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TECHNICAL MEMORANDUM

Date:	July 26, 2017	**TG:**	1.17166.00
To:	Jeff Fant & Dave Smith, City of Olympia		
From:	Darwin Li & Mike Swenson, PE, PTOE – Transpo Group		
Subject:	East Bay Lot A Traffic Impact Analysis		

This memorandum summarizes the results of the Traffic Impact Analysis prepared for the proposed mixed use development (East Bay Lot A). This memorandum includes a project description, identification of the study area as determined through coordination with the City, estimated trip generation, project trip distribution and assignment, future traffic operations within the identified study area, and a signal warrant analysis at the Olympia Ave NE / East Bay Drive NE intersection.

Project Description

The proposed East Bay Lot A project would include 74 apartment units, 12 townhome units, and approximately 8,500 square feet of miscellaneous retail. The project site is located north of State Avenue NE and east of Jefferson Street NE. The project site is currency undeveloped. Access to the site is proposed along the Jefferson Street NE frontage, just south of Olympia Avenue NE. The project is anticipated to be fully constructed by late 2019. Figure 1 shows the site location and vicinity and Figure 2 shows the preliminary site plan.

Figure 1. Site Vicinity & Study Intersections

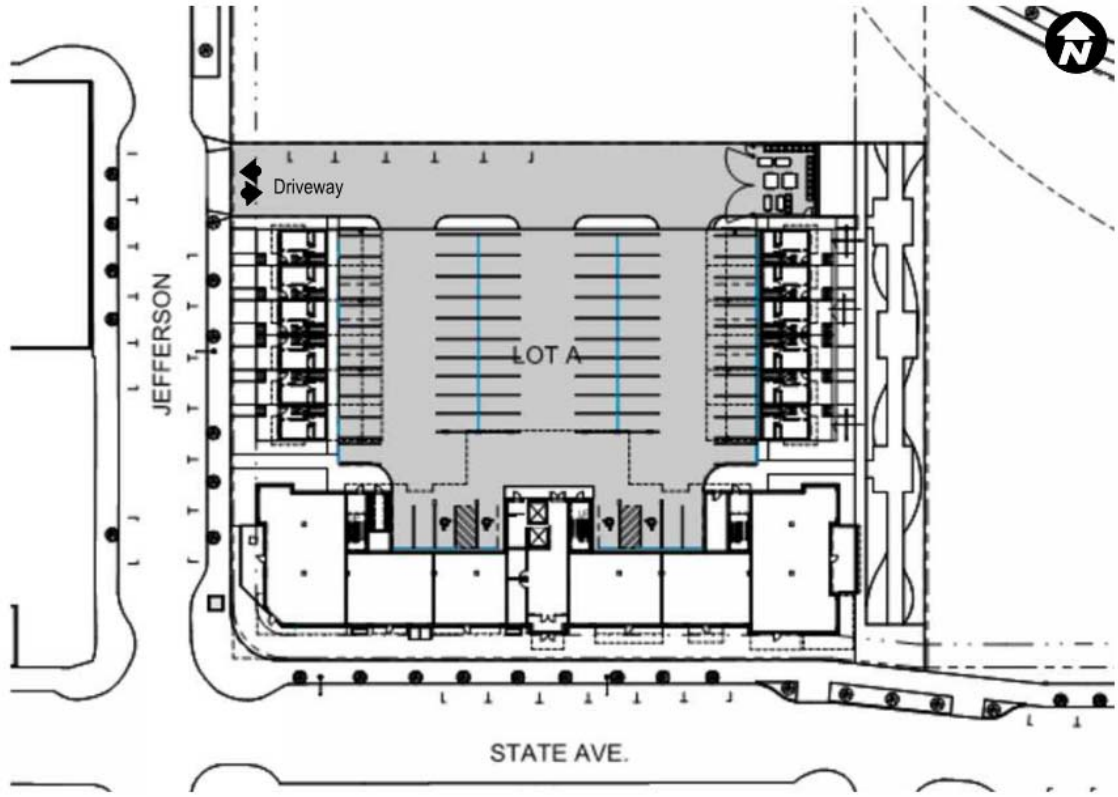

Figure 2. Preliminary Site Plan

Study Scope

Based on coordination with City of Olympia staff, three intersections were identified to be analyzed and are listed below:

- Thurston Avenue NE / Jefferson Street NE
- State Avenue NE / Jefferson Street NE
- New proposed Driveway / Jefferson Street NE

In addition to the three intersections identified above, the City of Olympia has also requested a signal warrant analysis be completed for the Olympia Avenue NE / East Bay Drive NE intersection during projected future 2019 and 2024 with-project traffic conditions.

Traffic Volumes

Existing traffic counts at the three study intersections were provided by the collected on typical weekdays in August 2015[1] , April 2017, and May 2017. Turning movement counts and 24-hour tube counts were also collected by the City at the Olympia Avenue NE / East Bay Drive NE intersection in May 2016 and utilized for the signal warrant analysis. Future (2019) without-project traffic volumes were forecast by growing the existing volumes by a two percent annual growth rate until the 2019 completion year based on coordination with City of Olympia planning staff. Four

[1] Counts collected prior to 2017 were grown 2% annually to match existing (2017) traffic conditions.

pipeline projects were also identified and included when forecasting future without-project traffic volumes and are listed below:

- Olympia Commons
- Columbia Place
- Adams and Legion
- Olympia Mixed Use (Columbia Heights)

Traffic Operations

The operational characteristics of an intersection are determined by calculating the intersection's level of service (LOS). For signalized locations, LOS is measured in average delay per vehicle and is reported for the intersection as a whole. At unsignalized intersections, LOS is calculated by a weighted average of all intersection approaches. Traffic operations for an intersection can be described alphabetically with a range of levels of service (LOS A through F), with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and long vehicle delays. Attachment 1 contains a detailed explanation of LOS criteria and definitions.

Weekday PM Peak hour traffic operations for existing and future (2019) without-project conditions were evaluated based on the procedures identified in the *Highway Capacity Manual (HCM)* (2010) using the *Synchro 9* software program and the two hour LOS method found in the City of Olympia TIA Guidelines[2]. LOS worksheets are provided in Attachment 2. Table 1 summarizes the existing and future without-project operations.

Table 1. Level of Service Summary (PM Peak Hour)

	Existing			2019 Without-Project		
Intersection	**LOS[1]**	**Delay[2]**	**WM[3]**	**LOS**	**Delay**	**WM**
Jefferson St / Thurston Ave NE	A	3.7	SB	A	3.6	SB
Jefferson St / State Ave NE	A	1.1	NB	A	1.3	SB

1. Level of service, based on 2010 Highway Capacity Manual methodology.
2. Weighted average delay of the intersection in seconds per vehicle.
3. Worst approach reported for unsignalized intersections.

As shown in Table 1, the two off-site study intersections currently operate at LOS A with under 5 seconds of averaged weighted delay. With the addition of background growth and pipeline projects, the average weighted delays would remain approximately the same as existing.

Trip Generation

Estimated trip generation was based on trip generation rates referenced from Table 3 of *Transportation Impact Fee Update, November 2016* as well as *Trip Generation Manual* (9th Edition, 2012). The following table summarizes the anticipated number of new daily, AM peak hour, PM peak hour of the proposed mixed use development. Detailed trip generation calculations are provided in Attachment 3.

[2] *City of Olympia Traffic Impact Analysis (TIA) Guidelines for New Development*

Table 2. Trip Generation Summary

Land Use	Size	Daily Trips	AM Peak-Hour Trips[1]			PM Peak-Hour Trips[1]		
			In	Out	Total	In	Out	Total
Multi-Family	86 DU	560	9	34	43	21	10	31
Misc. Retail	8,500 sf	360	4	4	8	7	10	17
Net New Total		**920**	**13**	**38**	**51**	**28**	**20**	**48**

As shown in Table 2, the proposed development is anticipated to generate approximately 920 new daily trips, 51 new AM peak hour trips and 48 new PM peak hour trips.

Trip Distribution & Assignment

Trip distribution and assignment patterns were provided from a traffic model ran by the Thurston Regional Planning Council (TRPC) as well as adjustments adjacent to the site based on localized travel patterns and guidance from City staff for the proposed development. These project trips were then assigned to the study intersections and driveway to forecast 2019 with-project traffic volumes. Figure 3 illustrates the trip distribution and assignment of the proposed development and Figure 4 illustrates the PM peak hour traffic volumes for all three study intersections during existing and future conditions.

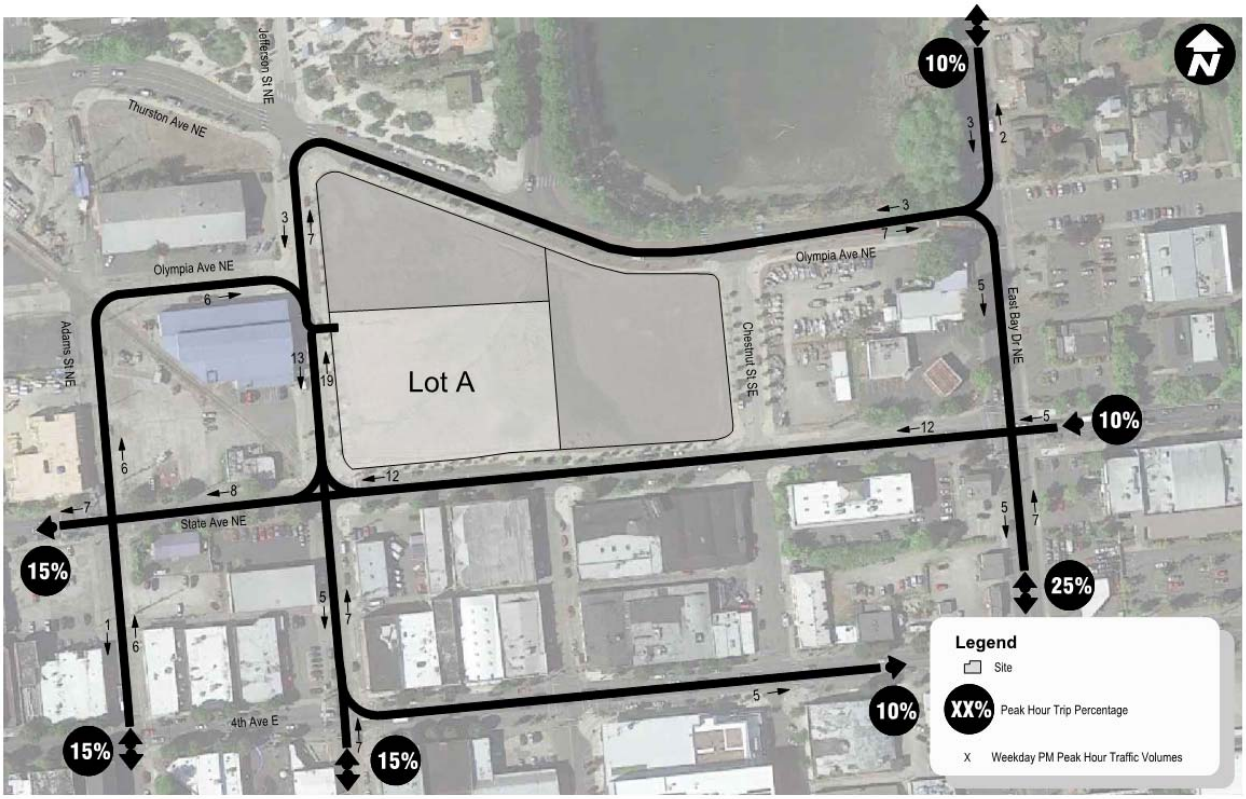

Figure 3. Project Trip Distribution & Assignment (PM Peak Hour)

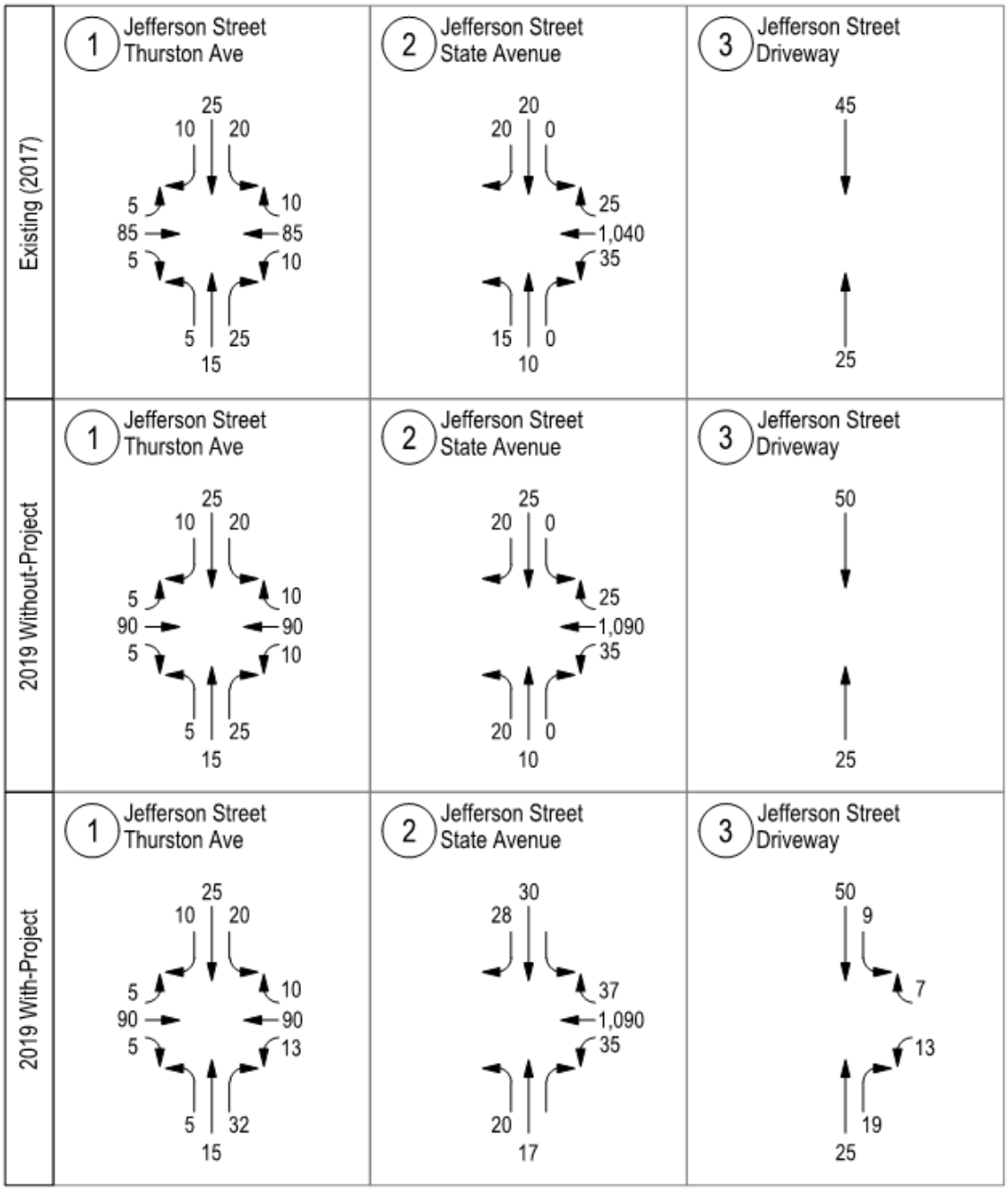

Figure 4. PM Peak Hour Traffic Volumes

With-Project Traffic Operations

Weekday PM Peak hour traffic operations for future (2019) without-project conditions were evaluated at the study intersections based on the procedures identified in the *Highway Capacity Manual (HCM)* (2010) and using the *Synchro 9* software program. LOS worksheets are provided in Attachment 2. Table 3 summarizes the existing and future without-project operations.

Table 3. Level of Service Summary

	2019 Without-Project			2019 With-Project		
Intersection	**LOS[1]**	**Delay[2]**	**WM[3]**	**LOS**	**Delay**	**WM**
Jefferson St / Thurston Ave NE	A	3.6	SB	A	3.8	SB
Jefferson St / State Ave NE	A	1.3	SB	A	1.7	NB
Driveway / Jefferson St	-	-	-	A	2.0	WB

1. Level of service, based on 2010 Highway Capacity Manual methodology.
2. Weighted average delay of the intersection in seconds per vehicle.
3. Worst approach reported for unsignalized intersections.

As seen in the table, the two off-site study intersections would continue to operate at LOS A and experience less than one additional second of averaged weighted delay with the addition of project trips. The project driveway is anticipated to operate at LOS A with an average weighted delay of two seconds per vehicle.

Site Access Spacing Analysis

The site access on Jefferson Street is located approximately 70 feet (centerline to centerline) and 40 feet (nearest edge to edge) away from the existing Jefferson Street NE / Olympia Avenue NE intersection. Per Olympia design guidelines[3], the minimum spacing between two access points is required to be 95 feet (nearest edge to edge) when considering the operating speed of 25 mph on Jefferson Street. Exceptions to the minimum spacing requirements can be made through the following:

- In cases where corner clearances are not attainable because property frontages are narrow, access should be located as close as practicable to the property line most distant from the intersection. At such locations, serious consideration should be given to physically prohibiting left turns into and out of the driveway.

- Driveway locations near controlled intersections must not interfere with traffic operations that develop from the 90th percentile queue length. This situation must be checked for Item C and H in Tables 19 and 20. Conduct independent intersection queue analysis for determination. In situations where this is unavoidable, the City Engineer may limit the access point to a right-turn only in-and-out operation.

The applicant is seeking an exception to the minimum spacing requirements by conducting an queueing analysis at the proposed driveway and Jefferson Street NE / Olympia Avenue NE intersection to show that there would be no blockage issues caused by vehicular queueing.

Queues along Jefferson Street NE were analyzed for potential blockage issues considering the proposed driveway's proximity to the existing Jefferson Street NE / Olympia Avenue NE

[3] City of Olympia Municipal Code 4I.060 Table 20. Corner Clearance from Intersections

intersection mentioned earlier. Based on forecast 2019 with-project traffic volumes, 95th percentile queues during the PM peak hour are summarized below:

- For the southbound left movement entering the driveway, the 95th percentile queue is approximately 0 feet (~0 vehicles).
- For the northbound left movement entering the Jefferson Street / Olympia Avenue intersection, the 95th percentile queue is approximately 0 feet (~0 vehicles).

Thus, no potential blocking issues created by queued vehicles entering the driveway or entering the Jefferson Street / Olympia Avenue intersection are anticipated. Queueing information is found in the LOS worksheets that are provided in Attachment 2.

Turning diagrams in Autoturn were also conducted to analyze vehicle turning paths to make sure there were no potential conflicts when two vehicles are entering in and out of the proposed driveway simultaneously. Autoturn diagrams can be found in Attachment 4.

Signal Warrant Analysis

Signal warrants at the East Bay Drive / Olympia Avenue intersection were analyzed during the 2019 and 2024[4] with-project traffic conditions. It was found that the intersection would not meet any signal warrants during 2019 with-project traffic conditions while the intersection would meet Warrants 2 & 3 (Four-Hour Vehicular Volume and Peak Hour) during 2024 with-project traffic conditions. Warrant summary worksheets are provided in Attachment 5.

Considering future growth in traffic from 2017 to 2024 conditions at this intersection, the project's share of the total entering volumes (growth only) constitutes 0.4 percent.

Findings & Conclusion

- The proposed East Bay Lot A project consists of 74 apartment units, 12 townhome units, and approximately 8,500 square feet of miscellaneous retail.
- The project site is located north of State Avenue NE and east of Jefferson Street NE. The project site is currency undeveloped.
- Proposed access to the site would be provided on the east side of Jefferson Street NE, just south of Olympia Avenue NE. The project is anticipated to be fully constructed by late 2019.
- The proposed project is anticipated to generate approximately 920 new daily trips, 51 new AM peak hour trips and 48 new PM peak hour trips.
- The study intersections and the driveway are anticipated to operate at LOS A or better during the 2019 with-project PM peak hour.
- Queues at the driveway and nearby Olympia Avenue / Jefferson Street intersection are not anticipated to create blockage conflicts at the driveway or intersection.
- Signal warrants at the East Bay Drive / Olympia Avenue intersection were not met during the 2019 with-project conditions. Warrants 2 & 3 were met for the 2024 with-project conditions.

[4] 2024 traffic volumes were forecast by applying a 2 percent growth rate for five consecutive years to the 2019 traffic volumes per coordination with City of Olympia Staff.

Attachment 1: LOS Definitions

Highway Capacity Manual 2010

Signalized intersection level of service (LOS) is defined in terms of a weighted average control delay for the entire intersection. Control delay quantifies the increase in travel time that a vehicle experiences due to the traffic signal control as well as provides a surrogate measure for driver discomfort and fuel consumption. Signalized intersection LOS is stated in terms of average control delay per vehicle (in seconds) during a specified time period (e.g., weekday PM peak hour). Control delay is a complex measure based on many variables, including signal phasing and coordination (i.e., progression of movements through the intersection and along the corridor), signal cycle length, and traffic volumes with respect to intersection capacity and resulting queues. Table 1 summarizes the LOS criteria for signalized intersections, as described in the *Highway Capacity Manual 2010* (Transportation Research Board, 2010).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	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 (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F[1]	>80	Forced flow (congested and queues fail to clear)

Source: *Highway Capacity Manual 2010*, Transportation Research Board, 2010.

1. If the volume-to-capacity (v/c) ratio for a lane group exceeds 1.0 LOS F is assigned to the individual lane group. LOS for overall approach or intersection is determined solely by the control delay.

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop and two-way stop control. All-way stop control intersection LOS is expressed in terms of the weighted average control delay of the overall intersection or by approach. Two-way stop-controlled intersection LOS is defined in terms of the average control delay for each minor-street movement (or shared movement) as well as major-street left-turns. This approach is because major-street through vehicles are assumed to experience zero delay, a weighted average of all movements results in very low overall average delay, and this calculated low delay could mask deficiencies of minor movements. Table 2 shows LOS criteria for unsignalized intersections.

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)
A	0 – 10
B	>10 – 15
C	>15 – 25
D	>25 – 35
E	>35 – 50
F[1]	>50

Source: *Highway Capacity Manual 2010*, Transportation Research Board, 2010.

1. If the volume-to-capacity (v/c) ratio exceeds 1.0, LOS F is assigned an individual lane group for all unsignalized intersections, or minor street approach at two-way stop-controlled intersections. Overall intersection LOS is determined solely by control delay.

Attachment 2: LOS Worksheets

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	85	5	10	85	10	5	15	25	20	25	10
Future Vol, veh/h	5	85	5	10	85	10	5	15	25	20	25	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	1	1	1	2	2	2	2	2	2	0	0	0
Mvmt Flow	5	85	5	10	85	10	5	15	25	20	25	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	95	0	0	90	0	0	226	213	88	228	210	90
Stage 1	-	-	-	-	-	-	98	98	-	110	110	-
Stage 2	-	-	-	-	-	-	128	115	-	118	100	-
Critical Hdwy	4.11	-	-	4.12	-	-	7.12	6.52	6.22	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.218	-	-	3.518	4.018	3.318	3.5	4	3.3
Pot Cap-1 Maneuver	1505	-	-	1505	-	-	729	684	970	731	691	973
Stage 1	-	-	-	-	-	-	908	814	-	900	808	-
Stage 2	-	-	-	-	-	-	876	800	-	891	816	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1505	-	-	1505	-	-	696	677	970	695	684	973
Mov Cap-2 Maneuver	-	-	-	-	-	-	696	677	-	695	684	-
Stage 1	-	-	-	-	-	-	905	812	-	897	802	-
Stage 2	-	-	-	-	-	-	834	794	-	849	814	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.7	9.7	10.4
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	816	1505	-	-	1505	-	-	727
HCM Lane V/C Ratio	0.055	0.003	-	-	0.007	-	-	0.076
HCM Control Delay (s)	9.7	7.4	0	-	7.4	0	-	10.4
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	35	1040	25	15	10	0	0	20	20
Future Vol, veh/h	0	0	0	35	1040	25	15	10	0	0	20	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	2	2	2	1	1	1	0	0	0
Mvmt Flow	0	0	0	35	1040	25	15	10	0	0	20	20

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	600	1135	-	-	1123	533
Stage 1	-	-	-	0	0	-	-	1123	-
Stage 2	-	-	-	600	1135	-	-	0	-
Critical Hdwy	4.14	-	-	7.52	6.52	-	-	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.5	-
Critical Hdwy Stg 2	-	-	-	6.52	5.52	-	-	-	-
Follow-up Hdwy	2.22	-	-	3.51	4.01	-	-	4	3.3
Pot Cap-1 Maneuver	-	-	-	387	202	0	0	207	496
Stage 1	-	-	-	-	-	0	0	283	-
Stage 2	-	-	-	457	278	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	344	202	-	-	207	496
Mov Cap-2 Maneuver	-	-	-	344	202	-	-	207	-
Stage 1	-	-	-	-	-	-	-	283	-
Stage 2	-	-	-	408	278	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		19.8	19.3
HCM LOS		C	C

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	269	-	-	-	292
HCM Lane V/C Ratio	0.093	-	-	-	0.137
HCM Control Delay (s)	19.8	-	-	-	19.3
HCM Lane LOS	C	-	-	-	C
HCM 95th %tile Q(veh)	0.3	-	-	-	0.5

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	90	5	10	90	10	5	15	25	20	25	10
Future Vol, veh/h	5	90	5	10	90	10	5	15	25	20	25	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	1	1	1	2	2	2	2	2	2	0	0	0
Mvmt Flow	5	90	5	10	90	10	5	15	25	20	25	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	100	0	0	95	0	0	236	223	93	238	220	95
Stage 1	-	-	-	-	-	-	103	103	-	115	115	-
Stage 2	-	-	-	-	-	-	133	120	-	123	105	-
Critical Hdwy	4.11	-	-	4.12	-	-	7.12	6.52	6.22	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.218	-	-	3.518	4.018	3.318	3.5	4	3.3
Pot Cap-1 Maneuver	1499	-	-	1499	-	-	718	676	964	721	682	967
Stage 1	-	-	-	-	-	-	903	810	-	895	804	-
Stage 2	-	-	-	-	-	-	870	796	-	886	812	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1499	-	-	1499	-	-	685	669	964	685	675	967
Mov Cap-2 Maneuver	-	-	-	-	-	-	685	669	-	685	675	-
Stage 1	-	-	-	-	-	-	899	807	-	891	798	-
Stage 2	-	-	-	-	-	-	828	790	-	844	809	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.7	9.7	10.4
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	809	1499	-	-	1499	-	-	718
HCM Lane V/C Ratio	0.056	0.003	-	-	0.007	-	-	0.077
HCM Control Delay (s)	9.7	7.4	0	-	7.4	0	-	10.4
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	35	1090	25	20	10	0	0	25	20
Future Vol, veh/h	0	0	0	35	1090	25	20	10	0	0	25	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	2	2	2	1	1	1	0	0	0
Mvmt Flow	0	0	0	35	1090	25	20	10	0	0	25	20

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	628	1185	-	-	1173	558
Stage 1	-	-	-	0	0	-	-	1173	-
Stage 2	-	-	-	628	1185	-	-	0	-
Critical Hdwy	4.14	-	-	7.52	6.52	-	-	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.5	-
Critical Hdwy Stg 2	-	-	-	6.52	5.52	-	-	-	-
Follow-up Hdwy	2.22	-	-	3.51	4.01	-	-	4	3.3
Pot Cap-1 Maneuver	-	-	-	369	189	0	0	194	478
Stage 1	-	-	-	-	-	0	0	268	-
Stage 2	-	-	-	440	263	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	319	189	-	-	194	478
Mov Cap-2 Maneuver	-	-	-	319	189	-	-	194	-
Stage 1	-	-	-	-	-	-	-	268	-
Stage 2	-	-	-	382	263	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		20.6	21.4
HCM LOS		C	C

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	260	-	-	-	264
HCM Lane V/C Ratio	0.115	-	-	-	0.17
HCM Control Delay (s)	20.6	-	-	-	21.4
HCM Lane LOS	C	-	-	-	C
HCM 95th %tile Q(veh)	0.4	-	-	-	0.6

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	90	5	13	90	10	5	15	32	20	25	10
Future Vol, veh/h	5	90	5	13	90	10	5	15	32	20	25	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	1	1	1	2	2	2	2	2	2	0	0	0
Mvmt Flow	5	90	5	13	90	10	5	15	32	20	25	10

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	100	0	0	95	0	0	242	229	93	247	226	95
Stage 1	-	-	-	-	-	-	103	103	-	121	121	-
Stage 2	-	-	-	-	-	-	139	126	-	126	105	-
Critical Hdwy	4.11	-	-	4.12	-	-	7.12	6.52	6.22	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.1	5.5	-
Follow-up Hdwy	2.209	-	-	2.218	-	-	3.518	4.018	3.318	3.5	4	3.3
Pot Cap-1 Maneuver	1499	-	-	1499	-	-	712	671	964	711	677	967
Stage 1	-	-	-	-	-	-	903	810	-	888	800	-
Stage 2	-	-	-	-	-	-	864	792	-	883	812	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1499	-	-	1499	-	-	678	662	964	669	668	967
Mov Cap-2 Maneuver	-	-	-	-	-	-	678	662	-	669	668	-
Stage 1	-	-	-	-	-	-	899	807	-	884	793	-
Stage 2	-	-	-	-	-	-	821	785	-	834	809	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.9	9.7	10.5
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	822	1499	-	-	1499	-	-	708
HCM Lane V/C Ratio	0.063	0.003	-	-	0.009	-	-	0.078
HCM Control Delay (s)	9.7	7.4	0	-	7.4	0	-	10.5
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	35	1090	37	20	17	0	0	30	28
Future Vol, veh/h	0	0	0	35	1090	37	20	17	0	0	30	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	2	2	2	1	1	1	0	0	0
Mvmt Flow	0	0	0	35	1090	37	20	17	0	0	30	28

Major/Minor	Major2			Minor1			Minor2		
Conflicting Flow All	0	0	0	630	1197	-	-	1179	564
Stage 1	-	-	-	0	0	-	-	1179	-
Stage 2	-	-	-	630	1197	-	-	0	-
Critical Hdwy	4.14	-	-	7.52	6.52	-	-	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	-	5.5	-
Critical Hdwy Stg 2	-	-	-	6.52	5.52	-	-	-	-
Follow-up Hdwy	2.22	-	-	3.51	4.01	-	-	4	3.3
Pot Cap-1 Maneuver	-	-	-	368	186	0	0	192	474
Stage 1	-	-	-	-	-	0	0	267	-
Stage 2	-	-	-	439	259	0	0	-	-
Platoon blocked, %		-	-						
Mov Cap-1 Maneuver	-	-	-	305	186	-	-	192	474
Mov Cap-2 Maneuver	-	-	-	305	186	-	-	192	-
Stage 1	-	-	-	-	-	-	-	267	-
Stage 2	-	-	-	367	259	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s		23.1	22
HCM LOS		C	C

Minor Lane/Major Mvmt	NBLn1	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	236	-	-	-	269
HCM Lane V/C Ratio	0.157	-	-	-	0.216
HCM Control Delay (s)	23.1	-	-	-	22
HCM Lane LOS	C	-	-	-	C
HCM 95th %tile Q(veh)	0.5	-	-	-	0.8

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	13	7	25	19	9	50
Future Vol, veh/h	13	7	25	19	9	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	13	7	25	19	9	50

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	103	35	0	0	44	0
Stage 1	35	-	-	-	-	-
Stage 2	68	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	900	1044	-	-	1577	-
Stage 1	993	-	-	-	-	-
Stage 2	960	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	895	1044	-	-	1577	-
Mov Cap-2 Maneuver	895	-	-	-	-	-
Stage 1	993	-	-	-	-	-
Stage 2	954	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	1.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	942	1577	-
HCM Lane V/C Ratio	-	-	0.021	0.006	-
HCM Control Delay (s)	-	-	8.9	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	21	5	27	23	5
Future Vol, veh/h	20	21	5	27	23	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	5	5	2	2	3	3
Mvmt Flow	20	21	5	27	23	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	63	26	28	0	-	0
Stage 1	26	-	-	-	-	-
Stage 2	37	-	-	-	-	-
Critical Hdwy	6.45	6.25	4.12	-	-	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.345	2.218	-	-	-
Pot Cap-1 Maneuver	936	1041	1585	-	-	-
Stage 1	989	-	-	-	-	-
Stage 2	978	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	933	1041	1585	-	-	-
Mov Cap-2 Maneuver	933	-	-	-	-	-
Stage 1	989	-	-	-	-	-
Stage 2	975	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.8	1.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1585	-	985	-	-
HCM Lane V/C Ratio	0.003	-	0.042	-	-
HCM Control Delay (s)	7.3	0	8.8	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Attachment 3: Trip Generation

Attachment 3: Trip Generation

			Daily		AM Peak Hour				PM Peak Hour			
Land Use	**Land Use #**	**Size**	**Daily Trip Rate**	**Daily Trips**	**AM Trip Rate**	**Inbound Trips**	**Outbound Trips**	**Total Trips**	**PM Trip Rate**	**Inbound Trips**	**Outbound Trips**	**Total Trips**
Residential Townhouse	230	12 DU	5.81	70	0.44	1	4	5	0.36	3	1	4
Apartment	220	74 DU	6.65	490	0.51	8	30	38	0.36	18	9	27
Miscellaneous Retail	820	8500 sf	42.7	360	0.96	4	4	8	2.04	7	10	17
Net New	***-***	***-***	***-***	***920***	***-***	***13***	***38***	***51***	***-***	***28***	***20***	***48***

PM rates based on Table 3 *of Transportation Impact Fee Update, November 2016* for Downtown Area

Daily, AM, and inbound/outbound percentage rates based on *Trip Generation* , 9th Edition, Institute of Transportation Engineers (ITE), 2012

Attachment 4: Autoturn Diagram

PSE HAS
BLANKET
EASEMENT OVER
THEIR FACILITIES

P
AASHTO 2011 (US)

SSMH
RIM 14.02
IE 48" CL CHANNEL W,S 5.72

8"W

BRK

UP

JEFFERSO

10' WIDE QWEST
EASEMENT AFN
4288189

N

SCALE IN FEET
0 10 20

Attachment 5: Signal Warrants

Warrants Summary

Information

Analyst	Transpo Group	Intersection	Olympia Ave NE / East Bay Dr
Agency/Co		Jurisdiction	Olympia
Date Performed	5/2/2017	Units	U.S. Customary
Project ID	East Bay Lot A	Time Period Analyzed	2019 Future PM Peak Period
East/West Street	Olympia Ave NE		
File Name	2019 WP.xhy	North/South Street	East Bay Dr NE
		Major Street	East-West

Project Description *East Bay Lot A*

General				Roadway Network	
Major Street Speed (mph)	30	☐	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	300	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	0	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	1	1	0	0	1	0	0	2	0	0	2	0
Lane usage	L	TR			LTR			LTR			LTR	
Vehicle Volume Averages (vph)	58	14	107	4	9	14	92	450	25	9	274	117
Peds (ped/h) / Gaps (gaps/h)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--
Delay (s/veh) / (veh-hr)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--

Warrant 1: Eight-Hour Vehicular Volume	☐
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☐
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 (80%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 2: Four-Hour Vehicular Volume	☐
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 3: Peak Hour	☐
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 4: Pedestrian Volume	☐
4 A. Four Hour Volumes --or--	☐
4 B. One-Hour Volumes	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐

7 C. (80%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☐
Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐
Warrant 9: Grade Crossing	☐
9 A. Grade Crossing within 140 ft --and--	☐
9 B. Peak-Hour Vehicular Volumes	☐

 HCS7™ Warrants Version 7.1 Generated: 7/24/2017 1:01 PM

Warrants Summary

Information

Analyst	Transpo Group	Intersection	Olympia Ave NE / East Bay Dr
Agency/Co		Jurisdiction	Olympia
Date Performed	5/2/2017	Units	U.S. Customary
Project ID	East Bay Lot A	Time Period Analyzed	2024 Future PM Peak Period
East/West Street	Olympia Ave NE		
File Name	2024 WP.xhy	North/South Street	East Bay Dr NE
		Major Street	East-West

Project Description *East Bay Lot A*

General				Roadway Network	
Major Street Speed (mph)	30	☐	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	300	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	0	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	1	1	0	0	1	0	0	2	0	0	2	0
Lane usage	L	TR			LTR			LTR			LTR	
Vehicle Volume Averages (vph)	65	15	118	5	10	15	102	497	27	10	302	129
Peds (ped/h) / Gaps (gaps/h)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--
Delay (s/veh) / (veh-hr)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--

Warrant 1: Eight-Hour Vehicular Volume	☐
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☐
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 (80%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 2: Four-Hour Vehicular Volume	☑
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 3: Peak Hour	☑
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 4: Pedestrian Volume	☐
4 A. Four Hour Volumes --or--	☐
4 B. One-Hour Volumes	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐

7 C. (80%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☐
Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐
Warrant 9: Grade Crossing	☐
9 A. Grade Crossing within 140 ft --and--	☐
9 B. Peak-Hour Vehicular Volumes	☐