US 2 Westbound Trestle Alternatives Development and Traffic Evaluation

Introduction

Travel times for commuters using the US 2 westbound trestle are slow and unreliable during the morning commute period. Today's trip across the westbound trestle includes congestion at the ends of the trestle during peak hours which impacts US 2. In addition, the structure itself is approaching the ends of its useful life. The purpose of the United States Highway Route 2 (US 2) Westbound Trestle Project is to develop a long-term, fundable solution that, among other needs, improves travel reliability, improves safety, and provides improved system linkages to support regional and local planned growth.

In 2016 the Washington State Legislature directed WSDOT to study potential improvements to the US 2/SR 204/20th Street SE interchange east of Everett. WSDOT used findings from the support team and public survey to develop an Interchange Justification Report (IJR), which was completed in April 2018. The IJR outlined a preliminary preferred alternative for the US 2/SR 204/20th Street SE interchange that included some primary assumptions about the US 2 westbound trestle that had not yet undergone full study or environmental analysis. In an effort to confirm the assumptions and provide a more system-level evaluation of the transportation system, this study was requested and funded by the Washington State Legislature.

This phase of the US 2 Westbound Trestle Project begins the work to develop US 2 corridor concepts that meet the project needs. Additionally, the findings from this study are planned to be used for future environmental documentation and selection of a preferred alternative. This phase of work included traffic analysis of the Existing Conditions, Year 2040 No Build, and Year 2040 Build Alternatives with several sensitivity test scenarios.

This document summarizes the following elements of the traffic analysis:

- Existing data collection
- Traffic simulation methods
- Traffic volume forecasts
- Alternatives development and screening
- Traffic operations results

Methods and Assumptions

Data Collection

The following information was collected in order to complete the traffic analysis for the US 2 Westbound Trestle Project. The collected data is summarized below in the Existing Conditions section.

Volumes

The volume data collected for this project included 24-hour roadway segment volumes (also known as tube counts) and 2-hour AM and PM peak intersection turning movement counts. Volume data was provided by the following sources:

- US 2/SR 204/20th Street SE Interchange Justification Report (IJR)
- WSDOT Traffic Data GeoPortal
- Northwest Region
- I-5/Marine View Drive to SR 528 Project
- City of Everett
- Additional counts collected in October 2018

The locations of the tube counts and turning movement counts (TMCs) collected from the IJR, WSDOT, and the additional October 2018 counts are summarized in Attachment 1. Tube counts and TMCs were also provided by the City of Everett at and near six intersections in downtown Everett.

At the locations where 24-hour tube counts were collected in October 2018, vehicle classifications were also collected. These were used to determine the percentage of heavy vehicle traffic.

Travel Times and Speed

Floating Car Travel Times were collected during the 5-hour morning (4:00–9:00 AM) and evening (1:30–6:30 PM) commute periods in October 2018 between the origins/destinations listed below. There were three locations west of the US 2 Trestle and three locations east of the US 2 Trestle, which equates to nine origin/destination pairs and 18 pathways (nine westbound and nine eastbound).

West of the US 2 Trestle:

1. SR 204 at 81st Avenue
2. 20th Street SE at SR 9
3. US 2 at Bickford Avenue

East of the US 2 Trestle:

1. I-5 north of Marine View Drive
2. US 2 ramps to and from Downtown Everett
3. I-5 at the SR 526 interchange

The floating car travel time runs were recorded with a dash camera and the videos were reviewed to observe locations and durations of congestion. The trips were also tracked using a Global Positioning System (GPS) application to record the speed along the pathway. The speed data was reviewed in tandem with the dash camera video to determine the actual speed at each point on the corridor during congested conditions.

The floating car travel time data was compared to travel time runs performed during peak periods in November 2016 and January/February 2017 along SR 204, 20th Street SE, and US 2 as well as peak hour queueing collected in November 2016 and January/February 2017 at the I-5/US 2 and US 2/SR 204/20th Street SE interchanges and along the 20th Street SE and SR 204 corridors. These travel time runs and peak hour queuing were performed for the IJR.

The floating car travel time data collected in October 2018 provided a more robust data set than the travel time data collected in November 2016 and January/February 2017. The 2018 data sample size was larger, as it was collected over a two-day period, and provided a broader understanding of where and when congestion starts, builds, and dissipates over time because it was collected over a 5-hour period.

There are also annual trends in traffic volumes, and volumes during the month of October tend to be higher than volumes during the November, January and February. The higher volume levels in October correlate with higher congestion levels, and this was supported in the travel time data comparison. Peak westbound travel times between SR 9 and US 2 (via 20th Street and via SR 204) were three to four minutes longer in the October 2018 data.

Transit and High Occupancy Vehicle (HOV)

The following transit service and HOV data was collected from the IJR:

- Daily boardings and alighting's by stop for routes 280 and 425, provided by Community Transit
- Vanpool program information, provided by Community Transit
- Occupancy data at two locations on I-5, provided by WSDOT
- Occupancy data at SR 204 and 20th Street SE prior to the US 2/SR 204/20th Street SE interchange

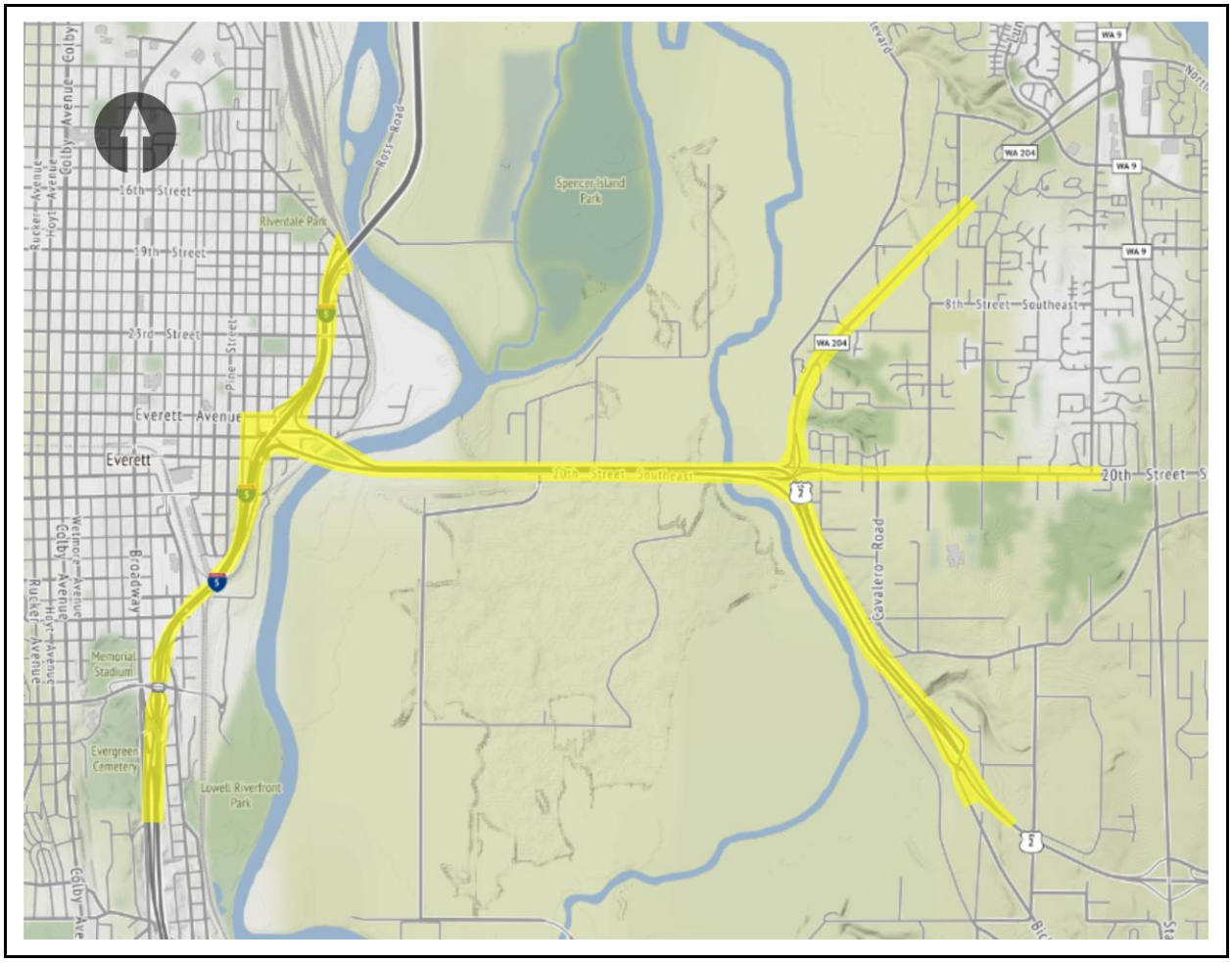
Safety

Existing crash data was collected from the IJR for the five-year period from 2011 to 2015.

VISSIM Model

All alternatives were quantitatively analyzed using a VISSIM microsimulation traffic model. The traffic analysis for the project encompassed the I-5 mainline, US 2, 20th Street SE, and SR 204 corridors, but was focused on the US 2 westbound trestle during the morning commute. The limits of the VISSIM model are displayed below in Figure 1.

Figure 1. VISSIM Model Limits



The VISSIM model was originally developed as part of the IJR using VISSIM version 8 and only included I-5 as far south as the Pacific Avenue ramps. VISSIM simulation models were developed for the AM and PM peak periods, though only the AM peak period was analyzed for this phase of the project. Updates to the VISSIM model network coding, parameters, and data input were completed according to the WSDOT VISSIM Protocol (September 2014), which provides in-depth instructions for freeway and urban street simulation networks. The original IJR model was only coded for a single peak hour of operation.

The existing year AM VISSIM model was updated and validated based on the new traffic volume counts and updated travel time runs collected in October 2018. Two separate criteria were met to justify the validity of the model and its usefulness in evaluating the transportation system: confidence and calibration.

- Confidence – This criterion ensures that the reported model results for each micro-simulation run are representative of the model and not skewed toward a statistical outlier. For the Existing Conditions model, 20 simulation runs were performed.

- Calibration – This criterion ensures that the model results match real-world conditions The Existing Condition model was calibrated to traffic counts and speed/travel times. The key corridors measured by floating car travel times were calibrated to the observed travel times. The visual inspection of freeway queuing was compared with the Existing Conditions model to validate that the model is reasonably replicating field queuing conditions.

For this analysis, the traffic team updated the VISSIM model to include a 5-hour AM peak period (4:00–9:00 AM). The following modes were accounted for in the model and the following metrics were used to analyze the Existing Conditions, Year 2040 No Build, and Year 2040 Build Alternatives.

- Modes:
    - General purpose traffic
    - HOV traffic
    - Transit (bus) traffic
    - Heavy vehicle (freight truck) traffic
- Performance Metrics:
    - Person throughput
    - Vehicle throughput
    - Travel times
    - Speeds
    - Queues
    - Extents and duration of congestion

Traffic Volume Refinement

Traffic Volume Demand and Throughput

When collecting traffic data using tube counts or in person counts, the data collected only includes the number of vehicles that pass a certain point during the counting period. This is referred to as traffic throughput. If traffic is congested behind the counting location and is not counted during the time period, it is referred to as demand. An example of this situation is that during the morning peak hour we might count 1,500 vehicles passing a specific point on a roadway, but there might be another 100 vehicles sitting in congestion that do not get counted. This means that the "demand" for that hour is actually 1,600 vehicles. When modeling existing conditions, it is important to use the traffic demand when setting up the model so that the congestion develops similar to existing conditions. The following text describes how the traffic volume count data was refined to reflect traffic volume demand data.

1. Traffic congestion information collected during the travel time runs was used to outline time periods when congestion begins, is maximum, and then dissipates. This was then used to help engineers develop a volume adjustment strategy.
2. The strategy involved using the VISSIM model with an initial set of input volumes that were estimated to create existing levels of congestion and travel time. The model was then run, and the output was reviewed in an iterative process until congestion, traffic throughput, and travel time objectives were met.
3. The final adjusted traffic volumes represent the existing traffic demand volumes. The Existing Condition demand volumes were the baseline for the traffic volume forecast for Year 2040 No Build.

Traffic Volume Forecast

The forecasted volumes for Year 2040 No Build and Year 2040 Build Alternatives were produced according to the process described below. The travel demand model analysis included the AM peak period, PM peak period, and average weekday. The AM peak period of 6:00-9:00 AM aligned with the PSRC model. The existing 5-hour morning (4:00–9:00 AM) commute period demand volumes were used to develop future traffic volume forecasts for the same 5-hour period. The two-hour period from 4:00 – 6:00 AM is not represented in the PSRC model. The AM peak period growth rate from the 6:00 – 9:00 AM period was also applied to the existing demand volumes for the 4:00 – 6:00 AM period.

Travel Demand Model

The PSRC EMME model was used to produce travel demand forecasts for each of the study alternatives. This ensured consistency with the most recently adopted regional travel demand (EMME) model developed by the PSRC. The most recent PSRC model has a horizon year of 2040.

The EMME model was validated and updated for this study according to the following steps.

1. Compared additional 2018 traffic counts to model-estimate vehicle volumes at key locations in the study area. The targeted accuracy of the travel demand model was the industry standard of +/- 10 percent of the existing count data across screenlines.
2. Performed a base year (2017/2018) model validation analysis and prepared necessary summary results. This included using StreetLight origin-destination data to adjust base year trip tables produced by the PSRC model.

3. Coordinated with WSDOT and Snohomish County regarding consistency between demographic forecasts prepared by PSRC and Snohomish County for the City of Everett, which have been used in previous modeling efforts.
4. Accounted for relevant roadway and transit projects listed in the Regional Transportation Plan, both in the Existing Conditions and Year 2040 alternatives.

The regional projects included in the 2040 No Build Travel Demand Modeling are listed in Table 1.

Table 1

Approved Highway and Transit Regional Projects for 2040 No Build Travel Demand Modeling
US2 Westbound Trestle Pre-NEPA Documentation
(Note: Systewide per-mile pricing assumption used in the PSRC 2040 RTP Model will not be used)

Project	Funded	Opening Year	Include in Demand Model	Notes
Roadway				
US 2/SR 204/20th Street Interchange Improvements	N		N	TBD for possible inclusion in build network
US 2 - Bickford to Monroe, widen to four lanes	N	2040	N	To be considered in the Cumulative Effects modeling analysis
SR 9/SR 204 Interchange improvements	Y	2021	Y	
SR 9 - US 2 to Lake Stevens Road Widening	-		Y	
SR 9 - Snohomish River Bridge Replacement	Y	2027	Y	
SR 9 - Marsh Rd to 2nd St Widening	-		Y	
SR 9 - 176th Street SE to SR 96	-		Y	Interim improvements included. Full widening has no construction funding
SR 520 West				
Montlake Interchange & West Approach Bridge South	Y	2024	Y	
Portage Bay Bridge	Y	2029	Y	
I-5 Express Lanes Connection	Y	2023	Y	
Montlake Bridge	Y	?	Y	
SR 520 @ 148th Ave. NE Interchange - Overlake Access Ramp	Y	2021	Y	
Alaskan Way Viaduct				
SR 99 Tunnel	Y	2019	Y	
Alaskan Way & Elliott Way	Y	2023	Y	
2-Way Columbia Transit Corridor	Y	2019	Y	
Puget Sound Gateway Program				
SR 509 Stage 1	Y	2025	Y	
SR 509 Stage 2	Y	2031	Y	
SR 167 Stage 1	Y	2025	Y	
SR 167 Stage 2	Y	2031	Y	
SR 518: Des Moines Memorial Drive Interchange Improvements	Y	2019	Y	
SR 99: S 359th St to S 340th St Widening	Y	2018	Y	
SR 524 (196th St SW): 48th Ave W to 37th Ave W Widening	Y	2020	Y	
I-405: Bellevue to Renton Express Toll Lanes	Y	2024	Y	
I-405: SR 167 Direct HOV Ramps	Y	2019	Y	
I-5: Northbound Seneca to SR 520	Y	2020	Y	
I-5: Marine View Dr to SR 528 Peak Use Shoulder	Y	2022	Y	
I-5: DuPont-Steilacoom Rd to Thorne Ln - Corridor Improvements	Y	2021	Y	
I-5: SR 16 to Port of Tacoma Rd HOV	Y	2021	Y	
88th St NE: State Ave to 67th Ave NE Widening	Y	2025	Y	
Canyon Rd E, 187th St E to Frederickson Industrial Park Road E	Y	2019	Y	
SR 161: 36th to Vicinity 24th St E - Widen to 5 lanes	Y	2027	Y	
SR 202: Sammamish River Bridge and Road Widening	Y	2019	Y	
NE 145th Street/SR 522 BRT	Y	2024	Y	
Lander Street Overpass	Y	2020	-	
NE 65th St Vision Zero Project	Y	2019	Y	
23rd Ave E Vison Zero Project (Channelization Changes)	Y	2018	Y	
15th Ave NE Paving Project (Channelization Changes)	Y	2019	Y	
Northgate Station Area Roadway Changes	Y	2021	-	
Transit				
128th St SW/Airport Rd BAT Lanes	N	2033	Y	
20th Street BAT Lane (City of Lake Stevens)	-		Y	
RapidRide G Line (Madison BRT)	Partial	2022	Y	
Roosevelt RapidRide	Partial	2024	Y	
Center City Connector Streetcar	Partial	2025	Y	
CT SWIFT BRT Green Line - Canyon Park to Paine Field/Boeing	Y	2019	Y	
CT SWIFT Orange Line - Edmonds to Mill Creek	Partial	2024	Y	
CT SWIFT Red Line - Everett to Smokey Point	-	2024	Y	
Tacoma Link Expansion (Theater District to MLK/19th St)	Y	2023	Y	
Lynnwood Link Extension	Y	2024	Y	
Federal Way Link Extension	Y	2024	Y	
Downtown Redmond Link Extension	Y	2024	Y	
SR 522 & I-405 BRT	Y	2024	Y	
Tacoma Dome Link Extension	Y	2030	Y	
West Seattle Link Extension	Y	2030	Y	
Sound Transit Infill Stations	Y	2031	Y	
Ballard Link Extension	Y	2035	Y	
Everett Link Extension	Y	2036	Y	

Notes: Regional trails, ferry dock relocation/replacement/expansion, and rail grade-crossing projects not included in this list.

Sources:

- PSRC's RTP 2018, Appendix G, Regional Capacity Projects List (Adopted May 2018 - Updated January 2019): https://www.psrc.org/sites/default/files/rtp-appendixg-regionalcapacityprojectlist.pdf. PSRC's project list includes both funding "approved" and "candidate" projects. The above list includes all PSRC's projects designated as funding "approved" and a few "candidate" projects relevant to US 2.
- The 2015 Connecting Washington funding package: http://www.wsdot.wa.gov/construction-planning/funding/connecting-washington

Forecasting

Future year traffic volumes were forecast using the procedures outlined in the National Cooperative Highway Research Program (NCHRP) reports 255 and 765. Once the travel demand models were completed, the differences between the Existing Conditions and Year 2040 No Build travel demand model volumes were applied to the existing count data to develop the Year 2040 No Build traffic volumes.

Additional travel demand model runs were completed for the Year 2040 Build Alternatives. Though each alternative includes several design elements, the element that has the most impact on travel demand is the number of lanes across the US 2 westbound trestle. Traffic volumes for two Year 2040 Build Alternatives were forecast. The two alternatives included one alternative with 2 general purpose (GP) lanes and an HOV lane and a second alternative with 3 GP lanes and 1 HOV lane.

Similar to the Year 2040 No Build volumes, the Year 2040 Build Alternative volumes were forecast using the procedures outlined in the NCHRP reports 255 and 765. The volumes from the two Year 2040 Build Alternative travel demand model runs were compared to the volumes from the Year 2040 No Build model runs to produce volumes for the Year 2040 3-Lane Build Alternative and the Year 2040 4-Lane Build Alternative.

Existing Conditions

Corridor

The traffic analysis for the US 2 Westbound Trestle Project included 26 study intersections and the following study corridors:

- I-5 mainline between (and including) the 41st Street interchange ramps and the Marine View Drive interchange
- US 2 between (and including) I-5 and west of the SR 9 interchange
- 20th Street SE between (and including) US 2 and west of the SR 9 intersection
- SR 204 between (and including) US 2 and west of the SR 9 intersection

Attachment 2 illustrates the number and type of lanes and the mileposts of the gore points along the US 2 and I-5 corridors in the project area. The study intersections are also shown as signalized and stop controlled intersections.

The existing channelization for westbound US 2 includes:

- One westbound lane at the SR 204/20th Street SE interchange
- One-lane on-ramp to westbound US 2 at the SR 204/20th Street SE interchange
- Two lanes across the US 2 westbound trestle with 2-foot shoulders on either side
- One-lane off-ramp to northbound I-5
- One-lane off-ramp to southbound I-5
- Two-lane off-ramp to downtown Everett, entering the local system at California Street/Maple Street/Walnut Street
- No HOV-only facilities along westbound US 2

Traffic Volumes

As discussed in the Methods and Assumptions section, the volume data was compiled from several sources. Tube counts and turning movements counts were collected in October 2018 which were validated by volume data collected from the IJR, WSDOT, and the City of Everett. As illustrated in Attachment 3, there appears to be a decline in daily traffic along US 2 westbound trestle as well as a shift from a 7:00 AM peak hour to 5:00 AM peak hour. However, it was determined that the 2018 tube counts on the US 2 westbound trestle east of the I-5 interchange were faulty, as the data was not consistent with annual data collected from WSDOT's permanent data collection station at the same location, as shown in Attachment 4. Because the field count data appeared to have an error, the traffic team used information collected from the WSDOT data station for volume refinements and validation.

Attachment 5 illustrates the AM and PM peak hour mainline and ramp volumes along the US 2 and I-5 corridors in the project area. It also includes the percentages of heavy vehicles, where available, and the daily volumes along the US 2 Trestle. Attachment 6 summarizes the AM and PM peak hour turning movement volumes at the study intersections.

Average weekday traffic volumes crossing the US 2 westbound trestle on an average weekday are as follows:

- Daily – US 2 carries 77,000 vehicles in both directions across the Snohomish River
- Daily – US 2 carries 41,400 vehicles in the westbound direction across the Snohomish River
- Daily – US 2 carries 11 percent heavy vehicles in the westbound direction and 16 percent heavy vehicles in the eastbound direction
- AM Peak Hour – US 2 carries 3,200 vehicles vph (vehicles per hour) in the westbound direction
- AM Peak Hour – US 2 carries 93 percent single-occupant passenger vehicles in the westbound direction

Volume Throughput

The existing throughput volumes were refined based on the process discussed in Methods and Assumptions. Attachment 7 illustrates the demand volume compared to the throughput volume for westbound US 2 during the AM peak period. The total demand volume during the 5-hour study period is the same as the total throughput volume during the 5-hour study period.

Operations

Travel Times and Speed

As discussed in Methods and Assumptions, floating car travel time runs were used to determine travel times and speeds along the I-5 mainline, US 2, 20th Street SE, and SR 204 corridors. Attachment 8 illustrates the Existing Condition AM and PM peak hour travel times and speeds, both to and from eastbound US 2 and westbound US 2.

Congestion

Attachment 9 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, westbound SR 204, and southbound I-5.

The congestion maps show the average travel speed at any given point along the corridors as a percentage of the posted speed limit. Segments that are highlighted red are nearing 0% of the posted speed limit, meaning traffic is not moving. Segments that are highlighted in dark green are operating at 100% of the posted speed limit.

Each congestion map shows the travel speeds in each lane[1] for 15-minute intervals during the 5-hour morning commute period. On the east-west corridors (US 2, 20th Street, SR 204) time of day is on the vertical axis and location is on the horizontal axis, on the north-south corridor (I-5) the axes are switched. The figures at the bottom of the congestion maps represent the lane configurations for each corridor, including the approximate locations of the on-ramps and off-ramps along US 2 and I-5 and the intersections along 20th Street SE and SR 204.

As shown in Attachment 9, the demand volume for Existing Conditions exceeds capacity at the US 2/ SR 204/20th Street SE interchange, causing substantial backups on westbound SR 204 and westbound 20th Street SE. On 20th Street congestion (red and yellow) spills back from the on ramp to US 2 westbound to 83rd Avenue. On SR 204 congestion spills back from the on ramp to US 2 westbound to 81st Avenue. Some specific issues contributing to the congestion on 20th Street and on SR 204 are:

- The combined volume from westbound SR 204 and westbound 20th Street SE exceeds 1,900 vph which is the capacity for one lane of traffic under ideal conditions

[1] On the I-5 corridor, the speeds are not shown in each lane. Instead, the average speed across all lanes is shown.

- Traffic from westbound SR 204 travels along a 30 mph curve prior to a short merge with 20th Street SE, the reduced speed through the ramp contributes to lower than ideal capacity at the ramp.
- There is weaving along westbound US 2 between the US 2/ SR 204/20th Street SE interchange and the off-ramp to the lower roadway. The weaving traffic causes speeds to drop to 70 to 80 percent of the posted speed for approximately one hour, contributing to the already congested conditions through the 20th Street and SR 204 merge and on ramp.

At the on ramp from the lower roadway, speeds drop to approximately 60 percent of posted speed for about 90 minutes, contributing to congestion on US 2 westbound that spills back to the lower roadway off ramp.

The demand volume also exceeds capacity at the off-ramp from westbound US 2 to southbound I-5. The US 2/ SR 204/20th Street SE interchange acts as a meter for westbound US 2 and reduces the traffic demand that can reach the off-ramp to southbound I-5, but enough traffic still reaches the off-ramp to cause backups on the US 2 westbound trestle. As shown in Attachment 9, the slowdown is more pronounced in the left lane with speeds between 60 to 70 percent of the posted speed. Drivers are lining up to access the ramp to southbound I-5, but the single-lane ramp does not have the capacity to serve the demand volume.

Non-Motorized

There is currently a barrier-separated trail along the south side of eastbound US 2. The US 2 trail extends from the eastbound US 2 on-ramp at Hewitt Avenue to 43rd Avenue SE, where the trail turns and provides access to Ebey Island. Pedestrians and bicycles are prohibited on the freeway shoulder.

Safety

Existing crash data was collected from the IJR, which collected and analyzed crash data along US 2 and SR 204 from January 2011 to December 2015. Over the five-year study period, there were 467 collisions in the study area. Attachment 10 illustrates the locations of these collisions.

Along westbound US 2, the majority of collisions occur in the morning and between the 51st Ave SE on-ramp and the I-5 off-ramps. There is congestion approaching the I-5 off-ramps which leads to frequent lane changes and rear-end collisions. Collisions along westbound US 2 are also frequent at the SR 204/20th Street SE on-ramp and at the Bickford Avenue interchange, both of which experience significant merging and diverging.

Of the 467 reported collisions, two resulted in serious injuries and one resulted in a fatality. The serious injury collisions both occurred near the Bickford Avenue interchange, one during the AM peak period and one occurring in the afternoon before the PM peak period. The fatality occurred west of the Snohomish River shortly after midnight. An additional bicycle fatality occurred at the SR 204/20th Street SE intersection after December 2015 and was not included in the IJR.

Collision rates were calculated for the intersections and roadway segments within the study area as part of the IJR. The collision rates were calculated according to FHWA methodology, which considers the total number of collisions and average daily traffic (ADT) entering the intersection or traveling along the roadway segment. For the intersections studied, the collision rates per million entering vehicles (MEV) were below average collision rates for similar intersections. Snohomish County averages 236 collisions

per MVMT for all county roads according to the 2015 WSDOT Statewide Annual Collision Summary. For the roadway segments studied, the collision rates per 100 million vehicle miles traveled (MVMT) were mostly below the Snohomish County average. The following segments experienced collision rates greater than the county average.

- Westbound US 2 between 51st Ave SE on-ramp and the I-5 off-ramps (260 MVMT)
- SR 204 on-ramp to westbound US 2 (2,360 MVMT)
- SR 204/20th Street SE on-ramp to westbound US 2 (1,580 MVMT)
- 51st Ave SE on-ramp to westbound US 2 (890 MVMT)

Some possible factors contributing to higher than average collision rates are:

- The existing channelization along the US 2 westbound trestle includes narrow 2-foot shoulders and narrow 11-foot lanes
- The ramp from US 2 to I-5 southbound is over capacity during the AM peak, causing congestion on the US 2 westbound trestle
- The signed 30 mph ramp from SR 204 to US 2, followed by the short merge at the SR 204 and 20th Street on ramps

Year 2040 Traffic Volume Forecast

The process for forecasting volumes for the Year 2040 No Build and Year 2040 Build Alternatives was discussed in the Traffic Volume Forecast section included in the Methods and Assumptions.

Daily Volumes

- For Year 2040 No Build, demand volumes across the US 2 westbound trestle would increase by 9,300 vehicles per day (vpd) compared to Existing Conditions. Volumes increase through most of the day, except for volumes between 11:00 PM and 2:00 AM which match the Existing Condition.
- For the Year 2040 3-Lane Build Alternative (2 GP, 1 HOV), demand volumes across the US 2 westbound trestle would increase by 8,300 vpd compared to Year 2040 No Build. Volumes increase through most of the day, with volumes between 11:00 PM and 3:30 AM matching those for the Year 2040 No Build Alternative.
- For the Year 2040 4-Lane Build Alternative (3 GP, 1 HOV), demand volumes across the US 2 westbound trestle would increase by 10,300 vpd compared to Year 2040 No Build. Volumes only increase during the AM peak period, with volumes through the rest of the day matching those for the 3-Lane Build Alternative.

Attachment 11 shows the hourly demand volume for the Existing Condition, Year 2040 No Build, and Year 2040 Build Alternatives (3-Lane and 4-Lane) along the US 2 westbound trestle. The horizontal lines reflect the approximate capacity of the trestle for three configurations, assuming a capacity of 2,000 vphpl for a GP lane and 1,500 vphpl for an HOV lane.

As shown, both the 3-Lane Build and 4-Lane Build configurations provide enough capacity to serve the demand volume for all alternatives. The configuration that included 2 GP lanes and 1 HOV lane provides enough capacity to serve the demand volumes under the 3-Lane Build Alternative and most of the demand for the 4-Lane Build Alternative assuming a full HOV lane during the AM peak period. If the HOV lane is not fully utilized, there would be some congestion in the GP lanes. Congestion in a GP lane would incentivize any HOV bypass lane and higher occupancy mode of travel. If there is no congestion on the corridor, there would be little incentive for people to coordinate carpools or transit schedules.

Peak Volumes

For the Year 2040 Build Alternatives (3-Lane and 4-Lane), the westbound US 2 traffic flow approaching the US 2/I-5 interchange would increase if the US 2/SR 204/20th Street SE interchange were improved because the eastside interchange would no longer act as a meter for traffic to getting onto the US 2 westbound trestle.

Attachment 12 illustrates the forecasted 3-hour volumes for the morning commute period to and from westbound US 2 for the Existing Condition, Year 2040 No Build, and Year 2040 Build Alternatives (3-Lane and 4-Lane).

Attachment 13 summarizes the mode split for the 1-hour AM peak along westbound US 2. The modes included are GP cars, GP freight, HOV, and transit.

Some key takeaways from the forecasted traffic volumes include:

- Given the congestion that exists on the corridor today with 2 GP lanes, if an HOV lane were added, all additional demand in the future would need to be in the HOV lane just to maintain existing congestion levels. For context, in the Year 2040 No Build Alternative the 3-hour AM peak period demand volume increases by over 1,800 vph. Assuming 60 people per bus, this is the equivalent of 30 full busloads over the 3-hour peak (10 buses per hour, or a bus every 6 minutes). This would only maintain today's congested conditions on the corridor.
- Peak hour demand volumes at the off-ramp from westbound US 2 to southbound I-5 would be between 3,000 and 3,300 vph. 2 GP lanes would be required to serve this volume demand.
- Peak hour demand volumes at the off-ramp from westbound US 2 to downtown Everett would be about 1,600 vph. One benefit of today's exit ramps to downtown Everett is that it provides multiple access points. This strategy should be maintained in the future to avoid overloading a single point in the network.
- For the Year 2040 4-Lane Build Alternative, peak hour demand volumes on 20th Street SE are high enough that the signalized intersections along 20th Street SE become a constraint, resulting in backups on 20th Street SE that are unrelated to operations along the US 2/SR 204/20th Street SE interchange or the US 2 westbound trestle.

Year 2040 No Build Analysis

Corridor

The channelization for Year 2040 No Build is identical to the Existing Condition with the exception of westbound 20th Street SE, which includes a BAT lane between 91st Avenue SE and Cavalero Road.

Traffic Volumes

The forecasted volumes, as shown in Attachment 11 through Attachment 13, represent the demand volumes for the intersections and corridors in the study area.

Operations

Travel Times

The anticipated AM peak hour travel times for the Existing Conditions, Year 2040 No Build, and Year 2040 Build Alternatives during the AM peak hour are illustrated in Attachment 14. Travel times are shown for both GP and HOV traffic for the following segments:

A. SR 204 from SR 9 to westbound US 2
B. 20th Street SE from SR 9 to westbound US 2
C. US 2 from SR 9 to the SR 204/20th Street SE interchange
D. US 2 from the SR 204/20th Street SE interchange to the I-5 interchange

Travel times along westbound SR 204 (Segment A) and westbound 20th Street SE (Segment B) are expected to increase significantly in the No Build Alternative because the existing 20th Street SE and SR 204 merge is already over capacity in the Existing Conditions, so the additional demand volume in the No Build Alternative adds to the back of the existing queue on these two corridors. West of the US 2/SR 204/20th Street SE interchange, travel times across the US 2 westbound trestle (Segment D) increase more modestly because while there is additional congestion spilling back from I-5 onto the US 2 westbound trestle, the eastside interchange still meters traffic accessing the corridor. The BAT lane on 20th Street provides substantial travel time benefits to transit and HOV traffic, compared to general purpose traffic, but only along the 20th Street segment. Once on the westbound trestle, HOV and transit traffic would travel in the congested GP lanes.

The No Build Alternative travel times compared to the Existing Conditions travel times are displayed in Table 2 below.

Table 2. Year 2040 No Build Travel Times

Segment	Description	Existing Conditions Travel Time (mins)	Year 2040 No Build Travel Time (mins)
A	SR 9 to US 2 Trestle via SR 204	19	69
B	SR 9 to US 2 Trestle via 20th St	13	95 (BAT Lane: 17)
C	SR 9 to US 2 Trestle via US 2	3	49
D	US 2 Trestle between Eastside Interchange and I-5	4	19

Congestion

Attachment 15 shows the demand and throughput volume for Existing Conditions and Year 2040 No Build. As discussed in the Volume Forecast section above, AM peak period demand volumes on US 2 westbound increase between Existing Conditions (dashed blue line) and the Year 2040 No Build Alternative (dashed yellow line). The existing throughput (solid blue line) was already less than the demand volume early in the peak, meaning there are unserved vehicles on the corridor, i.e. congestion. In the future No Build Alternative, there is no additional capacity on the corridor, so the additional demand volume translates to more unserved vehicles and more congestion. However, the No Build throughput volume (solid yellow line) is lower than the existing throughput volume (solid blue line). This is because in the Year 2040 No Build Alternative, congestion on I-5 spills back onto the US 2 westbound trestle. The combination of increased demand volume (due to population and employment growth in the region) and the ability to serve fewer vehicles to I-5 southbound causes congestion to increase in the future.

As shown in Attachment 12, the No Build traffic volume demand for the downtown Everett ramps grows by 54% in the future. The traffic demand also increases at the ramp from US 2 to I-5 southbound by 7%. As noted in the Existing Conditions section of this white paper, the ramp from US to I-5 southbound is already at capacity. Early during the AM peak, the additional demand from the westbound US 2 off-ramp to southbound I-5 is limited by congestion on southbound I-5, so the new traffic demand spills back onto westbound US 2. This system level congestion results in longer travel times on westbound US 2 than in the Existing Condition. Later during the AM peak, southbound I-5 becomes constrained due to queues from the Everett Avenue off-ramp backing up onto the I-5 mainline. This causes congestion on southbound I-5 north of downtown Everett which meters traffic on southbound I-5 thus allowing more traffic from US 2 to enter the I-5 corridor.

Congestion on I-5 and the inability for traffic from US 2 to enter the I-5 corridor results in congestion on US 2 that extends across the trestle and out onto SR 204, onto 20th Street SE, and further east on US 2. This congestion is more extensive than the Existing Condition.

Attachment 16 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, westbound SR 204, and southbound I-5 for No Build.

As shown, US 2, SR 204 and 20th Street are congested for most of the 5-hour peak period. As discussed above, the primary factor contributing to the congestion on US 2, SR 204 and 20th Street is congestion on I-5 southbound limiting the receiving capacity of the US 2 westbound to I-5 southbound ramp. Some specific issues include:

- Southbound I-5 congestion south of the Pacific Street on-ramp limits traffic from the US-2 on-ramp from entering I-5. This limited I-5 capacity results in congestion on the US 2 corridor.
- Congestion on I-5 north of the westbound US 2 to southbound on-ramp worsens through the peak period and eventually causes a metering affect at the Everett Avenue off-ramp. This metering affect allows more traffic from US 2 to merge onto southbound I-5.
- Congestion from I-5 spills back across the US 2 westbound trestle and onto westbound SR 204 and westbound 20th Street SE. This congestion backs up past SR 9 to the east.

Sensitivity Analysis

The VISSIM model was run for the No Build Alternative, but the ramp from US 2 westbound to I-5 southbound was set to operate without any constraints from the I-5 corridor. The purpose for running the simulation model in this manner was to determine how much of the I-5 corridor congestion impacts operations on the US 2 corridor. Attachment 17 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, and westbound SR 204 for the No Build (Without I-5) sensitivity test. Congestion on the US 2 Trestle without any constraints from the I-5 corridor would be reduced compared to the No Build Alternative, indicating the degree to which conditions on southbound I-5 southbound influence conditions on the US 2 westbound trestle.

The US 2 westbound trestle is still congested, primarily in the left lane approaching the ramp to I-5 southbound, indicating that the one-lane ramp from US 2 westbound to I-5 southbound does not provide sufficient capacity to serve demand volumes. The merge from the lower roadway on ramp exacerbates the congestion in the left lane, reducing speeds to 50 percent of the posted speed or lower for approximately two hours.

SR 204, 20th Street, and US 2 east of the eastside interchange are all still congested, even when the I-5 constraint is removed. This indicates that the existing eastside interchange does not provide sufficient capacity to serve the future demand volumes

Non-Motorized

The channelization for the Year 2040 No Build is identical to the Existing Condition, which includes the US 2 trail along the south side of eastbound US 2.

Safety

The safety of the Year 2040 No Build Alternative was not analyzed qualitatively. The channelization for the Year 2040 No Build Alternative is identical to the Existing Condition, but more congestion is expected in the No Build Alternative, which is expected to have an impact on safety conditions. Crash severity tends to decrease during traffic congestion due to lower travel speeds, but crash frequency tends to increase.

Alternatives Development

Please see the Alternatives Development section of the Planning and Environmental Linkage document for information about the development and preliminary screening of alternatives that meet the project need.

Year 2040 Build Alternative 1

Corridor

The proposed layout for Alternative 1, shown in Attachment 18, consists of the following:

- One westbound US 2 lane at the SR 204/20th Street SE interchange
- Two-lane on-ramp to westbound US 2 at the SR 204/20th Street SE interchange
- Three GP lanes across the US 2 westbound trestle
    - On-ramp from lower roadway to westbound US 2 relocated to Cherry Avenue
- One-lane ramp from westbound US 2 to northbound I-5 widening to two lanes for ramp meter storage
- Two-lane off-ramp from westbound US 2 to southbound I-5 merging to one lane prior to accessing I-5
- Two-lane off-ramp from westbound US 2 to downtown Everett, entering the local system at the Everett Avenue/I-5 Northbound On-Ramp intersection
- Additional one-lane transit-only off-ramp from westbound US 2 to downtown Everett, entering the local system at California Street/Maple Street
- Local improvements, including:
    - Two-way local bridge west of the SR 204/20th Street SE interchange
    - Local improvements at 20th Street SE/SR 204 intersection
    - Local improvements at Cherry Avenue
    - Local improvements along Everett Avenue – potential diverging diamond interchange (DDI)

Traffic Volumes

Alternative 1 includes three lanes across the US 2 westbound trestle with 2 GP and 1 HOV lane. The 3-Lane Build Alternative volumes described in in the Year 2040 Traffic Volume Forecast section were used for the analysis of this alternative. Refer to Attachment 11 through Attachment 13.

Operations

Prior to analyzing Alternative 1 in VISSIM, the preliminary alternative configuration and lane assumptions was assessed qualitatively.

Over 1,500 vph would use the off-ramp from westbound US 2 to downtown Everett during the AM peak hour. This level of traffic volume at a controlled intersection would require three left-turn lanes from the off-ramp to westbound Everett Avenue to avoid having queues back onto westbound US 2. Triple left turn lane configuration are constructed in some locations, but it is an uncommon practice. It is uncommon because it requires three receiving lanes, operates with unbalanced lane utilization, and requires several lanes with adequate storage length. As described in the Alternatives Development section of the Planning and Environmental Report, Alternative 1 was screened out for further consideration due to anticipated impact to I-5.

Alternative 1 was not analyzed in VISSIM.

Year 2040 Build Alternative 2

Corridor

The proposed layout for Alternative 2, shown in Attachment 19, consists of the following:

- Two westbound US 2 lanes at the SR 204/20th Street SE interchange
- Two-lane on-ramp to westbound US 2 at the SR 204/20th Street SE interchange
    - 20th Street westbound is two lanes east of Cavalero Road (one GP lane and one BAT lane), but merges to one lane west of Cavalero Road, a direct connection between the BAT lane and the HOV lane on the US 2 trestle is not provided.
    - The on-ramp from 20th Street SE flies over the on-ramp from SR 204 to become the northernmost ramp along westbound US 2
- Four lanes across the US 2 westbound trestle – 3 GP lanes + 1 HOV lane on the left
    - On-ramp from lower roadway to westbound US 2 relocated to Cherry Avenue
- One-lane off-ramp from westbound US 2 to northbound I-5 widening to two lanes for ramp meter storage
- Two-lane off-ramp from westbound US 2 to southbound I-5 merging to one lane prior to accessing I-5
- Two-lane off-ramp (1 GP, 1 HOV) from westbound US 2 to downtown Everett, entering the local system at Hewitt Avenue/Walnut Street
- Local improvements, including:
    - Two-way local bridge west of the SR 204/20th Street SE interchange
    - Local improvements at 20th Street SE/SR 204 intersection
    - Local improvements at Cherry Avenue
    - Local improvements along Hewitt Avenue

Traffic Volumes

Alternative 2 includes four lanes across the US 2 westbound trestle, so the 4-Lane Build volumes were used for the analysis of this alternative. Refer to Attachment 11 through Attachment 13.

Operations

Travel Times

The anticipated AM peak hour travel times for Alternative 2 are shown in Attachment 14. Travel times on SR 204 between SR 9 and US 2 are worse compared to the No Build Alternative because congestion from the westside interchange area spills back across the trestle and onto SR 204. GP travel times on 20th Street SE between SR 9 and US 2 improve compared to the No Build Alternative because the congestion on the US 2 Trestle is worse in the center two lanes compared to the right lane, and the 20th Street SE on-ramp flies over the SR 204 on-ramp to connect to the northernmost lane. There is additional demand volume on the ramp from westbound US 2 to southbound I-5 compared to the No Build Alternative, but the ramp is already over capacity in the No Build Alternative (in large part due to limited receiving capacity on I-5 southbound), so the additional volume adds to the back of the queue.

The HOV lane provides a travel time benefit compared to GP traffic, even though congestion from the westside interchange spills into the HOV lane. HOV traffic destined for downtown Everett receive the most benefit from the left-side HOV lane, as it provides a direct connection to the downtown Everett off ramp. Despite the missing connection between the BAT lane on 20th Street and the HOV lane on the US 2 westbound trestle, the travel time savings for provide an incentive for would-be single occupant drivers to use transit or organize carpools.

The Alternative 2 travel times compared to the No Build Alternative travel times are displayed in Table 3 below.

Table 3. Year 2040 Build Alternative 2 Travel Times

Segment	Description	Year 2040 No Build Travel Time (mins)	Year 2040 Build Alternative 2 Travel Time (mins)
A	SR 9 to US 2 Trestle via SR 204	69	92
B	SR 9 to US 2 Trestle via 20th St	95 (BAT Lane: 17)	69 (BAT Lane: 14)
C	SR 9 to US 2 Trestle via US 2	49	80
D	US 2 Trestle between Eastside Interchange and I-5	19	38 (BAT Lane: 26)

Congestion

Attachment 20 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, westbound SR 204, and southbound I-5 for Alternative 2.

Alternative 2 improves the eastside interchange compared to the No Build Alternative, allowing demand volumes to reach the I-5/Downtown Everett interchange on the westside. However, I-5 southbound has the same limited receiving capacity as in the No Build Alternative which is the primary factor contributing to the congestion on US 2, SR 204 and 20th Street early during the peak period. Later during the AM peak period, southbound I-5 becomes constrained due to queues from the Everett Avenue off-ramp backing up onto the I-5 mainline. This causes congestion on southbound I-5 north of downtown Everett which meters traffic on southbound I-5, increasing the receiving capacity south of US 2. But the single lane off-ramp from US 2 westbound to I-5 southbound does not provide sufficient capacity to serve the demand so backups on the US 2 westbound trestle that extend well beyond the eastside interchange and past SR 9 do not dissipate during the five-hour AM peak period.

Sensitivity Analysis

The congestion in Alternative 2 spilling back onto the 4-lane US 2 Westbound Trestle makes it difficult to assess how well the alternative would function without the downstream constraint on southbound I-5. The congestion in Alternative 2 also indicates that the increase in demand volumes over the No Build Alternative may be less than the initial travel demand model results indicate. Future iterations of the work should utilize a dynamic traffic assignment model to account for the effects of congestion when developing future year demand volumes.

Additional sensitivity tests were run for Alternative 2 to test how the alternative would operate under different conditions. These tests included:

- Alternative 2 (Ramp Location): this sensitivity test analyzed an alternate configuration for the on-ramps from SR 204 and 20th Street SE. Instead of 20th Street SE flying over SR 204 to become the northernmost ramp along westbound US 2, the on-ramps from SR 204 and 20th Street SE would maintain the same relative positions as in existing conditions with SR 204 as the northernmost ramp.
- Alternative 2 (Without I-5): this sensitivity test assumed a 2-lane off ramp from US 2 westbound to I-5 southbound, and removed the downstream constraints on I-5, representing how Alternative 2 would operate with enough ramp capacity to meet demand, and without congestion on I-5 influencing conditions across the US 2 westbound trestle.
- Alternative 2 (No Build Volumes): this test used the demand volumes from the Year 2040 No Build Alternative, representing how Alternative 2 would operate if demand volumes did not increase above No Build levels. The vehicle inputs in the model were reduced to No Build volumes, but the traffic patterns and origin destination percentages were maintained as in Alternative 2.

Attachment 21 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, and westbound SR 204 for the Alternative 2 (Ramp Location) sensitivity test. The results of this test indicate that while system operations are typically the same, the congestion levels and travel times on 20th Street SE and on SR 204 switch. The northernmost lane is the least congested GP lane on the westbound trestle, and whichever ramp aligns with the northernmost lane will experience slightly less congestion and faster travel times than the other ramp. Attachment 21. Alternative 2 (Ramp Location) Congestion Diagram

Attachment 22 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, and westbound SR 204 for the Alternative 2 (Without I-5) sensitivity test. The results of this test indicate that if there is sufficient receiving capacity on I-5 southbound, and a two-lane ramp from US 2 westbound to I-5 southbound is provided, the additional demand volume reaching downtown Everett would cause congestion at downtown intersections that impacts the trestle. However, the impact of downtown Everett congestion is less than the impact from I-5 congestion. The additional demand volume reaching Everett Avenue would cause congestion at intersections on Maple Street, especially the Maple Street and Pacific Avenue intersection.

This test also revealed that the intersections on 20th Street SE would be over capacity, resulting in congestion between the Cavalero Road and SR 9 intersections.

Attachment 23 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, westbound SR 204, and southbound I-5 for the Alternative 2 (No Build Volumes) sensitivity test. The results of this test indicate that Alternative 2 would operate better than the No Build Alternative on SR 204 and across the Trestle. There is still congestion on the Trestle, but the HOV lane does provide a bypass for buses and HOV traffic. Near the west interchange, the HOV lane begins to experience some congestion as HOV vehicles destined for I-5 southbound merge into GP traffic

Non-Motorized

Non-motorized improvements like bike lanes, shared lanes, and pedestrian connectivity were assumed to be an integral part of every alternative. As each of the alternative roadway configurations were being developed, a clear understanding about the need to include non-motorized connectivity was understood to be a final update to the alternatives. The US 2/SR 204/20th Street SE IJR identified the lower roadway (20th Street) as the primary location for the non-motorized crossing of Ebey Island. Including a shared-use path along one side of the new US 2 trestle was not excluded from consideration and both concepts would require further coordination with the local agencies, non-motorized groups, and WSDOT to finalize these concepts. No final analysis was completed for traffic operational impacts caused by potential non-motorized connections, but it was clear that those connections would not be a differentiator between the various alternatives.

Safety

The safety of the Year 2040 Build Alternative 2 was not analyzed quantitatively at this phase. The existing channelization along the US 2 westbound trestle includes two lanes with 2-foot shoulders on either side. The Year 2040 Build Alternative 2 would provide standard shoulder widths of 8 to 10 feet, which are expected to improve safety along the corridor. Without the sensitivity tests, there is more congestion in Alternative 2 than in the No Build Alternative, which is expected to have an impact on safety conditions. Crash severity tends to decrease during traffic congestion due to lower travel speeds, but crash frequency tends to increase.

Year 2040 Build Alternative 3

Corridor

The proposed layout for Alternative 3, shown in Attachment 24, consists of the following:

- Two westbound US 2 lanes at the SR 204/20th Street SE interchange
- One-lane on-ramp to westbound US 2 at the SR 204/20th Street SE interchange
- Three GP lanes across the US 2 Westbound Trestle
    - On-ramp from lower roadway to westbound US 2 relocated to Cherry Avenue
- One-lane off-ramp from westbound US 2 to northbound I-5 widening to two lanes for ramp meter storage
- One-lane HOV off-ramp and one-lane general purpose off-ramp from westbound US 2 to southbound I-5, both merge to a one-lane ramp to I-5
- One-lane off-ramp from westbound US 2 to downtown Everett, entering the local system at California Street/Maple Street
- Local improvements, including:
    - Two-way local bridge west of the SR 204/20th Street SE interchange
    - Local improvements at 20th Street SE/SR 204 intersection
    - Local improvements at Cherry Avenue

Traffic Volumes

Alternative 2 includes three lanes across the US 2 Westbound Trestle, so the 3-Lane Build volumes were used for the analysis of this alternative. Refer to Attachment 11 through Attachment 13.

Operations

Travel Times

The anticipated AM peak hour travel times for Alternative 3 are shown in Attachment 14. Travel times on SR 204 between SR 9 and US 2 improve compared to the No Build Alternative because the SR 204 and 20th Street SE merge is improved, and although there is congestion on the 3-lane US 2 Westbound Trestle, the congestion is worse in the left two lanes compared to the right lane. Travel times on 20th Street SE between SR 9 and US 2 and on US 2 both east and west of the SR 204/20th Street SE interchange are worse compared to the No Build Alternative. There is additional demand volume on the ramp from westbound US 2 to southbound I-5 compared to the No Build Alternative, but the ramp is already over capacity in the No Build Alternative, so the additional volume adds to the back of the queue.

The BAT lane on 20th provides a benefit for HOV traffic, but no connecting HOV facilities are provided on US 2 and HOV and bus traffic would travel in the congested GP lanes.

The Alternative 3 travel times compared to the No Build Alternative travel times are displayed in Table 4 below.

Table 4. Year 2040 Build Alternative 3 Travel Times

Segment	Description	Year 2040 No Build Travel Time (mins)	Year 2040 Build Alternative 3 Travel Time (mins)
A	SR 9 to US 2 Trestle via SR 204	69	64
B	SR 9 to US 2 Trestle via 20th St	95 (BAT Lane: 17)	130 (BAT Lane: 19)
C	SR 9 to US 2 Trestle via US 2	49	75
D	US 2 Trestle between Eastside Interchange and I-5	19	33

Congestion

Attachment 25 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, westbound SR 204, and southbound I-5 for Alternative 2. Similar to Alternative 2, Alternative 3 improves the eastside interchange compared to the No Build Alternative, allowing demand volumes to reach the I-5/Downtown Everett interchange on the westside. However, I-5 southbound has the same limited receiving capacity which is the primary factor contributing to the congestion on US 2, SR 204 and 20th Street early during the peak period. Later during the AM peak period, southbound I-5 becomes constrained due to queues from the Everett Avenue off-ramp backing up onto the I-5 mainline. This causes congestion on southbound I-5 north of downtown Everett which meters traffic on southbound I-5, increasing the receiving capacity south of US 2. But the single lane off-ramp from US 2 westbound to I-5 southbound does not provide sufficient capacity to serve the demand so backups on the US 2 westbound trestle that extend well beyond the eastside interchange and past SR 9 do not dissipate during the five-hour AM peak period.

Sensitivity Analysis

The congestion in Alternative 3 spilling back onto the 3-lane US 2 Westbound Trestle makes it difficult to assess how well the alternative would function without the downstream constraint on southbound I-5. The congestion in Alternative 3 also indicates that the increase in demand volumes over the No Build Alternative may be less than the initial travel demand model results. Future iterations of the work should utilize a dynamic traffic assignment model to account for the effects of congestion when developing future year demand volumes.

Additional sensitivity tests were run for Alternative 3 to test how the alternative would operate under different conditions. These tests included:

- Alternative 3 (I-5 SB Two Lanes): this test included two GP lanes on the off-ramp from westbound US 2 to southbound I-5 with two lanes entering southbound I-5 and an added peak use shoulder lane on I-5 southbound between US 2 and south of the 41st interchange, representing how Alternative 3 would operate with enough ramp capacity to meet demand.
- Alternative 3 (Without I-5): this sensitivity test assumed a 2-lane GP off ramp from US 2 westbound to I-5 southbound, and cut the ramp, representing how Alternative 3 would operate with enough ramp capacity to meet demand, and without congestion on I-5 influencing conditions across the US 2 westbound trestle.
- Alternative 3 (No Build Volumes): this test used the demand volumes from the Year 2040 No Build Alternative, representing how Alternative 3 would operate if demand volumes did not increase above No Build levels. The vehicle inputs in the model were reduced to No Build volumes, but the traffic patterns and origin destination percentages were maintained as in Alternative 2.

Attachment 26 illustrates the AM peak hour congestions along westbound US 2, westbound 20th Street SE, westbound SR 204, and southbound I-5 for the Alternative 3 (I-5 SB Two Lanes) sensitivity test. The two-lane off-ramp allows volume from US 2 to access southbound I-5, but the additional volume from US 2 onto would cause congestion on southbound I-5 between the on-ramps from US 2 and Pacific Street and the off-ramp to 41st Street. The right lanes on I-5 become congested as people positioning to exit at 41st Street mix with traffic entering from US 2 and Pacific Street. The congestion on I-5 would back up on the US 2 Westbound Trestle, beyond the eastside interchange, and past SR 9. The results of this sensitivity test indicate that without improvements to I-5, congestion from I-5 will impact trestle operations in the future, even if sufficient capacity is provided on the off-ramp from westbound US 2 to southbound I-5.

Attachment 27 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, and westbound SR 204 for the Alternative 3 (Without I-5) sensitivity test. The results of this test indicate that if congestion on I-5 is not influencing conditions on the US 2 Westbound Trestle, the additional demand volume reaching downtown Everett would cause congestion that impacts the trestle. However, the congestion from downtown Everett is less than the impact from congestion on I-5.

Attachment 28 illustrates the AM peak hour congestion along westbound US 2, westbound 20th Street SE, westbound SR 204, and southbound I-5 for the Alternative 3 (No Build Volumes) sensitivity test. The results of this test indicate that Alternative 3 would operate better than the No Build Alternative on SR 204 and across the Trestle.

Non-Motorized

Non-motorized improvements like bike lanes, shared lanes, and pedestrian connectivity were assumed to be an integral part of every alternative. As each of the alternative roadway configurations were being developed, a clear understanding about the need to include non-motorized connectivity was understood to be a final update to the alternatives. The US 2/SR 204/20th Street SE IJR identified the lower roadway (20th Street) as the primary location for the non-motorized crossing of Ebey Island. Including a shared use path along one side of the new US 2 trestle was not excluded from consideration and both concepts would require further coordination with the local agencies, non-motorized groups, and WSDOT to finalize these concepts. No final analysis was completed for traffic operational impacts caused by potential non-motorized connections, but it was clear that those connections would not be a differentiator between the various alternatives.

Safety

The safety of the Year 2040 Build Alternative 3 was not analyzed qualitatively. The existing channelization along the US 2 westbound trestle includes two lanes with 2-foot shoulders on either side. The Year 2040 Build Alternative 3 would provide standard shoulder widths of 8 to 10 feet, which are expected to improve safety along the corridor. Without the sensitivity tests, there is more congestion in Alternative 3 than in the No Build Alternative, which is expected to have an impact on safety conditions. Crash severity tends to decrease during traffic congestion due to lower travel speeds, but crash frequency tends to increase.

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