Technical Report: Interstate 5 Existing Conditions Analysis Mount Vernon / Burlington

I-5 Mount Vernon, north

Old 99 Highway (Exit 222.5) to Cook Road (Exit 233)

Final Report
September 10, 2021

Prepared by:
Washington State Department of Transportation Northwest Region
Mount Baker Area Multimodal Transportation Planning Office

Washington State
Department of Transportation

Washington State Department of Transportation

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Under 23 U.S. Code § 148 and 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

COVID-19 implications for the results of this study are currently unknown. WSDOT and our partners conducted this study between July 2018 and January 2020. Modeling used historic data on regional population, job growth and travel behavior to project future demand. This did not account for potential impacts of major disruptions such as COVID-19. While the near- and long-term effects of the pandemic are unknown, it will likely be different from the assumptions used in this study.

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Washington State Department of Transportation

Interstate 5 Existing Conditions Baseline Analysis Mount Vernon / Burlington

The Washington State Department of Transportation (WSDOT) NW Region Mount Baker Area (MBA) together with the Skagit Council of Governments (SCOG) initiated an existing conditions baseline analysis of Interstate 5 (I-5) in the Mount Vernon / Burlington urban area in the spring of 2021. The purpose of the baseline analysis was to determine if I-5 is meeting regional transportation performance expectations.

Why study the corridor?

Statewide Highway Review

Safety and mobility needs were identified on I-5 in Skagit County during a 2017 statewide study of state highway corridors. This statewide study effort became known as the Corridor Sketch Initiative (CSI). CSI was a new approach to evaluate state highway facilities and their role in a connected, multimodal transportation system with partnering agencies. The outcome of CSI was designed to help inform decision makers where state highways were performing within expectations and identify where problems may exist. CSI examined a range of issues including mobility, safety, preservation and environment issues. In the case of I-5 through Skagit County mobility and safety were the only issues identified as a potential problem, however CSI did not specifically identify the extent or location of a problem or need. Another key focus of CSI was the engagement with local and state multimodal, multidisciplinary agencies who helped to identify challenges on state highways and participated in the identification of complementary strategies.

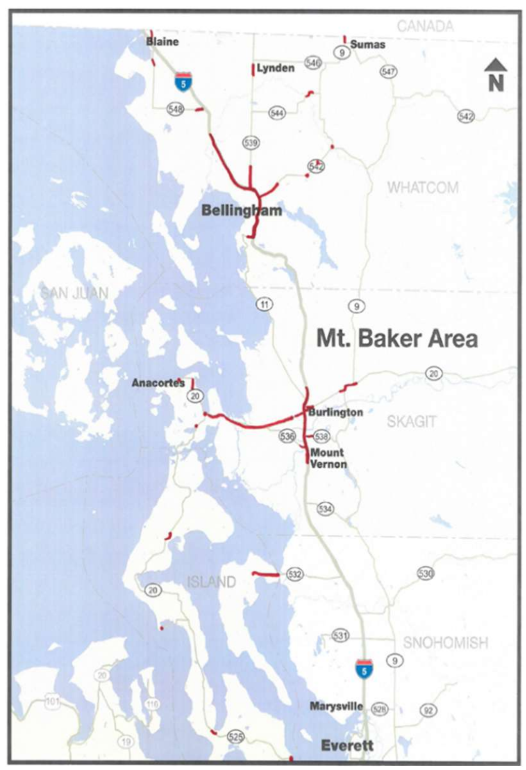

Exhibit A. Potential congested highway corridor segments.

In the Mount Baker Area 27 corridor segments on 17 state routes (463 lane miles) were evaluated in a three-county area, Skagit, Whatcom, and Island. About 67-miles or 14 percent of the state highway in this area were found to have mobility (congestion) issues. Mobility challenges on the system were primarily located in urban areas during peak travel periods between 2:30 p.m. and 7:00 p.m. There were several factors cited that contributed to mobility challenges including: high volume of traffic during commute periods, inefficient intersections and local street network, turning movements from uncontrolled driveway access points onto the state highway and large numbers of singleoccupancy vehicles. To help address these issues partnering agencies identified a host of potential strategies including: managing demand by developing better transportation connections with all modes of transportation and optimizing multimodal transportation operations on local streets and highways. Exhibit A shows the location of corridors segments identified in CSI with possible mobility/congestion issues. I-5 through the urban areas of Mount Vernon and Burlington was one of the areas identified.

Skagit Council of Government (SCOG) Regional Analysis

In 2016 and again in 2021 SCOG updated its Regional Transportation Plan. The update included an analysis of all regional transportation facilities including I-5 through Mount Vernon and Burlington. The analysis found that population growth and regional travel would exceed the adopted Level of Services (LOS) standards on the I-5 corridor in the next 20 years if measures were not taken to address it. Exhibit B shows the existing demand on the interstate in 2018 with projected future growth in 2045. The area most impacted on I-5 was between the SR 20 Interchange and the Kincaid Interchange.

To address mobility on I-5, the updated Regional Transportation Plan included a number of strategies

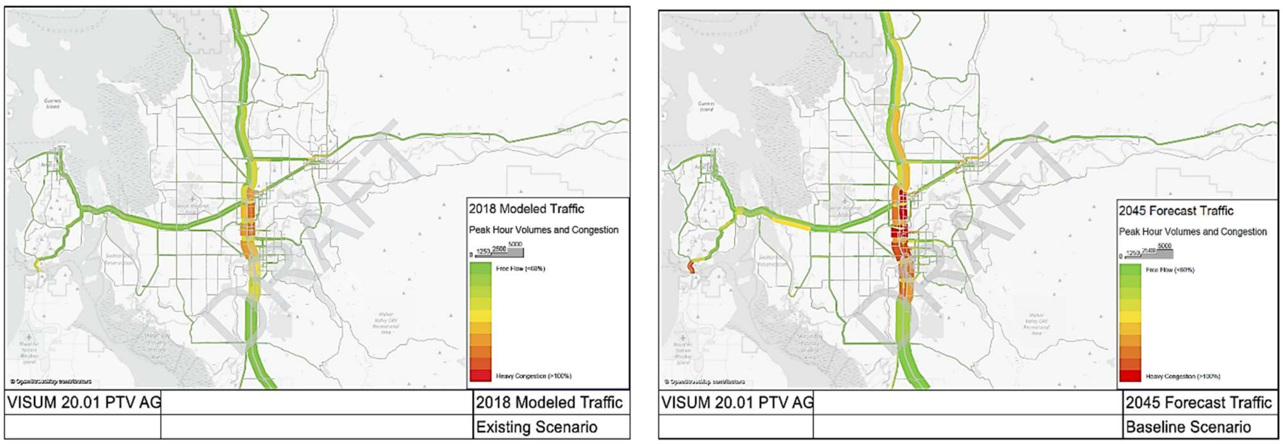

Exhibit B. Skagit Regional Transportation Plan Traffic Demand Model Output for 2018 and 2045.

and proposed local improvement projects at three major interchanges on I-5 through the Mount Vernon-Burlington urban area. Many local street network improvements and enhancements for bicycles and pedestrians were also included.

Strategies

- Reduce or spread-out traffic demand through the use of intelligent transportation systems (ITS) and operational improvements on I-5. Improvements may include adaptive intersection signal system improvements, traffic information signs, and ramp metering.
- Increase modal connectivity by addressing multimodal transportation system gaps and emphasizing modal linkages for all modes of transportation.

Proposed Improvements

- Burlington George Hopper / I-5 Interchange improvements. Lane addition on east side and partial cloverleaf in the northwest quadrant to minimize left turn movements.
- Hickox Road (Old Highway 99) / I-5 Interchange full southbound and northbound access improvements to I-5.
- WSDOT Cook Road / I-5 interchange. Lane addition and signal improvements.

- WSDOT I-5 Active Traffic Management. System-wide improvements to optimize intersection signals, adaptive ramp meters, and traveler information signs.

What actions have been taken to study the corridor?

Beginning in 2017, WSDOT and SCOG identified a corridor project in the Skagit Regional Transportation Plan to analyze I-5 in the urban areas of Mount Vernon and Burlington. In the fall of 2019 both parties met to discuss analyzing the I-5 corridor to determine the extent of mobility and safety needs on the corridor. The initial meeting established the Study Area limits together with the notion of developing a work plan to conduct a limited (baseline) analysis of the corridor to help determine if the corridor was meeting existing regional and statewide objectives as well as determine if there were potential problems and needs on the corridor that should be addressed.

Where is the study area?

The study area is in Skagit County between Old Highway 99 at mile post 222.5 and Cook Road at mile post 233 and is within the urban areas of the cities of Mount Vernon and Burlington. See Exhibit C.

Exhibit C. Old 99 Highway (MP 222.5) to Cook Road to (MP 233)

What measures were taken to engage stakeholders?

Stakeholder and public engagement are essential components of transportation planning in Washington State and the region. As part of the study analysis, a communication and stakeholder engagement strategy was developed to respond to the needs and wants of the community to be informed about transportation issues. The engagement plan outlined key outcomes to promote and encourage fair and equal opportunities for stakeholders and the public to be informed about the process and results of the transportation analysis on I-5. Several actions were taken to connect issues with stakeholders and the public on study issues. These actions included:

- Engaging and informing elected and local jurisdictions and agencies about the study progress and results through the SCOG at the Technical Advisory Committee and Policy Board.
- Community survey targeting key interest groups in the community. Interest groups included traditionally underserved populations, Tribes, economic development interests, freight, and the general public.

Follow-up engagement with the public and local jurisdictions and agencies are planned following the conclusion of the study effort to inform stakeholders on the results of the analysis and next steps.

How was the corridor analyzed?

The initial assessment of the corridor included a high-level baseline analysis of the existing condition (pre-COVID-19) for the I-5 mainline and associated ramps. If a problem and need are identified during the process the technical team would decide if further analysis was needed to develop strategies and alternatives to address significant problems or needs on the interstate.

The baseline analysis of the corridor included the following analysis:

A. Traffic Operations.

- Highway Capacity Analysis This analysis looked at existing traffic operations performance on the I-5 mainline during peak mid-weekday travel periods for the 2021 analysis year. The analysis was developed using the adopted Highway Capacity Manual (HCM) (speed, volumes, and delay) as well as person throughput. WSDOT's performance standard for I-5 in this location is LOS D. When the level of service exceeds LOS D (i.e., LOS E) it indicates that I-5 is at or nearing capacity and may begin to lose some of its capacity to move traffic safely and efficiently.
- Pre-pandemic and Seasonal Traffic Value Adjustments Hourly traffic design values were post-processed to obtain seasonally adjusted and pre-pandemic traffic values for 2015 – 2019 using the methodology outline in the current version of the Federal Highway Administration (FHWA) Traffic Monitoring Guide and FHWA Traffic Data Computation Method Guide for the 2021 analysis year.
- Freeway Facility Analysis Analyzes connected interstate segments over a set of sequential 15-minute periods and added the ability to capture and analyze oversaturated and undersaturated conditions on the I-5 corridor.

B. Safety.

- Target Zero Summary. This summary provides information on crash types, users, and circumstances of the higher severity crashes from data collected from 2016 to 2020.
- Crash Summary Assessment. This assessment looked at the historical crash data from 2016 to 2020 to help identify characteristics and patterns such as time of day, directionality, and lane location throughout the corridor.
- HSM Analysis. This analysis provides information on where the corridor is experiencing an excess of fatal and serious injury crashes than what a typical site would. The analysis was conducted using the Interactive Highway Safety Design Model (IHSDM) with data from 2016 to 2020 and supporting traffic operations analysis.

C. I-5 On-Ramps.

- Merge Lane Volume Threshold Analysis. This analysis showed where there is a need to manage the flow of on-ramp traffic to the I-5 mainline.
- Ramp Operations Analysis and Geometric Assessment. This assessment analyzed on-ramp acceleration using factors identified in the WSDOT Design Manual Section 1360.04(4), of 720 feet. Ramp storage capacity was also analyzed and was derived from peak hour volumes with a minimum of 450 feet.

What are the study area characteristics?

I-5 in Skagit County is part of a 48,000-lane mile system of interconnected controlled or limited access highways that forms part of the National Highway System. The FHWA, along with the Washington State Department of Transportation (WSDOT), is responsible for this system and recognizes that the interstate system is not only a part of the National Highway System but is also a part of regional and local transportation systems.

In this location I-5 runs north – south from the U.S. / Canadian border to Mexico through Skagit County. The study area is about 9-miles in length with an estimated urban area population in Mount Vernon / Burlington to be about 49,500 in 2019-2020 according to the Washington State Office of Financial Management (OFM). I-5 is a four-lane divided interstate and consists of 12-foot driving lanes and 8-foot shoulder, with exception of the Skagit River Bridge where the shoulders narrow to 3 feet. Bicycles are permitted on a portion of the interstate but restricted between the College Way Interchange (Exit 227) and George Hopper Road Interchange at (Exit 229). Additionally, many local streets in the urban area permit bicycle use. The posted speed limit varies between 60 MPH and 70 MPH in the study area, with the urban area posted speed limit set at 60 MPH, which is primarily south of the SR 11 interchange.

There are eight interchanges within the corridor with a total of 30 ramps that provide access on and off the interstate to local communities. All interchanges are separated by one or more miles with four interchanges that carry traffic to four other state routes. These routes include SR 536, SR 538, SR 20 and SR 11. In Burlington, there is one pedestrian / bicycle east-west crossing under I-5, and four east-west street corridors over or under I-5 in Mount Vernon. The Skagit River is a major barrier between the two communities of Mount Vernon and Burlington. There are only two north-south bridges across the Skagit River; the Skagit River Bridge (now formally known as the I-5 Trooper Sean M. O'Connell Jr. Memorial Bridge) and the Riverside Bridge, a local bridge that serves the communities of Burlington and Mount Vernon. In Mount Vernon, the SR 536 Division Street Bridge serves east and west Mount Vernon and is an alternative route to Anacortes/San Juan Ferry and Whidbey Island.

Traffic operations analysis

The Annual Daily Traffic (ADT) varies significantly through the study area corridor from between 73,000 ADT at the Old Highway 99 interchange to 81,000 at the Skagit River Bridge, and 77,000 at SR 20. There is about 54,000 ADT at the northern limits of the study area at Cook Road. Freight traffic is constant at 9.45 percent throughout the corridor.

To assess existing conditions of I-5, traffic data was collected, processed, and analyzed using adopted traffic operations analysis methods and principles[1] to obtain pre-pandemic years (2015 to 2019) design hour volume for the 2021 analysis year. Seasonal and design hour factors were also calculated for all days in 2021 as well as the Level of Service (LOS)[2] for multilane highway segments to determine passenger vehicle density on the corridor.

The baseline analysis on I-5 for analysis year 2021 revealed that there are some segments of I-5 that may experience poor levels of service during peak hour week-day travel periods. The primary break down appears to be northbound on I-5 between Kincaid Street and George Hopper Road adjacent to the Skagit River Bridge between 5 and 6 p.m. Southbound travel shows degraded performance but it is not as severe. Exhibit D northbound and Exhibit E southbound shows passenger vehicle density and

[1] FHWA Traffic Monitoring Guide and FHWA Traffic Data Computation Method Guide,
[2] Highway Capacity Manual 6th Edition and Highway Capacity Software version 7.

Level of Service segments on I-5. The areas identified as red and black indicate that the Level of Service (LOS) and /or density exceed the performance measure established by WSDOT for I-5 in the study area.

More detailed information on the traffic analysis is located in Appendix B. I-5 Traffic Operations Analysis.

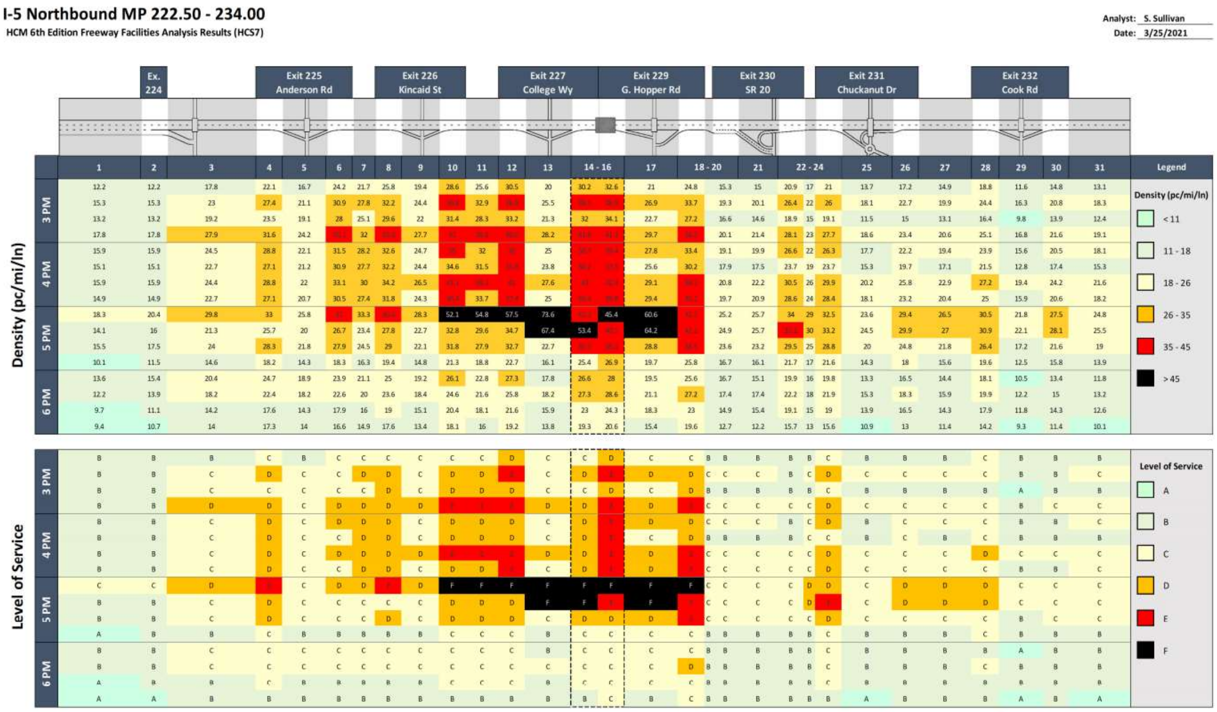

Exhibit D. Northbound Density (pc/mi/ln) and Level of Service Analysis

------- Skagit River Bridge

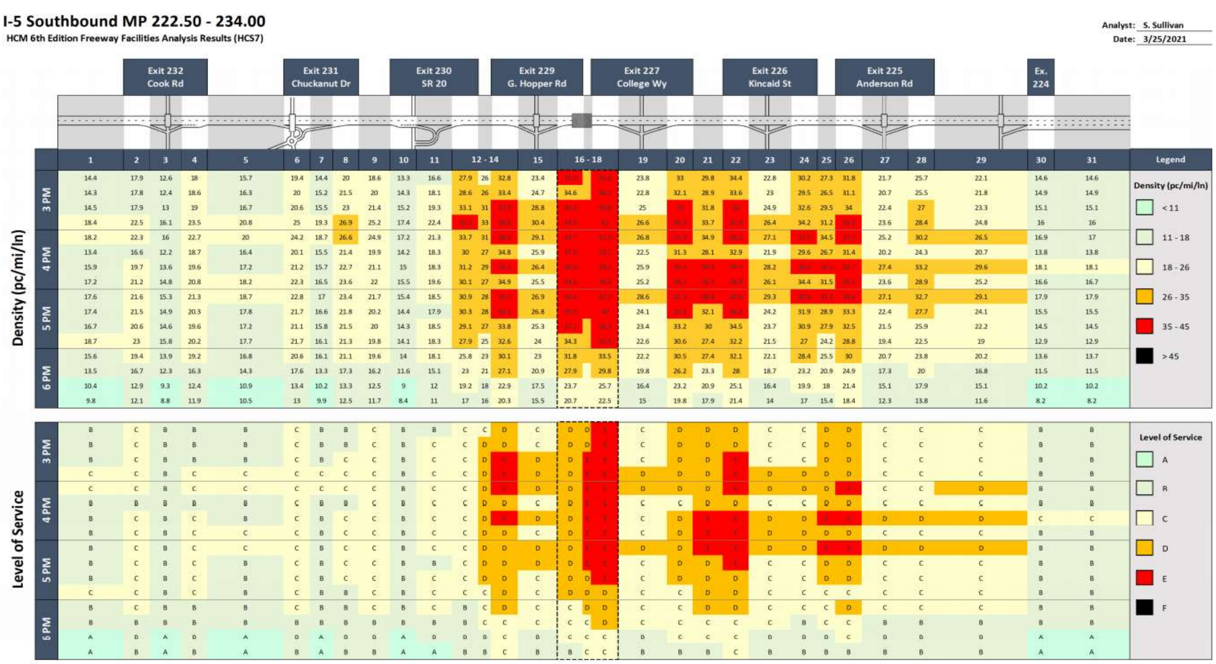

Exhibit E. Southbound Density (pc/mi/ln) and Level of Service Analysis

------- Skagit River Bridge

Safety analysis

A safety analysis was conducted as part of the baseline traffic operations analysis to determine if any areas or conditions in the corridor present safety issues. A separate analysis was conducted to determine if conditions on the corridor were better or worse than other similar corridors in the state.

The analysis addressed five years of data from 2016 to 2020. During that time there were 1,301 crashes. 73-percent of crashes were on the mainline of I-5. Of these 21-percent were injury crashes. There were five serious injury crashes and five fatal crashes that included two pedestrian fatalities. Most crashes were rear-ends, sideswipes and crashes with fixed objects (runoff the road). Exhibit F provides a summary of crash types by Year. Exhibit G provides information of crashes by time of day and northbound versus southbound travel with 34-percent of mainline crashes due to following too closely and 14-percent attributed to inattention.

COLLISION TYPE (SIMPLE)	2016	2017	2018	2019	2020	Grand Total
Animal	2	2	2	5	4	15
Entering at angle	12	10	7	8	7	44
Fixed object	98	70	87	62	46	363
Misc	3	4	3	3	9	22
Opp Dir 1LT-1STR	5	5	5	5	4	24
Opposite direction	1	4	1		1	7
Overturn	9	5	3	4	1	22
Parking	3					3
Pedalcycle	1	1				2
Pedestrian		1		1		2
Rear-end	126	143	148	148	49	614
Same Dir-Misc	11	4	5	2	11	33
Sideswipe	35	25	25	45	20	150
Grand Total	**306**	**274**	**286**	**283**	**152**	**1301**

Exhibit F. Crash types by year.

In the Study Area 54-percent of crashes were northbound and 45-percent southbound with approximately 27-percent of crashes occurred weekday afternoon during the p.m. peak period.

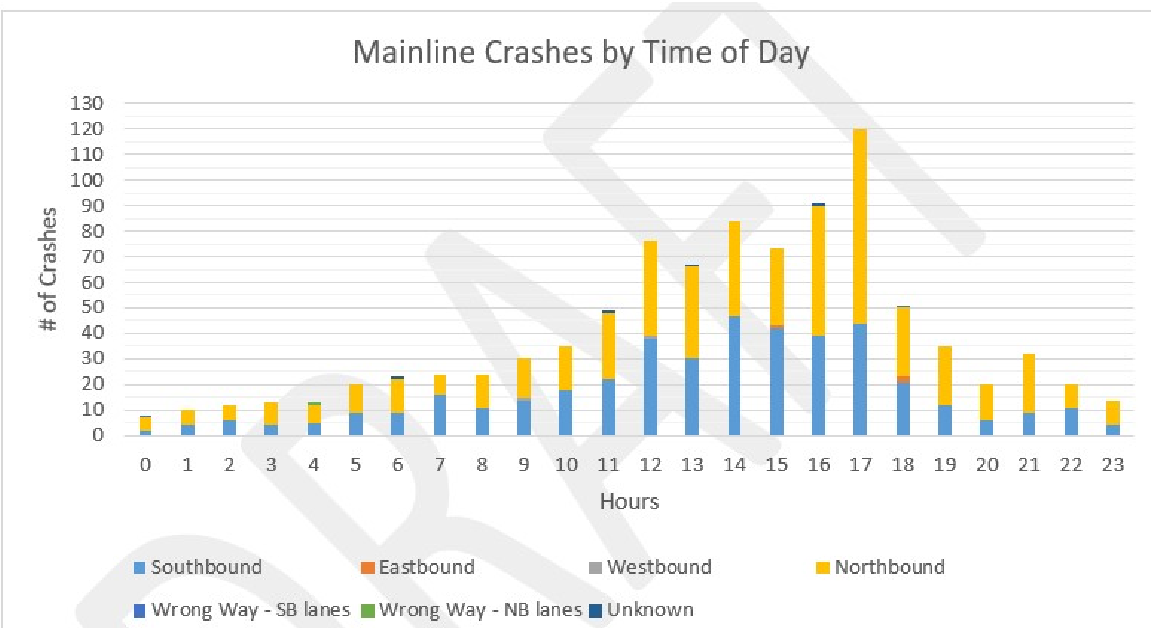

Exhibit G. Mainline crashes by time of day and direction of travel.

Following too closely, speed and inattention were the top three causes in most crashes. Exhibit H shows the type of crashes experienced for both northbound and southbound traffic.

Most of "all crashes" occurred northbound between exit 224 at Old Highway 99 interchange and exit 229 at the George Hopper interchange with the highest percentage of crashes occurring at the College Way interchange from 3 to 7 p.m. peak as shown in Exhibit H and I respectfully.

Crash Type	Southbound	Northbound	Entering from the Right	Entering from the Left	Unk
Fixed object	43%	56%			1%
Rear-end	46%	54%	<1%		
Sideswipe	44%	53%		2%	2%
% of above crash types versus the total directional crashes	**91%**	**91%**	**50%**	**67%**	**100%**

Exhibit H. Mainline crashes by time of day and direction

Northbound all crashes

Exhibit I. Northbound crashes all day

------- **Skagit River Bridge**

Northbound p.m. peak crashes

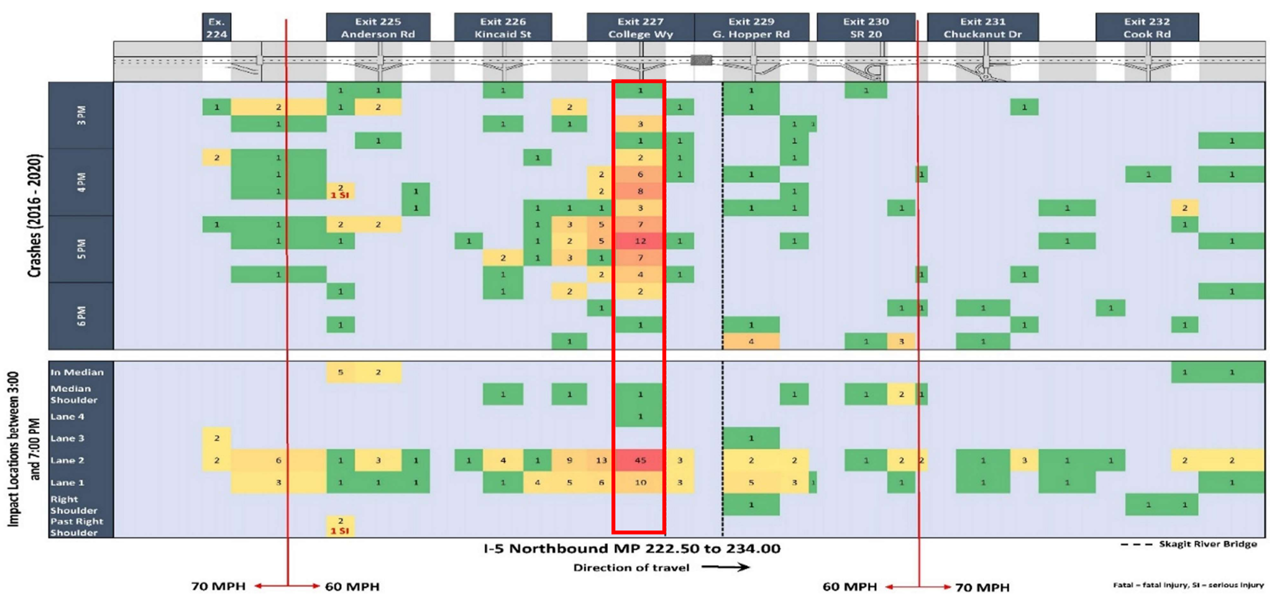

Exhibit J. Northbound p.m. peak crashes

------- **Skagit River Bridge**

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The analysis for southbound showed that 86-percent of crashes were spread out within the urban area between Anderson Road at exit 225 and SR 20 at exit 230 with a large number of crashes occurring most often approaching the southbound off-ramp to SR 20. Higher frequencies of incidents were also noted at George Hopper, College Way and Kincaid interchanges which is also reflected during 3 to 7 p.m. peak period as shown in Exhibit J and Exhibit K, respectfully.

Southbound crashes all day

Exhibit K. Southbound crashes all day

------- Skagit River Bridge

Southbound p.m. peak crashes

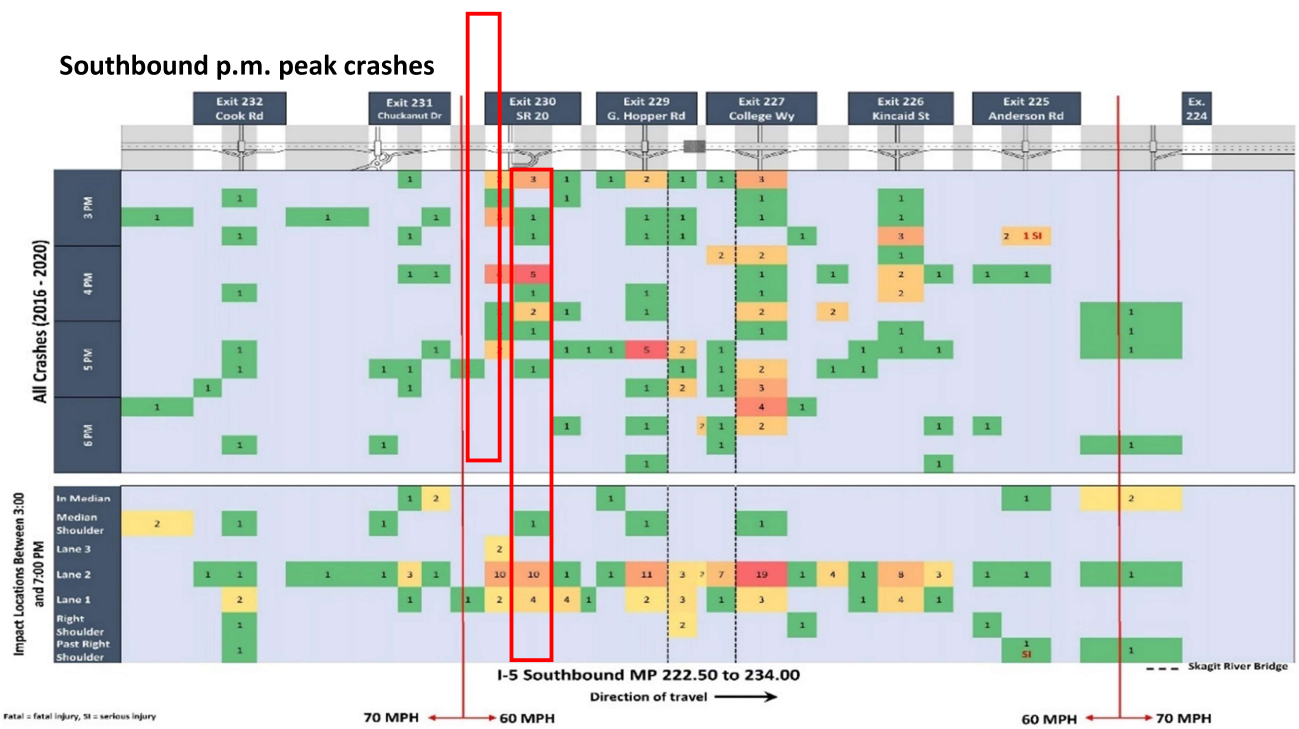

Exhibit L. Southbound p.m. peak crashes

------- Skagit River Bridge

The Highway Safety Manual Analysis revealed that the entire study area corridor is performing better than the average freeway in Washington. However, two areas stood out as performing worse than the average freeway. The first segment is SR 538 / College Way to south of George Hopper Road (MP 227.52-228.50). This is roughly a 1-mile segment experiencing an excess fatal and serious injury crash frequency (K+A) of 0.22 crashes per year, or 1 excess fatal/serious crash approximately every 4.5 years. The second segment is the SR 20 vicinity (MP 229.81-230.60), which is a roughly 0.8-mile segment and is experiencing an excess fatal and serious injury crash frequency (K+A) of 0.17 crashes per year, or 1 excess fatal/serious crash every 6 years.

Fatal and serious injury crash frequency - average

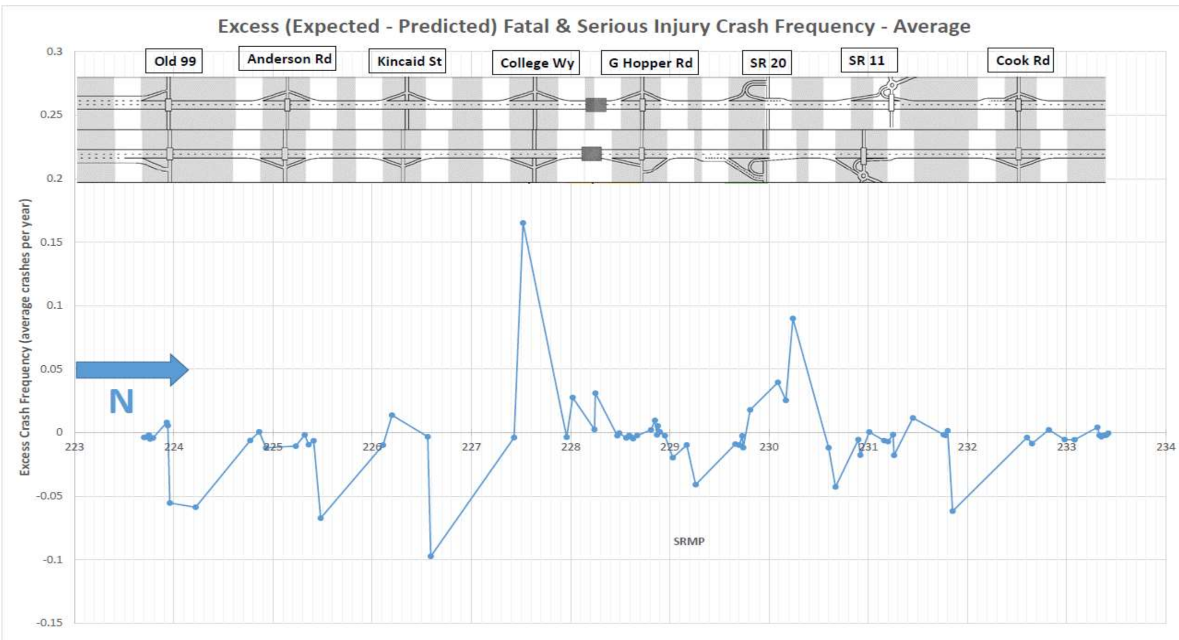

Exhibit M. Highway Safety Manual Analysis of (expected and predicted) fatal and serious injury crash frequency

Interstate ramp operations and geometrics analysis

In the study area there are eight interchanges with associated north and south bound ramps on I-5. These facilities are essential for providing reasonable access and mobility to the community and for regional activities. However, over time as traffic conditions change interchanges and ramps can also diminish in functionality, decreasing their effectiveness for carrying traffic in a safe and effective manner. To understand more about the relationship of interchange ramp operations and traffic operations on the I-5 mainline, a Merge Lane Volume Threshold Analysis and geometric feasibility analysis was conducted to determine operating conditions on to the I-5 mainline and viability for implementing low-cost operational improvements to existing on-ramps in the study area at the following interchanges:

- Exit 224 Old Highway 99 / Mount Vernon Road
- Exit 225 Anderson Road
- Exit 226 Kincaid Street / SR 536
- Exit 227College Way / SR 538

- Exit 229 George Hopper Road
- Exit 230 Avon Cutoff / SR 20
- Exit 231 Chuckanut Dr / SR 11
- Exit 232 Cook Road

Merge Lane Volume Threshold Analysis

WSDOT Merge Lane Volume Threshold analysis was used to determine if existing traffic volumes show a need to manage the flow of traffic where on-ramps merge onto the I-5 mainline. The existing conditions analysis was based on I-5 mainline and ramp traffic volumes for an average mid-weekday in 2019, which were queried from WSDOT's vehicle detection loops for the p.m. peak hours. The on-ramp volumes were added to the right lane volume on I-5 at all the on-ramp merge points for every 15-minute period. When the combined traffic volume meets or exceeds a Merge Lane Volume Threshold of 1,700 vehicle/lane/hour it is an indication of a need to manage traffic flow in the merge lane at one or more locations on I-5.

Exhibits N and O provide a summary of the Merge Lane Volume Threshold Analysis for existing conditions on I-5 northbound and southbound. The locations and times that are at or above the 1700 vehicle/lane/hour threshold are shown as colored sections in the charts. The darker the colors, the higher the merge lane volumes, and the greater the need to manage traffic flow in the merge lane. Based on this analysis Kincaid, College Way and George Hopper Road on-ramps all have merge-lane volumes for both northbound and southbound traffic that exceed 1900 vehicle/lane/hour threshold. During the p.m. peak SR 20 is also affected for a short duration. Additionally, it was noted with higher densities of traffic, vehicular crashes were also occurring more frequently. See Exhibit J and L on page 8 and 9.

I-5 Nothbound Ramp Operations Heat Map
I-5 Milepost 224.0 to 234.0

	Exit 225	Exit 226	Exit 227	Exit 229	Exit 230	Exit 231	Exit 232
Time Period	Anderson Rd	Kincaid St	College Wy	George Hopper	SR 20	SR 11	Cook Rd
2:00 PM - 2:15 PM	261	286	316	310	234	211	196
2:15 PM - 2:30 PM	320	355	381	365	279	254	221
2:30 PM - 2:45 PM	340	369	385	372	307	278	271
2:45 PM - 3:00 PM	400	441	475	446	385	355	320
3:00 PM - 3:15 PM	302	352	375	348	289	258	226
3:15 PM - 3:30 PM	376	424	448	438	358	335	312
3:30 PM - 3:45 PM	346	381	393	377	262	225	213
3:45 PM - 4:00 PM	417	467	476	456	379	344	323
4:00 PM - 4:15 PM	381	416	454	435	361	328	309
4:15 PM - 4:30 PM	375	412	432	406	324	293	263
4:30 PM - 4:45 PM	399	470	486	472	407	375	358
4:45 PM - 5:00 PM	372	430	460	447	386	341	310
5:00 PM - 5:15 PM	465	520	557	567	485	452	427
5:15 PM - 5:30 PM	353	392	428	435	388	357	332
5:30 PM - 5:45 PM	369	409	453	454	363	325	286
5:45 PM - 6:00 PM	242	281	311	298	253	233	194
6:00 PM - 6:15 PM	338	365	389	387	325	299	251
6:15 PM - 6:30 PM	297	328	372	372	319	299	263
6:30 PM - 6:45 PM	245	265	294	291	232	209	186
6:45 PM - 7:00 PM	226	245	251	246	200	184	159

Exhibit N. Northbound Lane Volume Threshold Analysis

I-5 Southbound Ramp Operations Heat Map
I-5 Milepost 224.0 to 234.0

	Exit 232	Exit 231	Exit 230	Exit 229	Exit 227	Exit 226	Exit 225	Exit 224
Time Period	Cook Rd	SR 11	SR 20	George Hopper	College Wy	Kincaid St	Anderson Rd	Old Hwy 99
2:00 PM - 2:15 PM	245	284	371	395	381	347	342	354
2:15 PM - 2:30 PM	280	313	383	399	391	372	358	368
2:30 PM - 2:45 PM	218	266	370	411	399	373	353	362
2:45 PM - 3:00 PM	288	332	438	465	430	397	394	404
3:00 PM - 3:15 PM	276	308	388	430	404	378	371	386
3:15 PM - 3:30 PM	285	331	396	421	396	369	368	393
3:30 PM - 3:45 PM	292	352	449	472	423	402	387	398
3:45 PM - 4:00 PM	355	402	469	497	440	418	406	420
4:00 PM - 4:15 PM	343	398	454	496	449	446	425	444
4:15 PM - 4:30 PM	287	329	413	451	387	371	353	365
4:30 PM - 4:45 PM	301	347	427	458	464	459	458	471
4:45 PM - 5:00 PM	316	359	413	459	454	420	411	437
5:00 PM - 5:15 PM	323	356	424	497	477	467	453	466
5:15 PM - 5:30 PM	309	334	417	463	426	395	397	409
5:30 PM - 5:45 PM	300	331	401	445	406	385	373	382
5:45 PM - 6:00 PM	307	327	387	419	379	342	329	340
6:00 PM - 6:15 PM	293	324	359	394	379	357	345	360
6:15 PM - 6:30 PM	251	269	324	350	330	297	294	303
6:30 PM - 6:45 PM	191	208	274	302	296	256	264	270
6:45 PM - 7:00 PM	185	195	243	267	254	219	204	215

Exhibit 0. Southbound Lane Volume Threshold Analysis

Ramp and geometric analysis

On-ramps to the interstate were evaluated to determine feasibility for introducing strategies to improve traffic operations to the I-5 mainline through the introduction of ramp meters. Ramp metering shown to be an effective tool for decreasing crashes on interstates by reducing and smoothing the flow rate of vehicles entering onto the system. Meters are also effective in breaking up large platoons of vehicles by introducing them at a slower rate to the mainline.

To determine the feasibility of ramp meters, an analysis was conducted to determine if the on-ramp from each of the eight interchanges met the design standards for acceleration and storage length. The acceleration length and storage length were based on the WSDOT Design Manual M 22-01.19, Section 1360.04(4) – Interchanges: On-Connections. Google map satellite images were also utilized as a base map for calculating acceleration and storage length. For additional information on the analysis and findings for each on-ramp see Appendix D Ramp Meter Feasibility and Geometric Analysis.

The analysis revealed that of the 15 on-ramps in the study area for both north and southbound lanes eight on-ramps met design requirements, three on-ramps could meet the requirements with a little effort and cost, and four on-ramps would need substantial improvement to meet requirements. A summary of the analysis is presented in Exhibit P.

Mile Post	Interchange	Direction	Assessment
223.9	Old SR99	SB	Sufficient
225.1	Anderson Road	SB	Sufficient
225.1	Anderson Road	NB	Sufficient
226.4	Kincaid Street	SB	Sufficient
226.4	Kincaid Street	NB	Does not meet req.
227.7	College Way	SB	Does not meet req.
227.7	College Way	NB	Meets req. with little effort
228.8	George Hopper	SB	Meets req. with little effort
228.8	George Hopper	NB	Sufficient
230.1	SR 20	SB	Meets req. with little effort
230.1	SR 20	NB	Sufficient
231.2	SR11	SB	Does not meet req.
231.2	SR 11	NB	Sufficient
[illegible]	[illegible]	[illegible]	[illegible]
232.8	Cook Road	NB	Sufficient

Exhibit P. Ramp operations and geometric assessment results

Follow-up evaluation needed to determine feasibility with the local street network and design attributes for system operations. Additionally, with any proposed improvements to I-5 close coordination with regional, local partners and the public is a key component to addressing regional and community needs and priorities.

Community and stakeholder outreach

Public and stakeholder engagement was initiated early in the study with the development of an engagement and outreach plan. The plan identified three approaches to help achieve project expectations and minimize risks, which included:

- Engaging and informing elected and local jurisdictions and agencies about the study progress and results through the Skagit Council of Governments at the Technical Advisory Committee and Policy Board.
- Community survey targeting key interest group. Interest groups included traditionally underrepresented populations, Tribes, economic development interests, freight and surrounding community.
- Follow-up of study results by WSDOT and SCOG with state and local agencies, economic development interests, Tribes and other interested parties at the conclusion of the Study later this year.

Community survey highlights

On April 22 a community survey was initiated. The survey was open for three weeks. During that time 762 persons responded to the survey. Survey respondents were primarily located within the immediate areas around Burlington, Mount Vernon and Sedro Woolley. There were a total of 17 questions that asked about what their primary purpose was for traveling on the corridor, what mode of transportation they used and what their overall experience was on I-5.

The survey data confirmed much of the same information that was revealed through data analysis.

- 81 percent of respondents indicated they experience traffic congestion in the corridor.
- Three areas of concern were highlighted by the public via open text response:
  - Skagit River Bridge
  - Kincaid Street to the Skagit River Bridge
  - Cook Road interchange and northbound on-ramp
- Congestion was also reported relatively evenly on most days of the week with a peak on Fridays and a dip on Sundays.
- Congestion is reported as most significant between 2-5 p.m., followed by 5-7 p.m. with little to no congestion reported between 7 p.m. – 7 a.m.
- When asked to rank what WSDOT should prioritize as a transportation goal, more than 50-percent of respondents indicated "safety."

The survey also revealed the following information:

- The primary mode of transportation was a personal vehicle at 97 percent. Public transit was reported at 1.75 percent.
- 37 percent of people used the interstate to commute to/from work with 50 percent using the interstate for local travel (errands, recreation)
- 25 percent merge onto I-5 at Cook Road/Sedro-Woolley with up to 15 percent exiting the system at the same location.
- When asked how their travel routines changed over the past year (COVID-19) 37 percent indicated reduced work trips and a 51 percent increase in home delivery services. 22 percent reported an increase in walking and biking.

See Appendix A for more information on the public and stakeholder outreach.

Study summary and recommendations

The purpose of the study was to determine if the corridor is meeting regional mobility and safety performance expectations. And, second to determine if performance was not being met, what steps or measures should be taken to address identified problems and needs.

The I-5 study corridor is about 9-miles long and has eight interchanges with thirty on-and off-ramps that serve the community and regional travel through the urban areas of Mount Vernon and Burlington. The analysis included a review of existing conditions (pre-COVID) on the I-5 mainline using performance metrics for traffic, safety and ramp operations. The analysis also included an assessment of I-5 on-ramp geometrics. Outreach to the community and key stakeholder was an important component of the study.

Study summary

The study analysis revealed that some corridor segments are not performing within expectations. The traffic operations analysis, safety analysis and merge threshold analysis revealed that there are some segments on the corridor that experience higher vehicle density and poor levels of service both in regards to traffic, ramp operations and crashes. The general locations include Kincaid Street (exit 226) to George Hopper (exit 229) northbound and SR 20 (exit 230) to Kincaid Street (exit 226) southbound as indicated on the heat maps located on the following pages and Exhibits:

- Page 6 Exhibit D. northbound and E. southbound traffic operations LOS and density during peak traffic periods 3 to 6 p.m.
- Page 8 and 9 Exhibit J. northbound p.m. peak crashes and L. southbound p.m. peak crashes.
- Page 11 Exhibit N. Northbound Lane Volume Threshold Analysis and Figure O. Southbound Lane Volume Threshold Analysis.

Additionally, the Highway Safety Manual Analysis revealed that while the majority of the corridor was performing better than the average freeway in Washington State two areas stood out as performing worse than the average freeway. These locations included:

- SR 538/College Way to South of George Hopper Road (MP 227.52-228.50), which is roughly a 1-mile segment and is experiencing an excess fatal and serious injury crash frequency (K+A) of 0.22 crashes per year, or 1 excess fatal/serious crash approximately every ~4.5 years.
- SR 20 vicinity (MP 229.81-230.60), which is a roughly 0.8-mile segment and is experiencing an excess fatal and serious injury crash frequency (K+A) of 0.17 crashes per year, or 1 excess fatal/serious crash every 6 years.

It is also interesting to note, that about 24-percent more vehicles (73,000 ADT) were entering the urban area of Mount Vernon and Burlington from the south than exiting the study area north at Cook Road (54,000 ADT). There was also a 10-percent jump in vehicle operations (81,000 ADT) at the Skagit River Bridge near interchanges with major commercial/retail business at College Way (exit 227) and George Hopper (exit 229). The increase in traffic at these locations may have influenced traffic mobility and safety in the corridor between Kincaid Street and George Hopper Road. The pattern suggests that the Skagit River Bridge may influence travel behavior.

In Addition, it should be noted that the baseline analysis did not consider the impacts of future population growth in the study area and therefore it may be prudent to explore the impacts of future growth on the regional transportation system. For example, residential and industrial growth is expected to continue at the current rate of growth at the Skagit Regional Airport and City of Anacortes west of Burlington on SR 20, and east of Burlington on SR 20 and Cook Road at Sedro-Woolley and beyond.

Recommended actions

1) Was a problem or need identified on the I-5 corridor within the study area?

Yes, based on the existing conditions analysis congestion and safety issues were identified on the I-5 corridor with more congestion occurring northbound on I-5 between Kincaid Street and George Hopper Road, with safety performance performing worse southbound on I-5 near SR 538/College Way to George Hopper Road and the SR 20 vicinity.

2) Should further analysis be conducted to develop feasible alternatives to address problems identified during the analysis on I-5?

Based on the results of the I-5 Baseline Analysis additional review of some or all of the initial study area should be investigated to help determine improvement measures needed to address existing and future capacity and safety challenges identified in the corridor.

3) Should the study area be resized to address the specific problems and needs identified in the Study?

The analysis revealed that many segments both northbound and southbound on I-5 in the study area had capacity and safety challenges during peak travel periods of the day. The primary locations were located between Kincaid Street (exit 226) to George Hopper Road (exit 229) northbound, and SR 20 (exit 230) to Anderson Road Street southbound. Additionally, while the existing conditions analysis did not reveal significant traffic operations or safety problems at Cook Road the Merge Lane Volume Threshold Analysis indicated that traffic density may be increasing above the 1700 vehicle/lane/hour threshold. Cook Road was also identified during the stakeholder survey as one of three areas of concern. The other two areas mentioned in the survey included the I-5 Skagit River Bridge and College Way, which were also identified as problems in the technical analysis.

Based on the existing conditions analysis the area most impacted from congestion and safety challenges included an area between Kincaid (exit 226) and SR 20 (exit 230) northbound and SR 20 to Anderson Road (exit 225) southbound. In addition, to the traffic operations analysis and safety analysis the Skagit Regional Transportation Plan included several interchange transportation projects at Cook Road (exit 232), George Hopper Road and Old Highway 99 (exit 224) to address local traffic issues on the regional transportation network.

With the factors noted in the report and the issues addressed below, the Leadership Team recommended that further analysis was needed in the initial study area to determine future conditions and identify potential solution strategies to address problems and needs identified in the corridor.

- The corridor analysis only included an existing conditions assessment and did not factor in future growth needs.
- Urban type growth is already occurring between Anderson Road and Old 99 Highway, and between SR 11 to Cook Road which is expected to continue due to the limitations for industrial growth in the urban area.
- There is significant traffic operations occurring between SR 11 and Cook Road and this will only increase as Sedro-Woolley and areas to the east and west continue to encourage more residential and industrial growth. Additionally, the ramp geometric assessment indicated that the southbound onramp was inadequate and should be evaluated together with proposed improvements of the Cook Road interchange.

Appendix Index

Appendix A Communications and Stakeholder Outreach

- Stakeholder Engagement Summary
- Stakeholder Survey
- Communications and Stakeholder Engagement Strategy

Appendix B I-5 Traffic Operations

- I-5 Traffic Operations Analysis Technical Report

Appendix C I-5 Safety Assessment

- I-5 Mount Vernon/Burlington Crash Analysis

Appendix D Interstate Ramp Operations and Geometric Analysis

- I-5 Traffic Operations: Merge Lane Volume Threshold Analysis