The Transpo Group

MEMORANDUM

Date:	May 28, 2008	**TG:**	06229.01
To:	Gary Davis, Whatcom County		
From:	Jamal El Zarif, PhD, Transpo Jon Pascal, P.E., PTOE, Transpo		
Subject:	Foothills Subarea Transportation Analysis – Summary of Results		

Whatcom County is currently completing a Supplemental Environmental Impact Statement (SEIS) to evaluate the impacts associated with increased development in the Foothills Subarea, located in the northeast portion of the County. Transpo was directed to complete an evaluation of the relative differences between the three proposed land use alternatives and document the level of mitigation likely required to address intersection safety issues and traffic operational delays associated with the proposed land use alternatives. Since the transportation analysis focused specifically on the relative differences between the alternatives in terms of future traffic operations, an existing conditions analyses and a review of the other travel modes was not included in the analysis.

This memorandum summarizes the results and findings of the transportation analysis.

What Are The Conclusions Of This Analysis?

The main findings of the transportation analysis include the following:

- The evaluation of the relative differences between the three proposed land use alternatives indicates the level of mitigation likely required to address intersection safety issues and traffic operational delays is slightly different between the alternatives.
- Five intersections are forecast to operate poorly by 2022 regardless of the amount of development in the Foothills Subarea. These locations are influenced by increased background growth outside the subarea.
- Each of the three alternatives will impact at least 8 of the 16 study intersections, whereby some level of mitigation is necessary by 2022 to address intersection safety and operational issues.
- Alternative 1 results in the highest amount of impacts, with ten of the study intersections needing some level of mitigation.
- The number of deficient intersections would decrease to nine and eight intersections under alternatives 2 and 3, respectively.

- Many of the mitigation measures are expected to be traffic control improvements at state highway intersections. These improvements could include a traffic signal or roundabout and need to be more closely evaluated as the need arises.
- All mitigation measures required are intersection improvements that consist of either installation of traffic signal/roundabout and/or channelization improvements such as adding right and left turn lanes. No further widening is required along roadway segments connected to those intersections other than the addition of new turn lane pockets at intersection approaches.
- Seasonal variation in traffic volumes could impact the scope of the resulting mitigation improvements. Additional improvements are likely needed if traffic volumes fluctuate by more than 10 percent over those assumed as part of this analysis.

How Was The Transportation Analysis Conducted?

The scope of the analysis focused on the evaluation of future roadway and intersection traffic operations and the resulting capacity projects that would be needed to address intersection safety and operational delays. Travel forecasts were developed for Year 2022 for each of the three land use alternatives. Possible mitigation measures were then evaluated to address those locations that were anticipated to operate poorly in 2022.

The study area was agreed upon with Whatcom County staff and included the areas east of the Hannegan Road corridor. A total of 16 study intersections were identified for evaluation and are shown in Figure 1. Many of the intersections were with state highways or City of Bellingham arterials. A traffic operation analysis for the 2022 weekday PM peak hour traffic was conducted for each study intersection. Future traffic operations were evaluated by adding Foothills development-generated traffic for each of the alternatives to future background traffic volumes. Development-generated impacts were identified based on the difference in traffic operations between forecasted with- and without-development conditions.

What Alternatives Were Evaluated?

Based on alternative descriptions provided by Whatcom County, the Foothills SEIS is evaluating the following land use alternatives:

Alternative 1 - Subarea Plan Land Use Designation: Under this alternative, the comprehensive plan and zoning designations would follow the growth scenario set by the Draft Foothills Subarea Plan (October 2007). Population projection has been adjusted from 2027 horizon of the Subarea Plan to 2022 for purpose of consistency with the Comprehensive Plan planning year of 2022 and to maintain consistency between alternatives. Population is expected to grow from 6,700 to about 10,000

residents (49 percent by 2022). Employment will grow in the subarea as projected in the high growth scenario with an increase of approximately 700 jobs by year 2022.

Alternative 2 - No Action, Existing Land Use Designations: This alternative assumes that the comprehensive plan and zoning designations would not be changed and would be consistent with the existing Comprehensive Plan and Official Zoning Ordinance maps. Population by year 2022 is expected to increase by 36 percent to reach 9,100 residents. Employment will follow the medium growth scenario, thus adding about 500 jobs to the subarea by 2022.

Alternative 3 - LAMIRD Land Use Designations: Under this alternative the Columbia Valley UGA would be designated as a Limited Area of More Intensive Rural Development (LAMIRD). The areas designated as Small Towns and Resort/Recreational Subdivisions in Deming, Kendall, Maple Falls and Glacier would be reduced in size. The land use growth is anticipated to be the lowest among all alternatives with residential population only increasing by 1,300 people (19 percent). Employment in the subarea would follow the low growth assumption with 330 new jobs by 2022.

Table 1 provides a summary of land use growth projections for each of the three alternatives. More detailed land use projections can be found in Appendix A (Foothills SEIS – Summary of Alternatives).

How Was The Growth Allocated?

The Draft Foothills Subarea Plan divides the subarea into five areas: Columbia Valley UGA, Glacier, Maple Falls, Deming and the remaining areas. As Table 1 shows, the growth alternatives project residential growth at an area level. However, no similar geographic distribution among the five areas was made for employment projections. Therefore, it was agreed upon with County staff that retail and government employment would be distributed among the areas following the same distribution of the population. For industrial employment, it was assumed that 80 percent of the projected employment growth would occur in the Columbia Valley UGA, and the remaining 20 percent would be distributed among the rest of the areas evenly.

Table 2 provides the allocation of land use growth by 2022 for each of areas in the Foothills Subarea.

Table 1. Alternative Land Use Projections

Area	2006 Population	Year 2022 Population Projection		
		Alternative 1	Alternative 2	Alternative 3
Columbia Valley UGA	3,853	6,346	5,833	4,925
Glacier	284	367	325	307
Maple Falls	213	244	244	230
Deming	220	252	252	238
Remaining Subarea	2,152	2,781	2,466	2,327
Total Population	6,722	9,990	9,120	8,027
Employment Category	**2007 Employment***	**Year 2022 Employment Projection**		
		Alternative 1	**Alternative 2**	**Alternative 3**
Retail and Services	428	700	633	582
Industrial	221	350	316	291
Government	962	1,283	1,160	1,068
Total Employment	1,611	2,333	2,109	1,941

Source: Whatcom County, Foothills SEIS – Summary of Alternatives– Draft 1/9/2008.

* 2007 Employment numbers are for Alternative 3. Refer to Appendix A for more detailed data.

Table 2. 2022 Land Use Growth by Area

Area	Residential Dwelling Unit	Employment		
		Retail & Services	Industrial	Government
Alternative 1				
Columbia Valley UGA	894	200	100	228
Glacier Area	42	7	6	8
Maple Falls Area	13	2	6	3
Deming Small Town	13	3	6	3
Remaining Subarea	278	51	6	58
Total Alternative 1	**1,240**	**263**	**124**	**300**
Alternative 2				
Columbia Valley UGA	710	166	73	156
Glacier Area	21	3	5	3
Maple Falls Area	13	3	5	2
Deming Small Town	13	3	5	3
Remaining Subarea	139	26	5	25
Total Alternative 2	**896**	**201**	**93**	**189**
Alternative 3				
Columbia Valley UGA	385	126	54	88
Glacier Area	12	3	4	2
Maple Falls Area	7	2	4	1
Deming Small Town	7	2	4	1
Remaining Subarea	78	21	4	14
Total Alternative 3	**489**	**154**	**70**	**106**

Source: Based on Foothills SEIS – Summary of Alternatives– Draft 1/9/2008 and discussions with County staff.

How Were The Travel Forecasts Developed?

Travel forecasts for Year 2022 were developed based upon the estimated land use projections shown in Table 2. The travel forecasts are described by the amount of PM peak hour vehicle trips and consist of two components:

1. **Background Traffic:** The existing number of vehicles along the roadway combined with a growth in vehicle trips caused by development external to the Foothills Subarea. The background traffic accounts for no additional traffic generated within the Foothills Subarea beyond the amount that exists today.
2. **Subarea Growth Generated Traffic:** The additional number of new vehicle trips generated by new development within the Foothills Subarea by each land use alternative.

The resulting PM peak hour traffic forecasts by alternative were calculated by combining the background traffic with the new traffic generated under each alternative.

How Was Background Traffic Growth Estimated?

Existing traffic volumes at the study intersections was the starting point of estimating background traffic. Traffic counts collected at the study intersections between 2005 and 2007 were provided by Whatcom County. Many of these traffic counts were obtained from the Traffic Impact Analysis (TIA) prepared for the Balfour Village development in the Columbia Valley UGA (October 2007). Other counts were provided by the Washington State Department of Transportation (WSDOT) to supplement information from the Balfour Village TIA.

The Whatcom Council of Government's (WCOG) travel demand model was utilized to assist in estimating the growth in background traffic. The base year model is Year 2005 and the horizon year model represents Year 2027. Each of the transportation analysis zones (TAZs) comprising the Foothills Subarea were identified within the model. The growth in background traffic was identified by keeping the land use in the 2027 horizon year model consistent with the 2005 estimates for all TAZs within the Foothills Subarea. By not assuming any growth in those respective TAZs, the growth in background traffic could be identified and isolated from any new traffic that might be generated by future development within the Foothills Subarea. The process provided a reasonable estimate in background traffic growth without double counting growth related traffic in the Foothills Subarea.

Using the results from the modified 2027 model, the traffic forecasts for all major roadway segments east of Hannegan Road were compared to the existing 2005 model volumes. Based on the difference between the existing and future model volumes, the average annual background traffic growth was derived for each roadway segment as shown in Table 3.

Table 3. Average Annual Background Traffic Volume Growth on Major Roadway Segments

Roadway Segment	Two-Way PM Peak Hour Traffic Volumes		Average Growth Rate per Year
	2005 Model	Modified 2027 Model	
SR 542 e/o Maple Falls	440	552	1.0%
Kendall Road n/o Wheeler Road	458	492	0.3%
Nooksack Road s/o Massey Road	106	127	0.8%
South Pass Road e/o Nooksack Road	92	145	2.1%
Everson-Goshen Road n/o Smith Road	391	572	1.7%
Pole Road e/ o Hannegan Road	584	786	1.4%
Hannegan Road n/o Pole Road	1,026	1,404	1.4%
Hannegan Road s/o Kelly Road	2,024	2,355	0.7%
Mt Baker Highway ne/o Valley Hwy	1,038	1,134	0.4%
Mt Baker Highway n/o Smith Road	2,159	2,542	0.7%
SR 9 e/o Lawrence Road	1,582	1,814	0.6%
Smith Road w/o Mt Baker Hwy	885	1,098	1.0%
SR 542 e/o Hannegan Road	1,707	2,183	1.1%
Total	**14,497**	**17,231**	**0.8%**

Source: WCOG Models 2005 and 2027 (modified)

Generally the average annual growth rates were calculated to be between 0.3 to 2.1 percent. On average, the growth in background traffic was approximately one percent based on a summation of the data. The one percent a year average growth rate was applied to existing traffic counts to calculate the background traffic for Year 2022.

How Was Development-Generated Traffic Estimated?

PM peak hour traffic volumes were estimated for each land use alternative using average vehicle trip rates by land use category. The trip generation rates are expressed by Dwelling Unit (DU) for residential land use and by Employee for retail, industrial and government land use categories. The trip rates were based on information specified in the *Institute of Transportation Engineers (ITE) Trip Generation, 7th Edition (2003*). For the retail category, rates were taken from the *Application of Trip Generation Rates (1985).*

The SEIS land use alternatives are not specific to the type of actual retail or industrial development that might take place at a particular location, such as a restaurant, grocery store, etc. Therefore, the resulting trip rates were based on the following ITE land use types:

- The residential category is represented by Detached Single Family, Apartments and Condos/Townhouse land use types (Land Use Codes (LUC) No. 210, 220 and 230 respectively).
- Retail category is represented by the Shopping Center (LUC No. 820).

- The industrial category was represented by the Light Industry and Industrial Park (LUC No. 110 and 130).
- Government category is represented by General Office Building and Government Office Complex (LUC No. 710 and 733).

Table 4 lists the average trip generation rates by land use category used in calculating the resulting PM peak hour vehicle trips generated by each alternative.

Table 4. Average Trip Generation Rates by Land Use Category

Land Use Category	ITE Land Use Type	Average Trip Rate per Land Use Category			
		Unit	In	Out	Total
Residential	210, 220, 230*	DU	0.60	0.32	0.92
Retail	820	Employee	2.28	2.42	4.70
Industrial	110, 130	Employee	0.09	0.35	0.44
Government	710, 733	Employee	0.15	0.48	0.63

Source: Based on *ITE* Trip *Generation, 7th Edition* (2003) and *Application of Trip Generation Rates* (1985).
*Assuming 80% of dwelling units are Detached Single Family, 10% Condos/Townhouses and 10% Apartments

What Adjustments Were Made To Trip Generation?

The individual trip generation rates shown in Table 4 assume that all patrons and visitors would drive to/from the development site. However, it is likely that land uses would attract one another, with a portion of the trips internally-captured and therefore never leaving the area. *ITE Trip Generation Handbook* presents internal capture rates between three pairs of land uses only: retail, office and residential. No data is available for other land use categories like industrial land uses. Appendix B shows the internal captured rates among land use categories recommended by *ITE Trip Generation Handbook (2004)* for multiple land uses expressed by percentages of total origin and destination trip ends.

Based on the information documented in Appendix B, internal capture rates were applied to retail, residential and government land uses. No internal capture rates were applied to the industrial land uses since there is little documentation and research to support such an assumption. The resulting internal capture rates were only applied to the land uses in the Columbia Valley UGA. For other the areas, it was assumed that they are less urbanized and would likely not support or generate a significant amount of internal trips.

How Many Vehicle Trips Are Generated By the Proposed Alternatives?

The total number of new PM peak hour vehicle trips produced by each land use alternative was estimated by using the trip rates listed in Table 4 and the internal capture rates in Appendix B. Table 5 provides a summary of the number of vehicle

trips generated by each area under the three land use alternatives. The information is broken down by the number of trips generated and destined (In and Out) to each area.

Table 5. Number of New PM Peak Hour Vehicle Trips by Alternative

Area	Alternative 1			Alternative 2			Alternative 3		
	In	Out	Total	In	Out	Total	In	Out	Total
Columbia Valley	839	756	1,595	674	599	1,273	435	402	837
Glacier Area	43	37	80	20	17	37	14	13	27
Maple Falls Area	14	12	26	15	14	29	9	8	17
Deming Small Town	16	14	30	15	14	29	9	8	17
Remaining Subarea	293	243	536	146	122	268	97	84	181
Total	**1,205**	**1,062**	**2,267**	**870**	**766**	**1,636**	**564**	**515**	**1,079**

Source: The Transpo Group (2008)

The resulting information shown in Table 5 is consistent with the amount of land use growth assumed under each alternative. Alternative 1 would generate approximately 2,270 vehicle trips, whereas alternatives 2 and 3 would generate around 1,640 and 1,080 vehicle trips, respectively. Alternatives 2 and 3 generate significantly fewer trips than Alternative1 by approximately 28 and 52 percent, respectively. The detailed trip generation process by land use type for the three alternatives is presented in Appendix C.

How Were The Growth Trips Distributed?

The WCOG Travel Model was used to support trip distribution assumptions for subarea generated traffic. The trip distribution patterns for the five areas within the Foothills Subarea were estimated by using the WCOG model. Figures 2 to 6 display the approximate vehicle trip distribution assumed for each land use alternative. The City of Bellingham is a major attraction with approximately one-third of Foothills generated traffic destined to or originating from Bellingham. The Mount Baker Highway (SR 542) serves as the primary roadway to and from the subarea and is estimated to handle approximately three-quarters of the Foothills growth related traffic.

The Foothills generated PM peak hour vehicle trips for each land use alternative were assigned to the study intersections by using the trip distribution patterns shown in Figures 2 to 6. The traffic volumes associated with each study intersection are presented in Figure 7 and only include the new growth related traffic under each land use alternative.

What Are The Traffic Volume Forecasts?

The forecast traffic volumes for the 2022 horizon year were estimated for each of the study intersections by adding the traffic volumes generated by the land use alternatives

(shown in Figure 7) to the estimated amount of background traffic. The 2022 PM peak hour traffic volumes are illustrated in Figure 8. The figure includes estimates of 2022 traffic volumes for each of the alternatives.

How Were The Traffic Impacts Evaluated?

The traffic impacts caused by each land use alternative were measured by evaluating the intersection level of service at the study intersections. Year 2022 intersection level of service, delays, and volume-to-capacity (v/c) ratios were calculated based on the traffic volumes shown in Figure 8. The traffic operations analysis is based on methodologies contained in the *Highway Capacity Manual 2000*. LOS and average delays at intersections were calculated using *Synchro* (version 6.0).

The operational characteristics of an intersection are determined by calculating the intersection's level of service (LOS). The intersection as a whole and its individual turning movements can be described alphabetically with a range of levels of service (A through F), with LOS A indicating free-flow traffic and LOS F indicating congestion and long vehicle delays. LOS is measured in average control delay per vehicle and is typically reported for the intersection as a whole at signalized and all-way stop control intersections. The LOS of the two-way stop controlled intersections is expressed by the LOS of the worst intersection movement. Control delay is defined as the combination of initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

For Whatcom County's roads, LOS standards are based on a roadway volume to capacity (v/c) ratio by road classification. The premise being that different classes of roads serve different functions. Since roadway v/c ratios were likely not to be an issue under any alternative in 2022, intersection operations were analyzed to compare impacts between the alternatives and define appropriate mitigation measures. The minimum LOS values that have been defined are consistent with the functional classification of the roadway. Therefore, LOS C or better is considered an acceptable intersection operation for intersections located on Minor Collector roads and LOS D or better for intersections located at Major Collector roads. For state highways, the analysis considers LOS C or better for intersections in rural areas, and LOS D or better in urban areas (as per the Comprehensive Plan LOS standards for state facilities p. 4-6).

What Are The Traffic Impacts Under Each Alternative?

The traffic operations analysis results are shown in Table 6 and include the resulting intersection LOS for each land use alternative. Also included in the table is a baseline alternative that assumes no growth in the Foothills Subarea. The baseline alternative provides a reference point to help determine the improvements triggered under each alternative. The minimum LOS value used to compare the results against is also listed in the table.

Table 6 shows that if no growth took place in Foothills Subarea, as shown under the baseline alternative, approximately five out of the sixteen intersections would operate below the minimum LOS value. The number of intersections operating below the minimum LOS value would increase to ten by 2022 under Alternative 1. For alternatives 2 and 3, the number of intersections operating below the minimum LOS value would decrease to nine and eight, respectively, as shown in Table 6. Appendix D contains detailed LOS worksheets of the 2022 PM peak hour operations for the baseline and the three land use alternatives.

Table 6. Year 2022 Intersection Level of Service (LOS) by Alternative (PM Peak Hour)

Int. #	Intersection	Baseline[5]			Alternative 1			Alternative 2			Alternative 3			Min LOS Value
		LOS[1]	Delay[2]	v/c or WM[3]	LOS	Delay	v/c or WM	LOS	Delay	v/c or WM	LOS	Delay	v/c or WM	
1.	S Pass Rd/Kendall Rd	A	7	SB	A	9	NB	-[4]	-	-	-	-	-	C
3.	SR 542/Kendall Rd	A	10	NB	**F**	**72**	**NB**	**D**	**32**	**NB**	B	13	NB	C
4.	SR 542/SR 9	C	19	NB	**F**	**>200**	**NB**	**F**	**>200**	**NB**	**F**	**>200**	**NB**	C
5.	S Pass Rd/Nooksack Rd (West)	C	21	SB	**D**	**27**	**SB**	C	25	SB	**-**	**-**	**-**	C
6.	SR 542/Lawrence Rd	**F**	**99**	**SB**	**F**	**>200**	**NB**	**F**	**>200**	**SB**	**F**	**>200**	**SB**	C
7.	SR 542/E Smith Rd	**F**	**98**	**EB**	**F**	**>200**	**EB**	**F**	**>200**	**EB**	**F**	**>200**	**EB**	C
8.	E Smith Rd/Everson-Goshen Rd	C	17	NA	**F**	**>200**	**EB**	**F**	**153**	**EB**	**F**	**80**	**EB**	D
9.	SR 542/Everson-Goshen Rd	C	16	SB	**F**	**74**	**SB**	**E**	**38**	**SB**	**D**	**26**	**SB**	C
10.	E Pole Rd/Hannegan Rd	**F**	**71**	**NA**	**F**	**91**	**NB**	**F**	**85**	**NB**	**F**	**80**	**NB**	C
11.	E Smith Rd/Hannegan Rd	B	18	0.83	D	52	1.05	-	-	-	**-**	**-**	**-**	D
12.	SR 542/Hannegan Rd	**F**	**111**	**0.98**	**F**	**121**	**1.16**	**F**	**111**	**1.12**	**F**	**108**	**1.08**	D
20.	SR 542/Silver Lake Rd	B	11	NB	B	14	NB	-	-	-	**-**	**-**	**-**	C
21.	S Pass Rd/Nooksack Road (East)	B	13	NB	B	15	NB	-	-	-	**-**	**-**	**-**	C
30.	E Sunset Dr/Britton Rd	**D**	**26**	**NB**	**F**	**199**	**NB**	**F**	**102**	**NB**	**F**	**55**	**NB**	C
31.	E Pole Rd/Everson-Goshen Rd	C	17	NB	C	18	NB	-	-	-	-	-	-	C
32.	E Sunset Dr/McLeod Rd	C	35	0.59	C	34	0.74	-	-	-	-	-	-	D

BOLD: Indicates a location operating below minimum LOS value.

1. Level of service, based on 2000 Highway Capacity Manual methodology.
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections, Worst movement reported for unsignalized intersections
4. The hyphen (-) indicates locations not analyzed because the intersections were shown to operate at or above minimum LOS value under Alternative 1.
5. Includes no growth in the Foothills Subarea and provides a comparison against to measure the impacts of each alternative.

What Mitigation Projects Would Be Needed To Address The Identified Intersection Deficiencies?

Based on the operations analysis performed for each of the alternatives, specific improvements are proposed to mitigate traffic operational impacts at those intersections below the minimum LOS value. Mitigation measures have been identified to reduce delay at the intersections and improve the overall level of service.

The proposed measures include mainly channelization improvements at intersections and installation of traffic signals as presented in Table 7. No roadway segments' widening is required other than the addition of new turn lanes pockets at intersection approaches.

Table 7 summarizes the mitigation improvements recommended at each intersection. It also includes the resulting LOS once the corresponding improvement has been made. Appendix E contains LOS worksheets of 2022 PM peak hour conditions with mitigation.

Table 7 shows that alternatives 1 and 2 require the same mitigation improvements at nine study intersections, with 6 of those locations showing a need for improved traffic control, such as a traffic signal. However, alternative 1 requires additional channelization improvements at the S Pass Road /Nooksack Road intersection (#5) to mitigate LOS D conditions, which is not needed under alternatives 2 or 3. Under alternative 3, the SR 542 / Kendall Road intersection requires no improvements where as in alternatives 1 and 2 a traffic signal is needed to address the LOS F and D conditions, respectively.

It should be noted that roundabouts could also be an alternative solution to increase intersection capacity and improve operating level of service for those locations that are shown for traffic signals.

Table 7. Mitigation Improvements by Alternative

Intersection		Possible Mitigation Improvement	2022 Post Mitigation LOS					
			Alternative 1[1]	LOS [2] (Delay)	Alternative 2	LOS (Delay)	Alternative 3	LOS (Delay)
1.	S Pass Rd/Kendall Rd	none						
3.	SR 542/Kendall Rd	Install traffic signal*	✓	A (6)	✓	A (5)		
4.	SR 542/SR 9	Install traffic signal*	✓	C (25)	✓	B (14)	✓	B (11)
5.	S Pass Rd/Nooksack Rd (West)	Separate SB right and left turn lanes	✓	C (18)				
6.	SR 542/Lawrence Rd	Install traffic signal*	✓	C (26)	✓	B (15)	✓	C (11)
7.	SR 542/E Smith Rd	Install traffic signal*, EB/WB LT lanes (Remove WBR lane), add SBR lane	✓	C (26)	✓	B (16)	✓	B (11)
8.	E Smith Rd/Everson-Goshen Rd	Install traffic signal*, EBL lane	✓	B (16)	✓	B (10)	✓	B(9)
9.	SR 542/Everson-Goshen Rd	Separate SBR and LT lanes, install traffic signal	✓	A (10)	✓	A (10)	✓	A (9)
10.	E Pole Rd/Hannegan Rd	LT lane at each approach, install traffic signal*	✓	C (20)	✓	A (8)	✓	A (8)
11.	E Smith Rd/Hannegan Rd	none						
12.	SR 542/Hannegan Rd	Dual Left turns, all approaches**	✓	D (45)	✓	D (43)	✓	D (42)
20.	SR 542/Silver Lake Rd	none						
21.	S Pass Rd/Nooksack Road (East)	none						
30.	E Sunset Dr/Britton Rd	Add EBR lane, install traffic signa*l	✓	B (19)	✓	B (17)	✓	B (11)
31.	E Pole Rd/Everson-Goshen Rd	none						
32.	E Sunset Dr/McLeod Rd	none						

1- **(*): A Roundabout could also be an alternate solution to a traffic signal improvement**

2- **(**): Because of potential geometric limitations at the intersection, further investigation for alternate capacity mitigation improvements could be required.**

3- **(✓): sign indicates that the proposed mitigation is required under the corresponding alternative**

4- A (6): Post mitigation level of service and average delay in seconds

Do Seasonal Variations In Traffic Volumes Impact The Resulting Mitigation?

The traffic volumes included in the analysis reflect average PM peak hour traffic for an average weekday. Unlike other regions where the seasonal peak usually occurs during the summer months, the peak season in the Foothills Subarea appears to occur in the winter. The Mount Baker Ski Area at the end of SR 542 likely attracts a higher number of vehicles during the winter months. However, no reliable information was found (including WSDOT annual traffic reports) to document the likely impacts of seasonal activities in relation to traffic volumes within the subarea. Therefore, a sensitivity test was completed to understand how an increase in traffic might further impact the operations at the mitigated intersections shown in Table 7.

This analysis was conducted by inflating traffic volumes under Alternative 1 (the alternative with the greatest amount of land use growth) by 10 percent. The inflated traffic volumes were used to evaluate intersection operations again at all study intersections. The results of the analyses are summarized in Table 8.

Table 8. Sensitivity Analysis Results – Year 2022 Intersection LOS (PM Peak Hour)

		Alternative 1 w/Mitigation			Sensitivity Test – Volumes +10%			Min LOS Value
	Intersection	LOS[1]	Delay[2]	v/c or WM[3]	LOS	Delay	v/c or WM	
1.	S Pass Rd/Kendall Rd	A	9	NB	A	9	NB	C
3.	SR 542/Kendall Rd	A	6	0.60	A	6	0.66	C
4.	SR 542/SR 9	C	25	0.96	**D**	**40**	**1.04**	C
5.	S Pass Rd/Nooksack Rd (West)	C	18	SB	C	22	SB	C
6.	SR 542/Lawrence Rd	C	26	0.96	**D**	**43**	**1.15**	C
7.	SR 542/E Smith Rd	C	26	0.94	**D**	**39**	**1.01**	C
8.	E Smith Rd/Everson-Goshen Rd	B	16	0.8	C	21	0.89	D
9.	SR 542/Everson-Goshen Rd	A	10	0.79	C	20	1.01	C
10.	E Pole Rd/Hannegan Rd	A	8	0.53	A	9	0.58	C
11.	E Smith Rd/Hannegan Rd	D	52	1.05	**F**	**86**	**1.17**	D
12.	SR 542/Hannegan Rd	D	45	0.82	**E**	**56**	**0.91**	D
20.	SR 542/Silver Lake Rd	B	14	NB	B	15	NB	C
21.	S Pass Rd/Nooksack Road (East)	B	15	NB	C	17	NB	C
30.	E Sunset Dr/Britton Rd	B	19	1.03	**E**	**62**	**2.21**	C
31.	E Pole Rd/Everson-Goshen Rd	C	18	NB	C	23	NB	C
32.	E Sunset Dr/McLeod Rd	C	34	0.74	C	32	0.78	D

1. Level of service, based on 2000 Highway Capacity Manual methodology
2. Average delay in seconds per vehicle.
3. Volume-to-capacity ratio reported for signalized intersections, worst movement reported for unsignalized intersections

The analysis indicates that six intersections would operate below the minimum LOS value during the PM peak hour if traffic volumes were to increase by another 10 percent over Alternative 1 estimates. However, only one intersection at E Smith Road / Hannegan Road (#11) would operate at LOS F. To mitigate this deficiency, left turn lanes could be provided along the east and west approaches. This type of improvement would bring the level of service back to LOS D. The other five intersections would be operating below the minimum LOS value during PM peak hour in peak season but at level of service D or E. No further mitigation is recommended at these intersections because the County is not required to mitigate based on peak season demand.