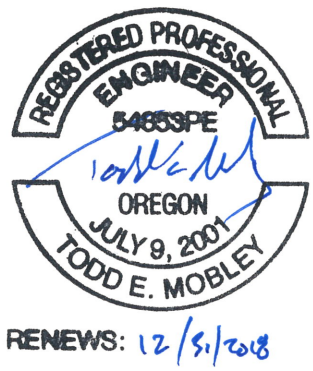
Technical Memorandum



LANCASTER
ENGINEERING
321 SW 4th Ave., Suite 400
Portland, OR 97204
phone: 503.248.0313
fax: 503.248.9251
lancasterengineering.com

To: Mark Handris, Icon Construction & Development

From: Daniel Stumpf, EI
Todd Mobley, PE

Date: April 9, 2018

Subject: Park Place Annexation:
Transportation Impact Study Addendum #2

Introduction

This memorandum is written as an addendum to the original *Park Place Annexation Transportation Impact Study* (TIS), dated August 2nd, 2017. Comments on the TIS were received from Clackamas County dated April 3, 2018. Lancaster Engineering then issued a response dated April 5, 2018, which precipitated updated comments from the County dated April 6, 2018. For reference, all three of those documents are attached to this addendum.

There is one outstanding item requested by Clackamas County as a result of these comments and responses, and that is analysis at the intersection of Redland Road and Anchor Way. That analysis is provided in this addendum.

Traffic Volumes

Manual turning movement counts during the morning and evening peak hours were conducted at the intersection from 7:00 to 9:00 AM on Thursday, April 5th and from 4:00 to 6:00 PM on Wednesday, April 5th. A growth rate was then applied to these volumes to estimate 2035 conditions without the proposed annexation using the same methodology for future volume forecasting that was implemented in the original TIS. Site trips were then added to the 2035 traffic volumes to show conditions with the annexation area at full build out.

Updated figures showing existing volumes, the assignment of site trips, and 2035 conditions both with and without the annexation area are attached to this memorandum.

Planned Intersection Improvements

The City of Oregon City Transportation System Plan (TSP) calls for the installation of a traffic signal at this location. Because warrants are clearly satisfied for a left-turn lane at this location even without the proposed annexation, to achieve safe operation, a future improvement project at this location would have to either A)

install a left-turn lane and a traffic signal, or B) install a three-phase traffic signal with a separate exclusive phase for each leg of the intersection. With this configuration, a left-turn lane would not be necessary.

Operational Analysis

An examination of left-turn lane warrants and traffic signal warrants was done to determine when these improvements would be necessary. Details are included in the attached to this addendum, but the analysis shows that a left-turn lane is presently warranted during both the morning and evening peak hours for existing conditions. By 2035 a traffic signal will be warranted even without the proposed annexation. The table below shows a summary of when warrants are satisfied for a left-turn lane and for a traffic signal. As shown in the table, improvements are needed at the intersection, even without the proposed annexation.

Table 1: Left-Turn Lane & Traffic Signal Warrant Summary

		Left-Turn Lane Needed?		
		AM Peak Hour	**PM Peak Hour**	**Traffic Signal Needed?**
A.	**Redland Road at Anchor Way**			
	Existing Conditions	Yes	Yes	No
	2035 Planning Horizon (w/o Annexation Trips)	Yes	Yes	Yes
	2035 Planning Horizon (w/ Annexation Trips)	Yes	Yes	Yes

In addition, a capacity analysis was conducted to determine the level of service, delay, and volume-to-capacity (v/c) ratio for all the scenarios examined. Detailed capacity analysis output is attached to this addendum, but the analysis shows that the intersection currently meets Clackamas County operational standards, but experiences long delays on the stop-controlled Anchor Way approach during the evening peak hour.

By 2035 the intersection will fail during both peak hours, even without trips from the annexation area. The addition of a traffic signal and a left-turn lane on Redland Road will result in acceptable operation at the planning horizon with the annexation area at full build out.

A summary of the results of the capacity analysis are shown in the following table.

Table 2: Capacity Analysis Summary

		Morning Peak Hour			Evening Peak Hour		
		LOS	Delay	v/c	LOS	Delay	v/c
A.	**Redland Road at Anchor Way**						
	Existing Conditions	D	33	0.54	F	89	0.95
	2035 Planning Horizon (w/o Annexation Trips)	F	>99	0.98	F	>99	**1.65**
	2035 Planning Horizon (w/ Annexation Trips)	F	>99	**1.56**	F	>99	**>2**
	2035 w/ Annexation, w/ left-turn lane & signal	B	13	0.81	D	40	0.96

BOLDED results exceed Clackamas County operational standard

Transportation Planning Rule

This analysis shows that the infrastructure considered in the TSP will provide acceptable operation at the planning horizon with the annexation area in place. As such, the Transportation Planning Rule is satisfied, provided the improvement is reasonably likely to be constructed. It is recommended that this intersection be monitored during the Master Plan stage for projects within the Park Place Concept Plan area to determine when mitigation is necessary.

CLACKAMAS COUNTY

DAN JOHNSON
DIRECTOR

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
DEVELOPMENT SERVICES BUILDING
150 BEAVERCREEK ROAD OREGON CITY, OR 97045

Date: April 3, 2018
To: Pete Walter, City of Oregon City
From: Christian Snuffin, P.E., PTOE, Clackamas County
Rick Nys, P.E., Clackamas County
Subject: AN 17-0004 / ZC 17-0005: Park Place Annexation and Rezoning of 92 acres

Mr. Walter,

We have the following comments about this project:

- Clackamas County has jurisdiction over several of the study intersections and roadways including a portion of Redland Road, Livesay Road, a portion of Holcomb Boulevard, and Holly Lane.
- The County was not contacted by the applicant to participate in the traffic impact analysis (TIA) scoping process.
- The zone change has a significant effect on the Redland Road/Holly Lane intersection per the TIA. The proposed mitigation suggested by Replinger & Associates for a proportional share contribution is agreeable to Clackamas County. We question the assumption that both the Holly Lane extension and the Redland Road/Holly Lane intersection improvement projects can be considered as planned per the Transportation Planning Rule without a more defined funding plan. We have concerns about the Redland Road/Holly Lane operations without the provision of a roundabout or other intersection improvement when the Holly Lane extension is constructed. Alternatively, additional study should be conducted that establishes compliance with the Transportation Planning Rule as well as compliance with County safety criteria to determine the appropriate intersection improvement at the Redland Road/Holly Lane intersection with the construction of the extension. This can be accomplished as part of a Master Plan TIA.
- Either with or without a connection to Redland Road via a Holly Lane extension, the County has concerns about the impact to Livesay Road and its intersection with Redland Road, which would directly serve a future development. The TIA assumes no site traffic on Livesay Road, which we think is not realistic without further analysis. The Oregon City Transportation System Plan assumes no planned improvements for the Redland Road/Livesay Road intersection. The TIA should evaluate the Redland Road/Livesay Road intersection and the need for a westbound left turn lane. This analysis should be conducted prior to approval of the zone change.
- The intersection of Redland Road/Anchor Way should be analyzed as part of a revised TIA. With the Holly Lane connection, this intersection will experience a substantial increase in traffic. That evaluation should include evaluating the need for a westbound left turn lane on Redland Road. This analysis should be conducted prior to approval of the zone change.

Should you have any questions or comments, please contact Christian Snuffin at 503-742-4716.

Technical Memorandum

LANCASTER ENGINEERING

321 SW 4th Ave., Suite 400
Portland, OR 97204
phone: 503.248.0313
fax: 503.248.9251
lancasterengineering.com

To: Christian Snuffin, PE, PTOE & Rick Nys, PE
Clackamas County Department of Transportation & Development

From: Todd Mobley, PE

Date: April 5, 2018

Subject: Park Place Annexation in Oregon City, AN 17-0004/ZC 17-0005

Introduction

This memorandum is written in response to comments on the subject application received from Clackamas County, dated April 3, 2018. Our response focuses on the last three bulleted items in the County comments.

Redland Road at Holly Lane & Holly Lane Extension

The Holly Lane extension and any necessary intersection improvements are planned in the City of Oregon City Transportation System Plan (TSP) and development within the Park Place area will rely on these improvements. Development on the subject site will be consistent with that considered in the Concept Plan, and thereby the TSP. Therefore, the future Holly Lane extension and the intersection with Redland Road considered in the TSP will be sufficient to serve the Park Place area, including the subject site.

Still, as noted in the third bullet of the County comments, specific intersection designs that will be needed to support development and to satisfy the standards that will be applicable can be considered at the time of the Transportation Impact Study (TIS) for the future Master Plan application.

Livesay Road Traffic Impacts

The intent of development in the annexation area is not to rely on Livesay Road west of the project site. The roadway is generally narrow and unimproved. For this reason, the original TIS did not assign trips to the roadway or rely on it for access. The Park Place Concept Plan considers a functional upgrade to Livesay Road to a Neighborhood Collector classification between the planned Swan Avenue and Holly Lane extensions. This is shown in Figure 1 below, which is the Functional Classification Map from the Concept Plan. Consistent with the Concept Plan, development on the site is intended to rely on streets other than Livesay Road.

Traffic impacts to Livesay Road should be carefully monitored and controlled during the Master Plan process. This can be accomplished through the thoughtful timing and configuration of new street connections to development in the Park Place area, which can be done strategically to emphasize the use of new higher-classification facilities such as the Swan Avenue and Holly Lane extensions.

For these reasons, the evaluation of the intersection of Livesay Road and Redland Road is not necessary at this time. Rather, impacts to Livesay Road should be carefully examined and minimized as development occurs through the Master Plan process.

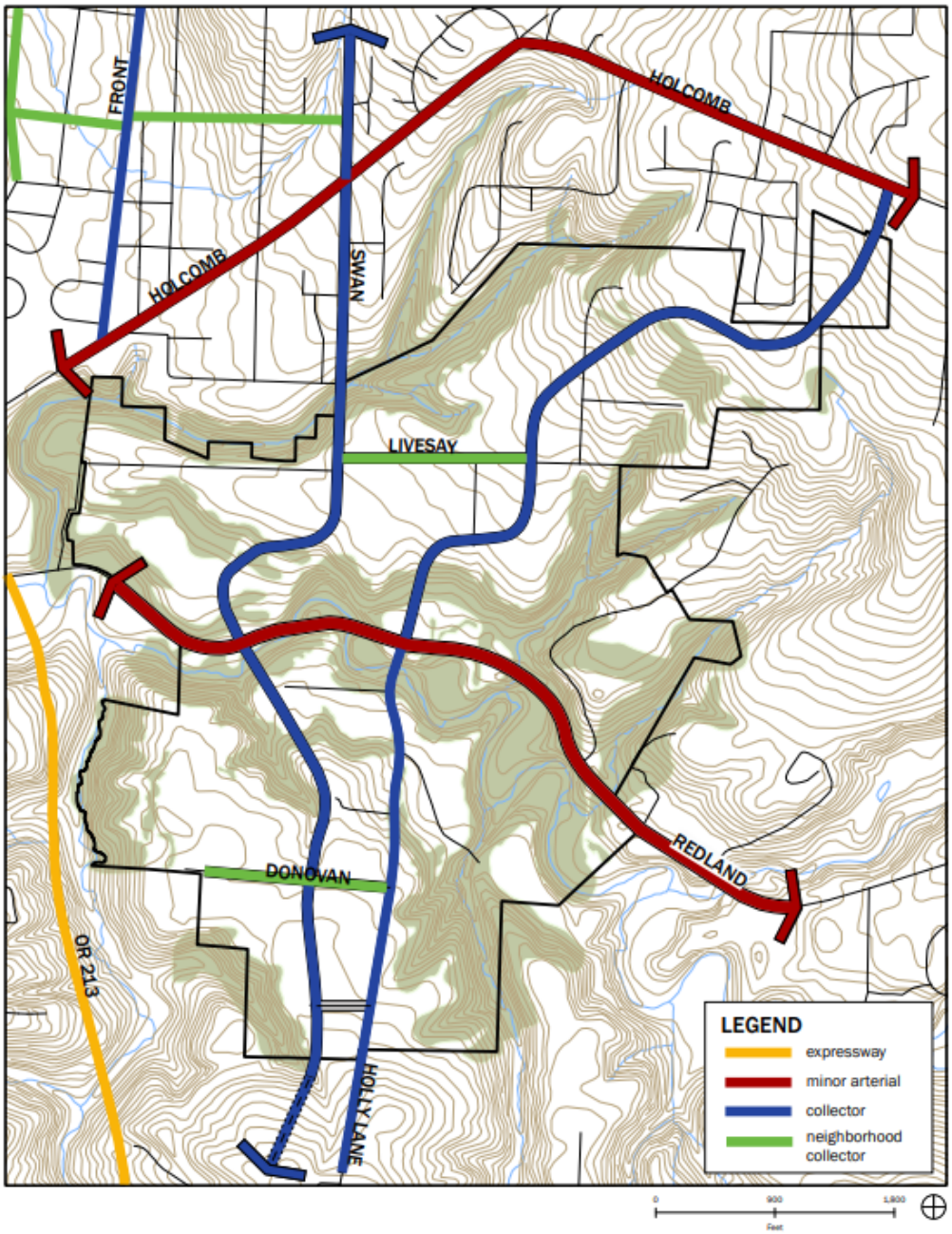


Figure 1 - Functional Classification Map from Park Place Concept Plan

Redland Road at Anchor Way

The intersection of Redland Road at Anchor Way was not included in the study since only three percent of the site traffic is expected to use Anchor Way. While through traffic will be added, trips to and from Anchor Way will be minor. In fact, the trip assignment shows that only 11 morning peak hour trips and 8 evening peak hour trips will be added to the westbound left-turning movement that was raised as a concern in the County comments.

Further, the intersection is planned for signalization in the TSP. This intersection could be selected for further study as part of future Master Plan applications for development within the Park Place area but based on the trip generation and distribution analysis in this report, minor-street impacts will be very small.

If you have any questions regarding the responses and information in this memo, please don't hesitate to contact me directly.

CLACKAMAS COUNTY

DAN JOHNSON
DIRECTOR

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
DEVELOPMENT SERVICES BUILDING
150 BEAVERCREEK ROAD OREGON CITY, OR 97045

Date: April 6, 2018
To: Pete Walter, City of Oregon City
From: Christian Snuffin, P.E., PTOE, Clackamas County
Rick Nys, P.E., Clackamas County
Subject: AN 17-0004 / ZC 17-0005: Park Place Annexation and Rezoning of 92 acres

Mr. Walter,

We've reviewed the April 5, 2018 memorandum from Lancaster Engineering. We have the following updated comments about this project:

- We are satisfied with the assertion that the intent of the development is not to rely on Livesay Road to the west of the project site, and that planned improvements to the eastern portion of Livesay, as well as the Swan Avenue connector, will address future transportation needs.
- In our previous memo, dated April 3, 2018, we asked for additional analysis at the Redland Road/Anchor Way intersection. Mr. Mobley's memo does describe the additional site trips on Redland Rd, and it indicates that the number of additional site trips are not significant. However, a capacity analysis that addresses requirements of the Transportation Planning Rule and a westbound left turn lane analysis is still needed. This analysis should be conducted prior to approval of the zone change.

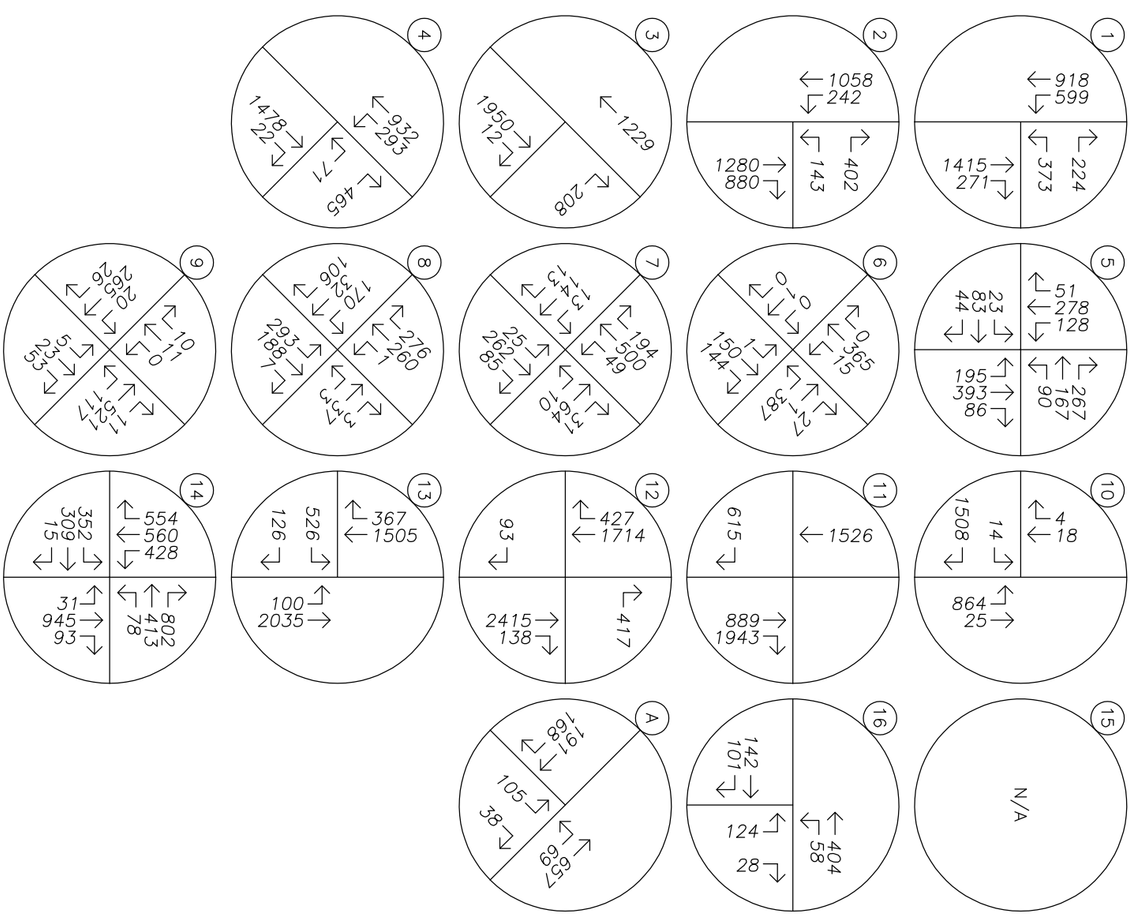
Should you have any questions or comments, please contact Christian Snuffin at 503-742-4716.

FIGURE 1

VICINITY MAP
Intersection Configurations
Traffic Control Devices and Lane Configurations

*Matches the alignment in the City's TSP

No Scale

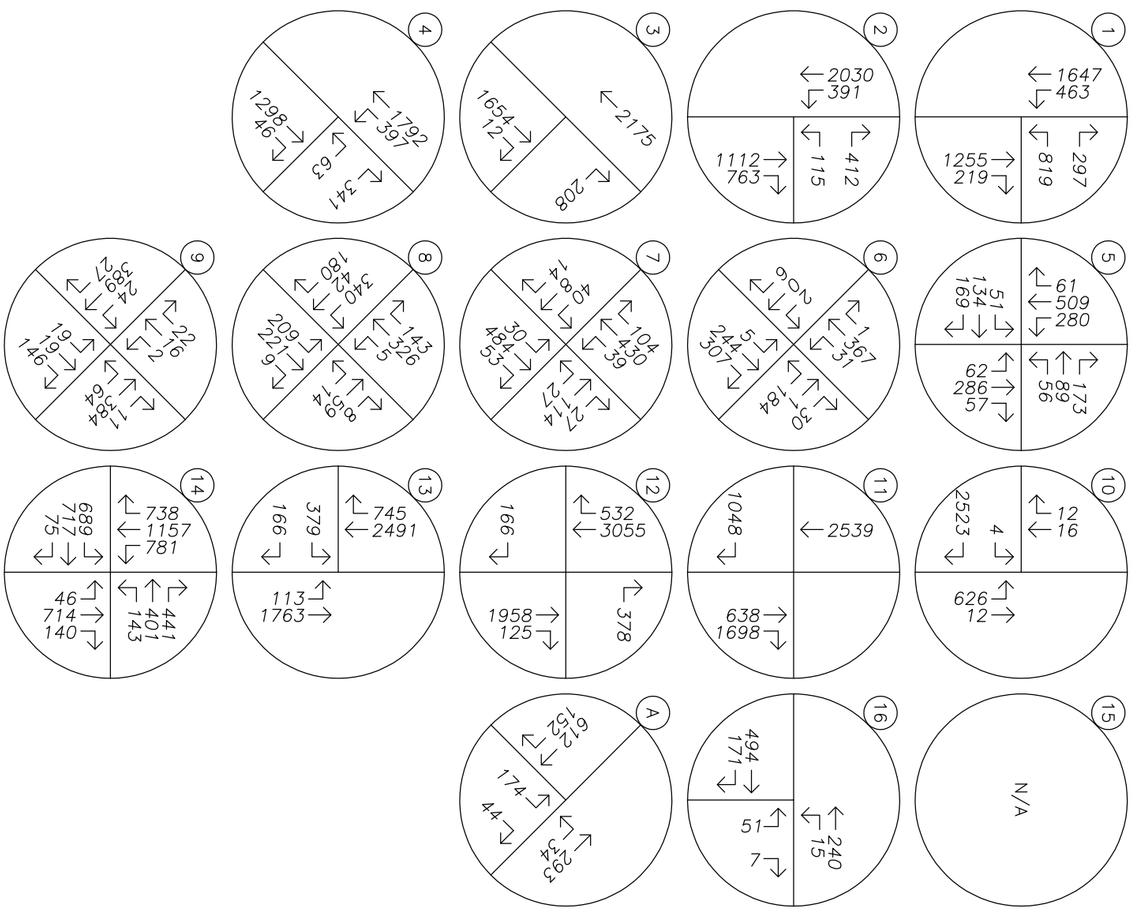


*Matches the alignment in the City's TSP

No Scale

TRAFFIC VOLUMES
Existing Conditions
AM Peak Hour

FIGURE 2



*Matches the alignment in the City's TSP

No Scale

TRAFFIC VOLUMES
Existing Conditions
PM Peak Hour

FIGURE 3

SITE TRIP DISTRIBUTION

Inbound & Outbound Percentages – Site Trips AM & PM Peak Hours

FIGURE 4

*Matches the alignment in the City's TSP

No Scale

SITE TRIP ASSIGNMENT

Proposed Zone Change – Net Additional Site Trips

AM Peak Hour

FIGURE 5

NET ADDITIONAL TRIP GENERATION			
	IN	OUT	TOTAL
AM	182	348	530

*Matches the alignment in the City's TSP

1
15
0
0
0
28
0
5
0
64
16
0
9
37
31
17
0
70
122
0
10
0
0
0
46
52
0
15
0
16
0
34
65
32
2
15
0
0
0
28
0
6
0
0
0

SITE TRIP ASSIGNMENT

Proposed Zone Change – Net Additional Site Trips

PM Peak Hour

FIGURE 6

NET ADDITIONAL TRIP GENERATION			
	IN	OUT	TOTAL
PM	405	263	668

*Matches the alignment in the City's TSP

No Scale

OR–99E FACILITY GROWTH RATE: 0.81 PERCENT PER YEAR LINEAR
OR–213 FACILITY GROWTH RATE: 0.73 PERCENT PER YEAR LINEAR
LOCAL FACILITY GROWTH RATE: 2.02 PERCENT PER YEAR COMPOUNDED

*Matches the alignment in the City's TSP

No Scale

TRAFFIC VOLUMES
Year 2035 Planning Horizon – w/ Holly Extension
AM Peak Hour

FIGURE 7

OR–99E FACILITY GROWTH RATE: 0.81 PERCENT PER YEAR LINEAR
OR–213 FACILITY GROWTH RATE: 0.73 PERCENT PER YEAR LINEAR
LOCAL FACILITY GROWTH RATE: 2.02 PERCENT PER YEAR COMPOUNDED

*Matches the alignment in the City's TSP

No Scale

TRAFFIC VOLUMES
Year 2035 Planning Horizon – w/ Holly Extension
PM Peak Hour

FIGURE 8

OR-99E FACILITY GROWTH RATE: 0.81 PERCENT PER YEAR LINEAR
OR-213 FACILITY GROWTH RATE: 0.73 PERCENT PER YEAR LINEAR
LOCAL FACILITY GROWTH RATE: 2.02 PERCENT PER YEAR COMPOUNDED

*Matches the alignment in the City's TSP

No Scale

TRAFFIC VOLUMES
Year 2035 Planning Horizon plus Annexation
AM Peak Hour

FIGURE 9

OR-99E FACILITY GROWTH RATE: 0.81 PERCENT PER YEAR LINEAR
OR-213 FACILITY GROWTH RATE: 0.73 PERCENT PER YEAR LINEAR
LOCAL FACILITY GROWTH RATE: 2.02 PERCENT PER YEAR COMPOUNDED

*Matches the alignment in the City's TSP

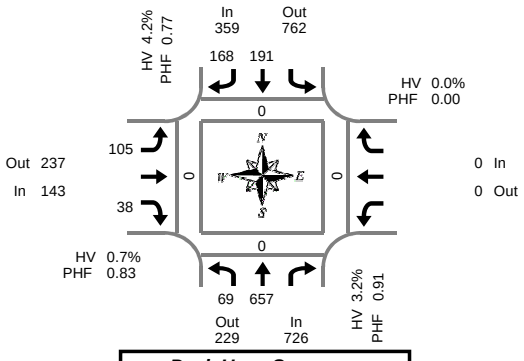
No Scale

TRAFFIC VOLUMES
Year 2035 Planning Horizon plus Annexation
PM Peak Hour

FIGURE 10

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
7:15 AM to 8:15 AM

Redland Rd & S Anchor Way

Thursday, April 05, 2018
7:00 AM to 9:00 AM

5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R	Bikes	L		R	Bikes				Bikes		North	South	East	West
7:00 AM	1	43		0	11	7	0	1		4	0				0	67	0	0	0	0
7:05 AM	0	60		0	10	9	0	6		3	0				0	88	0	0	0	0
7:10 AM	1	38		0	13	4	0	5		3	0				0	64	0	0	0	0
7:15 AM	6	60		0	17	11	0	4		4	0				0	102	0	0	0	0
7:20 AM	3	52		0	9	7	0	13		6	0				0	90	0	0	0	0
7:25 AM	6	73		0	18	13	0	8		4	0				0	122	0	0	0	0
7:30 AM	8	43		0	19	14	0	8		3	0				0	95	0	0	0	0
7:35 AM	6	54		0	13	5	0	17		3	0				0	98	0	0	0	0
7:40 AM	7	68		0	12	8	0	8		2	0				0	105	0	0	0	0
7:45 AM	7	48		0	18	18	0	7		2	0				0	100	0	0	0	0
7:50 AM	9	58		0	14	17	0	12		3	0				0	113	0	0	0	0
7:55 AM	4	44		0	18	23	0	7		1	0				0	97	0	0	0	0
8:00 AM	3	56		0	14	20	0	6		4	0				0	103	0	0	0	0
8:05 AM	5	49		0	24	17	0	6		4	0				0	105	0	0	0	0
8:10 AM	5	52		0	15	15	0	9		2	0				0	98	0	0	0	0
8:15 AM	3	38		0	15	11	0	4		3	0				0	74	0	0	0	0
8:20 AM	3	51		0	14	13	0	4		2	0				0	87	0	0	0	0
8:25 AM	6	37		0	20	12	0	4		7	0				0	86	0	0	0	0
8:30 AM	4	41		0	25	12	0	7		2	0				0	91	0	0	0	0
8:35 AM	8	41		0	26	14	0	5		7	0				0	101	0	0	0	0
8:40 AM	8	53		0	22	19	0	5		3	0				0	110	0	0	0	0
8:45 AM	8	57		0	17	16	0	8		2	0				0	108	0	0	0	0
8:50 AM	3	56		0	17	8	0	13		0	0				0	97	0	0	0	0
8:55 AM	3	37		0	17	14	0	5		1	0				0	77	0	0	0	0
Total Survey	117	1,209		0	398	307	0	172		75	0				0	2,278	0	0	0	0

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R	Bikes	L		R	Bikes				Bikes		North	South	East	West
7:00 AM	2	141		0	34	20	0	12		10	0				0	219	0	0	0	0
7:15 AM	15	185		0	44	31	0	25		14	0				0	314	0	0	0	0
7:30 AM	21	165		0	44	27	0	33		8	0				0	298	0	0	0	0
7:45 AM	20	150		0	50	58	0	26		6	0				0	310	0	0	0	0
8:00 AM	13	157		0	53	52	0	21		10	0				0	306	0	0	0	0
8:15 AM	12	126		0	49	36	0	12		12	0				0	247	0	0	0	0
8:30 AM	20	135		0	73	45	0	17		12	0				0	302	0	0	0	0
8:45 AM	14	150		0	51	38	0	26		3	0				0	282	0	0	0	0
Total Survey	117	1,209		0	398	307	0	172		75	0				0	2,278	0	0	0	0

Peak Hour Summary
7:15 AM to 8:15 AM

By Approach	Northbound Redland Rd				Southbound Redland Rd				Eastbound S Anchor Way				Westbound S Anchor Way				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	726	229	955	0	359	762	1,121	0	143	237	380	0	0	0	0	0	1,228	0	0	0	0
%HV	3.2%				4.2%				0.7%				0.0%				3.2%				
PHF	0.91				0.77				0.83				0.00				0.97				

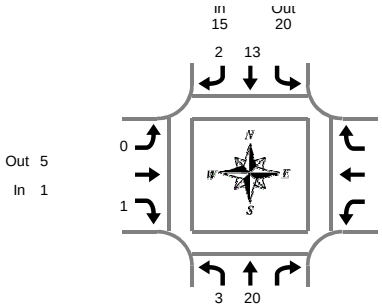
By Movement	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Total
	L	T		Total	T	R	Total	L		R	Total				Total	
Volume	69	657		726	191	168	359	105		38	143				0	1,228
%HV	4.3%	3.0%	NA	3.2%	6.8%	1.2%	4.2%	0.0%	NA	2.6%	0.7%	NA	NA	NA	0.0%	3.2%
PHF	0.75	0.89		0.91	0.85	0.70	0.77	0.80		0.68	0.83				0.00	0.97

Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R	Bikes	L		R	Bikes				Bikes		North	South	East	West
7:00 AM	58	641		0	172	136	0	96		38	0				0	1,141	0	0	0	0
7:15 AM	69	657		0	191	168	0	105		38	0				0	1,228	0	0	0	0
7:30 AM	66	598		0	196	173	0	92		36	0				0	1,161	0	0	0	0
7:45 AM	65	568		0	225	191	0	76		40	0				0	1,165	0	0	0	0
8:00 AM	59	568		0	226	171	0	76		37	0				0	1,137	0	0	0	0

Heavy Vehicle Summary

Clay Carney
(503) 833-2740



Redland Rd & S Anchor Way

Thursday, April 05, 2018
7:00 AM to 9:00 AM

Peak Hour Summary
7:15 AM to 8:15 AM

Heavy Vehicle 5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total
	L	T		Total	T	R	Total	L		R	Total				Total	
7:00 AM	0	4		4	1	0	1	0		1	1				0	6
7:05 AM	0	1		1	1	0	1	0		1	1				0	3
7:10 AM	0	4		4	2	0	2	0		0	0				0	6
7:15 AM	0	3		3	0	0	0	0		0	0				0	3
7:20 AM	0	1		1	1	0	1	0		0	0				0	2
7:25 AM	1	3		4	1	0	1	0		0	0				0	5
7:30 AM	0	0		0	1	0	1	0		0	0				0	1
7:35 AM	1	1		2	2	0	2	0		0	0				0	4
7:40 AM	0	2		2	0	0	0	0		0	0				0	2
7:45 AM	0	1		1	0	0	0	0		0	0				0	1
7:50 AM	0	0		0	1	2	3	0		0	0				0	3
7:55 AM	0	2		2	1	0	1	0		0	0				0	3
8:00 AM	0	2		2	1	0	1	0		1	1				0	4
8:05 AM	1	4		5	5	0	5	0		0	0				0	10
8:10 AM	0	1		1	0	0	0	0		0	0				0	1
8:15 AM	0	2		2	1	0	1	0		0	0				0	3
8:20 AM	0	1		1	1	1	2	0		0	0				0	3
8:25 AM	0	1		1	3	0	3	0		1	1				0	5
8:30 AM	0	4		4	3	0	3	0		1	1				0	8
8:35 AM	0	3		3	2	0	2	0		0	0				0	5
8:40 AM	0	1		1	2	2	4	0		1	1				0	6
8:45 AM	0	0		0	2	0	2	0		0	0				0	2
8:50 AM	0	2		2	0	1	1	0		0	0				0	3
8:55 AM	0	0		0	1	2	3	0		0	0				0	3
Total Survey	3	43		46	32	8	40	0		6	6				0	92

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total
	L	T		Total	T	R	Total	L		R	Total				Total	
7:00 AM	0	9		9	4	0	4	0		2	2				0	15
7:15 AM	1	7		8	2	0	2	0		0	0				0	10
7:30 AM	1	3		4	3	0	3	0		0	0				0	7
7:45 AM	0	3		3	2	2	4	0		0	0				0	7
8:00 AM	1	7		8	6	0	6	0		1	1				0	15
8:15 AM	0	4		4	5	1	6	0		1	1				0	11
8:30 AM	0	8		8	7	2	9	0		2	2				0	19
8:45 AM	0	2		2	3	3	6	0		0	0				0	8
Total Survey	3	43		46	32	8	40	0		6	6				0	92

Heavy Vehicle Peak Hour Summary
7:15 AM to 8:15 AM

By Approach	Northbound Redland Rd			Southbound Redland Rd			Eastbound S Anchor Way			Westbound S Anchor Way			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	23	14	37	15	20	35	1	5	6	0	0	0	39
PHF	0.64			0.54			0.25			0.00			0.57

By Movement	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Total
	L	T		Total	T	R	Total	L		R	Total				Total	
Volume	3	20		23	13	2	15	0		1	1				0	39
PHF	0.38	0.63		0.64	0.46	0.25	0.54	0.00		0.25	0.25				0.00	0.57

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

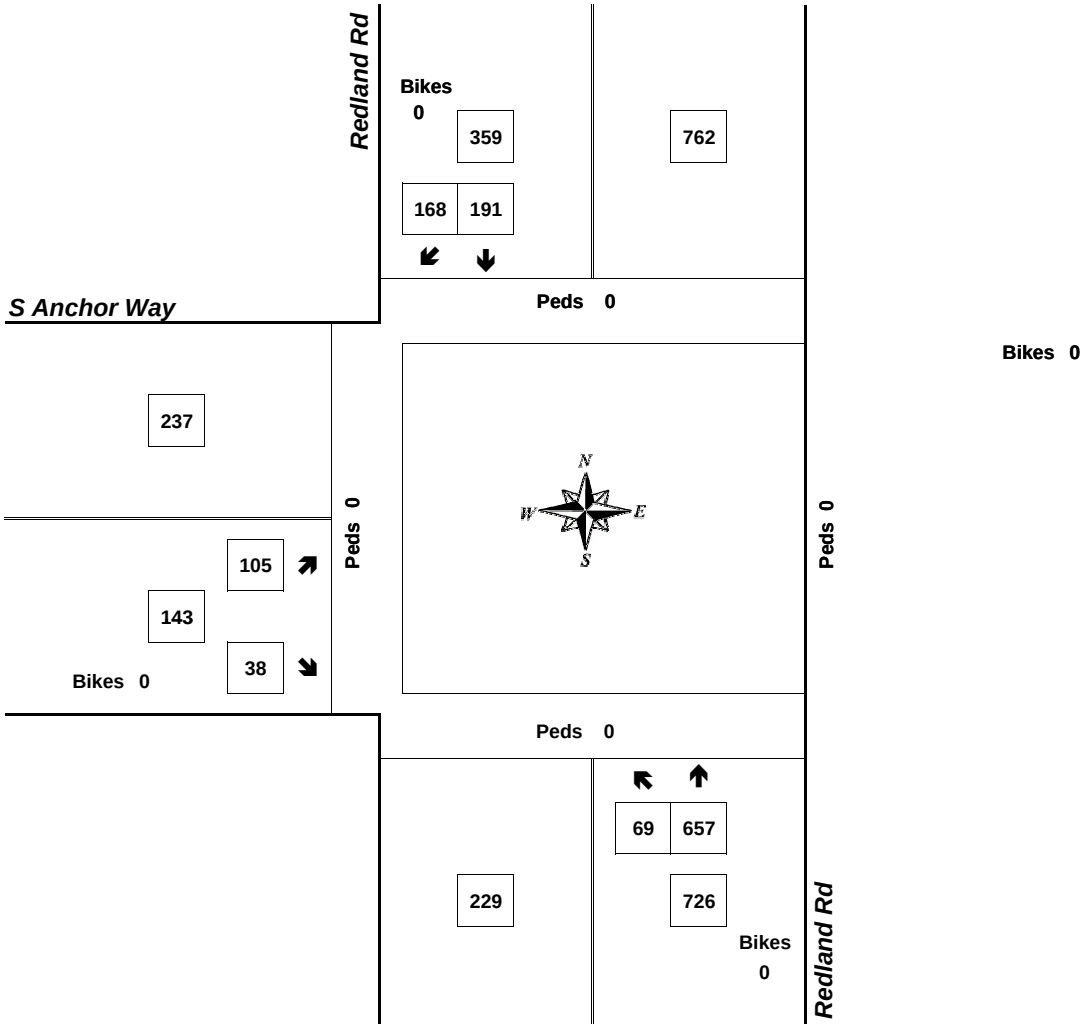
Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total
	L	T		Total	T	R	Total	L		R	Total				Total	
7:00 AM	2	22		24	11	2	13	0		2	2				0	39
7:15 AM	3	20		23	13	2	15	0		1	1				0	39
7:30 AM	2	17		19	16	3	19	0		2	2				0	40
7:45 AM	1	22		23	20	5	25	0		4	4				0	52
8:00 AM	1	21		22	21	6	27	0		4	4				0	53

Peak Hour Summary

Clay Carney
(503) 833-2740

Redland Rd & S Anchor Way

7:15 AM to 8:15 AM
Thursday, April 05, 2018

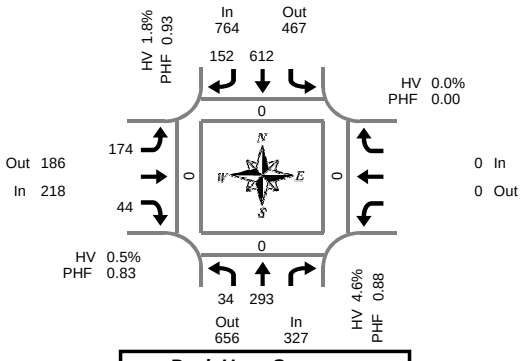


Approach	PHF	HV%	Volume
EB	0.83	0.7%	143
WB	0.00	0.0%	0
NB	0.91	3.2%	726
SB	0.77	4.2%	359
Intersection	0.97	3.2%	1,228

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:20 PM to 5:20 PM

Redland Rd & S Anchor Way

Wednesday, April 04, 2018
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way			Westbound S Anchor Way			Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R	Bikes	L		R	Bikes			Bikes		North	South	East	West
4:00 PM	5	31		0	64	22	0	10		6	0			0	138	0	0	0	0
4:05 PM	3	33		0	51	16	0	15		6	0			0	124	0	0	0	0
4:10 PM	5	20		0	39	9	0	15		7	1			0	95	0	0	0	0
4:15 PM	0	19		0	44	10	0	9		3	0			0	85	0	0	0	0
4:20 PM	5	24		0	57	12	0	11		1	0			0	110	0	0	0	0
4:25 PM	5	25		0	42	13	0	15		5	0			0	105	0	0	0	0
4:30 PM	2	21		0	53	14	0	13		1	0			0	104	0	0	0	0
4:35 PM	2	30		0	52	11	0	13		5	0			0	113	0	0	0	0
4:40 PM	1	30		0	29	15	0	15		3	0			0	93	0	0	0	0
4:45 PM	2	28		0	45	11	0	14		4	0			0	104	0	0	0	0
4:50 PM	5	22		0	57	15	0	10		5	0			0	114	0	0	0	0
4:55 PM	1	23		0	47	12	0	16		3	0			0	102	0	0	0	0
5:00 PM	2	22		0	59	15	0	14		4	0			0	116	0	0	0	0
5:05 PM	0	23		0	47	20	0	19		6	0			0	115	0	0	0	0
5:10 PM	8	21		0	54	5	0	18		2	0			0	108	0	0	0	0
5:15 PM	1	24		0	70	9	0	16		5	0			0	125	0	0	0	0
5:20 PM	2	15		0	58	13	0	17		4	0			0	109	0	0	0	0
5:25 PM	1	22		0	46	14	0	9		5	0			0	97	0	0	0	0
5:30 PM	2	23		0	57	9	0	13		2	0			0	106	0	0	0	0
5:35 PM	2	20		0	50	8	0	6		4	0			0	90	0	0	0	0
5:40 PM	2	21		0	69	16	0	5		3	0			0	116	0	0	0	0
5:45 PM	7	15		0	48	14	0	5		6	0			0	95	0	0	0	0
5:50 PM	4	23		0	58	14	0	8		4	0			0	111	0	0	0	0
5:55 PM	3	19		0	42	6	0	5		2	0			0	77	0	0	0	0
Total Survey	70	554		0	1,238	303	0	291		96	1			0	2,552	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way			Westbound S Anchor Way			Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R	Bikes	L		R	Bikes			Bikes		North	South	East	West
4:00 PM	13	84		0	154	47	0	40		19	1			0	357	0	0	0	0
4:15 PM	10	68		0	143	35	0	35		9	0			0	300	0	0	0	0
4:30 PM	5	81		0	134	40	0	41		9	0			0	310	0	0	0	0
4:45 PM	8	73		0	149	38	0	40		12	0			0	320	0	0	0	0
5:00 PM	10	66		0	160	40	0	51		12	0			0	339	0	0	0	0
5:15 PM	4	61		0	174	36	0	42		14	0			0	331	0	0	0	0
5:30 PM	6	64		0	176	33	0	24		9	0			0	312	0	0	0	0
5:45 PM	14	57		0	148	34	0	18		12	0			0	283	0	0	0	0
Total Survey	70	554		0	1,238	303	0	291		96	1			0	2,552	0	0	0	0

Peak Hour Summary
4:20 PM to 5:20 PM

By Approach	Northbound Redland Rd				Southbound Redland Rd				Eastbound S Anchor Way				Westbound S Anchor Way				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	327	656	983	0	764	467	1,231	0	218	186	404	0	0	0	0	0	1,309	0	0	0	0
%HV	4.6%				1.8%				0.5%				0.0%				2.3%				
PHF	0.88				0.93				0.83				0.00				0.94				

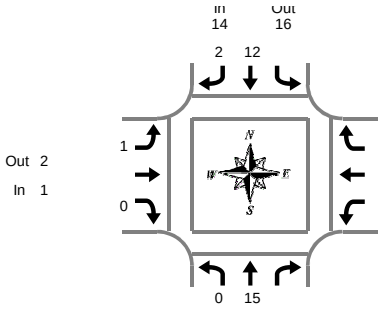
By Movement	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Total
	L	T		Total	T	R	Total	L		R	Total				Total	
Volume	34	293		327	612	152	764	174		44	218				0	1,309
%HV	0.0%	5.1%	NA	4.6%	2.0%	1.3%	1.8%	0.6%	NA	0.0%	0.5%	NA	NA	NA	0.0%	2.3%
PHF	0.71	0.83		0.88	0.89	0.81	0.93	0.82		0.85	0.83				0.00	0.94

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way			Westbound S Anchor Way			Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R	Bikes	L		R	Bikes			Bikes		North	South	East	West
4:00 PM	36	306		0	580	160	0	156		49	1			0	1,287	0	0	0	0
4:15 PM	33	288		0	586	153	0	167		42	0			0	1,269	0	0	0	0
4:30 PM	27	281		0	617	154	0	174		47	0			0	1,300	0	0	0	0
4:45 PM	28	264		0	659	147	0	157		47	0			0	1,302	0	0	0	0
5:00 PM	34	248		0	658	143	0	135		47	0			0	1,265	0	0	0	0

Heavy Vehicle Summary

Clay Carney
(503) 833-2740



Redland Rd & S Anchor Way

Wednesday, April 04, 2018
4:00 PM to 6:00 PM

Peak Hour Summary
4:20 PM to 5:20 PM

Heavy Vehicle 5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total
	L	T		Total	T	R	Total	L		R	Total				Total	
4:00 PM	0	2		2	4	0	4	0		0	0				0	6
4:05 PM	0	0		0	3	0	3	0		0	0				0	3
4:10 PM	0	1		1	1	0	1	0		0	0				0	2
4:15 PM	0	0		0	4	0	4	1		0	1				0	5
4:20 PM	0	1		1	0	0	0	0		0	0				0	1
4:25 PM	0	0		0	2	0	2	0		0	0				0	2
4:30 PM	0	1		1	0	0	0	0		0	0				0	1
4:35 PM	0	0		0	1	0	1	0		0	0				0	1
4:40 PM	0	2		2	0	0	0	0		0	0				0	2
4:45 PM	0	2		2	2	0	2	0		0	0				0	4
4:50 PM	0	0		0	3	0	3	0		0	0				0	3
4:55 PM	0	3		3	1	0	1	1		0	1				0	5
5:00 PM	0	0		0	1	2	3	0		0	0				0	3
5:05 PM	0	1		1	1	0	1	0		0	0				0	2
5:10 PM	0	0		0	1	0	1	0		0	0				0	1
5:15 PM	0	5		5	0	0	0	0		0	0				0	5
5:20 PM	0	0		0	0	0	0	0		0	0				0	0
5:25 PM	0	1		1	1	0	1	0		0	0				0	2
5:30 PM	0	3		3	0	0	0	0		0	0				0	3
5:35 PM	0	1		1	1	0	1	0		0	0				0	2
5:40 PM	0	0		0	1	0	1	0		0	0				0	1
5:45 PM	0	0		0	2	0	2	0		0	0				0	2
5:50 PM	0	1		1	0	0	0	0		0	0				0	1
5:55 PM	0	0		0	3	0	3	0		0	0				0	3
Total Survey	0	24		24	32	2	34	2		0	2				0	60

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total
	L	T		Total	T	R	Total	L		R	Total				Total	
4:00 PM	0	3		3	8	0	8	0		0	0				0	11
4:15 PM	0	1		1	6	0	6	1		0	1				0	8
4:30 PM	0	3		3	1	0	1	0		0	0				0	4
4:45 PM	0	5		5	6	0	6	1		0	1				0	12
5:00 PM	0	1		1	3	2	5	0		0	0				0	6
5:15 PM	0	6		6	1	0	1	0		0	0				0	7
5:30 PM	0	4		4	2	0	2	0		0	0				0	6
5:45 PM	0	1		1	5	0	5	0		0	0				0	6
Total Survey	0	24		24	32	2	34	2		0	2				0	60

Heavy Vehicle Peak Hour Summary
4:20 PM to 5:20 PM

By Approach	Northbound Redland Rd			Southbound Redland Rd			Eastbound S Anchor Way			Westbound S Anchor Way			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	15	12	27	14	16	30	1	2	3	0	0	0	30
PHF	0.63			0.50			0.25			0.00			0.63

By Movement	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Total
	L	T		Total	T	R	Total	L		R	Total				Total	
Volume	0	15		15	12	2	14	1		0	1				0	30
PHF	0.00	0.63		0.63	0.50	0.25	0.50	0.25		0.00	0.25				0.00	0.63

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

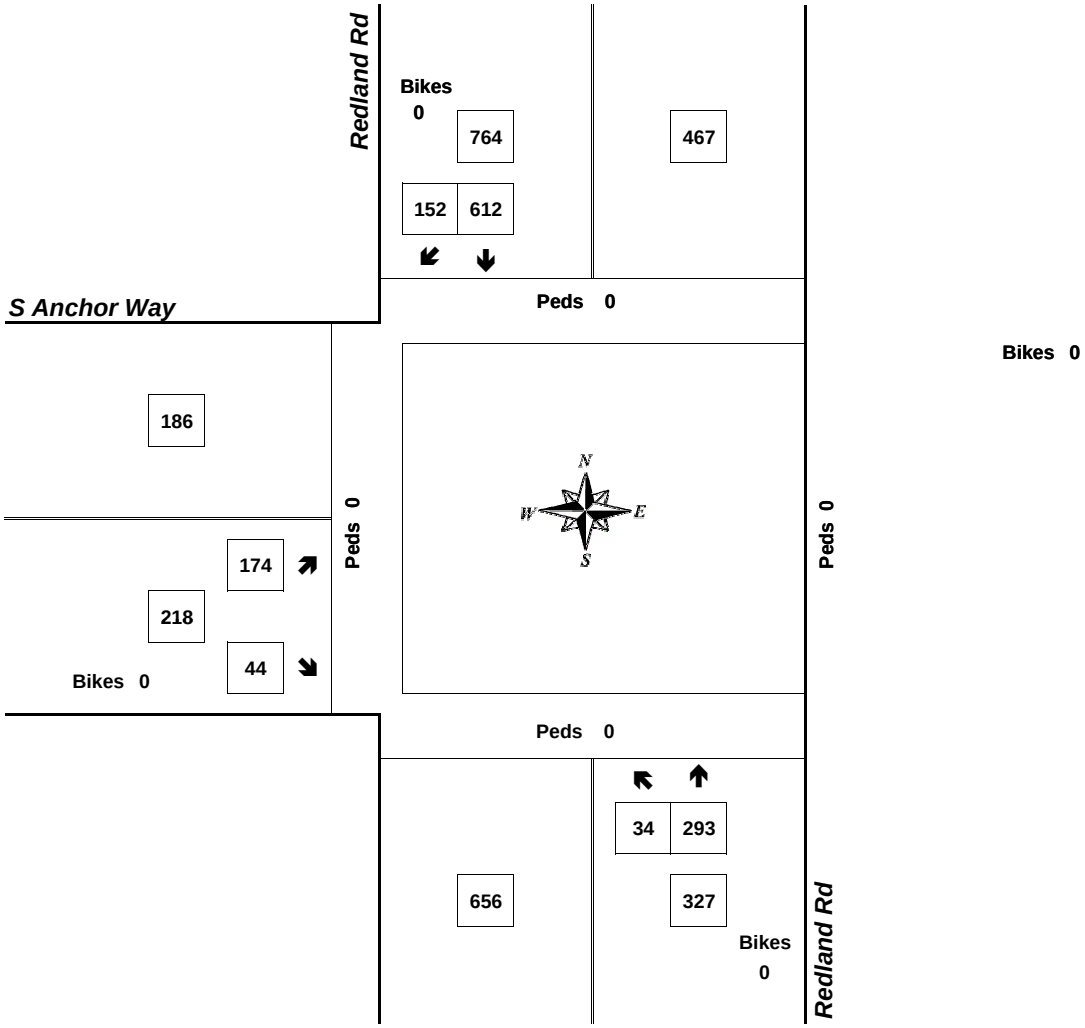
Interval Start Time	Northbound Redland Rd				Southbound Redland Rd			Eastbound S Anchor Way				Westbound S Anchor Way				Interval Total
	L	T		Total	T	R	Total	L		R	Total				Total	
4:00 PM	0	12		12	21	0	21	2		0	2				0	35
4:15 PM	0	10		10	16	2	18	2		0	2				0	30
4:30 PM	0	15		15	11	2	13	1		0	1				0	29
4:45 PM	0	16		16	12	2	14	1		0	1				0	31
5:00 PM	0	12		12	11	2	13	0		0	0				0	25

Peak Hour Summary

Clay Carney
(503) 833-2740

Redland Rd & S Anchor Way

4:20 PM to 5:20 PM
Wednesday, April 04, 2018



Approach	PHF	HV%	Volume
EB	0.83	0.5%	218
WB	0.00	0.0%	0
NB	0.88	4.6%	327
SB	0.93	1.8%	764
Intersection	0.94	2.3%	1,309

Count Period: 4:00 PM to 6:00 PM

Left-Turn Lane Warrant Analysis

Project: 17038 - Park Place Annexation
Intersection: S Redland Road at S Anchor Way
Date: 4/9/2018
Scenario: Existing Conditions - AM Peak Hour

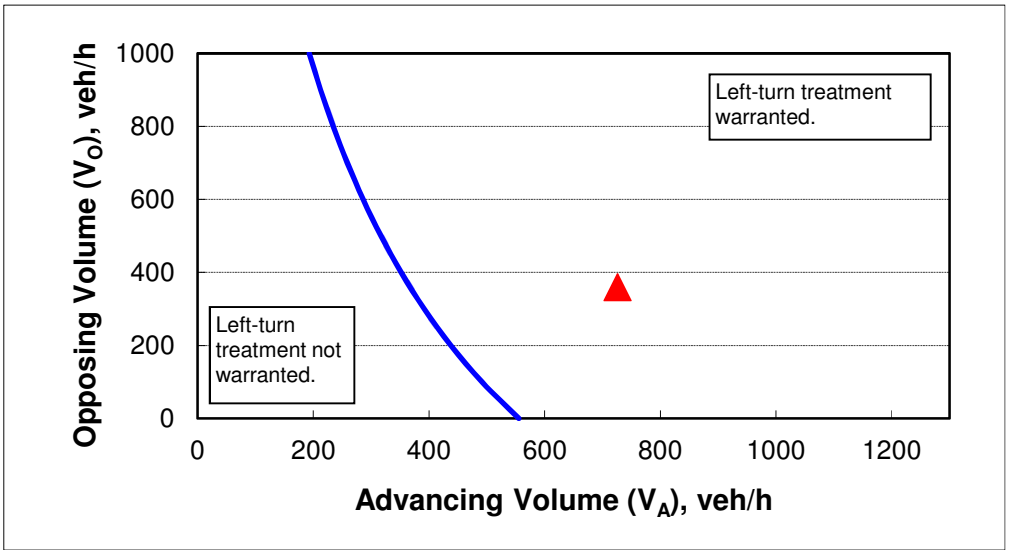
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	45
Number of left-turns in advancing volume (V_A), veh/h:	69
Advancing volume (V_A), veh/h:	726
Opposing volume (V_O), veh/h:	359

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	368
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Left-Turn Lane Warrant Analysis

Project: 17038 - Park Place Annexation
Intersection: S Redland Road at S Anchor Way
Date: 4/9/2018
Scenario: Existing Conditions - PM Peak Hour

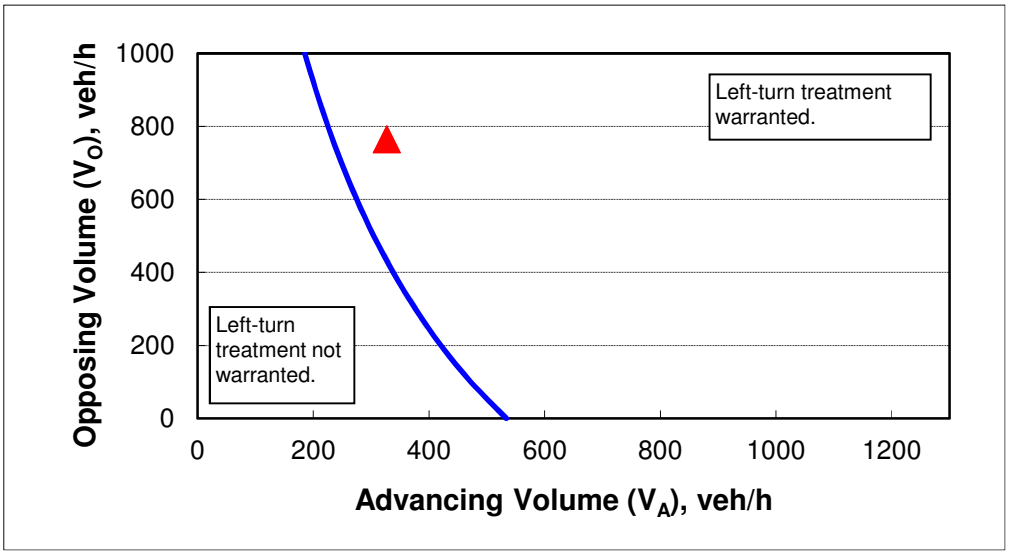
2-lane roadway (English)

INPUT

Variable	Value
85th percentile speed, mph:	45
Number of left-turns in advancing volume (V_A), veh/h:	34
Advancing volume (V_A), veh/h:	327
Opposing volume (V_O), veh/h:	764

OUTPUT

Variable	Value
Limiting advancing volume (V_A), veh/h:	233
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	



CALIBRATION CONSTANTS

Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9

Traffic Signal Warrant Analysis

Project: 17038 - Park Place Annexation
Date: 4/9/2018
Scenario: Year 2035 Planning Horizon

Major Street:	S Redland Road	Minor Street:	S Anchor Way
Number of Lanes:	1	Number of Lanes:	1
PM Peak Hour Volumes:	1289	PM Peak Hour Volumes:	276

Warrant Used:

X 100 percent of standard warrants used

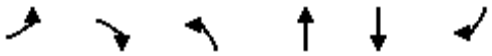
_____ 70 percent of standard warrants used due to 85th percentile speed in excess of 40 mph or isolated community with population less than 10,000.

Number of Lanes for Moving Traffic on Each Approach:		ADT on Major St. (total of both approaches)		ADT on Minor St. (higher-volume approach)	
WARRANT 1, CONDITION A		100%	70%	100%	70%
Major St.	Minor St.	Warrants	Warrants	Warrants	Warrants
1	1	8,850	6,200	2,650	1,850
2 or more	1	10,600	7,400	2,650	1,850
2 or more	2 or more	10,600	7,400	3,550	2,500
1	2 or more	8,850	6,200	3,550	2,500
WARRANT 1, CONDITION B					
1	1	13,300	9,300	1,350	950
2 or more	1	15,900	11,100	1,350	950
2 or more	2 or more	15,900	11,100	1,750	1,250
1	2 or more	13,300	9,300	1,750	1,250

Note: ADT volumes assume 8th highest hour is 5.6% of the daily volume

	Approach Volumes	Minimum Volumes	Is Signal Warrant Met?
Warrant 1			
Condition A: Minimum Vehicular Volume			
Major Street	12,890	8,850	
Minor Street*	2,760	2,650	**Yes**
Condition B: Interruption of Continuous Traffic			
Major Street	12,890	13,300	
Minor Street*	2,760	1,350	**No**
Combination Warrant			
Major Street	12,890	10,640	
Minor Street*	2,760	2,120	**Yes**

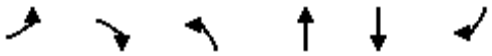
* Minor street right-turning traffic volumes reduced by 25%.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	105	38	69	657	191	168
Future Volume (Veh/h)	105	38	69	657	191	168
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	108	39	71	677	197	173
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	1102	284	370			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1102	284	370			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	51	95	94			
cM capacity (veh/h)	221	758	1183			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	147	748	370
Volume Left	108	71	0
Volume Right	39	0	173
cSH	272	1183	1700
Volume to Capacity	0.54	0.06	0.22
Queue Length 95th (ft)	74	5	0
Control Delay (s)	32.8	1.5	0.0
Lane LOS	D	A	
Approach Delay (s)	32.8	1.5	0.0
Approach LOS	D		

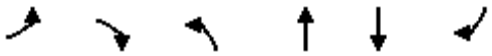
Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	174	44	34	293	612	152
Future Volume (Veh/h)	174	44	34	293	612	152
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	185	47	36	312	651	162
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	1116	732	813			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1116	732	813			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	16	89	96			
cM capacity (veh/h)	220	423	801			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	232	348	813
Volume Left	185	36	0
Volume Right	47	0	162
cSH	244	801	1700
Volume to Capacity	0.95	0.04	0.48
Queue Length 95th (ft)	215	4	0
Control Delay (s)	88.9	1.5	0.0
Lane LOS	F	A	
Approach Delay (s)	88.9	1.5	0.0
Approach LOS	F		

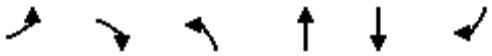
Intersection Summary			
Average Delay	15.2		
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	147	53	97	712	214	235
Future Volume (Veh/h)	147	53	97	712	214	235
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	152	55	100	734	221	242
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	1276	342	463			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1276	342	463			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	9	92	91			
cM capacity (veh/h)	168	703	1093			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	207	834	463
Volume Left	152	100	0
Volume Right	55	0	242
cSH	211	1093	1700
Volume to Capacity	0.98	0.09	0.27
Queue Length 95th (ft)	215	8	0
Control Delay (s)	105.4	2.3	0.0
Lane LOS	F	A	
Approach Delay (s)	105.4	2.3	0.0
Approach LOS	F		

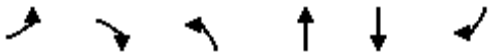
Intersection Summary			
Average Delay	15.8		
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	229	62	48	328	720	193
Future Volume (Veh/h)	229	62	48	328	720	193
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)	241	65	51	345	758	203
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	1306	860	961			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1306	860	961			
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	82	93			
cM capacity (veh/h)	164	357	704			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	306	396	961
Volume Left	241	51	0
Volume Right	65	0	203
cSH	186	704	1700
Volume to Capacity	1.65	0.07	0.57
Queue Length 95th (ft)	515	6	0
Control Delay (s)	359.2	2.2	0.0
Lane LOS	F	A	
Approach Delay (s)	359.2	2.2	0.0
Approach LOS	F		

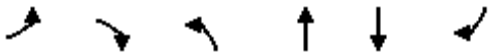
Intersection Summary			
Average Delay	66.6		
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	147	59	108	904	315	235
Future Volume (Veh/h)	147	59	108	904	315	235
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	152	61	111	932	325	242
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	1600	446	567			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1600	446	567			
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	90	89			
cM capacity (veh/h)	104	614	1000			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	213	1043	567
Volume Left	152	111	0
Volume Right	61	0	242
cSH	137	1000	1700
Volume to Capacity	1.56	0.11	0.33
Queue Length 95th (ft)	372	9	0
Control Delay (s)	341.3	2.9	0.0
Lane LOS	F	A	
Approach Delay (s)	341.3	2.9	0.0
Approach LOS	F		

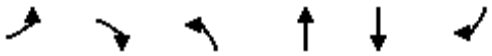
Intersection Summary			
Average Delay	41.6		
Intersection Capacity Utilization	106.2%	ICU Level of Service	G
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	229	74	56	476	946	193
Future Volume (Veh/h)	229	74	56	476	946	193
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)	241	78	59	501	996	203
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	1716	1098	1199			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1716	1098	1199			
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	70	90			
cM capacity (veh/h)	89	260	572			

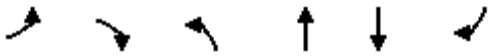
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	319	560	1199
Volume Left	241	59	0
Volume Right	78	0	203
cSH	106	572	1700
Volume to Capacity	3.00	0.10	0.71
Queue Length 95th (ft)	Err	9	0
Control Delay (s)	Err	2.8	0.0
Lane LOS	F	A	
Approach Delay (s)	Err	2.8	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	1535.7		
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	147	59	108	904	315	235
Future Volume (vph)	147	59	108	904	315	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.96		1.00	1.00	0.94	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1746		1752	1845	1722	
Flt Permitted	0.97		0.26	1.00	1.00	
Satd. Flow (perm)	1746		474	1845	1722	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	152	61	111	932	325	242
RTOR Reduction (vph)	25	0	0	0	38	0
Lane Group Flow (vph)	188	0	111	932	529	0
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Turn Type	Prot		pm+pt	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases			2			
Actuated Green, G (s)	11.3		35.0	35.0	26.4	
Effective Green, g (s)	11.3		35.0	35.0	26.4	
Actuated g/C Ratio	0.20		0.63	0.63	0.48	
Clearance Time (s)	4.5		4.5	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	356		394	1167	822	
v/s Ratio Prot	c0.11		0.02	c0.51	0.31	
v/s Ratio Perm			0.16			
v/c Ratio	0.53		0.28	0.80	0.64	
Uniform Delay, d1	19.6		5.8	7.5	10.9	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.4		0.4	3.9	1.7	
Delay (s)	21.0		6.2	11.4	12.6	
Level of Service	C		A	B	B	
Approach Delay (s)	21.0			10.9	12.6	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	55.3	Sum of lost time (s)	13.5
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	229	74	56	476	946	193
Future Volume (vph)	229	74	56	476	946	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frpb, ped/bikes	0.99		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.97		1.00	1.00	0.98	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1743		1719	1810	1820	
Flt Permitted	0.96		0.05	1.00	1.00	
Satd. Flow (perm)	1743		87	1810	1820	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	241	78	59	501	996	203
RTOR Reduction (vph)	10	0	0	0	6	0
Lane Group Flow (vph)	309	0	59	501	1193	0
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	1%	1%	5%	5%	2%	2%
Turn Type	Prot		pm+pt	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases			2			
Actuated Green, G (s)	21.6		86.9	86.9	78.3	
Effective Green, g (s)	21.6		86.9	86.9	78.3	
Actuated g/C Ratio	0.18		0.74	0.74	0.67	
Clearance Time (s)	4.5		4.5	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	320		121	1338	1212	
v/s Ratio Prot	c0.18		0.02	c0.28	c0.66	
v/s Ratio Perm			0.34			
v/c Ratio	0.97		0.49	0.37	0.98	
Uniform Delay, d1	47.6		31.2	5.5	19.0	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	40.9		3.1	0.2	22.0	
Delay (s)	88.4		34.2	5.7	41.0	
Level of Service	F		C	A	D	
Approach Delay (s)	88.4			8.7	41.0	
Approach LOS	F			A	D	

Intersection Summary			
HCM 2000 Control Delay	39.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	117.5	Sum of lost time (s)	13.5
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group