

MEMORANDUM

DATE: September 3, 2015

TO: Rachel Nathansn, Nathanson Associates

CC: Jerry Henke, Muckleshoot Indian Tribe

FROM: Michael Read, PE, Principal, TENW

SUBJECT: Salish Lodge Expansion – Traffic Analysis Addendum for Increased Residential Density
TENW Project No. 3420

This memorandum summarizes the results of a study addendum to the traffic impact analysis associated with a *Salish Lodge Expansion* project in Snoqualmie, WA. Upon completion, the project is proposed to include up to 250 hotel rooms, up to 33,250 square feet of meeting space, a 15,500 square feet fitness center, and an on-site restaurant/lounge area to support guest and meeting attendees. In addition, up to 175 residential units would be developed on properties north of the resort hotel, of which 15 percent would be built as affordable housing (a minimum of 27 units).

An as addendum to the original November 30, 2001, *Salish Lodge Expansion Transportation Impact Study*, and supplement to include residential on October 10, 2002, this evaluation is limited to an estimate of net changes in project vehicle trips that would be generated by the proposal and an operational analysis of the planned roundabout at the intersection of SR 202 and Tokul Road/Mill Pond Road intersection group by the City of Snoqualmie. Traffic operational analysis is based on traffic projections and planned geometric configuration of the planned roundabout as outlined in the *SR 202/Tokul Road Improvement Project, Roundabout Analysis*, HDR, January 2009, per the City of Snoqualmie.

Project Trip Generation

Average trip rate equations compiled by the Institute of Transportation Engineers (ITE) *Trip Generation, 9th Edition*, 2012, were used to estimate daily and p.m. peak hour traffic that would be generated by the proposed development assuming the proposed resort hotel/conference center and up to 148 Single Family Homes lots (ITE Land Use Code 210) and up to 27 Condominium/Townhome units (ITE Land Use Code 230).

As shown in **Table 1**, an estimated total of approximately 3,270 daily and 415 p.m. peak hour vehicular trips (160 entering and 255 exiting) are estimated to be generated at full build-out of the project with up to 175 residential units. This is approximately 470 additional daily and 55 additional p.m. peak hour trips more than previously evaluated in the context of traffic impacts

under SEPA for the proposed Salish Lodge Expansion project. **Attachment A** provides a detailed calculation of vehicle trip generation.

Table 1
Salish Lodge Expansion Trip Generation Summary (175 Units)

Time Period	In	Out	Total
Weekday PM Peak Hour	160	255	415
<i>PM Peak Hour Net Increase from 110 Residential Units</i>	<i>+32</i>	<i>+23</i>	<i>+55</i>
Weekday Daily	1,635	1,635	3,270
<i>Weekday Daily Net Increase from 110 Residential Units</i>	<i>+235</i>	<i>+235</i>	<i>+470</i>

Source: Trip Generation Manual, 9th Edition, ITE, 2012.

Roundabout Analysis

Intersection level of service (LOS) analyses at the planned roundabout intersection of SR 202 at Tokul Road/Mill Pond Road was conducted during the weekday PM peak hour using a 2026 horizon year. Comparative traffic operational analysis included scenarios of buildout at the Salish Lodge Expansion under current entitlement (i.e., resort hotel/conference with 110 residential units) and increased residential density (i.e., resort hotel/conference with 175 residential units).

LOS refers to the degree of congestion on a roadway or intersection. It is a measure of vehicle operating speed, travel time, travel delays, and driving comfort. A letter scale from A to F generally describes LOS. At signalized intersections, LOS A represents free-flow conditions-motorists experience little or no delays, and LOS F represents forced-flow conditions-motorists experience an average delay in excess of 80 seconds per vehicle. The LOS reported for signalized intersections represents the average control delay per vehicle entering the intersection. The LOS reported at stop-controlled or yield intersections (such as roundabouts), is also based on the average control delay (seconds/vehicle) and is reported for each movement or approach group. The reported LOS at unsignalized stop-controlled intersections does not represent a measure of the overall operations of the intersection as major street flows are in free flow conditions. Roundabouts however, have yield, or in some cases stop controlled movements, on all approaches of the intersection, and therefore an overall performance or LOS for the intersection as a whole can be determined.

LOS calculations for the SR 202 at Tokul Road/Mill Pond Road roundabout intersection was calculated using the methodologies and procedures outlined in the 2010 *Highway Capacity Manual (HCM)*, Special Report 209, Transportation Research Board (TRB). For reference, **Table 2** outlines the LOS criteria for signalized and unsignalized intersections based on these methodologies.

As summarized in **Table 3**, with the increase in residential density at the proposed Salish Lodge Expansion from 110 units to 175 units, average delay would increase at the SR 202 and Tokul Road/Mill Pond Road intersection by approximately 1 second per vehicle in 2026. With the project in 2026, the planned single-lane roundabout would operate at LOS C with an average

Table 2 - Level of Service Criteria for Signalized and Unsignalized Intersections

Level of Service	Signalized Intersection	Unsignalized Intersection
	Average Delay Range (sec)	Delay Range (sec)
A	≤ 10	≤ 10
B	> 10 to ≤ 20	> 10 to ≤ 15
C	> 20 to ≤ 35	> 15 to ≤ 25
D	> 35 to ≤ 55	> 25 to ≤ 35
E	> 55 to ≤ 80	> 35 to ≤ 50
F	> 80	> 50

Source: "Highway Capacity Manual", Special Report 209, Transportation Research Board, 2010.

delay of approximately 15 seconds per vehicle, meeting adopted LOS standards of the City of Snoqualmie. Detailed LOS summary worksheets and 2026 turning movement assumptions under each scenario are provided in **Attachment B**.

Table 3: 2026 PM Intersection Level of Service Impacts with Buildout of Salish Lodge Expansion

Study Intersection	PM Peak Hour with 110 Units			PM Peak Hour with 175 Units		
	LOS	Delay (sec)	V/C Ratio	LOS	Delay (sec)	V/C Ratio
SR 202 at Tokul Rd/Mill Pond Rd <i>Roundabout Treatment - Single Lane</i>	B	14.2	--	C	15.3	--
Eastbound Approach (SR 202)	C	17.4	0.71	C	18.8	0.73
Westbound Approach (SR 202)	A	8.2	0.14	A	8.6	0.15
Northbound Approach (SR 202)	B	12.3	0.64	B	13.3	0.67
Southbound Approach (SR 202)	B	13.4	0.44	B	14.5	0.48

Source: TENW using Synchro 8.0.

Conclusions

The proposed *Salish Lodge Expansion* was evaluated for increased traffic demands and intersection operations under a potential residential buildout of 175 units, an increase from the previous analysis of 110 units. A net increase of approximately 415 daily and 55 p.m. peak hour vehicular trips would result. With buildout by 2026, the planned single-lane roundabout at SR 202 and Tokul Road/Mill Pond Road intersection would operate at LOS C (average delay of approximately 15 seconds per vehicle), meeting adopted LOS standards of the City of Snoqualmie.

In comparison to the original *Salish Lodge Expansion Transportation Impact Analysis*, November 2001, TENW, that served as the basis for the SEPA determination with buildout of 110 residential units, the projected level of service at the Tokul Road/SR 202 intersection would improve from an LOS D (with a signal) to an LOS C under the proposed consolidated intersection and roundabout treatment with buildout of 175 residential units. As such, no significant adverse traffic impacts would occur with increased residential density of up to 175 units at the proposed *Salish Lodge Expansion* project.

Attachment A
Detailed Project Trip Generation Estimates

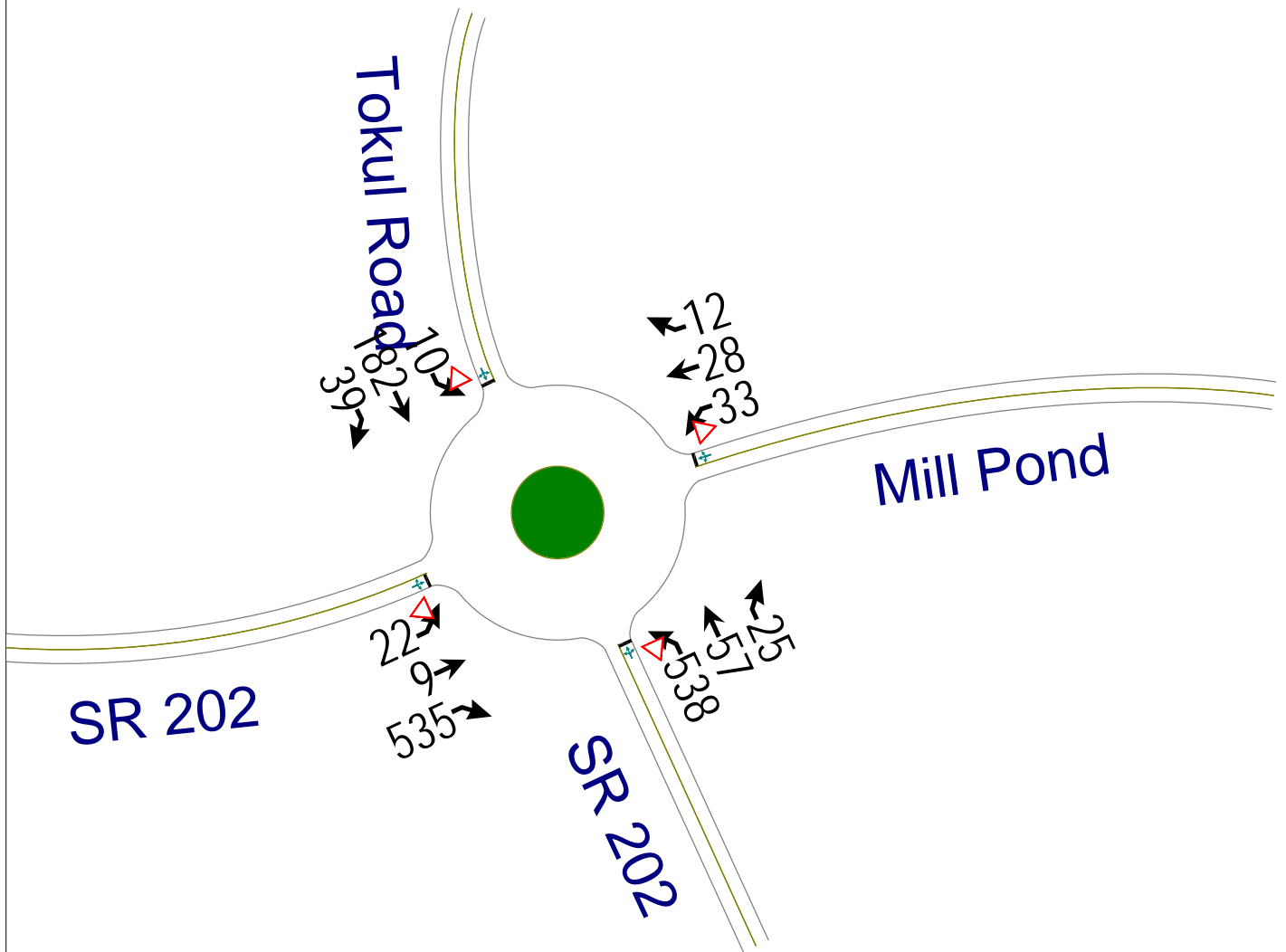
Salish Lodge Expansion - Trip Generation Analysis of 175-Unit Development Scenario

Land Use	ITE Code	Units/Size	Daily	PM	Enter	Exit
Townhomes (Owner Occupied)	230	27	155	14	9	5
SF Detached	210	148	1,415	150	95	56
Resort Hotel/Conference (250-room with Conf. Center)	Activities-based		<u>1,700</u>	<u>250</u>	<u>56</u>	<u>194</u>
	Totals	175	3,270	415	160	255
<i>October 2012 Site Trip Generation</i>			<i>2,800</i>	<i>360</i>	<i>128</i>	<i>232</i>
Net Increase			470	55	32	23

Source: ITE Trip Generation Manual, 9th Edition, 2012.

Attachment B

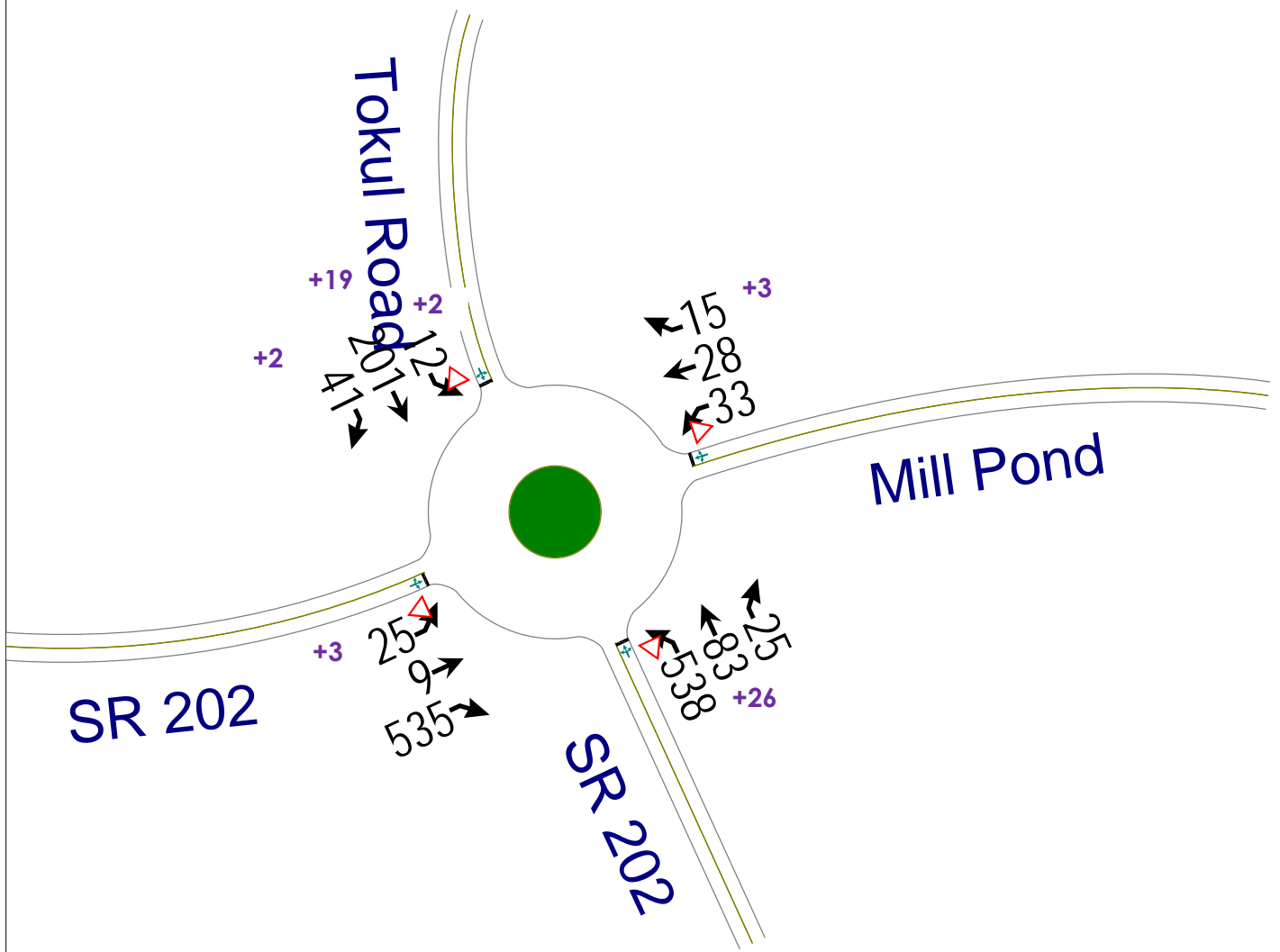
2026 PM Peak Hour Turning Movements and Intersection Level of Service Calculations



HCM 2010 Roundabout
 3: SR 202 & Mill Pond & Tokul Road

7/9/2015

Intersection				
Intersection Delay, s/veh	14.2			
Intersection LOS	B			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	616	79	674	251
Demand Flow Rate, veh/h	628	81	687	256
Vehicles Circulating, veh/h	250	683	45	665
Vehicles Exiting, veh/h	671	49	833	99
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	17.4	8.2	12.3	13.4
Approach LOS	C	A	B	B
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	628	81	687	256
Cap Entry Lane, veh/h	880	571	1080	581
Entry HV Adj Factor	0.981	0.980	0.981	0.981
Flow Entry, veh/h	616	79	674	251
Cap Entry, veh/h	863	559	1060	570
V/C Ratio	0.714	0.142	0.636	0.441
Control Delay, s/veh	17.4	8.2	12.3	13.4
LOS	C	A	B	B
95th %tile Queue, veh	6	0	5	2



+ 32 enter
+ 23 exit
+ 55 total

Total Trips Added from 110 Unit Scenario

Intersection				
Intersection Delay, s/veh	15.3			
Intersection LOS	C			
Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	619	82	702	276
Demand Flow Rate, veh/h	632	84	715	281
Vehicles Circulating, veh/h	272	715	51	665
Vehicles Exiting, veh/h	674	51	853	134
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	18.8	8.6	13.3	14.5
Approach LOS	C	A	B	B
Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	632	84	715	281
Cap Entry Lane, veh/h	861	553	1074	581
Entry HV Adj Factor	0.979	0.981	0.982	0.981
Flow Entry, veh/h	619	82	702	276
Cap Entry, veh/h	843	542	1054	570
V/C Ratio	0.734	0.152	0.666	0.484
Control Delay, s/veh	18.8	8.6	13.3	14.5
LOS	C	A	B	B
95th %tile Queue, veh	7	1	5	3