Seattle Department of Transportation

CITY OF SEATTLE BRIDGE SAFETY ANALYSIS

February 2018

VISION ZERO
SAFER STREETS FOR SEATTLE

SDOT
Seattle Department of Transportation


FREMONT BRIDGE

CONTENTS

ACKNOWLEDGMENTS

SDOT Project Development Division
SDOT Traffic Operations Division
SDOT Capital Projects and Roadway Structures Division
Toole Design Group, LLC

EXECUTIVE SUMMARY

The City of Seattle has many bridges that serve as critical connections between neighborhoods. Many of these bridges are also pinch points in the transportation network where travel demand by all travel modes is very high, which results in a higher potential for conflicts among different users of the bridge facilities. This report provides preliminary design and planning-level cost estimates for 10 bridge-related projects across Seattle that would reduce conflicts and improve safety for bicyclists and pedestrians, the most vulnerable users. The report builds on the Bicycle Pedestrian Safety Analysis (BPSA), which identified significant risk factors associated with bicycle and pedestrian collisions. Data from the BPSA was used to identify bridge-related locations within the city that have a high potential for future bicycle and pedestrian crashes. The locations include roadway bridges and structures that have bicycle and pedestrian activity, as well as intersections adjacent to the structures or bridge approaches.

The safety improvement concepts in this report are based on an analysis of collision data compiled by the Seattle Department of Transportation for the period between 1/1/2004 and 8/1/2017. The concepts draw upon on the safety countermeasure recommendations developed for the BPSA. These preliminary designs are concepts only; additional analysis and design will be required before moving forward with implementation.

Cost estimates were developed using Seattle bid tabs as the basis of costs.

INTRODUCTION

PURPOSE AND NEED

To enhance safety and create a more comfortable environment for walking and biking across the city, this report addresses safety issues on bridge-related structures. The analysis reviews and evaluates existing conditions and collision history at nine key bridge-related locations. Proposed design concepts follow these analyses. The report provides information to help the City of Seattle eliminate traffic related deaths and serious injuries by 2030.

The locations included in this analysis are listed in **Table 1** and displayed on **Map 1** on **Page 3**.

LOCATION SELECTION METHODOLOGY

The methodology used to select locations for this study builds on the City of Seattle Bicycle and Pedestrian Safety Analysis, 2016 (BPSA). The BPSA analyzed bicycle and pedestrian crashes that occurred in Seattle from 2007 to 2014 in order to identify problems that could be addressed through better street design and traffic operations. The BPSA's analyses yielded useful information about where and how crashes happen, and the significance of various factors that may contribute to crashes. Data from the BPSA was used to identify bridge-related locations within Seattle that have a high potential for future bicycle and pedestrian crashes.

The BPSA uses "exposure" as a measure of how many people walking or biking may be at risk for crashes in an area. Exposure allows us to compare and rank locations across the City with different levels of bicycle and pedestrian activity. If we do not account for exposure, we cannot accurately assess the risk at a given location. For example, a location with three crashes, but few people biking, may be higher risk than a location with an equal number of crashes, but many more people biking and walking.

TABLE 1: Bridge Safety Analysis Locations (not prioritized)

#	BRIDGE	LOCATION
1	Ballard Bridge South	15th Ave NW and W Emerson St
2	Ballard Bridge Sidewalk	Between W Emerson St and NW Ballard Way
3	Ballard Bridge Northwest (On-Ramp)	On-ramp at 15th Ave NW and NW Ballard Way
4	Ballard Bridge Northeast (Off-Ramp)	Off-ramp at 15th Ave NW and NW Ballard Way
5	University Bridge	Eastlake Ave E and Fuhrman Ave
6	1st Ave S Bridge	1st Ave S Bridge NB Shared Use Path and S Michigan St
7	Fremont Bridge	Fremont Ave N and N 34th St
8	Jose Rizal Bridge South	Golf Dr S and S Charles St
9	Jose Rizal Bridge North	12th Ave S and S Weller St

For this report, the bridges and adjacent intersections were ranked by the exposure level for people walking and biking. The bridge locations with the most exposure for people biking and walking throughout the city were selected for further analysis.

This bridge safety analysis includes roadway bridges and overpasses with pedestrian and bicycle activity on them. Bridges are defined as expanses that span or cross physical objects, such as waterways or roads. The analysis also includes the intersections adjacent to the bridges as these are typically where people walking and biking must transition from one facility to the bridge.

This analysis excludes freeways and their respective on- and off-ramps, dedicated pedestrian and bicycle bridges, smaller overpasses, and raised structures. Some bridges in Seattle are raised structures that behave more as elevated roadways. One example is 2nd and 4th Avenues by South Jackson Street as shown in the photo below.

COLLISION DATA SUMMARY METHODOLOGY

This analysis uses collision data from the period between 1/1/2004 and 8/1/2017 compiled by SDOT. The collision data was spatially queried to select crashes occurring on bridge structures and within 200' of the ends of the bridges, to capture potentially relevant proximate issues. The collision data was assessed and summarized to determine if any trends emerged. The results from the collision summary were used to develop proposed designs for each study location. Detailed collision tables are included for each site-specific location where improvements are being made, as is a general crash summary table for each project corridor.

Collision Data Note

- EMT/hospital data was not available for the analysis and is not included in this report.

PROPOSED DESIGN CONCEPTS

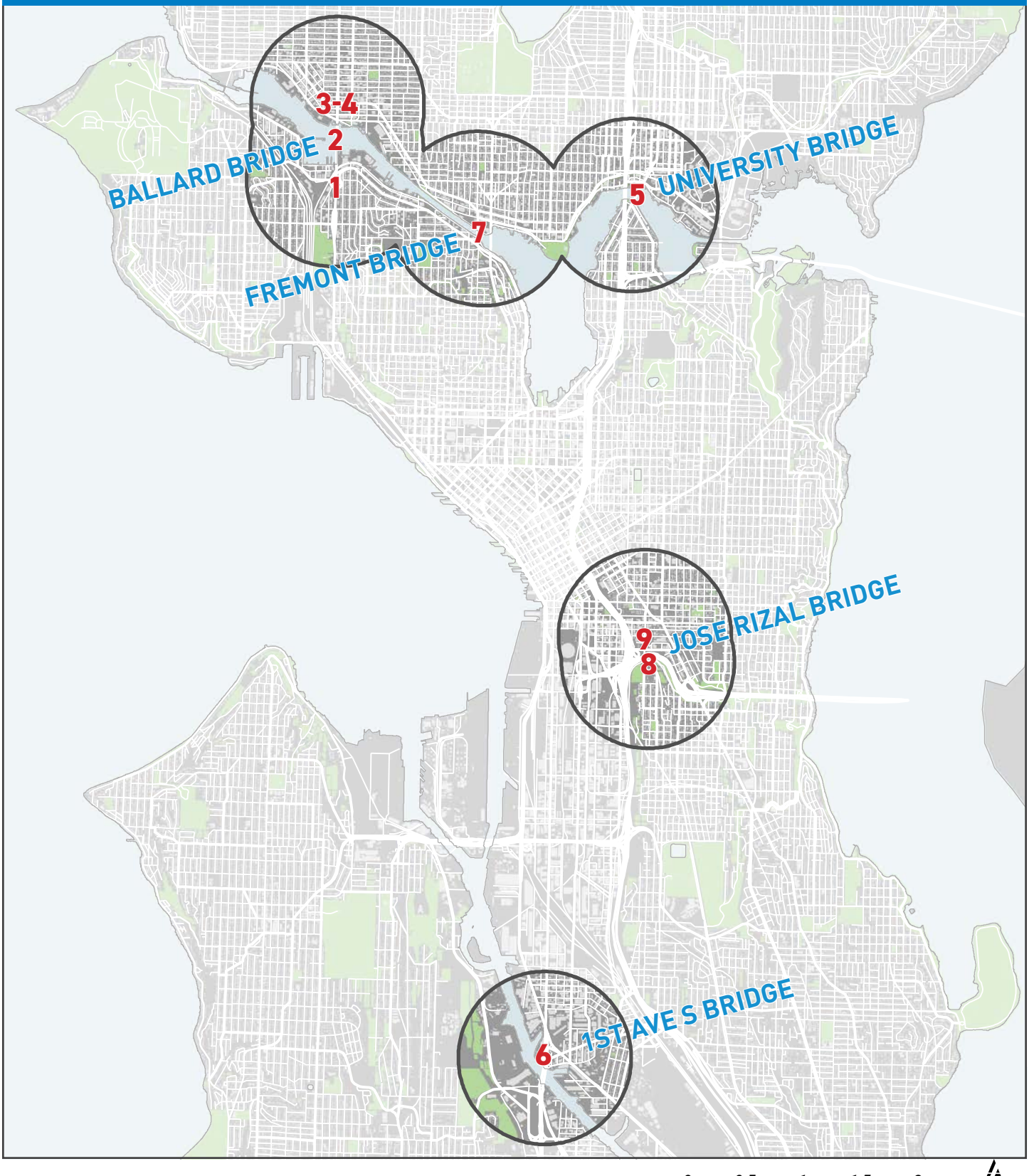
Concepts were developed by reviewing existing conditions, examining collision and GIS data, researching existing design concepts, and conducting field observations at each location. Cost estimates and a structural analysis (where appropriate) have been developed for each proposed design.

PROJECT PRIORITIZATION

A prioritized list of the nine bridge locations was developed using key risk factors identified in the BPSA. The BPSA risk factors and the prioritized project list can be viewed at the end of this document in **Table 23** and on **Page 42**.

Raised structures, such as 2nd and 4th Avenues in SODO, were excluded from this analysis.
Photo credit: Google Maps

MAP 1: BRIDGE SAFETY ANALYSIS LOCATIONS



**BRIDGE ANALYSIS LOCATION**

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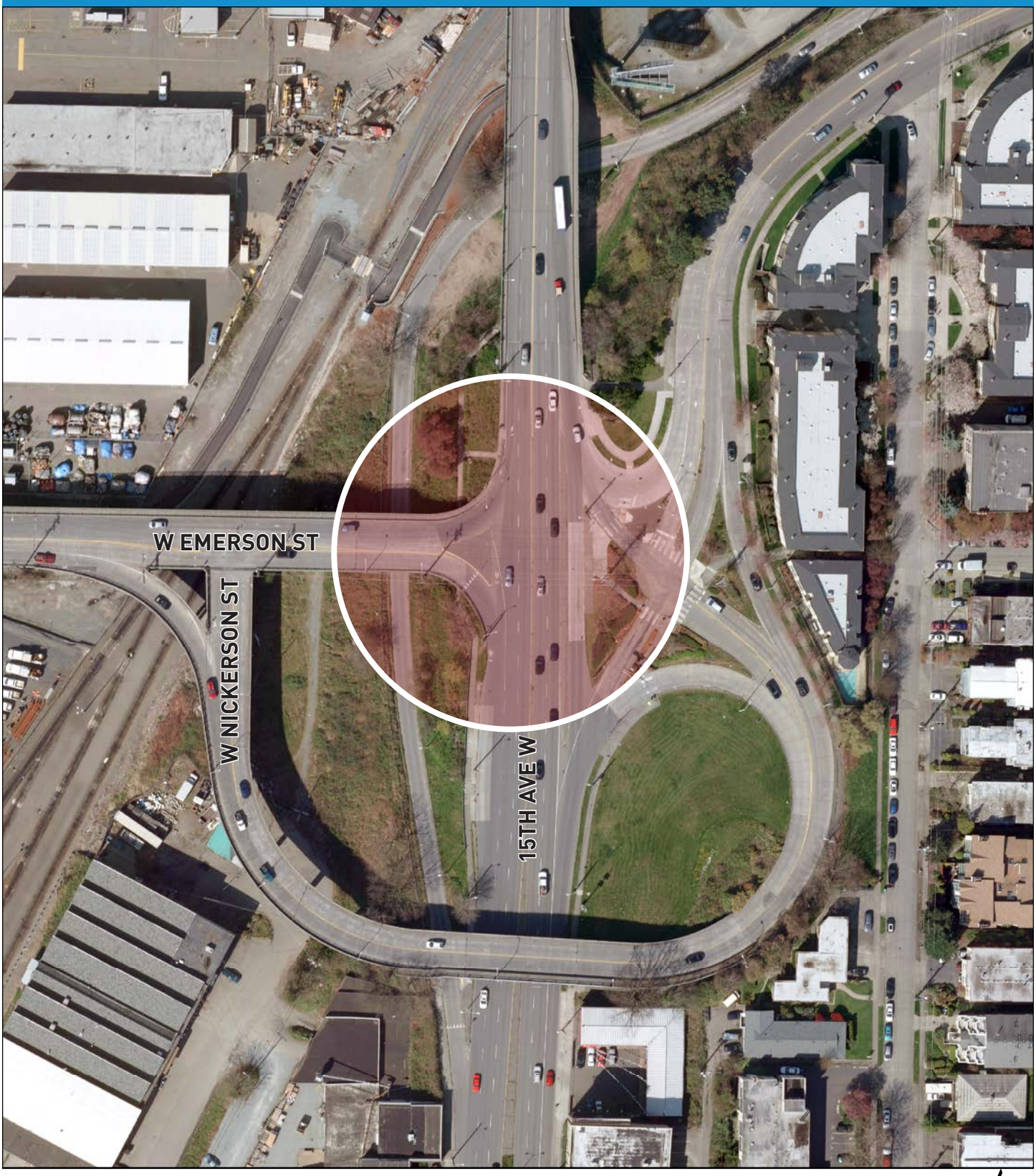
MAP 2: BALLARD BRIDGE SOUTH - 15TH AVE W AND W EMERSON ST



BRIDGE STUDY AREA

0 50 100 150 200 Feet

N

LOCATION 1: BALLARD BRIDGE SOUTH

15th Ave W and W Emerson St

EXISTING CONDITIONS

At this location, there are two southbound lanes on 15th Ave W as it crosses over the Lake Washington Ship Canal on the Ballard Bridge. The intersection of 15th Ave W and W Emerson is on structure, with sidewalks on the west side of 15th Ave W and the north side of W Emerson St. A diverter island at the intersection creates two slip lanes for vehicles turning onto/off of W Emerson St from 15th Ave W. There is stop control on the eastbound leg of W Emerson St and W Nickerson St, and yield control where W Emerson St meets 15th Ave W (eastbound to southbound). There is no traffic control for vehicles turning from 15th Ave W southbound onto W Emerson St westbound. Bicyclists traveling south on 15th Ave W must exit the sidewalk along the west side of the bridge, using an opening in the short barrier just north of W Emerson St, and merge onto the roadway (the opening can be seen in image to the right). There are no at-grade crossings on W Emerson St at this location. Pedestrians and bicyclists wishing to cross 15th Ave W or W Emerson St must use the staircases that descend from the structure on either side of 15th Ave W. There is a short segment of southbound receiving bike lane on 15th Ave W just south of W Emerson St, marked with flexposts and pavement markings, adjacent to the diverter island on W Emerson St. There is a RapidRide stop immediately south of the intersection on the west side of 15th Ave W. A map of Location 1 can be viewed on **Page 4**.

The northern leg of 15th Ave W and W Emerson St, looking south.

TABLE 2: Bicyclist and Pedestrian Collision, Ballard Bridge at 15th Ave W and W Emerson St, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	0	3	0	3
Pedestrian	0	2	0	2

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

Major Issues

- There are no dedicated bicycle facilities or treatments through the W Emerson St crossing to provide space or awareness of bicyclists using the facility.
- Southbound bicyclists must come to a stop, turn to look back at oncoming southbound traffic, and wait for a gap before entering the roadway, then quickly accelerate to merge with traffic.
- There is limited signage for motorists to let them know bicyclists are entering the roadway.

- Southbound RapidRide buses merge to the curb immediately after the island, in the area where bicyclists are using the vehicle lane.

COLLISION DATA SUMMARY

From 1/1/2004 to 8/1/2017, there were five reported pedestrian and bicyclist collisions that resulted in injuries (see **Table 3** on Page **7**). The two pedestrian collisions happened when motorists struck pedestrians attempting to cross the north leg of 15th Ave W.

PROPOSED DESIGN CONCEPT

The proposed design concept (see **Page 8**) is intended to improve conditions for pedestrians wanting to cross to W Emerson St to access the RapidRide stop and for southbound bicyclists traveling through the intersection and continuing southbound on 15th Ave W. There is a perception that this location is unsafe for bicyclists, which may be a deterrence for many bicyclists and potential bicyclists.

The concept provides a crossing on the east leg at the intersection of W Emerson St and W Nickerson St, approximately 180 feet to the west of 15th Ave

The intersection of 15th Ave W and W Emerson St, looking west.

W. Bicyclists and pedestrians will use the existing sidewalk on the north side of W Emerson St to reach the new curb ramp and marked crosswalk at the proposed crossing. The crossing will be stop-controlled on all three legs. A 6-foot-wide shared use path on the south side of W Emerson St will be created using a c-curb and a 2-foot buffer from the existing motor vehicle lane. Pedestrians and bicyclists will travel approximately 120 feet on the existing bridge roadway before ramping up to a new sidewalk located at the corner of W Emerson St and 15th Ave W. The sidewalk section will then be marked (with green pavement) to identify specific space for bicyclists continuing southbound on 15th Ave W, and pedestrians accessing the RapidRide stop. The existing bridge railing will be removed and replaced with a pedestrian railing. A structural analysis of the design can be viewed in **Table 4**.

ESTIMATED COST RANGE

The range for these estimates considers unknown risks related to the design and/or construction of the concepts presented including traffic control, critical areas, and utility coordination. The estimated cost range for this design concept is $1,019,000 to $1,325,000.

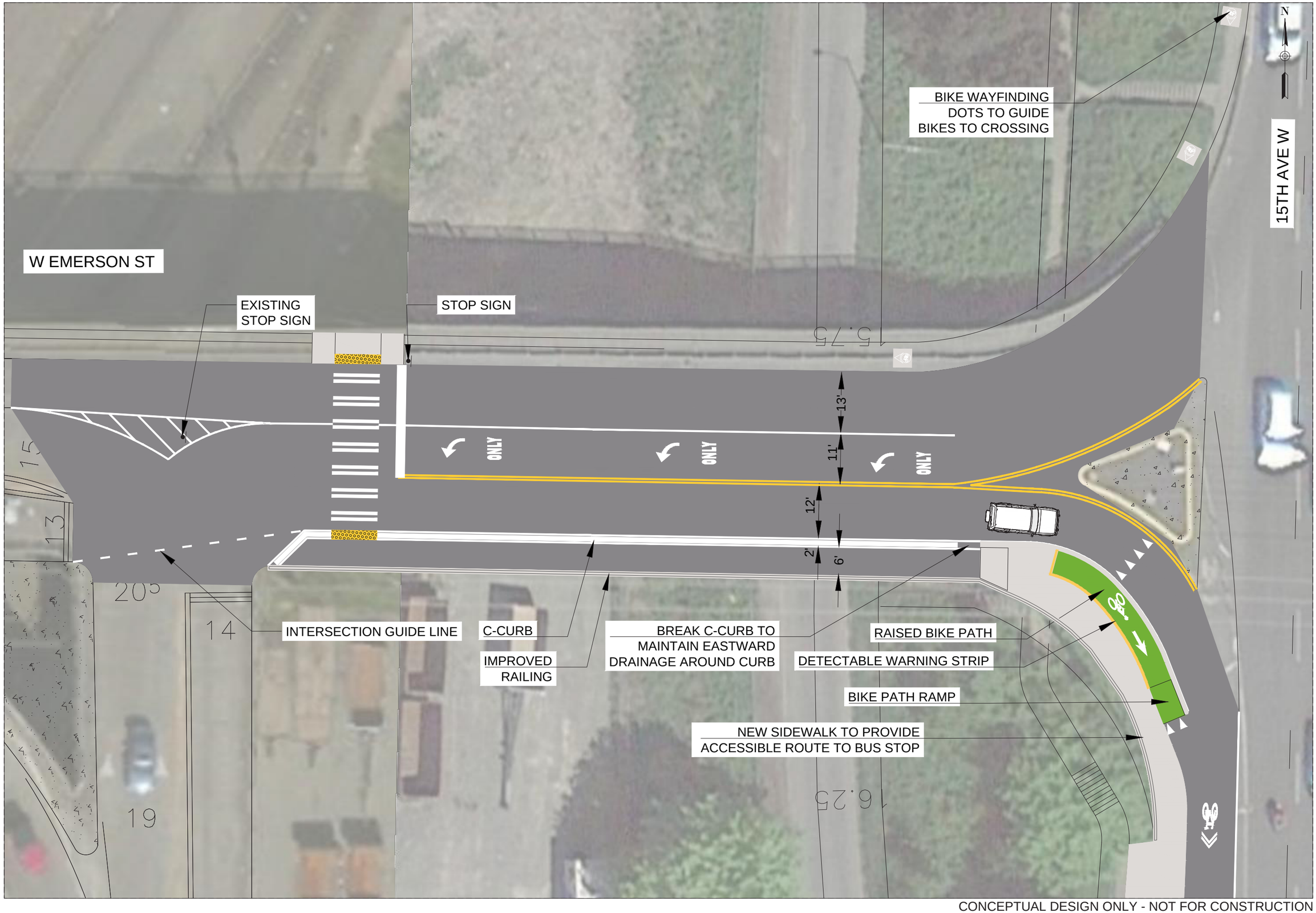
TABLE 3: 15th Ave W and NW Emerson St - Collision Data 1/1/2004-8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Pedestrian	Injury Collision	11/16/2005	11:05 AM	Clear or Partly Cloudy	Dry	Daylight	NB(T) - WB(ped)	NB vehicle traveling north on 15th Ave W struck WB pedestrian north of W Emerson St. WB pedestrian crossed outside of marked crosswalk.
Pedestrian	Injury Collision	12/10/2009	5:04 PM	Clear or Partly Cloudy	Dry	Dark - Street Lights On	WB(R) - SB(ped)	WB vehicle turning right from W Nickerson St to 15th Ave W struck SB pedestrian. SB pedestrian crossed outside of marked crosswalk.
Cycles	Injury Collision	5/25/2011	2:34 PM	Raining	Wet	Daylight	SB(T) - SB(bike)	SB bicyclist on west sidewalk struck raised median. Bicyclist entered west curb lane on 15th Ave W, was struck by SB vehicle.
Cycles	Property Damage Only	9/12/2008	2:52 PM	Clear	Dry	Daylight	WB(R) – SB(bike)	WB vehicle turning right onto Ballard Bridge struck by SB bicyclist in east crosswalk. Unable to determine fault.
Cycles	Injury	2/24/2015	8:15 AM	Unknown	Unknown	Unknown	NB(T) – EB(bike)	NB vehicle traveling through intersection struck EB bicyclist traveling through intersection. NB vehicle failed to yield.

Data Source: Seattle Department of Transportation

TABLE 4: Structural Assessment and Recommendations

MODIFICATION	STRUCTURAL ASSESSMENT	STRUCTURAL RECOMMENDATION
Remove existing railing and replace with new railing. A new sidewalk will be provided that will be raised along the curved right turn lane to be used as bike path.	There is no sidewalk on the south side of W Emerson St bridge, either on the straight or the turn lane. The straight section is a steel girder bridge and the curved section is concrete beam bridge. The existing railing is attached to the edge beam in the deck slab. The existing railing is approximately 24 inches high.	The sidewalk will be constructed with 4 inches to 6 inches thick new concrete slab that will be reinforced and tied to the existing deck slab with drilled dowels. The new railing will be 54 inches high and bike safety compliant. The railing will be attached to the edge beam in the roadway deck slab. To withstand the tension pull out load in the upper row of anchors, it is recommended that the upper row anchors be drilled and extend into the new concrete sidewalk slab to distribute these loads over a wider section of the deck slab. Where the new sidewalk is not proposed, the railing posts would be spaced closer to develop the anchorage forces.
Curb to be installed between vehicle lane and mixed use path.	Concrete curb can be constructed on the roadway deck slab.	A 6-inch high concrete curb will be installed and anchored to the roadway deck slab with drilled in dowels.



CONCEPTUAL DESIGN ONLY - NOT FOR CONSTRUCTION

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BALLARD BRIDGE (SOUTH)

BRIDGE SAFETY ANALYSIS
CITY OF SEATTLE, WA

0 5 10 20

PREPARED: INITIALS
CHECKED: INITIALS

DATE
02/19/2018

REV 1 -
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MAP 3: BALLARD BRIDGE SIDEWALK

LOCATION 2: BALLARD BRIDGE SIDEWALK

Between W Emerson St and NW Ballard Way

EXISTING CONDITIONS

Along the Ballard Bridge, there are narrow sidewalks on both sides of the bridge with a typical width of 4 feet, narrowing down to 3.5 feet of the location of regularly spaced railing posts. The sidewalks are separated from traffic with a 12-inch high concrete curb, which lacks a railing to separate moving vehicles from bicyclists and pedestrians using the sidewalk; only the bascule portion of the bridge features a railing. The narrow width of the sidewalk makes passing other sidewalk users while on a bicycle challenging. Oversized mirrors on trucks and buses have the potential to encroach into the sidewalk space. A map of Location 2 can be viewed on **Page 9**.

Major Issues

- Minimal separation of the sidewalk from heavy vehicle volumes and high vehicle speeds contributes to an uncomfortable environment for walking and biking.
- The narrow width of the sidewalk leaves little room for bicyclists and pedestrians traveling in the same or opposite direction to pass one another.

Ballard Bridge sidewalk, looking north.

TABLE 5: Bicyclist and Pedestrian Collision, at Ballard Bridge Between W Emerson St and NW Ballard Way, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS NJURY*	INJURY	PDO*	TOTAL
Bicyclist	2	0	0	2
Pedestrian	0	0	0	0

PDO = Property Damage Only
Data Source: Seattle Department of Transportation
*Does not include fatality that occurred 6 months after collision

COLLISION DATA SUMMARY

From 1/1/2004 to 8/1/2017, there were two reported bicyclist collisions resulting in serious injuries (see **Table 5** and **Table 6**). The bicyclists in both collisions were riding on the western sidewalk. One of the collisions occurred after the bicyclist struck the raised barrier separating the sidewalk from the travel lane, causing them to fall into the southbound travel lane where a moving motor vehicle then struck them. The second collision occurred when a southbound bicyclist on the western sidewalk was struck by the side mirror of a southbound bus.

PROPOSED DESIGN CONCEPT

Installing a railing between the sidewalk and the vehicle travel lane along the Ballard Bridge could increase perceived and actual safety by forcing bicyclists to ride farther from the edge of the concrete barrier and at slower speeds. This treatment would reduce the potential for conflicts between motorists and sidewalk users but may not improve interactions between bicyclists and pedestrians (see **Figure 1** and **Page 13** for proposed

sidewalk cross sections and railing details). The proposed railing would provide a physical barrier to prevent bicyclists from falling into the roadway, eliminating the potential for serious injury. The railing would be a WSDOT standard BP railing (42-inch high pipe railing) added atop the existing vehicle barrier, for a total railing height of 4 feet 6 inches, per guidelines from the AASHTO *Guide for the Development of Bicycle Facilities*. The railing would include bicycle-friendly design features to prevent handlebars from getting caught in the railing. A structural analysis of the design can be viewed in **Table 7**.

ESTIMATED COST RANGE

The cost range for these estimates consider unknown risks related to the design and/or construction of the concepts presented, including traffic control, critical areas, utility coordination, and 5,900 linear feet of railing. The estimated cost range for this design is $9,271,000 to $12,053,000.

TABLE 6: Ballard Bridge Between W Emerson St and NW Ballard Way - Collision Data 1/1/2004-8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Cycles	Serious Injury Collision	7/6/2007	12:16 PM	Clear or Partly Cloudy	Dry	Daylight	SB(T) - NB(bike)	NB bicyclist on west sidewalk struck raised median. The bicyclist entered west curb lane and was struck by SB vehicle traveling straight.
Cycles	Serious Injury Collision	6/5/2010	5:38 PM	Clear or Partly Cloudy	Dry	Daylight	SB(T) - SB(bike)	SB bicyclist on the west sidewalk struck by side mirror of SB metro bus.

Data Source: Seattle Department of Transportation

Figure 1: Potential Physical Conflict Points With and Without Proposed Bicycle Railing

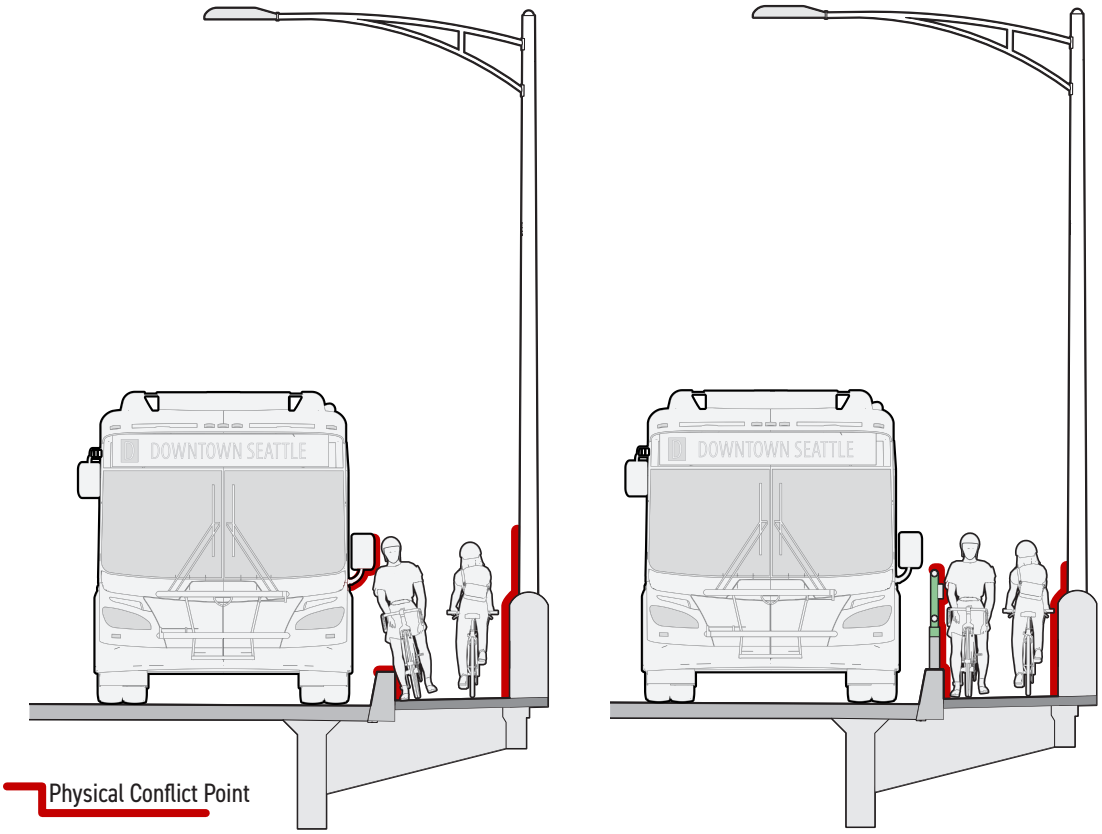
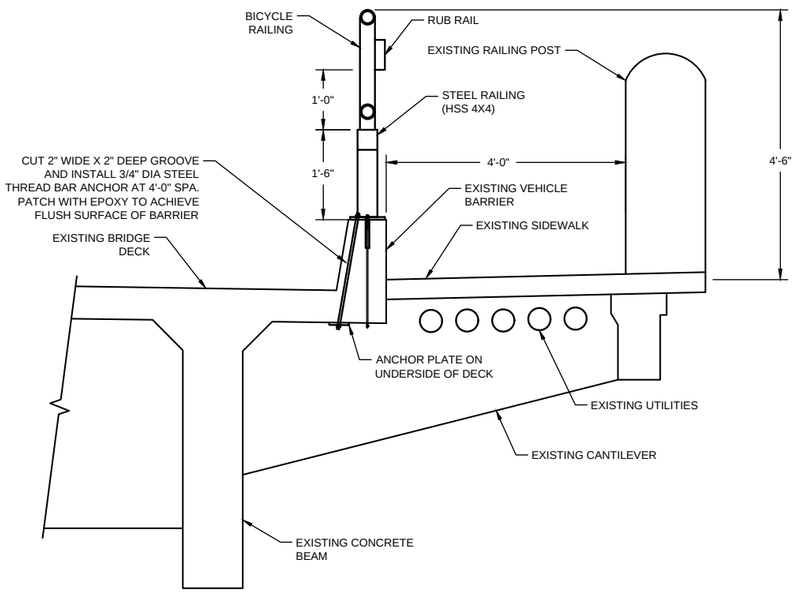


TABLE 7: Structural Assessment and Recommendations

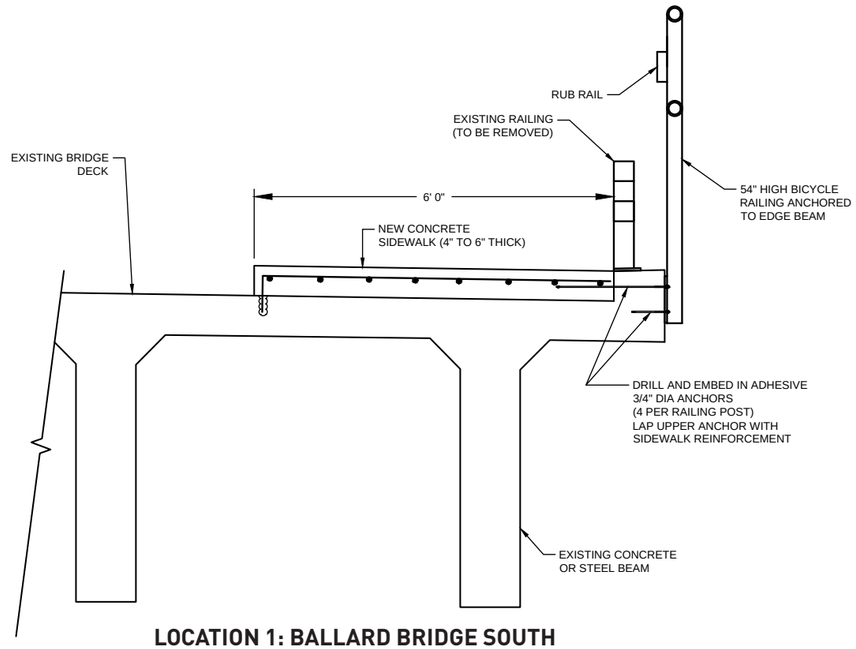
MODIFICATION	STRUCTURAL ASSESSMENT	STRUCTURAL RECOMMENDATION
Add new bicycle railing between vehicle lane and sidewalk.	The 15th Ave Bridge is comprised of various structure types in sections. Some of the structure types are concrete T-beams, concrete box girders, steel girders, and concrete slab. There is a 4-foot-wide sidewalk on both sides of the bridge. The existing concrete barrier between vehicle lane and sidewalk is 12 inches high, and is in fair condition.	To support a new bicycle railing, it is recommended that it be installed on the existing barrier over a structural steel framing that can be securely anchored to the barrier and that will distribute lateral design loads on the railing over a greater impact length of the barrier. An 18-inch-high steel railing comprised of welded HSS 4x4 sections with posts at 18 inches spacing and top horizontal rail continuous over the posts will be installed as lower railing. This steel railing will be anchored to the barrier by epoxy anchors on top of barrier as well as by steel anchor on the sloped face of barrier. This steel anchor will be installed by cutting a groove on the sloped face and anchored on the underside of the deck. This will strengthen the barrier against lateral impact loads that result in tension or pull out effects. The bicycle railing will be fastened to the lower steel railing by anchors or welding. Total railing height that includes existing barrier, lower steel railing and upper bicycle railing will be 4 feet 6 inches. The bicycle railing may be steel, aluminium, or other appropriate material.



LOCATION 2: BALLARD BRIDGE SIDEWALK

BICYCLE RAILING ON EXISTING VEHICLE BARRIER (1)

SCALE: 3/8" = 1'-0"



LOCATION 1: BALLARD BRIDGE SOUTH

NEW SIDEWALK AND RAILING (2)

SCALE: 3/8" = 1'-0"

3/8" = 1'-0" SCALE FOR 11 X 17 PLOT SIZE

NOT FOR CONSTRUCTION

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BALLARD BRIDGE
BRIDGE SAFETY ANALYSIS
CITY OF SEATTLE, WA

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SCALE IN FEET

PREPARED: AK
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DATE
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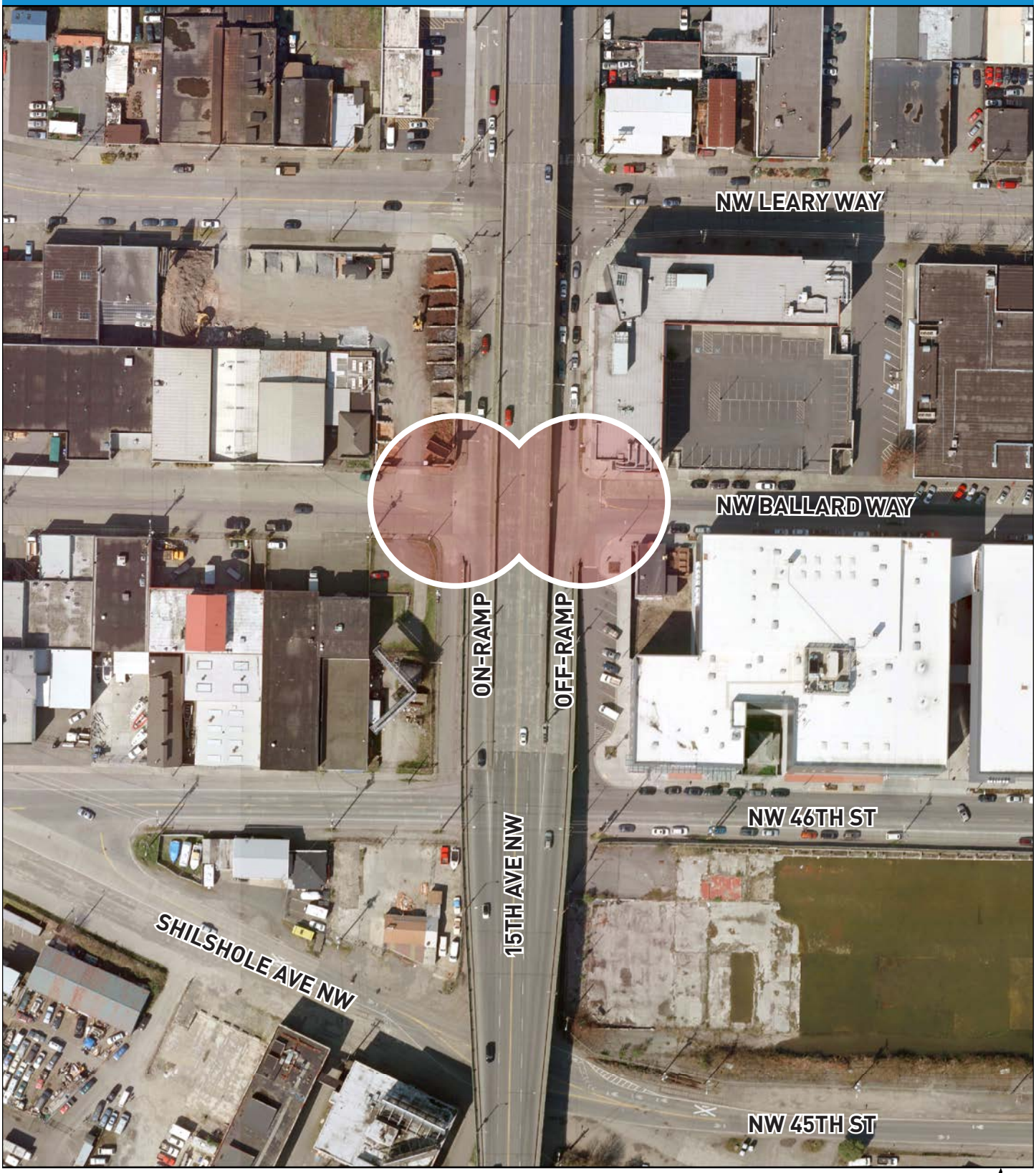
MAP 4: BALLARD BRIDGE - ON/OFF RAMPS



BRIDGE STUDY AREA

0 50 100 150 200 Feet

N

LOCATION 3: BALLARD BRIDGE NORTHWEST

On-Ramp at NW Ballard Way

EXISTING CONDITIONS

On the west side of the northern bridge approach, NW Ballard Way meets 15th Ave NW, which is one-way southbound and at grade through the intersection. Just south of where it meets NW Ballard Way, the eastern lane of 15th Ave NW becomes the bridge on-ramp, rising to meet the bridge approach on structure. The western lane descends south to NW 46th St. The west approach of NW Ballard Way is stop-controlled with a RIGHT TURN ONLY sign but there are no stop bars, crosswalks, or any other pavement markings that indicate how pedestrians reach the start of the Ballard Bridge sidewalk, which sits on the structure between descending and ascending lanes of 15th Ave NW. A map of Location 3 can be viewed on **Page 14**.

Major Issues

- Wide, exposed crossing for bicyclists and pedestrians, especially for those crossing NW Ballard Way to access the sidewalk on the on-ramp in order to cross the bridge.
- Lack of pavement markings to establish pedestrian right-of-way or promote yielding to bicyclists and pedestrians.

Ballard Bridge on-ramp at NW Ballard Way, looking north.

COLLISION DATA SUMMARY

There was one crash that occurred at the Ballard Bridge on-ramp that involved a non-motorized roadway user (**Table 8**). This crash involved a bicyclist being stuck by an eastbound motorist turning right onto the Ballard Bridge on-ramp. The bicyclist was riding northbound at the time of the collision, and likely had been riding on the western sidewalk prior to the collision. See table **Table 9** for additional details.

TABLE 8: Bicyclist and Pedestrian Collision, Ballard Bridge at On-Ramp and NW Ballard Way, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	0	1	0	1
Pedestrian	0	0	0	0

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

TABLE 9: Ballard Bridge On-Ramp - Bike/Ped Collision Data 1/1/2004 Through 8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Cycles	Injury Collision	8/11/2004	11:41 AM	Clear or Partly Cloudy	Dry	Daylight	EB(R) - NB(bike)	EB vehicle turning right from NW Ballard Way onto Ballard Bridge On Ramp struck NB bicyclist in SB lanes.

Data Source: Seattle Department of Transportation

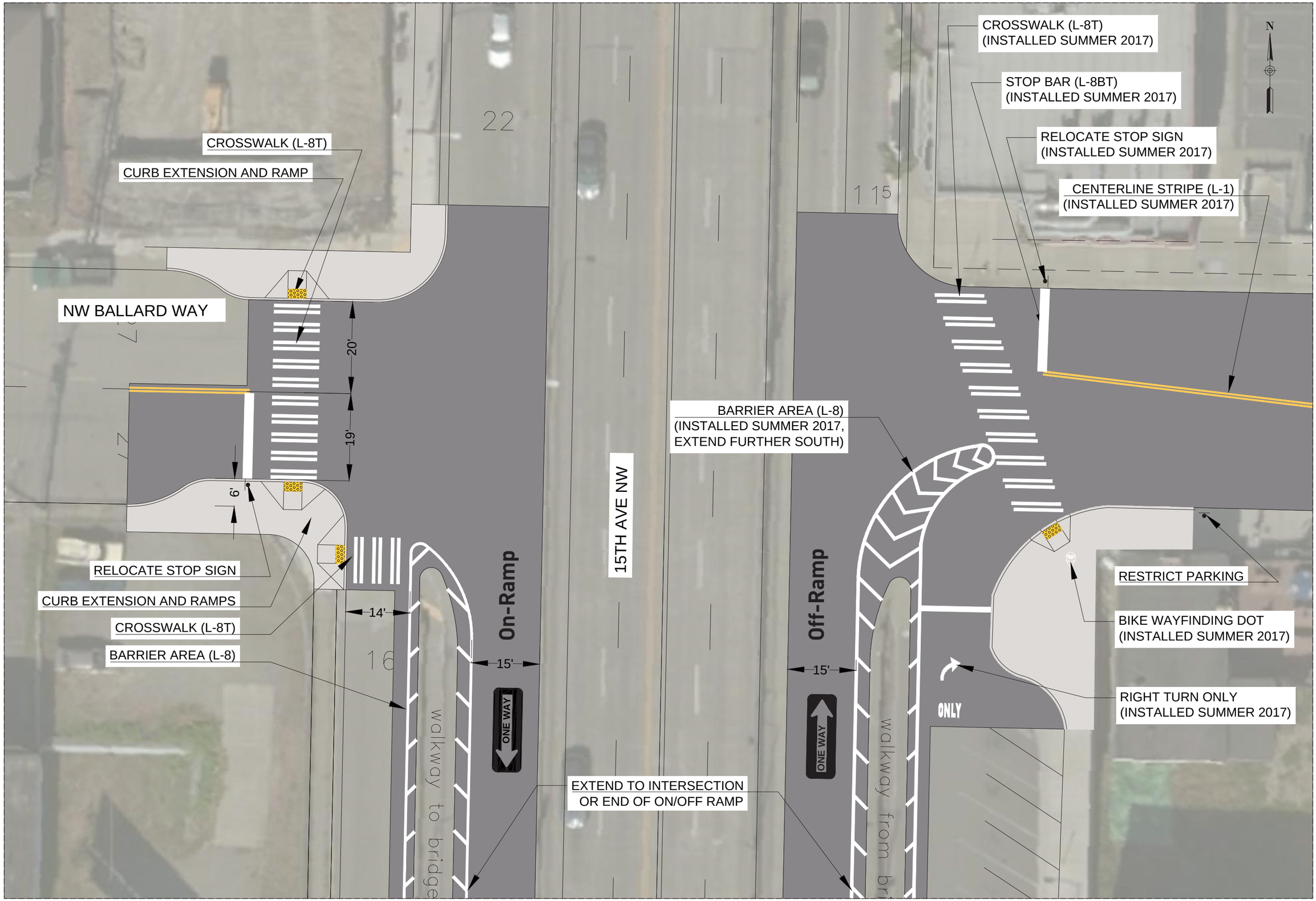
PROPOSED DESIGN CONCEPT

The proposed design concept (see **Page 17** for drawing) features curb extensions on the western leg of NW Ballard Way, and new high-visibility crosswalks. The curb extensions will improve the visibility of pedestrians, improve sight lines and forward positioning, and reduce turning vehicle speeds. The high-visibility crosswalks will provide a defined space for pedestrians who are crossing NW Ballard Way to enter the sidewalk on the Ballard Bridge. The crosswalks will also provide an indication to motorists to yield to pedestrians. Southbound lane striping with hatching (around the barrier area) should be installed surrounding the east and west pedestrian sidewalks to the Ballard Bridge to improve channelization and provide bicyclists and pedestrians more space to use the sidewalk and encourage motorists to position their vehicles farther away from the sidewalk.

ESTIMATED COST RANGE

The range for these estimates considers unknown risks related to the design and/or construction of the concepts presented including traffic control, critical areas, and utility coordination. The estimated cost range for this design is $207,000 to $270,000.

Ballard Bridge On-Ramp at NW Ballard Way, looking south.



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BALLARD BRIDGE (NORTH)

BRIDGE SAFETY ANALYSIS
CITY OF SEATTLE, WA

0 5 10 20

PREPARED: INITIALS
CHECKED: INITIALS

DATE
02/19/2018

REV 1 -
REV. 2 -
REV. 3 -

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OF ##

LOCATION 4: BALLARD BRIDGE NORTHEAST
Off-Ramp at NW Ballard Way

EXISTING CONDITIONS

On the east side of the bridge, the off-ramp meets 15th Ave NW (one-way northbound) and NW Ballard Way (two-way to the east). NW Ballard Way is stop-controlled, as is the eastern at-grade lane of 15th Ave NW. The lane also has a RIGHT TURN ONLY sign to channel vehicles onto eastbound NW Ballard Way. A crosswalk, stop bar, centerline stripe, and a striped barrier area were installed in the summer of 2017. A map of Location 4 can be viewed on **Page 14**.

Major Issues

- Wide, exposed crossing for bicyclists and pedestrians, especially for those exiting the sidewalk on the bridge off-ramp.
- Previously there were no signage or pavement markings indicating that motorists should yield to pedestrians or bicyclists entering/exiting the bridge sidewalk or to indicate where bicyclists and pedestrians should position themselves.

COLLISION DATA SUMMARY

There were two crashes that occurred at the Ballard Bridge off-ramp at NW Ballard Way (see table **Table 10** and **Table 11**). A northbound bicyclist traveling on 15th Ave NW was struck by a northbound vehicle attempting a right turn onto NW Ballard Way. The second collision occurring at this intersection involved westbound motorist failing to yield and striking a pedestrian crossing NW Ballard Way in an unmarked crosswalk.

Ballard Bridge off-ramp at NW Ballard Way, looking north.

TABLE 10: Bicyclist and Pedestrian Collision, Ballard Bridge at Off-Ramp and NW Ballard Way, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	0	1	0	1
Pedestrian	0	1	0	1

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

PROPOSED DESIGN CONCEPT

The proposed design concept aims to supplement recent improvements that have been made in the summer of 2017 (see **Page 17**). The 2017 improvements include a new high-visibility crosswalk, bike wayfinding dots, RIGHT TURN ONLY symbols and signage, a new striped centerline and stop bar, and new lane striping and hatching (barrier area). This proposed design concept suggests modifications to the striped barrier area and parking restrictions to build upon the previous improvements. It is recommended that the barrier area be extended farther south to provide increased separation between moving

vehicles and the pedestrian walkway. Parking restrictions should be placed on the south side of NW Ballard Way east of 15th Ave NW to allow for vehicles to make a right turn from 15th Ave NW.

ESTIMATED COST RANGE

Due to the scale of this design concept and the improvements made in the summer of 2017 the cost estimate for this location has been included in the location 3 cost estimates.

TABLE 11: Ballard Bridge Off-Ramp - Bike/Ped Collision Data 1/1/2004-8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Cycles	Injury Collision	10/10/2007	10:21 AM	Overcast	Wet	Daylight	NB(R) - NB(bike)	NB vehicle turning right onto NW Ballard Way from Ballard Bridge off-ramp struck NB bicyclist turning right from 15th Ave NW.
Pedestrian	Injury Collision	1/3/2012	4:09 PM	Clear or Partly Cloudy	Wet	Daylight	WB(R) - SB(ped)	WB vehicle turning right from NW Ballard Way struck SB pedestrian in unmarked crosswalk.

Data Source: Seattle Department of Transportation

Ballard Bridge off-ramp at NW Ballard Way, looking north.

MAP 5: UNIVERSITY BRIDGE

LOCATION 5: UNIVERSITY BRIDGE

At Eastlake Ave E and Fuhrman Ave E

EXISTING CONDITIONS

At the southbound approach of the University Bridge, bicycle facilities on Eastlake Ave E (which has two northbound and two southbound through lanes) meet the intersection of Fuhrman Ave E (one lane in either direction). There are green bike lane extension markings in the northbound direction, but none for the southbound bike lane. The intersection is signalized with protected/permissive turn phases on Eastlake Ave E to Furhman Ave E, southbound to westbound and northbound to eastbound. The permissive left turns from Eastlake Ave E can conflict with through bicycle movements in either direction. However, bridge operations limit the length of the left turn lane on the northbound leg (for southbound to eastbound turns).

On the southwest quadrant, sight distance is limited due to the alignment of the east approach of Fuhrman Ave E the curb radius. A map of Location 5 can be viewed on **Page 20**.

Major Issues:

- Sight distance limitations and wider crossing distance contribute to higher exposure on east leg.
- Speed of southbound left-turning vehicles (due to geometry) and drivers having to negotiate a gap in two northbound vehicle lanes during permissive left-turn phase.

University Bridge at At Eastlake Ave E and Fuhrman Ave E, looking north.

TABLE 12: Bicyclist and Pedestrian Collisions, University Bridge from Fuhrman Ave E to NE Lincoln Way, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Cycles	4	26	1	31
Pedestrian	1	2	0	3

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

TABLE 13: Bicyclist and Pedestrian Collisions, University Bridge at Eastlake Ave E and Fuhrman Ave E, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Cycles	3	17	1	21
Pedestrian	1	2	0	3

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

COLLISION DATA SUMMARY

General Summary

There were 34 total crashes involving a pedestrian or bicyclist that occurred from 1/1/2004 to 8/1/2017 between Fuhrman Ave E and NE 40th St. Thirty-one of the collisions involved a bicyclist. Nearly all reported collisions resulted in an injury; four were serious injuries and one resulted in the fatality of a bicyclist (see **Table 12**). The most common collision type was a front end angle (motorist making a turn and striking a bicyclist traveling straight), accounting for almost 80 percent of all bicyclists crashes. Crashes occurring along University Bridge between Fuhrman Ave E and NE 40th St were geographically concentrated at the intersection of Eastlake Ave E and Fuhrman Ave E, accounting for 24 of the 34 total crashes.

Site-Specific Summary

This summary focuses on Eastlake Ave E and Fuhrman Ave E. Twenty-one of the 24 reported collisions in this area involved a bicyclist and three pedestrians. There were a total of 19 injury collisions, three serious injury collisions, and one fatality (see **Table 13** and **Table 14**). The predominant movement of the motor vehicles involved was a turning movement. Five of the bicyclist collisions involved northbound vehicles turning right across northbound bicycles, one involved a westbound vehicle turning right across a northbound bicycle, and 12 involved southbound vehicles turning left across northbound bicycles. The most common pre-collision direction of travel of the striking unit (motor vehicle) was southbound, accounting for 63 percent of all collisions. Bicyclist direction of travel was predominantly northbound, accounting for 79% of all collisions.

A green bicycle lane and bike lane extension markings were installed in August 2010. Prior to the installation, there were two northbound right hooks and seven southbound left hooks involving bicyclists between January 2004 to August 2010. After the installation, there were three northbound right hooks and five southbound left hook collisions.

PROPOSED DESIGN CONCEPT

The proposed design concept (see **Page 25**) modifies the northwest and northeast corners of the intersection, and extends the southbound through and left-turn lanes to tighten the radius of turning vehicles and to provide more storage space for southbound to eastbound left turning vehicles.

The design also proposes a realignment on the east leg of Fuhrman Ave E by extending the northeast curb and shifting the centerline to reduce the crossing width, tighten up the vehicle lanes, and reduce the vehicle turning radii to reduce turning speeds.

An additional STOP FOR PEDESTRIANS WHEN TURNING sign is proposed in the sightline for southbound vehicles turning left, at the southeast corner of the intersection.

SDOT is also examining signal operations at this location to determine if there are signal modifications that could be made, which would complement this design concept and further reduce conflicts between motor vehicles and people walking and bicycling.

ESTIMATED COST RANGE

The range for these estimates considers unknown risks related to the design and/or construction of the concepts presented including traffic control, critical areas, and utility coordination. The estimated cost range for this design is $244,000 to $318,000.

TABLE 14: Eastlake Ave E and Fuhrman Ave E - Collision Data 1/1/2004-8/1/2017

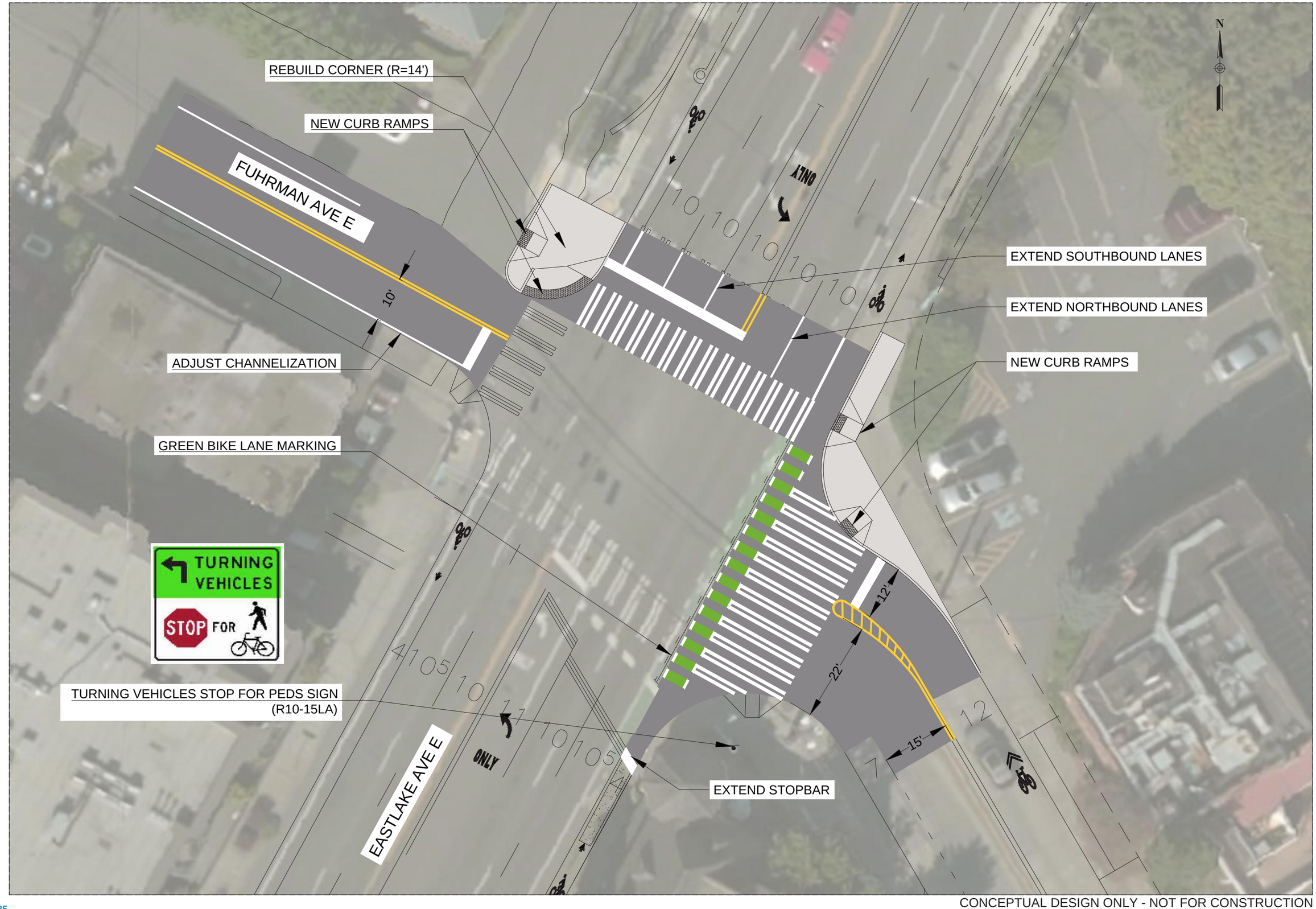
COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Cycles	Fatality Collision	9/7/2007	2:54 PM	Clear or Partly Cloudy	Dry	Daylight	NB(R) - NB(bike)	NB vehicle turning right struck NB bicyclist in east bike lane.
Pedestrian	Injury Collision	1/28/2004	7:00 PM	Raining	Wet	Dark - Street Lights On	SB(L) - NB(bike)	SB vehicle turning left struck NB pedestrian in east crosswalk.
Cycles	Injury Collision	7/20/2004	1:51 PM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	2/18/2005	12:44 PM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	5/3/2005	9:25 AM	Overcast	Dry	Daylight	WB(R) - NB(bike)	WB vehicle turning right struck NB bicyclist in east bike lane.
Cycles	Injury Collision	9/7/2005	7:50 AM	Clear or Partly Cloudy	Dry	Daylight	EB(L) - WB(bike)	EB vehicle turning left struck WB bicyclist in north crosswalk.
Pedestrian	Serious Injury Collision	11/2/2006	6:49 PM	Raining	Wet	Dark - Street Lights On	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south crosswalk.
Cycles	Injury Collision	1/18/2007	5:00 PM	Overcast	Wet	Dusk	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Pedestrian	Injury Collision	3/13/2008	12:57 PM	Overcast	Wet	Daylight	EB(L) - WB(ped)	EB vehicle turning left struck WB pedestrian in north crosswalk.
Cycles	Injury Collision	3/17/2008	2:58 PM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	5/9/2008	2:51 PM	Overcast	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	6/27/2008	12:47 PM	Clear or Partly Cloudy	Dry	Daylight	NB(R) - NB(bike)	NB vehicle turning right struck NB bicyclist in east bike lane.
Cycles	Injury Collision	7/16/2008	9:34 AM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	9/12/2008	5:36 PM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	8/6/2011	4:30 PM	Clear or Partly Cloudy	Dry	Daylight	NB(R) - NB(bike)	NB vehicle turning right struck NB bicyclist in east bike lane.
Cycles	Injury Collision	8/16/2011	9:40 AM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	5/22/2013	3:40 PM	Overcast	Dry	Daylight	SB - SB	SB bicyclist rear ended SB vehicle.
Cycles	Serious Injury Collision	11/8/2013	12:43 PM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	11/19/2013	12:47 PM	Overcast	Wet	Daylight	SB(R) - SB(bike)	SB vehicle turning right struck SB bicyclist in west bike lane.

Data Source: Seattle Department of Transportation

TABLE 14: Eastlake Ave E and Fuhrman Ave E - Collision Data 1/1/2004-8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Cycles	Injury Collision	1/5/2014	12:54 PM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	3/20/2014	1:00 PM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Property Damage Only Collision	9/22/2014	8:31 AM	Raining	Wet	Daylight	NB(R) - NB(bike)	NB vehicle turning right struck NB bicyclist in east bike lane.
Cycles	Serious Injury Collision	1/2/2015	6:25 PM	Raining	Wet	Dark - Street Lights On	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist in east bike lane.
Cycles	Injury Collision	1/20/2017	4:50 PM	Clear or Partly Cloudy	Dry	Daylight	NB(R) - NB(bike)	NB vehicle turning right struck NB bicyclist in east bike lane.

Data Source: Seattle Department of Transportation



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UNIVERSITY BRIDGE (SOUTH)

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MAP 6: 1ST AVE S BRIDGE

LOCATION 6: 1ST AVE S BRIDGE

At Shared Use Path and S Michigan St

EXISTING CONDITIONS

This location is the northern entry/exit point for the shared use path that runs along the east side of the 1st Ave S Bridge (SR99/509). At this location, the shared use path descends to meet grade under the bridge structure along S Michigan St, just east of where 1st Ave S, S Front St, and S River St meet. This shared use path provides an alternate route for bicyclists to reach the intersection of S Michigan St and E Marginal St Way S. The area where the streets intersect at the shared use path lacks any pavement markings or traffic control. Additionally, the bridge pillars and curving roadways limit sight distance for people entering the street from the shared used path. Much of the vehicle traffic passing through the intersection observed during field visits were large trucks accessing the industrial land uses. A map of Location 6 can be viewed on **Page 26**.

Major Issues

- Intersection lacks traffic control and pavement markings, resulting in right of way priority that is not inherently clear.
- Limited sight distance.
- Lack of wayfinding and orientation.
- Streets are primarily used by large trucks (low volumes).

COLLISION DATA SUMMARY

There were no reported collisions at the study area where the shared use path intersects with S Michigan St from 1/1/2004 to 8/1/2017.

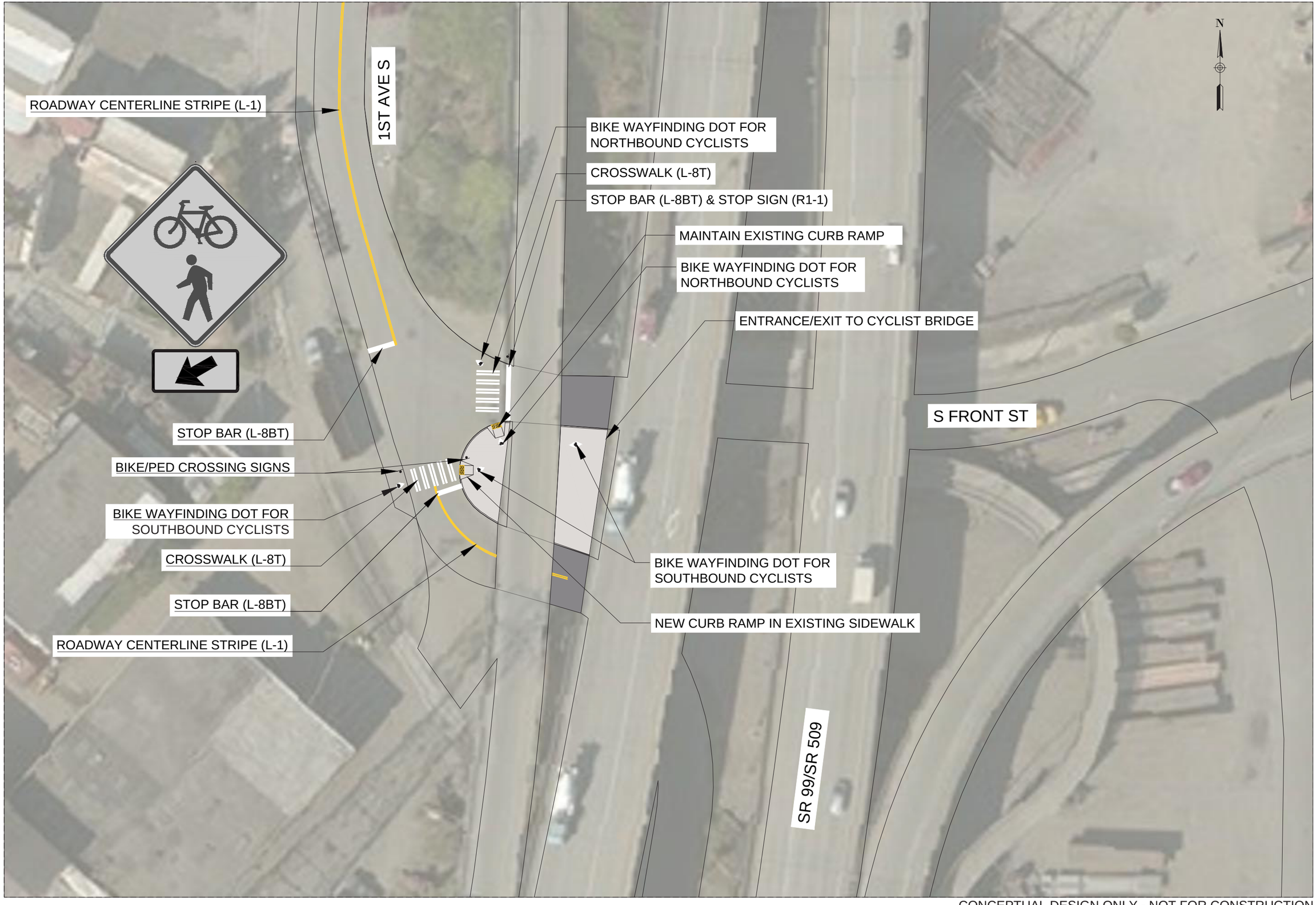
1st Ave S and S Michigan St, looking northwest.

PROPOSED CONCEPT DESIGNS

The proposed design concept (see **page 28**) aims to improve wayfinding and guidance for bicyclists and pedestrians traveling to and from the 1st Ave S Bridge. Bike wayfinding dots with directional arrows will help guide bicyclists through the intersection and to/from the bridge. A new stop sign is proposed on S Front St and on the southern leg of 1st Ave S. New crosswalks and stop bars are recommended to be installed on the south and east legs of the intersections and associated signing assist with pedestrian and bicyclist crossings. A centerline should be installed on 1st Ave S to help delineate travel lanes while roadway users approach and depart the intersection.

ESTIMATED COST RANGE

The range for these estimates consider unknown risks related to the design and/or construction of the concepts presented including traffic control and utility coordination. The estimated cost range for this design is $179,000 to $206,000.



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1ST AVE SOUTH BRIDGE

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MAP 7: FREMONT BRIDGE

BRIDGE STUDY AREA

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LOCATION 7: FREMONT BRIDGE

At 34th Ave N and Fremont Ave N

EXISTING CONDITIONS

At the north end of the Fremont Bridge, on Fremont Ave N, northbound cyclists exit the eastern separated sidewalk and ramp down to street level. This lane becomes the right turn only lane for motorists turning eastbound onto N 34th St.

At the first intersection after crossing the bridge northbound, Fremont Ave N intersects with N 34th St. At this location, on the south leg, there are three northbound lanes (two through lanes and one right turn only lane) and two southbound lanes on the south leg of the intersection. On the west leg of the intersection the roadway is a one-way westbound with one lane for motor vehicles, and a two-way protected bike lane. On the east leg of the intersection, N 34th St is one-way westbound with two left turn only lanes and one through-right lane, and westbound bicycle lane. Farther east, the northbound to eastbound slip lane from Fremont Ave N joins the roadway to create two-way motor vehicle traffic. A map of Location 7 can be viewed on **Page 29**.

Major Issues

- There are very high bicyclist volumes through the study area.
- There is no defined mixing zone on the south approach to the N 34th St intersection, as bicyclists emerge from the east side of the bridge crossing.
- The northbound to eastbound slip lane vehicle movement conflicts with northbound and eastbound bicycle movements.

Fremont Ave N at 34th Ave N, looking south

TABLE 15: Bicyclist and Pedestrian Collisions, Fremont Bridge from Westlake Ave N to 34th Ave N, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	2	17	1	20
Pedestrian	0	3	1	4

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

TABLE 16: Bicyclist and Pedestrian Collisions, Fremont Bridge at 34th Ave N and Fremont Ave N, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	2	10	1	13
Pedestrian	0	2	1	3

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

- The eastbound bike lane on N 34th St intersects the slip lane at an acute angle, resulting in sight distance limitations.
- Bicyclists use both sides of the bridge to travel northbound and southbound, and the bike facilities on either ends of the bridge neither accommodate nor deter these patterns. As a result, bicycle movements can seem unpredictable and unintuitive to drivers.

COLLISION DATA SUMMARY

General Summary

There were 24 crashes involving a bicyclist or a pedestrian from 1/1/2004 to 8/1/2017 (see table **Table 15**). Bicyclists accounted for the majority of crashes with 20 of the 24 collisions, with two resulting in serious injury, and 17 resulting in other injuries. Collisions that occurred along this bridge study area were geographically concentrated at the intersection of 34th Ave N and Fremont Ave, which accounted for 16 of the 24 collisions that occurred within the study area.

Site-Specific Summary

From 1/1/2004 through 8/1/2017, there were 16 reported collisions involving a bicyclist or a pedestrian (see table **Table 16** and **Table 17**). Of the 16 total collisions, 13 involved a bicyclist and two were serious injury collisions.

In 2017, a two-way protected bike lane was installed on the west leg of the intersection and a bike turn queue box on the east leg of the intersection. All four of the westbound bike collisions occurred prior to the installation of the bike turn queue box and two-way protected bike lane. This design is currently being monitored to determine how these changes are working to improve safety.

PROPOSED CONCEPT DESIGN

The proposed concept design extends the existing northbound protected bike lane on Fremont Ave N by approximately 250 feet to allow for a more defined and predictable merge point for motorists and bicyclists. A striped buffer is proposed between the northbound travel and the northbound bike to provide increase separation between bicyclists and motor vehicles. The existing bike lane within the right turn lane will be converted to a buffered bike lane to provide more space for bicyclists and to narrow the vehicle travel lane. The existing green bike lane will be changed from a solid green lane to dashed green bike lane extension markings and the installation of yield markings will inform motorists that bicyclists have the right-of-way. There are no structural modifications proposed in this concept (see **Pages 33-34** for the proposed design).

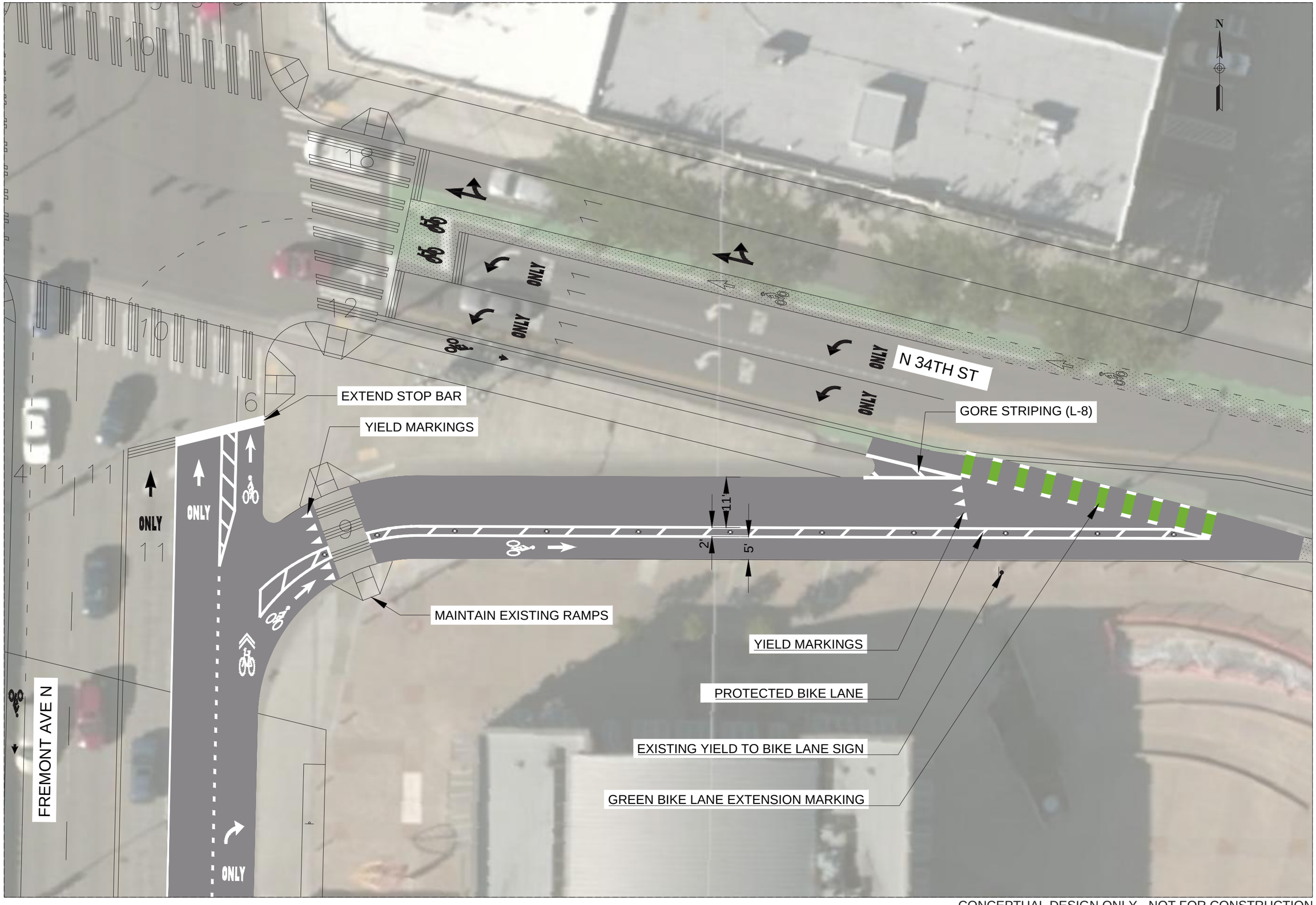
ESTIMATED COST RANGE

The range for these estimates considers unknown risks related to the design and/or construction of the concepts presented including traffic control and utility coordination. The estimated cost for this design ranges between $164,000 to $189,000.

TABLE 17: Fremont Bridge at Fremont Ave N and N 34th St - Collision Data 1/1/2004-8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Cycles	Injury Collision	3/1/2004	7:30 AM	Clear or Partly Cloudy	Dry	Daylight	SB(R) - SB(bike)	SB vehicle turning right from inside lane struck SB bicyclist traveling straight in outside lane.
Cycles	Serious Injury Collision	4/29/2004	10:10 AM	Clear or Partly Cloudy	Dry	Daylight	WB(L) - EB(bike)	WB vehicle turning left struck EB bicyclist in south crosswalk.
Cycles	Property Damage Only Collision	6/29/2004	12:30 PM	Clear or Partly Cloudy	Dry	Daylight	WB(L) - EB(bike)	WB vehicle turning left struck EB bicyclist in south crosswalk.
Pedestrian	Injury Collision	2/8/2005	2:49 PM	Clear or Partly Cloudy	Dry	Daylight	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south crosswalk.
Pedestrian	Property Damage Only Collision	12/14/2005	2:08 PM	Clear or Partly Cloudy	Dry	Daylight	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south crosswalk.
Cycles	Injury Collision	1/17/2006	10:15 AM	Clear or Partly Cloudy	Dry	Daylight	WB(L) - EB(bike)	WB vehicle turning left struck EB bicyclist traveling straight.
Cycles	Serious Injury Collision	4/19/2006	4:10 PM	Clear or Partly Cloudy	Dry	Daylight	WB(R) - NB(bike)	WB vehicle turning right struck NB bicyclist in east crosswalk.
Cycles	Injury Collision	5/12/2006	7:28 PM	Clear or Partly Cloudy	Dry	Daylight	WB(L) - EB(bike)	WB vehicle turning left struck EB bicyclist in south crosswalk.
Pedestrian	Injury Collision	10/21/2007	7:56 PM	Raining	Wet	Dark - Street Lights On	WB(R) - WB(ped)	WB vehicle turning right struck WB pedestrian in north crosswalk.
Cycles	Injury Collision	5/19/2009	7:20 AM	Overcast	Dry	Daylight	NB(L) - SB(bike)	NB vehicle turning left struck SB bicyclist traveling straight.
Cycles	Injury Collision	9/1/2010	5:58 AM	Overcast	Wet	Dark - Street Lights On	NB(L) - SB(bike)	NB vehicle turning left struck SB bicyclist traveling straight.
Cycles	Injury Collision	11/6/2012	8:38 AM	Clear or Partly Cloudy	Dry	Daylight	NB(L) - SB(bike)	NB vehicle turning left struck SB bicyclist traveling straight.
Cycles	Injury Collision	7/5/2014	5:28 PM	Clear or Partly Cloudy	Dry	Daylight	NB(L) - SB(bike)	NB vehicle turning left struck SB bicyclist traveling straight.
Cycles	Injury Collision	7/28/2015	9:25 AM	Clear or Partly Cloudy	Dry	Daylight	EB(R) - WB(bike)	EB vehicle turning right struck WB bicyclist turning left.
Cycles	Injury Collision	12/4/2016	8:33 PM	Clear or Partly Cloudy	Dry	Dark - Street Lights On	WB(L) - NEB(bike	WB vehicle turning left struck bicyclist traveling NE across lanes from west sidewalk approximately 100 ft south of intersection.
Cycles	Injury Collision	1/31/2017	8:37 AM	Clear or Partly Cloudy	Dry	Daylight	NB(L) - SB(bike)	NB vehicle turning left struck SB bicyclist traveling straight.

Data Source: Seattle Department of Transportation



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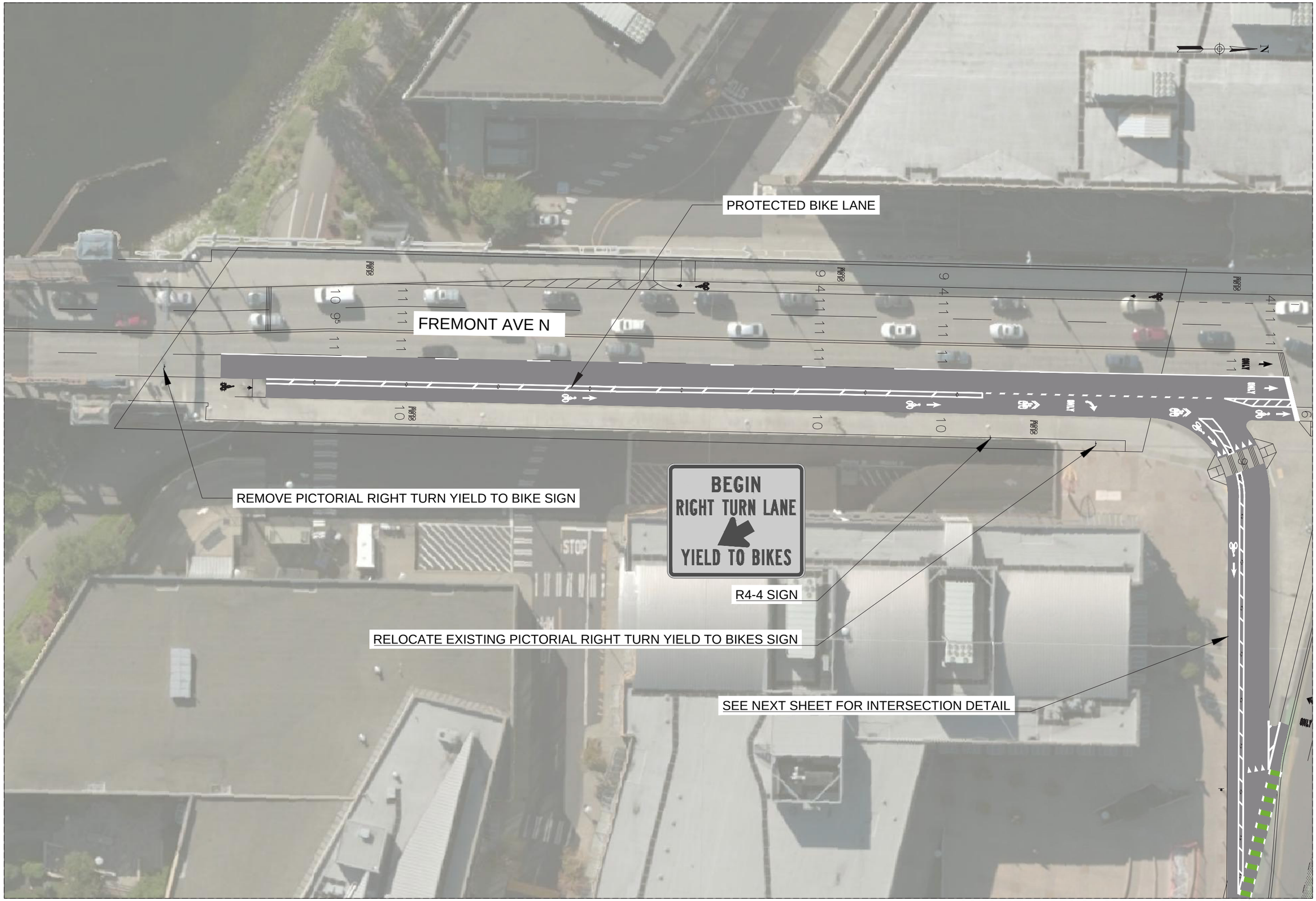

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MAP 8: JOSE RIZAL BRIDGE SOUTH

LOCATION 8: JOSE RIZAL BRIDGE SOUTH

At Golf Dr S and S Charles St

EXISTING CONDITIONS

At this intersection at the south approach to the Jose Rizal Bridge, people traveling both northbound and southbound on bicycles on Golf Drive S/12th Ave S share the travel lane with vehicles. The north leg consists of two northbound lanes, one southbound through lane, and one southbound to eastbound right turn only lane. The southern leg has one curbside parking lane on the east side, a northbound through lane, and a wide shared southbound lane that splits into a parking lane, bike lane, and travel lane farther south. The intersecting east/west streets have one eastbound and one westbound lane each. A large curb radius on the southwest corner and slip lane on the northwest corner enable higher speed vehicle turning movements. The intersection is signalized but lacks protected turn movements. A map of Location 8 can be viewed on **Page 35**.

Major Issues

- Lack of dedicated bicycle facilities through intersection.
- Size of intersection and large curb radii result in higher crossing exposure for bicycles and pedestrians.
- Bicyclists traveling northbound approach the intersection at high speed, increasing the potential for conflicts with southbound left-turning and northbound right-turning vehicles.
- The size of the intersection and the speed of northbound vehicles descending on Golf Dr S, may also encourage higher speed turns onto S Charles St, creating the potential for conflict with north-south bicycle movements through the intersection.

Golf Dr S and S Charles St, looking south

TABLE 18: Bicyclist and Pedestrian Collision, Jose Rizal Bridge from S Charles St to S Weller St 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	0	10	0	10
Pedestrian	2	12	0	14

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

TABLE 19: Bicyclist and Pedestrian Collision, Jose Rizal Bridge at Golf Dr S and S Charles St, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	0	4	0	4
Pedestrian	0	1	0	1

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

TABLE 20: Jose Rizal Bridge at Golf Dr S and S Charles St - Collision Data 1/1/2004-8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Pedestrian	Injury Collision	1/17/2005	10:20 PM	Overcast	Wet	Dark - Street Lights On	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south marked crosswalk.
Cycles	Injury Collision	11/12/2009	9:49 AM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist traveling straight.
Cycles	Injury Collision	10/26/2010	9:50 AM	Overcast	Dry	Daylight	NB(R) - NB(bike)	NB vehicle turning right struck NB bicyclist traveling straight.
Cycles	Injury Collision	11/5/2010	5:56 PM	Raining	Wet	Dark - Street Lights On	SB(L) - NB(bike)	SB vehicle turning left struck NB bicyclist traveling straight.
Cycles	Injury Collision	10/27/2014	6:20 AM	Overcast	Unknown	Dark - Street Lights On	WB(R) - NB(bike)	WB vehicle turning right struck NB bicyclist traveling straight.

Data Source: Seattle Department of Transportation

COLLISION DATA SUMMARY

General Summary

There were a total of 24 total crashes that occurred from 1/1/2004 to 8/1/2017. Ten of those crashes involved bicyclists and fourteen involved pedestrians (see **Table 18**). In all fourteen crashes involving a pedestrian, the pedestrians had the right of way at the time of the collision.

Site-Specific Summary

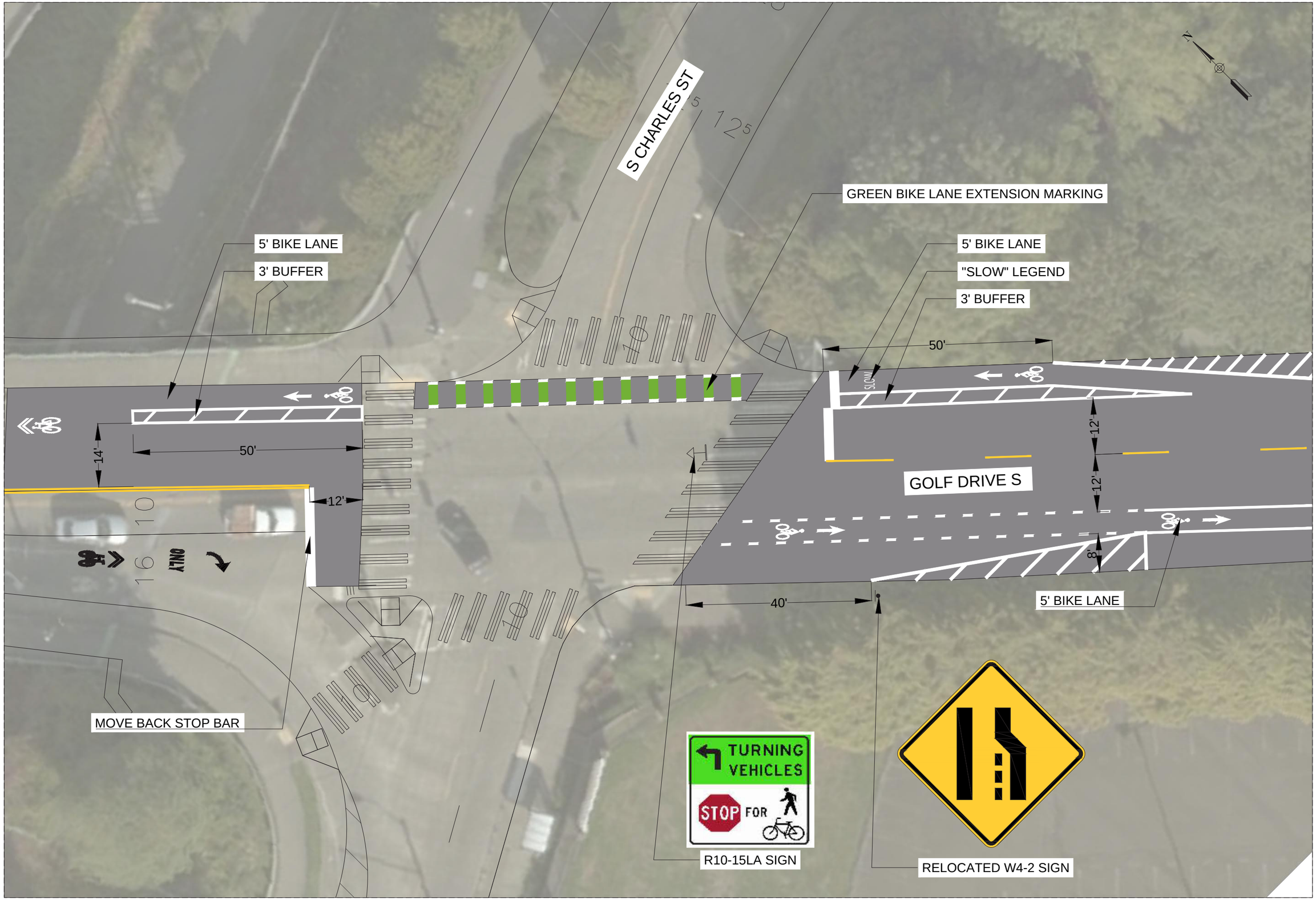
There were five total collisions that occurred involving a bicyclist or pedestrian (see **Table 19**). Four of the five collisions involved northbound bicyclists being struck while traveling straight. Two collisions were the result of southbound vehicles turning left across the bicyclist, one was the result of a northbound vehicle turning right across the bicyclist, and one was the result of a westbound vehicle turning right in front of the bicyclist. Detailed crash records can be viewed in **Table 20**.

PROPOSED CONCEPT DESIGN

A southbound buffered bike lane is proposed, with green bike lane extension markings through the intersection to define the bicycle crossing and to increase motorist awareness. One northbound receiving lane on the north leg of the intersection is proposed to be converted to a buffered bike lane for a short distance beyond the intersection. Parking should be restricted on the south leg approach to allow for a buffered bike lane and improved visibility. A R10-15LA sign (TURNING VEHICLES STOP FOR BICYCLISTS AND PEDESTRIANS) is proposed to for installation facing the southbound vehicle lane. To improve visibility while approaching the intersection, nearby trees should be trimmed to brighten the roadway. It is also recommended that a non-slip coating or material be placed on bridge joints to provide a better surface for bicyclists to ride on during wet conditions. A southbound bike lane will is proposed on the southern leg of the intersection with a portion of that bike lane being dashed to accommodate buses pulling over to the bus stop. Some parking spaces can be installed on the south the of the southbound bus stop. See **Page 38** for the concept design.

ESTIMATED COST RANGE

The range for these estimates considers unknown risks related to the design and/or construction of the concepts presented including traffic control and utility coordination. The estimated cost range for this design is $166,000 to $191,000.



CONCEPTUAL DESIGN ONLY - NOT FOR CONSTRUCTION

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JOSE RIZAL (SOUTH)

BRIDGE SAFETY ANALYSIS
CITY OF SEATTLE, WA

0 5 10 20

PREPARED: INITIALS
CHECKED: INITIALS

DATE
02/19/2018

REV 1 -
REV. 2 -
REV. 3 -

SHEET NAME

DRAWING NUMBER

SHEET NUMBER
OF ##

LOCATION 9: JOSE RIZAL BRIDGE NORTH

At 12th Ave S and S Weller St

EXISTING CONDITIONS

At this location, two blocks north of location 8, 12th Ave S meets S Weller St at a signalized intersection. There are both eastbound and westbound bike lanes on S Weller St up to the approach of the intersection. On the east side of the intersection, there is a westbound bike lane and eastbound shared lanes markings, with parking on both sides of the street. The grade on S Weller St descends eastward. On the west side of the intersection there is a westbound and an eastbound bike lane with parking on the north side of the street and a driveway on the south side of the street. On 12th Ave S, there are two lanes in either direction with a center striped median, and shared lane markings on the outside lanes. There is no on-street parking on 12th Ave S, and there are bus stops on both sides of the street south of the intersection. All four legs of the intersection have striped cross walks, and there are STOP FOR PED WHEN TURNING signs on the span wires for the eastbound and westbound directions (on S Weller St). A map of Location 9 can be viewed on Page 35.

12th Ave S at S Weller St, looking north

TABLE 21: Bicyclist and Pedestrian Collision, Jose Rizal Bridge at 12th Ave S and S Weller St, 1/1/2004-8/1/2017

ROADWAY USER	FATALITY/ SERIOUS INJURY	INJURY	PDO*	TOTAL
Bicyclist	0	4	0	4
Pedestrian	1	10	0	11

PDO = Property Damage Only
Data Source: Seattle Department of Transportation

Major Issues

- Sight distance is limited for westbound motorists due to the ascending grade. On-street parking right up to the intersection may also limit sight lines.

COLLISION DATA SUMMARY

General summary can be viewed on Page 36.

Site-Specific Summary

There were 15 total collisions that occurred from 1/1/2004 to 8/1/2017 involving a bicyclist or pedestrian (see Table 21). Pedestrian crashes accounted for the majority of crashes, with one serious injury crash and 10 injury crashes. Four collisions involving bicyclists resulted in an injury. Twelve of the 15 crashes occurred while a motorist struck a pedestrian or bicyclist while making a turn. Eight of the 12 turning-related crashes involved a left turn. Detailed crash records can be viewed in Table 22.

PROPOSED DESIGN CONCEPT

The proposed design concept (see page 41) involves creating protected left turns on S Weller St with parking restrictions up to the intersection approaches. A striped curb side bike lane is

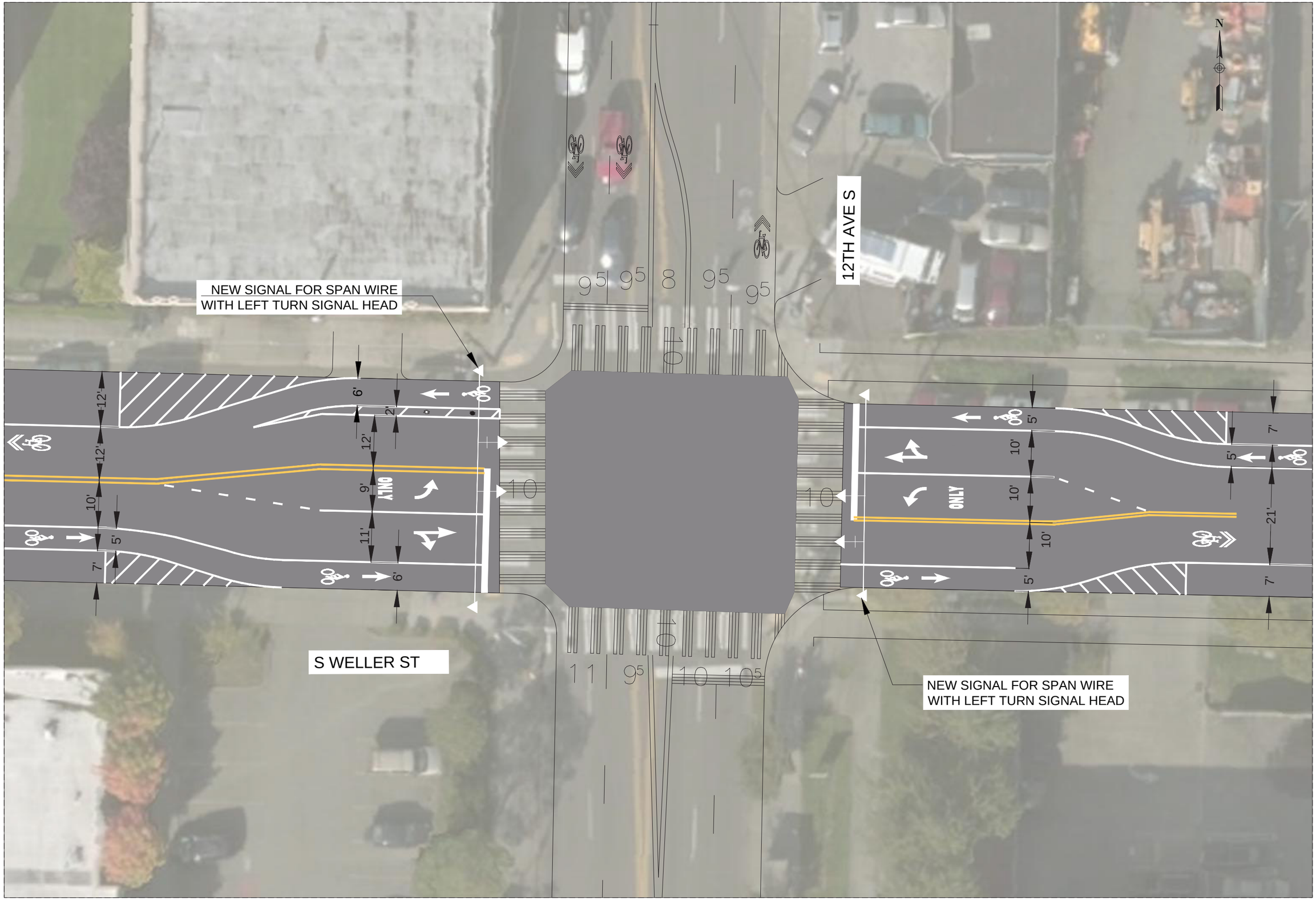
proposed on the approach and departing lanes on S Weller St. A leading pedestrian interval for the eastbound/westbound crosswalks could also be considered.

ESTIMATED COST RANGE

The range for these estimates considers unknown risks related to the design and/or construction of the concepts presented including traffic control and utility coordination. The estimated cost range is $240,000 to $312,000.

TABLE 22: 12th Ave S and S Weller St - Bike/Ped Collision Data 1/1/2004-8/1/2017

COLLISIONS DESCRIPTION	INJURY SEVERITY	DATE	TIME	WEATHER	ROAD CONDITION	LIGHT CONDITION	DIRECTION	NOTES
Pedestrian	Injury Collision	9/16/2004	1:25 PM	Overcast	Dry	Daylight	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south crosswalk.
Pedestrian	Injury Collision	12/11/2004	2:45 PM	Clear or Partly Cloudy	Dry	Daylight	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south crosswalk.
Pedestrian	Injury Collision	1/18/2005	5:34 PM	Raining	Wet	Dark - Street Lights On	NB(L) - NB(ped)	NB vehicle turning left struck NB pedestrian in west crosswalk.
Pedestrian	Injury Collision	9/20/2005	3:00 PM	Clear or Partly Cloudy	Dry	Daylight	EB(T) - NB(ped)	EB vehicle traveling straight struck NB pedestrian in west crosswalk.
Pedestrian	Injury Collision	10/14/2005	1:10 PM	Overcast	Dry	Daylight	EB(R) - NB(ped)	EB vehicle turning right struck NB pedestrian in west crosswalk.
Pedestrian	Injury Collision	4/18/2008	8:59 AM	Overcast	Dry	Daylight	WB(L) - WB(ped)	WB vehicle turning left struck WB pedestrian in south crosswalk.
Pedestrian	Injury Collision	10/13/2008	6:30 PM	Raining	Wet	Unknown	NEI	Not Enough Information
Pedestrian	Injury Collision	3/1/2009	3:33 PM	Raining	Wet	Daylight	EB(R) - NB(ped)	EB vehicle turning right struck NB pedestrian in west crosswalk.
Cycles	Injury Collision	4/17/2009	5:41 PM	Clear or Partly Cloudy	Dry	Daylight	NB(L) - SB(bike)	NB vehicle turning left struck SB bicycle traveling straight.
Pedestrian	Injury Collision	7/20/2009	12:24 PM	Clear or Partly Cloudy	Dry	Daylight	SB(R) - SB(ped)	SB vehicle turning right struck SB pedestrian in west crosswalk.
Pedestrian	Serious Injury Collision	8/4/2010	3:00 PM	Overcast	Wet	Daylight	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south crosswalk.
Cycles	Injury Collision	2/11/2014	7:30 PM	Raining	Wet	Dark - Street Lights On	EB(R) - SB(bike)	EB vehicle turning right struck SB bicycle traveling straight.
Cycles	Injury Collision	8/14/2014	5:36 PM	Clear or Partly Cloudy	Dry	Daylight	SB(T) - SB(bike)	SB vehicle traveling straight struck SB bicycle traveling straight.
Cycles	Injury Collision	3/4/2015	8:50 AM	Clear or Partly Cloudy	Dry	Daylight	SB(L) - NB(bike)	SB vehicle turning left struck NB bicycle traveling straight.
Pedestrian	Injury Collision	10/31/2015	8:31 AM	Raining	Wet	Daylight	WB(L) - EB(ped)	WB vehicle turning left struck EB pedestrian in south crosswalk.



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12TH AVE S & S WELLER ST

BRIDGE SAFETY ANALYSIS
CITY OF SEATTLE, WA

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OF ##

PRIORITIZED LOCATIONS

PRIORITIZATION RESULTS

The Bicycle Pedestrian Safety Analysis (BPSA) identified a number of risk factors that can increase the potential for bicyclist and pedestrian crashes. Using these factors, each bridge location included in this study was evaluated and ranked based on the number of risk factors present. Locations with the highest number of risk factors present received a higher priority.

After assessing each location using the key risk factors identified in the BPSA, a prioritized list of locations was created, as shown in **Table 23**.

PRIORITIZATION FACTORS:

Arterial street intersections and large and complex intersections: These types of intersections have a higher potential risk for all bicycle crash types. Traffic speed increases the risk of serious or fatal injury for people walking and biking. Large and complex intersections also increase the time needed for pedestrians and bicyclists to travel through the intersection, resulting in longer exposure times and an increased risk of being struck by a vehicle. Locations with irregular geometries and approximate widths greater than 60 feet are considered larger or complex in this model.

TABLE 23: Prioritized List of Locations

LOCATION	LARGE/ COMPLEX INTERSECTION	SIGNALIZED INTER-SECTION	COMMER-CIAL AREA	TRANSIT	BIKE FACILITY	CENTER TURN LANE	DOWN-HILL APPROACH	PARKING	HIGH BIKE VOLUME*	PRIORITY RANK
University Bridge: Eastlake Ave E and Fuhrman Ave	✔	✔	✔	✔	✔	✔		✔	✔	1
Jose Rizal Bridge South: Golf Dr S and S Charles St	✔	✔		✔	✔		✔	✔	✔	2
Fremont Bridge: Fremont Ave N and N 34th St	✔	✔	✔	✔	✔				✔	3
Jose Rizal Bridge North: 12th Ave S and S Weller St		✔	✔	✔	✔		✔			4
Ballard Bridge North: Off-Ramp	✔		✔	✔					✔	5
Ballard Bridge North: On-Ramp	✔		✔	✔						6
Ballard Bridge South: 15th Ave NW and W Emerson St	✔			✔						7
Ballard Bridge Sidewalk				✔						8
1st Ave S Bridge: 1st Ave S and S Michigan St	✔									9

* High bike volume locations are determined using estimated annual bike volumes used in the BPSA. Locations in the top 50 percent receive a "✔" value.

Signalized intersections: The BPSA found that signalized intersections are positively related to bicycle intersection collisions, even when controlling for volumes.

Commercial land uses: In Seattle, there is a greater likelihood for a bicycle collision to occur at locations near commercial buildings due to higher levels of activity.

Transit: The BPSA found that the potential for crashes tends to be higher in locations with transit activity. The BPSA analysis did not provide specific factors that lead to the higher probability of crashes occurring, either for obstructed sightlines or aggressive maneuvering by motorists to get around transit vehicles.

Bike facilities: Bicycle crashes are more likely to occur at intersections that have bike lanes or shared lanes. However, the BPSA did not determine whether or not the crash happened in a bike lane because this information wasn't readily available in a coded format for analysis. The finding did show that special attention is required at intersections with bike facilities in order to provide a safe passage through the intersection for people to ride a bike.

Intersections with center turn lanes: Center left turn lanes at intersections are associated with a higher number of bicycle crashes. As with the findings on bike lanes, one should interpret this finding cautiously, as there are likely other factors at play such as the common practice of allowing permissive left turns. Additional information is needed on a crash-by-crash basis to determine the factor that caused the collision.

On-street parking: For all bicycle crashes, and in particular left-hook crashes, there is a higher potential for crashes at locations with on-street parking. This finding could be related to visibility or other factors.

Downhill approach: The BPSA found that downhill approaches to intersections may increase the potential for bicycle left-hook crashes, but not bicycle angle crashes. Additional factors such as bicyclist and driver speed, traffic volumes, and visibility should be further explored.

Funding: Due to age and extensive use, some of Seattle's most heavily travelled bridges are deteriorating and in need of significant repair. Other bridges are in need of seismic upgrades in order to make the bridge less vulnerable to

TABLE 24: Cost Estimates Summary for Prioritized Proposed Bridge Safety Design Concepts

PRIORITY RANK	BRIDGE	LOCATION	COST ESTIMATE RANGE
1	University Bridge	Eastlake Ave E and Fuhrman Ave	$244,000 to $318,000
2	Jose Rizal Bridge South	Golf Dr S and S Charles St	$166,000 to $191,000
3	Fremont Bridge	Fremont Ave N and N 34th St	$164,000 to 189,000
4	Jose Rizal Bridge North	12th Ave S and S Weller St	$240,000 to $312,000
5	Ballard Bridge Northeast: Off-Ramp	Off-ramp at 15th Ave NW and NW Ballard Way	Combined $207,000 to $270,000
6	Ballard Bridge Northwest: On-Ramp	On-ramp at 15th Ave NW and NW Ballard Way	
7	Ballard Bridge South	15th Ave NW and W Emerson St	$1,019,000 to $1,325,000
8	Ballard Bridge Sidewalk	Between W Emerson St and NW Ballard Way	$9,271,000 to $12,053,000
9	1st Ave S Bridge	1st Ave S Bridge NB Shared Use Path and S Michigan St	$179,000 to $206,000

Total $11,490,000 to $14,864,000

earthquakes. To help meet the needs of our most vulnerable bridges, SDOT implements program to rehabilitate, replace, and/or seismically retrofit multiple bridges across the city.

Estimated construction cost ranges for each project can be viewed in **Table 24**.

Approved by voters in November 2015, the 9-year, $930 million Move Seattle Levy provides funding to improve safety for all travelers, maintain our streets and bridges, and invest in reliable, affordable travel options for a growing city.

The Move Seattle Levy authorized funding for the continuation of the Bridge Rehabilitation and Replacement Program. The primary objective of this program is to develop planning studies that would either identify recommendations and costs for either rehabilitating or replacing the bridge identified in the Move Seattle Levy after 2024. A portion of the funding from this program can be used for implementing near-term pedestrian and bicycle safety projects on bridges being studied for replacement or rehabilitation (in addition to leveraging funds provided for pedestrian and bicycle safety projects in other elements).

Conclusion: Most locations in this analysis have large/complex intersections, transit, and a center turn lane, downhill approaches, and on-street parking. Locations that scored the highest have high bicycle volumes, existing bicycle facilities, and a traffic signal.

These bridge-related locations represent pinch points in the network where high volumes of traffic, including pedestrians and bicycles, are funneled into constrained conditions, therefore creating a higher potential for conflicts. The purpose of this analysis is to reduce conflict and improve safety at these locations that are so critical for multimodal mobility.

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APPENDIX: COST ESTIMATES

1 Ballard Bridge South

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
8-22	L-1 (TWO PARALLEL 4" SOLID YELLOW STRIPES, PAINT)	LF	240	$ 6	$ 1,440
8-22	L-5A (4" WHITE STRIPE, 2' DASH 4' SKIP, PAINT)	LF	60	$ 3	$ 180
8-22	L-6A (4" WHITE STRIPE, PAINT)	LF	490	$ 3	$ 1,470
8-22	L-8 (8" BARRIER LINE, PAINT)	LF	155	$ 3	$ 465
8-22	L-8T (8" CROSSWALK, THERMOPLASTIC)	LF	120	$ 4	$ 480
8-22	L-8BT (24" WHITE STOPBAR, THERMOPLASTIC)	LF	25	$ 12	$ 300
8-22	L-20T (LEFT ARROW LEGEND, THERMOPLASTIC)	EA	3	$ 150	$ 450
8-22	L-25T ("ONLY" LEGEND, THERMOPLASTIC)	EA	3	$ 150	$ 450
8-22	L-28AT (BIKE LANE LEGEND, THERMOPLASTIC)	EA	1	$ 800	$ 800
8-22	L-28BT (SHARROW, THERMOPLASTIC)	EA	1	$ 400	$ 400
8-22	YIELD MARKINGS (THERMOPLASTIC)	EA	10	$ 20	$ 200
8-22	SIGNS AND POST	EA	1	$ 500	$ 500
	C CURB	LF	140	$ 25	$ 3,500
	CHANNELIZATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 11,000**
6-03	STEEL FRAMING*	LB	6250	$ 10	$ 62,500
6-02	DRILL AND INSTALL FRAME ANCHORS*	EA	100	$ 150	$ 15,000
6-02	CONCRETE DIAPHRAGM*	CY	7.5	$ 2,000	$ 15,000
6-02	DRILL AND INSTALL DOWELS*	EA	121	$ 150	$ 18,150
6-02	DRILL AND INSTALL ANCHORS, 12 INCH SPACING*	EA	12.5	$ 150	$ 1,875
2-02	REMOVE EXISTING RAILING*	LF	275	$ 25	$ 6,875
6-02	DRILL AND INSTALL ANCHORS, RAILING*	EA	380	$ 75	$ 28,500
6-03	BICYCLE RAILING, 54 INCH HIGH*	LF	275	$ 110	$ 30,250
6-03	INSTALL BICYCLE RAILING*	LF	275	$ 50	$ 13,750
	CONCRETE SIDEWALK REMOVAL	SY	15	$ 18	$ 270
6-02	ROUGHEN CONCRETE DECK*	SF	420	$ 20	$ 8,400
6-02	REINFORCEMENT*	LB	817	$ 5	$ 4,085
	CONCRETE SIDEWALK ON BRIDGE DECK*	CY	15.5	$ 2,000	$ 31,000
6-02	CONCRETE CURB	LF	155	$ 100	$ 15,500
	RAISED ASPHALT BIKE PATH	SY	30	$ 80	$ 2,400
	CURB RAMP	EA	1	$ 5,000	$ 5,000
	EMERSON BRIDGE WIDENING, SIDEWALK, AND RAILING SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 259,000**
6-02	CONCRETE SIDEWALK*	CY	33	$ 25	$ 825
	CONCRETE SIDEWALK ON BRIDGE DECK*	CY	7.5	$ 1,000	$ 7,500
6-02	CONCRETE RETAINING WALL*	CY	15	$ 2,000	$ 30,000
6-02	DRILL AND INSTALL DOWELS*	EA	100	$ 150	$ 15,000
6-03	BICYCLE RAILING, 54 INCH HIGH*	LF	50	$ 110	$ 5,500
6-03	INSTALL BICYCLE RAILING*	LF	50	$ 50	$ 2,500
	15TH AVE SIDEWALK AND RAILING SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 62,000**
1-09	MOBILIZATION (10% OR MIN $10000)	LS	1	$ 33,200	$ 33,200
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10000)	LS	1	$ 33,200	$ 33,200
1-10	TRAFFIC CONTROL (10% OR MIN $25000)	LS	1	$ 33,200	$ 33,200
	CONSTRUCTION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 100,000**
	PLANNING (5% OR MIN $10000)	LS	1.00		$ 21,600
	DESIGN (25% OR MIN $10000)	LS	1.00		$ 108,000
	PUBLIC OUTREACH (10% OR MIN $10000)	LS	1.00		$ 43,200
	CONSTRUCTION MANAGEMENT (35% OR MIN $10000)	LS	1.00		$ 151,200
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $10000)	LS	1.00	$ 33,300	$ 129,600
	PROJECT ADMINISTRATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 454,000**

Project Summary

SUBTOTAL	**$**	**886,000**	*(ROUNDED UP TO NEXT $1,000)*
CONSTRUCTION CONTINGENCY (15%)	$	132,900	
TOTAL	**$**	**1,019,000**	*(ROUNDED UP TO NEXT $1,000)*
30% COST RANGE BASED ON RISK CONSIDERATIONS	**$**	**1,019,000**	**$ 1,325,000**

**COSTS AND QUANTITIES PROVIDED BY STRUCTURAL ENGINEERING CONSULTANT*

2 Ballard Bridge Sidewalk

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
6-02	CUT, DRILL AND INSTALL THREAD BARS, PER 4 FEET LENGTH	EA	1475	$ 500	$ 737,500
6-02	DRILL AND INSTALL ANCHORS, 12 INCH SPACING	EA	5900	$ 50	$ 295,000
6-03	STEEL LOWER RAILING	LB	221250	$ 5	$ 1,106,250
6-03	BICYCLE RAILING, 30 INCH HIGH	LF	5900	$ 100	$ 590,000
6-03	INSTALL BICYCLE RAILING	LF	5900	$ 50	$ 295,000
	MATERIALS SUBTOTAL *(ROUNDED UP TO NEXT $1,000)*				**$ 3,024,000**
1-09	MOBILIZATION (10% OR MIN $10000)	LS	1	$ 302,400	$ 302,400
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10000)	LS	1	$ 302,400	$ 302,400
1-10	TRAFFIC CONTROL (10% OR MIN $25000)	LS	1	$ 302,400	$ 302,400
	CONSTRUCTION SUBTOTAL *(ROUNDED UP TO NEXT $1,000)*				**$ 908,000**
	PLANNING (5% OR MIN $10000)	LS	1.00		$ 196,600
	DESIGN (25% OR MIN $10000)	LS	1.00		$ 983,000
	PUBLIC OUTREACH (10% OR MIN $10000)	LS	1.00		$ 393,200
	CONSTRUCTION MANAGEMENT (35% OR MIN $10000)	LS	1.00		$ 1,376,200
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $10000)	LS	1.00	$ 1,179,600	$ 1,179,600
	PROJECT ADMINISTRATION SUBTOTAL *(ROUNDED UP TO NEXT $1,000)*				**$ 4,129,000**

Project Summary

SUBTOTAL	**$ 8,061,000**	*(ROUNDED UP TO NEXT $1,000)*
CONSTRUCTION CONTINGENCY (15%)	$ 1,209,150	
TOTAL	**$ 9,271,000**	*(ROUNDED UP TO NEXT $1,000)*
30% COST RANGE BASED ON RISK CONSIDERATIONS	**$ 9,271,000**	**$ 12,053,000**

3 & 4 Ballard Bridge North: On-Ramp and Off-Ramp

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
8-22	L-1 (TWO PARALLEL 4" SOLID YELLOW STRIPES, PAINT)	LF	60	$ 6	$ 360
8-22	L-8 (8" BARRIER LINE, PAINT)	LF	170	$ 3	$ 510
8-22	L-8T (8" CROSSWALK, THERMOPLASTIC)	LF	290	$ 4	$ 1,160
8-22	L-8BT (24" STOP BAR, THERMOPLASTIC)	LF	12	$ 12	$ 144
	CONCRETE SIDEWALK REMOVAL	SY	65	$ 18	$ 1,170
	CONCRETE SIDEWALK INSTALL	SY	120	$ 75	$ 9,000
	CONCRETE CURB	LF	130	$ 45	$ 5,850
	CURB RAMP	EA	3	$ 5,000	$ 15,000
	PEDESTRIAN PUSH BUTTON	EA	2	$ 700	$ 1,400
	ASPHALT ROADWAY REMOVAL	SY	75	$ 16	$ 1,200
	ON RAMP MATERIALS SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 36,000**
8-22	L-8 (8" BARRIER LINE, PAINT)	LF	575	$ 3	$ 1,725
8-22	SIGN AND POST	EA	1	$ 500	$ 500
	OFF RAMP MATERIALS SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 3,000**
1-09	MOBILIZATION (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-10	TRAFFIC CONTROL (10% OR MIN $25000)	LS	1	$ 25,000	$ 25,000
	CONSTRUCTION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 45,000**
	PLANNING (5% OR MIN $10000)	LS	1.00		$ 10,000
	DESIGN (25% OR MIN $10000)	LS	1.00		$ 21,000
	PUBLIC OUTREACH (10% OR MIN $10000)	LS	1.00		$ 10,000
	CONSTRUCTION MANAGEMENT (35% OR MIN $10000)	LS	1.00		$ 29,400
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $10000)	LS	1.00	$ 25,200	$ 25,200
	PROJECT ADMINISTRATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 96,000**

Project Summary

SUBTOTAL	**$**	**180,000**	*(ROUNDED UP TO NEXT $1,000)*
CONSTRUCTION CONTINGENCY (15%)	$	27,000	
TOTAL	**$**	**207,000**	*(ROUNDED UP TO NEXT $1,000)*
30% COST RANGE BASED ON RISK CONSIDERATIONS	**$**	**207,000**	**$ 270,000**

5 University Bridge

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
8-22	L-1 (TWO PARALLEL 4" SOLID YELLOW STRIPES, PAINT)	LF	100	$ 6	$ 600
8-22	L-2 (4" YELLOW STRIPE, PAINT)	LF	90	$ 3	$ 270
8-22	L-5BT (6" WHITE STRIPE, 2' DASH, 4' SKIP, THERMOPLASTIC)	LF	120	$ 4	$ 480
8-22	L-6A (4" WHITE STRIPE, PAINT)	LF	20	$ 3	$ 60
8-22	L-6B (6" WHITE STRIPE, PAINT)	LF	25	$ 3	$ 75
8-22	L-7 (4" WHITE PARKING LINE, PAINT)	LF	130	$ 3	$ 390
8-22	L-8T (8" CROSSWALK, THERMOPLASTIC)	LF	725	$ 4	$ 2,900
8-22	L-8BT (24" STOP BAR, THERMOPLASTIC)	LF	60	$ 12	$ 720
8-22	GREEN PAVEMENT (MMA)	SF	135	$ 100	$ 13,500
8-22	SIGN AND POST	EA	1	$ 500	$ 500
	CONCRETE SIDEWALK REMOVAL	SY	75	$ 18	$ 1,350
	CONCRETE SIDEWALK INSTALL	SY	105	$ 75	$ 7,875
	CONCRETE CURB	LF	150	$ 45	$ 6,750
	CURB RAMP	EA	4	$ 5,000	$ 20,000
	ASPHALT ROADWAY REMOVAL	SY	30	$ 16	$ 480
	MATERIALS SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 56,000**
1-09	MOBILIZATION (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-10	TRAFFIC CONTROL (10% OR MIN $25000)	LS	1	$ 25,000	$ 25,000
	CONSTRUCTION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 45,000**
	PLANNING (5% OR MIN $10000)	LS	1.00		$ 10,000
	DESIGN (25% OR MIN $10000)	LS	1.00		$ 25,250
	PUBLIC OUTREACH (10% OR MIN $10000)	LS	1.00		$ 10,100
	CONSTRUCTION MANAGEMENT (35% OR MIN $10000)	LS	1.00		$ 35,350
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $10000)	LS	1.00	$ 30,300	$ 30,300
	PROJECT ADMINISTRATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 111,000**

Project Summary

SUBTOTAL	**$**	**212,000**	*(ROUNDED UP TO NEXT $1,000)*
CONSTRUCTION CONTINGENCY (15%)	$	31,800	
TOTAL	**$**	**244,000**	*(ROUNDED UP TO NEXT $1,000)*
30% COST RANGE BASED ON RISK CONSIDERATIONS	**$**	**244,000**	**$ 318,000**

6 1st Ave S Bridge

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
8-22	L-1 (TWO PARALLEL 4" SOLID YELLOW STRIPES, PAINT)	LF	220	$ 6	$ 1,320
8-22	L-8T (8" CROSSWALK, THERMOPLASTIC)	LF	200	$ 4	$ 800
8-22	L-8BT (24" STOP BAR, THERMOPLASTIC)	LF	24	$ 12	$ 288
8-22	L-BKDT (BIKE DOT, THERMOPLASTIC)	EA	5	$ 500	$ 2,500
8-22	SIGNS AND POST	EA	3	$ 500	$ 1,500
	CONCRETE SIDEWALK REMOVAL	SY	10	$ 18	$ 180
	CURB RAMP	EA	1	$ 5,000	$ 5,000
	ASPHALT ROADWAY	SY	175	$ 80	$ 14,000
	MATERIALS SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 26,000**
1-09	MOBILIZATION (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-10	TRAFFIC CONTROL (10% OR MIN $25000)	LS	1	$ 25,000	$ 25,000
	CONSTRUCTION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 45,000**
	PLANNING (5% OR MIN $10000)	LS	1.00		$ 10,000
	DESIGN (25% OR MIN $10000)	LS	1.00		$ 17,750
	PUBLIC OUTREACH (10% OR MIN $10000)	LS	1.00		$ 10,000
	CONSTRUCTION MANAGEMENT (35% OR MIN $10000)	LS	1.00		$ 24,850
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $10000)	LS	1.00	$ 21,300	$ 21,300
	PROJECT ADMINISTRATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 84,000**

Project Summary

SUBTOTAL	**$ 155,000**	*(ROUNDED UP TO NEXT $1,000)*	
CONSTRUCTION CONTINGENCY (15%)	$ 23,250		
TOTAL	**$ 179,000**	*(ROUNDED UP TO NEXT $1,000)*	
15% COST RANGE BASED ON RISK CONSIDERATIONS	**$ 179,000**	**$ 206,000**	

7 Fremont Bridge

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
8-22	L-5B (6" WHITE STRIPE, 2' DASH, 4' SKIP, PAINT)	LF	105	$ 3	$ 315
8-22	L-5BT (6" WHITE STRIPE, 2' DASH, 4' SKIP, THERMOPLASTIC)	LF	110	$ 4	$ 440
8-22	L-6B (6" WHITE STRIPE, PAINT)	LF	1095	$ 3	$ 3,285
8-22	L-8 (8" BARRIER LINE, PAINT)	LF	45	$ 3	$ 135
8-22	L-8BT (24" STOP BAR,THERMOPLASTIC)	LF	6	$ 12	$ 72
8-22	L-21T (RIGHT TURN LEGEND, THERMOPLASTIC)	EA	1	$ 150	$ 150
8-22	L-22T (THRU LEGEND, THERMOPLASTIC)	EA	1	$ 150	$ 150
8-22	L-25T ("ONLY" LEGEND, THERMOPLASTIC)	EA	2	$ 150	$ 300
8-22	L-28AT (BIKE LANE LEGEND, THERMOPLASTIC)	EA	4	$ 800	$ 3,200
8-22	L-28BT (SHARROW, THERMOPLASTIC)	EA	2	$ 400	$ 800
8-22	L-TP28W (22" WHITE TUFF POST WITH PINCHED TOP AND WHITE BASE)	EA	20	$ 50	$ 1,000
8-22	GREEN PAVEMENT (MMA)	SF	80	$ 100	$ 8,000
8-22	YIELD MARKINGS (THERMOPLASTIC)	EA	8	$ 20	$ 160
8-22	SIGN AND POST	EA	1	$ 500	$ 500
	MATERIALS SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 19,000**
1-09	MOBILIZATION (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-10	TRAFFIC CONTROL (10% OR MIN $25000)	LS	1	$ 25,000	$ 25,000
	CONSTRUCTION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 45,000**
	PLANNING (5% OR MIN $10000)	LS	1.00		$ 10,000
	DESIGN (25% OR MIN $10000)	LS	1.00		$ 16,000
	PUBLIC OUTREACH (10% OR MIN $10000)	LS	1.00		$ 10,000
	CONSTRUCTION MANAGEMENT (35% OR MIN $10000)	LS	1.00		$ 22,400
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $10000)	LS	1.00	$ 19,200	$ 19,200
	PROJECT ADMINISTRATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 78,000**

Project Summary

SUBTOTAL	**$**	**142,000**	*(ROUNDED UP TO NEXT $1,000)*
CONSTRUCTION CONTINGENCY (15%)	$	21,300	
TOTAL	**$**	**164,000**	*(ROUNDED UP TO NEXT $1,000)*
15% COST RANGE BASED ON RISK CONSIDERATIONS	**$**	**164,000**	**$ 189,000**

8 Jose Rizal Bridge: South
Golf Dr S and S Charles St

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
8-22	L-5B (DASHED 6" WHITE STRIPE, 2' PAINT 4' SKIP)	LF	200	$ 3	$ 600
8-22	L-5BT (DASHED 6" WHITE STRIPE, 2' PAINT 4' SKIP, THERMOPLASTIC)	LF	140	$ 4	$ 560
8-22	L-6B (6" WHITE EDGE LINE, PAINT)	LF	515	$ 3	$ 1,545
8-22	L-8 (8" BARRIER LINE, PAINT)	LF	260	$ 3	$ 780
8-22	L-8AT (16" STOP BAR, THERMOPLASTIC)	LF	10	$ 8	$ 80
8-22	L-8BT (24" STOP BAR, THERMOPLASTIC)	LF	35	$ 12	$ 420
8-22	L-28AT (BIKE LANE LEGEND, THERMOPLASTIC)	EA	5	$ 800	$ 4,000
8-22	L-28BT (BIKE SHARROW, THERMOPLASTIC)	EA	1	$ 400	$ 400
8-22	SLOW ("SLOW" LEGEND, THERMOPLASTIC)	EA	1	$ 200	$ 200
8-22	GREEN PAVEMENT (MMA)	SF	100	$ 100	$ 10,000
8-22	SIGN AND POST	EA	2	$ 500	$ 1,000
	MATERIALS SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 20,000**
1-09	MOBILIZATION (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10000)	LS	1	$ 10,000	$ 10,000
1-10	TRAFFIC CONTROL (10% OR MIN $25000)	LS	1	$ 25,000	$ 25,000
	CONSTRUCTION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 45,000**
	PLANNING (5% OR MIN $10000)	LS	1.00		$ 10,000
	DESIGN (25% OR MIN $10000)	LS	1.00		$ 16,250
	PUBLIC OUTREACH (10% OR MIN $10000)	LS	1.00		$ 10,000
	CONSTRUCTION MANAGEMENT (35% OR MIN $10000)	LS	1.00		$ 22,750
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $10000)	LS	1.00	$ 19,500	$ 19,500
	PROJECT ADMINISTRATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 79,000**

Project Summary

SUBTOTAL	**$**	**144,000**	*(ROUNDED UP TO NEXT $1,000)*
CONSTRUCTION CONTINGENCY (15%)	$	21,600	
TOTAL	**$**	**166,000**	*(ROUNDED UP TO NEXT $1,000)*
15% COST RANGE BASED ON RISK CONSIDERATIONS	**$**	**166,000**	**$ 191,000**

9 Jose Rizal Bridge: North
12th Ave S and S Weller St

SPEC	ITEM	UNIT	GENERAL QUANTITY	UNIT COST	TOTAL PROJECT COST
8-22	L-1 (TWO PARALLEL 4" SOLID YELLOW STRIPES, PAINT)	LF	195	$ 6	$ 1,170
8-22	L-5A (4" WHITE STRIPE, 2' DASH 4' SKIP, PAINT)	LF	58	$ 3	$ 174
8-22	L-6A (4" WHITE STRIPE, PAINT)	LF	80	$ 3	$ 240
8-22	L-6B (6" WHITE STRIPE, PAINT)	LF	515	$ 3	$ 1,545
8-22	L-7 (4" WHITE STRIPE, PAINT)	LF	120	$ 3	$ 360
8-22	L-8 (8" WHITE STRIPE, PAINT)	LF	400	$ 3	$ 1,200
8-22	L-8BT (24" WHITE STOPBAR, THERMOPLASTIC)	LF	50	$ 12	$ 600
8-22	L-20T (LEFT ARROW LEGEND, THERMOPLASTIC)	EA	2	$ 150	$ 300
8-22	L-24T (RIGHT AND THROUGH ARROW LEGEND, THERMOPLASTIC)	EA	2	$ 150	$ 300
8-22	L-25T ("ONLY" LEGEND, THERMOPLASTIC)	EA	2	$ 150	$ 300
8-22	L-28AT (BIKE LANE LEGEND, THERMOPLASTIC)	EA	5	$ 800	$ 4,000
8-22	L-28BT (SHARROW LEGEND, THERMOPLASTIC)	EA	2	$ 400	$ 800
8-22	L-TP28W (28" WHITE TUFF POST WITH PINCHED TOP AND WHITE BASE)	EA	2	$ 50	$ 100
	SIGNAL HEAD	EA	4	$ 1,000	$ 4,000
	MATERIALS SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 16,000**
1-09	MOBILIZATION (10% OR MIN $10,000)	LS	1	$ 10,000	$ 10,000
1-05	CONSTRUCTION SURVEYING (10% OR MIN $10,000)	LS	1	$ 10,000	$ 10,000
1-10	TRAFFIC CONTROL (10% OR MIN $25,000)	LS	1	$ 25,000	$ 25,000
	CONSTRUCTION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 61,000**
	PLANNING (5% OR MIN $)	LS	1.00		$ 3,850
	DESIGN (25% OR MIN $)	LS	1.00		$ 19,250
	TRAFFIC MODELING	LS	1.00	$ 50,000	$ 50,000
	PUBLIC OUTREACH (10% OR MIN $)	LS	1.00		$ 7,700
	CONSTRUCTION MANAGEMENT (35% OR MIN $)	LS	1.00		$ 26,950
	PLANNING-LEVEL CONTINGENCY (30% OR MIN $)	LS	1.00	$ 23,100	$ 23,100
	PROJECT ADMINISTRATION SUBTOTAL	*(ROUNDED UP TO NEXT $1,000)*			**$ 131,000**

Project Summary

SUBTOTAL	**$**	**208,000**	*(ROUNDED UP TO NEXT $1,000)*
CONSTRUCTION CONTINGENCY (15%)	$	31,200	
TOTAL	**$**	**240,000**	*(ROUNDED UP TO NEXT $1,000)*
30% COST RANGE BASED ON RISK CONSIDERATIONS	**$**	**240,000**	**$ 312,000**

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