, then connecting to the University of Washington main campus and the Burke Gilman Trail via the Rainier Vista Land Bridge. This combined proposal would separate pedestrians and bicycles from vehicles and buses using Montlake Boulevard, while still allowing for enhanced at-grade pedestrian crossings at both the Montlake Boulevard/Pacific Street and Montlake Boulevard/Pacific Place intersections. The overcrossing option also provides multiple choices for regional and local bicycle users and efficient connections between transit modes in the Triangle area.

At-grade crossing designs

While a number of at-grade crossing improvements were considered, at-grade crossing improvements alone could not efficiently accommodate the increase in pedestrian and bicycle traffic expected in the area without impacting vehicle traffic. MTC participants identified key improvements that would benefit pedestrian and bicycle mobility in the Montlake Triangle area, and recommended that those improvements be made regardless of the final overcrossing or undercrossing options advanced for design refinement and adoption.

Final Montlake Triangle Charrette recommendation

MTC participants recommended further design and evaluation of an overcrossing between the Sound Transit UW station and the Montlake Triangle. The overcrossing would include a ramp on the west side of the UW station. MTC participants also recommended advancing the University of Washington Rainier Vista Land Bridge project, completing a number of at-grade crossing enhancements, providing improvements to connect the SR 520 shared use path to the Burke Gilman Trail, and making associated improvements to the Burke Gilman Trail, which together would ultimately provide a comprehensive solution for bicycle and pedestrian connectivity at the Montlake Triangle. This recommendation improves bicycle and pedestrian connections to the University of Washington and improves the walk time by reducing the distance between current and planned transit improvements in the Montlake area. Recommended at-grade improvements to be combined with the overcrossing option and the Rainier Vista Land Bridge include:

- At-grade enhancements at Pacific Street and Montlake Boulevard intersection, as provided in Sound Transit's UW station design plans.
- Paths for bicycles and pedestrians on the east side of Montlake Boulevard between the Montlake Cut and NE Pacific Place.
- Sidewalk enhancements to increase the size of bus stop waiting areas for all bus stops near the Triangle.
- Pedestrian paths between the bus tops and the pedestrian bridges.

The MTC recommended considering additional at-grade improvements in the Montlake area, including:

- Widening the Burke Gilman Trail between the existing Hec Edmonson bridge and the Hitchcock Hall bridge along NE Pacific Street, west of the Health Sciences Building.
- Creating an additional Pacific Street crosswalk near the UW Medical Center.
- Modifying the right turn from Montlake Boulevard to NE Pacific Place and enhancing crossing conditions at the intersection.
- Enlarging the pedestrian triangle at the right turn from Montlake Boulevard to NE Pacific Street.

Next steps

WSDOT, Sound Transit, King County Metro, University of Washington, and SDOT are working together at the staff and executive level to advance the MTC recommendation. Agency coordination includes options for moving forward with design, construction, funding, environmental review, and permitting of the design. In particular, the recommended design must be submitted for approval as an overpass structure to the City of Seattle, and be part of Sound Transit's NEPA reevaluation based on design changes to Sound Transit's UW station construction project. The recommended overcrossing option and enhanced at-grade crossings are shown in exhibit 1. Many elements of the recommended option and at-grade crossing improvements require further refinement and are currently under discussion.

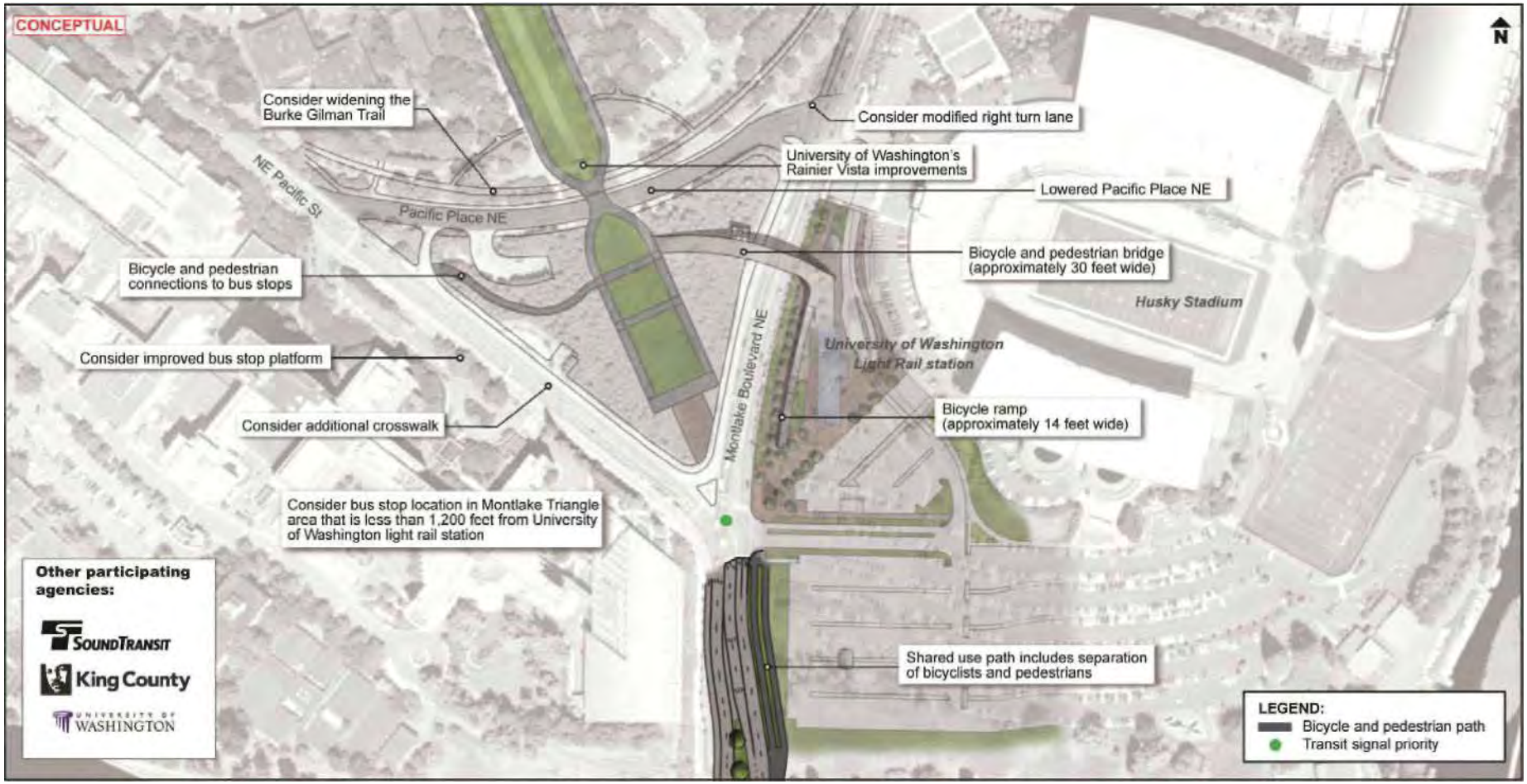


Exhibit 1. Montlake Triangle Charrette recommendations.