Appendix M

Study Preferred Alternative Considerations

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Appendix M-1

Burwell Street to 6th Street Memo

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Parametrix
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TECHNICAL MEMORANDUM

DATE:	November 9, 2020
TO:	Katie Ketterer, City of Bremerton
FROM:	Michael Horntvedt, Parametrix
SUBJECT:	Roadway conditions between Burwell and 6th Streets on Warren Avenue
PROJECT NUMBER:	554-1896-156
PROJECT NAME:	SR 303 Corridor Study

Introduction

This white paper is intended to inform and document the City of Bremerton's decision process about the center median on Warren Avenue between Burwell Street and 5th Street. Existing and future conditions are outlined and potential solutions have been evaluated; the discussion results in a recommended course of action for inclusion in the SR 303 Corridor Study's preferred alternative.

The center median was installed to provide a safer crossing for bicycles and pedestrians and includes crosswalks and pedestrian refuge islands at 4th and 5th Streets. The right of way through this segment of SR 303 is constrained. Therefore the area for the median was accommodated by repurposing the western most northbound through lane; this resulted in a loss of roadway capacity on SR 303. At the time of installation technologies that would have preserved roadway capacity while providing safe crossing options for pedestrians, such as Rectangular Rapid Flashing Beacons (RRFB), were not available.

During the SR 303 Corridor Study alternative's development stage, stakeholder and community feedback highlighted operational issues at Burwell and SR 303 intersection due to the reduced capacity on SR 303 between Burwell and 5th Street. Comments noted that the vehicle queue from 6th Street negatively impacts the operation of the Burwell and SR 303 signal causing congestion on SR 303 and on Burwell (SR 304).

Existing Conditions

Warren Avenue operates with side street stop control at both 4th Street and 5th Street. Left turns from all directions are also restricted at both intersections. The intersection located at 6th Street is signalized and has been considered in this evaluation to help evaluate queuing impacts. The intersection of Warren Avenue/ 6th Street operates with a LOS D during the existing PM peak hour.

There is approximately 350 feet of storage capacity for northbound traffic at the intersection of Warren Avenue/6th Street. This includes the 50 feet of storage in the northbound left-turn lane and the two through lanes between 5th Street and 6th Street. As shown in **Figure 1**, the existing PM peak hour 95th percentile queues total almost 700 feet.

Figure 1: Existing PM Peak Hour Northbound Queues at Warren Avenue/6th Street.

	NB LT	NB TH	Total NB
AVAILABLE STORAGE	50	300	350
50th percentile queue	247	234	481
95th percentile queue	364	330	694
Total distance - 6th Street to 5th Street		~ 200 feet	
Total distance - 6th Street to 4th Street		~ 400 feet	

On average traffic models show the congestion during the PM peak hour extends to south of 5th Street. Because the model used in this evaluation does not fully capture system level congestion, we worked with the City of Bremerton staff to understand that during daily periods of severe congestion, queues are seen extending all the way back to Burwell Street. This level of congestion then impacts Burwell because people can't turn onto Warren Avenue. This type of system congestion causes additional delay with in the area.

Existing bicycle and pedestrian counts were collected in May 2019 to allow the traffic team to baseline all traffic analysis. Figure 2 and Figure 3 illustrates the traffic data collected during the morning and evening two-hour peak periods at Warren Avenue/4th Street and Warren Avenue/5th Street. The highest pedestrian volumes, during both peak periods, occurs at 4th Street with the highest use at the southern-most crossing. The pedestrian activity at these intersections is considered low to moderate and the bicycle activity is considered low.

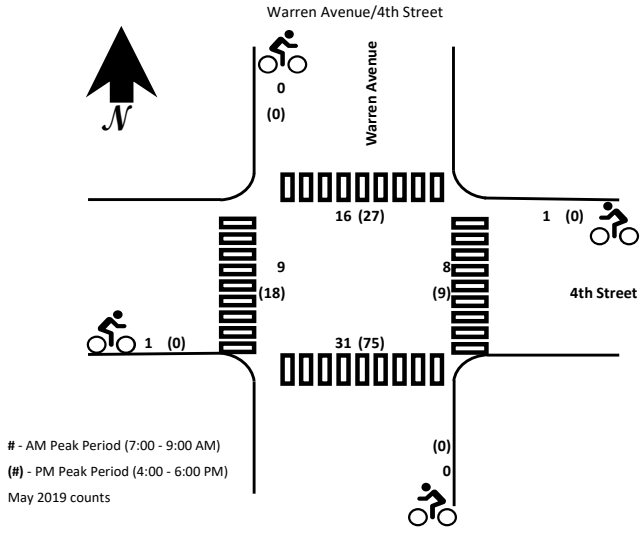


Figure 2: Peak Hour Turning Movement Counts at Warren Avenue/4th Street

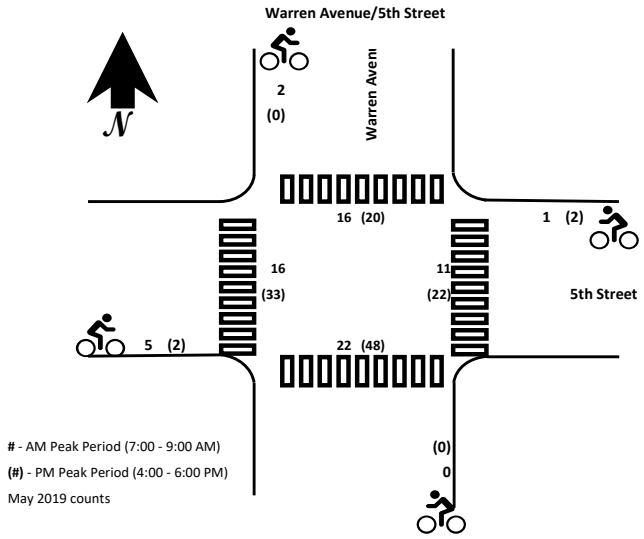


Figure 3: Peak Hour Turning Movement Counts at Warren Avenue/5th Street

2040 Future Conditions (No Build)

The project team evaluated the corridor using year 2040 PM peak hour volumes for a No Build and Build condition that allowed comparison of operations with and without the median. Results from the analysis show that traffic volumes are expected to increase by about 30% by the year 2040. Pedestrian and bicycle use would also likely increase; however, since a clear approach to forecasting pedestrian growth has not been established, the team did not make any modifications to the estimates. This assumption could be reconsidered as further analysis is pursued.

During the 2040 PM peak hour, the intersection of Warren Avenue/6th Street is forecasted to operate at LOS E. This assumes signal timing has been optimized to improve delay on Warren Avenue, causing increased delays on 6th Street.

2040 Build Alternative #1

Under the proposed Build Alternative #1, the existing median would be removed and replaced with a second northbound lane between Burwell and 6th Street. When analyzed this alternative showed that northbound queuing from 6th Street would extend past 5th Street but congestion would rarely reach 4th Street. The congestion length is shorter with Build Alternative #1 compared to No Build because the additional northbound through lane acts, in part, as a queue storage lane for NB left-turns at 6th Street.

Build Alternative #1 would reduce the amount of time northbound traffic would be backed up through the 4th Street intersection, improving travel time for this portion of the corridor, between 6th Street and Burwell. This could also result in improvements for people turning left from Burwell onto Warren Avenue because there would be additional receiving capacity on Warren Avenue.

Because the crosswalks at 4th and 5th Streets are marked, pedestrians are legally given the right-of-way under both the No Build and Build Alternative #1 conditions and the length of crossing is the same in both conditions. However, with the removal of the pedestrian refuge islands at 4th and 5th Streets, it is

Figure 4. Build Alternative #1

recommended that additional pedestrian safety countermeasures such as a rectangular rapid-flashing beacon (RRFB) or a pedestrian hybrid beacon (PHB) be installed, per FHWA guidelines and recommendations.

Figure 5 shows a relative comparison of PM peak hour northbound queues at Warren Avenue/6th Street, including existing, 2040 No Build and 2040 Build Alternative #1 conditions. As shown in Figure 4, operations at the 6th Street intersection under the 2040 PM peak hour No Build condition show northbound congestion extending farther south of 4th Street than under existing conditions. Like existing conditions, it is expected that in times of severe congestion queues will extend back to Burwell under the 2040 No Build PM peak hour.

FHWA Pedestrian Safety Countermeasures

Build Alternative #1 recommends installing additional pedestrian safety countermeasures at the intersections of Warren Avenue/4th Street or Warren Avenue/5th Street. FHWA recommends several countermeasure options for improving pedestrian safety at uncontrolled crossing locations, Figure 6 illustrates FHWA's countermeasures for various roadway conditions, with conditions that match Warren Avenue highlight in red.

The matrix shown in Figure 6 shows four countermeasures "that should always be considered, but not mandated or required" for the roadway conditions that match Warren Avenue. Removing the median on Warren Avenue and adding either a RRFB or PHB 4th and 5th Streets will provide safety benefits for pedestrians and bicyclists at the same time as providing additional needed vehicle storage capacity along Warren Avenue.

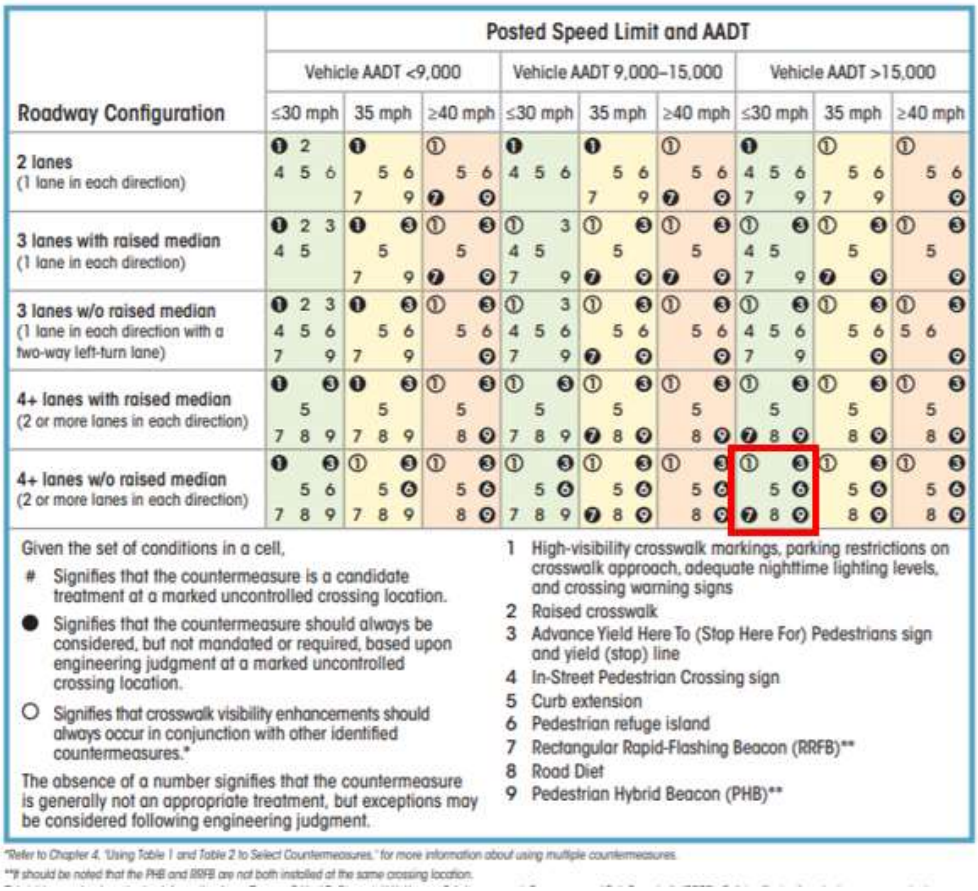
NB queues at SR 303/6th	Alterantive		
	Existing PM Peak	2040 No Build PM Peak	2040 Build Alt #1 PM Peak
50th Percentile			
95th Percentile			

Figure 5: Comparison of estimated PM Peak Hour Queues

2040 Build Alternative #2

A variation of the proposed Build Alternative, based on public input, was also analyzed. Under Build Alternative #2, the northbound left-turn lane at 6th Street would be extended by 100 feet to provide more left turn storage, Warren Avenue would be widened between 6th Street and 5th Street, the median between 6th Street and just north of 5th Street would be removed and replaced with a second northbound through lane. Under Build Alternative #2, the median refuge for bicyclists and pedestrians at Warren Avenue/4th Street would remain, and no additional pedestrian safety countermeasures would be installed.

Extending the northbound left-turn lane at Warren Avenue/6th Street would require right-of-way (ROW) on the west side of Warren Avenue to accommodate the new roadway cross section between 5th Street and 6th Street. **Figure 7** illustrates Build Alternative #2.



Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	● 2 4 5 6	● 5 6 7 9	○ 5 6 ● ○	● 4 5 6	● 5 6 7 9	○ 5 6 ● ○	● 4 5 6 7 9	○ 5 6 7 9	○ 5 6 ● ○
3 lanes with raised median (1 lane in each direction)	● 2 3 4 5	● ◆ 5 7 9	○ ◆ 5 ● ○	○ 3 4 5 7 9	○ ◆ 5 ● ○	○ ◆ 5 ● ○	○ 4 5 7 9	○ ◆ 5 ● ○	○ ◆ 5 ● ○
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	● 2 3 4 5 6 7 9	● ◆ 5 6 7 9	○ ◆ 5 6 ○	○ 3 4 5 6 7 9	○ ◆ 5 6 ● ○	○ ◆ 5 6 ○	○ 4 5 6 7 9	○ ◆ 5 6 ○	○ ◆ 5 6 ○
4+ lanes with raised median (2 or more lanes in each direction)	● ◆ 5 7 8 9	● ◆ 5 7 8 9	○ ◆ 5 8 ○	○ ◆ 5 7 8 9	○ ◆ 5 ● 8 ○	○ ◆ 5 8 ○	○ ◆ 5 7 8 ○	○ ◆ 5 8 ○	○ ◆ 5 8 ○
4+ lanes w/o raised median (2 or more lanes in each direction)	● ◆ 5 6 7 8 9	○ ◆ 5 ◆ 7 8 9	○ ◆ 5 ◆ 8 ○	○ ◆ 5 ◆ 7 8 9	○ ◆ 5 ◆ ● 8 ○	○ ◆ 5 ◆ 8 ○	○ ◆ 5 ◆ 7 8 ○	○ ◆ 5 ◆ 8 ○	○ ◆ 5 ◆ 8 ○

Given the set of conditions in a cell,

\# Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.

● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.

○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2 Raised crosswalk
3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4 In-Street Pedestrian Crossing sign
5 Curb extension
6 Pedestrian refuge island
7 Rectangular Rapid-Flashing Beacon (RRFB)**
8 Road Diet
9 Pedestrian Hybrid Beacon (PHB)**

*Refer to Chapter 4, "Using Table 1 and Table 2 to Select Countermeasures," for more information about using multiple countermeasures.

**It should be noted that the PHB and RRFB are not both installed at the same crossing location.

Figure 6: FHWA's Application of Pedestrian Crash Countermeasures for Roadway Feature

Analysis of 2040 PM peak hour conditions showed that under Build Alternative #2 queues from the northbound left-turn at 6th Street are larger than the available storage capacity and would extend southbound, similar to No Build and Build Alternative #1 conditions. While queuing is expected to be shorter under Build Alternative #2 compared to the No Build, queues during severely congested times would be longer than compared to Build Alternative #1. However, without the additional storage capacity provided by a second northbound through lane between 4th Street and Burwell Street, during congested peak hours northbound queues under Build Alternative #2 would be longer than under Build Alternative #1. The preliminary cost estimate for this alternative including ROW would be $300,000 to $500,000. This estimate does not include relocation, lost revenue, or other negotiated items that could inflate the cost.

Therefore, due to the expected ROW impacts and the longer queues, it is not recommended to move forward with Build Alternative #2.

Figure 7: Build Alternative #2

Additional Considerations

Concerns about the congestion from Warren Avenue 6th Street backing up to Burwell Street are the driver for removing the median and replacing the northbound left through lane.

Results from the analysis show a benefit to queueing and congestion on the Warren Avenue corridor by removing the center median. However, implementation of new traffic control devices that provide dynamic signal timing are also expected to help improve congestion, queuing, and travel times along the corridor.

It is recommended that implementation of new traffic control devices be implemented prior to removing the medians. The concept of removing the medians could be considered through time and a congestion monitoring program in conjunction with a bicycle and pedestrian monitoring program. This will be particularly important as the City of Bremerton and Naval Base Kitsap consider multi-modal improvements as part of their Joint Compatibility Transportation Plan (JCTP). If that plan identifies parking changes within the adjacent neighborhoods, improved shuttle/bus service for NBK, or other concepts, the use of this crossing could change considerably.

Recommendation

It is our recommendation to re-establish the two northbound through lanes on Warren Avenue between Burwell and 6th Street to help reduce system level congestion and provide trip mobility for all modes. Additionally, early phasing of dynamic signal timing to reduce existing congestion patterns is recommended.

Several items for consideration have come to light that should be evaluated before a final recommendation for pedestrian safety countermeasures is made::

1. Potential for use of RRFB or PHB at the pedestrian crossings
2. Consideration of shorter length medians to reduce ROW impacts while providing crossing safety
3. Ensuring any recommendations from the JCTP are considered with the final configuration of this corridor

Because the above measures will be combined for consideration and evaluation as part of the JCTP, it is recommended that the final configuration be a key outcome from the JCTP. The SR 303 Corridor Study does recommend implementing a dynamic signal control strategy for the Warren Avenue corridor as soon as possible to help manage corridor delay and congestion.

Appendix M-2

11th Street Intersection Alternatives White Paper

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SR 303 Corridor Study

Preliminary layout for internal review and consideration

Year 2040 PM Peak Hour Analysis Comparison for 11th Street/Warren Avenue Intersection

Alternative	Intersection Level (sec/veh)		By Approach			Planning Level Cost Range	Benefits	Issues
	LOS	Overall Delay	Approach	Delay (sec/veh)	Max 95th Percentile Queue (ft)			
Existing	F	80	NB	85	#650	N/A	N/A	N/A
			SB	40	840			
			EB	95	#700			
			WB	125	#560			
No Build	F	110	NB	115	m#920	N/A	• Maintain context of neighborhood • No cost	• Long delays through the peak 2 hour period • No bypass for transit • Congestion on SR 303 and Warren Ave in front of homes • Impacts freight travel times during the peak • Requires modification of concurrency requirements with City and State • Does not meet City concurrency policy
			SB	65	m#870			
			EB	120	#1140			
			WB	160	#940			
Triple left	F	85	NB	115	m#910	$800K – $1,380K	• Improves delay and eastbound level of service • Reduces congestion along the corridors • Purchase of property could allow for new park space	• Impacts homes along SR 303 from 11th to 13th • Impacts park land • Increases pedestrian crossing distance on west leg • Increases pavement in neighborhood • Not consistent with neighborhood context • Does not meet City concurrency policy • High level cost
			SB	65	m#880			
			EB	65	#630			
			WB	125	#890			
Roundabout ✓	B	20	NB	35	460	$5,120K – $8,960K	• Provides traffic calming • Improves intersection delay • Improves safety for drivers and pedestrians • Reduces congestion along the corridors • Fits with the neighborhood context • Provided sustainable solution that can be signalized to address peak demand issues beyond the analysis years • Meets City concurrency standard	• Impacts homes and property in each quadrant of intersection • Might impact park land • Perceived difficulty for freight and transit • Mid-level cost
			SB	5	65			
			EB	26	455			
			WB	20	175			

Year 2040 PM Peak Hour Analysis Comparison for 11th Street/Warren Avenue Intersection

Alternative	Intersection Level (sec/veh)		By Approach			Planning Level Cost Range	Benefits	Issues
	LOS	Overall Delay	Approach	Delay (sec/veh)	Max 95th Percentile Queue (ft)			
Flyover	D	36	NB	45	m500	$9,670K – $16,925K	• Improves delay • Reduces congestion • Purchase of property along Warren Ave could allow for new park space • Meets City concurrency standard	• Less flexible for future modification • Does not fit neighborhood context • Introduces visual obstruction • Increase noise impacts with raised structure • Impacts homes between 11th and 13th • Impacts park land • High-level cost
			SB	10	m310			
			EB	60	590			
			WB	65	640			

1 - analysis completed using Synchro v10 except the Roundabout that used SIDRA 8 per the WSDOT Roundabout Analysis Policy.

Appendix M-3

11th Street to Warren Avenue Bridge Memo

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TECHNICAL MEMORANDUM

DATE:	November 4, 2020
TO:	Katie Ketterer
FROM:	Michael Horntvedt
SUBJECT:	SR 303 Corridor Study: 11th Street to Warren Ave Bridge
CC:	Alex Atchison, David Dinkuhn
PROJECT NUMBER:	554-1896-156
PROJECT NAME:	SR 303 Corridor Study

INTRODUCTION

This memo is intended to help advise the City of Bremerton about several proposed concepts to improve mobility and safety on Warren Avenue between 11th Street and the Warren Avenue Bridge. During the SR 303 Corridor Study alternative's development stage, several stakeholder members requested additional concepts be evaluated for inclusion in the Preferred Alternative.

This memo outlines the proposed concepts, describes benefits and impacts of each concept, and recommends concepts to be included in the Preferred Alternative.

ADDITIONAL CONCEPTS

Four additional concepts have been proposed, including:

- Close the 18th Street southbound access ramp onto Warren Avenue to improve safety and provide additional right-of-way to accommodate wider sidewalks between 16th and 18th Streets,
- Extend length of northbound left turn pocket at 16th Street to contain vehicles queuing to turn into Olympic College outside of the through lanes,
- Widen sidewalks on both side of Warren Avenue to 10 feet between 11th Street and 16th Street,
- Provide a two way left turn lane between 11th Street and 16th Street

Several of these concepts could be built together, such as extending the length of the northbound left-turn at Warren Avenue/16th Street and widening the sidewalks to 10 feet. Cumulative impacts are described below.

Close 18th Street southbound access ramp

Southbound access is currently available from 18th Street to Warren Avenue. The access is stop controlled and operates like a slip ramp in its current configuration. Drivers using this access must look over their shoulder and accelerate onto Warren Avenue from a stopped condition, merging with traffic traveling at speeds greater than 48 mph and weaving with southbound traffic turning right at 16th Street.

The project team evaluated the operational impacts of closing this access and redirecting traffic to the intersection of Warren Avenue/16th Street. Count data was not available for the ramp, so the project team used a conservative estimate of 200 vehicles per hour that would relocate to 16th Street from 18th Street. This estimate is based on comparing existing traffic counts taken on the north end of the Warren Avenue Bridge and counts

taken at the intersection of Warren Avenue/16th Street. Operational results show the intersection will operate at LOS C during the 2040 PM peak hour. 95th percentile queues for the eastbound movement is expected to increase approximately 50 feet, or two car lengths, to just over 200 feet total, due to the redirected traffic. The LOS C operation and queue length are considered acceptable per City and State level of service standards for SR 303 that shows a LOS E operations as the lowest acceptable level. When Olympic College completes projects in their master plan, the queue distance between Warren Avenue and the newly relocated Broadway Ave will be over 250 feet and will accommodate the peak queue in the year 2040. Continued coordination with Olympic College will occur to outline any additional improvements that might be beneficial. (http://geo.wa.gov/datasets/WSDOT::wsdot-level-of-service-standard-for-state-routes?geometry=-122.719%2C47.560%2C-122.555%2C47.581)

Closing the 18th Street access to Warren Avenue is expected to improve safety by eliminating a conflict point for southbound traffic on Warren Avenue and removing the southbound weaving movement between 18th Street and 16th Street. This concept is not expected to have negative impacts to traffic operations at the intersection of Warren Avenue/16th Street.

- Extend the length of the northbound left-turn pocket at 16th Street

The northbound left-turn lane at Warren Avenue/16th Street is approximately 75 feet long. Northbound left-turn queues frequently extend beyond the available storage capacity causing vehicles in the northbound inside lane to stop. Chapter 1301 of the WSDOT Design Manual notes at signalized intersections, a traffic signal analysis should be used to determine the storage length of left-turn lanes. FHWA recommends "as a rule of thumb, the left-turn lane should be designed to accommodate one and one-half to two times the average number of vehicle queues per cycle."

The project team used Synchro to evaluate the 2040 PM peak hour condition to estimate the average future queue length for the northbound left-turn movement. Results showed the 50th percentile queue to be approximately 185 feet during the 2040 PM Peak hour. Given then results, the northbound left-turn lane should be extended to provide approximately 275 feet of storage capacity. This storage length should adequately accommodate expected peak hour demand, including transit vehicles, and prevent northbound left-turns from queuing back into the northbound through lanes.

To accommodate an extended northbound left-turn lane, additional right of way (ROW) will be required on the west side of the corridor. An approximate outline of the area of impact is shown on attached **Figure 1**. Approximately 1,676 square feet (sf) of additional ROW would be acquired from parcels owned by Olympic College (OC). The area would be taken from existing planters and it is anticipated that no parking stalls would be lost. A short retaining wall would be needed to support the grade difference between the parking lot and back of sidewalk. Final design of the walls and sidewalk would be required to determine if the parking stalls would need to be shortened to 15 feet and designated for compact vehicles.

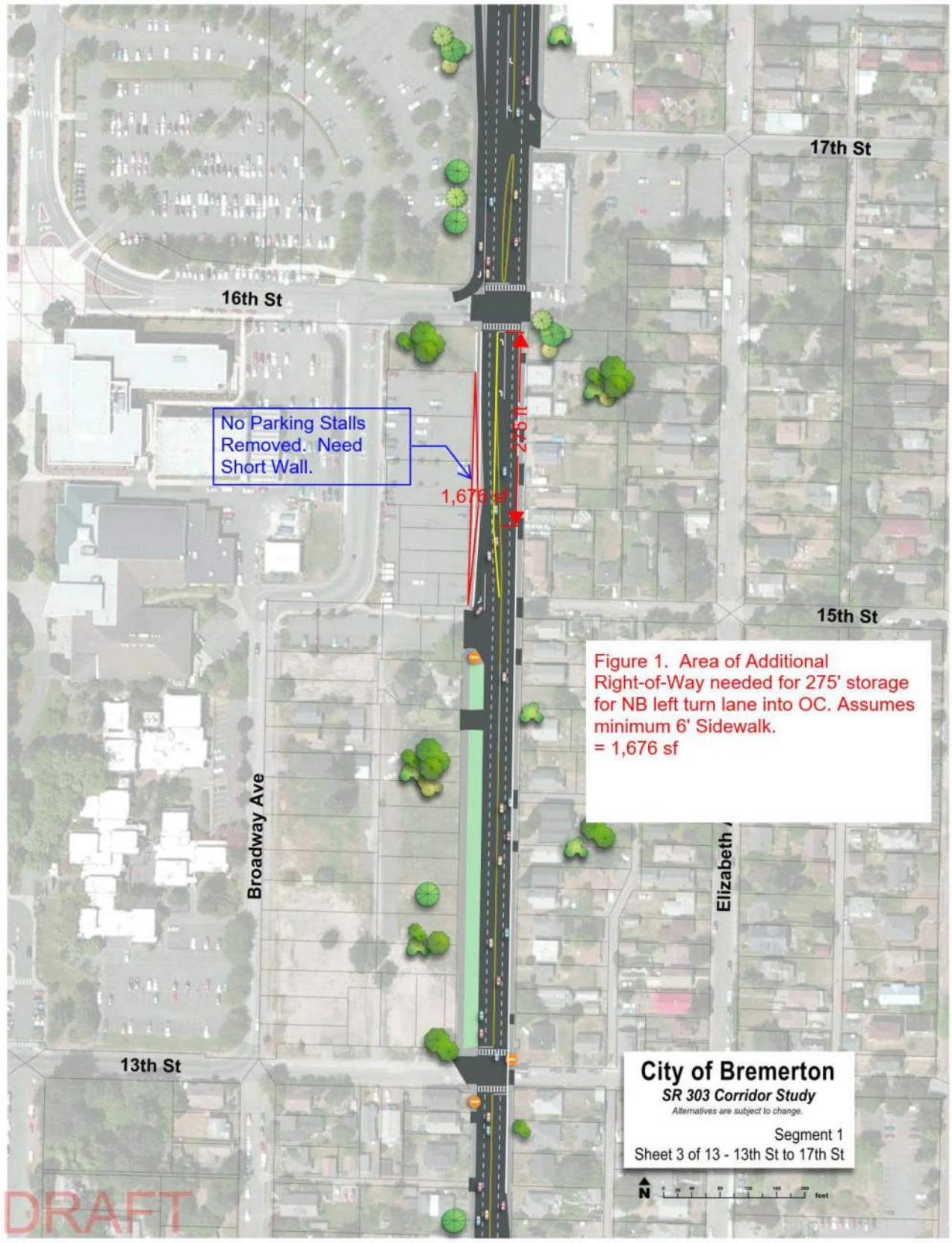

Figure 1. 16th Street Left Turn Extension

- Widen sidewalks on both sides to 10 feet Warren Avenue Bridge to 11th Street

Because of the variation in roadway cross-sections and available right-of-way along this section of the corridor, the impacts are described by segments of the corridor. The assumed typical cross-section for a widened 10-foot sidewalk, shown below includes a 3 foot buffer and 11 foot lanes for a total width of 70 feet.

Between the south end of the Warren Avenue bridge and 16th Street, there is room to include a 10' sidewalk on both sides of the roadway. This could require some reconstruction of the retaining wall on the west side of the roadway near the 16th Street intersection.

From 16th Street to 15th Street, widening the sidewalks in conjunction with extending the northbound left turn lane into Olympic College would impact the entire front row of parking stalls at the Olympic College parking lot facing Warren Avenue. It is assumed that all parking stalls along this frontage would be eliminated (37 total). A short retaining wall would also be needed between the parking lot and the new back of sidewalk. Further coordination with Olympic College would be required.

This concept takes advantage of available right-of-way width between 15th and 13th Streets to provide widened sidewalks for this segment of the corridor. The concept is shown graphically on **Figures 3a and 3b.** Approximately 6,996 sf of additional ROW would be needed.

Widening the sidewalks south of 13th Street would either require the full acquisition of five residential properties on the west side of Warren Avenue as shown in figure 3c. The homes on the east side of the corridor were avoided in this analysis because they are located in a federally recognized opportunity zone. If widening were considered to occur on both sides of Warren Avenue, coordination with 10 or more property owners would be necessary to acquire portions of their property.

If the sidewalks are widened to 10 feet on both sides of Warren Avenue to the north of 13th Street, but not on the south, there would be a lane alignment off-set through the intersection. The offset would be four feet to the west and would be delineated with a curb and lane markings.

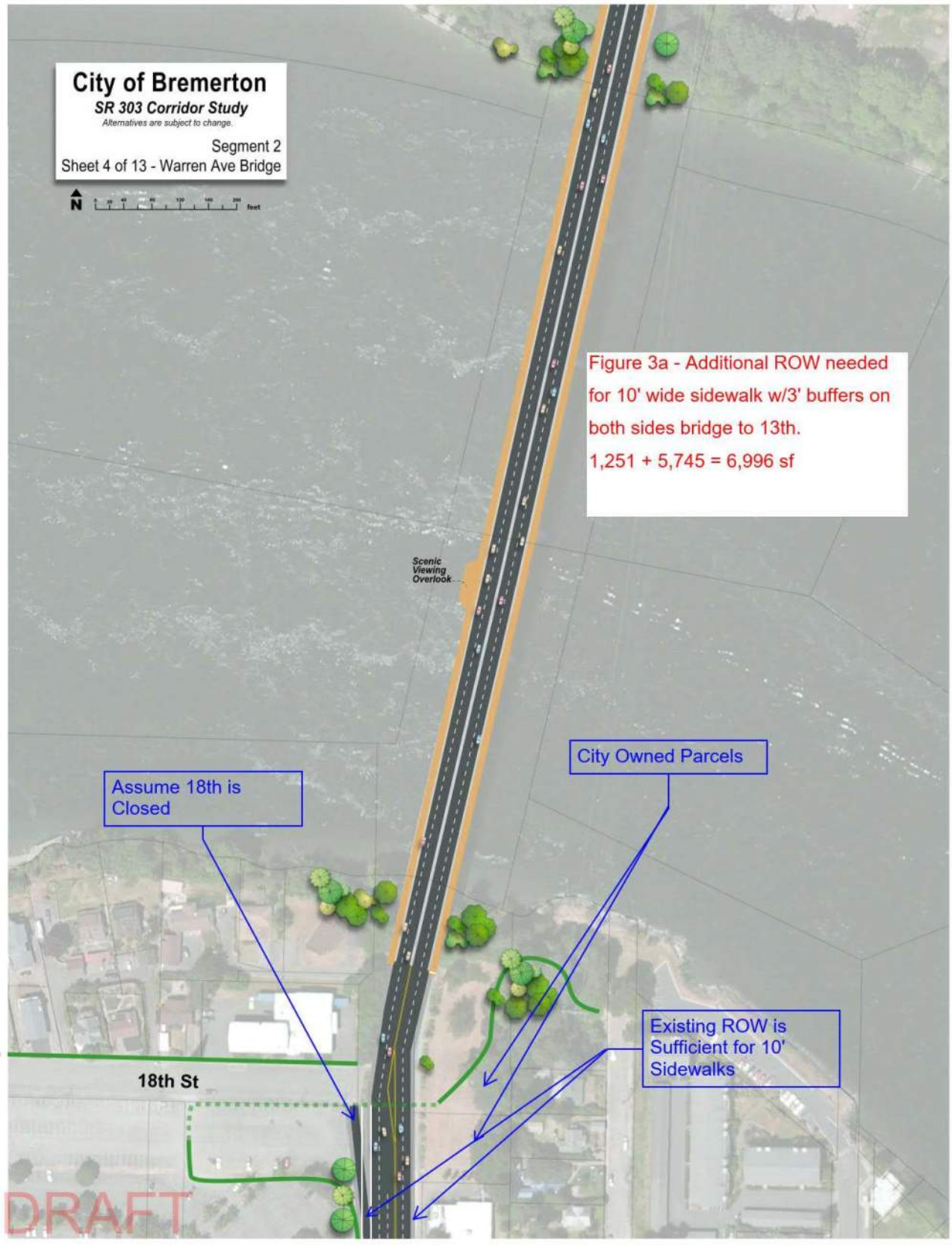

Figure 3a. 10 foot sidewalks

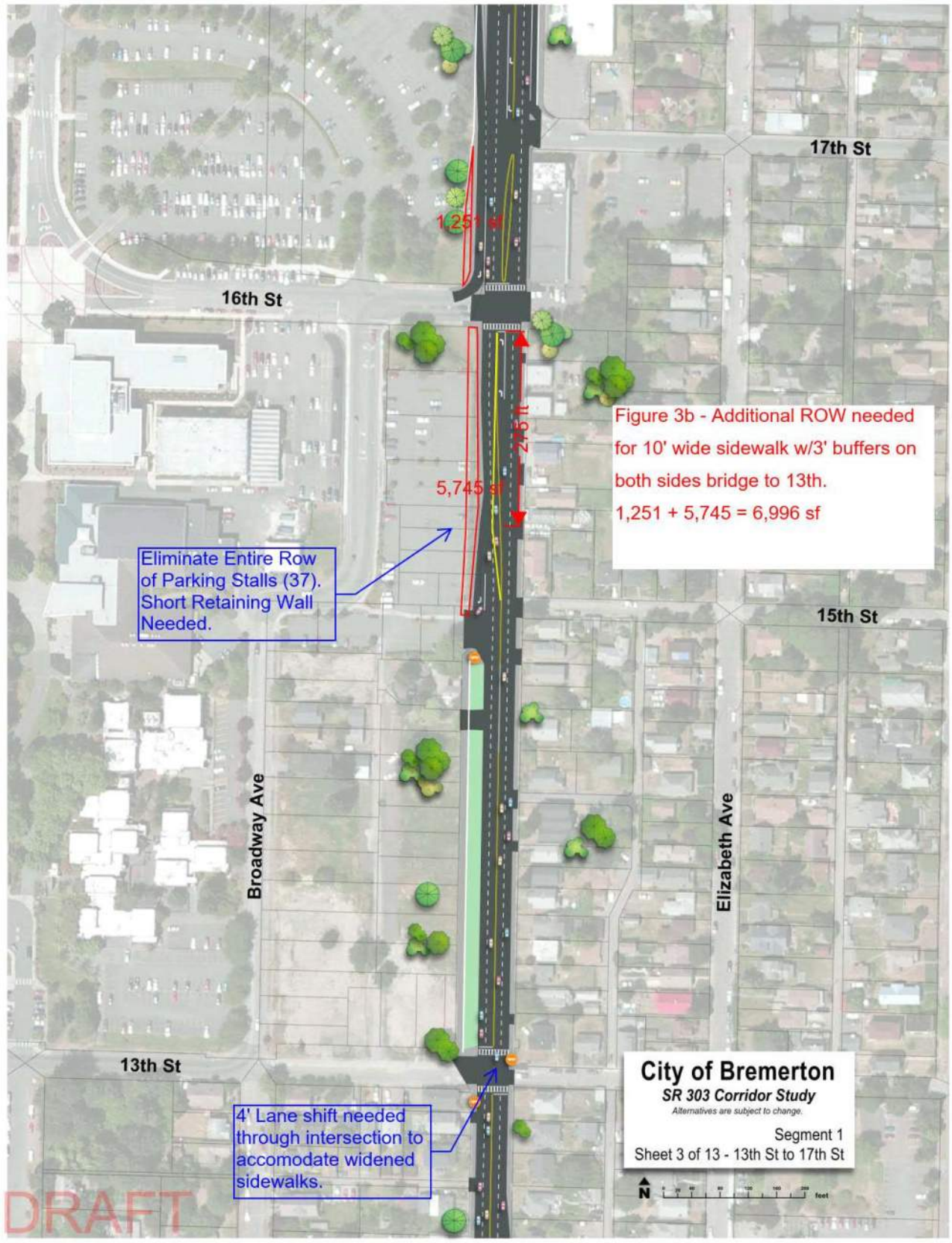

Figure 3b. 10 foot sidewalks

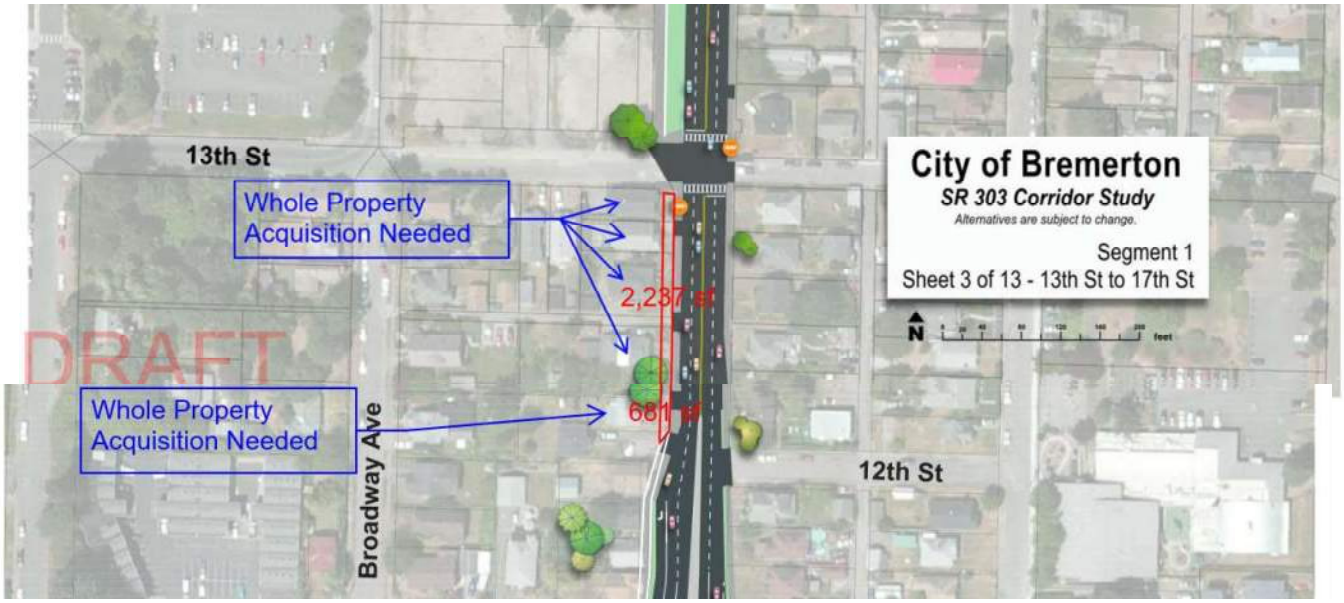

Figure 3c. 10 foot sidewalks

- Provide a two way left turn lane between 11th Street and 16th Street

Currently there are three midblock driveways on the west side of Warren Avenue between 11th Street and 16th Street. On the eastside of Warren Avenue, there are seven driveways, with most residents that front Warren Avenue having access from alleys behind the houses. Midblock left-turn occurrences are limited because the movement is currently discouraged as indicated by the double yellow centerline on Warren Avenue and a short section of c-curb adjacent to the Olympic College exit. Reported crashes on Warren Avenue for the five-year period between 2014-2018 show a total of 83 crashes with three of those being left turn related. All three left turns were at intersections with one at 16th Street and the other two at 13th Street. No fatalities or serious injury crashes were reported between 11th Street and 16th Street. Data does not highlight a safety issue trend related to left turn access.

A two-way left-turn lane (TWLTL) provides the most benefit on roads with closely spaced driveways on both sides of the main roadway. The purpose of a TWLTL is to move higher volume left-turning traffic out of the through lane, similar to a standard left turn lane. The TWLTL lane allows left turns from either direction to use the same lane.

A TWLTL on a three-lane roadway has been found to reduce crash rates 19% to 47%, reduces vehicles speeds, and improves the safety of pedestrian crossings. Research has also shown that TWLTs are not as safe as the addition of raised medians and exclusive turn lanes on high volume roadways of 20,000 or more vehicles per day.

TWLTs are typically limited to 17,500 vehicles per day on a three-lane or 28,000 vehicles per day on a five-lane roadway[1]. Traffic data collected by WSDOT in 2019 showed the average daily traffic (ADT) volumes on Warren Avenue at 12th Street was approximately 36,000 vehicles per day.

A five-lane roadway section would be needed if a TWLT was added on Warren Avenue, due to existing traffic volumes. Widening Warren Avenue to include a TWLT would require additional ROW. All the additional ROW would need to be on the westside of the roadway as taking any ROW on the eastside of Warren Avenue north of 13th Street would impact the residential homes and likely remove any sources or destinations for a TWLT.. Approximately 13,729 sf of additional ROW would be needed. The entire front row of parking stalls at the Olympic College parking lot facing Warren Avenue between 16th Street and 15th Street would be eliminated (37 total). Due to frontage impacts, at least six residential properties on the west side of Warren Avenue south of 13th Street would need to be acquired wholly. A short retaining wall would be needed between the parking lot and the new back of sidewalk.

For the following reasons, it is not recommended to pursue construction of a TWLT lane on Warren Ave.

- There is a low number of sources or destinations
- Low crash rates for left-turning vehicles between 11th Street and 16th Street
- Would introduce new left turning conflict points on Warren Avenue reducing safety on the corridor
- High impact to ROW
- Impact on Olympic College parking
- Likely high cost associated with no benefits

[1] Road Diet Information Guide, FHWA Safety Program: US Department of Transportation, 2014

- Does not follow best practice per FHWA Safety Program

Recommendation

The following concepts are recommended for inclusion in the preferred alternative:

- Close 18th Street access ramp – this concept will provide safety benefits by eliminating a conflict point for southbound traffic on Warren Avenue and removing the southbound weaving movement between 18th Street and 16th Street. An additional advantage is the recovered right-of-way accommodates the 10-ft wide sidewalk in this area. This concept is not expected to have negative impacts to traffic operations at the intersection of Warren Avenue/16th Street.
- Extend northbound left-turn at 16th Avenue – this concept would extend the northbound left-turn lane to provide approximately 275 feet of storage capacity. This storage length should adequately accommodate expected peak hour demand, including transit vehicles, and prevent northbound left-turns from queuing back into the northbound through lanes. To accommodate an extended northbound left-turn lane, approximately 1,676 square feet of additional right of way (ROW) will be required on the west side of the corridor. It is anticipated that no parking stalls would be lost, but they might be shortened to 15 feet. Final design would be required to confirm.
- Widen sidewalks to 10 feet - This concept is recommended in conjunction with the extended northbound left turn lane. It is recommended to widen sidewalks on both sides of Warren Avenue to 10 feet between the Warren Avenue Bridge and 17th Street where there is available right of way. Including the recommended 3 foot buffer between the curb and sidewalk is also recommended where no full acquisition right of way impacts would occur. It is also recommended to include a 10 foot sidewalk on the west side of Warren Avenue from 17th Street to 13th Street including the 3 foot buffer. Final layout would be determined after conversations with Olympic College about impacts to parking. This concept would provide widened sidewalks and buffers to make the active transportation network adjacent to the college more comfortable for multiple modes of travel, access to transit stops, and walking along Warren Avenue. This recommendation is compatible with the proposed shared use path cross-section over the Warren Avenue bridge. It is further recommended that additional design, planning, and outreach effort be used to outline improvements for the east side of Warren Avenue between 17th Street and a location about 450 feet south. This effort would consider a widened sidewalk or improved delineation between traffic and pedestrians using a raised curb, barrier, or hardscape buffer.

The following concept is not recommended for inclusion in the preferred alternative.

- Provide a two way left turn lane between 11th Street and 16th Street – this concept is not recommended because it is not expected to provide to provide a safety benefit, it introduces new permitted conflict points, due to the high traffic volumes does not meet best practice. Mid-block left-turns are currently discouraged given the double yellow centerline on Warren Avenue. Additionally, ROW impacts and costs associated with this concept would outweigh benefits associated with this concept.

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Appendix M-4

NE Furneys Lane Intersection Memo

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Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

719 2ND AVENUE, SUITE 200 | SEATTLE, WA 98104 | P 206.394.3700

MEMORANDUM

DATE:	August 21, 2020
TO:	Kaite Ketterer
FROM:	Michael Horntvedt
SUBJECT:	DRAFT SR 303/Furneys Lane Intersection Configuration
CC:	
PROJECT NUMBER:	554-1896-156
PROJECT NAME:	SR 303 Corridor Study

In response to concerns expressed about the SR 303/Furneys Lane intersection at SAG meeting #6 and per your request, we have evaluated several concepts at the intersection that would be intended to improve the experience for people using active transportation as a mode of travel.

At the request of Kitsap County, we evaluated the removal of the NB right-turn lane and the receiving lane at SR 303/Furneys Lane, with the goal of reducing the number of lanes on the east and south legs thereby reducing the crossing distance for pedestrians.

- Under the 2040 Baseline conditions (maintaining the existing configuration), the northbound approach delay is 78 seconds (LOS E) and the 95th percentile queue length for the northbound through movement is 1650 feet.
    - The distance between NE Furneys Lane and NE Riddell Road to the south is 1100 feet, so the northbound queue is already spilling back into the NE Riddell Road intersection.
- Removing the existing northbound right turn lane and converting to a shared through-right would cause the traffic operations at the NE Furneys Lane intersection to get worse.
    - The northbound approach delay would increase to 124 seconds (LOS F) and the 95th percentile queue length for the northbound through movement would increase to 1950 feet.

Because of the delay and system impacts from longer queuing, we do not recommend moving forward with this concept.

Another concept was considered to reduce the walking distance for pedestrians at the intersection. That concept included a pedestrian refuge island that could be constructed on the east leg. This concept would allow pedestrians to walk across the right turn lane and then have an area to wait for the signal to change and allow them to cross either to the north or west. Because the west leg of the intersection allows for a through movement to the east, the refuge island would need to be designed to maintain that through movement thus restricting the ability to shorten the pedestrian crossing for north/south travel. However, the island would reduce the crossing distance for east/west travel. The figure below illustrates the concept.

At this schematic level of consideration, it appears that there would be some right-of-way impacts to the grass area east of SR 303 and possibly to the parking area in the southeast quadrant of the intersection. This would be cause by some possible realignment of the right turn lane to maintain lane widths and turning radii.

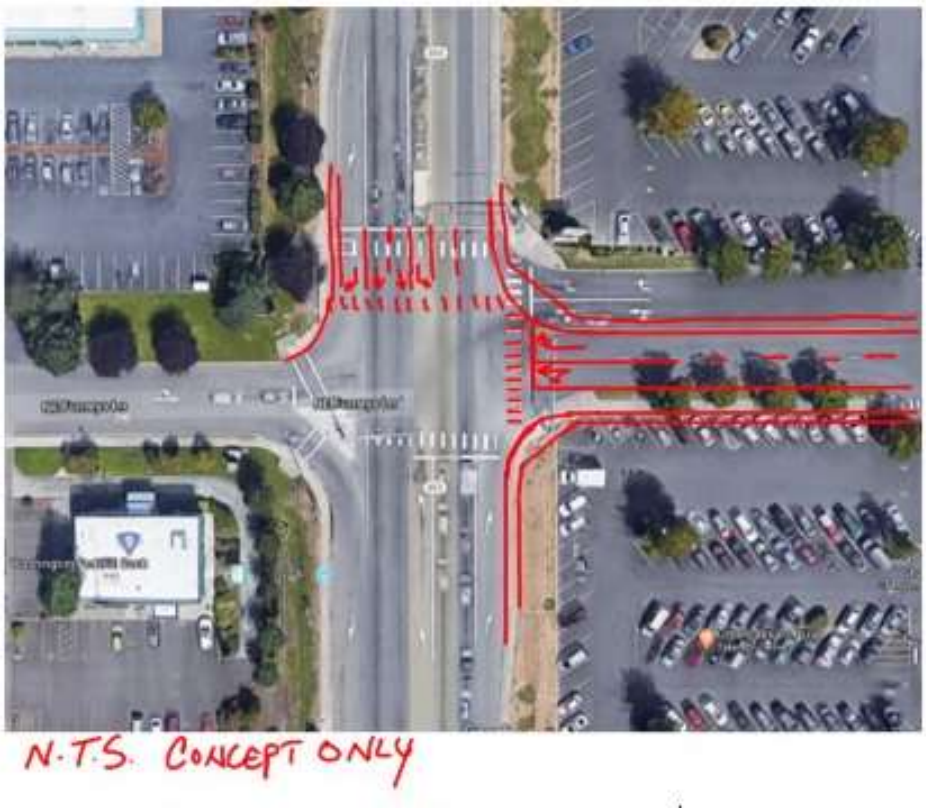
Possible Pedestrian Refuge Island Concept

Two additional concepts, as described below and shown in the figure below, that could be implemented together would improve pedestrian safety on the east leg of Furnerys Lane.

1. Adding a leading pedestrian interval (LPI) to the signal timing. https://safety.fhwa.dot.gov/provencountermeasures/lead_ped_int/

   A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn left. LPIs provide the following benefits:
   - *Increased visibility of crossing pedestrians.*
   - *Reduced conflicts between pedestrians and vehicles.*
   - *Increased likelihood of motorists yielding to pedestrians.*
   - *Enhanced safety for pedestrians who may be slower to start into the intersection.*

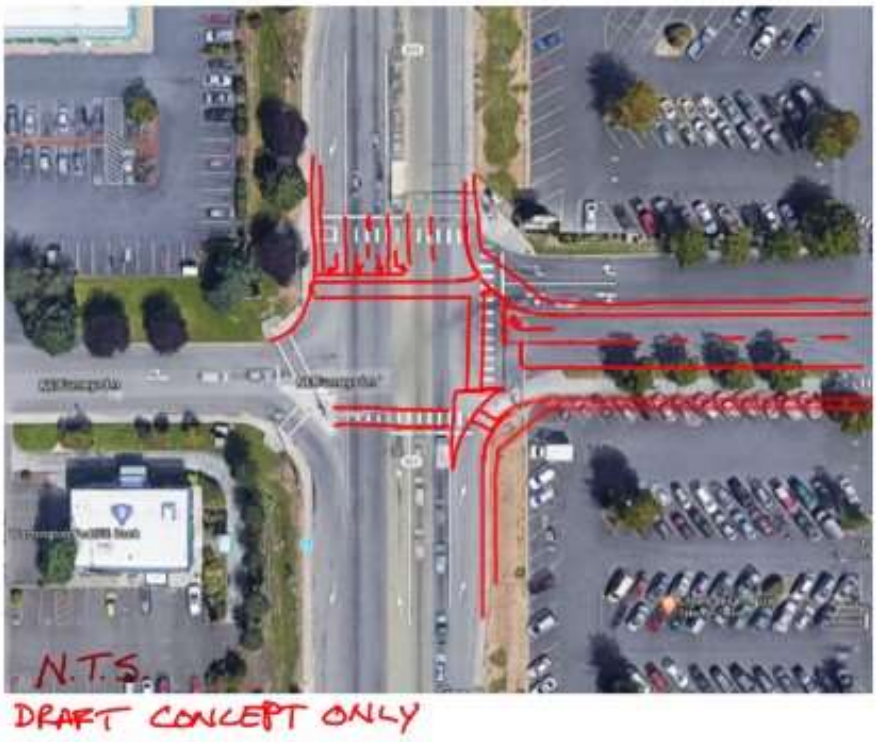
2. Correct the alignment of the east leg of the SR 303/Furneys Lane intersection to better align with the west leg
   - Remove one of the of receiving lanes on the east leg
     - This is not expected to have an impact on freight deliveries
     - It appears from analyzing Google Maps that all freight deliveries to Fred Meyer are required to access the building from the south (one-way signage and pavement markings).
   - Shift the entire leg on the east side approximately 15 feet to the south.
   - This option will reduce the crossing distance for pedestrians, improving safety.



Draft Realignment Concept

Recommendation

Considering all concepts evaluated, the project team recommends moving forward with the pedestrian refuge island combined with the LPI and realignment. This would improve active transportation for people crossing SR 303 on the south leg and on the east leg of the intersection. The figure below illustrates a schematic layout of the recommended intersection configuration.



Recommended SR 303/Furneys Lane Intersection Configuration

Appendix M-5

NE Fairgrounds Road Extension
Traffic Operations Results

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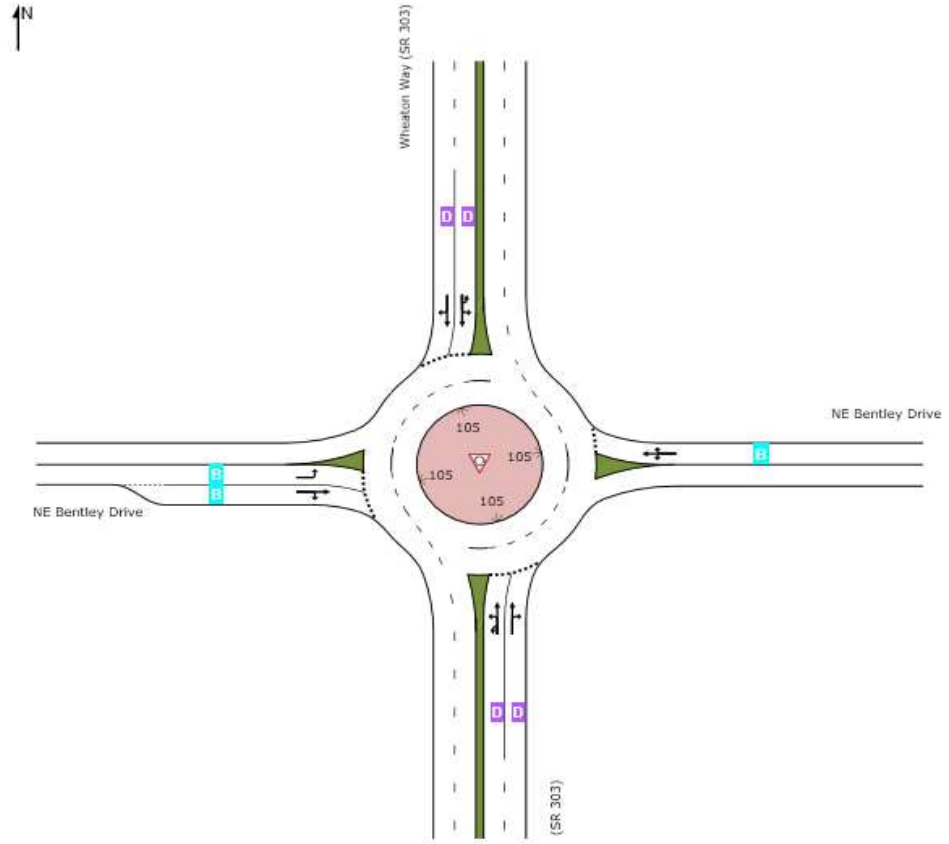
SR 303 / Bentley	2019 PM Peak Hour			2040 PM Peak Hour					
	Signal			Signal			Multi-Lane Roundabout		
	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C
Overall intersection	C	26.5	0.83	D	47.4	0.98	B	16.2	0.94
NB approach	C	21.1	-	D	46.6	-	B	15.7	0.94
	95th Percentile Queue			95th Percentile Queue			95th Percentile Queue		
NB Queues	440 feet			750 feet			470 feet		
SB Queues	500 feet			1200 feet			470 feet		



SR 303 / Fairgrounds	2019 PM Peak Hour			2040 PM Peak Hour					
	Signal			Signal			Multi-Lane Roundabout		
	LOS	Delay	V/C	LOS	Delay	V/C	LOS	Delay	V/C
Overall intersection	C	34.9	0.83	D	46.8	0.92	B	14.6	0.86
NB approach	C	27.6	-	C	34.4	-	B	13.5	0.85
	95th Percentile Queue			95th Percentile Queue			95th Percentile Queue		
NB Queues	530 feet			600 feet			370 feet		
SB Queues	520 feet			960 feet			350 feet