



## TECHNICAL MEMORANDUM

**TO:** Bart Stepp, PE

**FROM:** Anne Sylvester, PTE  
Scott Sawyer, PE

**DATE:** April 4, 2014

**PROJECT #:** 0729.01

**SUBJECT:** Traffic Analysis of Improvement Options for SR 503 at Scott Avenue

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### 1. INTRODUCTION

The purpose of this memorandum is to present traffic analysis of improvement options at the intersection of SR 503 with Scott Avenue in the City of Woodland. Analysis includes the development of improved and/or expanded intersection channelization with either signal or roundabout traffic control.

Included in this memorandum are the following:

- 2012 and 2040 PM peak hour analysis of the existing intersection with stop control (no build condition)
- 2040 PM peak hour analysis with signalization and either a single or double eastbound left turn lane using traffic volumes prepared for the Scott Avenue Reconnection Project (SARP) with either Alternative 0 or Alternative 4a
- 2040 PM peak hour analysis with a roundabout and either a single or double eastbound left turn lane using the same SARP volumes
- 2015 Opening Year analysis with either a signal or roundabout with similar lane channelization options
- Sensitivity analysis to identify likely year of failure for either the signal or roundabout concept with a single eastbound left turn lane

Analysis assumptions and methods, along with key findings and conclusions are presented below.

### 2. EXISTING CONDITIONS

#### 2.1 Existing Geometrics

Figure 1 illustrates the vicinity of the SR 503 (Lewis River Road) and Scott Avenue intersection. As shown in this aerial photograph, SR 503 is a two-lane highway with a pavement width of approximately 30 feet. There are existing shoulders along this road that average approximately 3 feet in width. There is no on-street parking, bike lanes or sidewalks through the project area. Scott Avenue has a similar cross-section



**Figure 1. Project Vicinity**





and pavement width, and is stop sign-controlled at its intersection with SR 503. Scott Avenue meets SR 503 on the outside of an approximate 90-degree curve. South of this intersection, SR 503 curves again that creates a sight distance impairment approaching the intersection. There are several driveways in the immediate vicinity of the intersection.

## 2.2 Existing Traffic Volumes and Operations

Attachment A presents existing PM peak hour traffic volumes at this location for 2012. Based on these volumes with existing lane geometry and traffic control, 2012 intersection operating performance has been evaluated. The results of this analysis are summarized in Table 1. Operations analysis worksheets are included in Attachment B. As indicated in the table, the most critical movement is the stop-controlled eastbound left. This movement currently operates at Level of Service (LOS) D which is considered acceptable performance.

**Table 1. Scott Avenue at SR 503 Intersection Operational Summary for No Build Conditions**

Analysis Year	Alternative/Geometrics	Movement	PM Peak Hour Results			
			Delay	Volume/ Capacity	LOS	95 <sup>th</sup> % Queue
2012	Existing Geometry/Stop Control	All	3.7	0.44	A	--
		EBL	32.8	0.52	D	--
2040	Existing Geometry/Stop Control	All	>200	0.97	F	--
		EBL	>200	>1.50	F	--

## 3. FUTURE 2040 CONDITIONS

A design year of 2040 was selected for assessing future needs and developing improvement recommendations. This design year is consistent with the on-going planning and engineering work for the SARP which will influence future traffic volumes at the Scott Avenue intersection with SR 503. Development of traffic forecasts and evaluation of operations at this intersection focused on the PM peak hour. Analysis was conducted for the 2040 baseline condition which assumes that no improvements would be made. Analysis was also conducted for 2040 PM peak hour conditions with two improvement alternatives for reconnecting Scott Avenue. At the time of the analysis in this report, SARP Alternatives 0 and 4a were the leading improvement options. A specific improvement recommendation had not been made.

### 3.1 2040 Baseline or No Build Traffic Forecasts and Operations

2040 PM peak hour forecasts for baseline (no build) conditions developed for the SARP were used for the analysis documented in this report. These projections were developed based on the following assumptions:

- 2005 *Comprehensive Plan* land use patterns and an annualized population growth rate of 3.5 percent were assumed. While the *Comprehensive Plan* horizon year is 2025, a 2040 projection of future population for the city was obtained by applying the 3.5 percent annualized growth rate to the 2025 projections to estimate additional growth through 2040. The 2040 city population was estimated to be 14,500 persons.
- The traffic forecasts developed for the 2008 *Woodland Transportation Infrastructure Strategic Plan (TISP)* formed the starting point in developing 2040 traffic estimates. Forecasts for the *TISP* were developed using a travel demand model developed for that study. The planning horizon



year was 2025, consistent with the *Comprehensive Plan* and its expected land use development patterns. For the SARP, the growth in population to 2040 was converted to households with a 2040 target of 5,899 households (a 49 percent increase over 2025). This growth was distributed throughout the city and input into the Woodland travel demand model, updating it to represent 2040 conditions. This model was then used to produce 2040 PM peak hour baseline forecasts.

- Travel model output was post-processed to develop 2040 PM peak hour baseline turning movement projections. The forecast for the intersection of Scott Avenue with SR 503 is illustrated in Attachment A.

Traffic operations analysis was conducted based on the existing geometric configuration at the intersection for the planning horizon year. Results are presented in Table 1. Analysis worksheets are included in Attachment B. As indicated in the table, by 2040 the intersection is expected to operate at LOS F during the PM peak hour, with delays in excess of 200 seconds per average vehicle.

## 4. EVALUATION OF INTERSECTION IMPROVEMENT OPTIONS

### 4.1 Development of Traffic Forecasts

2040 PM peak hour traffic forecasts were developed for a variety of Scott Avenue reconnection improvement options. These forecasts were developed using the Woodland travel demand model to redistribute the 2040 baseline volumes in response to changes in the road network. Many options were considered as part of the SARP, with Alternatives 0 and 4a rising to top. These options are described below:

- **Alternative 0** – this option is similar to the concept developed as part of the Woodland *TISP* and includes a direct connection of Scott Avenue under a raised I-5 mainline. The effect of this improvement on the intersection of Scott Avenue with SR 503 will be to increase traffic volumes using Scott Avenue to travel from the west side of the city to residential areas on the east side. This would reduce traffic volumes on SR 503 south of the Scott Avenue intersection (the current route used to travel between the east side and the west side). More specifically, eastbound left movements from Scott Avenue to SR 503 are expected to increase to reflect the diversion of traffic away from SR 503. Additionally, southbound right turns from SR 503 onto Scott Avenue would also increase with a corresponding decrease in the through movement on SR 503. 2040 PM peak hour traffic projections for this alternative are shown in Attachment A.
- **Alternative 4a** – this option uses available vacant property east of I-5 and south of Scott Avenue to create a direct connection between Scott Avenue on the west side of the freeway and SR 503 south of Goerig Road. This new road would cross I-5 on a bridge and would be connected to the Atlantic and Pacific Avenue frontage roads via two new local streets. Additionally, this alternative would close the SR 503/Goerig Road intersection. The net effect of these changes is to increase north/south through traffic on SR 503 at the Scott Avenue intersection, and to significantly increase northbound left turns and eastbound right turns to accommodate traffic shifted from Goerig Road. 2040 PM peak hour projections for this alternative are shown in Attachment A.
- **2015 Opening Year Forecasts** – Turning movement forecasts were prepared for this time period by interpolating between the 2012 counts and the 2040 projections for the No Build condition. These projections are also shown in Attachment A.



## 4.2 Initial Improvement Concepts

Attachment C presents two preliminary concepts for improving the intersection of Scott Avenue with SR 503. These concepts include:

- Intersection realignment with roadway widening and installation of a traffic signal.
- Intersection realignment with roadway widening and installation of a multi-lane roundabout.

### 4.2.1 Traffic Signal Alternative

The first general concept involves realigning SR 503 through the intersection to reduce the degree of existing curvature and improve intersection sight distance. Both streets would be widened to accommodate turn lanes, bicycle lanes and sidewalks. As shown on the concept in Attachment C, improvements on Scott Avenue would provide for eastbound left only and eastbound left/right turn lanes with two receiving through lanes on SR 503 for some distance north of the intersection. Other improvements on SR 503 would add a northbound left turn lane and a southbound right turn lane. Crosswalks would be provided on all three legs of the intersection and modifications would be made to some existing driveways. A variation on this improvement concept was also evaluated that included only a single eastbound left turn lane to reduce costs and potential right-of-way impacts.

The two signalized concepts (with single or dual eastbound left turn lanes) were evaluated using projected traffic volumes with SARP Alternatives 0 and 4a. Analysis results are presented in Table 2. Backup analysis worksheets are included in Attachment D.

**Table 2. Scott Avenue at SR 503 Intersection Operational Summary for 2040 Build Conditions with Signalized Improvements**

Analysis Year	Alternative/Geometrics	Movement	PM Peak Hour Results			
			Delay	Volume/ Capacity	LOS	95 <sup>th</sup> % Queue
<b>Signalized Improvements</b>						
2040	SARP Alternative 0 with Single EB Left Lane and Signal	All	45.5	1.05	D	--
		EBL	81.9	1.06	F	1,335 ft
		NBT	45.7	0.97	D	2,473 FT
		SBT	21.7	0.59	C	373 ft
2040	SARP Alternative 0 with Dual EB Left Lane and Signal	All	17.7	0.90	B	--
		EBL	31.1	0.86	C	174 ft
		NBT	16.0	0.83	B	413 ft
		SBT	10.8	0.52	B	189 ft
2040	SARP Alternative 4a with Single EB Left Lane and Signal	All	116.9	1.25	F	--
		EBL	156.4	1.23	F	3,015 ft
		NBT	103.4	1.14	F	3,990 ft
		SBT	101.6	1.08	F	2,775 ft
2040	SARP Alternative 4a with Dual EB Left Lane and Signal	All	37.0	1.04	D	--
		EBL	42.0	0.91	D	1,033 ft
		NBT	28.4	0.96	C	2,513 ft
		SBT	36.9	0.91	D	506 ft

As indicated in Table 2, neither of the options that include a single eastbound left turn lane would operate with an acceptable level of service during the 2040 PM peak hour. Although an overall LOS D could be experienced with SARP Alternative 0 traffic volumes, the eastbound left turn movement is



expected to fail. Overall LOS F is expected with Alternative 4a volumes. Significant traffic queues would be experienced with either set of traffic forecasts ranging from over 1,000 feet to nearly 4,000 feet depending on alternative and movement.

With a dual eastbound left turn lane, overall operations with either set of traffic projections would be acceptable, but the scenario with SARP Alternative 4a would experience a higher level of congestion, as well as significant traffic queues ranging from 1,000 to over 2,500 feet, depending on movement.

#### 4.2.2 Roundabout Alternative

The second general concept involves realigning SR 503 through the intersection with Scott Avenue, widening of both SR 503 and Scott Avenue to accommodate turn lanes, bike lanes and sidewalks, and installing a roundabout instead of traffic signal control. Similar to the signalized concept, provision is made to accommodate either a single or a dual eastbound left turn lane with a second northbound through lane to receive the dual lefts accompanying that option. Both roundabout concepts were evaluated using 2040 PM peak hour projections for SARP Alternatives 0 and 4a. Analysis results are presented in Table 3, and backup analysis worksheets are included in Attachment E.

**Table 3. Scott Avenue at SR 503 Intersection Operational Summary for 2040 Build Conditions with Roundabout Improvements**

Analysis Year	Alternative/Geometrics	Movement	PM Peak Hour Results			
			Delay	Volume/ Capacity	LOS	95 <sup>th</sup> Queue
<b>Roundabout Improvements</b>						
2040	SARP Alternative 0 with Single EB Left Lane and Roundabout	All	186.3	2.00	F	--
		EBL	60.0	1.03	E	832 ft
		NBT	>200	2.00	F	4,389 ft
		SBT	5.0	0.86	A	720 ft
2040	SARP Alternative 0 with Dual EB Left Lane and Roundabout	All	11.2	0.86	B	--
		EBL	16.5	0.46	B	76 ft
		NBT	12.4	0.70	B	136 ft
		SBT	6.0	0.86	A	653 ft
2040	SARP Alternative 4a with Single EB Left Lane and Roundabout	All	> 200	> 2.00	F	--
		EBL	> 200	1.46	F	2,542 ft
		NBT	>200	>2.00	F	7,632 ft
		SBT	78.0	1.13	E	1,700 ft
2040	SARP Alternative 4a with Dual EB Left Lane and Roundabout	All	92.2	1.44	F	--
		EBL	16.8	0.55	B	114 ft
		NBT	53.2	1.06	D	905 ft
		SBT	>200	1.44	F	2,995 ft

As indicated in Table 3, the roundabout concept that uses 2040 PM peak hour volumes from SARP Alternative 0 would operate far better than the concept using volumes from Alternative 4a. Overall operations with Alternative 0 would be LOS F for the concept with a single eastbound left turn lane and LOS B with a dual eastbound left. With Alternative 4a, LOS F is expected with either a single or dual eastbound left turn lane. Additionally, there would be significant traffic queues with Alternative 4a.



#### 4.2.3 2015 Opening Year

Table 4 presents a summary of PM peak hour traffic operations analysis for a project opening year of 2015. As indicated in the table, traffic operations would be acceptable with either a signal or a roundabout with single or dual eastbound left turn lanes. Traffic queuing for all movements would be minimal. Analysis worksheets for opening year traffic are included in Attachment F.

**Table 4. Scott Avenue at SR 503 Intersection Operational Summary for 2015 Opening Year**

Analysis Year	Alternative/Geometrics	Movement	PM Peak Hour Results			
			Delay	Volume/ Capacity	LOS	95 <sup>th</sup> % Queue
<b>Signalized Improvements</b>						
2015	With Single EB Left Lane and Signal	All	8.4	0.59	A	--
		EBL	23.6	0.62	C	95 ft
		NBT	5.7	0.52	A	176 ft
		SBT	6.9	0.38	A	121 ft
2015	With Dual EB Left Lane and Signal	All	7.1	0.53	A	--
		EBL	20.2	0.40	C	63 ft
		NBT	4.6	0.49	A	182 ft
		SBT	5.8	0.37	A	107 ft
<b>Roundabout Improvements</b>						
2015	With Single EB Left Lane and Roundabout	All	8.0	0.68	A	--
		EBL	15.5	0.24	B	32 ft
		NBT	8.1	0.68	A	185 ft
		SBT	4.9	0.46	A	105 ft
2015	With Dual EB Left Lane and Roundabout	All	7.5	0.45	A	--
		EBL	14.3	0.11	B	12 ft
		NBT	6.8	0.32	A	42 ft
		SBT	5.8	0.45	A	96 ft

## 5. SENSITIVITY ANALYSIS OF GROWTH PROJECTIONS

Given the unknown nature of the Scott Avenue Reconnection alternative that will be selected and its ultimate design, a sensitivity analysis was conducted of operational impacts based on the different traffic growth projections associated with SARP Alternatives 0 and 4a. The object was to identify a potential year of failure for both intersection concepts. The threshold selected for making this determination considered two factors, either of which would represent a failure. On one hand, traffic operations would need to meet at least level of service D performance based on average or worst movement intersection delay. On the other hand, the expected presence of a traffic queue in excess of approximately 500 feet (which represents approximately 20 cars) was also considered to represent intersection failure.

This analysis was based on PM peak hour traffic volume estimates that were methodically interpolated up from 2012 to 2040 at an annualized rate of growth until a volume was reached which caused intersection failure. The year at which failure was anticipated could then be identified. It should be noted that actual traffic growth is more highly correlated with both land development and the timing of roadway improvements, and is not usually linear. However, the analysis method used in this report represents the best approach when many of the factors contributing to actual traffic growth cannot be



predicted. Results of this analysis are presented in Table 5 for options with a single eastbound left turn lane, and Table 6 for options with dual eastbound left turn lanes. Worksheets are included in Attachment G.

As indicated in the tables, a longer life expectancy is anticipated with the signalized concept, either with SARP Alternative 0 or 4a volumes. Also, the dual eastbound left turn lane options have longer life expectancy than the corresponding single eastbound left turn lane options.

For single eastbound turn lane options, the signalized concept with SARP Alternative 0 volumes would last until 2033, while the concept with Alternative 4a volumes would last until 2026. The roundabout concept is expected to fail by 2022 with SARP Alternative 0 volumes, and by 2018 with Alternative 4a.

**Table 5. Scott Avenue at SR 503 Evaluation of Potential Year of Failure with Single Eastbound Left Turn Lane – Signal or Roundabout Improvement Concepts**

Analysis Year	Alternative/Geometrics	Movement	PM Peak Hour Results			
			Delay	Volume/ Capacity	LOS	95 <sup>th</sup> % Queue
<b>Signalized Improvements</b>						
2033	SARP Alternative 0 with Single EB Left Lane and Signal	All	28.1	0.94	C	--
		EBL	61.1	0.99	E	504 ft
		NBT	21.1	0.83	C	519 ft
		SBT	15.0	0.52	B	205 ft
2026	SARP Alternative 4a with Single EB Left Lane and Signal	All	21.8	0.93	C	--
		EBL	39.8	0.90	D	408 ft
		NBT	17.7	0.83	B	492 ft
		SBT	20.5	0.71	C	280 ft
<b>Roundabout Improvements</b>						
2022	SARP Alternative 0 with Single EB Left Lane and Roundabout	All	14.8	0.91	B	--
		EBL	16.6	0.45	B	73 ft
		NBT	22.7	0.91	C	506 ft
		SBT	4.9	0.57	A	170 ft
2018	SARP Alternative 4a with Single EB Left Lane and Roundabout	All	13.2	0.89	B	--
		EBL	16.2	0.39	B	64 ft
		NBT	16.7	0.89	B	511 ft
		SBT	6.2	0.58	A	146 ft

For the dual eastbound turn lane options, the signalized concept with SARP Alternative 0 volumes would last beyond 2040, while the concept with Alternative 4a volumes would last until 2035. The roundabout concept is expected to fail by 2037 with SARP Alternative 0 volumes, and by 2028 with Alternative 4a.



**Table 6. Scott Avenue at SR 503 Evaluation of Potential Year of Failure for Dual Eastbound Left Turn Lane – Signal or Roundabout Improvement Concepts**

Analysis Year	Alternative/Geometrics	Movement	PM Peak Hour Results			
			Delay	Volume/ Capacity	LOS	95 <sup>th</sup> % Queue
<b>Signalized Improvements</b>						
>2040 <sup>1</sup>	SARP Alternative 0 with Dual EB Left Lane and Signal	All	17.7	0.90	B	--
		EBL	31.1	0.86	C	174 ft
		NBT	16.0	0.83	B	413 ft
		SBT	10.8	0.52	B	189 ft
2035	SARP Alternative 4a with Dual EB Left Lane and Signal	All	23.4	0.92	C	--
		EBL	27.3	0.76	C	294 ft
		NBT	18.9	0.88	B	566 ft
		SBT	26.0	0.82	C	427 ft
<b>Roundabout Improvements</b>						
2037	SARP Alternative 0 with Dual EB Left Lane and Roundabout	All	10.6	0.81	B	--
		EBL	15.8	0.41	B	60 ft
		NBT	11.2	0.64	B	115 ft
		SBT	5.9	0.81	A	470 ft
2028	SARP Alternative 4a with Dual EB Left Lane and Roundabout	All	14.6	0.90	B	--
		EBL	15.8	0.39	B	64 ft
		NBT	10.1	0.68	B	160 ft
		SBT	19.3	0.90	B	495 ft

1. PM Peak Hour Results reported for 2040. Operations do not fail by 2040 (see Table 2).

## 6. CONCLUSIONS

Based on the analysis of the foregoing intersection improvement options, a clear long-term (2040) distinction can be seen between options that are based on development of SARP Alternative 0 and those based on Alternative 4a. While, the project to improve the SR 503/Scott Avenue intersection has no control over the ultimate selection of a Scott Avenue reconnection concept, it is useful to keep in mind the implications of that choice for this important community intersection.

With SARP Alternative 0, either the signalized or the roundabout option with dual eastbound left turn lanes would accommodate 2040 PM peak hour traffic volumes. If Alternative 4a is selected as the preferred SARP improvement, the signalized option appears to provide the best operational performance, although the intersection would be congested with traffic queues over 2,500 feet long along northbound SR 503 (see Table 2).

The SARP volumes projected for 2040 at the intersection are high. Under either SARP alternative, the PM peak hour volume on northbound SR 503 north of Scott Avenue is over 1,600 vehicles/hour. A typical range for lane capacity for a two-lane arterial transitioning from urban to rural is about 600 vehicles/hour to 800 vehicles/hour depending on the frequency of intersections and driveways<sup>1</sup>. The use of a center median to restrict left turns could increase the range up to about 1,000 vehicles/hour. Given the City of Woodland has no long range plans to widen SR 503 to a four-lane cross-section with lefts, a

<sup>1</sup> "2009 Quality/Level of Service Handbook", State of Florida Department of Transportation at Table 5, Page 143 of the PDF at [http://www.fltdot.com/research/fdot/quality\\_level\\_of\\_service\\_handbook.pdf](http://www.fltdot.com/research/fdot/quality_level_of_service_handbook.pdf). Class 1, 2 lane undivided road with a -20% adjustment for no exclusive left or right turn lanes.



forecasted demand volume of 1,600 vehicles/hours is likely not achievable. People would adjust their travel habits and peak hour trips would spread over a longer time period until the actual demand approximated the available capacity along SR 503. By reporting on PM Peak Hour results at a theoretical failure year, the sensitivity analysis in Section 5 provides insight into the relative performance of intersection options using more likely volumes.

For a single lane roundabout, the volume along northbound SR 503 north of Scott Avenue ranges from 900 vehicles/hour to 1,000 vehicles/hour at the failure year depending on the SARP alternative selected, Alternative 4A and Alternative 0, respectively.

For a signalized option with a single eastbound left turn lane, the volume along northbound SR 503 north of Scott Avenue ranges from 1,100 vehicles/hour to 1,400 vehicles/hour at the failure year depending on the SARP alternative selected, Alternative 4A and Alternative 0, respectively.

It should be noted that implementation of the concepts with dual eastbound left turn lanes will require widening of SR 503 to accommodate two northbound through lanes. Based on judgment, the length of the second northbound through lane should be at least 1,000 feet long to provide space for vehicles to merge back into one lane. Even at 1,000 of additional northbound lane, people will favor the inside through lane to avoid the need to merge and the imbalance in lane utilization with impact operations at the intersection. The length to provide balanced lane utilization is about one-mile. We have not included imbalance in lane utilization in the analysis of dual eastbound left turn lane options. If dual eastbound turn lane options are carried forward for consideration, more detailed analysis is warranted with lane utilization adjusted based on the length of the second northbound through lane on SR 503 north of Scott Avenue.

**ATTACHMENT A**  
**TRAFFIC VOLUMES AND PROJECTIONS**



Attachment A - Woodland - Scott Avenue @ SR 503 Alternative Traffic Forecasts

Alternatives	Intersection			2040 Future Volumes											
				Northbound			Southbound			Eastbound			Westbound		
	N/S Street	E/W Street	#	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
2012	Lewis River Rd	E. Scott Ave	12	0	567	0	0	370	88	126	0	4	0	0	0
2015	Lewis River Rd	E. Scott Ave	12	1	621	0	0	396	123	181	0	5	0	0	0
No-Build	Lewis River Rd	E. Scott Ave	12	5	1,020	0	0	585	380	585	0	10	0	0	0
<b>0</b>	<b>Lewis River Rd</b>	<b>E. Scott Ave</b>	<b>12</b>	<b>5</b>	<b>920</b>	<b>0</b>	<b>0</b>	<b>505</b>	<b>460</b>	<b>685</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>
3	Lewis River Rd	E. Scott Ave	12	500	1,075	0	0	605	360	530	0	305	0	0	0
4	Lewis River Rd	E. Scott Ave	12	450	1,115	0	0	645	320	490	0	300	0	0	0
<b>4a</b>	<b>Lewis River Rd</b>	<b>E. Scott Ave</b>	<b>12</b>	<b>445</b>	<b>1,115</b>	<b>0</b>	<b>0</b>	<b>645</b>	<b>320</b>	<b>490</b>	<b>0</b>	<b>295</b>	<b>0</b>	<b>0</b>	<b>0</b>



**ATTACHMENT B**  
**2012 AND 2040 NO BUILD TRAFFIC ANALYSIS WORKSHEETS**



SR-503 at Scott Avenue Improvements  
 1: Lewis River Rd (SR 503) & Scott Ave

2012 PM Peak Hour with Existing Geometry



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	126	4	0	567	370	88
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	133	4	0	597	389	93
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1033	436	482			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1033	436	482			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	49	99	100			
cM capacity (veh/h)	258	620	1081			
<b>Direction, Lane #</b>						
	EB 1	NB 1	SB 1			
Volume Total	137	597	482			
Volume Left	133	0	0			
Volume Right	4	0	93			
cSH	262	1081	1700			
Volume to Capacity	0.52	0.00	0.28			
Queue Length 95th (ft)	69	0	0			
Control Delay (s)	32.8	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	32.8	0.0	0.0			
Approach LOS	D					
<b>Intersection Summary</b>						
Average Delay			3.7			
Intersection Capacity Utilization		43.7%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

3/17/2014



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	585	10	5	1020	585	380
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	616	11	5	1074	616	400
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1700	616	1016			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1700	616	1016			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	98	99			
cM capacity (veh/h)	100	491	683			

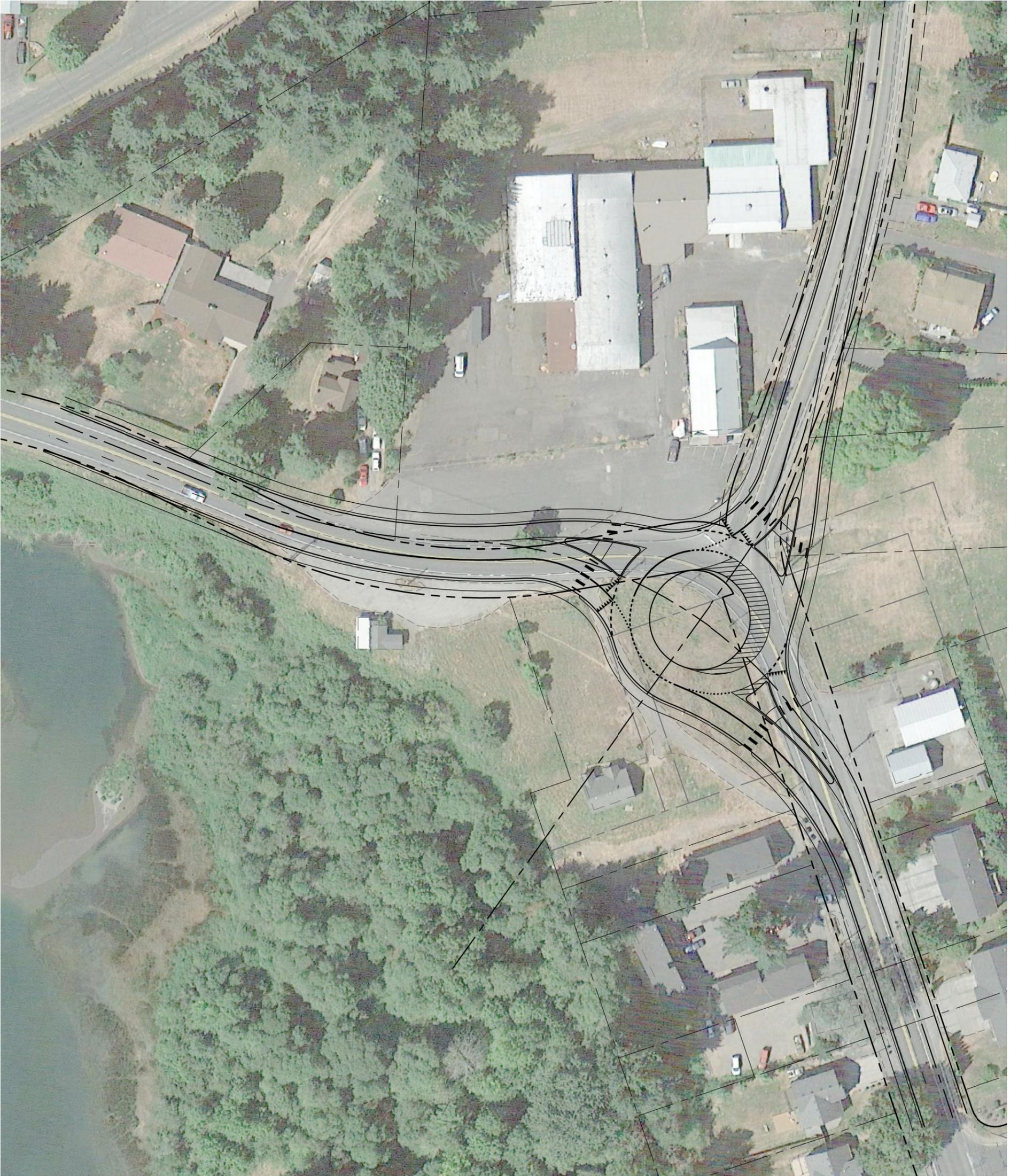
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	626	5	1074	616	400
Volume Left	616	5	0	0	0
Volume Right	11	0	0	0	400
cSH	102	683	1700	1700	1700
Volume to Capacity	6.15	0.01	0.63	0.36	0.24
Queue Length 95th (ft)	Err	1	0	0	0
Control Delay (s)	Err	10.3	0.0	0.0	0.0
Lane LOS	F	B			
Approach Delay (s)	Err	0.1		0.0	
Approach LOS	F				

Intersection Summary					
Average Delay			2301.5		
Intersection Capacity Utilization			93.4%	ICU Level of Service	F
Analysis Period (min)			15		

**ATTACHMENT C**  
**INTERSECTION CONCEPTS EVALUATED**







**APPENDIX D**  
**2040 TRAFFIC OPERATIONS ANALYSIS WORKSHEETS FOR SIGNALIZED**  
**IMPROVEMENTS**



HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2040 Single EB Left - Alt 0  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	685	5	5	920	505	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	0.95		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1773		1770	1863	1863	1583
Flt Permitted	0.95		0.28	1.00	1.00	1.00
Satd. Flow (perm)	1773		515	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	721	5	5	968	532	484
RTOR Reduction (vph)	0	0	0	0	0	248
Lane Group Flow (vph)	726	0	5	968	532	236
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	40.0		55.2	55.2	50.4	50.4
Effective Green, g (s)	40.0		55.2	55.2	50.4	50.4
Actuated g/C Ratio	0.39		0.53	0.53	0.49	0.49
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	687		285	996	909	773
v/s Ratio Prot	c0.41		0.00	c0.52	0.29	
v/s Ratio Perm			0.01			0.15
v/c Ratio	1.06		0.02	0.97	0.59	0.31
Uniform Delay, d1	31.6		13.6	23.2	18.9	15.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	50.3		0.0	22.5	2.8	1.0
Delay (s)	81.9		13.6	45.7	21.7	16.9
Level of Service	F		B	D	C	B
Approach Delay (s)	81.9			45.6	19.4	
Approach LOS	F			D	B	

Intersection Summary

HCM 2000 Control Delay	45.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	103.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
Projected 2040 Single EB Left - Alt 0

3/10/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	NB	NB	SB	SB
Directions Served	LR	L	T	T	R
Maximum Queue (ft)	1173	79	1698	469	225
Average Queue (ft)	684	6	1012	195	115
95th Queue (ft)	1335	46	2473	373	237
Link Distance (ft)	2466		3489	2237	
Upstream Blk Time (%)			5		
Queuing Penalty (veh)			0		
Storage Bay Dist (ft)		250			200
Storage Blk Time (%)			38	5	0
Queuing Penalty (veh)			2	23	0

Network Summary

Network wide Queuing Penalty: 25

HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2040 - Alt 0  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	685	5	5	920	505	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	0.95		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3439		1770	1863	1863	1583
Flt Permitted	0.95		0.32	1.00	1.00	1.00
Satd. Flow (perm)	3439		601	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	721	5	5	968	532	484
RTOR Reduction (vph)	1	0	0	0	0	218
Lane Group Flow (vph)	725	0	5	968	532	266
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	15.4		39.2	39.2	34.4	34.4
Effective Green, g (s)	15.4		39.2	39.2	34.4	34.4
Actuated g/C Ratio	0.25		0.63	0.63	0.55	0.55
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	846		391	1166	1023	869
v/s Ratio Prot	c0.21		0.00	c0.52	0.29	
v/s Ratio Perm			0.01			0.17
v/c Ratio	0.86		0.01	0.83	0.52	0.31
Uniform Delay, d1	22.5		5.5	9.1	8.9	7.6
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	8.6		0.0	6.9	1.9	0.9
Delay (s)	31.1		5.5	16.0	10.8	8.5
Level of Service	C		A	B	B	A
Approach Delay (s)	31.1			16.0	9.7	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	62.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
 Projected 2040 - Alt 0

3/10/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	LR	L	T	T	R
Maximum Queue (ft)	187	212	80	459	229	182
Average Queue (ft)	118	137	6	235	108	69
95th Queue (ft)	174	195	46	413	189	133
Link Distance (ft)	3021	3021		3808	3218	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			250			200
Storage Blk Time (%)				7	0	0
Queuing Penalty (veh)				0	1	0

Network Summary

Network wide Queuing Penalty: 2

HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2040 Single EB Left - Alt 4a  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	490	295	445	1115	645	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.95		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1715		1770	1863	1863	1583
Flt Permitted	0.97		0.08	1.00	1.00	1.00
Satd. Flow (perm)	1715		155	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	516	311	468	1174	679	337
RTOR Reduction (vph)	17	0	0	0	0	124
Lane Group Flow (vph)	810	0	468	1174	679	213
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	50.0		72.0	72.0	44.0	44.0
Effective Green, g (s)	50.0		72.0	72.0	44.0	44.0
Actuated g/C Ratio	0.38		0.55	0.55	0.34	0.34
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	659		384	1031	630	535
v/s Ratio Prot	c0.47		c0.23	0.63	0.36	
v/s Ratio Perm			c0.45			0.13
v/c Ratio	1.23		1.22	1.14	1.08	0.40
Uniform Delay, d1	40.0		42.3	29.0	43.0	32.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	116.4		119.9	74.4	58.6	2.2
Delay (s)	156.4		162.1	103.4	101.6	35.1
Level of Service	F		F	F	F	D
Approach Delay (s)	156.4			120.2	79.6	
Approach LOS	F			F	E	

Intersection Summary			
HCM 2000 Control Delay	116.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	113.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
Projected 2040 Single EB Left - Alt 4a

3/10/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	NB	NB	SB	SB
Directions Served	LR	L	T	T	R
Maximum Queue (ft)	2519	275	3546	2288	225
Average Queue (ft)	2258	256	3438	2057	191
95th Queue (ft)	3015	323	3990	2775	299
Link Distance (ft)	2466		3489	2237	
Upstream Blk Time (%)	71		61	63	
Queuing Penalty (veh)	0		0	0	
Storage Bay Dist (ft)		250			200
Storage Blk Time (%)		20	26	55	0
Queuing Penalty (veh)		228	116	175	1

Network Summary

Network wide Queuing Penalty: 520

HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2040 Dual EB Left - Alt 4a  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	490	295	445	1115	645	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		1.00	1.00	1.00	1.00
Frt	0.94		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3307		1770	1863	1863	1583
Flt Permitted	0.97		0.12	1.00	1.00	1.00
Satd. Flow (perm)	3307		233	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	516	311	468	1174	679	337
RTOR Reduction (vph)	139	0	0	0	0	202
Lane Group Flow (vph)	688	0	468	1174	679	135
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	15.9		46.0	46.0	28.0	28.0
Effective Green, g (s)	15.9		46.0	46.0	28.0	28.0
Actuated g/C Ratio	0.23		0.66	0.66	0.40	0.40
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	752		461	1226	746	634
v/s Ratio Prot	c0.21		0.20	c0.63	0.36	
v/s Ratio Perm			c0.46			0.09
v/c Ratio	0.91		1.02	0.96	0.91	0.21
Uniform Delay, d1	26.3		20.0	11.0	19.8	13.7
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	15.6		45.8	17.4	17.2	0.8
Delay (s)	42.0		65.8	28.4	36.9	14.5
Level of Service	D		E	C	D	B
Approach Delay (s)	42.0			39.1	29.5	
Approach LOS	D			D	C	

Intersection Summary

HCM 2000 Control Delay	37.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	69.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
Projected 2040 Dual EB Left - Alt 4a

3/10/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	LR	L	T	T	R
Maximum Queue (ft)	801	836	275	3064	607	225
Average Queue (ft)	419	472	249	991	300	167
95th Queue (ft)	988	1033	329	2515	506	286
Link Distance (ft)	3021	3021		3808	3218	
Upstream Blk Time (%)				1		
Queuing Penalty (veh)				0		
Storage Bay Dist (ft)			250			200
Storage Blk Time (%)			13	9	17	0
Queuing Penalty (veh)			144	42	55	1

Network Summary

Network wide Queuing Penalty: 242

**APPENDIX E**  
**2040 TRAFFIC OPERATIONS ANALYSIS WORKSHEETS FOR**  
**ROUNDBOUT IMPROVEMENTS**



# MOVEMENT SUMMARY

Site: 2040 - Alt 0

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
North East: SB Lewis River Rd (SR 503)											
6X	T	532	2.0	0.860	5.0	LOS A	28.3	719.6	0.21	0.34	33.7
16X	R	484	2.0	0.860	6.4	LOS A	28.3	719.6	0.21	0.45	32.9
Approach		1016	2.0	0.860	5.7	LOS A	28.3	719.6	0.21	0.40	33.3
North West: EB Scott Ave											
7X	L	721	2.0	1.026	60.0	LOS E	32.8	832.0	1.00	1.90	15.2
14X	R	5	2.0	1.026	54.0	LOS D	32.8	832.0	1.00	1.90	15.2
Approach		726	2.0	1.026	60.0	LOS E	32.8	832.0	1.00	1.90	15.2
South West: NB Lewis River Rd (SR 503)											
5X	L	5	2.0	1.998	476.3	LOS F	172.8	4389.0	1.00	4.61	2.9
2X	T	968	2.0	1.998	469.0	LOS F	172.8	4389.0	1.00	4.61	2.7
Approach		974	2.0	1.998	469.0	LOS F	172.8	4389.0	1.00	4.61	2.7
All Vehicles		2716	2.0	1.998	186.3	LOS F	172.8	4389.0	0.71	2.31	6.3

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
North East: SB Lewis River Rd (SR 503)											
6X	T	532	2.0	0.855	6.0	LOS A	25.7	653.1	0.29	0.38	32.7
16X	R	484	2.0	0.855	6.8	LOS A	25.7	653.1	0.29	0.45	32.3
Approach		1016	2.0	0.855	6.4	LOS A	25.7	653.1	0.29	0.41	32.5
North West: EB Scott Ave											
7X	L	721	2.0	0.464	16.5	LOS B	3.0	75.8	0.70	0.90	27.6
14X	R	5	2.0	0.464	11.2	LOS B	3.0	75.8	0.70	0.83	29.7
Approach		726	2.0	0.464	16.5	LOS B	3.0	75.8	0.70	0.90	27.6
South West: NB Lewis River Rd (SR 503)											
5X	L	5	2.0	0.699	18.8	LOS B	5.4	135.9	0.83	1.10	27.2
2X	T	968	2.0	0.699	12.4	LOS B	5.4	135.9	0.83	1.01	29.4
Approach		974	2.0	0.699	12.4	LOS B	5.4	135.9	0.83	1.01	29.4
All Vehicles		2716	2.0	0.855	11.2	LOS B	25.7	653.1	0.59	0.76	29.9

Level of Service (LOS) Method: Delay (HCM 2000).  
 Roundabout LOS Method: Same as Signalised Intersections.  
 Vehicle movement LOS values are based on average delay per movement  
 Intersection and Approach LOS values are based on average delay for all vehicle movements.  
 Roundabout Capacity Model: SIDRA Standard.  
 SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2040 - Alt 4a

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
North East: SB Lewis River Rd (SR 503)											
6X	T	679	2.0	1.130	78.0	LOS E	66.9	1700.4	1.00	1.99	12.2
16X	R	337	2.0	1.130	79.3	LOS E	66.9	1700.4	1.00	1.99	12.1
Approach		1016	2.0	1.130	78.4	LOS E	66.9	1700.4	1.00	1.99	12.2
North West: EB Scott Ave											
7X	L	516	2.0	1.459	235.3	LOS F	100.1	2541.5	1.00	3.62	5.4
14X	R	311	2.0	1.459	229.3	LOS F	100.1	2541.5	1.00	3.62	5.2
Approach		826	2.0	1.459	233.1	LOS F	100.1	2541.5	1.00	3.62	5.3
South West: NB Lewis River Rd (SR 503)											
5X	L	468	2.0	2.124	526.2	LOS F	300.5	7632.2	1.00	5.74	2.6
2X	T	1174	2.0	2.124	518.9	LOS F	300.5	7632.2	1.00	5.74	2.5
Approach		1642	2.0	2.124	521.0	LOS F	300.5	7632.2	1.00	5.74	2.5
All Vehicles		3484	2.0	2.124	323.7	LOS F	300.5	7632.2	1.00	4.14	3.9

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2040 With Double EB Left - Alt  
4a

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
North East: SB Lewis River Rd (SR 503)											
6X	T	679	2.0	1.436	214.8	LOS F	117.9	2994.5	1.00	3.80	5.5
16X	R	337	2.0	1.436	215.6	LOS F	117.9	2994.5	1.00	3.80	5.5
Approach		1016	2.0	1.436	215.1	LOS F	117.9	2994.5	1.00	3.80	5.5
North West: EB Scott Ave											
7X	L	516	2.0	0.554	16.8	LOS B	4.5	113.8	0.80	0.93	27.5
14X	R	311	2.0	0.554	11.5	LOS B	4.5	113.8	0.80	0.90	29.8
Approach		826	2.0	0.554	14.8	LOS B	4.5	113.8	0.80	0.92	28.3
South West: NB Lewis River Rd (SR 503)											
5X	L	468	2.0	1.063	59.7	LOS E	35.6	905.4	1.00	2.01	15.3
2X	T	1174	2.0	1.063	53.2	LOS D	35.6	905.4	1.00	2.01	15.6
Approach		1642	2.0	1.063	55.1	LOS E	35.6	905.4	1.00	2.01	15.5
All Vehicles		3484	2.0	1.436	92.2	LOS F	117.9	2994.5	0.95	2.27	11.0

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

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SIDRA INTERSECTION 5.1.13.2093

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Project: N:\Projects\0729 City of Woodland\0729.01 SR 503 Scott Avenue Intersection Project\Phase 12-  
Intersection Control Analysis\Traffic\02-Analysis\Sidra\2040 Analysis.sip  
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**SIDRA**  
**INTERSECTION** 

**APPENDIX F**  
**2015 OPENING YEAR ANALYSIS WORKSHEETS**



HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2015 Single EB Left - Opening  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	175	5	1	615	395	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	0.95		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770		1770	1863	1863	1583
Flt Permitted	0.95		0.42	1.00	1.00	1.00
Satd. Flow (perm)	1770		782	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	184	5	1	647	416	126
RTOR Reduction (vph)	2	0	0	0	0	53
Lane Group Flow (vph)	187	0	1	647	416	73
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	8.9		35.0	35.0	30.2	30.2
Effective Green, g (s)	8.9		35.0	35.0	30.2	30.2
Actuated g/C Ratio	0.17		0.67	0.67	0.58	0.58
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	303		542	1256	1084	921
v/s Ratio Prot	c0.11		0.00	c0.35	0.22	
v/s Ratio Perm			0.00			0.05
v/c Ratio	0.62		0.00	0.52	0.38	0.08
Uniform Delay, d1	19.9		3.2	4.2	5.8	4.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	3.7		0.0	1.5	1.0	0.2
Delay (s)	23.6		3.2	5.7	6.9	4.9
Level of Service	C		A	A	A	A
Approach Delay (s)	23.6			5.7	6.4	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	51.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
Projected 2015 Single EB Left - Opening

4/3/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	NB	NB	SB	SB
Directions Served	LR	L	T	T	R
Maximum Queue (ft)	110	6	201	153	55
Average Queue (ft)	58	0	91	62	23
95th Queue (ft)	95	6	176	121	52
Link Distance (ft)	2466		3489	2237	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		250		200	
Storage Blk Time (%)			0		
Queuing Penalty (veh)			0		

Network Summary

Network wide Queuing Penalty: 0

HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2015 Dual EB Left - Opening  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	175	5	1	615	395	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	0.95		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3432		1770	1863	1863	1583
Flt Permitted	0.95		0.43	1.00	1.00	1.00
Satd. Flow (perm)	3432		801	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	184	5	1	647	416	126
RTOR Reduction (vph)	4	0	0	0	0	49
Lane Group Flow (vph)	185	0	1	647	416	77
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	6.6		34.8	34.8	30.0	30.0
Effective Green, g (s)	6.6		34.8	34.8	30.0	30.0
Actuated g/C Ratio	0.13		0.70	0.70	0.61	0.61
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	458		579	1312	1131	961
v/s Ratio Prot	c0.05		0.00	c0.35	0.22	
v/s Ratio Perm			0.00			0.05
v/c Ratio	0.40		0.00	0.49	0.37	0.08
Uniform Delay, d1	19.6		2.5	3.3	4.9	4.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6		0.0	1.3	0.9	0.2
Delay (s)	20.2		2.5	4.6	5.8	4.2
Level of Service	C		A	A	A	A
Approach Delay (s)	20.2			4.6	5.4	
Approach LOS	C			A	A	

Intersection Summary

HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	49.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
Projected 2015 Dual EB Left - Opening

4/3/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	LR	L	T	T	R
Maximum Queue (ft)	70	77	19	225	138	53
Average Queue (ft)	37	32	1	94	50	18
95th Queue (ft)	59	63	9	182	107	45
Link Distance (ft)	3021	3021		3808	3218	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			250			200
Storage Blk Time (%)				0	0	
Queuing Penalty (veh)				0	0	

Network Summary

Network wide Queuing Penalty: 0

# MOVEMENT SUMMARY

Site: 2015 - Opening

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph	
North East: SB Lewis River Rd (SR 503)												
6X	T	416	2.0	0.458	4.9	LOS A	4.1	105.3	0.03	0.40	34.8	
16X	R	126	2.0	0.458	6.3	LOS A	4.1	105.3	0.03	0.54	33.7	
Approach		542	2.0	0.458	5.2	LOS A	4.1	105.3	0.03	0.43	34.6	
North West: EB Scott Ave												
7X	L	184	2.0	0.237	15.5	LOS B	1.3	32.2	0.58	0.78	28.2	
14X	R	5	2.0	0.237	9.5	LOS A	1.3	32.2	0.58	0.68	30.6	
Approach		189	2.0	0.237	15.3	LOS B	1.3	32.2	0.58	0.78	28.3	
South West: NB Lewis River Rd (SR 503)												
5X	L	1	2.0	0.678	15.4	LOS B	7.3	184.7	0.74	0.83	29.3	
2X	T	647	2.0	0.678	8.1	LOS A	7.3	184.7	0.74	0.67	31.1	
Approach		648	2.0	0.678	8.1	LOS A	7.3	184.7	0.74	0.67	31.1	
All Vehicles		1380	2.0	0.678	8.0	LOS A	7.3	184.7	0.44	0.59	31.9	

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2015 With Double EB Left - Opening

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph	
North East: SB Lewis River Rd (SR 503)												
6X	T	416	2.0	0.454	5.8	LOS A	3.8	96.3	0.03	0.45	34.1	
16X	R	126	2.0	0.454	6.6	LOS A	3.8	96.3	0.03	0.55	33.4	
Approach		542	2.0	0.454	6.0	LOS A	3.8	96.3	0.03	0.48	34.0	
North West: EB Scott Ave												
7X	L	184	2.0	0.107	14.3	LOS B	0.5	11.7	0.46	0.74	28.7	
14X	R	5	2.0	0.107	9.0	LOS A	0.5	11.7	0.46	0.63	31.1	
Approach		189	2.0	0.107	14.1	LOS B	0.5	11.7	0.46	0.74	28.8	
South West: NB Lewis River Rd (SR 503)												
5X	L	1	2.0	0.318	13.2	LOS B	1.7	42.0	0.40	0.85	29.9	
2X	T	647	2.0	0.318	6.8	LOS A	1.7	42.0	0.40	0.56	32.3	
Approach		648	2.0	0.318	6.8	LOS A	1.7	42.0	0.40	0.56	32.3	
All Vehicles		1380	2.0	0.454	7.5	LOS A	3.8	96.3	0.27	0.55	32.3	

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

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Intersection Control Analysis\Traffic\02-Analysis\Project\Sidra\2040 Analysis.sip  
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**SIDRA**  
**INTERSECTION**

**APPENDIX G**  
**GROWTH SENSITIVITY ANALYSIS WORKSHEETS**



HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2033 Single EB Left - Alt 0  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	545	5	5	830	470	365
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	0.95		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1773		1770	1863	1863	1583
Flt Permitted	0.95		0.32	1.00	1.00	1.00
Satd. Flow (perm)	1773		597	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	574	5	5	874	495	384
RTOR Reduction (vph)	1	0	0	0	0	190
Lane Group Flow (vph)	578	0	5	874	495	194
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	25.6		44.2	44.2	39.4	39.4
Effective Green, g (s)	25.6		44.2	44.2	39.4	39.4
Actuated g/C Ratio	0.33		0.57	0.57	0.51	0.51
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	583		351	1058	943	801
v/s Ratio Prot	c0.33		0.00	c0.47	0.27	
v/s Ratio Perm			0.01			0.12
v/c Ratio	0.99		0.01	0.83	0.52	0.24
Uniform Delay, d1	26.0		8.6	13.7	12.9	10.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	35.1		0.0	7.4	2.1	0.7
Delay (s)	61.1		8.7	21.1	15.0	11.5
Level of Service	E		A	C	B	B
Approach Delay (s)	61.1			21.0	13.5	
Approach LOS	E			C	B	

Intersection Summary

HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	77.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
Projected 2033 Single EB Left - Alt 0

4/3/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	NB	NB	SB	SB
Directions Served	LR	L	T	T	R
Maximum Queue (ft)	542	79	520	242	199
Average Queue (ft)	299	6	292	121	66
95th Queue (ft)	504	46	519	205	139
Link Distance (ft)	2466		3489	2237	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		250			200
Storage Blk Time (%)			13	0	0
Queuing Penalty (veh)			1	2	0

Network Summary

Network wide Queuing Penalty: 2

HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2026 Single EB Left - Alt 4a  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	310	150	225	840	510	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1723		1770	1863	1863	1583
Flt Permitted	0.97		0.22	1.00	1.00	1.00
Satd. Flow (perm)	1723		401	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	326	158	237	884	537	216
RTOR Reduction (vph)	30	0	0	0	0	129
Lane Group Flow (vph)	454	0	237	884	537	87
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	17.3		34.0	34.0	24.0	24.0
Effective Green, g (s)	17.3		34.0	34.0	24.0	24.0
Actuated g/C Ratio	0.29		0.57	0.57	0.40	0.40
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	502		368	1068	753	640
v/s Ratio Prot	c0.26		0.07	c0.47	0.29	
v/s Ratio Perm			0.30			0.06
v/c Ratio	0.90		0.64	0.83	0.71	0.14
Uniform Delay, d1	20.2		8.8	10.3	14.8	11.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	19.6		3.8	7.4	5.7	0.4
Delay (s)	39.8		12.7	17.7	20.5	11.6
Level of Service	D		B	B	C	B
Approach Delay (s)	39.8			16.6	17.9	
Approach LOS	D			B	B	

Intersection Summary			
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	59.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
Projected 2026 Single EB Left - Alt 4a

4/3/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	NB	NB	SB	SB
Directions Served	LR	L	T	T	R
Maximum Queue (ft)	460	274	512	335	225
Average Queue (ft)	230	129	260	165	71
95th Queue (ft)	408	272	492	280	179
Link Distance (ft)	2466		3489	2237	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		250			200
Storage Blk Time (%)		0	7	4	0
Queuing Penalty (veh)		0	16	7	0

Network Summary

Network wide Queuing Penalty: 24

# MOVEMENT SUMMARY

Site: 2022 - Alt 0

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph	
North East: SB Lewis River Rd (SR 503)												
6X	T	442	2.0	0.570	4.9	LOS A	6.7	170.4	0.07	0.38	34.6	
16X	R	232	2.0	0.570	6.3	LOS A	6.7	170.4	0.07	0.52	33.6	
Approach		674	2.0	0.570	5.4	LOS A	6.7	170.4	0.07	0.43	34.2	
North West: EB Scott Ave												
7X	L	342	2.0	0.445	16.6	LOS B	2.9	73.0	0.69	0.85	27.6	
14X	R	5	2.0	0.445	10.6	LOS B	2.9	73.0	0.69	0.77	29.9	
Approach		347	2.0	0.445	16.5	LOS B	2.9	73.0	0.69	0.85	27.6	
South West: NB Lewis River Rd (SR 503)												
5X	L	2	2.0	0.911	30.0	LOS C	19.9	505.9	1.00	1.23	22.9	
2X	T	732	2.0	0.911	22.7	LOS C	19.9	505.9	1.00	1.23	24.1	
Approach		734	2.0	0.911	22.7	LOS C	19.9	505.9	1.00	1.23	24.1	
All Vehicles		1755	2.0	0.911	14.8	LOS B	19.9	505.9	0.58	0.85	28.0	

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2018 - Alt 4a

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
North East: SB Lewis River Rd (SR 503)											
6X	T	453	2.0	0.579	6.2	LOS A	5.8	146.4	0.55	0.50	31.9
16X	R	147	2.0	0.579	7.5	LOS A	5.8	146.4	0.55	0.57	31.7
Approach		600	2.0	0.579	6.5	LOS A	5.8	146.4	0.55	0.52	31.8
North West: EB Scott Ave											
7X	L	216	2.0	0.390	16.2	LOS B	2.5	63.5	0.72	0.85	27.9
14X	R	68	2.0	0.390	10.2	LOS B	2.5	63.5	0.72	0.77	30.1
Approach		284	2.0	0.390	14.7	LOS B	2.5	63.5	0.72	0.83	28.4
South West: NB Lewis River Rd (SR 503)											
5X	L	100	2.0	0.894	24.0	LOS C	20.1	510.8	1.00	0.98	25.2
2X	T	721	2.0	0.894	16.7	LOS B	20.1	510.8	1.00	0.98	26.8
Approach		821	2.0	0.894	17.6	LOS B	20.1	510.8	1.00	0.98	26.5
All Vehicles		1705	2.0	0.894	13.2	LOS B	20.1	510.8	0.79	0.80	28.5

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

HCM Signalized Intersection Capacity Analysis  
 1: Lewis River Rd (SR 503) & Scott Ave

Projected 2035 Dual EB Left - Alt 4a  
 PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	425	245	365	1015	595	280
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	0.97		1.00	1.00	1.00	1.00
Frt	0.95		1.00	1.00	1.00	0.85
Flt Protected	0.97		0.95	1.00	1.00	1.00
Satd. Flow (prot)	3310		1770	1863	1863	1583
Flt Permitted	0.97		0.14	1.00	1.00	1.00
Satd. Flow (perm)	3310		270	1863	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	447	258	384	1068	626	295
RTOR Reduction (vph)	140	0	0	0	0	174
Lane Group Flow (vph)	565	0	384	1068	626	121
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Actuated Green, G (s)	14.3		41.1	41.1	26.1	26.1
Effective Green, g (s)	14.3		41.1	41.1	26.1	26.1
Actuated g/C Ratio	0.23		0.65	0.65	0.41	0.41
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	746		435	1207	766	651
v/s Ratio Prot	c0.17		0.15	c0.57	0.34	
v/s Ratio Perm			0.42			0.08
v/c Ratio	0.76		0.88	0.88	0.82	0.19
Uniform Delay, d1	22.9		14.6	9.2	16.5	11.9
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	4.4		18.6	9.7	9.4	0.6
Delay (s)	27.3		33.2	18.9	26.0	12.5
Level of Service	C		C	B	C	B
Approach Delay (s)	27.3			22.7	21.7	
Approach LOS	C			C	C	

Intersection Summary			
HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	63.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queuing and Blocking Report  
 Projected 2035 Dual EB Left - Alt 4a

4/4/2014

Intersection: 1: Lewis River Rd (SR 503) & Scott Ave

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	LR	L	T	T	R
Maximum Queue (ft)	297	333	274	744	482	225
Average Queue (ft)	141	181	199	308	249	137
95th Queue (ft)	258	294	314	566	427	269
Link Distance (ft)	3021	3021		3808	3218	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)			250			200
Storage Blk Time (%)			4	7	13	0
Queuing Penalty (veh)			40	25	36	1

Network Summary

Network wide Queuing Penalty: 101

# MOVEMENT SUMMARY

Lewis River Road at Scott Ave  
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
North East: SB Lewis River Rd (SR 503)											
6X	T	516	2.0	0.806	5.9	LOS A	18.5	469.5	0.23	0.40	33.1
16X	R	442	2.0	0.806	6.8	LOS A	18.5	469.5	0.23	0.47	32.6
Approach		958	2.0	0.806	6.3	LOS A	18.5	469.5	0.23	0.43	32.9
North West: EB Scott Ave											
7X	L	658	2.0	0.414	15.8	LOS B	2.4	60.4	0.66	0.86	27.9
14X	R	5	2.0	0.414	10.5	LOS B	2.4	60.4	0.66	0.79	30.2
Approach		663	2.0	0.414	15.8	LOS B	2.4	60.4	0.66	0.86	27.9
South West: NB Lewis River Rd (SR 503)											
5X	L	5	2.0	0.639	17.6	LOS B	4.5	114.8	0.78	1.07	27.8
2X	T	926	2.0	0.639	11.2	LOS B	4.5	114.8	0.78	0.96	30.2
Approach		932	2.0	0.639	11.2	LOS B	4.5	114.8	0.78	0.96	30.2
All Vehicles		2553	2.0	0.806	10.6	LOS B	18.5	469.5	0.54	0.74	30.4

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

# MOVEMENT SUMMARY

Site: 2028 With Double EB Left - Alt 4a

Lewis River Road at Scott Ave Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
North East: SB Lewis River Rd (SR 503)											
6X	T	553	2.0	0.896	19.3	LOS B	19.5	495.0	1.00	1.08	25.5
16X	R	232	2.0	0.896	20.2	LOS C	19.5	495.0	1.00	1.08	25.4
Approach		784	2.0	0.896	19.6	LOS B	19.5	495.0	1.00	1.08	25.5
North West: EB Scott Ave											
7X	L	353	2.0	0.391	15.8	LOS B	2.5	63.8	0.76	0.89	28.0
14X	R	179	2.0	0.391	10.5	LOS B	2.5	63.8	0.76	0.84	30.1
Approach		532	2.0	0.391	14.0	LOS B	2.5	63.8	0.76	0.87	28.6
South West: NB Lewis River Rd (SR 503)											
5X	L	268	2.0	0.683	16.5	LOS B	6.3	159.9	0.77	0.95	28.0
2X	T	926	2.0	0.683	10.1	LOS B	6.3	159.9	0.77	0.86	30.4
Approach		1195	2.0	0.683	11.5	LOS B	6.3	159.9	0.77	0.88	29.8
All Vehicles		2511	2.0	0.896	14.6	LOS B	19.5	495.0	0.84	0.94	28.1

Level of Service (LOS) Method: Delay (HCM 2000).

Roundabout LOS Method: Same as Signalised Intersections.

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

Processed: Friday, April 04, 2014 11:43:09 AM  
SIDRA INTERSECTION 5.1.13.2093

Project: N:\Projects\0729 City of Woodland\0729.01 SR 503 Scott Avenue Intersection Project\Phase 12-Intersection Control Analysis\Traffic\02-Analysis\Project\Sidra\Sensitivity Analysis - Two Lane.sip  
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