Capacity Calculations & Traffic Analysis

- Traffic Analysis SR-125/SE Myra Rd Intersection Layout Options
- 2040 SR-125/SE Myra Rd Traffic Signal SIDRA Inputs
- 2040 SR-125/SE Myra Rd Roundabout SIDRA Inputs
- 2040 SR-125/SE Myra Rd Traffic Signal SIDRA Summary
- 2040 SR-125/SE Myra Rd Traffic Signal SIDRA Lane Level of Service
- 2040 SR-125/SE Myra Rd Traffic Signal SIDRA Travel Speed
- 2040 SR-125/SE Myra Rd Traffic Signal SIDRA CO_2
- 2040 SR-125/SE Myra Rd Roundabout SIDRA Summary
- 2040 SR-125/SE Myra Rd Roundabout SIDRA Lane Level of Service
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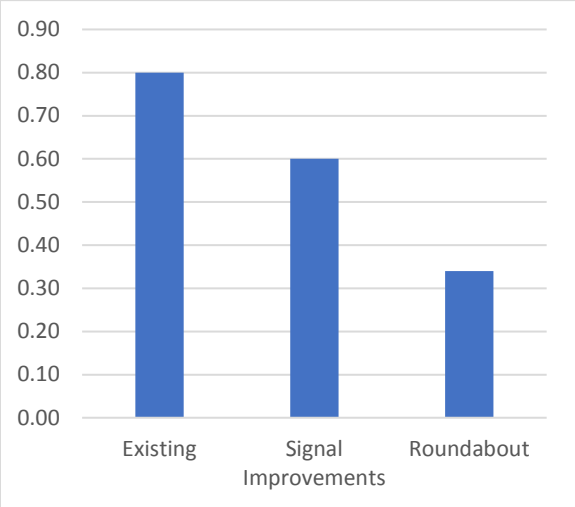
- 2040 SR-125/SE Myra Rd Roundabout SIDRA Movement Summary
- 2040 SR-125/SE Myra Rd Traffic Signal SIDRA Movement Summary
- Movement Summary
- September 26, 2016 Myra Road Extension Traffic Analysis

Traffic Analysis

SR-125 / SE Myra Rd Intersection Layout Options

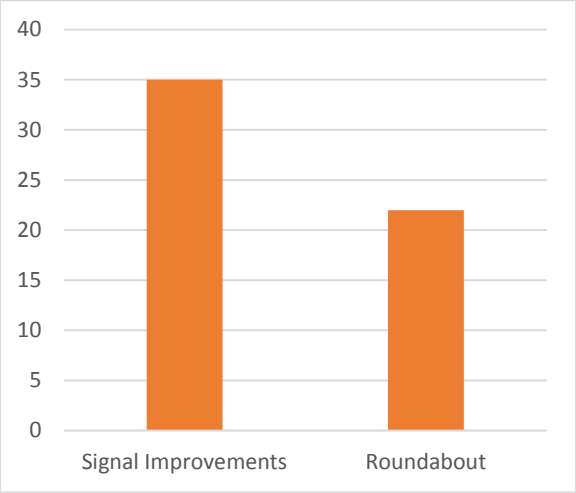
Intersection Safety – Expected Injuries

Intersection Layout	Expected # of Injury/Fatal Crashes Per Year
Existing	0.80
Signal Improvements	0.60
Roundabout	0.34



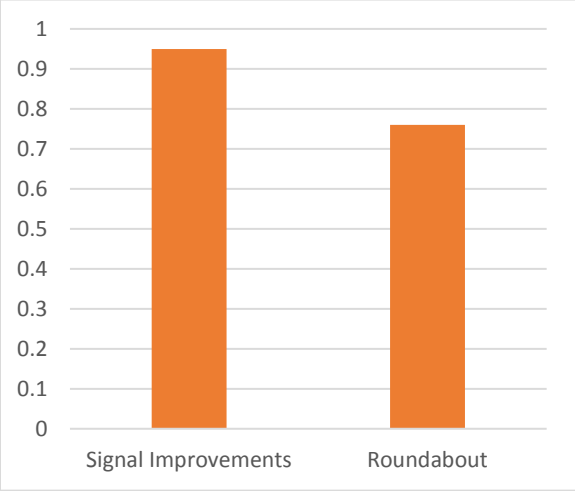
Intersection Mobility – Average Delay

Intersection Layout	Year 2040 Avg. Expected Delay per Vehicle – Peak Hour (Sec)
Signal Improvements	35
Roundabout	22



Volume /Capacity (Degree of Saturation) For Critical Movement on Approach

Intersection Layout	Year 2040 v/c ratio (degree of saturation)
Signal Improvements	0.95 SB Right Turn
Roundabout	0.76 EB



Intersection Mobility – Level of Service

Intersection Layout	Level of Service
Signal Improvements	C
Roundabout	C

LOS	Avg Delay	General Description
A	≤10	Free Flow
B	>10-20	Stable Flow (Slight Delays)
C	>20-35	Stable Flow (Acceptable Delays)
D	>35-55	Approaching Unstable Flow
E	>55-80	Unstable Flow
F	>80	Forced Flow-Queues Fail to clear

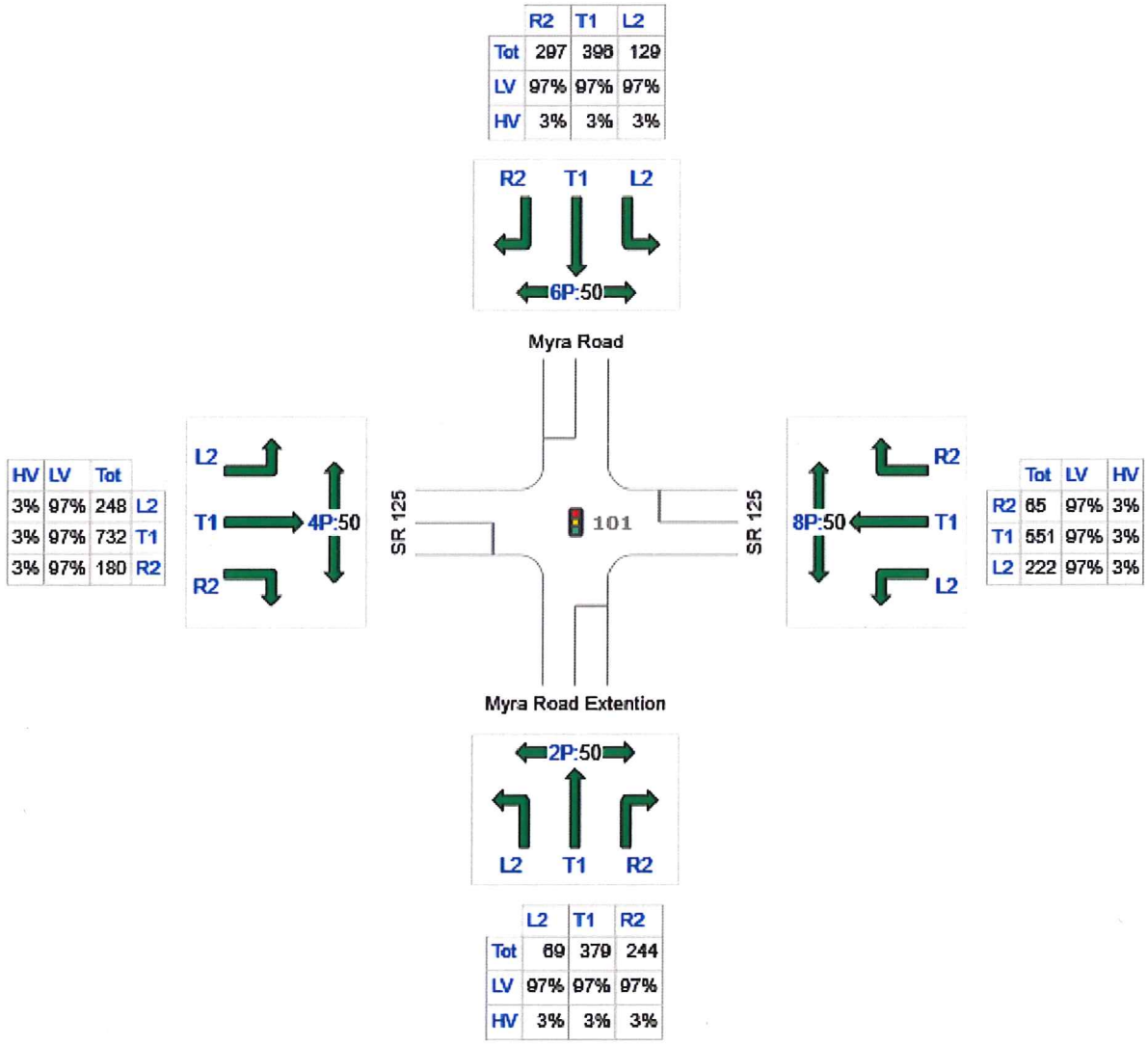
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [Myra Rd Ext 2040 PM Peak]

2040 with signal
Signals - Pretimed Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Myra Road Extention	692	671	21
E: SR 125	838	813	25
N: Myra Road	822	797	25
W: SR 125	1160	1125	35
Total	3512	3407	105

INPUT VOLUMES

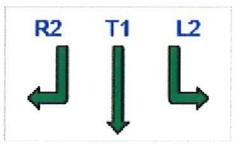
Vehicles and pedestrians per 60 minutes

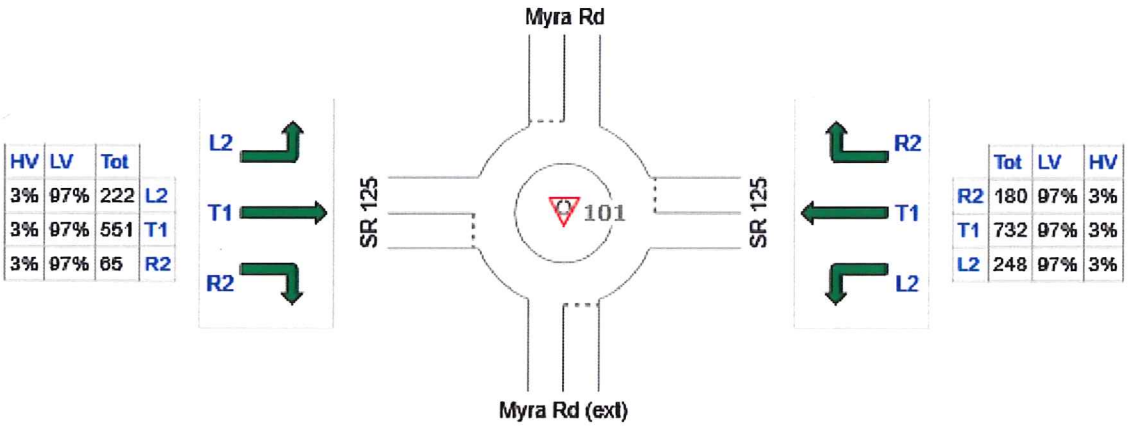
Site: 101 [Myra Rd Ext 2040 PM Peak HCM US]

Myra Road - SR 125 with 2-lane Roundabout
Roundabout

Volume Display Method: Total and %

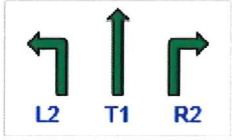
	R2	T1	L2
Tot	297	396	129
LV	97%	97%	97%
HV	3%	3%	3%





HV	LV	Tot	
3%	97%	222	L2
3%	97%	551	T1
3%	97%	65	R2

	Tot	LV	HV
R2	180	97%	3%
T1	732	97%	3%
L2	248	97%	3%



	L2	T1	R2
Tot	69	379	244
LV	97%	97%	97%
HV	3%	3%	3%

	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Myra Rd (ext)	692	671	21
E: SR 125	1160	1125	35
N: Myra Rd	822	797	25
W: SR 125	838	813	25
Total	3512	3407	105

INTERSECTION SUMMARY

Site: 101 [Myra Rd Ext 2040 PM Peak]

2040 with signal
Signals - Pretimed Isolated Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)

Intersection Performance - Hourly Values						
Performance Measure	Vehicles		Pedestrians		Persons	
Travel Speed (Average)	25.3	mph	1.6	mph	24.5	mph
Travel Distance (Total)	2368.2	veh-mi/h	6.0	ped-mi/h	2847.8	pers-mi/h
Travel Time (Total)	93.8	veh-h/h	3.8	ped-h/h	116.3	pers-h/h
Demand Flows (Total)	3817	veh/h	217	ped/h	4581	pers/h
Percent Heavy Vehicles (Demand)	3.0	%				
Degree of Saturation	0.885		0.038			
Practical Spare Capacity	1.7	%				
Effective Intersection Capacity	4312	veh/h				
Control Delay (Total)	31.07	veh-h/h	1.76	ped-h/h	39.04	pers-h/h
Control Delay (Average)	29.3	sec	29.1	sec	30.7	sec
Control Delay (Worst Lane)	55.1	sec				
Control Delay (Worst Movement)	55.1	sec	29.1	sec	55.1	sec
Geometric Delay (Average)	0.0	sec				
Stop-Line Delay (Average)	29.3	sec				
Idling Time (Average)	24.1	sec				
Intersection Level of Service (LOS)	LOS C		LOS C			
95% Back of Queue - Vehicles (Worst Lane)	18.6	veh				
95% Back of Queue - Distance (Worst Lane)	475.9	ft				
Queue Storage Ratio (Worst Lane)	0.18					
Total Effective Stops	3008	veh/h	192	ped/h	3801	pers/h
Effective Stop Rate	0.79	per veh	0.88	per ped	0.83	per pers
Proportion Queued	0.85		0.88		0.90	
Performance Index	221.9		4.9		226.8	
Cost (Total)	1370.45	$/h	39.46	$/h	1409.91	$/h
Fuel Consumption (Total)	109.3	gal/h				
Carbon Dioxide (Total)	979.1	kg/h				
Hydrocarbons (Total)	0.090	kg/h				
Carbon Monoxide (Total)	1.179	kg/h				
NOx (Total)	1.482	kg/h				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values						
Performance Measure	Vehicles		Pedestrians		Persons	
Demand Flows (Total)	1,832,348	veh/y	104,348	ped/y	2,198,818	pers/y
Delay	14,914	veh-h/y	844	ped-h/y	18,740	pers-h/y
Effective Stops	1,443,875	veh/y	92,035	ped/y	1,824,684	pers/y
Travel Distance	1,136,729	veh-mi/y	2,866	ped-mi/y	1,366,940	pers-mi/y
Travel Time	45,015	veh-h/y	1,821	ped-h/y	55,839	pers-h/y
Cost	657,817	$/y	18,939	$/y	676,756	$/y
Fuel Consumption	52,454	gal/y				
Carbon Dioxide	469,984	kg/y				
Hydrocarbons	43	kg/y				
Carbon Monoxide	566	kg/y				
NOx	711	kg/y				

LANE LEVEL OF SERVICE

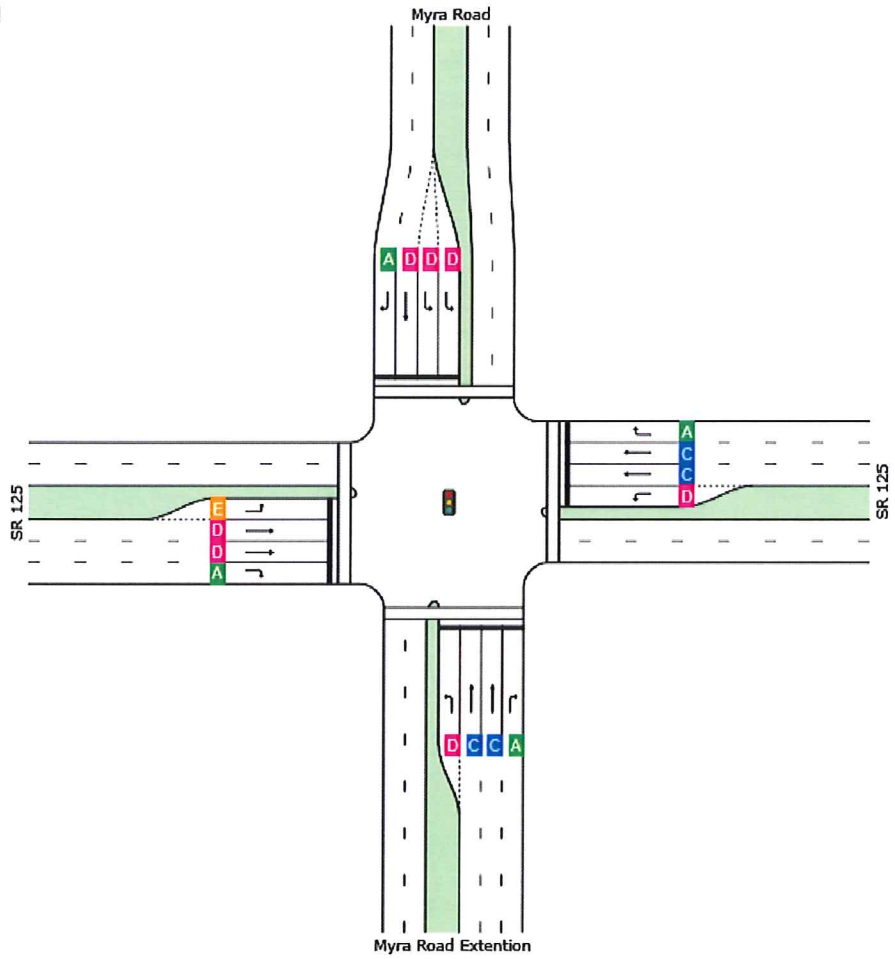
Lane Level of Service

Site: 101 [Myra Rd Ext 2040 PM Peak]

2040 with signal
Signals - Pretimed Isolated Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)

All Movement Classes

	South	East	North	West	Intersection
LOS	B	C	C	D	C



Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

TRAVEL SPEED

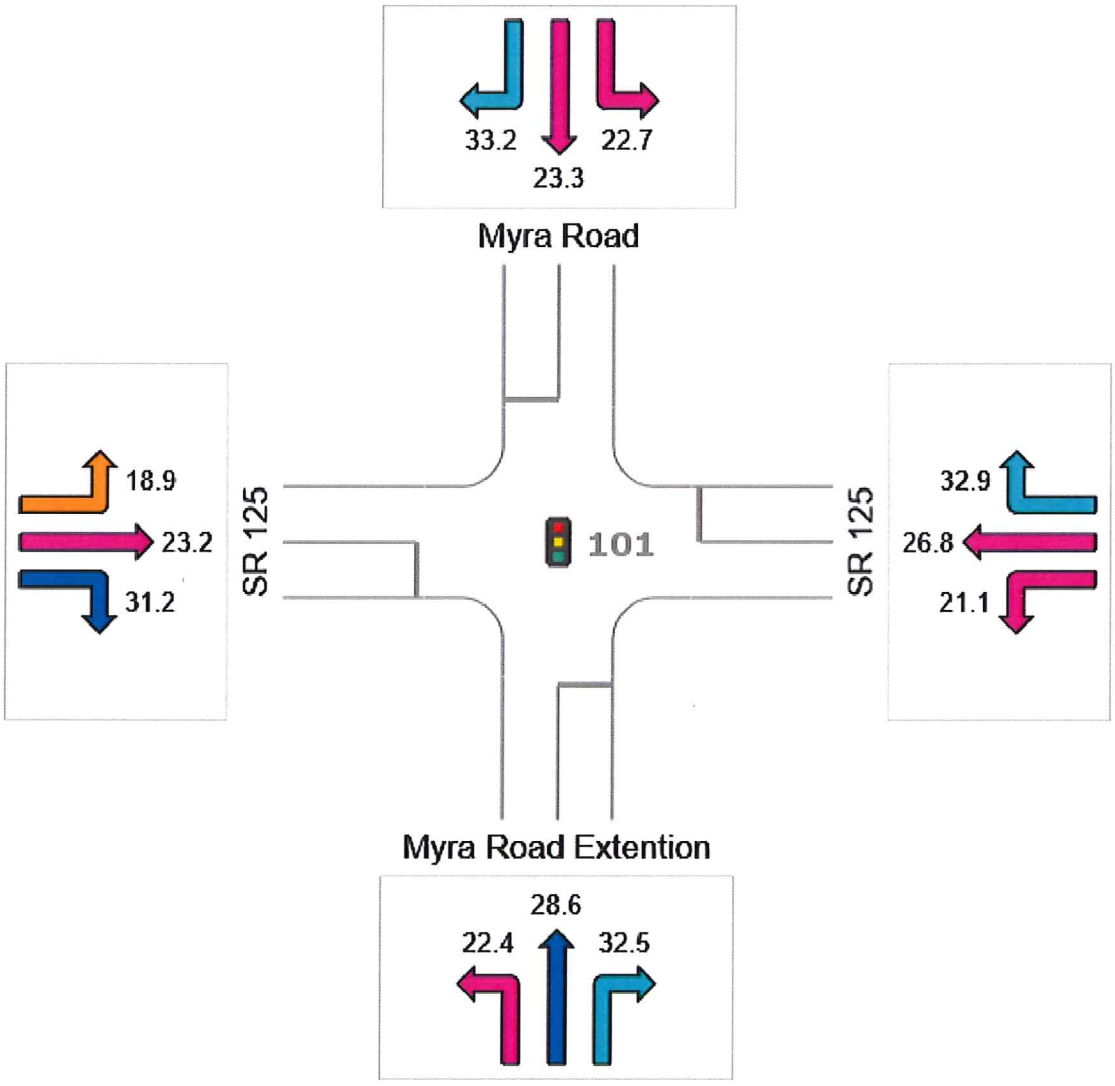
Average travel speed including all delay effects (mph)

Site: 101 [Myra Rd Ext 2040 PM Peak]

2040 with signal
Signals - Pretimed Isolated Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)

All Movement Classes

	South	East	North	West	Intersection
Travel Speed	29.0	25.3	26.0	23.0	25.3



Colour code based on Speed Efficiency Ratio

[0.9 – 1.0] [0.8 - 0.9] [0.7 – 0.8] [0.5 – 0.7] [0.3 – 0.5] [0 - 0.3]

CO2 (TOTAL)

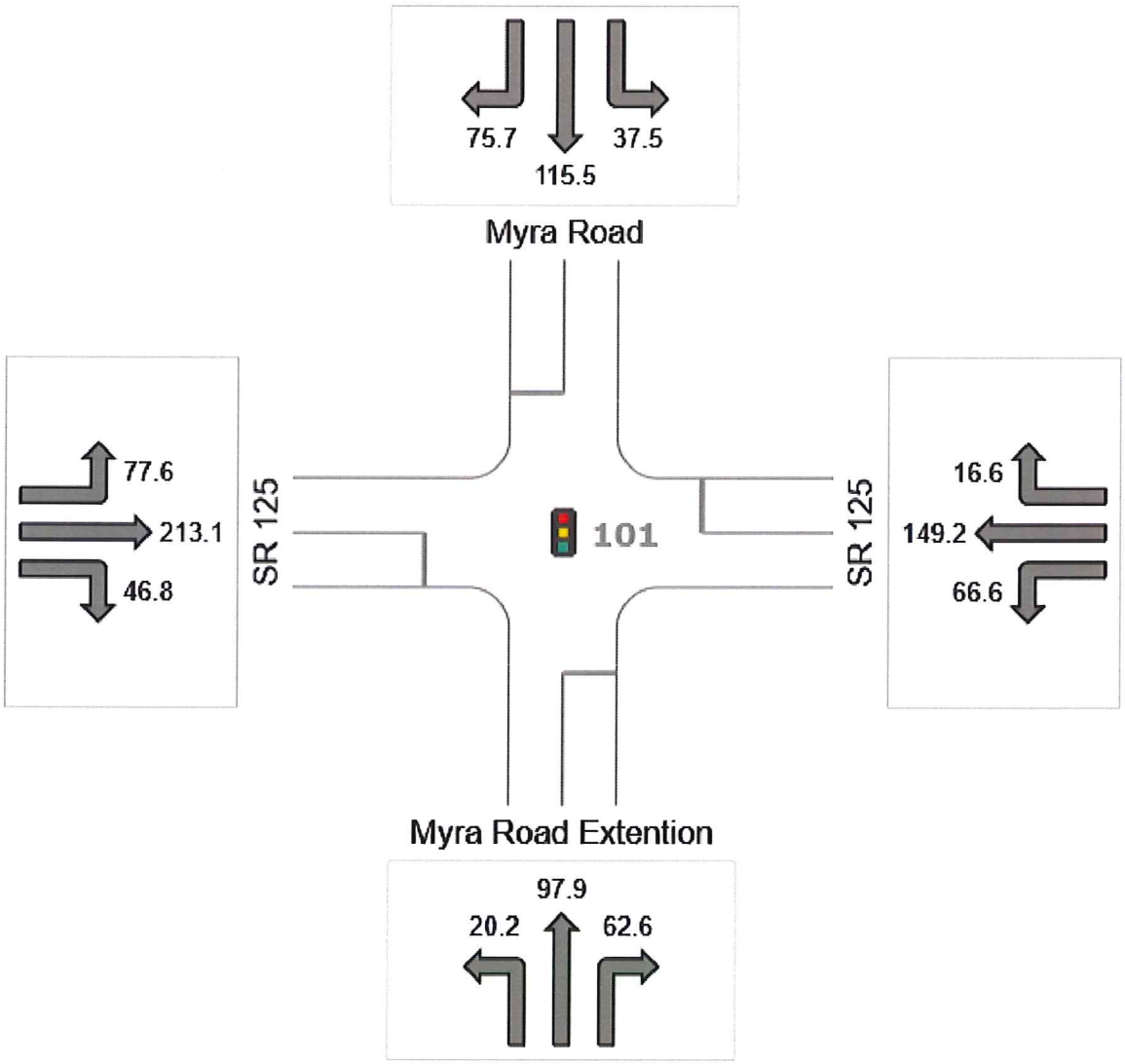
Total carbon dioxide emission (kg/h)

Site: 101 [Myra Rd Ext 2040 PM Peak]

2040 with signal
Signals - Pretimed Isolated Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)

All Movement Classes

	South	East	North	West	Intersection
CO2 (Total)	180.6	232.4	228.7	337.5	979.1



INTERSECTION SUMMARY

Site: 101 [Myra Rd Ext 2040 PM Peak HCM US]

Myra Road - SR 125 with 2-lane Roundabout
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	Vehicles		Persons	
Travel Speed (Average)	26.4	mph	26.4	mph
Travel Distance (Total)	2058.3	veh-mi/h	2469.9	pers-mi/h
Travel Time (Total)	78.1	veh-h/h	93.7	pers-h/h
Demand Flows (Total)	3817	veh/h	4581	pers/h
Percent Heavy Vehicles (Demand)	3.0	%		
Degree of Saturation	0.796			
Practical Spare Capacity	6.7	%		
Effective Intersection Capacity	4793	veh/h		
Control Delay (Total)	21.51	veh-h/h	25.81	pers-h/h
Control Delay (Average)	20.3	sec	20.3	sec
Control Delay (Worst Lane)	25.5	sec		
Control Delay (Worst Movement)	25.5	sec	25.5	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	20.3	sec		
Idling Time (Average)	12.4	sec		
Intersection Level of Service (LOS)	LOS C			
95% Back of Queue - Vehicles (Worst Lane)	11.4	veh		
95% Back of Queue - Distance (Worst Lane)	292.8	ft		
Queue Storage Ratio (Worst Lane)	0.15			
Total Effective Stops	4126	veh/h	4951	pers/h
Effective Stop Rate	1.08	per veh	1.08	per pers
Proportion Queued	0.94		0.94	
Performance Index	163.0		163.0	
Cost (Total)	1212.22	$/h	1212.22	$/h
Fuel Consumption (Total)	101.1	gal/h		
Carbon Dioxide (Total)	905.7	kg/h		
Hydrocarbons (Total)	0.084	kg/h		
Carbon Monoxide (Total)	1.066	kg/h		
NOx (Total)	1.384	kg/h		

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	Vehicles		Persons	
Demand Flows (Total)	1,832,348	veh/y	2,198,818	pers/y
Delay	10,322	veh-h/y	12,387	pers-h/y
Effective Stops	1,980,547	veh/y	2,376,657	pers/y
Travel Distance	987,965	veh-mi/y	1,185,558	pers-mi/y
Travel Time	37,493	veh-h/y	44,991	pers-h/y
Cost	581,863	$/y	581,863	$/y
Fuel Consumption	48,535	gal/y		
Carbon Dioxide	434,740	kg/y		
Hydrocarbons	40	kg/y		
Carbon Monoxide	512	kg/y		
NOx	664	kg/y		

LANE LEVEL OF SERVICE

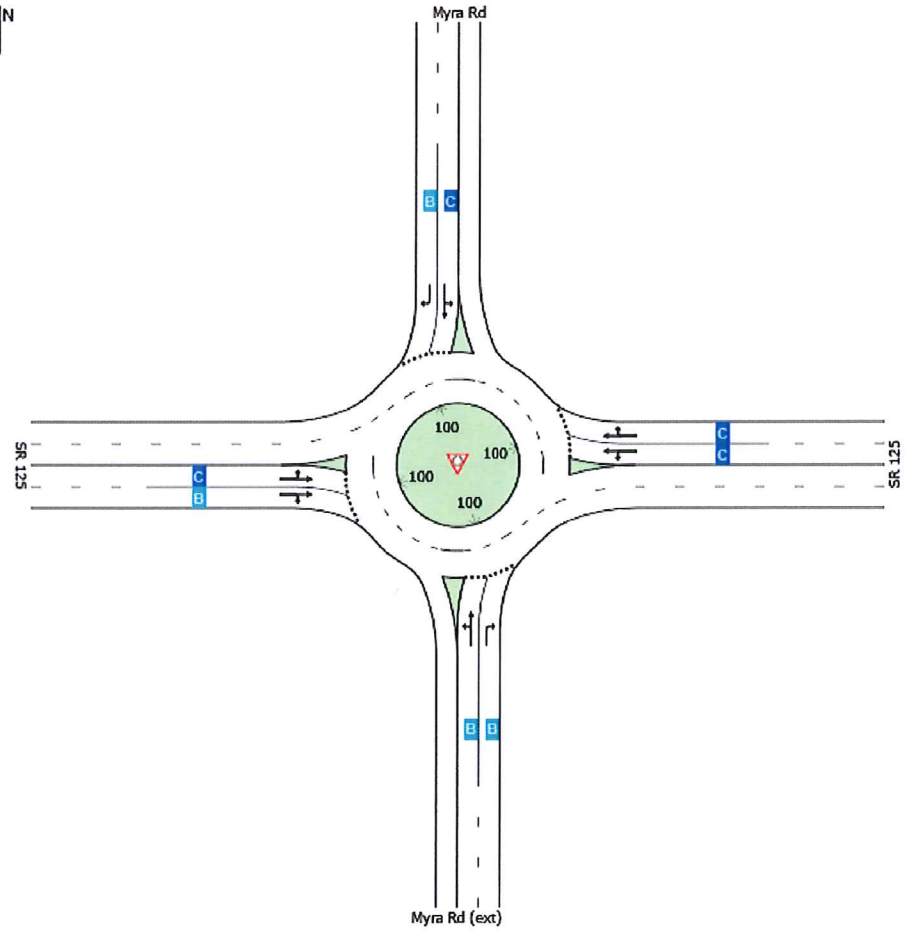
Lane Level of Service

Site: 101 [Myra Rd Ext 2040 PM Peak HCM US]

Myra Road - SR 125 with 2-lane Roundabout
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	B	C	C	B	C



Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

TRAVEL SPEED

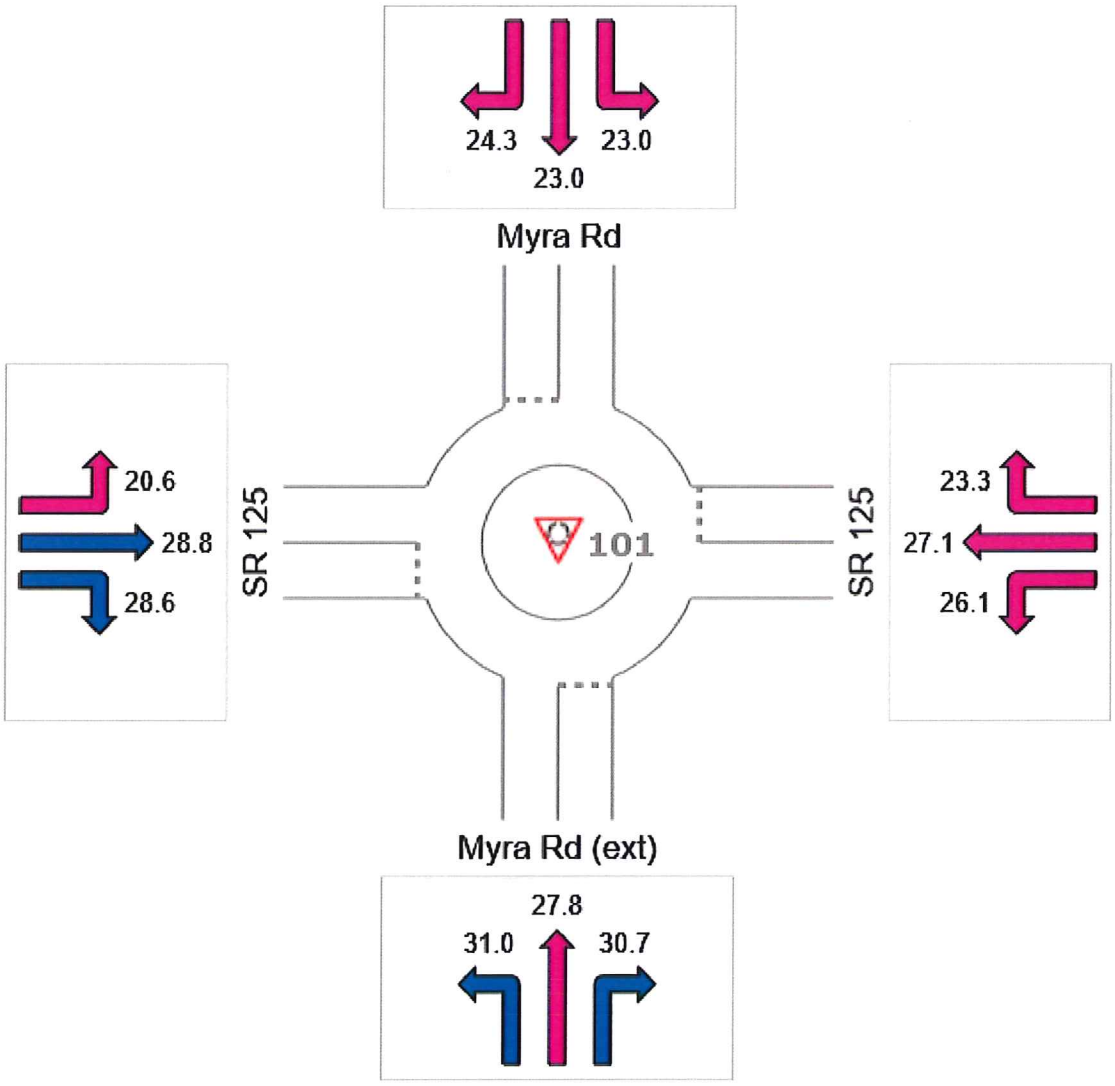
Average travel speed including all delay effects (mph)

Site: 101 [Myra Rd Ext 2040 PM Peak HCM US]

Myra Road - SR 125 with 2-lane Roundabout
Roundabout

All Movement Classes

	South	East	North	West	Intersection
Travel Speed	29.3	26.4	23.4	26.7	26.4



Colour code based on Speed Efficiency Ratio

[0.9 – 1.0] [0.8 - 0.9] [0.7 – 0.8] [0.5 – 0.7] [0.3 – 0.5] [0 - 0.3]

CO2 (TOTAL)

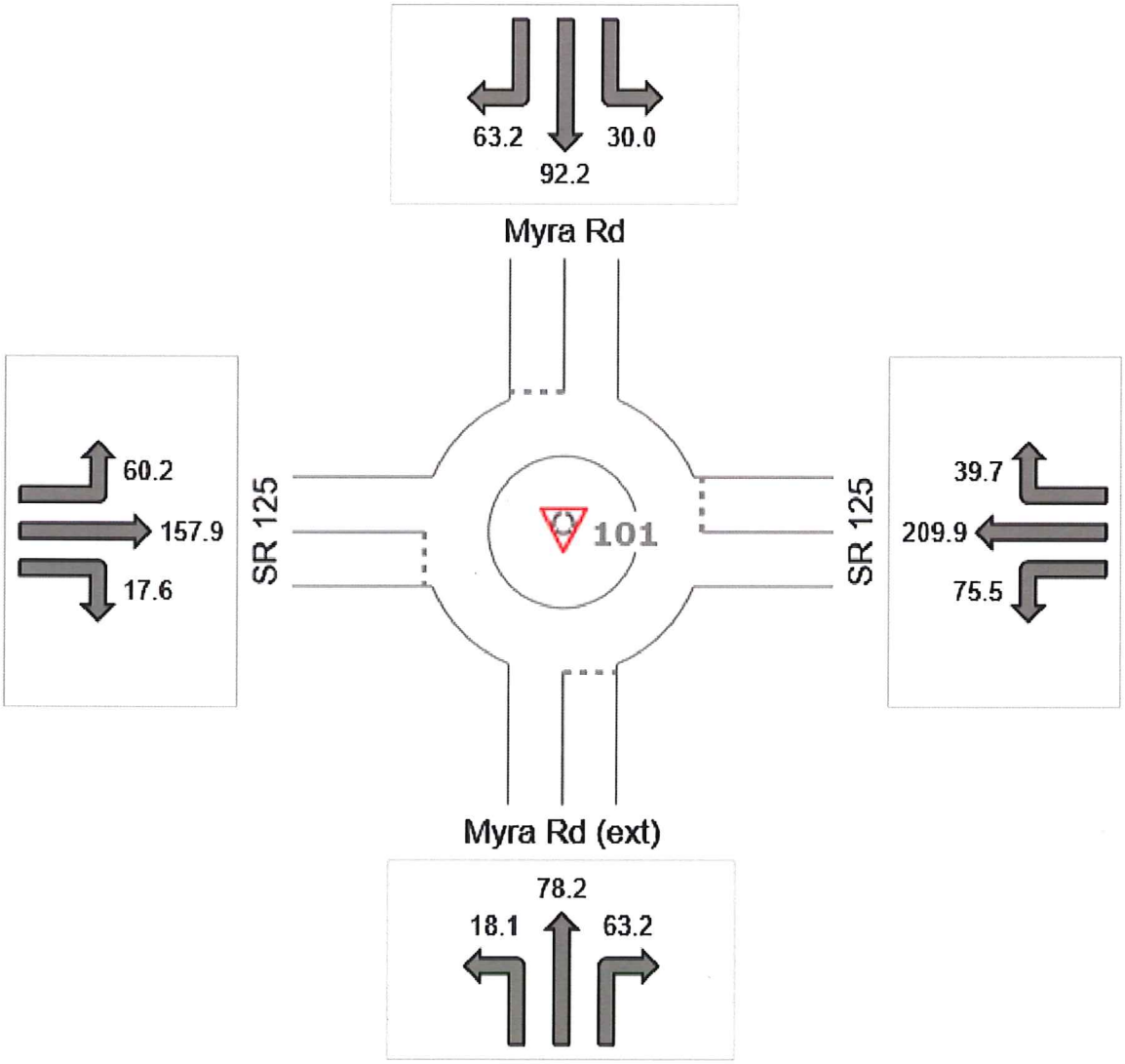
Total carbon dioxide emission (kg/h)

Site: 101 [Myra Rd Ext 2040 PM Peak HCM US]

Myra Road - SR 125 with 2-lane Roundabout
Roundabout

All Movement Classes

	South	East	North	West	Intersection
CO2 (Total)	159.4	325.1	185.4	235.7	905.7



MOVEMENT SUMMARY

Site: 101 [Myra Rd Ext 2040 PM Peak HCM US]

Myra Road - SR 125 with 2-lane Roundabout
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Myra Rd (ext)											
3	L2	75	3.0	0.588	13.3	LOS B	4.1	105.4	0.83	0.89	31.0
8	T1	412	3.0	0.588	13.3	LOS B	4.1	105.4	0.83	0.89	27.8
18	R2	265	3.0	0.425	12.1	LOS B	2.3	58.2	0.76	0.79	30.7
Approach		752	3.0	0.588	12.9	LOS B	4.1	105.4	0.80	0.85	29.3
East: SR 125											
1	L2	270	3.0	0.796	25.5	LOS C	10.4	265.1	0.99	1.23	26.1
6	T1	796	3.0	0.796	23.5	LOS C	11.4	292.8	1.00	1.22	27.1
16	R2	196	3.0	0.796	22.3	LOS C	11.4	292.8	1.00	1.21	23.3
Approach		1261	3.0	0.796	23.8	LOS C	11.4	292.8	1.00	1.22	26.4
North: Myra Rd											
7	L2	140	3.0	0.788	24.7	LOS C	7.2	183.7	0.95	1.10	23.0
4	T1	430	3.0	0.788	24.7	LOS C	7.2	183.7	0.95	1.10	23.0
14	R2	323	3.0	0.597	19.0	LOS B	3.8	96.2	0.86	0.93	24.3
Approach		893	3.0	0.788	22.6	LOS C	7.2	183.7	0.92	1.04	23.4
West: SR 125											
5	L2	241	3.0	0.678	20.9	LOS C	6.9	176.0	0.97	1.12	20.6
2	T1	599	3.0	0.678	18.7	LOS B	7.7	196.2	0.98	1.13	28.8
12	R2	71	3.0	0.678	17.9	LOS B	7.7	196.2	0.99	1.13	28.6
Approach		911	3.0	0.678	19.2	LOS B	7.7	196.2	0.98	1.12	26.7
All Vehicles		3817	3.0	0.796	20.3	LOS C	11.4	292.8	0.94	1.08	26.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Myra Rd Ext 2040 PM Peak]

2040 with signal
Signals - Pretimed Isolated Cycle Time = 75 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Myra Road Extention											
3	L2	75	3.0	0.534	36.3	LOS D	2.9	74.5	1.00	0.77	22.4
8	T1	412	3.0	0.399	22.3	LOS C	6.4	162.7	0.86	0.71	28.6
18	R2	265	3.0	0.287	4.3	LOS A	3.9	100.9	0.46	0.39	32.5
Approach		752	3.0	0.534	17.3	LOS B	6.4	162.7	0.73	0.60	29.0
East: SR 125											
1	L2	241	3.0	0.792	42.6	LOS D	10.2	260.4	1.00	0.93	21.1
6	T1	599	3.0	0.641	27.6	LOS C	10.7	274.3	0.95	0.80	26.8
16	R2	71	3.0	0.078	3.6	LOS A	0.9	22.4	0.38	0.30	32.9
Approach		911	3.0	0.792	29.7	LOS C	10.7	274.3	0.92	0.80	25.3
North: Myra Road											
7	L2	140	3.0	0.499	35.1	LOS D	2.7	68.8	1.00	0.76	22.7
4	T1	430	3.0	0.868	40.2	LOS D	18.6	475.9	1.00	1.03	23.3
14	R2	323	3.0	0.334	2.9	LOS A	4.2	107.6	0.40	0.35	33.2
Approach		893	3.0	0.868	25.9	LOS C	18.6	475.9	0.78	0.74	26.0
West: SR 125											
5	L2	270	3.0	0.885	55.1	LOS E	12.6	322.4	1.00	1.01	18.9
2	T1	796	3.0	0.853	40.6	LOS D	17.2	439.9	1.00	1.01	23.2
12	R2	196	3.0	0.248	7.3	LOS A	3.6	91.4	0.56	0.47	31.2
Approach		1261	3.0	0.885	38.5	LOS D	17.2	439.9	0.93	0.92	23.0
All Vehicles		3817	3.0	0.885	29.3	LOS C	18.6	475.9	0.85	0.79	25.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians							
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance ft	Prop. Queued	Effective Stop Rate per ped
2P	South Full Crossing	54	29.1	LOS C	0.1	0.3	0.88	0.88
8P	East Full Crossing	54	29.1	LOS C	0.1	0.3	0.88	0.88
6P	North Full Crossing	54	29.1	LOS C	0.1	0.3	0.88	0.88
4P	West Full Crossing	54	29.1	LOS C	0.1	0.3	0.88	0.88
All Pedestrians		217	29.1	LOS C			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

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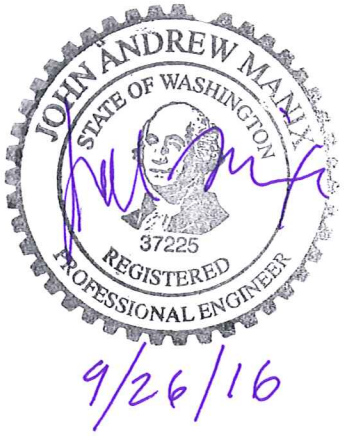

September 26, 2016

To: Neal Chavre, PE City of Walla Walla

From: John Manix, PE

Re: Myra Road Extension Traffic Analysis

The long term transportation system plan[1] calls for the extension of Myra Road from SR 125 to Taumarson Road. With the completion of Myra Road (US 12 to SR 125), there has been interest in the development of the large commercial parcel south of SR 125 at the southern terminus of Myra Road. Figure 1 provides a preliminary alignment of the proposed Myra Road extension as part of a conceptual plan for potential commercial development. Traffic analysis is required to verify the number of lanes and the storage length of left and right turn lanes needed of the proposed alignment.

This technical memorandum provides the analysis to support recommendations for right-of-way, channelization of turn lanes and traffic control on the Myra Road extension from SR 125 to Taumarson Road. The memorandum includes consideration of the Myra Road / SR 125 intersection and the proposed roundabout on the Myra Road extension as part of a potential commercial site plan. The analysis is not intended to cover the full scope of traffic impacts or as a Transportation Impact Analysis.

Background:
Myra Road from SR 125 to US 12 has recently been upgraded with the intent of it potentially becoming a part of the state route system in the future. The improvements on Myra Road north of SR 125 were based on an alternative analysis prepared by DKS and Associates in 2011[2].

Myra Road is classified as a minor arterial. The roadway extension plan calls for a single through lane in each direction and a continuous two-way left-turn lane. At a central location within the potential commercial development, a single lane roundabout is proposed to distribute trips from the potential commercial buildings to the east and west of Myra Road

Analysis:
The HDJ traffic analysis includes:

1. Trip generation and distribution of trips of the potential commercial land use.
2. Collect traffic counts for the PM peak hour.
3. Prepare design hour volume using output from the Walla Walla Valley Metropolitan Planning Organization (WWVMPO) Transportation Model.
4. Prepare analysis of the major intersections on Myra Road from SR 125 to Taumarson Road to include:
    a. Level of service, v/c ratio;
    b. Queueing analysis;
    c. Auxiliary lane layout; and

---

[1] Walla Walla Valley Metropolitan Planning Organization, *2040 Planned Projects by Phase,* December 2015
[2] DKS Technical Memorandum – *SE Myra Road Improvement Alternative Analysis,* August 26, 2011.

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d. Right-of-way recommendations.

5. Roundabout – a conceptual roundabout layout of the Myra Road intersection within a conceptual commercial development including LOS analysis and V/C ratio.
6. Myra Road extension alignment from the proposed roundabout to Taumarson Road using the concepts of context sensitive design and the City's Complete Street Policy.

Trip Generation and Distribution:

Figure 1, for the conceptual commercial development southwest of SR 125, shows a large anchor store (approximately 165,000 SF) with 15 other commercial buildings for a total of approximately 400,000 SF of gross leasable area. The ITE Trip Generation Manual was used to estimate the number of trips generated by a shopping center, land use code 820. See appendix A for the calculations and an excerpt from the Trip Generation Manual that describes the shopping center. Table 1 provides a summary of the total trip generation.

Table 1
Trip Generation

Land Use:	**Shopping Center (820)**	
Independent Variable:	1000 Square Feet	
Size:	400+/-	
Weekday ADT:	16,697	
Total Peak Hour Trips:	AM	PM
In:	251	749
Out:	160	812
Total:	**411**	**1561**

A 25% pass-by trip reduction was applied to the trips through the Myra Road / SR 125 intersection based on the *Trip Generation Handbook*[3]. The *Trip Generation Handbook* does not recommend use of internal trip-capture reduction for shopping centers.

The trip distribution from the conceptual development is based on a Flow Bundle Analysis from the Walla Walla Valley Metropolitan Planning Organization's (WWVMPO) transportation model output. The analysis distributes the trips from the Traffic Analysis Zone (TAZ) surrounding the Myra Road Extension onto the adjacent streets. The output needs to be post-processed to provide a percent of trips to each link of studied intersections. In this case the Myra Rd / SR 125 intersection. See Appendix B for the Flow Bundle Analysis output and the derived trip distribution. Figure 2 provides the trip distribution.

The trip distribution to public roads was used to assign turning movement volumes to the studied intersections. For the proposed roundabout within the development, trips internal to the shopping center were distributed to each approach to the roundabout by estimating driveway volumes. The driveway volumes are based on the proportion of square feet of shopping center served by each driveway. The percent of the site trips from each driveway were summed, balanced and distributed to the roundabout approaches and Myra Road. The percent of site trips were then converted into trip assignments (turning movements) for each roundabout approach.

[3] Institute of Transportation Engineers, *Trip Generation Manual, Volume 1: 9th Edition User's Guide and Handbook,* 2012

Traffic Volumes – Existing PM Peak and 2040 Design Hour

The 2011 turning movement counts at Myra Rd and SR 125 were reviewed for this analysis but were found unreliable after comparing them to a 24 hour count on SR 125 near Myra Road in 2012. PM peak hour turning movement counts were collected in August 2016 to best analyze existing traffic on Myra Road and estimate future design hour volumes. The 2040 PM Design Hour Volumes were prepared using the following steps:

- The transportation model output for the PM peak hour for the 2014 base year and the 2040 future year were supplied by the WWVMPO. See Appendix B for the model year outputs.
- The 2014 base year volumes were extrapolated to estimate the 2016 model volumes by calculating the annual growth rate between the 2014 base and the 2040 design year volumes. An annual growth rate of 0.53% was estimated between the model 2014 base year and the 2040 future year.
- The 2016 existing counts were compared to the 2016 model volumes. A correction factor for future years was estimated by dividing the total entering volume of the existing year volumes by the 2016 model year. The existing year volume is within 98% of the 2016 model year volume.
- The 2040 Design Hour Volume is estimated at 98% of the 2040 PM peak hour model volume output. Thus, each turning movement volume was multiplied by 0.98.
- The shopping center trips were added to the 2040 PM peak hour post process model volume. The pass-by trip reduction was applied to the sum of shopping center trips and 2040 Design Hour volume. See appendix C for the post processing calculations. Figure 2 shows the 2040 PM Design Hour volumes.

The 2040 Design Hour Volumes were used to estimate the level of service for the Myra Road / SR 125 intersection using HCM 2000 method and the Myra Road extension roundabout intersection using HCM 2010 method. Table 2 summarizes the results.

Table 2
2040 Design Hour Level of Service

INTERSECTION	2040 Weekday Level of Service		
	PM		
	LOS	*Delay (sec)*	*V/C*
Myra Rd and SR 125	C	33.5	0.87
Myra Rd extension roundabout - worst approach	B	12.1	0.65

The analysis shows that in the year 2040, the Myra Road / SR 125 intersection will operate within the City of Walla Walla standards with the alternative lane configurations. The proposed Myra Road extension roundabout will also operate within City standards as a single lane roundabout. See the LOS reports in Appendix D for more details.

Queueing Analysis

With the closely spaced intersections, both existing north of the Myra Road / SR 125 intersection and proposed south of the intersection, a queueing analysis was prepared using SimTraffic©. The primary concern was to provide a recommendation on the storage length for the number of travel lanes at the Myra Road / SR 125 intersection.

Two alternative lane configurations were prepared for evaluation of modifications to Myra Road from SR 125 to SE Commercial Drive / Twin Creek Place. Alternative A and B, are shown in Figures 3 and 4.

Alternative A, as shown in Figure 3, is based on minimizing impacts of the closely spaced intersections. In situations with close spacing between intersections, access to minor cross-streets (Commercial Drive and Twin Creeks Place) is often limited to right-in and right-out to the through roadway (Myra Road) to maintain safe and effective operation. In this case southbound Myra Road traffic is estimated to queue to the Commercial Drive and Twin Creek Place intersection. By allowing left turning access from Twin Creeks, as currently exits, the left turn storage on Myra Road at SR 125 is limited. As traffic increases, it will become more difficult for left turning traffic from Twin Creeks Place to Myra Road to merge into the through or right turn lanes.

Alternative B is based on *no change* to the access at Twin Creeks Place/Commercial Drive. As shown in Figure 4, the existing access is limited at Myra Road/Commercial Drive/Twin Creeks Place intersection to restricting left turning movements out of Commercial Drive and east-west through movements between Twin Creeks Place to Commercial Drive. The current access restrictions are assumed as the preferred alternative because of the high value businesses places on maximum traffic access. The access to the business on Twin Creeks Place currently has some limits but the left-in and left-out access was maintained due it being a dead-end street. The collision history for Myra Road from January 1, 2010 to the available data in 2016 was reviewed. Only two collisions were recorded near the Myra Road/Commercial Drive/Twin Creeks intersection. One, non-injury collision with potential to be corrected with additional access restrictions.

One important consideration is if the southbound queue on Myra Road at SR 125 will back up to Commercial Drive/Twin Creek Place. Table 3 summarizes the results of the queuing analysis with Alternative B. Figure 4 illustrates the length of the 95th percentile queue at SR 125/Myra Road intersection. As traffic grows, under the highest traffic conditions, the southbound queue is estimated to extend to Commercial Drive but still not significantly interfere with left turn access from Twin Creeks Place. See the Queuing and Blocking Report in Appendix D for more details.

Alternative B, related to further access restriction at Commercial Drive/Twin Creek Place is the recommended alternative for the following reasons:

- The current access restrictions are operating with a low frequency of collisions (less than one per year).
- The 95th percentile queue for the 2040 design hour has room for left turns out of Twin Creek Place.
- If traffic congestion or traffic collisions increase to the point of necessitating additional access restrictions, they can be accomplished with low cost modifications to the existing medians.

The operation of the left turning traffic from Twin Creek Place should be monitored as the potential commercial site is developed to minimize conflicts.

If access is further restricted on Twin Creek Place, the City should look into the feasibility of providing an additional access through extension of Twin Creeks Place.

Table 3
Queuing Analysis 2040 Design Hour

Intersection - PM	**Myra Road and SR 125**															
Direction of Travel	NB Lt	NB Th1	NB Th2	NB Rt	SB Lt1	SB Lt2	SB Th	SB Rt	EB Lt	EB Th1	EB Th2	EB Rt	WB Lt	WB Th1	WB Th2	WB Rt
95th% Queue Length (feet)	89	127	117	100	78	118	295	237	180	170	160	49	329	183	163	69
Proposed Storage Length (feet)	100	125	125	100	100	200	200	200	300	300	300	60	400	300	300	90
Notes							1	2				3				4

Intersection - PM	**Myra Road Extension Roundabout**			
Direction of Travel	NB	SB	EB	WB
95th% Queue Length (feet)	123	111	64	67
Proposed Storage Length (feet)	150	300	500	150
Notes	5	5	5	5

Notes

1. Average southbound queue is less than 180 feet and the through lane has more than 200 feet of storage, but conflicts with the SE Commercial Drive eastbound right turn movement.
2. Average southbound queue is less than 100 feet and right turn lane has more than 200 feet of storage, but conflicts with the SE Commercial Drive eastbound right turn movement.
3. Eastbound right turn lane was originally shown, but a right turn pocket is recommended per WSDOT Design Manual Section 1310.03(3).
4. The existing right turn lane meets intersection capacity but does not include a deceleration lane per WSDOT Design Manual Section 1310.03(3).
5. Roundabout queue length is a moving queue due to yield control on the approach of the roundabout. The estimated 95 percentile queues are a conservative estimate.

Right-of-Way Recommendations

The proposed right-of-way was compared to the City of Walla Walla Standard Plan 2-1 Arterial Roadway Section (see Appendix E), the level of service analysis for the intersection and the conceptual development plan.

The conceptual plan for Myra Road extension from Taumarson Road to the roundabout proposes three travel lanes, curb, planter strip and sidewalk within 100 feet of right-of-way. See Figure 5. The City's Standard Plan 2-1, as shown in Appendix E, calls for 44 foot width from curb face to curb face and is recommended for the proposed 3 travel lanes. The standard cross section is recommended to be further enhanced as follows:

- Install 10 foot wide sidewalk/multi-use path on both sides of Myra Road from SR 125th Ave to Taumarson Road. This will act as an extension of the current multi-use path on the existing Myra Road to the existing multi-use path on Taumarson. It also makes Myra Road more accessible for transit service if it is ever extended south of SR 125.
- Provide standard bike lanes on the Myra Road extension from Taumarson Road to the proposed roundabout. This extends the existing bike lane network on Taumarson Road. At the roundabout, the bike lanes would transition to a proposed multi-use path on Myra Road extension to maintain continuity with the existing Myra Road multi-use path.
- Provide left turn pocket on Taumarson Road at the Myra Road intersection. No data is available to adequately analyze the LOS of the intersection with or without a left turn lane. This recommendation is based on the intersection of two minor arterials and the WWVMPO 2040 Plan that assumes a traffic signal at this intersection. Based on the current improvements on Taumarson Road, the widening is most likely on the north side only. The necessary right-of-way appears available but this not certain.

The conceptual design shows the right-of-way for the proposed roundabout, within a 172 foot diameter circle. The traffic analysis demonstrates that a single lane roundabout will easily meet the City LOS standards and work within the proposed right-of-way of the conceptual design. As the roadway design and the development site plan proceeds, further refinement of the right-of-way will be needed. The total right of way at the roundabout is recommended to fit a 220 foot diameter octagon to provide for the curb returns and flexibility as the design moves forward.

The critical right-of-way consideration was the Myra Road / SR 125 intersection. The LOS and queueing analysis was used to size the number of lanes and length of each approach. The need for additional right-of-way for each approach is summarized below:

- SR 125, eastbound approach: No right-of way is needed for the widening associated with adding a right turn pocket.
- Myra Road, southbound approach: No right-of way is needed for the widening associated with adding a right turn lane.
- SR 125, westbound approach: No right-of-way is needed for the installation of a left turn lane and possible right turn deceleration lane.
- Myra Road, northbound approach: The right-of-way for the proposed Myra Road extension to the south is shown in Figure 6. The necessary right-of-way varies substantially from SR 125 to the proposed roundabout. The travel lanes, sidewalk and fill slope can be addressed in 165 feet of right-of-way just south of the SR 125 and reduced down to below 100 feet of right-of-way closer to the roundabout. The final width will be fine-tuned with, additional engineering and consultation with the property owner. This does not include the remnant property created by Myra Road extension as shown on Figure 6.

Myra Road Extension Alignment and Design Parameters

The conceptual plan shows alignment that is based on several important design parameter that will be used to refine the alignment as the project moves forward. The plan fits within the City's recently adopted "Complete Streets Policy" and is often described as Context-Sensitive Design, which the Journal of Transportation Engineering describes as:

"*Well-designed roadways should equally consider and address safety, mobility, and community needs. The concept of context sensitive design is an emerging project development and geometric design approach that aims to meet the objectives of these elements. Central to the design process is the selection of key design elements that have the potential to influence design choices and roadway elements. Design speed is probably the most influential factor and current practices on how this speed is selected and used may need to be revisited. The need to design a roadway that could provide all required clues to the driver in order to drive at desired operating speeds is also an issue that requires attention."*[4]

The design elements that were considered as part of the conceptual design and as the design moves forward.

- Intersection point with Taumarson Road - The point of intersection is based on the most likely right-of-way path between Highland Road and Taumarson Road. The lot is unoccupied and is least disruptive to the adjacent property.
- The alignment will meet the space needs of a conceptual commercial development - The conceptual plan is based on land use planning that relies on adequate lot sizes, accessible parking layout and internal circulation to achieve a successful commercial enterprise.
- Pedestrian/bicycle friendly and traffic calming design practices - The design speeds used for the roundabout and horizontal curves to the south will assure motorist are much more likely to yield the right-of-way to a pedestrian crossing the roadway. The blocks are short to minimize out of direction travel for non-motorized trips across Myra Road within the development. The 10 foot wide sidewalks will tie into the multi-use trail on the existing Myra Road and Taumarson Road to allow pedestrian and bicycle friendly access.
- Maintain through traffic capacity – With the minimal delay at the proposed roundabout, no STOP signs on Myra Road, and continuous left turn lanes, traffic will flow through without delay. But the design is not so capacity oriented that it will discourage pedestrian and bicycle activity.
- The Myra Road extension provides transition – The existing Myra Road is designed to accommodate higher capacity and truck traffic as an important through route between US 12 and SR 125. The Myra Road extension is proposed to transition back down to facilitate with lower speeds and volumes that is supports multi model transportation.

The conceptual commercial development will be within walking and biking distance of a large area of surrounding residential land use. The extension of Myra Road will also serve as an important link in the transportation network providing access to the State highway system. Thus, the Myra Road extension strikes the balance between safety, mobility and access to commercial land use.

Conclusions

A conceptual 400,000 square foot shopping center south of SR 125 on the Myra Road extension is estimated to generate as much as 1,650 PM peak hour trips with 65% using the Myra Road / SR 125 intersection. This report does not constitute a full Transportation Impact Analysis report but is intended to be used to size the Myra Road extension. As the site develops, it will continue to be refined. Care should be taken that the density does not substantially increase beyond the concepts contained herein.

[4] Stamatiadis, N, *Context-Sensitive Design: Issues and Design Elements,* Journal of Transportation Engineers, May 2005

The proposed roadway configuration for the Myra Road extension will meet the future demand of a development of similar density and land use based on the future travel volume from the WWVMPO transportation model.

The 95th percentile queues of 2040 southbound traffic will at times block traffic turning right from SE Commercial Drive but does not pose a safety concern.

The existing left turns from Twin Creek Place should be monitored for possible conflicts with the proposed lanes on Myra Road at SR 125. If the queue in southbound Myra Road left turn lane extends to Twin Creek Place or collision frequency significantly increases for left tuning traffic from Twin Creek Place, additional restrictions are recommended.

The necessary right-of-way for the Myra Road extension will vary between SR 125 and the roundabout. With the need to fill beyond the back of sidewalk, maximum necessary right-of-way width, is estimated at 150 feet near SR 125 and 115 feet closer to the roundabout.

The right-of-way for a single lane roundabout is estimated at approximately 220 foot diameter. Further refined may reduce the right-of-way as the roadway design and conceptual shopping center site plan proceeds.

The Myra Road extension from Taumarson Road to the roundabout is proposed with 100 feet of right of way but may be reduced to a minimum of 80 feet of right-of-way depending on City design criteria. The design and alignment will provide safe and efficient access for automobiles drivers, pedestrians, bicyclists and possible transit riders.

Recommendations:
If the Myra Road extension project should move forward the following design alternatives are recommended:

1. The north leg of the existing Myra Road/SR 125 intersection should be modified as proposed in Alternative B but the operation of the Myra Road/Twin Creek Place/Commercial Drive should be monitored to assure queueing does not compromise operation and safety. If the operation or safety problems are noted, additional intersection restrictions are recommended.
2. The right-of-way width on the Myra Road extension should be as follows:
    a. Taumarson Road to the Roundabout – 100 feet.
    b. Roundabout – The right-of-way diameter for a single lane roundabout, is 220 feet.
    c. Roundabout to SR 125 - Varies from 100 feet near the roundabout to 165 feet for the street width and fill slope.

    See Right-of-Way Exhibits A, B and C.

3. The Myra Road extension design should include the City's Complete Streets Policy elements such as:
    a. 10 foot wide sidewalks on both sides from SR 125 to Taumarson Road
    b. Bike lanes from the roundabout to Taumarson Road
    c. Horizontal curve design speed at or below 30 MPH
    d. Pedestrian enhancements to increase access across Myra Road
4. Taumarson Road should include a left turn pocket at the intersection of Myra Road intersection.

Attachments
Figure 1 – Conceptual Commercial Development Plan
Figure 2 – Trip Distribution, Existing and 2040 PM Peak Hour Turning Movement Volumes

Figure 3 – Alternative A for Myra Road Modifications
Figure 4 – Alternative B for Myra Road Modifications
Figure 5 – Right-of-way from the roundabout to Taumarson Road
Figure 6 – Right-of-way at SR 125

Right-of-Way Exhibits A, B and C

Appendix A – Trip generation for the shopping center
Appendix B – WWVMPO transportation model output and trip distribution
Appendix C – 2040 Design Year volume calculations and existing turning movement count
Appendix D – 2040 Level of Service and Queuing Analysis output reports
Appendix E – City of Walla Walla Standard Plan 2-1 Arterial Roadway Section

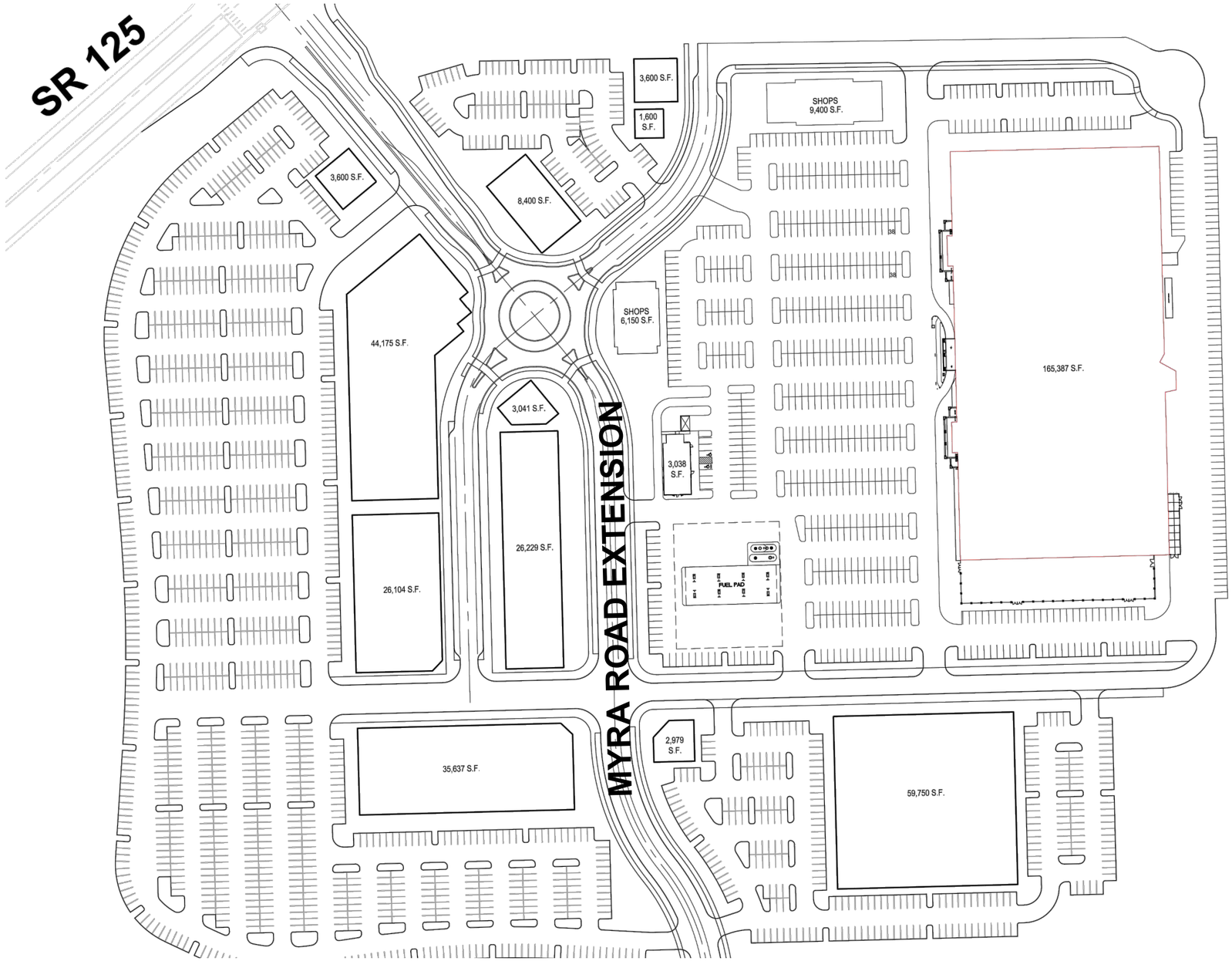

FIGURE 1

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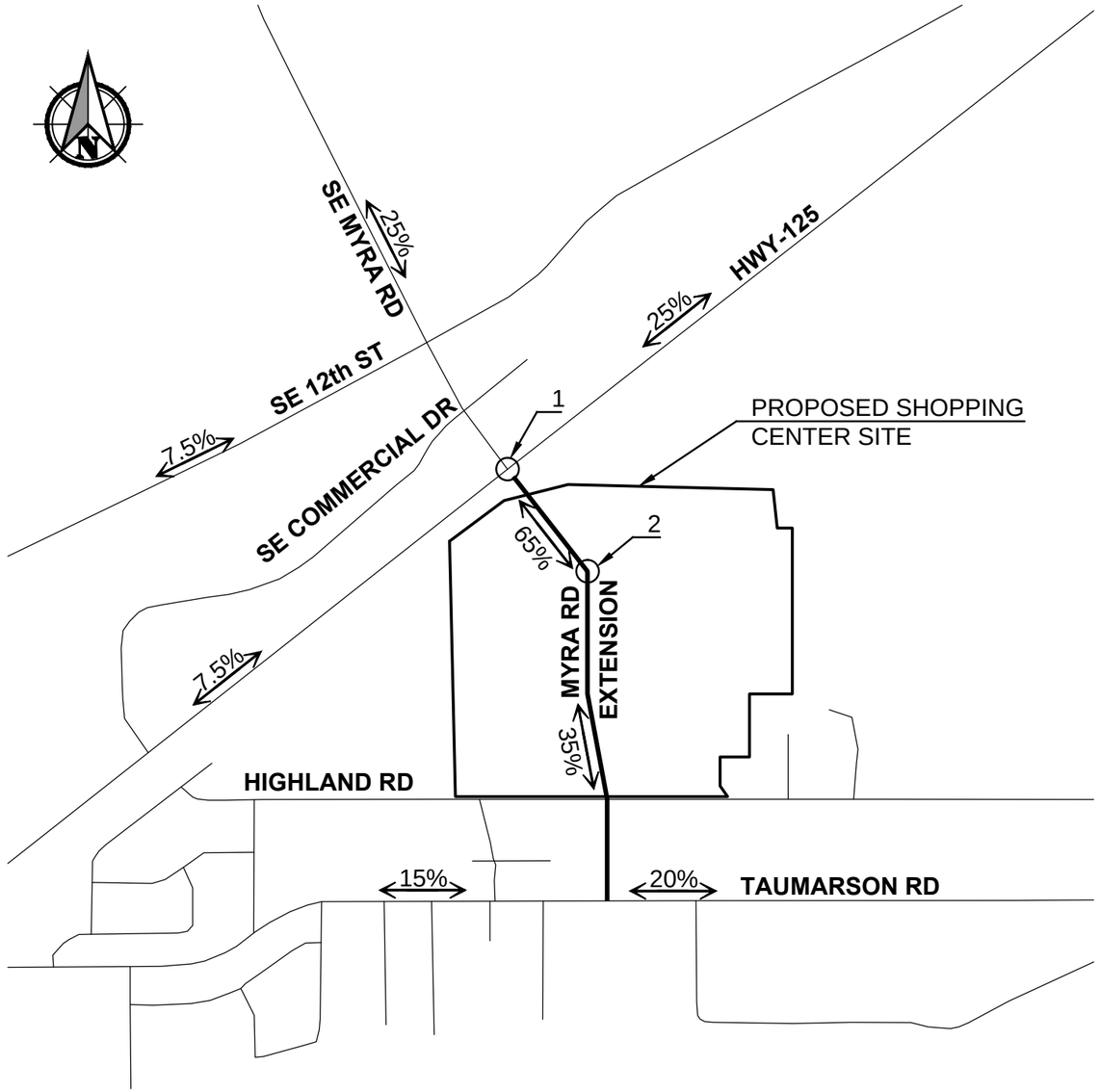
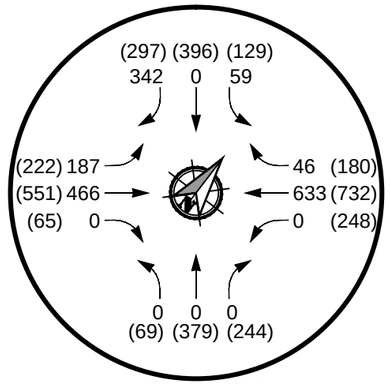
Conceptual Shopping Center
Myra Road Extension

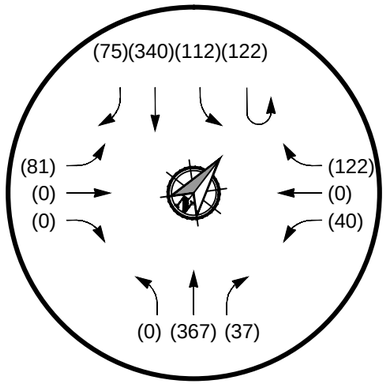


LEGEND

○	INTERSECTION
XXX	Existing PM Peak Hour
(XXX)	2040 PM Peak Hour



1. Myra Road / SR 125



2. Myra Road Extension Roundabout

FIGURE 2

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Trip Distribution, Existing & 2040 PM Peak Hour Turning Movement Counts
Myra Road Extension

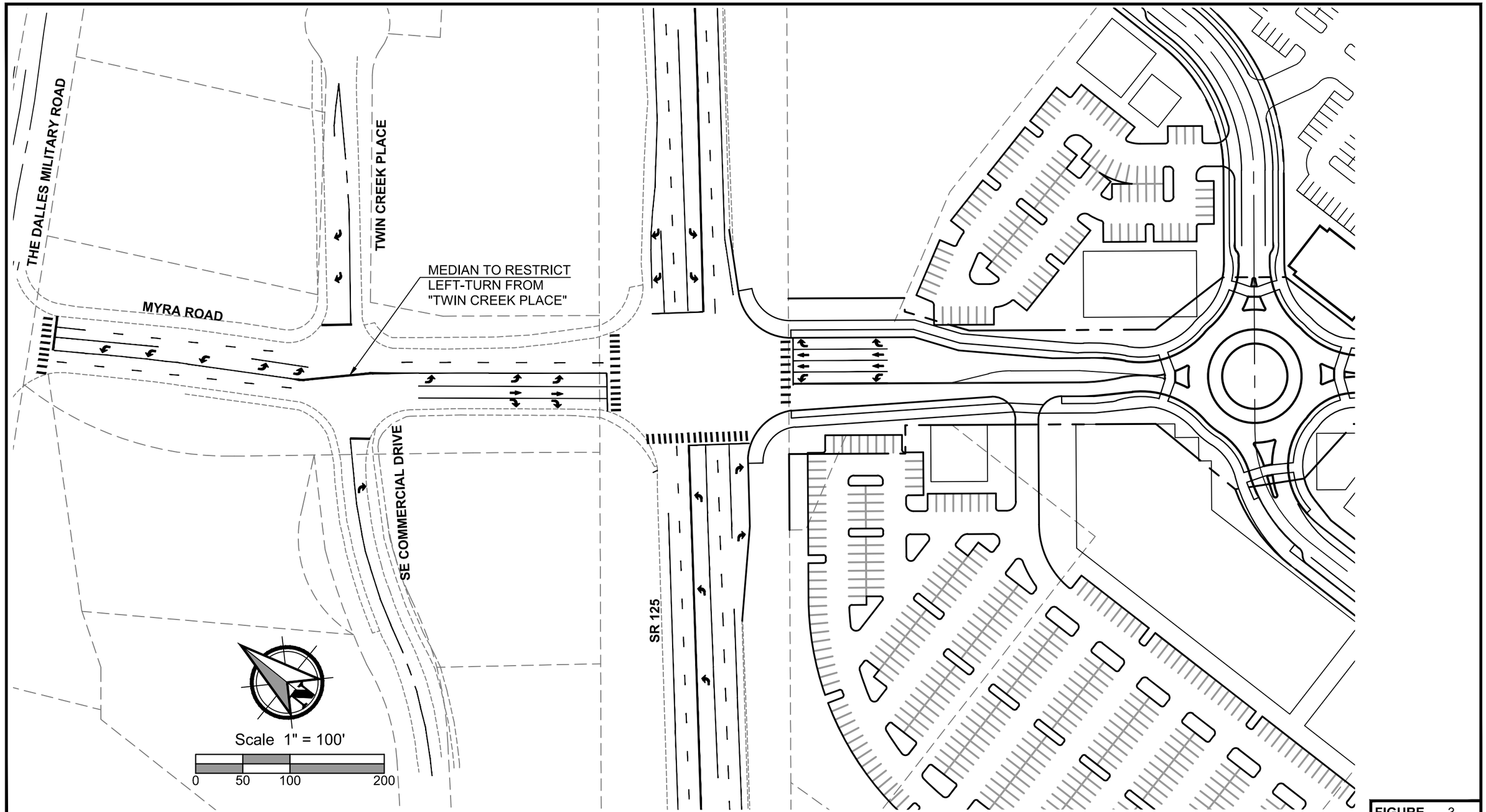

FIGURE 3

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Alternative A Myra Road Modification

Myra Road Extension

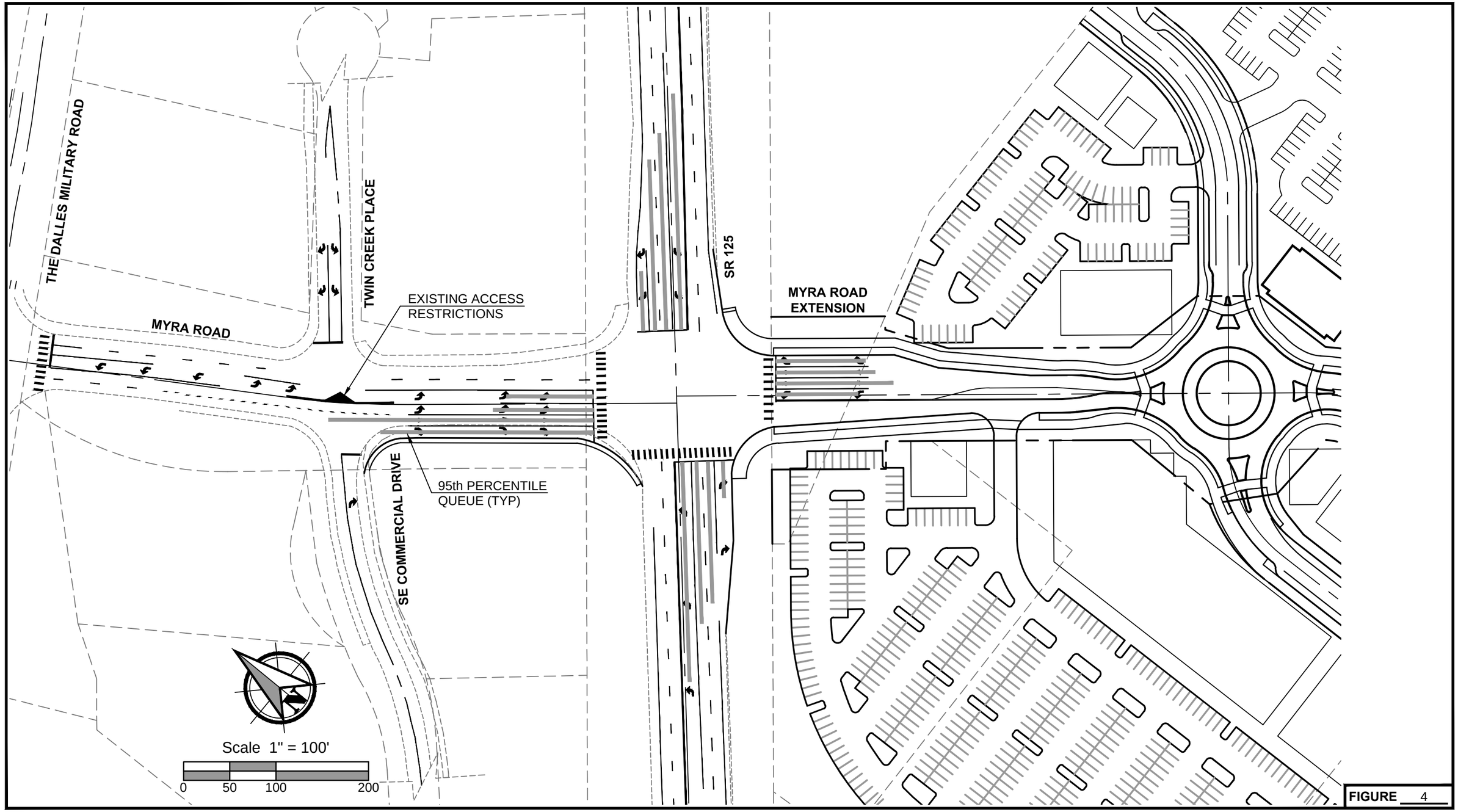

FIGURE 4

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Alternative B Myra Road Modification

Myra Road Extension

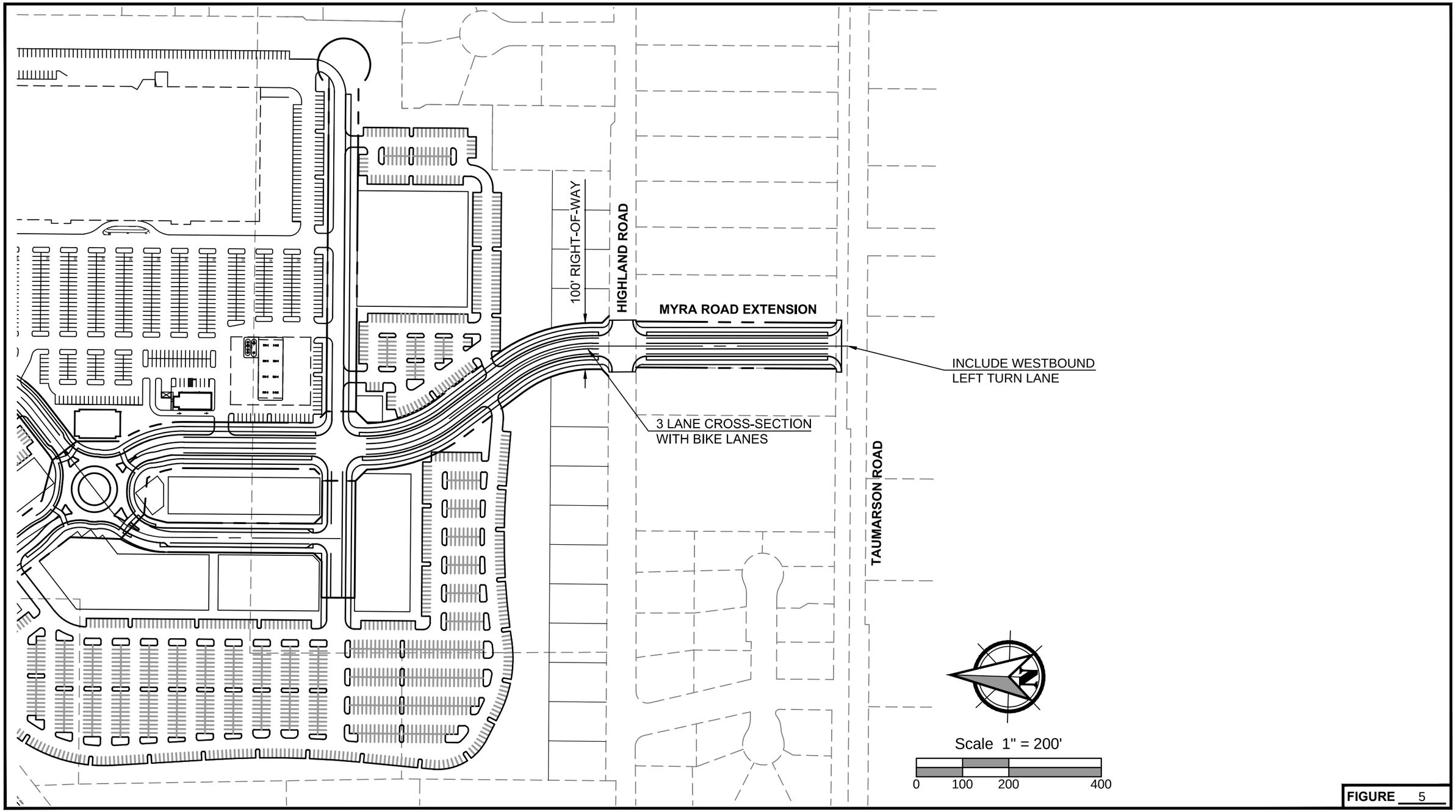

FIGURE 5

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Right Of Way From Roundabout To Taumarson Road

Myra Road Extension

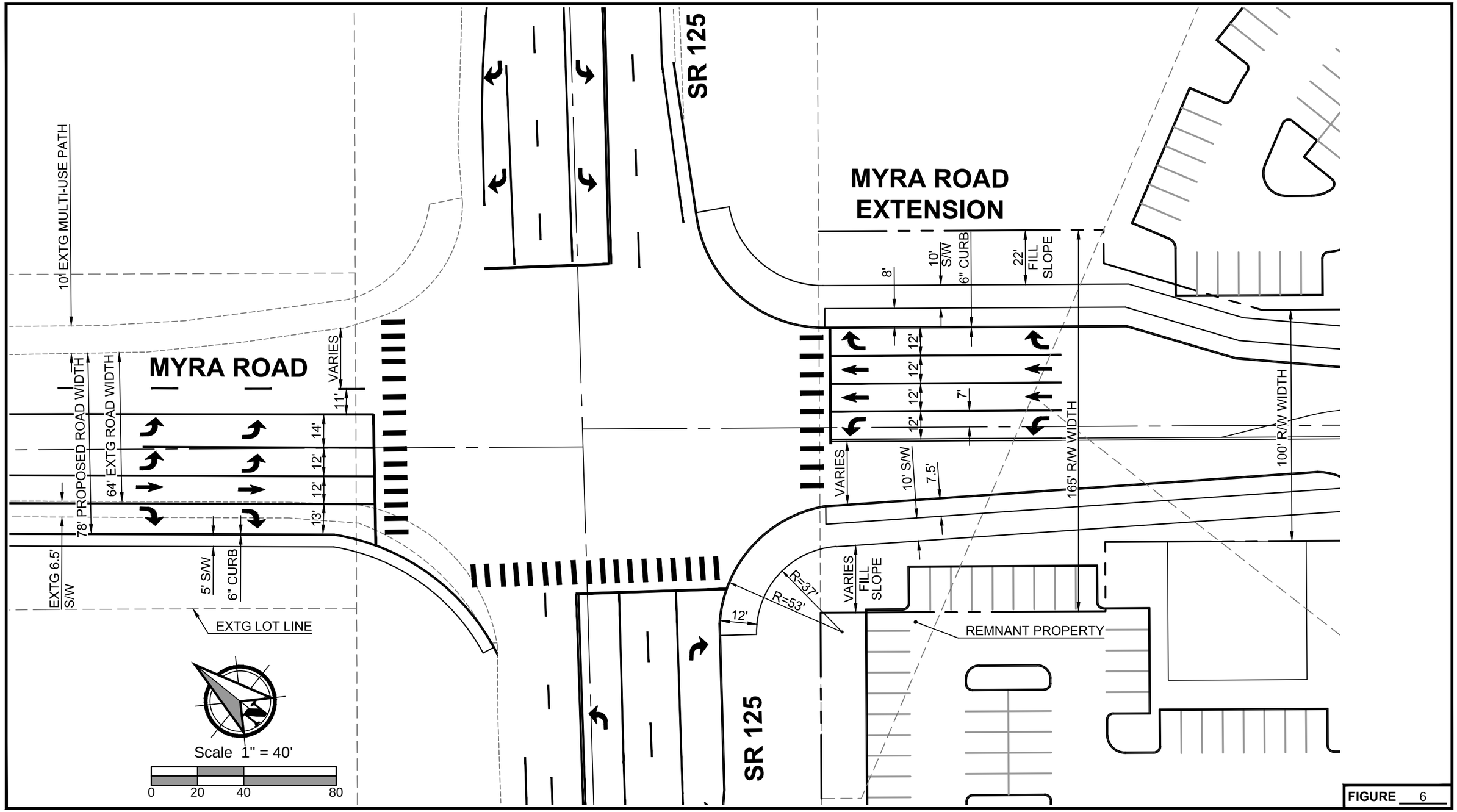

FIGURE 6

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Right-of-Way at SR125
Myra Road Extension

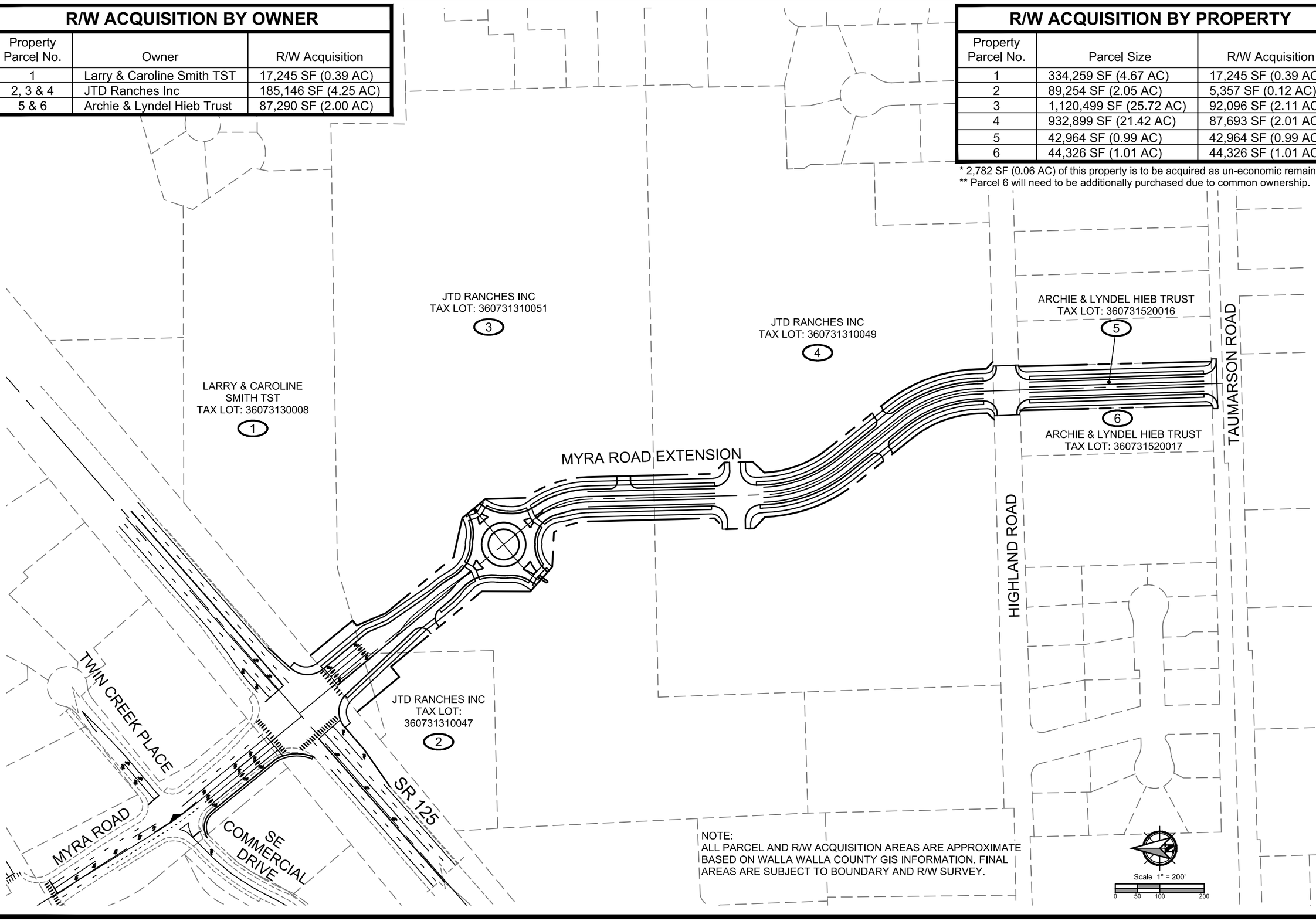
R/W ACQUISITION BY OWNER

Property Parcel No.	Owner	R/W Acquisition
1	Larry & Caroline Smith TST	17,245 SF (0.39 AC)
2, 3 & 4	JTD Ranches Inc	185,146 SF (4.25 AC)
5 & 6	Archie & Lyndel Hieb Trust	87,290 SF (2.00 AC)

R/W ACQUISITION BY PROPERTY

Property Parcel No.	Parcel Size	R/W Acquisition
1	334,259 SF (4.67 AC)	17,245 SF (0.39 AC)*
2	89,254 SF (2.05 AC)	5,357 SF (0.12 AC)
3	1,120,499 SF (25.72 AC)	92,096 SF (2.11 AC)
4	932,899 SF (21.42 AC)	87,693 SF (2.01 AC)
5	42,964 SF (0.99 AC)	42,964 SF (0.99 AC)
6	44,326 SF (1.01 AC)	44,326 SF (1.01 AC)**

* 2,782 SF (0.06 AC) of this property is to be acquired as un-economic remainder.
** Parcel 6 will need to be additionally purchased due to common ownership.



NOTE:
ALL PARCEL AND R/W ACQUISITION AREAS ARE APPROXIMATE BASED ON WALLA WALLA COUNTY GIS INFORMATION. FINAL AREAS ARE SUBJECT TO BOUNDARY AND R/W SURVEY.

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R/W EXHIBIT A - R/W ACQUISITION PLAN FOR:

MYRA ROAD EXTENSION

A PROJECT LOCATED IN THE CITY OF WALLA WALLA, WASHINGTON

DESIGNED:	JAM
DRAWN BY:	MPA
CHECKED:	GPJ
SCALE:	H: 1"=200' V: N/A
SEPT 2016	HDJ4443.000
SHEET	1 / 3

JTD RANCHES INC
TAX LOT: 360731310051
3

LARRY & CAROLINE
SMITH TST
TAX LOT: 36073130008
1

14,463 SF R/W
ACQUISITION

MYRA ROAD EXTENSION

SR 125

2,782 SF (0.06 AC) ADDITIONAL PROPERTY TO
BE ACQUIRED AS UN-ECONOMIC REMAINDER

JTD RANCHES INC
TAX LOT:
360731310047
2

MYRA ROAD

NOTE:
ALL PARCEL AND R/W ACQUISITION AREAS ARE APPROXIMATE BASED ON WALLA WALLA COUNTY GIS INFORMATION. FINAL AREAS ARE SUBJECT TO BOUNDARY AND R/W SURVEY.

Scale 1" = 50'
0 12.5 25 50

HDJ
A DIVISION OF PBS
314 W 15th Street
Vancouver, WA 98660-2927
360/695-3488
503/924-4005
360/695-8767 fax
www.hdjdg.com

R/W EXHIBIT B - SMITH PROPERTY FOR:

MYRA ROAD EXTENSION

A PROJECT LOCATED IN THE CITY OF WALLA WALLA, WASHINGTON

DESIGNED:	JAM
DRAWN BY:	MPA
CHECKED:	GPJ
SCALE:	H: 1"=50' V: N/A
SEPT 2016	HDJ4443.000
SHEET	2 / 3

ARCHIE & LYNDEL HIEB TRUST
TAX LOT: 360731520016
42,964 SF (0.99 AC)
5

MYRA ROAD EXTENSION

JTD RANCHES INC
TAX LOT: 360731310049
4

HIGHLAND ROAD

ARCHIE & LYNDEL HIEB TRUST
TAX LOT: 360731520017
44,326 SF (1.01 AC)
6*

* ADDITIONAL PURCHASE OF THIS PROPERTY
WILL BE REQUIRED DUE TO COMMON OWNERSHIP

TAUMARSON ROAD

NOTE:
ALL PARCEL AND R/W ACQUISITION AREAS ARE APPROXIMATE BASED ON WALLA WALLA COUNTY GIS INFORMATION. FINAL AREAS ARE SUBJECT TO BOUNDARY AND R/W SURVEY.

Scale 1" = 50'
0 12.5 25 50

HDJ A DIVISION OF PBS
314 W 15th Street
Vancouver, WA 98660-2927
360/695-3488
503/924-4005
360/695-8767 fax
www.hdjdg.com

R/W EXHIBIT C - HIEB TRUST PROPERTY FOR:

MYRA ROAD EXTENSION

A PROJECT LOCATED IN THE CITY OF WALLA WALLA, WASHINGTON

DESIGNED:	JAM
DRAWN BY:	MPA
CHECKED:	GPJ
SCALE:	H: 1"=50' V: N/A
SEPT 2016	HDJ4443.000
SHEET	3 / 3

Appendix A

Land Use: 820
Shopping Center

Description

A shopping center is an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. A shopping center's composition is related to its market area in terms of size, location and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. Specialty retail center (Land Use 826) and factory outlet center (Land Use 823) are related uses.

Additional Data

Shopping centers, including neighborhood centers, community centers, regional centers and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs and recreational facilities (for example, ice skating rinks or indoor miniature golf courses). The centers ranged in size from 1,700 to 2.2 million square feet gross leasable area (GLA). The centers studied were located in suburban areas throughout the United States and, therefore, represent typical U.S. suburban conditions.

Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include outparcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied included peripheral buildings, it can be assumed that some of the data show their effect.

The vehicle trips generated at a shopping center are based upon the total GLA of the center. In cases of smaller centers without an enclosed mall or peripheral buildings, the GLA could be the same as the gross floor area of the building.

Separate equations have been developed for shopping centers during the Christmas shopping season. Plots were included for the weekday peak hour of adjacent street traffic and the Saturday peak hour of the generator.

Information on approximate hourly, monthly and daily variation in shopping center traffic is shown in Tables 1–3. It should be noted, however, that the information contained in these tables is based on a limited sample size. Therefore, caution should be exercised when applying the data. Also, some information provided in the tables may conflict with the results obtained by applying the average rate or regression equations. When this occurs, it is suggested that the results from the average rate or regression equations be used, as they are based on a larger number of studies.

ITE Trip Generation

Trip Generation Based on Curve Fitting Equations

HDJ a Division of PBS

General			
Land Use Code	Shopping Center (sf)		
Independent Varible		1,000 Sq Ft	
Size (X)		399.1	
Land Use Code		820	

0

Date: 8/1/2016

Analyst: JAM

Project: Myra Road Ext

	In	Out	Total
Week Day	8,349	8,349	16,697
New Trips	8,349	8,349	16,697
AM Peak Hour	251	160	411
New Trips	251	160	411
PM Peak Hour on Adjace	749	812	1,561
New Trips	749	812	1,561

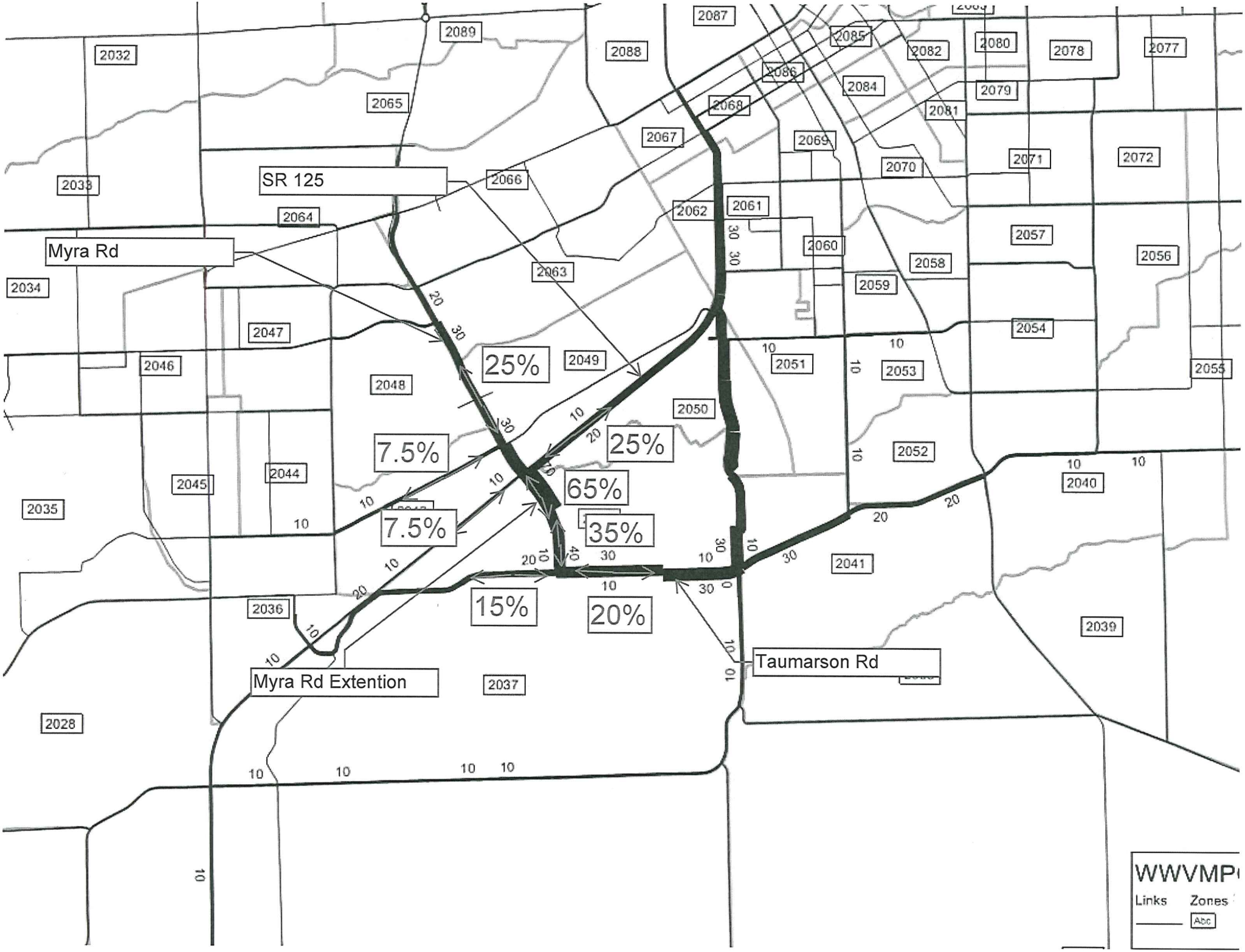
Comments:

Number of Studies	98	"+20 ?"	TRUE
Average Rate=AR	1.03		
Standard Deviation=SD	1.4		
SD/AR	1.359223	<1.1	FALSE
R^2	0.52	>= 0.75	FALSE
Use Line at Cluster?			FALSE
Use Weighted Rates?			FALSE
Use Equations?			TRUE
Eqation Forms	**A**	**B**	**Trips**
T= A*X+B	N-A	N-A	N-A
T= A*X-B	N-A	N-A	N-A
T=EXP((A*LN(T))+B)	0.6	2.29	359
T=EXP((A*LN(T))-B)	N-A	N-A	N-A
Average Rate	**Rate**		**Trips**
	1.03		411
	Total Trips		411
Entering / Exiting			
% Entering	61%		251
% Exiting	39%		160
New Trips			
% internal	0	In	Out
% pass by	0	251	160

Analysis Period	Week Day		
Regresssion Equation?	Yes	0=NO EQ	TRUE
Number of Studies	302	"+20 ?"	TRUE
Average Rate=AR	42.94		
Standard Deviation=SD	21.38		
SD/AR	0.4979041	<1.1	TRUE
R^2	0.78	>= 0.75	TRUE
Use Line at Cluster?			FALSE
Use Weighted Rates?			FALSE
Use Equations?			TRUE
Eqation Forms	**A**	**B**	**Trips**
T= A*X+B	N-A	N-A	N-A
T= A*X-B	N-A	N-A	N-A
T=EXP((A*LN(T))+B)	0.65	5.83	16697
T=EXP((A*LN(T))-B)	N-A	N-A	N-A
Average Rate	**Rate**		**Trips**
	TRUE		399
	Total Trips		16697
Entering / Exiting			
% Entering	50%		8349
% Exiting	50%		8349
New Trips			
% internal	0	In	Out
% pass by	0	8349	8349

Analysis Period	PM Peak Hour on Adjacent Street		
Regresssion Equation?	Yes	0=NO EQ	TRUE
Number of Studies	407	"+20 ?"	TRUE
Average Rate=AR	3.76		
Standard Deviation=SD	2.75		
SD/AR	0.731383	<1.1	TRUE
R^2	0.81	>= 0.75	TRUE
Use Line at Cluster?			FALSE
Use Weighted Rates?			FALSE
Use Equations?			TRUE
Eqation Forms	**A**	**B**	**Trips**
T= A*X+B	N-A	N-A	N-A
T= A*X-B	N-A	N-A	N-A
T=EXP((A*LN(T))+B)	0.66	3.4	1561
T=EXP((A*LN(T))-B)	N-A	N-A	N-A
Average Rate	**Rate**		**Trips**
	3.76		1501
	Total Trips		1561
Entering / Exiting			
% Entering	48%		749
% Exiting	52%		812
New Trips			
% internal	0	In	Out
% pass by	0	749	812

Appendix B


SR 125
Myra Rd
Myra Rd Extention
Taumarson Rd
25%
7.5%
7.5%
25%
65%
35%
15%
20%
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2044
2045
2046
2047
2048
2049
2050
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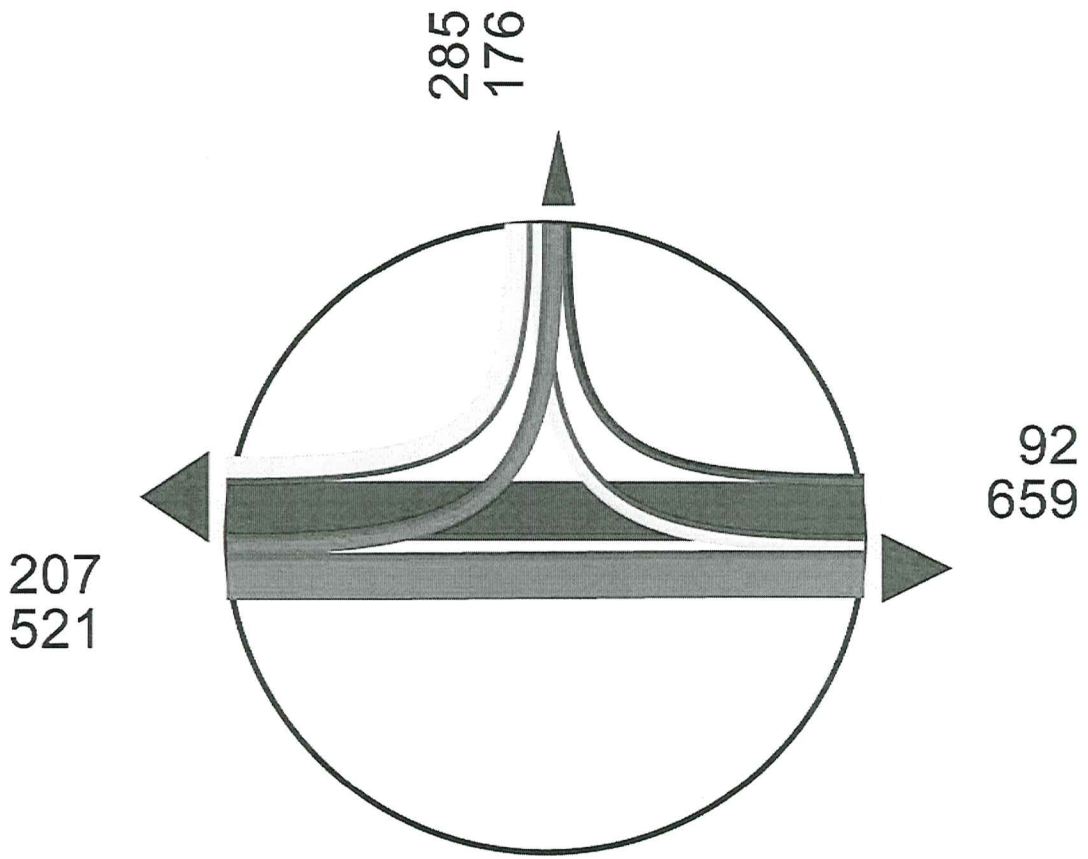
2072
2077
2078
2079
2080
2081
2082
2084
2085
2086
2087
2088
2089
WWVMP
Links
Zones
Abc

SE Myra Road & WA 125

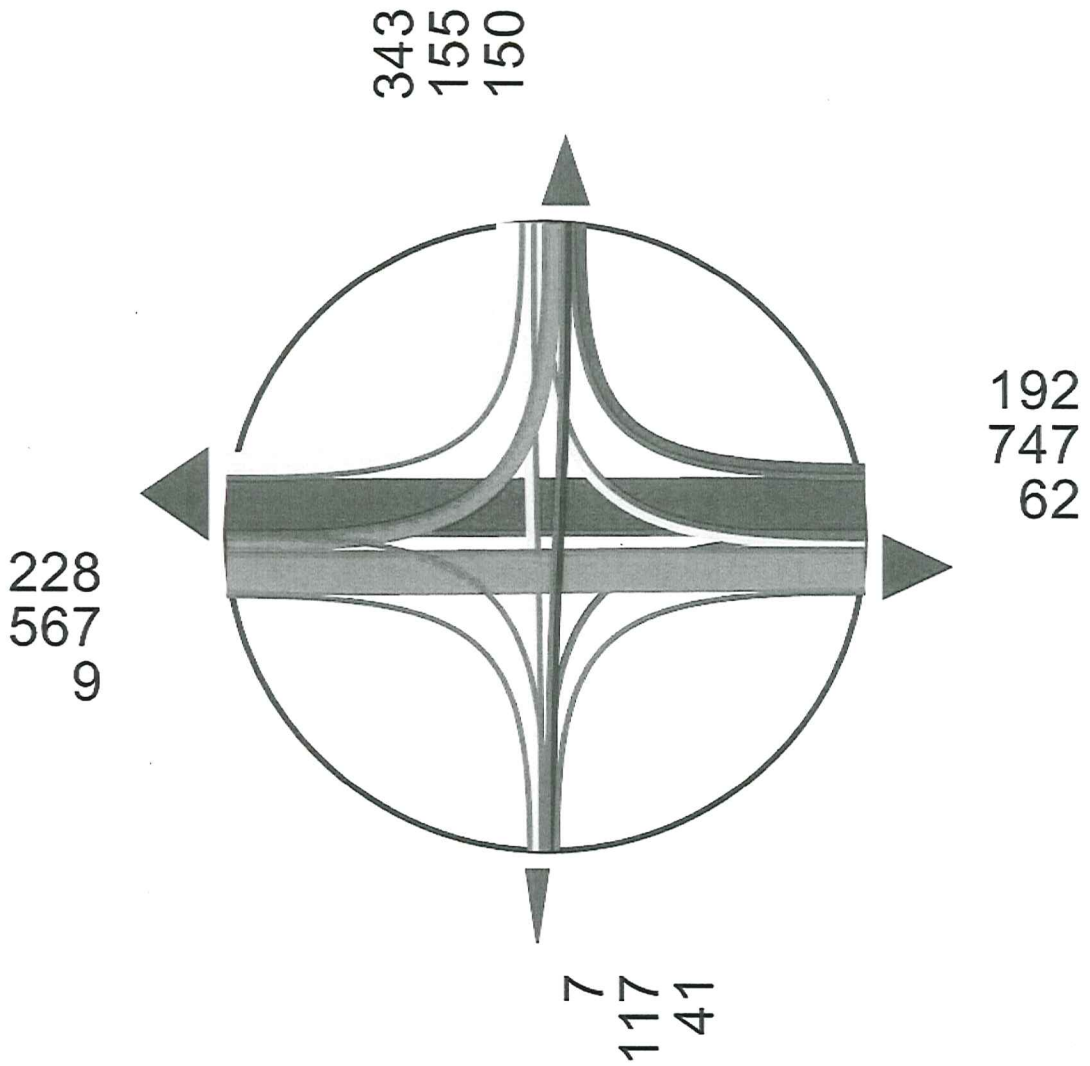
EXISTING 2014



Created on: 02.08.2016

SE Myra Road & WA 125

FUTURE 2040 WITH
MYRA ROAD EXTENSION



Created on: 02.08.2016

Appendix C

Myar Rd and SR 125 Intersection
PM Peak Hour Turning Movement Count
8/4/2016
4:00 to 6:00 PM

Myra Road assumed north-south and SR 125 assumed east-west

Time Period Ending	Eastbound			Southbound			Westbound			Total	
	Left	Through	Right	Left	Through	Right	Left	Through	Right		
4:15 PM	53	114	0	17	0	66	0	120	13	383	1603
4:30 PM	37	101	0	11	0	85	0	137	13	384	1670
4:45 PM	**42**	**93**	**0**	**14**	**0**	**88**	**0**	**159**	**8**	**404**	1733
5:00 PM	**44**	**121**	**0**	**17**	**0**	**84**	**0**	**154**	**12**	**432**	1704
5:15 PM	**58**	**122**	**0**	**15**	**0**	**85**	**0**	**157**	**13**	**450**	1626
5:30 PM	**43**	**130**	**0**	**13**	**0**	**85**	**0**	**163**	**13**	**447**	
5:45 PM	37	116	0	16	0	73	0	121	12	375	
6:00 PM	47	104	0	16	0	53	0	126	8	354	

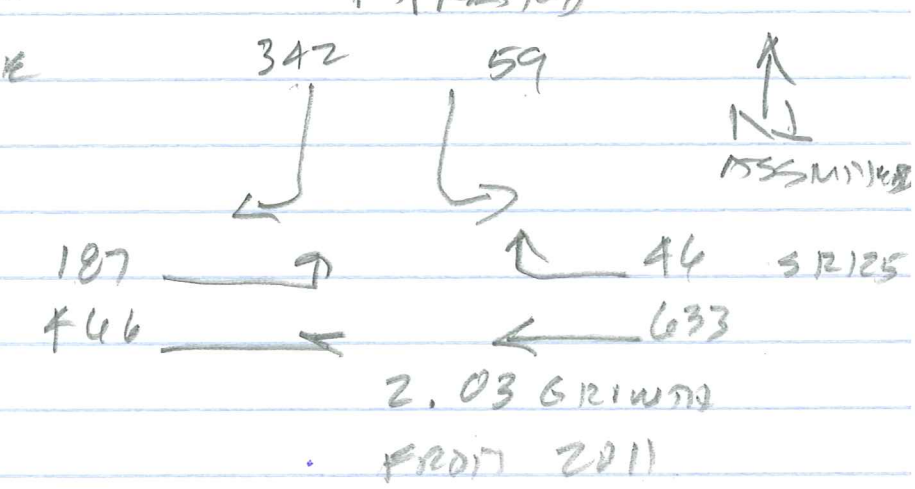
	Eastbound			Southbound			Westbound			Total
	Left	Through	Right	Left	Through	Right	Left	Through	Right	
Peak Hour	187	466	0	59	0	342	0	633	46	1733
4:30 to 5:30 PM		653			401			679		
		720			408			704		1800
Peak Hour Factor		0.91			0.98			0.96		0.96

Use 0.96 for phf

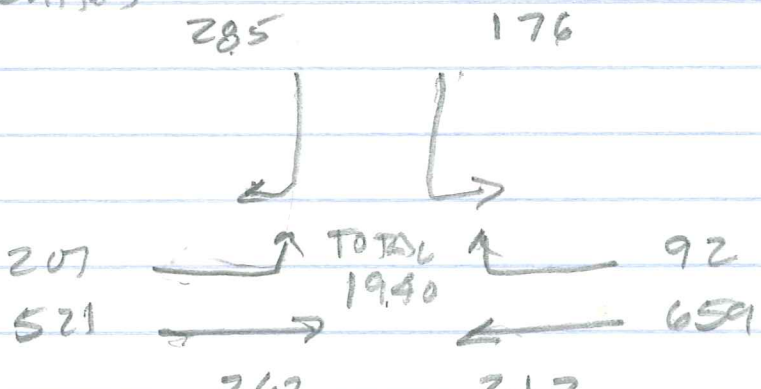
8/4/16

DESIGN HOUR VOLUME CALCULATIONS
PM PEAK HOUR

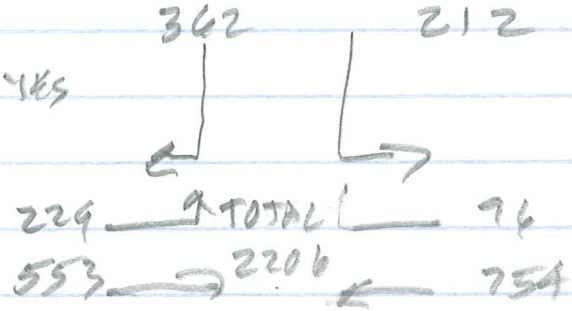
EXISTING VOLUME
2016



2014 MODEL VOLUMES



2040 MODEL VOLUMES



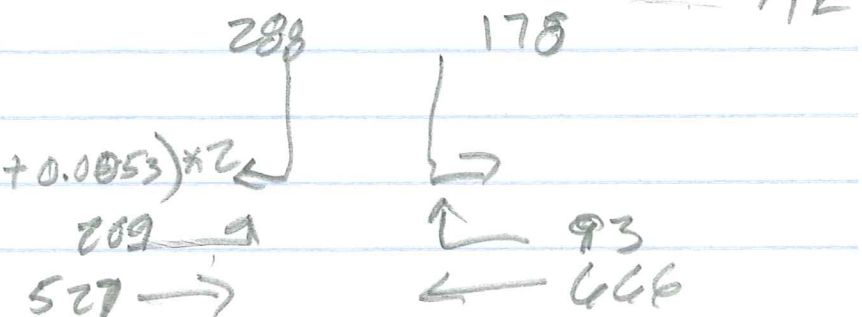
MODEL GROWTH RATE $\left[\left(\frac{1940}{2206}\right)-1\right] = 0.0053$ OR

26 YEARS 0.53%/YR

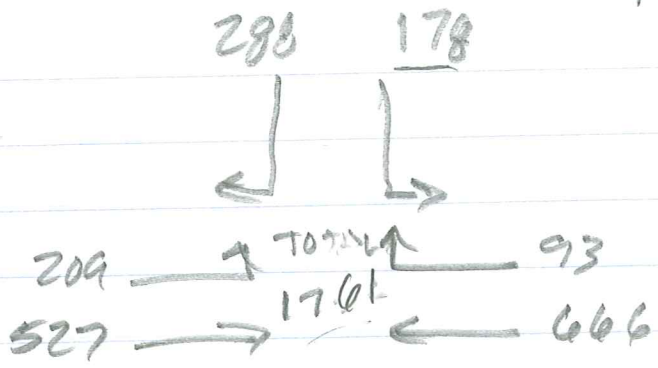
2016 EXTRAPOLATED MODEL VOLUME

(2014 MOVEMENT VOLUME) $\times [1+0.0053)^{*2}$

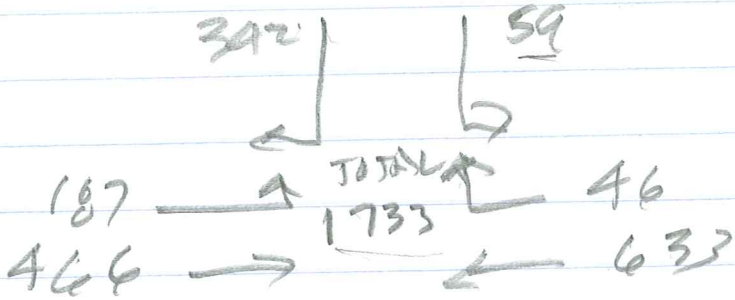
→ (VOLUME) $\times$ 1.016



2016 MODEL VOLUME

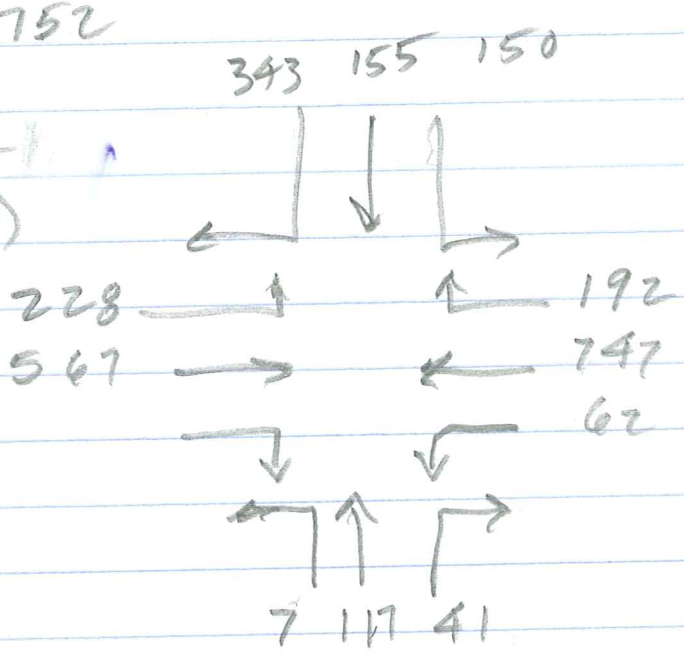


2016 EXISTING



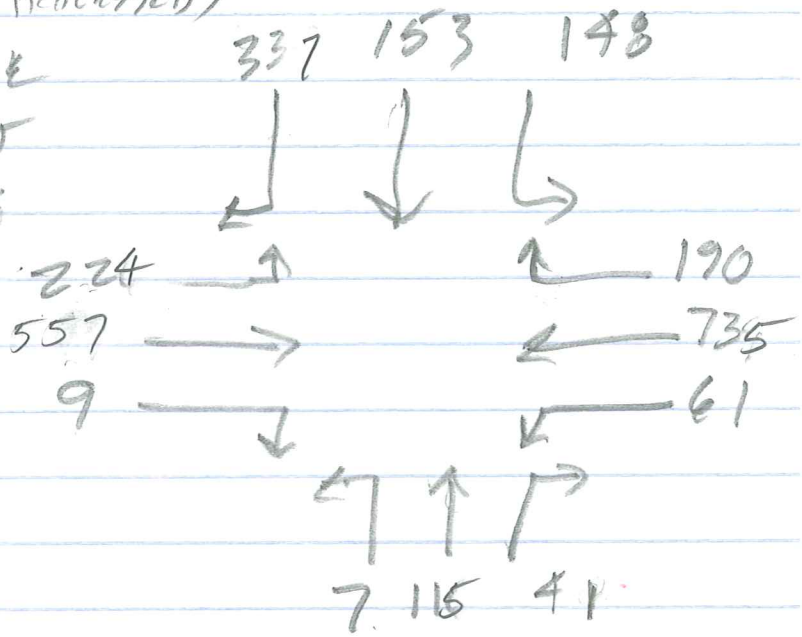
$\frac{1733}{1752} = 0.98$ or 98%

2040 PM VOLUMES W/ PROJECT (HYBRID)



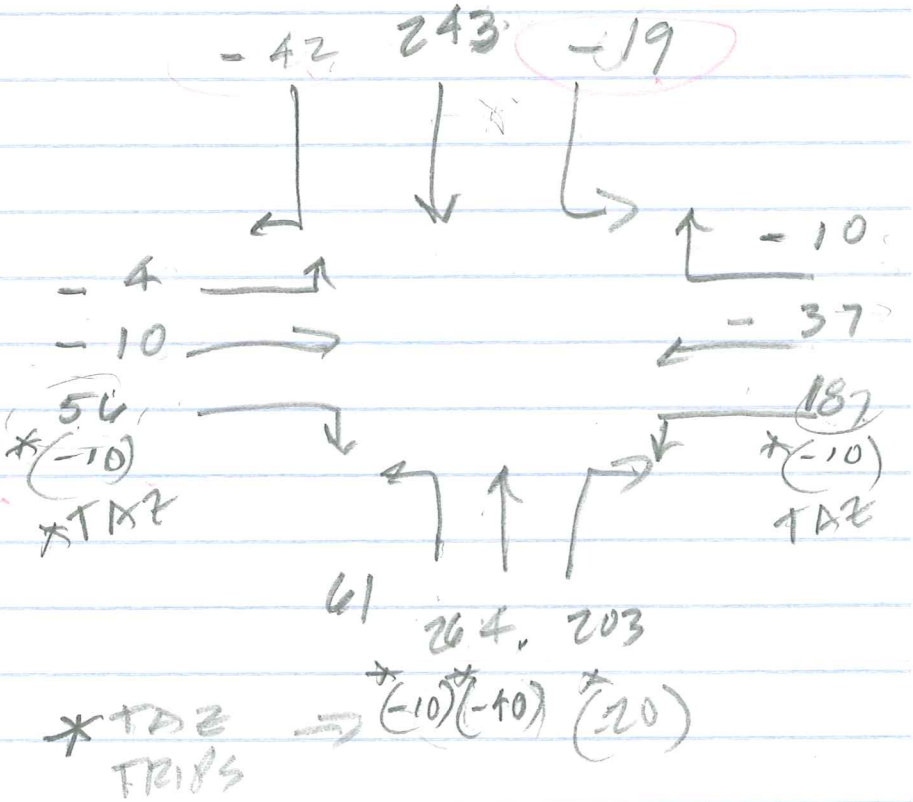
REDUCED EACH TO 98%

CALIBRATED (POST PROCESSED)
2040 PM VOLUME
W/ MIRA 120 EXT
WITHOUT SHOPPING
CENTER



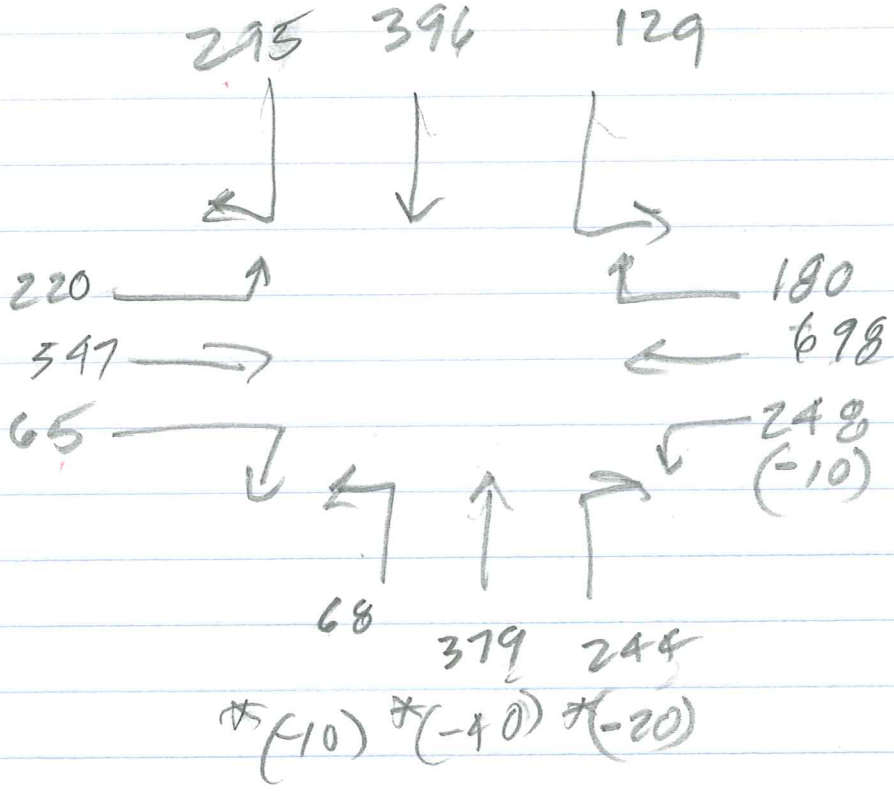
SHOPPING CENTER
TRIPS

NEGATIVE
TRIP AND
PASS-BY
REDUCTION →



TAZ TRIPS NOT DEDUCTED FROM TOTAL

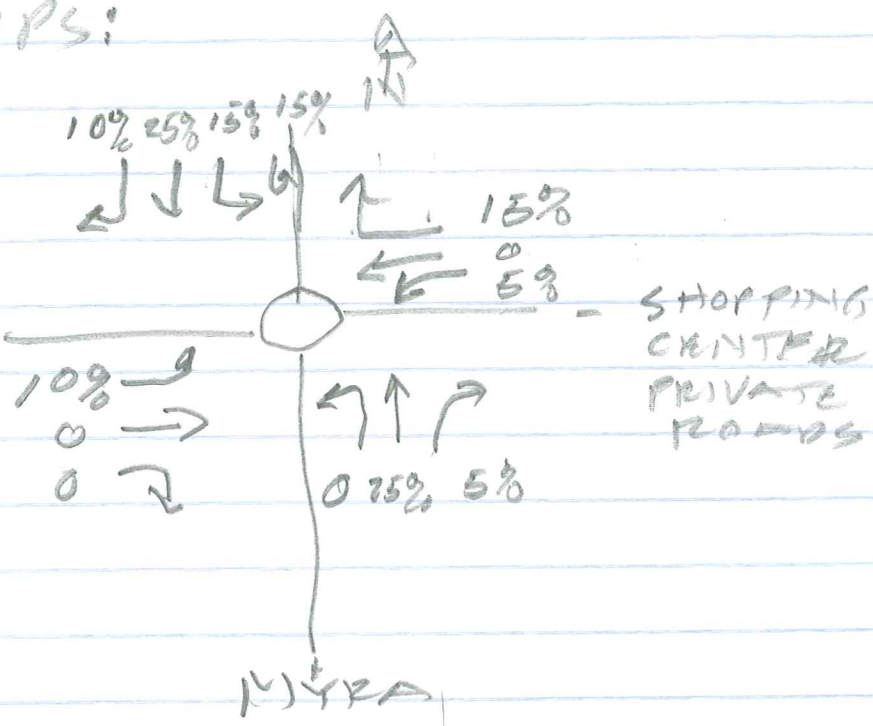
TOTAL 2040 PM PEAK
HOUR VOLUME



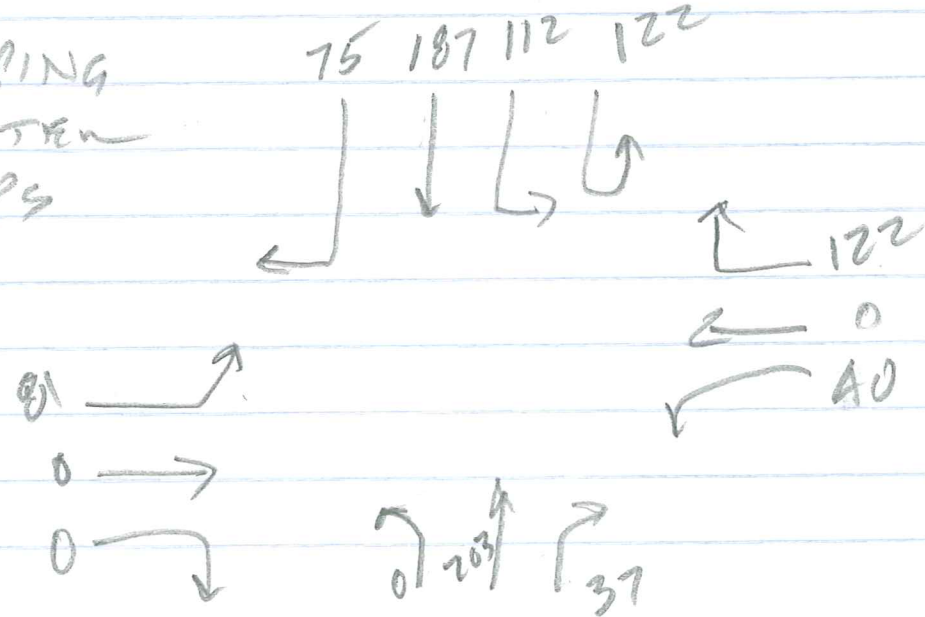
5/4

ROUNDABOUT DESIGN HOUR VOLUMES

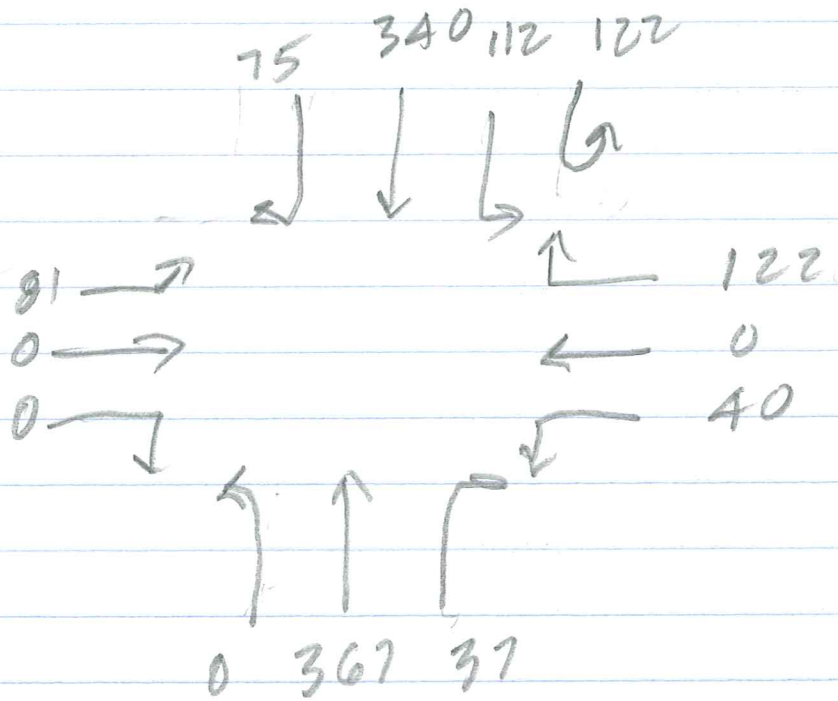
BASED TRIP DISTRIBUTION TO SITE & PROPORTIONED TO EACH DRIVE WAY, EACH APPROACH HAS THE FOLLOWING PERCENT SHOPPING CENTER TRIPS:



SHOPPING CENTER TRIPS



2040 COMBINED
THROUGH TRIPS &
SHOPPING CENTER TRIPS



Appendix D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	222	551	65	248	732	180	69	379	244	129	396	297
Future Volume (vph)	222	551	65	248	732	180	69	379	244	129	396	297
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	3539	1599	1787	3539	1553	1787	3574	1599	3367	1881	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1736	3539	1599	1787	3539	1553	1787	3574	1599	3367	1881	1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	234	580	68	261	771	189	73	399	257	136	417	313
RTOR Reduction (vph)	0	0	51	0	0	140	0	0	195	0	0	234
Lane Group Flow (vph)	234	580	17	261	771	49	73	399	62	136	417	79
Heavy Vehicles (%)	4%	2%	1%	1%	2%	4%	1%	1%	1%	4%	1%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	11.2	17.7	17.7	12.2	18.7	18.7	3.8	17.3	17.3	4.5	18.0	18.0
Effective Green, g (s)	11.2	17.7	17.7	12.2	18.7	18.7	3.8	17.3	17.3	4.5	18.0	18.0
Actuated g/C Ratio	0.16	0.25	0.25	0.17	0.26	0.26	0.05	0.24	0.24	0.06	0.25	0.25
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	271	873	394	304	923	405	94	862	385	211	472	389
v/s Ratio Prot	0.13	0.16		c0.15	c0.22		c0.04	0.11		0.04	c0.22	
v/s Ratio Perm			0.01			0.03			0.04			0.05
v/c Ratio	0.86	0.66	0.04	0.86	0.84	0.12	0.78	0.46	0.16	0.64	0.88	0.20
Uniform Delay, d1	29.5	24.3	20.6	28.9	25.0	20.2	33.5	23.2	21.5	32.8	25.8	21.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.6	1.9	0.0	20.6	6.6	0.1	32.2	0.4	0.2	6.6	17.5	0.3
Delay (s)	53.1	26.2	20.6	49.5	31.7	20.4	65.7	23.6	21.7	39.4	43.4	21.4
Level of Service	D	C	C	D	C	C	E	C	C	D	D	C
Approach Delay (s)		32.9			33.7			27.2			34.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	71.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	107	181	436	683
Demand Flow Rate, veh/h	108	182	440	690
Vehicles Circulating, veh/h	652	616	345	64
Vehicles Exiting, veh/h	102	169	415	734
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.5	9.9	12.7	12.8
Approach LOS	A	A	B	B

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	108	182	440	690
Cap Entry Lane, veh/h	589	610	800	1060
Entry HV Adj Factor	0.990	0.994	0.991	0.990
Flow Entry, veh/h	107	181	436	683
Cap Entry, veh/h	583	607	793	1049
V/C Ratio	0.183	0.298	0.550	0.651
Control Delay, s/veh	8.5	9.9	12.7	12.8
LOS	A	A	B	B
95th %tile Queue, veh	1	1	3	5

Intersection: 1: Myra Rd & SR 125

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB
Directions Served	L	T	T	R	L	T	T	R	L	T	T	R
Maximum Queue (ft)	242	203	168	62	272	247	212	96	102	146	133	127
Average Queue (ft)	130	116	87	19	150	146	125	33	49	82	71	55
95th Queue (ft)	236	181	152	45	251	216	191	70	89	127	117	100
Link Distance (ft)		1415	1415			1748	1748			486		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	350			150	300			150	135		135	135
Storage Blk Time (%)	1		1		1	0	3		0	0	0	0
Queuing Penalty (veh)	3		0		2	0	6		0	2	1	0

Intersection: 1: Myra Rd & SR 125

Movement	SB	SB	SB	SB
Directions Served	L	L	T	R
Maximum Queue (ft)	117	174	322	270
Average Queue (ft)	30	55	179	107
95th Queue (ft)	78	118	295	237
Link Distance (ft)	271	271	271	
Upstream Blk Time (%)		0	2	0
Queuing Penalty (veh)		0	5	0
Storage Bay Dist (ft)				180
Storage Blk Time (%)			11	0
Queuing Penalty (veh)			34	1

Intersection: 2: Myra Rd & Retail Roundabout

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	ULTR
Maximum Queue (ft)	74	79	162	151
Average Queue (ft)	31	37	62	39
95th Queue (ft)	64	67	123	111
Link Distance (ft)	507	415	508	486
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: Myra Rd & Commercial Dr/Twin Creek Pl

Movement	EB	WB	WB	NB	SB	SB
Directions Served	R	L	R	TR	L	TR
Maximum Queue (ft)	101	61	62	7	42	37
Average Queue (ft)	42	24	25	0	12	1
95th Queue (ft)	76	49	53	3	34	22
Link Distance (ft)	648	368	368	271		304
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					50	
Storage Blk Time (%)					0	
Queuing Penalty (veh)					1	

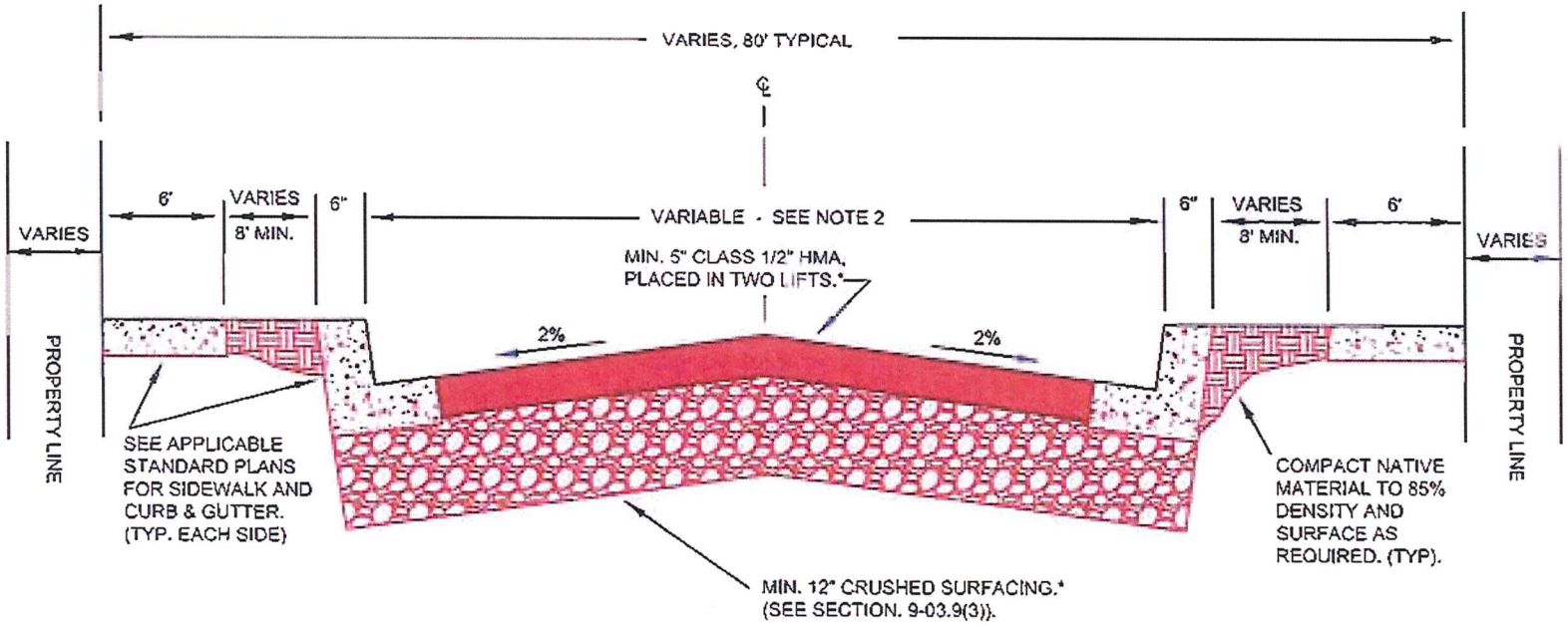
Network Summary

Network wide Queuing Penalty: 54

Appendix E

314 West 15th Street, Vancouver, WA 98660
360.695.3488 Main
360.695.8767 Fax
www.hdjdg.com | www.pbsenv.com

Bend | Boise | Coos Bay | Eugene | Portland | Seattle | Tri-Cities | Vancouver | Walla Walla



NOTES:

1. FOR PLACEMENT OF CRUSHED SURFACING, REFER TO THE WSDOT SPECIFICATIONS SECTION 4-04.3(4) FOR MAXIMUM NOMINAL DEPTH OF COMPACTED MATERIAL PER LIFT.

2. DEPENDING ON LOCATION, AS APPROVED BY CITY ENGINEER. TYPICALLY 44 FEET.

3. ASPHALT TACK COAT SHALL BE APPLIED BETWEEN EACH LIFT OF H.M.A., REGARDLESS OF TIME BETWEEN LIFT PLACEMENTS.

4. DEPTH OF PAVEMENT COURSES TO BE DETERMINED BY ENGINEERING DESIGN.

5. DESIGN OF GEOTEXTILE FABRIC SHALL MEET REQUIREMENT GUIDELINES OF SECTION 630.05 OF THE WSDOT DESIGN MANUAL. MATERIAL PROPERTIES OF THE GEOTEXTILE FABRIC SHALL MEET THE REQUIREMENTS OF THE WSDOT STANDARD SPECIFICATIONS SECTION 9-33.2 FOR WOVEN SOIL STABILIZATION FABRIC.

6. POTHOLE PATCHING OR PATCHING FOR CURB AND GUTTER WORK SHALL USE THIS CROSS SECTION.

* MINIMUM SURFACING DESIGN ALLOWED. THICKER SECTIONS MAY BE REQUIRED AS DETERMINED BY A GEOTECHNICAL REPORT.

CITY OF WALLA WALLA

ARTERIAL ROADWAY SECTION

DATE: 10/15/2012

APPROVED BY:

STANDARD PLAN 2-1