GLOBAL Transportation Engineering

MEMORANDUM

DATE: November 27, 2019

TO: Steve Miller, Emerio Design

FROM: Dana M. Beckwith, PE / PTOE
Richard Martin, EIT

SUBJECT: SUB-19-01 Bland Circle 25-Lot Subdivision Intersection Capacity & Safety Evaluation

This memorandum summarizes the intersection capacity and safety evaluation for the intersection of Weatherhill Road at Salamo Road, conducted in support of the proposed 25-lot subdivision located at 23190 Bland Circle in the City of West Linn, Oregon.

PROJECT DESCRIPTION

The proposed 25-lot subdivision at 23190 Bland Circle is located within an area of West Linn zoned as R-7 Single-Family Residential Detached and Attached. Figure 1 shows the detailed site plan. The proposed development is a conforming land use per the City of West Linn Municipal Code Section 12 and consists of 25 Single Family Dwelling Units. Concerns have been raised regarding the capacity and sight distance available at the intersection of Weatherhill Road at Salamo Road and the vehicle trips that will be added to the intersection as part of this development. This memorandum addresses those concerns.

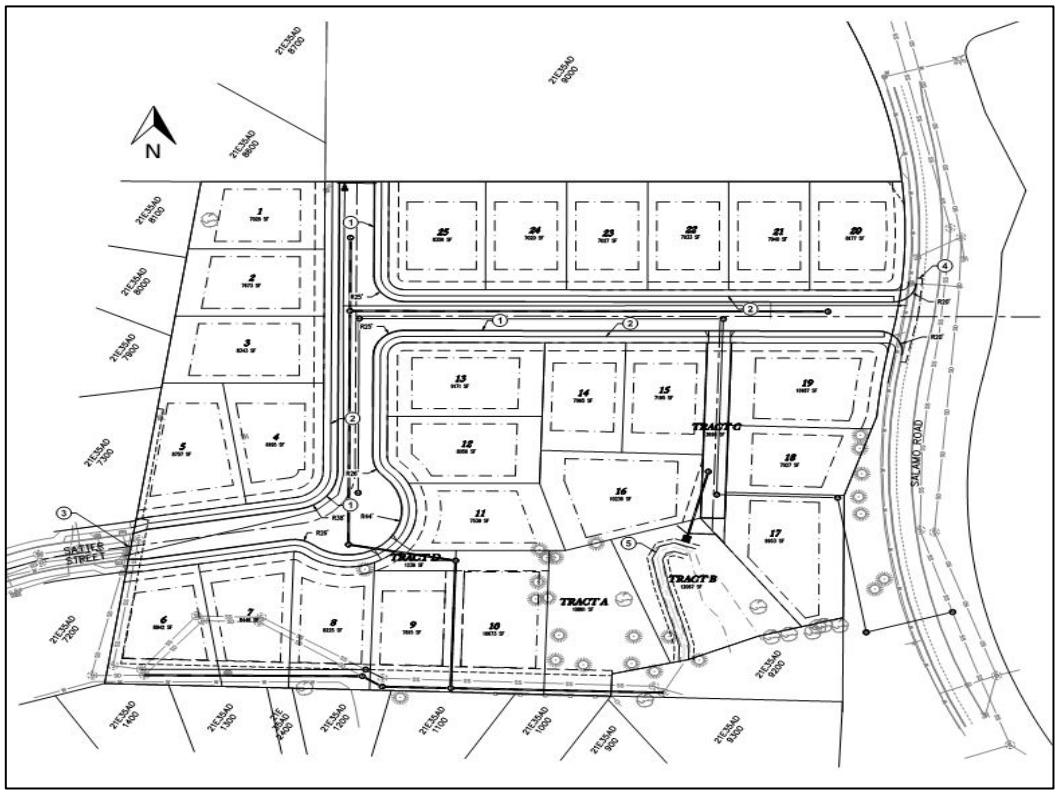


Figure 1: Site Plan

EXISTING CONDITIONS ANALYSIS

An intersection performance analysis was conducted to document the existing operations for the study intersection and to develop a baseline for analyzing future intersection operational needs. Intersection operations were analyzed for the current peak hour performance. The peak periods analyzed for this evaluation include the AM peak period (7:00 to 9:00 AM) and the PM peak period (4:00 to 6:00 PM). Detailed turn movement count data are summarized in Figure 2 and can be found in Appendix A.

The level of service (LOS) analyses presented in this report has been completed using the Synchro (Version 10) analysis software. Synchro is based on the 2010 Highway Capacity Manual (HCM) methodology. Analysis was performed for the minor street stop-controlled intersection of Weatherhill Road at Salamo Road.

The City of West Linn utilizes level of service standards to identify the maximum levels of congestion acceptable to the community and the threshold to determine transportation system deficiencies and improvement needs. The City of West Linn level of service standards are LOS D or better for all facilities except for principal arterials, where the minimum is LOS E. The following Table 1 summarizes the existing traffic operations for the study intersection. The detailed analysis results have been included in Appendix B.

Table 1: Existing Intersection Performance Summary

Weatherhill Road at Salamo Road	Peak Hour	2019 Existing Conditions		
		Control Delay (Sec)*	Level of Service	V/C
2019 Existing Conditions	AM	15.4	C	0.09
	PM	14.9	B	0.05

*Delay for unsignalized intersections is control delay for the worst minor street, controlled approach.

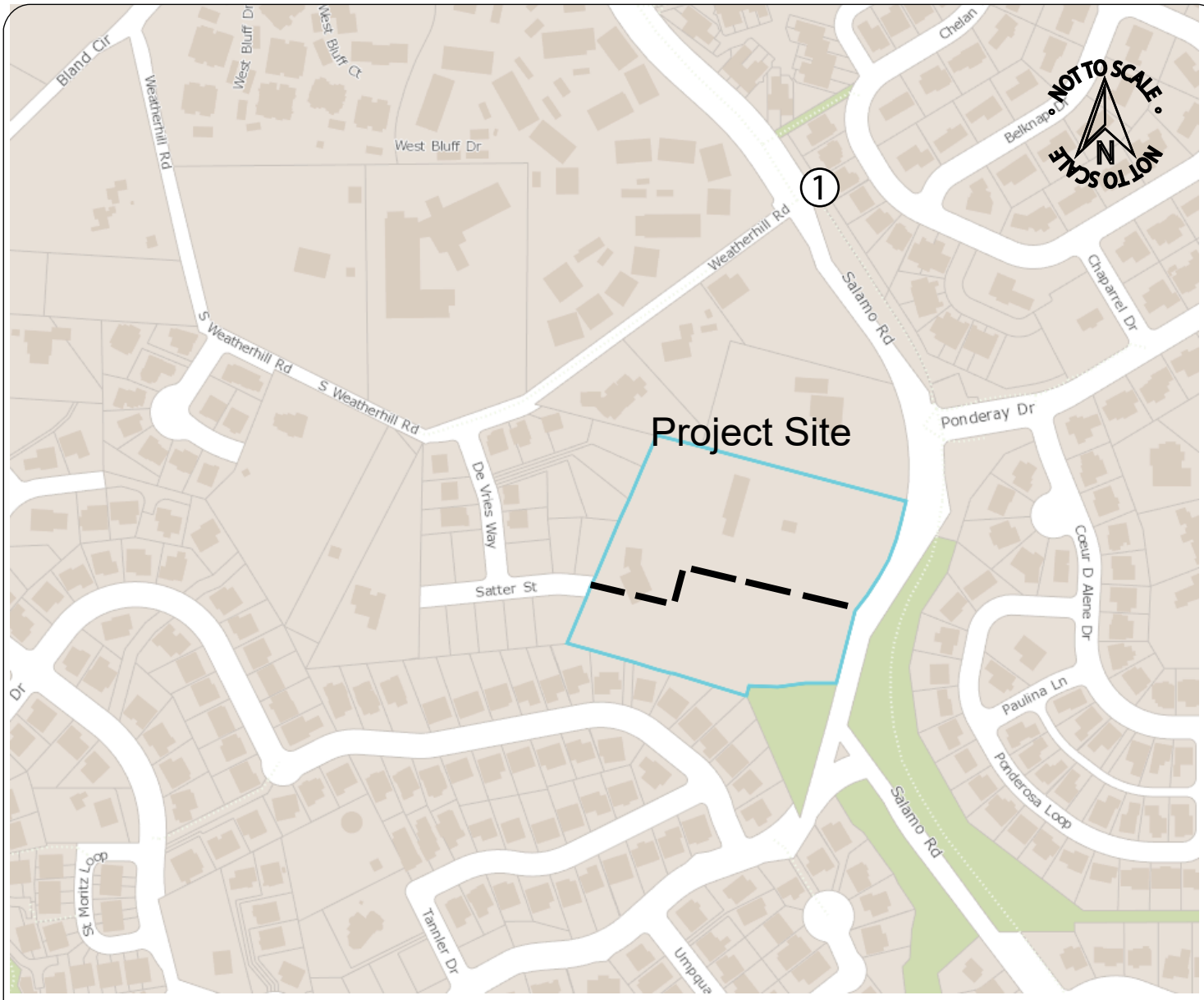
As shown in Table 1, the intersection operates at an acceptable level of service during both peak periods.

Crash Data

Reported crash data summarized by the State of Oregon for local roadways was reviewed for Weatherhill Road. Crash data from January 1, 2013 to December 31, 2018 was reviewed, with a single crash reported at the Weatherhill Road / Salamo Road intersection. The single crash over the evaluation period does not indicate there is an on-going safety issue at the intersection. Detailed crash data can be found in Appendix C.

TRIP GENERATION

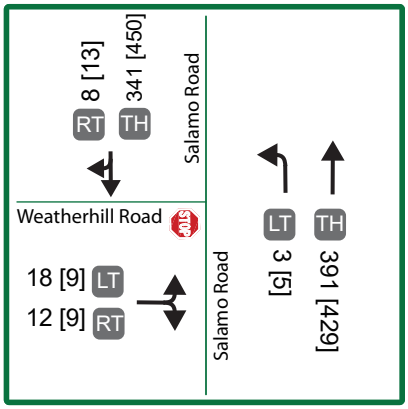
Trip rates presented in the Institute of Transportation Engineer's (ITE) *Trip Generation Manual, Tenth Edition*, were utilized to estimate the number of vehicle trips per dwelling unit, that are anticipated to be generated by the site. The site's trip generation is based on the ITE Single-Family Detached Housing



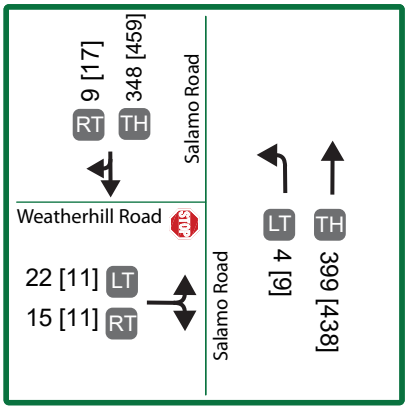
Weatherhill Road at Salamo Road

①

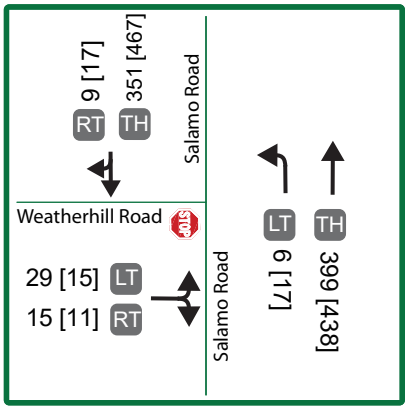
2019 Existing



2020 No-Build



2020 Buildout



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Future Roadway | STOP Stop Sign

= Lane Configuration | (X) = Study Intersection

LT TH RT = Left / Through / Right Turn

AM [PM] = Peak Hour Volumes

Figure 2: Traffic Volumes

land use (ITE Code 210) for weekdays during the peak hour of adjacent street traffic. Table 2 summarizes the estimated trip generation for the site[1].

Table 2: Trip Generation Summary

Land Use	Dwelling Units	Weekday						
		ADT [2]	AM Peak Hour			PM Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
Single-Family Detached Housing (ITE 210)								
Generation Rate Per Dwelling Units[1]	25	9.44	0.74	25%	75%	0.99	63%	37%
New Site Trips		236	19	5	14	25	16	9

[1] Source: *Trip Generation Manual, Tenth Edition*, ITE, 2017, average rates.
[2] Average Daily Trips

As summarized in Table 2, it is estimated that 236 daily trips including 19 AM peak hour trips and 25 PM peak hour trips will be generated and added to the local street network due to the proposed development.

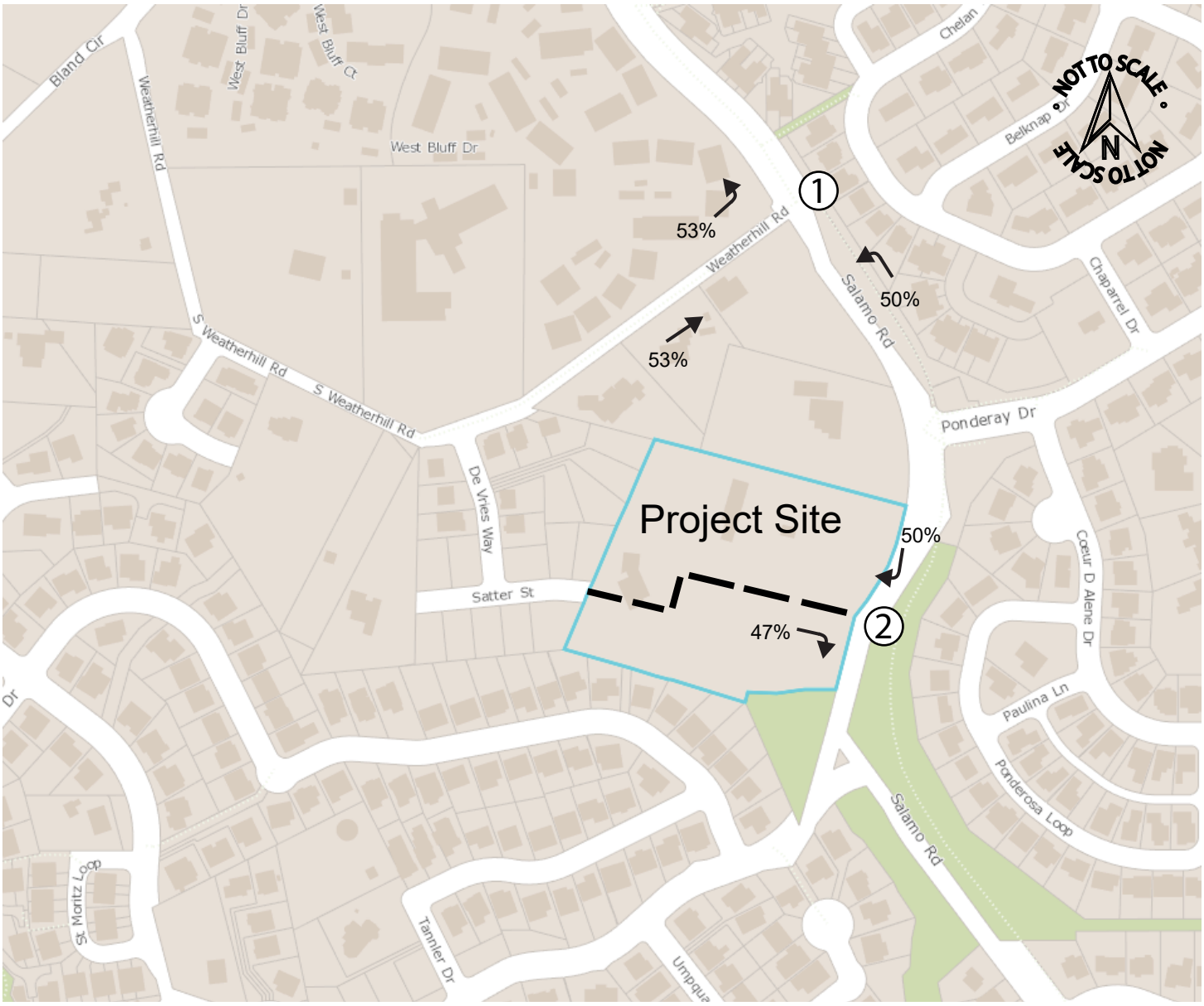
The site generated trips will be distributed to the roadway network based on existing traffic patterns identified from turn movement counts taken at the Weatherhill Road / Salamo Road intersection and a 24-hour speed/volume/classification count taken near the developments access onto Salamo Road. Based on the count data collected, the directional split of vehicles traveling in each direction on Salamo Road at Weatherhill Road is approximately equal. The site generated trips and detailed distribution are shown in Figure 3.

FUTURE CONDITIONS ANALYSIS

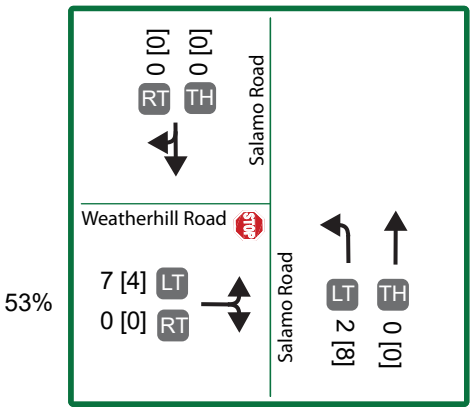
A future year capacity analysis was conducted for the Weatherhill Road / Salamo Road intersection. The City of West Linn was coordinated with to identify any developments that have been approved for construction but are not yet generating traffic that will impact the study intersection. The project SUB-18-04 at 22870 Weatherhill Road was identified as the only development in the immediate area that would produce in process trips. The in-process trips from this development were added to the intersection analysis based on the same distribution patterns identified for the site generated trips. Figure 4 summarizes the in-process trips.

The future year capacity analysis was conducted for a 2020 No-Build (without project) and 2021 Buildout (with project) scenarios. A two-percent per year growth rate was applied over one year to project background traffic growth at the intersection. The in-process trips were included in the 2020 No-Build scenario and the in-process plus project site trips were included in the 2020 Buildout scenario and are summarized in Figure 2. The capacity analysis results for the 2020 No-Build and 2020 Buildout scenarios are provided in Table 3 and in Appendix B.

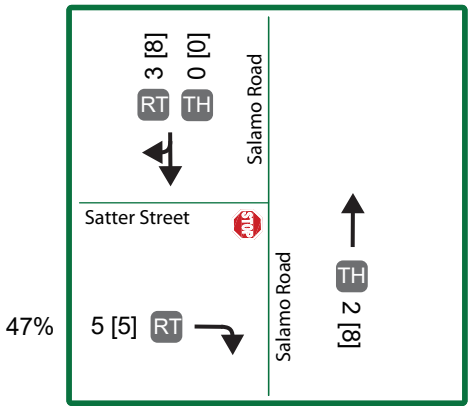
[1] Trip generation rates were obtained from the Global Transportations *West Linn Bland Circle Subdivision Trip Generation Memorandum*, dated April 5, 2019. Previously submitted to the City of West Linn.



1 Weatherhill Road at Salamo Road



2 Satter Street at Salamo Road



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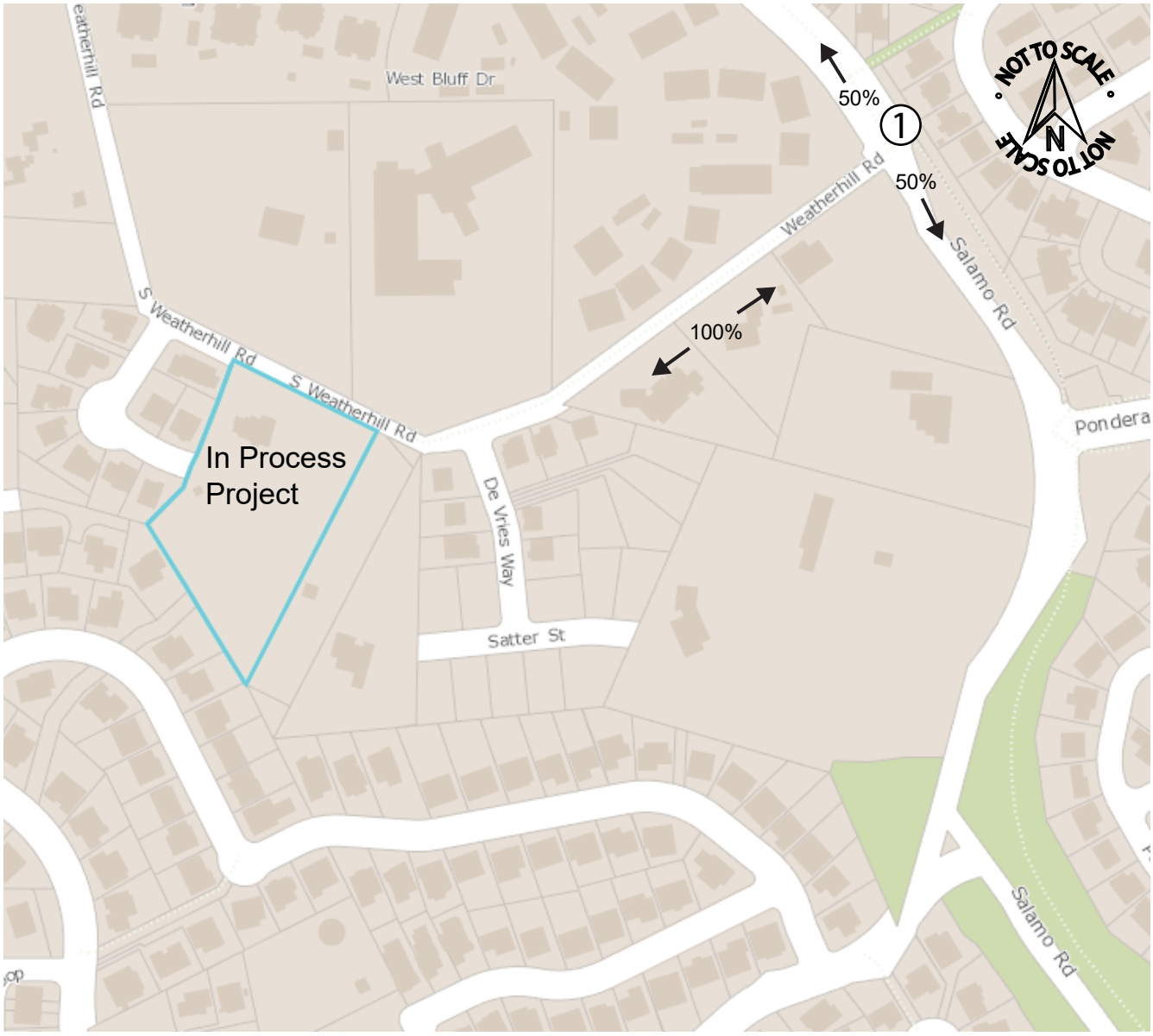
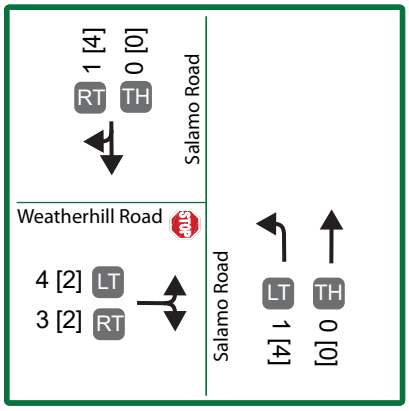
Future Roadway
STOP Stop Sign
= Lane Configuration
X = Study Intersection
LT TH RT = Left / Through / Right Turn
AM [PM] = Peak Hour Volumes

Figure 3: Trip Generation and Distribution



① Weatherhill Road at Salamo Road



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AM [PM] = Peak Hour Volumes
STOP Stop Sign
= Lane Configuration
X = Study Intersection
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Figure 4: In-Process Trips and Distribution

Table 3: Existing Intersection Performance Summary

Weatherhill Rd at Salamo Rd	Peak Hour	Control Delay (Sec)*	Level of Service	V/C
2020 No-Build Conditions	AM	15.9	C	0.12
	PM	15.4	C	0.06
2020 Buildout Conditions	AM	16.9	C	0.15
	PM	16.6	C	0.08

*Delay for unsignalized intersections is control delay for the worst minor street, controlled approach.

As shown in Table 3, the intersection continues to operate at an acceptable level of service during both peak periods under the No-Build and Buildout analysis scenarios. No capacity mitigations are necessary or recommended.

SIGHT DISTANCE EVALUATION

Intersection sight distance (ISD) and stopping sight distance (SSD) for the Weatherhill Road at Salamo Road intersection were evaluated under existing conditions. The sight distance evaluation follows the guidance provided in the AASHTO Geometric Design of Highway and Streets, 2011.

The posted speed along Salamo Road is 35 mph. A speed survey indicates an 85th percentile speed of 40 mph southbound and 37 mph northbound[2]. To calculate the intersection and stopping sight distance, the 85th percentile speeds were used in the analysis. Intersection sight distance is the minimum clear distance needed for drivers to anticipate and avoid collisions while determining whether to proceed through an intersection. The intersection sight distance evaluation assumes a driver's eye height of 3.5 feet, approaching object height of 3.5 feet, and setback of 14.5 feet from the existing traveled way. Intersection sight distance was compared to the AASHTO design intersection sight distance for the following cases:

- Case B1, Left Turn from the Minor Road[3]
- Case B2, Right Turn from the Minor Road[4]

Stopping sight distance for Salamo Road was also compared to the AASHTO Design Standards[5]. Stopping sight distance is the minimum sight distance needed for drivers to perceive, react, and stop for an object in the roadway. The sight distance evaluation is summarized in Table 4.

[2] Based on 85th percentile speed determined in tube counts, attached in the Appendix.
[3] AASHTO, Case B1 – Intersections with stop control on the minor road (AASHTO, Case B1, Table 9-6).
[4] AASHTO, Case B2 – Intersections with stop control on the minor road (AASHTO, Case B2, Table 9-8).
[5] AASHTO Stopping Sight Distance, Exhibit 3-1.

Table 4: Sight Distance Evaluation- Weatherhill Road at Salamo Road

Sight Distance Evaluated	Available Sightline (ft)		Sight Distance Standard (ft)	Meets Standard?
Weatherhill Road at Salamo Road				
Case B1: Left-turn	To the left	350	445	No
	To the right	285	415	No
Case B2: Right-turn	350		445	No
SSD Northbound Vehicle	285		270	Yes
SSD Southbound Vehicle	350		305	Yes

Findings

As summarized in Table 4, intersection site triangle standards are not met. This is due to horizontal and vertical curves in the roadway. However, stopping sight distance standards are met for both northbound and southbound vehicles. Stopping sight distance is typically the minimum standard accepted. Figure 5 and 6 show the existing view at 350 feet north and 285 feet south of the study intersection looking from a position adjacent to the anticipated driver's position on Salamo Road. To maximize intersection sight triangles, it is recommended to trim down the median vegetation south of the intersection trees as shown in Figure 6.

Figure 5: SB Salamo Rd from 350 feet North

Figure 6: NB Salamo Rd from 285 feet South

RECOMMENDATIONS

No capacity mitigations are necessary or recommended based on the capacity analysis. A review of crash data at the intersection does not identify a safety issue at the intersection. The sight distance analysis shows that intersection sight distance is not met in either direction due to crest vertical curves and horizontal curves in the roadway alignment. Stopping sight distance is met in both directions. No mitigation associated with this development is recommended for the Weatherhill Road / Salamo Road intersection.

Appendix

Appendix A: Traffic Count Data

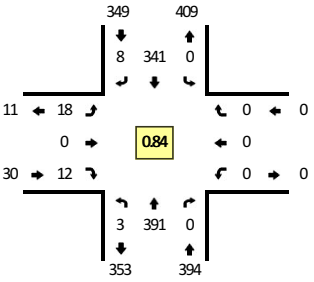
Type of peak hour being reported: Intersection Peak

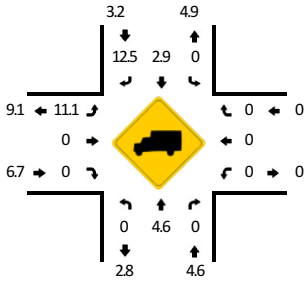
Method for determining peak hour: Total Entering Volume

LOCATION: Salamo Rd -- Weatherhill Rd
CITY/STATE: Clackamas, OR

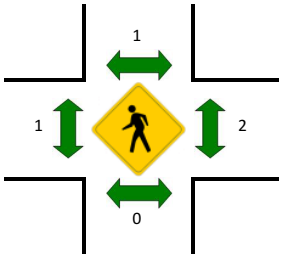
QC JOB #: 15127901
DATE: Thu, Nov 14 2019

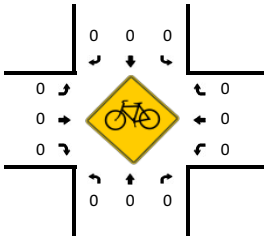
Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:35 AM -- 7:50 AM

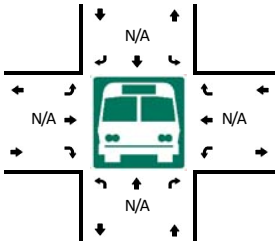


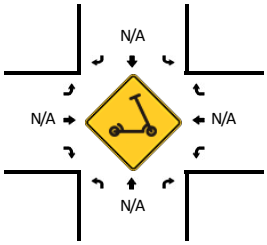


Quality Counts
DATA THAT DRIVES COMMUNITIES









5-Min Count Period Beginning At	Salamo Rd (Northbound)				Salamo Rd (Southbound)				Weatherhill Rd (Eastbound)				Weatherhill Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	17	0	0	0	11	0	0	1	0	1	0	0	0	0	0	30	
7:05 AM	0	21	0	0	0	24	0	0	0	0	0	0	0	0	0	0	45	
7:10 AM	0	17	0	0	0	33	0	0	2	0	0	0	0	0	0	0	52	
7:15 AM	0	20	0	0	0	33	0	0	1	0	0	0	0	0	0	0	54	
7:20 AM	1	25	0	0	0	31	1	0	0	0	2	0	0	0	0	0	60	
7:25 AM	0	30	0	0	0	18	0	0	0	0	0	0	0	0	0	0	48	
7:30 AM	0	30	0	0	0	26	0	0	5	0	1	0	0	0	0	0	62	
7:35 AM	0	48	0	0	0	35	1	0	3	0	1	0	0	0	0	0	88	
7:40 AM	0	44	0	0	0	30	0	0	2	0	0	0	0	0	0	0	76	
7:45 AM	0	31	0	0	0	33	0	0	1	0	2	0	0	0	0	0	67	
7:50 AM	0	36	0	0	0	34	3	0	1	0	4	0	0	0	0	0	78	
7:55 AM	1	32	0	0	0	31	1	0	1	0	0	0	0	0	0	0	66	726
8:00 AM	1	35	0	0	0	26	1	0	1	0	0	0	0	0	0	0	64	760
8:05 AM	0	25	0	0	0	18	1	0	2	0	1	0	0	0	0	0	47	762
8:10 AM	0	35	0	0	0	26	0	0	1	0	1	0	0	0	0	0	63	773
8:15 AM	1	29	0	0	0	19	2	0	1	0	1	0	0	0	0	0	53	772
8:20 AM	0	32	0	0	0	20	0	0	0	0	0	0	0	0	0	0	52	764
8:25 AM	0	30	0	0	0	22	0	0	2	0	0	0	0	0	0	0	54	770
8:30 AM	0	26	0	0	0	25	0	0	0	0	0	0	0	0	0	0	51	759
8:35 AM	1	30	0	0	0	22	1	0	1	0	0	0	0	0	0	0	55	726
8:40 AM	0	31	0	0	0	28	0	0	1	0	0	0	0	0	0	0	60	710
8:45 AM	0	22	0	0	0	27	0	0	0	0	2	0	0	0	0	0	51	694
8:50 AM	3	25	0	0	0	34	1	0	2	0	1	0	0	0	0	0	66	682
8:55 AM	0	25	0	0	0	36	1	0	0	0	0	0	0	0	0	0	62	678

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	492	0	0	0	392	4	0	24	0	12	0	0	0	0	0	924
Heavy Trucks	0	16	0		0	4	0		4	0	0		0	0	0		24
Buses																	
Pedestrians		0				0				4				0			4
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

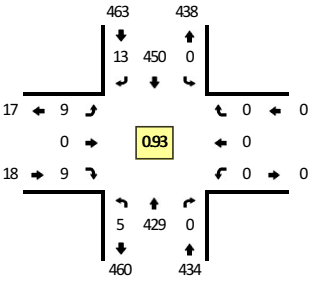
Report generated on 11/19/2019 2:36 PM

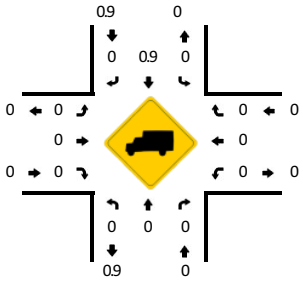
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: Salamo Rd -- Weatherhill Rd | **QC JOB #:** 15127902
CITY/STATE: Clackamas, OR | **DATE:** Thu, Nov 7 2019

Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:45 PM -- 6:00 PM





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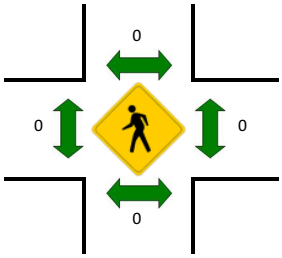
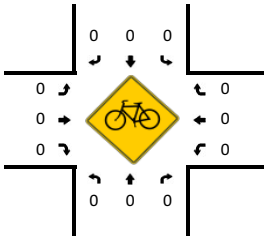
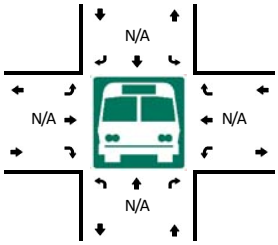
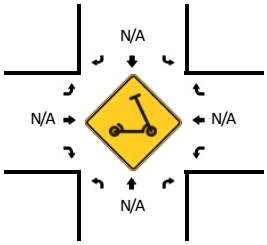








5-Min Count Period Beginning At	Salamo Rd (Northbound)				Salamo Rd (Southbound)				Weatherhill Rd (Eastbound)				Weatherhill Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	28	0	0	0	38	0	0	0	0	0	0	0	0	0	0	66	
4:05 PM	2	39	0	0	0	32	2	0	0	0	0	0	0	0	0	0	75	
4:10 PM	1	37	0	0	0	37	2	0	1	0	2	0	0	0	0	0	80	
4:15 PM	0	29	0	0	0	44	2	1	1	0	1	0	0	0	0	0	78	
4:20 PM	1	35	0	0	0	35	1	0	0	0	1	0	0	0	0	0	73	
4:25 PM	1	29	0	0	0	51	1	0	1	0	0	0	0	0	0	0	83	
4:30 PM	0	41	0	0	0	41	3	0	0	0	0	0	0	0	0	0	85	
4:35 PM	0	28	0	0	0	40	0	0	0	0	0	0	0	0	0	0	68	
4:40 PM	0	30	0	0	0	42	2	0	0	0	0	0	0	0	0	0	74	
4:45 PM	0	32	0	0	0	36	0	0	2	0	1	0	0	0	0	0	71	
4:50 PM	2	24	0	0	0	39	2	0	0	0	1	0	0	0	0	0	68	
4:55 PM	0	31	0	0	0	32	2	0	0	0	2	0	0	0	0	0	67	888
5:00 PM	0	30	0	0	0	48	2	0	1	0	0	0	0	0	0	0	81	903
5:05 PM	0	36	0	0	0	41	2	0	1	0	2	0	0	0	0	0	82	910
5:10 PM	0	29	0	0	0	37	1	0	2	0	0	0	0	0	0	0	69	899
5:15 PM	0	32	0	0	0	30	1	0	2	0	0	0	0	0	0	0	65	886
5:20 PM	0	31	0	0	0	42	1	0	0	0	2	0	0	0	0	0	76	889
5:25 PM	1	27	0	0	0	41	0	0	0	0	1	0	0	0	0	0	70	876
5:30 PM	1	40	0	0	0	27	1	0	0	0	1	0	0	0	0	0	70	861
5:35 PM	1	43	0	0	0	36	1	0	0	0	0	0	0	0	0	0	81	874
5:40 PM	0	35	0	1	0	36	1	0	0	0	1	0	0	0	0	0	74	874
5:45 PM	0	37	0	0	0	37	2	0	1	0	0	0	0	0	0	0	77	880
5:50 PM	1	48	0	0	0	34	0	0	0	0	1	0	0	0	0	0	84	896
5:55 PM	0	41	0	0	0	41	1	0	2	0	1	0	0	0	0	0	86	915

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	4	504	0	0	0	448	12	0	12	0	8	0	0	0	0	0	988
Heavy Trucks	0	0	0		0	8	0		0	0	0		0	0	0		8
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

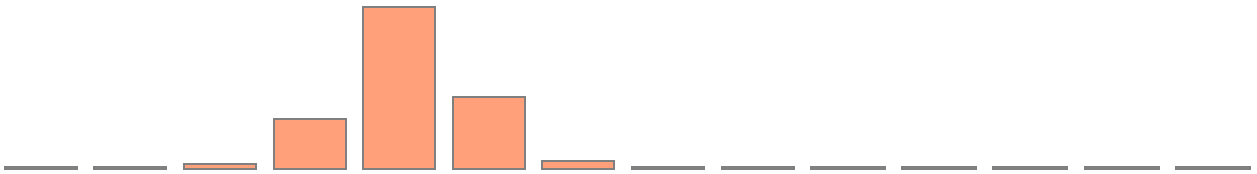
Comments:

Report generated on 11/19/2019 2:36 PM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of report: Tube Count - Speed Data

LOCATION: Salam Rd south of Ponderay Dr
QC JOB #: 15127903
SPECIFIC LOCATION:
DIRECTION: NB
CITY/STATE: Clackamas, OR
DATE: Nov 14 2019

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	**1**	0	1	0	1	5	0	0	0	0	0	0	0	0	8	31-40	6
01:00 AM	0	0	1	0	3	1	0	0	0	0	0	0	0	0	5	31-40	4
02:00 AM	0	0	0	0	1	2	2	0	0	0	0	0	0	0	5	36-45	4
03:00 AM	0	0	0	2	5	0	0	0	0	0	0	0	0	0	7	26-35	7
04:00 AM	0	0	0	1	8	4	0	0	0	0	0	0	0	0	13	31-40	12
05:00 AM	0	0	1	2	35	42	6	0	0	0	0	0	0	0	86	31-40	77
06:00 AM	0	0	0	19	63	43	**12**	0	0	0	0	0	0	0	137	31-40	106
07:00 AM	0	0	2	50	163	**80**	5	**3**	0	0	0	0	0	0	303	31-40	243
08:00 AM	0	0	**7**	**65**	172	71	6	1	0	0	0	0	0	0	**322**	31-40	243
09:00 AM	0	0	4	53	**183**	44	10	0	0	0	0	0	0	0	294	26-35	236
10:00 AM	0	0	0	42	147	75	5	0	0	0	0	0	0	0	269	31-40	222
11:00 AM	0	**1**	3	56	134	79	4	0	0	0	0	0	0	0	277	31-40	213
12:00 PM	**1**	0	4	40	179	89	7	0	0	0	0	0	0	0	320	31-40	268
01:00 PM	0	0	4	51	192	78	2	0	0	0	0	0	0	0	327	31-40	270
02:00 PM	0	0	7	62	165	**90**	4	0	0	0	0	0	0	0	328	31-40	255
03:00 PM	0	0	4	57	201	74	8	0	0	0	0	0	0	0	344	31-40	275
04:00 PM	0	0	4	**94**	219	72	3	0	0	0	0	0	0	0	392	26-35	313
05:00 PM	0	0	**10**	81	**271**	74	3	0	0	0	0	0	0	0	**439**	26-35	352
06:00 PM	0	0	7	63	213	80	5	**1**	0	0	0	0	0	0	369	31-40	293
07:00 PM	0	0	1	32	118	72	7	1	0	0	0	0	0	0	231	31-40	190
08:00 PM	0	0	7	23	97	52	**10**	1	0	0	0	0	0	0	190	31-40	149
09:00 PM	1	0	2	20	74	45	7	0	0	0	0	0	0	0	149	31-40	119
10:00 PM	0	0	0	8	25	21	2	0	0	0	0	0	0	0	56	31-40	46
11:00 PM	0	0	0	6	25	5	0	0	0	0	0	0	0	0	36	26-35	31
Day Total	3	1	69	827	2694	1198	108	7	0	0	0	0	0	0	4907	31-40	3892
Percent	0.1%	0%	1.4%	16.9%	54.9%	24.4%	2.2%	0.1%	0%	0%	0%	0%	0%	0%			
AM Peak	12:00 AM	11:00 AM	8:00 AM	8:00 AM	9:00 AM	7:00 AM	6:00 AM	7:00 AM	12:00 AM	12:00 AM	12:00 AM	12:00 AM	12:00 AM	12:00 AM	8:00 AM		
Volume	1	1	7	65	183	80	12	3	0	0	0	0	0	0	322		
PM Peak	12:00 PM	12:00 PM	5:00 PM	4:00 PM	5:00 PM	2:00 PM	8:00 PM	6:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	5:00 PM		
Volume	1	0	10	94	271	90	10	1	0	0	0	0	0	0	439		



Comments:

Report generated on 11/19/2019 2:37 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Speed Data

SUMMARY - Tube Count - Speed Data

LOCATION: Salam Rd south of Ponderay Dr
SPECIFIC LOCATION:
CITY/STATE: Clackamas, OR

QC JOB #: 15127903
DIRECTION: NB
DATE: Nov 14 2019 -

Speed Range	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
Grand Total	3	1	69	827	2694	1198	108	7	0	0	0	0	0	0	4907	31-40	3892
Percent	0.1%	0%	1.4%	16.9%	54.9%	24.4%	2.2%	0.1%	0%	0%	0%	0%	0%	0%			
Cumulative Percent	0.1%	0.1%	1.5%	18.3%	73.2%	97.7%	99.9%	100%	100%	100%	100%	100%	100%	100%			

ADT
4907

85th Percentile: 37 MPH
Mean Speed(Average): 32 MPH
Median: 32 MPH
Mode: 33 MPH

Comments:

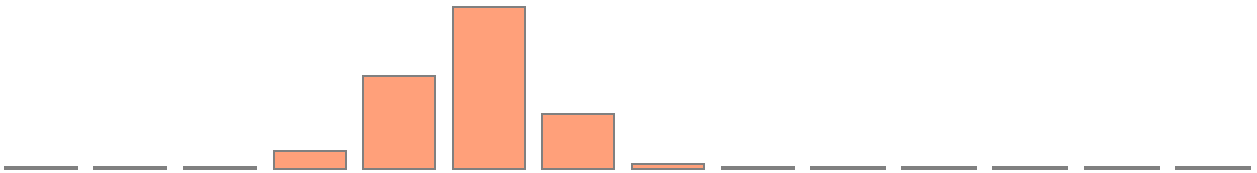
Report generated on 11/19/2019 2:37 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Speed Data

LOCATION: Salam Rd south of Ponderay Dr
QC JOB #: 15127903
SPECIFIC LOCATION:
DIRECTION: SB
CITY/STATE: Clackamas, OR
DATE: Nov 14 2019

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	0	1	1	5	0	0	0	0	0	0	0	0	7	31-40	6
01:00 AM	1	0	0	3	2	1	1	0	0	0	0	0	0	0	8	26-35	5
02:00 AM	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	31-40	2
03:00 AM	0	0	0	1	3	3	0	2	0	0	0	0	0	0	9	31-40	6
04:00 AM	0	0	0	1	0	14	3	0	0	0	0	0	0	0	18	36-45	17
05:00 AM	0	0	0	3	11	22	19	3	**1**	0	0	0	0	0	59	36-45	41
06:00 AM	0	0	0	13	41	71	35	4	1	0	0	0	0	0	165	31-40	112
07:00 AM	**2**	0	0	14	**100**	**189**	**82**	3	1	0	0	0	0	0	**391**	31-40	289
08:00 AM	0	0	1	20	94	176	57	**7**	0	0	0	0	0	0	355	31-40	270
09:00 AM	0	**1**	**2**	18	88	123	53	3	0	0	0	0	0	0	288	31-40	211
10:00 AM	1	0	0	13	94	133	51	7	0	0	0	0	0	0	299	31-40	227
11:00 AM	1	0	2	**23**	95	127	34	3	0	0	0	0	0	0	285	31-40	222
12:00 PM	1	**1**	0	13	106	168	55	3	0	0	0	0	0	0	347	31-40	274
01:00 PM	0	0	0	18	91	146	55	2	0	0	0	0	0	0	312	31-40	237
02:00 PM	**2**	0	0	19	101	181	50	5	**1**	0	0	0	0	0	359	31-40	282
03:00 PM	0	0	1	21	102	226	59	**7**	0	0	0	0	0	0	416	31-40	328
04:00 PM	0	0	**2**	**22**	**130**	212	**74**	4	0	0	0	0	0	0	444	31-40	342
05:00 PM	1	0	0	19	123	**235**	67	3	0	0	0	0	0	0	**448**	31-40	358
06:00 PM	0	0	0	5	105	185	55	1	0	0	0	0	0	0	351	31-40	290
07:00 PM	1	0	0	10	67	121	24	2	0	0	0	0	0	0	225	31-40	188
08:00 PM	0	0	0	8	42	81	23	3	0	0	0	0	0	0	157	31-40	123
09:00 PM	0	0	0	4	22	56	21	5	0	0	0	0	0	0	108	31-40	78
10:00 PM	1	0	0	5	11	21	12	1	0	0	0	0	0	0	51	36-45	33
11:00 PM	0	0	1	2	2	7	3	2	0	0	0	0	0	0	17	36-45	10
Day Total	11	2	9	256	1432	2504	833	70	4	0	0	0	0	0	5121	31-40	3936
Percent	0.2%	0%	0.2%	5%	28%	48.9%	16.3%	1.4%	0.1%	0%	0%	0%	0%	0%			
AM Peak	7:00 AM	9:00 AM	9:00 AM	11:00 AM	7:00 AM	7:00 AM	7:00 AM	8:00 AM	5:00 AM	12:00 AM	12:00 AM	12:00 AM	12:00 AM	12:00 AM	7:00 AM		
Volume	2	1	2	23	100	189	82	7	1	0	0	0	0	0	391		
PM Peak	2:00 PM	12:00 PM	4:00 PM	4:00 PM	4:00 PM	5:00 PM	4:00 PM	3:00 PM	2:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	5:00 PM		
Volume	2	1	2	22	130	235	74	7	1	0	0	0	0	0	448		



Comments:

Report generated on 11/19/2019 2:37 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Speed Data

SUMMARY - Tube Count - Speed Data

LOCATION: Salam Rd south of Ponderay Dr
SPECIFIC LOCATION:
CITY/STATE: Clackamas, OR

QC JOB #: 15127903
DIRECTION: SB
DATE: Nov 14 2019 -

Speed Range	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
Grand Total **Percent**	11 0.2%	2 0%	9 0.2%	256 5%	1432 28%	2504 48.9%	833 16.3%	70 1.4%	4 0.1%	0 0%	0 0%	0 0%	0 0%	0 0%	5121	31-40	3936
Cumulative Percent	0.2%	0.3%	0.4%	5.4%	33.4%	82.3%	98.6%	99.9%	100%	100%	100%	100%	100%	100%			

ADT
5121

85th Percentile: 40 MPH
Mean Speed(Average): 36 MPH
Median: 36 MPH
Mode: 38 MPH

Comments:

Report generated on 11/19/2019 2:37 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Weatherhill at Salamo AM Peak Hour

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
2019 Traffic Volume	3	391			341	8	18		12			
2.00%												
1 Year Background Growth	3	399	0	0	348	8	18	0	12	0	0	0
In-Process Trips	1					1	4		3			
2020 Background Volumes	4	399	0	0	348	9	22	0	15	0	0	0
Site Trips	2					0	7					
2020 Buildout Volumes	**6**	**399**	**0**	**0**	**348**	**9**	**29**	**0**	**15**	**0**	**0**	**0**

Weatherhill at Salamo PM Peak Hour

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
2019 Traffic Volume	5	429			450	13	9		9			
2.00%												
1 Year Background Volumes	5	438	0	0	459	13	9	0	9	0	0	0
In-Process Trips	4					4	2		2			
2020 Background Volumes	9	438	0	0	459	17	11	0	11	0	0	0
Site Trips	8					0	4					
2020 Buildout Volumes	**17**	**438**	**0**	**0**	**459**	**17**	**15**	**0**	**11**	**0**	**0**	**0**

Appendix B: HCM Reports

Intersection	
Int Delay, s/veh	0.6

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	341	8	3	391	18	12
Future Vol, veh/h	341	8	3	391	18	12
Conflicting Peds, #/hr	0	1	1	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	130	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	3	13	0	5	11	2
Mvmt Flow	406	10	4	465	21	14

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	417	0	886	412
Stage 1	-	-	-	-	412	-
Stage 2	-	-	-	-	474	-
Critical Hdwy	-	-	4.1	-	6.51	6.22
Critical Hdwy Stg 1	-	-	-	-	5.51	-
Critical Hdwy Stg 2	-	-	-	-	5.51	-
Follow-up Hdwy	-	-	2.2	-	3.599	3.318
Pot Cap-1 Maneuver	-	-	1153	-	304	640
Stage 1	-	-	-	-	650	-
Stage 2	-	-	-	-	608	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1152	-	302	639
Mov Cap-2 Maneuver	-	-	-	-	302	-
Stage 1	-	-	-	-	649	-
Stage 2	-	-	-	-	606	-

Approach	SE	NW	NE
HCM Control Delay, s	0	0.1	15.4
HCM LOS			C

Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET	SER
Capacity (veh/h)	383	1152	-	-	-
HCM Lane V/C Ratio	0.093	0.003	-	-	-
HCM Control Delay (s)	15.4	8.1	-	-	-
HCM Lane LOS	C	A	-	-	-
HCM 95th %tile Q(veh)	0.3	0	-	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	450	13	5	429	9	9
Future Vol, veh/h	450	13	5	429	9	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	130	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	1	0	0	0	0	0
Mvmt Flow	484	14	5	461	10	10

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	498	0	962	491
Stage 1	-	-	-	-	491	-
Stage 2	-	-	-	-	471	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1076	-	286	582
Stage 1	-	-	-	-	619	-
Stage 2	-	-	-	-	632	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1076	-	285	582
Mov Cap-2 Maneuver	-	-	-	-	285	-
Stage 1	-	-	-	-	619	-
Stage 2	-	-	-	-	629	-

Approach	SE	NW	NE
HCM Control Delay, s	0	0.1	14.9
HCM LOS			B

Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET	SER
Capacity (veh/h)	383	1076	-	-	-
HCM Lane V/C Ratio	0.051	0.005	-	-	-
HCM Control Delay (s)	14.9	8.4	-	-	-
HCM Lane LOS	B	A	-	-	-
HCM 95th %tile Q(veh)	0.2	0	-	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	348	9	4	399	22	15
Future Vol, veh/h	348	9	4	399	22	15
Conflicting Peds, #/hr	0	1	1	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	130	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	3	13	0	5	11	2
Mvmt Flow	414	11	5	475	26	18

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	426	0	907	421
Stage 1	-	-	-	-	421	-
Stage 2	-	-	-	-	486	-
Critical Hdwy	-	-	4.1	-	6.51	6.22
Critical Hdwy Stg 1	-	-	-	-	5.51	-
Critical Hdwy Stg 2	-	-	-	-	5.51	-
Follow-up Hdwy	-	-	2.2	-	3.599	3.318
Pot Cap-1 Maneuver	-	-	1144	-	295	632
Stage 1	-	-	-	-	643	-
Stage 2	-	-	-	-	600	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1143	-	293	631
Mov Cap-2 Maneuver	-	-	-	-	293	-
Stage 1	-	-	-	-	642	-
Stage 2	-	-	-	-	597	-

Approach	SE	NW	NE
HCM Control Delay, s	0	0.1	15.9
HCM LOS			C

Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET	SER
Capacity (veh/h)	374	1143	-	-	-
HCM Lane V/C Ratio	0.118	0.004	-	-	-
HCM Control Delay (s)	15.9	8.2	-	-	-
HCM Lane LOS	C	A	-	-	-
HCM 95th %tile Q(veh)	0.4	0	-	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	459	17	9	438	11	11
Future Vol, veh/h	459	17	9	438	11	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	130	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	1	0	0	0	0	0
Mvmt Flow	494	18	10	471	12	12

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	512	0	994	503
Stage 1	-	-	-	-	503	-
Stage 2	-	-	-	-	491	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1064	-	274	573
Stage 1	-	-	-	-	612	-
Stage 2	-	-	-	-	619	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1064	-	272	573
Mov Cap-2 Maneuver	-	-	-	-	272	-
Stage 1	-	-	-	-	612	-
Stage 2	-	-	-	-	613	-

Approach	SE	NW	NE
HCM Control Delay, s	0	0.2	15.4
HCM LOS			C

Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET	SER
Capacity (veh/h)	369	1064	-	-	-
HCM Lane V/C Ratio	0.064	0.009	-	-	-
HCM Control Delay (s)	15.4	8.4	-	-	-
HCM Lane LOS	C	A	-	-	-
HCM 95th %tile Q(veh)	0.2	0	-	-	-

Intersection	
Int Delay, s/veh	1

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	351	9	6	399	29	15
Future Vol, veh/h	351	9	6	399	29	15
Conflicting Peds, #/hr	0	1	1	0	1	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	130	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	3	13	0	5	11	2
Mvmt Flow	418	11	7	475	35	18

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	430	0	915	425
Stage 1	-	-	-	-	425	-
Stage 2	-	-	-	-	490	-
Critical Hdwy	-	-	4.1	-	6.51	6.22
Critical Hdwy Stg 1	-	-	-	-	5.51	-
Critical Hdwy Stg 2	-	-	-	-	5.51	-
Follow-up Hdwy	-	-	2.2	-	3.599	3.318
Pot Cap-1 Maneuver	-	-	1140	-	292	629
Stage 1	-	-	-	-	641	-
Stage 2	-	-	-	-	598	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1139	-	290	628
Mov Cap-2 Maneuver	-	-	-	-	290	-
Stage 1	-	-	-	-	640	-
Stage 2	-	-	-	-	594	-

Approach	SE	NW	NE
HCM Control Delay, s	0	0.1	16.9
HCM LOS			C

Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET	SER
Capacity (veh/h)	355	1139	-	-	-
HCM Lane V/C Ratio	0.148	0.006	-	-	-
HCM Control Delay (s)	16.9	8.2	-	-	-
HCM Lane LOS	C	A	-	-	-
HCM 95th %tile Q(veh)	0.5	0	-	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	467	17	17	438	15	11
Future Vol, veh/h	467	17	17	438	15	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	130	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	1	0	0	0	0	0
Mvmt Flow	502	18	18	471	16	12

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	520	0	1018	511
Stage 1	-	-	-	-	511	-
Stage 2	-	-	-	-	507	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1056	-	265	567
Stage 1	-	-	-	-	606	-
Stage 2	-	-	-	-	609	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1056	-	260	567
Mov Cap-2 Maneuver	-	-	-	-	260	-
Stage 1	-	-	-	-	606	-
Stage 2	-	-	-	-	599	-

Approach	SE	NW	NE
HCM Control Delay, s	0	0.3	16.6
HCM LOS			C

Minor Lane/Major Mvmt	NELn1	NWL	NWT	SET	SER
Capacity (veh/h)	337	1056	-	-	-
HCM Lane V/C Ratio	0.083	0.017	-	-	-
HCM Control Delay (s)	16.6	8.5	-	-	-
HCM Lane LOS	C	A	-	-	-
HCM 95th %tile Q(veh)	0.3	0.1	-	-	-

Appendix C: Crash Data

CITY OF WEST LINN, CLACKAMAS COUNTY

WEATHERHILL RD and SALAMO RD, City of West Linn, Clackamas County, 01/01/2013 to 12/31/2018

1 - 1 of 1 Crash records shown.

SER# / INVEST / RD DPT / UNLOC?	S P E D	A L C	D M R U G S	J I N V	S C H L	W O R K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT EVENT	CAUSE
04735	N	N	N				11/21/2014	17	SALAMO RD	INTER	3-LEG	N	N	RAIN	ANGL-OTH	01	NONE 0	TURN-L										02
NONE							FR	0	WEATHERHILL RD	N		UNKNOWN	N	WET	TURN		PRVTE	W -N									000	00
N							7P			05	0		N	DARK	PDO		PSNGR CAR		01	DRVR	NONE	52	F	OR-Y		028	000	02
N							45 21 39.12	-122 38 49.79																OR<25				
																02	NONE 0	STRGHT										
																	UNKN	S -N									000	00
																	PSNGR CAR		01	DRVR	NONE	00	F	UNK		000	000	00
																								UNK				