

Technical Memorandum

August 24, 2023

Project# 27311

To: John Fasana, PE and Jinde Zhu, PE
Washington County

CC: Jason Waters, PE, City of Sherwood

From: Tony Roos, PE; Wade Scarbrough, PE;
Claire Dougherty, PE; & Megan Mannion

RE: Ice Age Drive Extension Traffic Analysis – FINAL



EXPIRES: 06/30/24

Executive Summary

The City of Sherwood is planning to construct a new east-west collector road (Ice Age Drive) between SW Oregon Street and SW 124th Avenue to facilitate development within the Tonquin Employment Area (TEA). The proposed roadway is currently being progressed to final design, with construction anticipated in early 2024.

Kittelson evaluated the terminus intersections of Ice Age Drive at SW Oregon Street and SW 124th Avenue to determine the appropriate traffic control for near-term and long-term buildout of the TEA. The team determined a new traffic signal should be constructed at the new intersection of SW Oregon Street / Ice Age Drive as part of the roadway construction project, consistent with the *Oregon Street Access Management Plan (2021)*. The purpose of the memorandum is to document the need for the traffic signal at SW Oregon Street / Ice Age Drive and describe specific design considerations, including recommended signal phasing and turn-lane storage lengths.

Summary of Key Findings and Recommendations

Based on the completed traffic analysis the following findings and recommendations should be carried forward to the final design of Ice Age Drive:

- The intersection of SW 124th Avenue / Ice Age Drive should remain a two-way stop control in the near term. Future volumes on Ice Age Drive should be monitored and the need for a traffic signal be evaluated with future development applications.
- A traffic signal at the intersection of SW Oregon Street / Ice Age Drive should be installed with the construction of Ice Age Drive. Key signal design considerations include:
 - Closing the residential driveway from Taxlot 2S128C102 immediately north of the new SW Oregon Street / Ice Age Drive signalized intersection, as outlined in the *Oregon Street Access Management Plan* completed in 2021.
 - Closing the existing direct access from Taxlot 2S128C700 (currently City owned) at the time of redevelopment, as a new access will be provided to Ice Age Drive.
 - Constructing a northbound right-turn lane with 125 feet of storage and a taper designed per *Washington County Road Standard* section 320.050 Transitions.
 - Removing the temporary Sherwood Commerce Center driveway on SW Oregon Street.
 - Re-striping a southbound left-turn lane at the new traffic signal with 150 feet of storage and then a continuation of the existing center turn lane.
 - Implementing protected-permissive left-turn phasing on SW Oregon Street and permissive left-turn phasing on Ice Age Drive.

Introduction

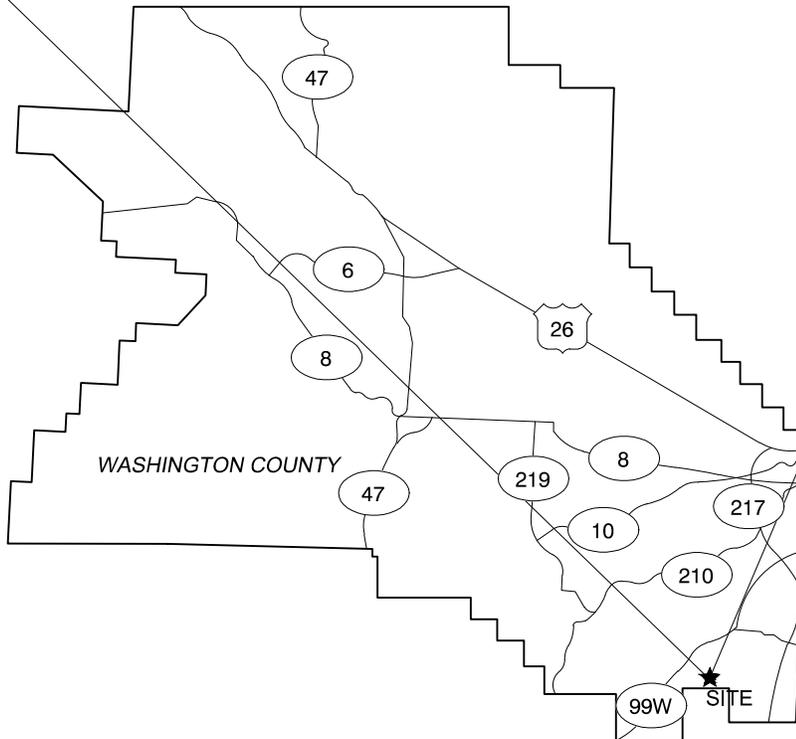
Project Background

The City of Sherwood is planning to create a new east-west connection between SW Oregon Street and SW 124th Avenue to facilitate development within the Tonquin Employment Area (TEA). Historically referred to as Blake Street and now called Ice Age Drive, the proposed collector roadway and associated utilities will provide for industrial development within the TEA. The proposed collector alignment will tie in with the roadway segment currently being constructed in conjunction with the Willamette Water Supply development at the intersection of SW 124th Avenue / Ice Age Drive-Blake Street, on the east end of the project limits. The west terminus along SW Oregon Street will align with an existing private driveway to 21389 SW Oregon Street that is just north of Allied Systems.

In 2022 Kittelson & Associates (Kittelson) developed 30% conceptual alignment alternatives and coordinated with City staff and area utility providers to determine the preferred alignment alternative and evaluate overall project feasibility. The southern alignment alternative was ultimately selected and is currently progressing to preliminary and final design.

Study Area

The TEA is located south of SW Tualatin-Sherwood Road, east of SW Oregon Street, and west of SW 124th Avenue, as shown in Figure 1. Figure 2 displays an ownership map and identifies known in-process developments and anticipated developable taxlots considered in this analysis within the TEA.



Site Vicinity Map
Sherwood, Oregon

Figure
1

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N



 IN-PROCESS / PLANNED DEVELOPMENTS

 TAXLOTS FOR FUTURE REDEVELOPMENT WITHIN TONQUIN EMPLOYMENT AREA

Property Limit Map
Sherwood, Oregon

Figure
2

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Traffic Analysis

Existing Conditions

Traffic Data – Peak Hour Movement Counts

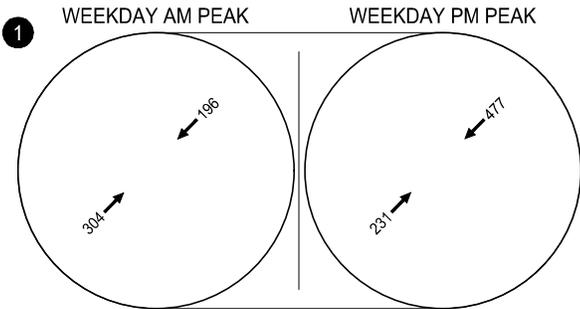
Intersection turning movements (TMCs) were conducted at the proposed terminus intersections in April 2022. The observed AM Peak hour was from 7:30 – 8:30 AM along SW Oregon Street and 7:45 – 8:45 AM along SW 124th Avenue. The PM peak hour was 4:30 – 5:30 PM along SW Oregon Street and 4:35 – 5:35 PM along SW 124th Avenue. Figure 3 illustrates the existing weekday peak hour traffic volumes at these two locations.

Because Ice Age Drive is not an existing facility, there are no traffic turning movements at these locations. Currently, access to the middle area taxlots is provided via SW Dahlke Lane, a north-south local access road within the TEA that connects to SW Oregon Street just south of Tualatin-Sherwood Road.

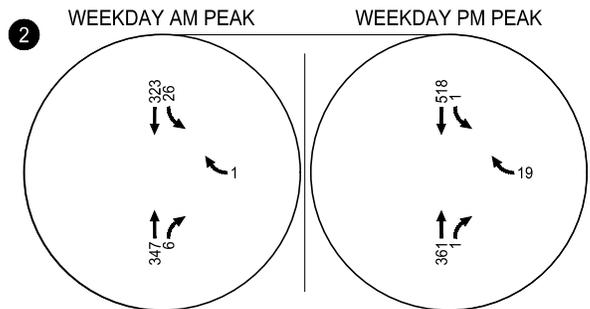
See Appendix A for traffic count data sheets.



SW OREGON STREET/ICE AGE DRIVE



**SW 124TH AVENUE/
ICE AGE DRIVE-SW BLAKE STREET**



Existing Year 2022 Traffic Volumes
AM and PM Peak Hours
Sherwood, Oregon

Figure
3

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Future Conditions

Operational Analysis

Intersection Analysis Methodology

The intersection analyses described in this memorandum were performed in accordance with the procedures stated in the *Highway Capacity Manual (HCM) 6th Edition* for unsignalized intersections and signalized intersections. In addition, the overall intersection volume-to-capacity ratio for signalized intersections were performed in accordance with the procedures stated in the *HCM 2000 Manual*.¹ (Reference 1, 2). Operational analysis was performed using Synchro 11 software. The peak 15-minute flow rates were used in the evaluation of all intersection level-of-service (LOS) and volume-to-capacity (V/C) ratios. For this reason, the analyses reflect conditions that are likely to occur for the peak 15 minutes out of each average peak hour.

Intersection Operating Standards

Per the City of Sherwood's TSP (Reference 3), for streets owned by Washington County or city-owned streets that are labeled on the Arterial and Throughway Network Map of Metro's 2014 Regional Transportation Plan (Reference 4), a regional 0.99 V/C operating standard applies. As SW Oregon Street and SW 124th Avenue are both included, this operating standard applies to both proposed terminus intersections.

Future Volume Development

Forecast future year 2025 and 2045 traffic volumes were estimated to inform traffic control needs in the near-term and longer term on Ice Age Drive considering growth of existing traffic on SW Oregon Street and SW 124th Avenue, known in-process area developments and the trip generation potential of other parcels within TEA.

Growth Rate

Based on review of the Washington County regional travel demand model, an annual growth rate of 1.5 percent was applied to the existing 2022 volumes to estimate future year volumes. This growth rate was informed by the 2015 and 2040 model outputs provided by Washington County and is consistent with recent projects within the project vicinity.

See Appendix B for Washington County 2015 and 2040 traffic models.

Re-routed Traffic

Once constructed, Ice Age Drive would provide a new east-west connection, which may facilitate limited re-routing of existing east-west traffic currently using SW Tualatin-Sherwood Road to travel between SW Oregon Street and SW 124th Avenue. However, the geometric features of horizontal and vertical curves, and relatively low speed (anticipated to be posted speed of 25-30 MPH) are not anticipated to attract many regional trips. Therefore, forecast future volumes include a limited re-route assumption of

¹Signalized intersection operations were analyzed using the HCM 2000 methodology in order to provide overall intersection volume-to-capacity ratio to be produced and compared to City and County operating standards.

approximately 25 peak hour trips that would otherwise travel via SW Tualatin-Sherwood Road that would instead utilize Ice Age Drive.

Additionally, the western terminus intersection at SW Oregon Street is planned to align with the primary access driveway to 21369 SW Oregon Street (TL 2S128C00102) which currently has two driveway accesses to SW Oregon Street, as shown in Exhibit 1. The City intends for Ice Age Drive to align with (be centered upon) the southernmost driveway to 21369 SW Oregon Street, and for the northern most driveway to be closed, due to the close proximity to the new SW Oregon Street / Ice Age Drive intersection, which is discussed further in the Signal Design Considerations section of this memorandum. The closure of the north driveway was therefore estimated to result in the potential re-routing of up to five peak hour trips to the southern driveway, which is reflected in future forecast volumes.

Exhibit 1 – SW Oregon Street / Ice Age Drive Intersection Alignment Concept



In-Process Developments

The following in-process, known near-term developments within the proposed Ice Age Drive vicinity were considered in estimating future 2025 traffic volumes on Ice Age Drive:

- Sherwood Commerce Center – Phase 1
- Willamette Water Treatment Plant²
- Majestic Realty Industrial (located east of SW 124th Avenue between SW 115th Avenue and SW 120th Avenue)
 - As SW Blake Street is envisioned to connect to SW 115th Avenue in the future, these existing warehouses would then be anticipated to add some trips to the east leg of the SW 124th Avenue / Ice Age Drive – SW Blake Street intersection. Therefore, consistent with the TIA prepared for the Majestic Realty Industrial site, a limited number of trips has been assigned to the east leg of the SW 124th Avenue / Ice Age Drive – SW Blake Street intersection.

² A traffic impact analysis for the Water Treatment Plant has not been conducted. A worst-case estimated trip generation of 40 peak hour trips was informed by the available parking stalls provided on site

Per conversations with the City, while the Sherwood Commerce Center may initially have direct access to SW Oregon Street, once Ice Age Drive is constructed, it is anticipated that the temporary direct access to SW Oregon Street will be closed and replaced by an access to Ice Age Drive.

Though Tualatin-Sherwood Corporate Park is also a known in-process development, it will not have direct access to Ice Age Drive.

While there are additional taxlots within the TEA that may redevelop longer-term, it is not anticipated that these developments could be complete by 2025. These parcels will be considered under future year 2045 conditions.

2025 Intersection Operations and Signal Warrants (Near Term)

Figure 4 shows the estimated 2025 traffic volumes, assumed lane configurations, and traffic operations for estimated 2025 traffic conditions. See *Appendix C for 2025 Synchro operations worksheets and signal warrant worksheets*. A summary of analysis findings for each study intersection is provided below.

SW Oregon Street / Ice Age Drive

As shown in Figure 4, the SW Oregon Street / Ice Age Drive intersection is expected to operate within standards as a two-way stop-controlled intersection under the projected 2025 traffic conditions. An analysis of MUTCD signal warrants found that signalization is not warranted at the intersection upon initial completion of Ice Age Drive. However, a sensitivity test was conducted that showed that if 25 percent of the TEA is built out within five years of Ice Age Drive being constructed (2030 timeframe), then Warrant #1 (eight-hour volumes) and Warrant #2 (four-hour volumes) are forecast to be met. Therefore, the City intends to construct the traffic signal at the intersection SW Oregon Street / Ice Age Drive with the construction of Ice Age Drive for construction cost efficiencies and to facilitate development within TEA.

Based on the above considerations, the SW Oregon Street / Ice Age Drive intersection was also analyzed as a traffic signal under 2025 conditions. The analysis showed that the intersection would operate at LOS A with a V/C of 0.31 and 0.51 during the AM and PM peak hours, respectively.

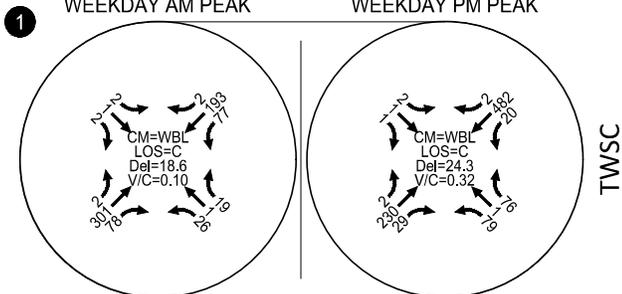
SW 124th Avenue / Ice Age Drive-Blake Street

The intersection of SW 124th Avenue / Ice Age Drive-Blake Street operates within City and County standards as a two-way stop-control intersection under anticipated 2025 traffic volumes and signal warrants are not met under 2025 volumes.

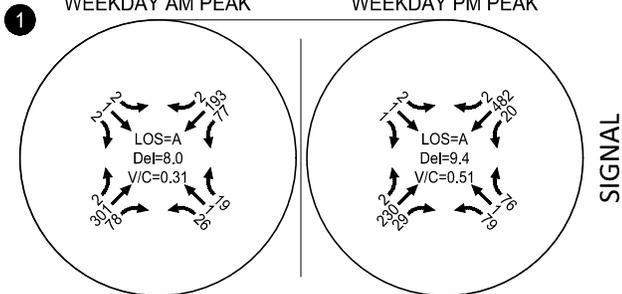


SW OREGON STREET/ICE AGE DRIVE

WEEKDAY AM PEAK WEEKDAY PM PEAK

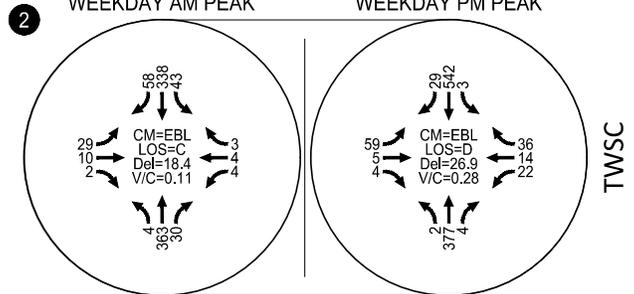


WEEKDAY AM PEAK WEEKDAY PM PEAK



**SW 124TH AVENUE/
ICE AGE DRIVE-SW BLAKE STREET**

WEEKDAY AM PEAK WEEKDAY PM PEAK



CM = CRITICAL MOVEMENT
 LOS = CRITICAL MOVEMENT LEVEL OF SERVICE
 Del = CRITICAL MOVEMENT CONTROL DELAY
 V/C = CRITICAL MOVEMENT VOLUME-TO-CAPACITY RATIO
 TWSC = TWO-WAY STOP-CONTROL

Future Year 2025 Total Traffic Conditions
 AM and PM Peak Hours
 Sherwood, Oregon

Figure
 4

H:\2727311 - Ice Age Drive Extension\001 - Ice Age Drive Final Design\report\figs\27311_Traffic Figs.dwg Aug 03, 2023 - 3:38pm - mmannion Layout Tab: 2025 Future Conditions_Fig 4

2045 Volumes (Long Term)

Additional trips anticipated to use Ice Age Drive in the longer term (2045) were estimated by a trip generation prepared for the remaining undeveloped property within TEA that will be directly served by Ice Age Drive. The total size of developed land was estimated assuming a floor-area ratio (FAR) of 0.25. A land use of General Light Industrial (ITE 155) as provided in *ITE Trip Generation Manual, 11th Edition* (Reference 5) was assumed for all properties, as envisioned by TEA planning documents. Table 1 displays the estimated trip generation. Figure 2 displays the properties included in this estimate that were otherwise not captured by any other known, in-process development. It was assumed that the lots severed by BPA and PGE power lines could utilize the area under the lines for surface parking. These trips are intended to serve as a reasonable, worst case development scenario to inform traffic control needs.

Table 1 – Tonquin Employment Area Estimated Trip Generation

Land Use	ITE Code	Size (SF)	Daily	Weekday AM Peak Hour			Weekday PM Peak Hour		
				Total	In	Out	Total	In	Out
General Light Industrial	110	734,096	3,575	543	478	65	477	67	410

Trip distribution for the TEA site-generated trips was assumed to follow a similar distribution as recent area industrial TIAs as follows:

- 35 percent to/from the west via SW Tualatin-Sherwood Road (north Oregon Street)
- 30 percent to/from the east via SW Tualatin-Sherwood Road (north Oregon Street)
- 15 percent to/from the south via SW Oregon Street
- 10 percent to/from the south via SW 124th Avenue
- 10 percent to the north via SW 124th Avenue

The final 2045 estimated total traffic volumes at the Ice Age Drive terminus intersections shown in Figure 5. It is noted that the resulting peak hour volumes PM peak hour, peak direction volumes are generally consistent with the Washington County 2040 model link volumes.

2045 Intersection Operations and Signal Warrants

The two terminus intersections, SW Oregon Street / Ice Age Drive and SW 124th Avenue / Ice Age Drive-Blake Street, were analyzed as both a two-way stop-control and traffic signal under 2045 total traffic conditions, representing at least a 20-year design life for the new Ice Age Drive and terminus intersections. Figure 5 shows the estimated traffic volumes, assumed lane configurations, and operations for both scenarios. See *Appendix D for the 2045 Synchro operations worksheets and signal warrant worksheets.*

SW Oregon Street/ Ice Age Drive

As shown, the intersection of SW Oregon Street / Ice Age Drive is forecast to operate at LOS F during the AM and PM peak hours as a two-way stop-control intersection. During the PM peak hour, the critical westbound approach would be nearly at the capacity threshold (V/C of 0.99). If signalized, the intersection would operate well below its capacity (V/C of 0.48 and 0.69 during the AM and PM peak hour, respectively) and with reduced delay.

Kittelson conducted an analysis of MUTCD traffic signal warrants under the projected 2045 traffic volumes and found that Warrant #1 (eight-hour volumes), Warrant #2 (four-hour volumes), and Warrant #3 (peak hour volumes) will be met. A sensitivity analysis was conducted to estimate at what level of re-development could occur within TEA before a traffic signal will be needed at the SW Oregon Street / Ice Age Drive intersection. The sensitivity analysis considered 0%, 25%, 50%, and 75% re-development of the middle parcels. Table 2 provides the intersection operations under each scenario and indicates whether signal warrants are met. See Appendix E for the 2045 Sensitivity Synchro operations worksheets and signal warrant worksheets.

Table 2 – SW Oregon Street/Ice Age Drive 2045 Sensitivity Analysis

Percent Development of Middle Parcels	Approximate Number of Trips AM/PM	TWSC Operations						Signal Warrants Met?
		AM			PM			
		V/C	LOS	Delay (sec)	V/C	LOS	Delay (sec)	
0%	0 / 0	0.14 (WBL)	C (WBL)	24.6 (WBL)	0.50 (WBL)	E (WBL)	44.7 (WBL)	Warrant 1 – Yes Warrant 2 – Yes Warrant 3 – No
25%	136 / 119	0.18 (WBL)	D (WBL)	30.1 (WBL)	0.61 (WBL)	F (WBL)	55.1 (WBL)	Warrant 1 – Yes Warrant 2 – Yes Warrant 3 – Yes
50%	272 / 239	0.24 (WBL)	E (WBL)	38.6 (WBL)	0.73 (WBL)	F (WBL)	69.7 (WBL)	Warrant 1 – Yes Warrant 2 – Yes Warrant 3 – Yes
75%	407 / 358	0.32 (WBL)	F (WBL)	50.9 (WBL)	0.86 (WBL)	F (WBL)	94.2 (WBL)	Warrant 1 – Yes Warrant 2 – Yes Warrant 3 – Yes

As shown in Table 2, Warrant #1 and Warrant #2 are met by 2045 without any re-development of the TEA and Warrant #3 is met after 25% of re-development occurs. Given the goal of Ice Age Drive is to promote re-development of the TEA and a signal will be warranted with the first developments, the City intends to install a traffic signal at the intersection SW Oregon Street / Ice Age Drive with the construction of Ice Age Drive. Signalizing the intersection is consistent with the *Oregon Street Access Management Plan* recommendations.

SW 124th Avenue/ Ice Age Drive

The intersection of SW 124th Avenue / Ice Age Drive-SW Blake Street is forecast to operate at LOS F and over capacity during the PM peak hour under 2045 volumes (V/C of 1.95). The overcapacity, critical movement, is the eastbound left-turn movement from Ice Age Drive to go northbound on SW 124th Avenue. If signalized, the intersection is forecast to operate within capacity during the AM and PM peak hours (V/C of 0.42 and 0.65, respectively).

Signal warrants were evaluated and Warrant #1 (eight-hour volumes), #2 (four-hour volumes), and #3 (peak hour volumes) are all forecast to be met under 2045 traffic conditions. A sensitivity analysis was conducted to estimate at what level of redevelopment could occur within TEA before a traffic signal will be needed at the SW 124th Avenue / Ice Age Drive-Blake Street intersection. The sensitivity analysis considered 0%, 25%, 50%, and 75% re-development of the middle parcels. Table 3 provides the intersection

operations under each scenario and indicates whether signal warrants are met. See Appendix E for the 2045 Sensitivity Synchro operations worksheets and signal warrant worksheets.

Table 3 – SW 124th/Ice Age Drive 2045 Sensitivity Analysis

Percent Development of Middle Parcels	Approximate Number of Trips AM/PM	TWSC Operations						Signal Warrants Met?
		AM			PM			
		V/C	LOS	Delay (sec)	V/C	LOS	Delay (sec)	
0%	0 / 0	0.15 (EBL)	D (EBL)	26 (EBL)	0.48 (EBL)	F (EBL)	54.1 (EBL)	Warrant 1 – No Warrant 2 – No Warrant 3 – No
25%	136 / 119	0.22 (EBL)	D (EBL)	30.2 (EBL)	0.83 (EBL)	F (EBL)	100.6 (EBL)	Warrant 1 – Yes Warrant 2 – No Warrant 3 – Yes
50%	272 / 239	0.28 (EBL)	E (EBL)	35.3 (EBL)	1.19 (EBL)	F (EBL)	204.3 (EBL)	Warrant 1 – Yes Warrant 2 – Yes Warrant 3 – Yes
75%	407 / 358	0.36 (EBL)	E (EBL)	42.2 (EBL)	1.56 (EBL)	F (EBL)	348.9 (EBL)	Warrant 1 – Yes Warrant 2 – Yes Warrant 3 – Yes

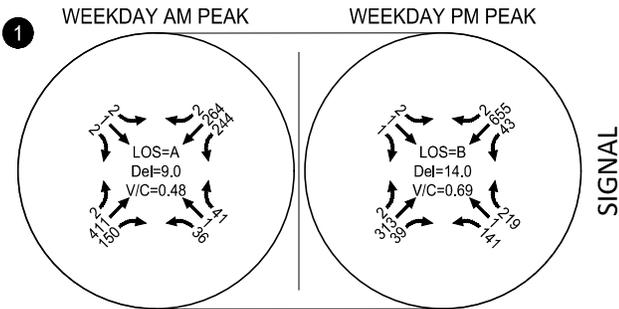
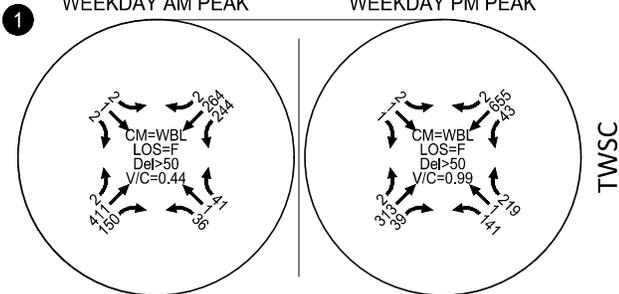
As shown in Table 3, the critical eastbound left-turn movement exceeds its capacity between 25-50% development of the TEA. Additionally, a signal is forecast to be warranted at approximately 25% development. This analysis suggests that there may not be an operational need for a traffic signal at the SW 124th Avenue / Ice Age Drive-Blake Street intersection until approximately 25%, or 185,000 square feet of light industrial development is constructed within the TEA, beyond the identified near-term known developments.

Given the intersection of SW 124th Avenue / Ice Age Drive is beyond the limits of the City-led Ice Age Drive roadway project, it is recommended that future volumes on Ice Age Drive be monitored and the need for a traffic signal be evaluated with future development applications.



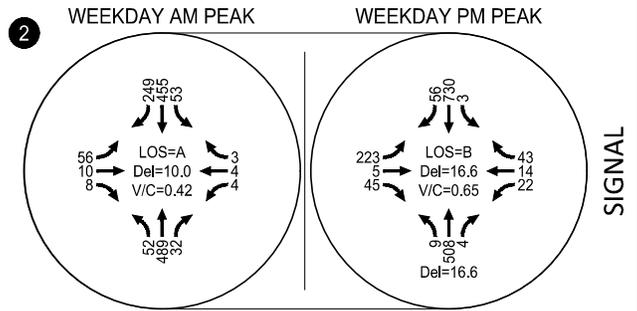
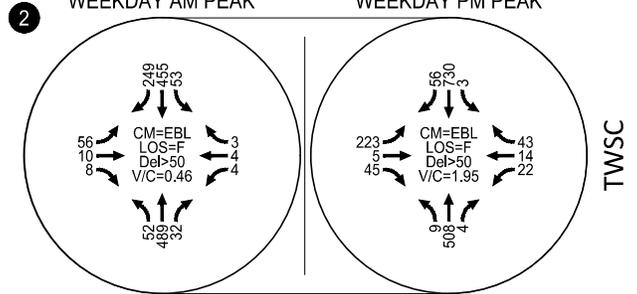
SW OREGON STREET/ICE AGE DRIVE

WEEKDAY AM PEAK WEEKDAY PM PEAK



**SW 124TH AVENUE/
ICE AGE DRIVE-SW BLAKE STREET**

WEEKDAY AM PEAK WEEKDAY PM PEAK



CM = CRITICAL MOVEMENT
 LOS = CRITICAL MOVEMENT LEVEL OF SERVICE
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 TWSC = TWO-WAY STOP-CONTROL

Future Year 2045 Total Traffic Conditions
 AM and PM Peak Hours
 Sherwood, Oregon

Figure
 5

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Signal Design Considerations

The following section outlines the design the traffic signal design considerations for the proposed traffic signal at SW Oregon Street / Ice Age Drive.

Access Management

In 2021 DKS Associates analyzed future roadway connections to SW Oregon Street between Tonquin Road and Tualatin-Sherwood Road as part of the Oregon Street Access Management Plan (AMP) process (Reference 6). See Appendix F for the Sherwood Oregon Street Access Management Plan. Three alternatives were provided. Alternative 3 discusses the construction of a new east-west collector between SW Oregon Street and 124th Avenue. This connector is known as Ice-age Drive and is currently in the design process. It is recommended within the AMP that a signalized intersection be provided at the connection of the east-west collector to SW Oregon Street. Additionally, the AMP recommended the driveway to SW Oregon Street from Taxlot 2S128C102 be closed and reconstructed to connect to the traffic signal at the time the new SW Oregon Street / Ice Age Drive intersection is constructed.

In advance of Ice Age Drive construction in 2024, the Sherwood Commerce Center is constructing a temporary site driveway with an exclusive right-turn lane along SW Oregon Street approximately 250 feet south of the proposed intersection. When Ice Age Drive is complete, this driveway will be removed and replaced by a right-turn lane at the proposed signal and Sherwood Commerce Center site trips will instead use a new driveway with direct access to Ice Age Drive.

Additionally, the existing direct access from Taxlot 2S128C700 (which is currently City owned) to SW Oregon Street will be removed when Ice Age Drive is constructed, as a new driveway to this parcel will be provided to Ice Age Drive.

Left-Turn Phasing

Appropriate left-turn phasing was determined based on guidance from ODOT's *Traffic Signal Policy and Guidelines* (Reference 7). The reported traffic signal operations and following queueing summary therefore includes these left-turn phasing assumptions.

SW Oregon Street

Given the anticipated future traffic volumes and characteristics, protected/permissive left-turn signal phasing should be provided along SW Oregon Street. Under future year 2045 AM peak hour traffic volumes, the product of the southbound left-turn and northbound through volumes exceeds the 50,000 threshold for protected/permissive phasing. Additionally, given the industrial nature of the TEA, heavy vehicles are expected to routinely make the southbound left-turn to Ice Age Drive which further supports providing protected left-turn phasing.

Ice Age Drive

Per the ODOT guidance, permissive left-turn phasing should be provided along Ice Age Drive. Given the future 2045 eastbound and westbound through volumes, the product of opposing through and left-turn hourly volumes in future year 2045 is well below the 50,000 threshold for protected/permissive phasing. Additionally, by not providing eastbound or westbound protected left-turn phases, more green time is available for the higher volume northbound and southbound approaches.

Queueing

The forecast 95th-percentile queues were examined at SW Oregon Street / Ice Age Drive. Table 4 provides a summary of the key project 2045 95th percentile queues by approach, rounded up to the nearest 25 feet (approximately one vehicle length).

Table 4 – SW Oregon Street / Ice Age Drive Future Year 2045 95th Percentile Queues

Intersection	Movement	95th Percentile Queue Length (feet)		Recommended Storage Length (feet)
		AM	PM	
1 SW Oregon Street / Ice Age Drive	Northbound left	≤25	≤25	100
	Northbound through	125	100	-
	Northbound right	50	≤25	125
	Westbound left	≤25	75	75
	Westbound through/right	≤25	125	-
	Southbound left	≤25	≤25	150 ¹
	Southbound through/right	50	250	-
	Eastbound left/through/right	≤25	≤25	-

¹250 feet of storage is needed for the 95th percentile southbound through/right queues to avoid blocking the southbound left-turn vehicles, however, to provide adequate space for a northbound left-turn vehicle using the driveway approximately 350 feet north of the driveway, a storage length of 150 feet is recommended.

Queueing analysis outlined in Table 4 suggests 125 foot storage lengths are needed for the left-turn and right-turn lanes to ensure the turn lanes will not be blocked by northbound through vehicles stopped at the signal. Given the low northbound left-turn volume, a 100 foot storage length is recommended. The right turn lane taper shall be designed per *Washington County Road Standard* section 320.050 Transitions.

Additionally, the queuing analysis suggests 250 feet of southbound left-turn storage is needed to provide sufficient storage for southbound left-turn vehicles to not be impeded by through vehicles queues at the traffic signal. However, to avoid the left-turn lane taper occurring at the driveway approximately 350 feet north of the intersection, and to allow a northbound left-turn at this driveway to use the two-way left-turn lane to wait for a gap, a 150 foot southbound left-turn lane is recommended.

As shown in Figures 6 and 7, forecast 2045 95th percentile queues on SW Oregon Street are not anticipated to restrict access to any driveways along Oregon Street with the exception of the existing residential driveway that will closed and reconfigured to use the new traffic signal once constructed.

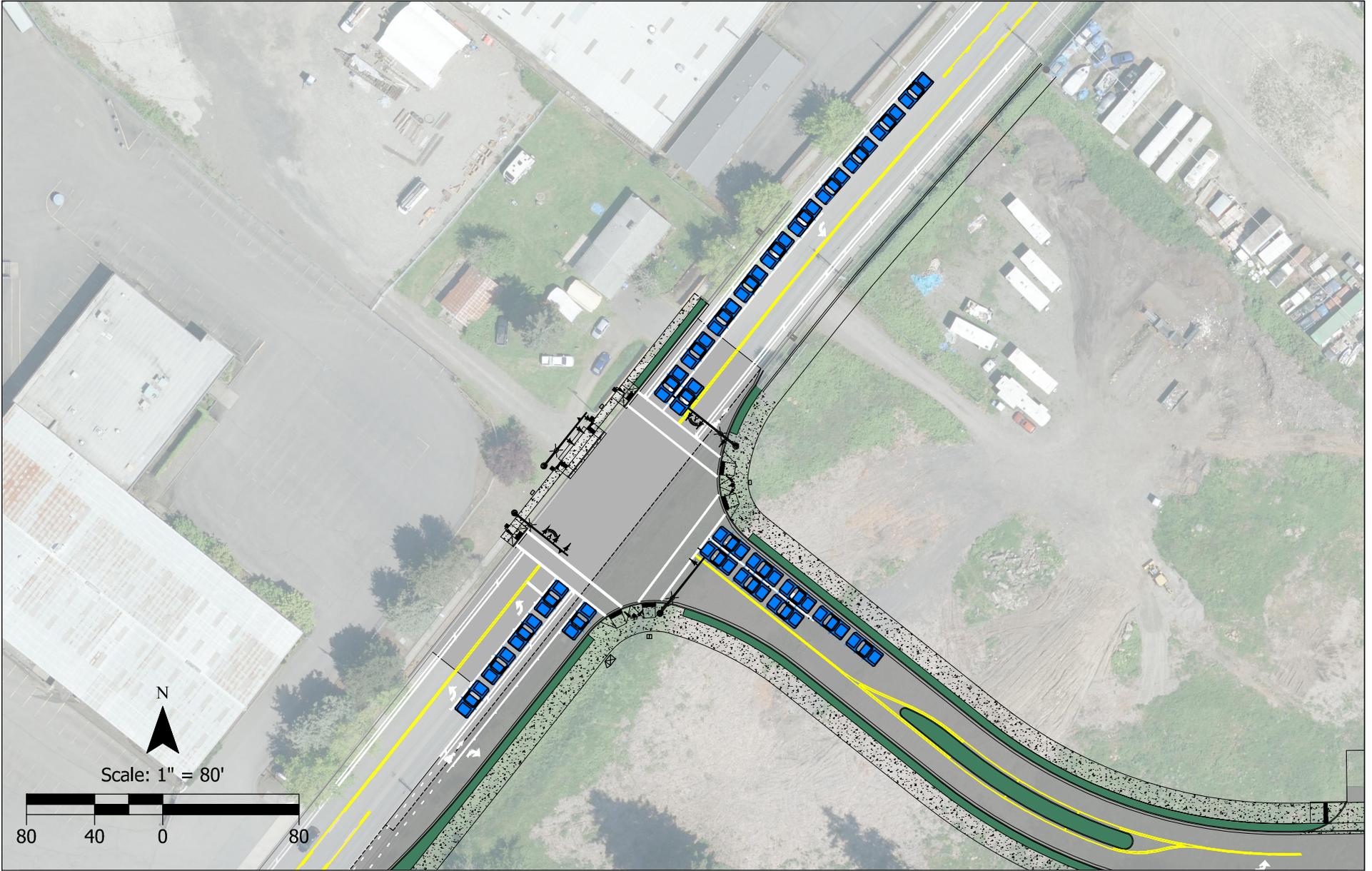
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95th Percentile Queues
AM Peak Hour
Sherwood, Oregon

Figure
6

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95th Percentile Queues
PM Peak Hour
Sherwood, Oregon

Figure
7

SW Oregon Street Cross Section

The proposed cross section on SW Oregon Street will provide centerline-to-curb width consistent with Washington County ultimate collector cross section on the east side of the roadway. However, as the project is only constructing a partial widening, the interim striping will provide 12 foot wide left-turn lanes (consistent with the existing condition) and the extra 1 foot width will be included in the bicycle lane. This is consistent with the recently approved Sherwood Commerce Center SW Oregon Street frontage improvements. See the figure on the following page for the proposed cross sections.

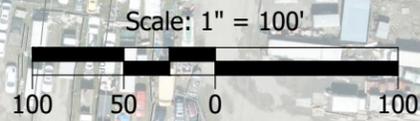
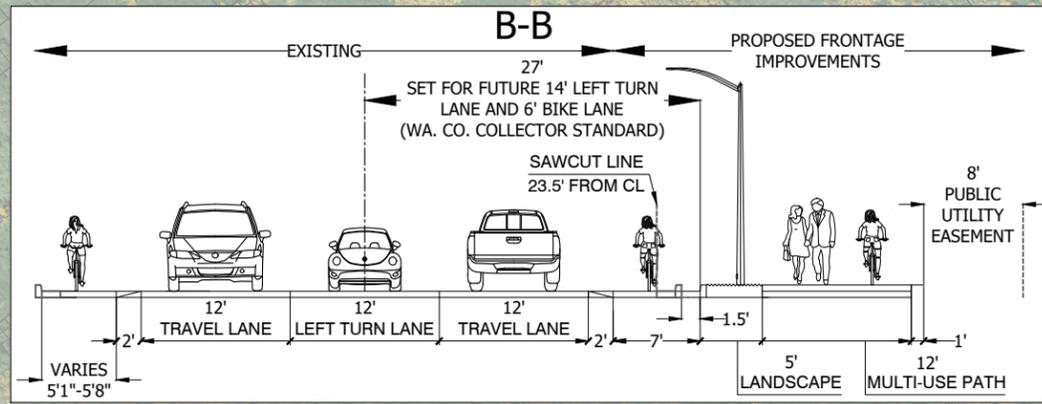
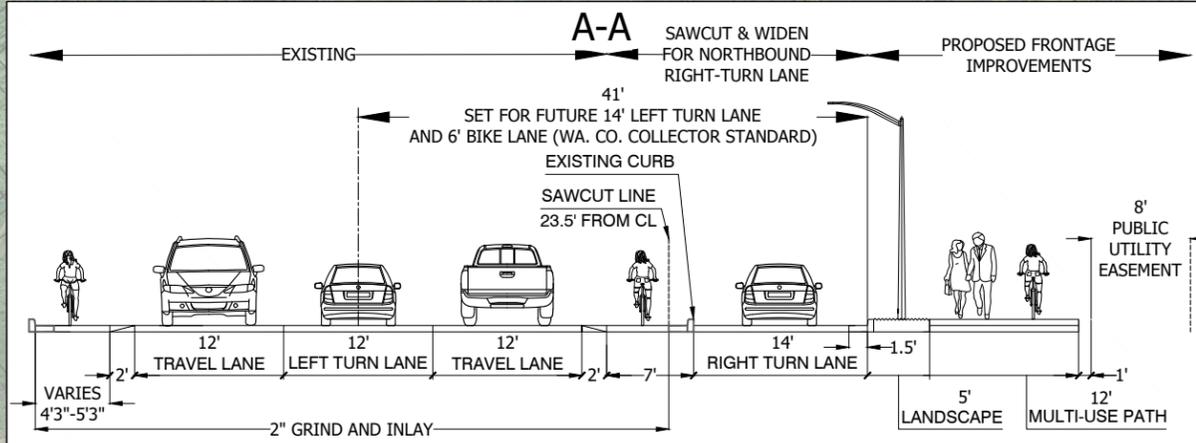
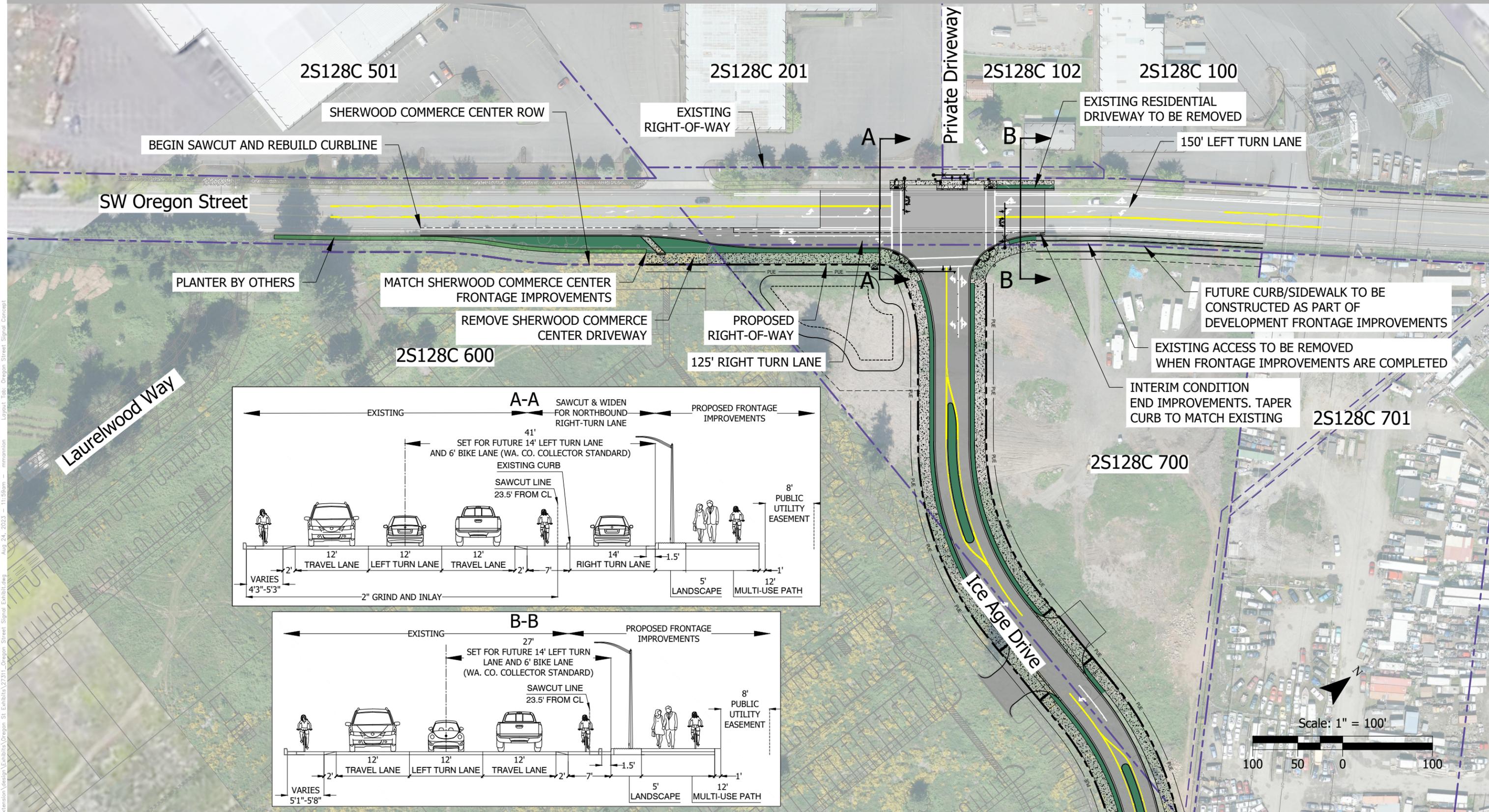
Additionally, north of the new SW Oregon Street/Ice Age Drive intersection, the City plans to terminate the new SW Oregon Street curbline just beyond the curb return radius and provide a taper back to the existing curb which is offset approximately 1 foot inward. The remaining curbline reconstruction and frontage improvements along Taxlot 2S128C700 would be provided by others at time of property redevelopment.

Truck Turning

Considering the industrial nature of the TEA, truck turning checks of a WB-67 design vehicle utilizing Autoturn software were conducted at the planned SW Oregon Street/Ice Age Drive intersection. The county minimum 40-foot curb return radii for arterial-collector intersections would not accommodate the design vehicle turning movements; therefore, the proposed geometric design uses "two-center" curves at the northeast and southeast corners of the intersection. The supporting truck turning exhibits are provided in Appendix G.

Figure 8 - Concept Layout

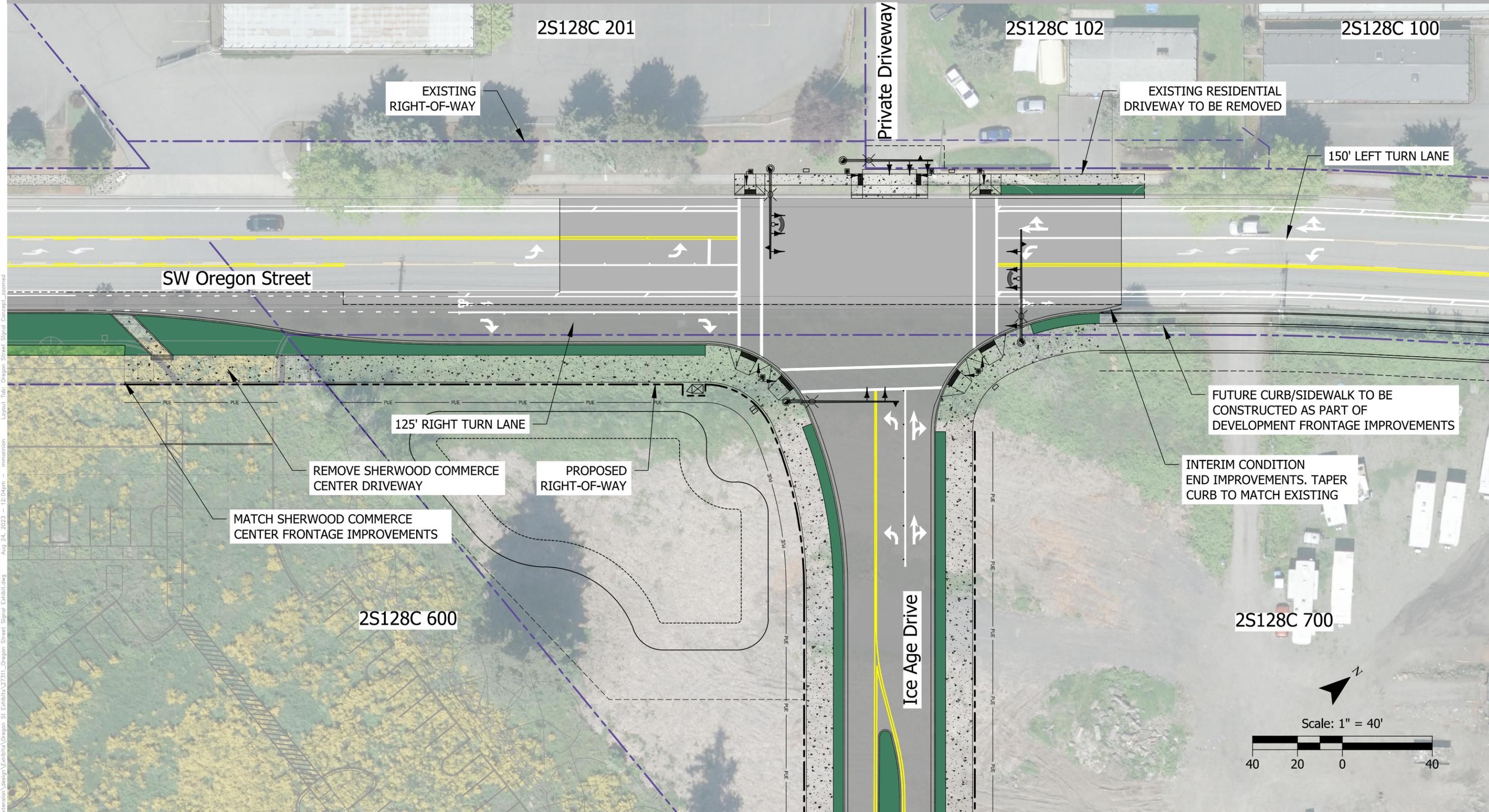
Preliminary Design Subject to Change
Date: August 2023



H:\271\27311 - Ice Age Drive Extension\Design\Exhibits\Oregon St Exhibits\27311_Oregon Street Signal Exhibit.dwg Aug 24, 2023 11:59am mmmmmmm

Figure 9 - Concept Layout

Preliminary Design Subject to Change
Date: August 2023



Layout Tab: Oregon Street Signal Concept_zoomed
Aug 24, 2023 - 12:04pm - rmmann
H:\271\27311 - Ice Age Drive Extension\design\Exhibits\Oregon St Exhibits\27311_Oregon Street Signal Exhibit.dwg

Summary of Key Findings and Recommendations

Based on the completed traffic analysis the following findings and recommendations should be carried forward to the final design of Ice Age Drive:

- The intersection of SW 124th Avenue / Ice Age Drive should remain a two-way stop control in the near term. Future volumes on Ice Age Drive should be monitored and the need for a traffic signal be evaluated with future development applications.
- A traffic signal at the intersection of SW Oregon Street / Ice Age Drive should be installed with the construction of Ice Age Drive. Key signal design considerations include:
 - Closing the residential driveway from Taxlot 2S128C102 immediately north of the new SW Oregon Street / Ice Age Drive signalized intersection, as outlined in the *Oregon Street Access Management Plan* completed in 2021.
 - Closing the existing direct access from Taxlot 2S128C700 (currently City owned) at the time of redevelopment, as a new access will be provided to Ice Age Drive.
 - Constructing a northbound right-turn lane with 125 feet of storage and a taper designed per *Washington County Road Standard* section 320.050 Transitions.
 - Removing the temporary Sherwood Commerce Center driveway on SW Oregon Street.
 - Re-striping a southbound left-turn lane at the new traffic signal with 150 feet of storage and then a continuation of the existing center turn lane.
 - Implementing protected-permissive left-turn phasing on SW Oregon Street and permissive left-turn phasing on Ice Age Drive.

References

1. Transportation Research Board. *Highway Capacity Manual, 6th Edition*. 2016.
2. Transportation Research Board. *Highway Capacity Manual 2000*. 2000.
3. City of Sherwood. *Transportation System Plan Update*. 2014.
4. Oregon Metro. *2014 Regional Transportation Plan*. 2014.
5. Institute of Transportation Engineers. *Trip Generation Manual, 11th Edition*. 2021.
6. DKS Associates. *Sherwood Oregon Street Access Management Plan (AMP)*. 2021
7. Oregon Department of Transportation. *Traffic Signal Policy and Guidelines*. 2023.

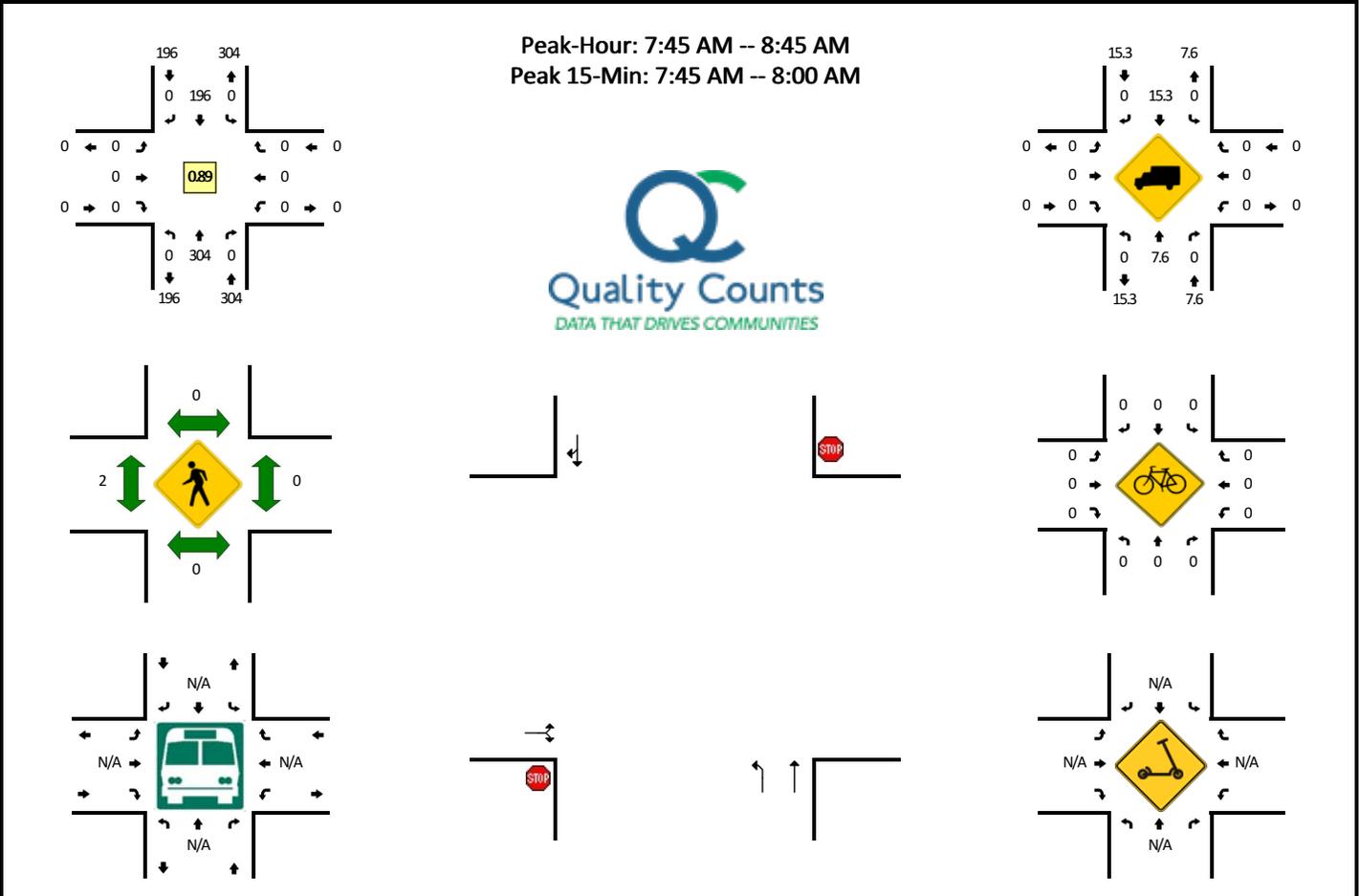
Appendices

- A. 2022 Traffic Counts Data Sheets
- B. Washington County Travel Demand Modeling
- C. 2025 Synchro Operations and Signal Warrant Worksheets
- D. 2045 Synchro Operations and Signal Warrant Worksheets
- E. 2045 Sensitivity Synchro Operations and Signal Warrant Worksheets
- F. Oregon Street Access Management Plan (AMP)
- G. WB-67 Truck Turning Exhibits

Appendix A: 2022 Traffic Counts Data Sheets

LOCATION: Southwest Oregon Street -- Dwy just north of Allied Systems Dwy
CITY/STATE: Sherwood, OR

QC JOB #: 15788603
DATE: Thu, Apr 28 2022

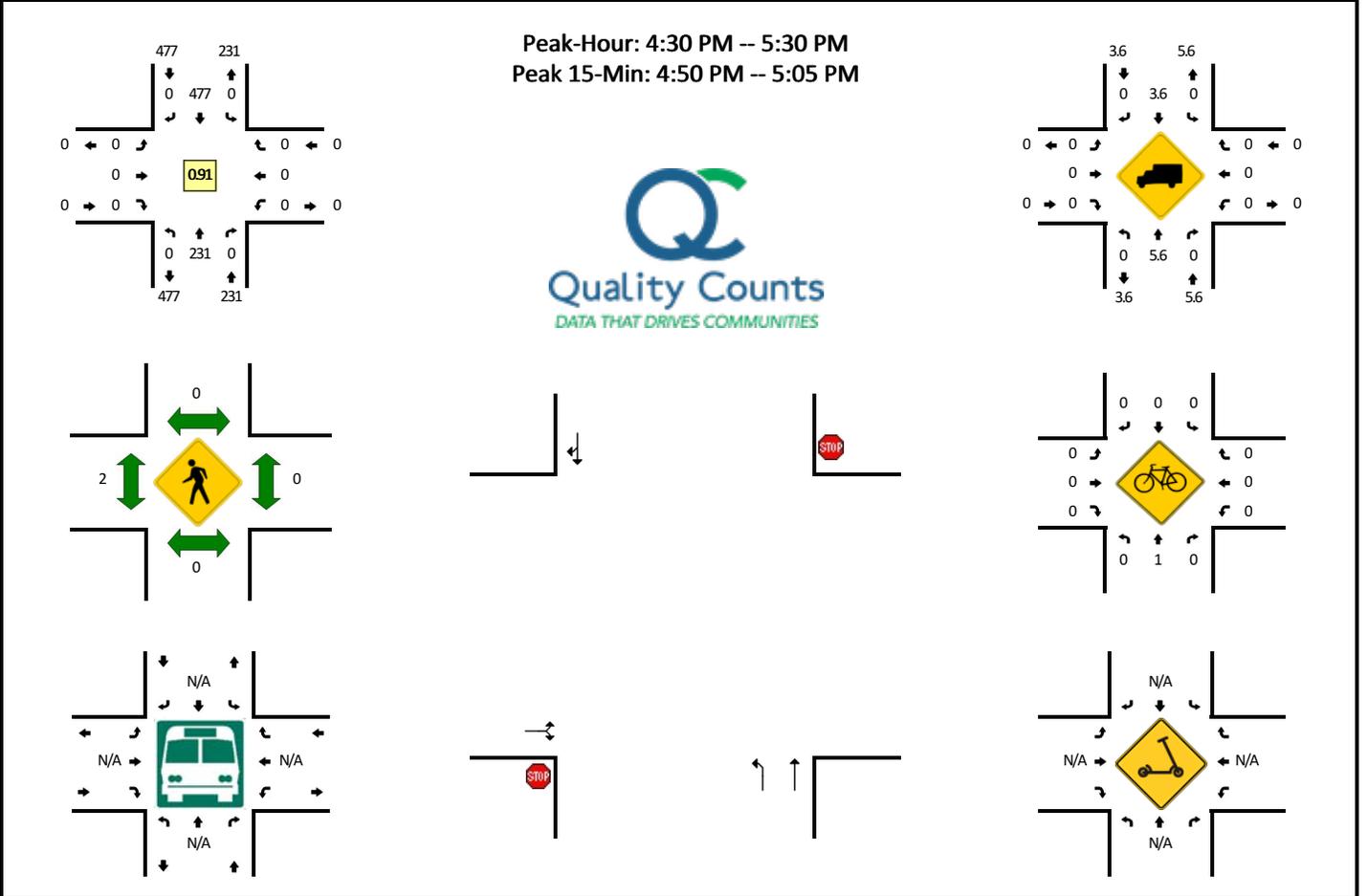


5-Min Count Period Beginning At	Southwest Oregon Street (Northbound)				Southwest Oregon Street (Southbound)				Dwy just north of Allied Systems Dwy (Eastbound)				Dwy just north of Allied Systems Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	22	0	0	0	17	0	0	0	0	0	0	0	0	0	0	39	
7:05 AM	0	24	0	0	0	10	0	0	0	0	0	0	0	0	0	0	34	
7:10 AM	0	20	0	0	0	13	0	0	0	0	0	0	0	0	0	0	33	
7:15 AM	0	28	0	0	0	7	0	0	0	0	0	0	0	0	0	0	35	
7:20 AM	0	25	0	0	0	10	0	0	0	0	0	0	0	0	0	0	35	
7:25 AM	0	23	0	0	0	9	0	0	0	0	0	0	0	0	0	0	32	
7:30 AM	0	26	0	0	0	11	0	0	0	0	0	0	0	0	0	0	37	
7:35 AM	0	28	0	0	0	11	0	0	0	0	0	0	0	0	0	0	39	
7:40 AM	0	31	0	0	0	11	0	0	0	0	0	0	0	0	0	0	42	
7:45 AM	0	33	0	0	0	12	0	0	0	0	0	0	0	0	0	0	45	
7:50 AM	0	30	0	0	0	19	0	0	0	0	0	0	0	0	0	0	49	
7:55 AM	0	24	0	0	0	23	0	0	0	0	0	0	0	0	0	0	47	467
8:00 AM	0	13	0	0	0	20	0	0	0	0	0	0	0	0	0	0	33	461
8:05 AM	0	24	0	0	0	11	0	0	0	0	0	0	0	0	0	0	35	462
8:10 AM	0	24	0	0	0	14	0	0	0	0	0	0	0	0	0	0	38	467
8:15 AM	0	31	0	0	0	15	0	0	0	0	0	0	0	0	0	0	46	478
8:20 AM	0	23	0	0	0	21	0	0	0	0	0	0	0	0	0	0	44	487
8:25 AM	0	22	0	0	0	13	0	0	0	0	0	0	0	0	0	0	35	490
8:30 AM	0	20	0	0	0	9	0	0	0	0	0	0	0	0	0	0	29	482
8:35 AM	0	29	0	0	0	15	0	0	0	0	0	0	0	0	0	0	44	487
8:40 AM	0	31	0	0	0	24	0	0	0	0	0	0	0	0	0	0	55	500
8:45 AM	0	20	0	0	0	15	0	0	0	0	0	0	0	0	0	0	35	490
8:50 AM	0	22	0	0	0	13	0	0	0	0	0	0	0	0	0	0	35	476
8:55 AM	0	17	0	0	0	12	0	0	0	0	0	0	0	0	0	0	29	458
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	348	0	0	0	216	0	0	0	0	0	0	0	0	0	0	564	
Heavy Trucks	0	16	0	0	0	28	0	0	0	0	0	0	0	0	0	0	44	
Buses																	0	
Pedestrians		0				0					0			0			0	
Bicycles	0	0	0		0	0	0			0	0	0		0	0		0	
Scoters																	0	

Comments:

LOCATION: Southwest Oregon Street -- Dwy just north of Allied Systems Dwy
CITY/STATE: Sherwood, OR

QC JOB #: 15788604
DATE: Wed, Apr 27 2022



5-Min Count Period Beginning At	Southwest Oregon Street (Northbound)				Southwest Oregon Street (Southbound)				Dwy just north of Allied Systems Dwy (Eastbound)				Dwy just north of Allied Systems Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	10	0	0	0	30	0	0	0	0	0	0	0	0	0	0	40	
4:05 PM	0	30	0	0	0	28	0	0	0	0	0	0	0	0	0	0	58	
4:10 PM	1	12	0	0	0	35	0	0	0	0	0	0	0	0	0	0	48	
4:15 PM	0	15	0	0	0	30	0	0	0	0	0	0	0	0	0	0	45	
4:20 PM	0	11	0	0	0	40	0	0	0	0	0	0	0	0	0	0	51	
4:25 PM	0	17	0	0	0	34	0	0	0	0	0	0	0	0	0	0	51	
4:30 PM	0	20	0	0	0	35	0	0	0	0	0	0	0	0	0	0	55	
4:35 PM	0	17	0	0	0	35	0	0	0	0	0	0	0	0	0	0	52	
4:40 PM	0	18	0	0	0	44	0	0	0	0	0	0	0	0	0	0	62	
4:45 PM	0	22	0	0	0	35	0	0	0	0	0	0	0	0	0	0	57	
4:50 PM	0	15	0	0	0	46	0	0	0	0	0	0	0	0	0	0	61	
4:55 PM	0	19	0	0	0	42	0	0	0	0	0	0	0	0	0	0	61	641
5:00 PM	0	17	0	0	0	55	0	0	0	0	0	0	0	0	0	0	72	673
5:05 PM	0	18	0	0	0	40	0	0	0	0	0	0	0	0	0	0	58	673
5:10 PM	0	30	0	0	0	31	0	0	0	0	0	0	0	0	0	0	61	686
5:15 PM	0	15	0	0	0	31	0	0	0	0	0	0	0	0	0	0	46	687
5:20 PM	0	24	0	0	0	39	0	0	0	0	0	0	0	0	0	0	63	699
5:25 PM	0	16	0	0	0	44	0	0	0	0	0	0	0	0	0	0	60	708
5:30 PM	0	11	0	0	0	39	0	0	0	0	0	0	0	0	0	0	50	703
5:35 PM	0	13	0	0	0	38	0	0	0	0	0	0	0	0	0	0	51	702
5:40 PM	0	18	0	0	0	28	0	0	0	0	0	0	0	0	0	0	46	686
5:45 PM	0	24	0	0	0	38	0	0	0	0	0	0	0	0	0	0	62	691
5:50 PM	0	14	0	0	0	23	1	0	0	0	0	0	0	0	0	0	38	668
5:55 PM	0	10	0	0	0	24	0	0	0	0	0	0	0	0	0	0	34	641
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	204	0	0	0	572	0	0	0	0	0	0	0	0	0	0	776	
Heavy Trucks	0	12	0	0	0	28	0	0	0	0	0	0	0	0	0	0	40	
Buses																	0	
Pedestrians		0				0					0			0			0	
Bicycles	0	0	0		0	0	0			0	0	0		0	0		0	
Scoters																	0	

Comments:

5-Min Count Period Beginning At	SW 124th St (Northbound)				SW 124th St (Southbound)				SW Blake St (Eastbound)				SW Blake St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
10:35 AM	0	12	0	0	0	25	0	0	0	0	0	0	0	0	0	0	37	466
10:40 AM	0	45	0	0	1	13	0	0	0	0	0	0	0	0	0	0	59	486
10:45 AM	0	16	0	0	2	14	0	0	0	0	0	0	0	0	2	0	34	469
10:50 AM	0	13	0	0	1	14	0	0	0	0	0	0	0	0	0	0	28	457
10:55 AM	0	20	0	0	0	15	0	0	0	0	0	0	0	0	0	0	35	461
11:00 AM	0	22	0	0	0	18	0	0	0	0	0	0	1	0	2	0	43	464
11:05 AM	0	19	0	0	1	19	0	1	0	0	0	0	0	0	0	0	40	479
11:10 AM	0	35	0	0	0	15	0	0	0	0	0	0	0	0	1	0	51	493
11:15 AM	0	18	0	0	0	14	0	0	0	0	0	0	1	0	1	0	34	486
11:20 AM	0	17	0	0	0	18	0	0	0	0	0	0	0	0	0	0	35	466
11:25 AM	0	14	0	0	0	25	0	0	0	0	0	0	0	0	0	0	39	472
11:30 AM	0	16	0	0	0	15	0	0	0	0	0	0	0	0	0	0	31	466
11:35 AM	0	10	0	0	2	15	0	0	0	0	0	0	2	0	2	0	31	460
11:40 AM	0	22	0	0	2	12	0	0	0	0	0	0	0	0	0	0	36	437
11:45 AM	0	11	0	0	2	20	0	0	0	0	0	0	0	0	1	0	34	437
11:50 AM	0	28	0	0	1	19	0	0	0	0	0	0	1	0	1	0	50	459
11:55 AM	0	20	0	0	0	19	0	0	0	0	0	0	1	0	0	0	40	464
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12:05 PM	0	17	1	0	1	20	0	0	0	0	0	0	0	0	1	0	40	470
12:10 PM	0	13	0	0	2	19	0	0	0	0	0	0	0	0	1	0	35	454
12:15 PM	0	20	0	0	1	15	0	0	0	0	0	0	0	0	4	0	40	460
12:20 PM	0	21	1	0	0	26	0	0	0	0	0	0	0	0	0	0	48	473
12:25 PM	0	13	0	0	1	23	0	0	0	0	0	0	0	0	2	0	39	473
12:30 PM	0	17	0	0	1	11	0	1	0	0	0	0	0	0	2	0	32	474
12:35 PM	0	15	0	0	3	17	0	0	0	0	0	0	0	0	0	0	35	478
12:40 PM	0	24	0	0	2	11	0	1	0	0	0	0	0	0	0	0	38	480
12:45 PM	0	17	0	0	1	23	0	0	0	0	0	0	0	0	0	0	41	487
12:50 PM	0	12	0	0	4	25	0	0	0	0	0	0	0	0	1	0	42	479
12:55 PM	0	24	1	0	5	21	0	0	0	0	0	0	0	0	1	0	52	491
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1:05 PM	0	13	0	0	3	28	0	0	0	0	0	0	0	0	2	0	46	481
1:10 PM	0	17	0	1	0	16	0	0	0	0	0	0	0	0	0	0	34	480
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1:20 PM	0	20	0	0	0	19	0	0	0	0	0	0	0	0	0	0	39	474
1:25 PM	0	24	0	0	2	21	0	0	0	0	0	0	1	0	3	0	51	486
1:30 PM	0	15	0	0	0	19	0	0	0	0	0	0	0	0	0	0	34	488
1:35 PM	0	15	0	0	0	16	0	0	0	0	0	0	0	0	1	0	32	485
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1:55 PM	0	23	0	0	0	20	0	0	0	0	0	0	0	0	1	0	44	480
2:00 PM	0	19	0	0	0	20	0	0	0	0	0	0	0	0	0	0	39	486
2:05 PM	0	19	0	0	0	24	0	0	0	0	0	0	0	0	1	0	44	484
2:10 PM	0	26	0	0	0	28	0	0	0	0	0	0	1	0	1	0	56	506
2:15 PM	0	17	1	0	0	27	0	0	0	0	0	0	0	0	1	0	46	509
2:20 PM	0	22	0	0	1	17	0	0	0	0	0	0	0	0	0	0	40	510
2:25 PM	0	23	1	0	1	22	0	0	0	0	0	0	0	0	3	0	50	509
2:30 PM	0	29	0	0	0	35	0	0	0	0	0	0	0	0	1	0	65	540
2:35 PM	0	18	1	0	0	31	0	0	0	0	0	0	0	0	2	0	52	560
2:40 PM	0	20	0	0	0	40	0	0	0	0	0	0	0	0	1	0	61	578
2:45 PM	0	30	0	0	1	18	0	0	0	0	0	0	0	0	1	0	50	585
2:50 PM	0	36	0	0	0	28	0	0	0	0	0	0	0	0	3	0	67	614
2:55 PM	0	27	1	0	0	23	0	1	0	0	0	0	0	0	0	0	52	622
3:00 PM	0	17	0	0	0	28	0	0	0	0	0	0	0	0	5	0	50	633
3:05 PM	0	27	0	0	0	28	0	0	0	0	0	0	0	0	0	0	55	644
3:10 PM	0	23	0	0	1	31	0	0	0	0	0	0	0	0	0	0	55	643
3:15 PM	0	26	0	0	0	33	0	0	0	0	0	0	0	0	4	0	63	660
3:20 PM	0	21	0	0	0	24	0	0	0	0	0	0	0	0	1	0	46	666
3:25 PM	0	24	0	0	0	47	0	0	0	0	0	0	0	0	1	0	72	688
3:30 PM	0	22	0	0	0	45	0	0	0	0	0	0	0	0	3	0	70	693
3:35 PM	0	29	0	0	1	60	0	0	0	0	0	0	0	0	1	0	91	732
3:40 PM	0	19	0	0	0	55	0	0	0	0	0	0	0	0	1	0	75	746
3:45 PM	0	37	0	0	0	42	0	0	0	0	0	0	0	0	2	0	81	777
3:50 PM	0	26	0	0	0	39	0	0	0	0	0	0	0	0	1	0	66	776
3:55 PM	0	29	0	0	0	31	0	0	0	0	0	0	0	0	1	0	61	785
4:00 PM	0	49	0	0	0	36	0	0	0	0	0	0	0	0	0	0	85	820
4:05 PM	0	39	0	0	0	38	0	0	0	0	0	0	0	0	4	0	81	846
4:10 PM	0	35	0	0	0	42	0	0	0	0	0	0	0	0	0	0	77	868
4:15 PM	0	28	1	0	0	39	0	0	0	0	0	0	0	0	2	0	70	875
4:20 PM	0	24	0	0	0	44	0	0	0	0	0	0	0	0	3	0	71	900
4:25 PM	0	23	0	0	0	38	0	0	0	0	0	0	1	0	6	0	68	896
4:30 PM	0	26	1	0	0	36	0	0	0	0	0	0	0	0	6	0	69	895
4:35 PM	0	26	0	0	0	40	0	0	0	0	0	0	0	0	5	0	71	875
4:40 PM	0	24	1	0	0	44	0	0	0	0	0	0	0	0	5	0	74	874
4:45 PM	0	34	0	0	0	58	0	0	0	0	0	0	0	0	1	0	93	886
4:50 PM	0	26	0	0	1	39	0	0	0	0	0	0	1	0	2	0	69	889
4:55 PM	0	24	0	0	1	39	0	0	0	0	0	0	0	0	2	0	66	894
5:00 PM	0	26	0	0	0	33	0	0	0	0	0	0	0	0	3	0	62	871
5:05 PM	0	25	1	0	0	51	0	0	0	0	0	0	1	0	5	0	83	873
5:10 PM	0	32	0	0	0	40	0	0	0	0	0	0	0	0	1	0	73	869
5:15 PM	0	30	0	0	1	51	0	0	0	0	0	0	1	0	1	0	84	883
5:20 PM	0	21	0	0	0	26	0	0	0	0	0	0	0	0	2	0	49	861
5:25 PM	0	27	0	0	0	43	0	0	0	0	0	0	0	0	0	0	70	863
5:30 PM	0	23	1	0	0	38	0	0	0	0	0	0	0	0	3	0	65	859
5:35 PM	0	23	0	0	0	34	0	0	0	0	0	0	0	0	4	0	61	849
5:40 PM	0	12	0	0	0	27	0	0	0	0	0	0	2	0	4	0	45	820
5:45 PM	0	23	0	0	0	28	0	0	0	0	0	0	0	0	1	0	52	779

5-Min Count Period Beginning At	SW 124th St (Northbound)				SW 124th St (Southbound)				SW Blake St (Eastbound)				SW Blake St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
5:50 PM	0	15	0	0	0	32	0	0	0	0	0	0	1	0	0	0	48	758
5:55 PM	0	19	0	0	0	26	0	0	0	0	0	0	0	0	0	0	45	737
6:00 PM	0	21	0	0	0	23	0	0	0	0	0	0	0	0	2	0	46	721
6:05 PM	0	14	0	0	0	38	0	0	0	0	0	0	1	0	0	0	53	691
6:10 PM	0	17	0	0	1	27	0	0	0	0	0	0	0	0	3	0	48	666
6:15 PM	0	14	0	0	0	16	0	0	0	0	0	0	0	0	0	0	30	612
6:20 PM	0	17	0	0	1	21	0	0	0	0	0	0	0	0	0	0	39	602
6:25 PM	0	12	0	0	1	25	0	0	0	0	0	0	0	0	1	0	39	571
6:30 PM	0	13	0	0	0	15	0	0	0	0	0	0	0	0	3	0	31	537
6:35 PM	0	15	0	0	0	20	0	0	0	0	0	0	0	0	1	0	36	512
6:40 PM	0	17	0	0	0	19	0	0	0	0	0	0	0	0	1	0	37	504
6:45 PM	0	11	0	0	1	14	0	0	0	0	0	0	0	0	0	0	26	478
6:50 PM	0	19	0	0	0	23	0	0	0	0	0	0	0	0	1	0	43	473
6:55 PM	0	12	0	0	0	19	0	0	0	0	0	0	0	0	0	0	31	459
7:00 PM	0	12	0	0	1	10	0	0	0	0	0	0	0	0	2	0	25	438
7:05 PM	0	12	0	0	0	11	0	0	0	0	0	0	0	0	0	0	23	408
7:10 PM	0	9	0	0	0	12	0	0	0	0	0	0	0	0	1	0	22	382
7:15 PM	0	14	0	0	0	10	0	0	0	0	0	0	0	0	0	0	24	376
7:20 PM	0	6	0	0	0	19	0	0	0	0	0	0	0	0	0	0	25	362
7:25 PM	0	10	0	0	0	15	0	0	0	0	0	0	0	0	1	0	26	349
7:30 PM	0	9	0	0	0	9	0	0	0	0	0	0	0	0	0	0	18	336
7:35 PM	0	6	0	0	0	24	0	0	0	0	0	0	0	0	0	0	30	330
7:40 PM	0	11	0	0	0	9	0	0	0	0	0	0	0	0	0	0	20	313
7:45 PM	0	17	0	0	0	14	0	0	0	0	0	0	0	0	0	0	31	318
7:50 PM	0	9	0	0	0	17	0	0	0	0	0	0	0	0	0	0	26	301
7:55 PM	0	9	0	0	0	15	0	0	0	0	0	0	0	0	0	0	24	294
8:00 PM	0	12	0	0	0	3	0	0	0	0	0	0	0	0	0	0	15	284
8:05 PM	0	3	0	0	0	8	0	0	0	0	0	0	0	0	0	0	11	272
8:10 PM	0	11	0	0	0	16	0	0	0	0	0	0	0	0	0	0	27	277
8:15 PM	0	10	0	0	0	11	0	0	0	0	0	0	0	0	0	0	21	274
8:20 PM	0	7	0	0	0	11	0	0	0	0	0	0	0	0	0	0	18	267
8:25 PM	0	8	0	0	0	9	0	0	0	0	0	0	0	0	0	0	17	258
8:30 PM	0	8	0	0	0	9	0	0	0	0	0	0	0	0	0	0	17	257
8:35 PM	0	8	0	0	0	6	0	0	0	0	0	0	0	0	0	0	14	241
8:40 PM	0	8	0	0	0	10	0	0	0	0	0	0	0	0	0	0	18	239
8:45 PM	0	8	0	0	0	7	0	0	0	0	0	0	0	0	0	0	15	223
8:50 PM	0	5	0	0	0	7	0	0	0	0	0	0	0	0	0	0	12	209
8:55 PM	0	4	0	0	0	7	0	0	0	0	0	0	0	0	0	0	11	196
9:00 PM	0	2	0	0	0	9	0	0	0	0	0	0	0	0	0	0	11	192
9:05 PM	0	3	0	0	0	6	0	0	0	0	0	0	0	0	0	0	9	190
9:10 PM	0	3	0	0	0	8	0	0	0	0	0	0	0	0	0	0	11	174
9:15 PM	0	2	0	0	0	7	0	0	0	0	0	0	0	0	0	0	9	162
9:20 PM	0	3	0	0	0	15	0	0	0	0	0	0	0	0	0	0	18	162
9:25 PM	0	4	0	0	0	5	0	0	0	0	0	0	0	0	0	0	9	154
9:30 PM	0	8	0	0	0	4	0	0	0	0	0	0	0	0	0	0	12	149
9:35 PM	0	2	0	0	0	6	0	0	0	0	0	0	0	0	1	0	9	144
9:40 PM	0	3	0	0	0	4	0	0	0	0	0	0	0	0	0	0	7	133
9:45 PM	0	7	0	0	0	5	0	0	0	0	0	0	0	0	0	0	12	130
9:50 PM	0	3	0	0	0	6	0	1	0	0	0	0	0	0	0	0	10	128
9:55 PM	0	6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7	124
10:00 PM	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	5	118
10:05 PM	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	4	113
10:10 PM	0	3	1	0	0	9	0	0	0	0	0	0	0	0	0	0	13	115
10:15 PM	0	2	0	0	0	5	0	0	0	0	0	0	0	0	0	0	7	113
10:20 PM	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	6	101
10:25 PM	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	5	97
10:30 PM	0	7	0	0	0	3	0	0	0	0	0	0	0	0	0	0	10	95
10:35 PM	0	1	0	0	0	6	0	0	0	0	0	0	0	0	0	0	7	93
10:40 PM	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	6	92
10:45 PM	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	7	87
10:50 PM	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	80
10:55 PM	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	3	76
11:00 PM	0	0	0	0	0	5	0	0	0	0	0	0	2	0	2	0	9	80
11:05 PM	0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	5	81
11:10 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	70
11:15 PM	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	67
11:20 PM	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	65
11:25 PM	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	62
11:30 PM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	54
11:35 PM	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	50
11:40 PM	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	4	48
11:45 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	42
11:50 PM	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5	44
11:55 PM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	43
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	340	0	0	4	628	0	0	0	0	0	0	0	0	16	0	988	
Heavy Trucks	0	52	0	0	0	84	0	0	0	0	0	0	0	0	0	0	136	
Buses																	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																	0	

Comments:

Appendix B: Washington County Travel Demand Modeling

Appendix C: 2025 Synchro Operations and Signal Warrant Worksheets

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕↕		↵	↕↕	
Traffic Vol, veh/h	29	10	2	4	4	3	4	363	30	43	338	58
Future Vol, veh/h	29	10	2	4	4	3	4	363	30	43	338	58
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	32	11	2	4	4	3	4	399	33	47	371	64

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	707	937	218	709	953	216	435	0	0	432	0	0
Stage 1	497	497	-	424	424	-	-	-	-	-	-	-
Stage 2	210	440	-	285	529	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	317	258	777	316	253	779	1100	-	-	1103	-	-
Stage 1	516	536	-	570	578	-	-	-	-	-	-	-
Stage 2	764	568	-	690	518	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	300	246	777	294	241	779	1100	-	-	1103	-	-
Mov Cap-2 Maneuver	300	246	-	294	241	-	-	-	-	-	-	-
Stage 1	514	513	-	568	576	-	-	-	-	-	-	-
Stage 2	752	566	-	645	496	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	18.5		16.4		0.1		0.8	
HCM LOS	C		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1100	-	-	300	278	294	342	1103	-	-
HCM Lane V/C Ratio	0.004	-	-	0.106	0.047	0.015	0.022	0.043	-	-
HCM Control Delay (s)	8.3	-	-	18.4	18.6	17.4	15.8	8.4	-	-
HCM Lane LOS	A	-	-	C	C	C	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0.1	0	0.1	0.1	-	-

Intersection												
Int Delay, s/veh	2.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕		↵	↕	
Traffic Vol, veh/h	59	5	4	22	14	36	2	377	4	3	542	29
Future Vol, veh/h	59	5	4	22	14	36	2	377	4	3	542	29
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	65	5	4	24	15	40	2	414	4	3	596	32

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	837	1040	314	727	1054	209	628	0	0	418	0	0
Stage 1	618	618	-	420	420	-	-	-	-	-	-	-
Stage 2	219	422	-	307	634	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	254	224	673	306	220	788	930	-	-	1116	-	-
Stage 1	436	472	-	573	580	-	-	-	-	-	-	-
Stage 2	755	579	-	669	464	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	228	223	673	297	219	788	930	-	-	1116	-	-
Mov Cap-2 Maneuver	228	223	-	297	219	-	-	-	-	-	-	-
Stage 1	435	471	-	572	579	-	-	-	-	-	-	-
Stage 2	697	578	-	655	463	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	25.6		15.3		0		0	
HCM LOS	D		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	930	-	-	228	317	297	456	1116	-	-
HCM Lane V/C Ratio	0.002	-	-	0.284	0.031	0.081	0.12	0.003	-	-
HCM Control Delay (s)	8.9	-	-	26.9	16.7	18.2	14	8.2	-	-
HCM Lane LOS	A	-	-	D	C	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1.1	0.1	0.3	0.4	0	-	-

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	2	26	1	19	2	301	78	77	193	2
Future Vol, veh/h	2	1	2	26	1	19	2	301	78	77	193	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	11	5
Mvmt Flow	2	1	2	29	1	21	2	334	87	86	214	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	780	812	215	771	770	378	216	0	0	421	0	0
Stage 1	387	387	-	382	382	-	-	-	-	-	-	-
Stage 2	393	425	-	389	388	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	309	310	817	313	328	662	1336	-	-	1122	-	-
Stage 1	631	604	-	634	607	-	-	-	-	-	-	-
Stage 2	626	581	-	629	604	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	281	286	817	293	302	662	1336	-	-	1122	-	-
Mov Cap-2 Maneuver	281	286	-	293	302	-	-	-	-	-	-	-
Stage 1	630	557	-	633	606	-	-	-	-	-	-	-
Stage 2	604	580	-	578	557	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	14.5		15.3		0		2.4	
HCM LOS	B		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1336	-	-	383	293	625	1122	-	-
HCM Lane V/C Ratio	0.002	-	-	0.015	0.099	0.036	0.076	-	-
HCM Control Delay (s)	7.7	-	-	14.5	18.6	11	8.5	-	-
HCM Lane LOS	A	-	-	B	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0.1	0.2	-	-

Intersection												
Int Delay, s/veh	3.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	1	79	1	76	2	230	29	20	482	2
Future Vol, veh/h	2	1	1	79	1	76	2	230	29	20	482	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	4	5
Mvmt Flow	2	1	1	87	1	84	2	253	32	22	530	2

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	891	864	531	849	849	269	532	0	0	285	0	0
Stage 1	575	575	-	273	273	-	-	-	-	-	-	-
Stage 2	316	289	-	576	576	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	260	289	542	278	295	762	1020	-	-	1260	-	-
Stage 1	498	498	-	726	678	-	-	-	-	-	-	-
Stage 2	689	668	-	497	497	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	228	284	542	272	289	762	1020	-	-	1260	-	-
Mov Cap-2 Maneuver	228	284	-	272	289	-	-	-	-	-	-	-
Stage 1	497	490	-	725	677	-	-	-	-	-	-	-
Stage 2	611	667	-	486	489	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	17.9		17.4		0.1		0.3	
HCM LOS	C		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1020	-	-	283	272	746	1260	-	-
HCM Lane V/C Ratio	0.002	-	-	0.016	0.319	0.113	0.017	-	-
HCM Control Delay (s)	8.5	-	-	17.9	24.3	10.4	7.9	-	-
HCM Lane LOS	A	-	-	C	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	1.3	0.4	0.1	-	-

HCM Signalized Intersection Capacity Analysis

8: SW Oregon St & Ice Age Dr

04/21/2023

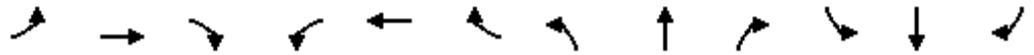


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↑	↗	↖	↖	↗
Traffic Volume (vph)	2	1	2	26	1	19	2	301	78	77	193	2
Future Volume (vph)	2	1	2	26	1	19	2	301	78	77	193	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.95		1.00	0.86		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1678		1719	1550		1719	1792	1538	1719	1710	
Flt Permitted		0.87		0.75	1.00		0.62	1.00	1.00	0.49	1.00	
Satd. Flow (perm)		1484		1365	1550		1127	1792	1538	882	1710	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	2	1	2	29	1	21	2	334	87	86	214	2
RTOR Reduction (vph)	0	2	0	0	19	0	0	0	43	0	0	0
Lane Group Flow (vph)	0	3	0	29	3	0	2	334	44	86	216	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	6%	5%	5%	11%	5%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4		8	8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		5.8		5.8	5.8		26.2	25.6	25.6	32.4	28.7	
Effective Green, g (s)		5.8		5.8	5.8		26.2	25.6	25.6	32.4	28.7	
Actuated g/C Ratio		0.12		0.12	0.12		0.52	0.51	0.51	0.65	0.57	
Clearance Time (s)		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	
Lane Grp Cap (vph)		171		158	179		596	915	785	632	979	
v/s Ratio Prot					0.00		0.00	c0.19		c0.01	c0.13	
v/s Ratio Perm		0.00		c0.02			0.00		0.03	0.08		
v/c Ratio		0.02		0.18	0.02		0.00	0.37	0.06	0.14	0.22	
Uniform Delay, d1		19.6		20.0	19.6		5.7	7.4	6.2	3.4	5.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.0		0.6	0.0		0.0	0.2	0.0	0.1	0.1	
Delay (s)		19.7		20.6	19.7		5.7	7.6	6.2	3.5	5.3	
Level of Service		B		C	B		A	A	A	A	A	
Approach Delay (s)		19.7			20.2			7.3			4.8	
Approach LOS		B			C			A			A	

Intersection Summary		
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.31	A
Actuated Cycle Length (s)	50.1	Sum of lost time (s)
Intersection Capacity Utilization	36.8%	15.0
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		A

HCM 6th Signalized Intersection Summary
 8: SW Oregon St & Ice Age Dr

04/16/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↑	↕	↕	↕	↕
Traffic Volume (veh/h)	2	1	2	26	1	19	2	301	78	77	193	2
Future Volume (veh/h)	2	1	2	26	1	19	2	301	78	77	193	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1826	1826	1826	1826	1826	1826	1826	1811	1826	1826	1737	1826
Adj Flow Rate, veh/h	2	1	2	29	1	21	2	334	87	86	214	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	5	6	5	5	11	5
Cap, veh/h	211	15	30	352	4	94	617	563	481	557	679	6
Arrive On Green	0.06	0.06	0.06	0.06	0.06	0.06	0.00	0.31	0.31	0.09	0.40	0.40
Sat Flow, veh/h	475	238	475	1380	71	1487	1739	1811	1547	1739	1718	16
Grp Volume(v), veh/h	5	0	0	29	0	22	2	334	87	86	0	216
Grp Sat Flow(s),veh/h/ln	1188	0	0	1380	0	1558	1739	1811	1547	1739	0	1734
Q Serve(g_s), s	0.1	0.0	0.0	0.0	0.0	0.4	0.0	4.3	1.1	0.9	0.0	2.4
Cycle Q Clear(g_c), s	0.5	0.0	0.0	0.4	0.0	0.4	0.0	4.3	1.1	0.9	0.0	2.4
Prop In Lane	0.40		0.40	1.00		0.95	1.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	256	0	0	352	0	98	617	563	481	557	0	686
V/C Ratio(X)	0.02	0.00	0.00	0.08	0.00	0.22	0.00	0.59	0.18	0.15	0.00	0.31
Avail Cap(c_a), veh/h	1623	0	0	1652	0	1567	923	2341	2000	1092	0	2615
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.6	0.0	0.0	12.4	0.0	12.4	6.6	8.1	7.0	5.7	0.0	5.8
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.1	0.0	1.1	0.0	1.0	0.2	0.1	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.0	0.3	0.0	0.2	0.0	1.9	0.4	0.3	0.0	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.6	0.0	0.0	12.5	0.0	13.5	6.6	9.1	7.2	5.8	0.0	6.1
LnGrp LOS	B	A	A	B	A	B	A	A	A	A	A	A
Approach Vol, veh/h		5			51			423			302	
Approach Delay, s/veh		12.6			13.0			8.7			6.0	
Approach LOS		B			B			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.4	13.7		6.8	5.1	16.0		6.8				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	11.0	36.0		27.0	5.0	42.0		28.0				
Max Q Clear Time (g_c+I1), s	2.9	6.3		2.5	2.0	4.4		2.4				
Green Ext Time (p_c), s	0.1	2.3		0.0	0.0	1.3		0.2				
Intersection Summary												
HCM 6th Ctrl Delay				8.0								
HCM 6th LOS				A								

HCM Signalized Intersection Capacity Analysis

8: SW Oregon St & Ice Age Dr

04/21/2023

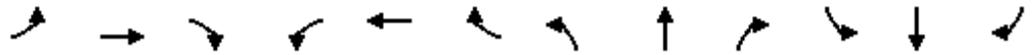


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↑	↗	↖	↖	↗
Traffic Volume (vph)	2	1	1	79	1	76	2	230	29	20	482	2
Future Volume (vph)	2	1	1	79	1	76	2	230	29	20	482	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frt		0.97		1.00	0.85		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1706		1719	1541		1719	1792	1538	1719	1826	
Flt Permitted		0.87		0.76	1.00		0.37	1.00	1.00	0.60	1.00	
Satd. Flow (perm)		1520		1366	1541		670	1792	1538	1090	1826	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	2	1	1	87	1	84	2	253	32	22	530	2
RTOR Reduction (vph)	0	1	0	0	69	0	0	0	16	0	0	0
Lane Group Flow (vph)	0	3	0	87	16	0	2	253	16	22	532	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	6%	5%	5%	4%	5%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4		8	8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		8.9		8.9	8.9		26.0	25.5	25.5	26.0	25.5	
Effective Green, g (s)		8.9		8.9	8.9		26.0	25.5	25.5	26.0	25.5	
Actuated g/C Ratio		0.18		0.18	0.18		0.52	0.51	0.51	0.52	0.51	
Clearance Time (s)		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	
Lane Grp Cap (vph)		271		243	274		359	915	785	574	933	
v/s Ratio Prot					0.01		0.00	0.14		c0.00	c0.29	
v/s Ratio Perm		0.00		c0.06			0.00		0.01	0.02		
v/c Ratio		0.01		0.36	0.06		0.01	0.28	0.02	0.04	0.57	
Uniform Delay, d1		16.9		18.0	17.0		6.0	6.9	6.0	5.8	8.4	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.0		0.9	0.1		0.0	0.2	0.0	0.0	0.8	
Delay (s)		16.9		18.9	17.1		6.0	7.1	6.0	5.8	9.3	
Level of Service		B		B	B		A	A	A	A	A	
Approach Delay (s)		16.9			18.0			7.0			9.1	
Approach LOS		B			B			A			A	

Intersection Summary		
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.51	B
Actuated Cycle Length (s)	49.9	Sum of lost time (s)
Intersection Capacity Utilization	41.5%	15.0
Analysis Period (min)	15	ICU Level of Service
		A
c Critical Lane Group		

HCM 6th Signalized Intersection Summary
 8: SW Oregon St & Ice Age Dr

04/16/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↖	↗		↖	↑	↗	↖	↗	
Traffic Volume (veh/h)	2	1	1	79	1	76	2	230	29	20	482	2
Future Volume (veh/h)	2	1	1	79	1	76	2	230	29	20	482	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1826	1826	1826	1826	1826	1826	1826	1811	1826	1826	1841	1826
Adj Flow Rate, veh/h	2	1	1	87	1	84	2	253	32	22	530	2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	5	5	5	5	5	5	5	6	5	5	4	5
Cap, veh/h	218	86	46	409	2	188	375	703	600	578	757	3
Arrive On Green	0.12	0.12	0.12	0.12	0.12	0.12	0.00	0.39	0.39	0.03	0.41	0.41
Sat Flow, veh/h	424	705	376	1381	18	1532	1739	1811	1547	1739	1833	7
Grp Volume(v), veh/h	4	0	0	87	0	85	2	253	32	22	0	532
Grp Sat Flow(s),veh/h/ln	1506	0	0	1381	0	1550	1739	1811	1547	1739	0	1839
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	1.7	0.0	3.2	0.4	0.2	0.0	7.8
Cycle Q Clear(g_c), s	1.7	0.0	0.0	1.5	0.0	1.7	0.0	3.2	0.4	0.2	0.0	7.8
Prop In Lane	0.50		0.25	1.00		0.99	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	351	0	0	409	0	190	375	703	600	578	0	760
V/C Ratio(X)	0.01	0.00	0.00	0.21	0.00	0.45	0.01	0.36	0.05	0.04	0.00	0.70
Avail Cap(c_a), veh/h	1380	0	0	1431	0	1336	638	2342	2001	798	0	2378
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.5	0.0	0.0	13.2	0.0	13.2	6.8	7.1	6.2	5.8	0.0	7.9
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.3	0.0	1.6	0.0	0.3	0.0	0.0	0.0	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.0	0.0	0.9	0.0	1.0	0.0	1.4	0.2	0.1	0.0	3.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.5	0.0	0.0	13.4	0.0	14.9	6.8	7.4	6.2	5.8	0.0	9.1
LnGrp LOS	B	A	A	B	A	B	A	A	A	A	A	A
Approach Vol, veh/h		4			172			287			554	
Approach Delay, s/veh		12.5			14.1			7.3			8.9	
Approach LOS		B			B			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.9	17.6		9.0	5.1	18.4		9.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	42.0		27.0	5.0	42.0		28.0				
Max Q Clear Time (g_c+I1), s	2.2	5.2		3.7	2.0	9.8		3.7				
Green Ext Time (p_c), s	0.0	1.6		0.0	0.0	3.7		0.7				
Intersection Summary												
HCM 6th Ctrl Delay				9.4								
HCM 6th LOS				A								



KITTELSON & ASSOCIATES, INC.
 610 SW Alder, Suite 700
 Portland, Oregon 97205
 (503) 228-5230

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 9/15/2022
File: H:\2\1\2\311 - Ice Age Drive Extension\traffic\signal warrants\Signal-Warrant-Analysis-Oregon St (2025).xslm\Data Input
Intersection: SW Oregon St/Ice Age Drive
Scenario: 2025 Total Traffic

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
4:30 PM	5:30 PM		261	504	4	156
2nd Highest Hour			247	477	4	148
3rd Highest Hour			244	470	4	146
4th Highest Hour			233	450	4	139
5th Highest Hour			230	444	4	137
6th Highest Hour			230	444	4	137
7th Highest Hour			219	423	3	131
8th Highest Hour			216	417	3	129
9th Highest Hour			209	403	3	125
10th Highest Hour			195	376	3	116
11th Highest Hour			188	363	3	112
12th Highest Hour			184	356	3	110
13th Highest Hour			177	343	3	106
14th Highest Hour			153	296	2	92
15th Highest Hour			122	235	2	73
16th Highest Hour			115	222	2	69
17th Highest Hour			80	155	1	48
18th Highest Hour			66	128	1	40
19th Highest Hour			35	67	1	21
20th Highest Hour			24	47	0	15
21st Highest Hour			21	40	0	12
22nd Highest Hour			14	27	0	8
23rd Highest Hour			7	13	0	4
24th Highest Hour			7	13	0	4

Warrant Summary

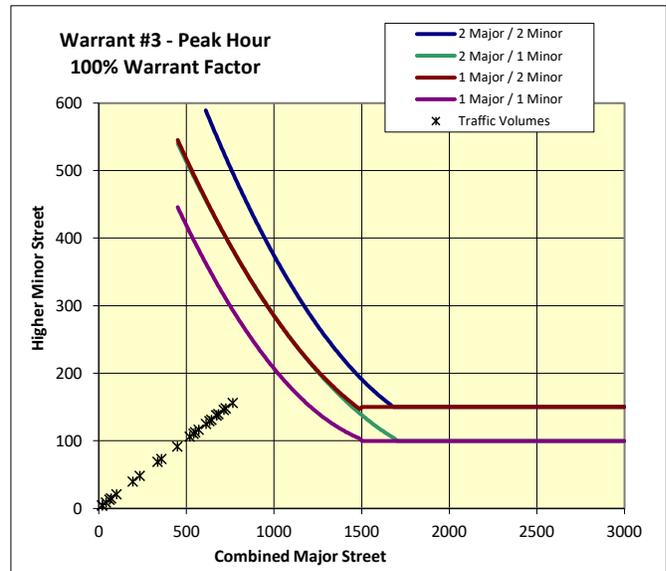
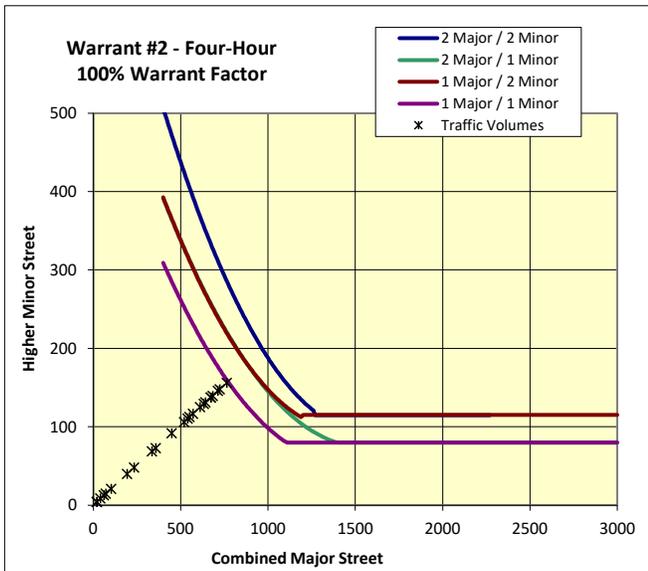
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	No
#2	Four-Hour Vehicular volume	Yes	No
#3	Peak Hour	Yes	No
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	1	No	No
	B	750	75	1	No	No
80%	A	400	120	9	Yes	Yes
	B	600	60	9	Yes	Yes
70%	A	350	105	13	Yes	Yes
	B	525	53	12	Yes	Yes
56%	A	280	84	14	Yes	Yes
	B	420	42	14	Yes	Yes





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Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
4:30 PM	5:30 PM		281	548	4	207
2nd Highest Hour			266	519	4	196
3rd Highest Hour			262	511	4	193
4th Highest Hour			251	490	4	185
5th Highest Hour			247	482	4	182
6th Highest Hour			247	482	4	182
7th Highest Hour			236	460	3	174
8th Highest Hour			232	453	3	171
9th Highest Hour			225	438	3	166
10th Highest Hour			210	409	3	155
11th Highest Hour			202	395	3	149
12th Highest Hour			199	387	3	146
13th Highest Hour			191	373	3	141
14th Highest Hour			165	321	2	121
15th Highest Hour			131	256	2	97
16th Highest Hour			124	241	2	91
17th Highest Hour			86	168	1	63
18th Highest Hour			71	139	1	52
19th Highest Hour			37	73	1	28
20th Highest Hour			26	51	0	19
21st Highest Hour			22	44	0	17
22nd Highest Hour			15	29	0	11
23rd Highest Hour			7	15	0	6
24th Highest Hour			7	15	0	6

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 5/17/2023
File: H:\2\12\311 - Ice Age Drive extension\traffic\signal warrants\sensitivity\Signal-Warrant-Analysis-Oregon 2030 (25%).xlsx>Data Inout
Intersection: SW Oregon St/Ice Age Drive
Scenario: 2030 Total Traffic (25% Development)

Warrant Summary

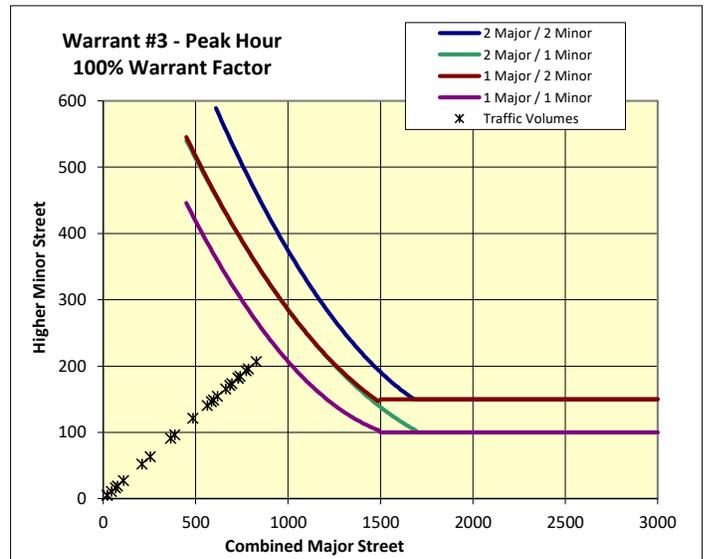
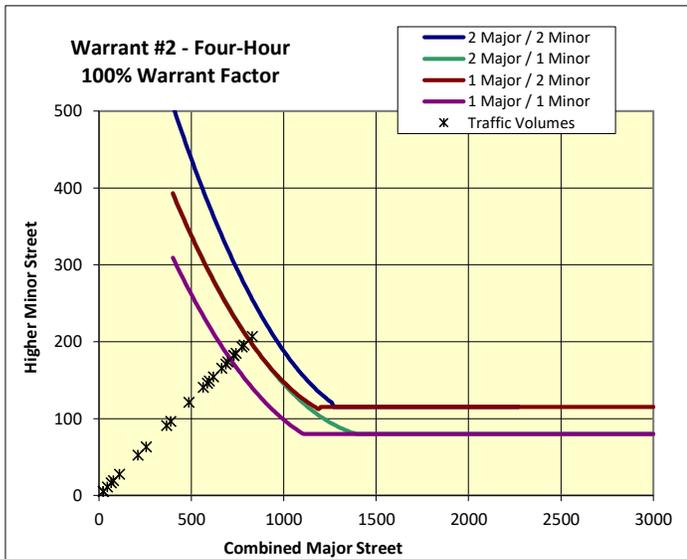
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	No
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	11	Yes	Yes
	B	750	75	3	No	
80%	A	400	120	14	Yes	Yes
	B	600	60	10	Yes	
70%	A	350	105	14	Yes	Yes
	B	525	53	13	Yes	
56%	A	280	84	16	Yes	Yes
	B	420	42	14	Yes	





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 Portland, Oregon 97205
 (503) 228-5230

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 9/15/2022
File: H:\2\1\2\311 - Ice Age Drive Extension\traffic\signal warrants\Signal-Warrant-Analysis-SW 124th (2025).xslm\Data Input
Intersection: SW 124th/Ice Age Drive
Scenario: 2025 Total Traffic

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
3:25 PM	4:25 PM		383	574	68	72
2nd Highest Hour			363	543	64	68
3rd Highest Hour			357	536	63	67
4th Highest Hour			342	513	61	64
5th Highest Hour			337	505	60	63
6th Highest Hour			337	505	60	63
7th Highest Hour			322	482	57	60
8th Highest Hour			317	475	56	60
9th Highest Hour			306	459	54	58
10th Highest Hour			286	429	51	54
11th Highest Hour			276	413	49	52
12th Highest Hour			271	406	48	51
13th Highest Hour			260	390	46	49
14th Highest Hour			225	337	40	42
15th Highest Hour			179	268	32	34
16th Highest Hour			169	253	30	32
17th Highest Hour			117	176	21	22
18th Highest Hour			97	145	17	18
19th Highest Hour			51	77	9	10
20th Highest Hour			36	54	6	7
21st Highest Hour			31	46	5	6
22nd Highest Hour			20	31	4	4
23rd Highest Hour			10	15	2	2
24th Highest Hour			10	15	2	2

Warrant Summary

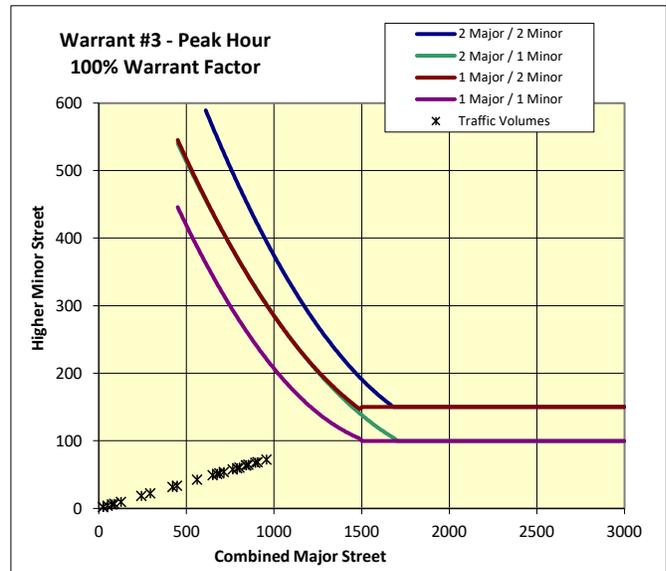
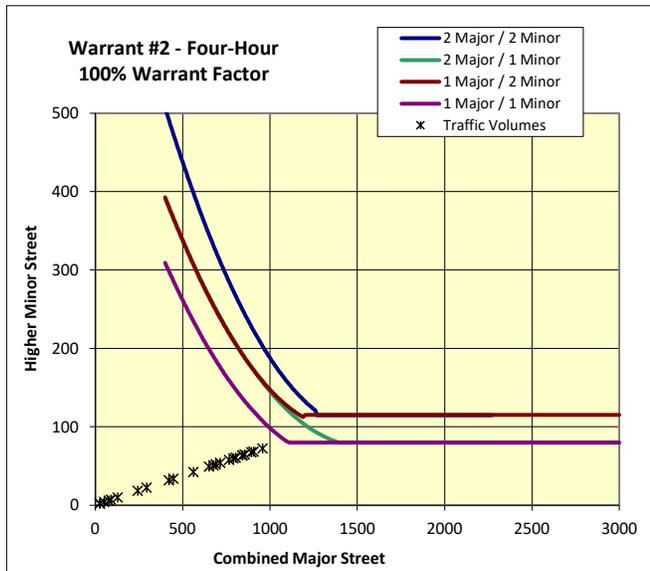
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	No
#2	Four-Hour Vehicular volume	Yes	No
#3	Peak Hour	Yes	No
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	2
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	600	150	0	No	No
	B	900	75	0	No	No
80%	A	480	120	0	No	Yes
	B	720	60	8	Yes	Yes
70%	A	420	105	0	No	Yes
	B	630	53	10	Yes	Yes
56%	A	336	84	0	No	Yes
	B	504	42	14	Yes	Yes



Appendix D:
2045 Synchro Operations and
Signal Warrant Worksheets

Intersection												
Int Delay, s/veh	3.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕↕		↵	↕↕	
Traffic Vol, veh/h	56	10	8	4	4	3	52	489	32	53	455	249
Future Vol, veh/h	56	10	8	4	4	3	52	489	32	53	455	249
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	62	11	9	4	4	3	57	537	35	58	500	274

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1138	1439	387	1041	1559	286	774	0	0	572	0	0
Stage 1	753	753	-	669	669	-	-	-	-	-	-	-
Stage 2	385	686	-	372	890	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	153	128	603	180	108	702	818	-	-	976	-	-
Stage 1	361	408	-	406	447	-	-	-	-	-	-	-
Stage 2	602	439	-	613	352	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	133	112	603	149	95	702	818	-	-	976	-	-
Mov Cap-2 Maneuver	133	112	-	149	95	-	-	-	-	-	-	-
Stage 1	336	384	-	378	416	-	-	-	-	-	-	-
Stage 2	552	408	-	552	331	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	47.3	30	0.9	0.6
HCM LOS	E	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	818	-	-	133	176	149	151	976	-	-
HCM Lane V/C Ratio	0.07	-	-	0.463	0.112	0.03	0.051	0.06	-	-
HCM Control Delay (s)	9.7	-	-	53.5	28	29.9	30.1	8.9	-	-
HCM Lane LOS	A	-	-	F	D	D	D	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	2.1	0.4	0.1	0.2	0.2	-	-

Intersection												
Int Delay, s/veh	70.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕↕		↵	↕↕	
Traffic Vol, veh/h	223	5	45	22	14	43	9	508	4	3	730	56
Future Vol, veh/h	223	5	45	22	14	43	9	508	4	3	730	56
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	245	5	49	24	15	47	10	558	4	3	802	62

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1146	1421	432	990	1450	281	864	0	0	562	0	0
Stage 1	839	839	-	580	580	-	-	-	-	-	-	-
Stage 2	307	582	-	410	870	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	~ 151	132	563	196	126	707	756	-	-	985	-	-
Stage 1	320	372	-	460	491	-	-	-	-	-	-	-
Stage 2	669	490	-	581	360	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 126	130	563	171	124	707	756	-	-	985	-	-
Mov Cap-2 Maneuver	~ 126	130	-	171	124	-	-	-	-	-	-	-
Stage 1	316	371	-	454	485	-	-	-	-	-	-	-
Stage 2	596	484	-	521	359	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	420.2	21.6	0.2	0
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	756	-	-	126	422	171	328	985	-	-
HCM Lane V/C Ratio	0.013	-	-	1.945	0.13	0.141	0.191	0.003	-	-
HCM Control Delay (s)	9.8	-	-	\$ 511.1	14.8	29.5	18.5	8.7	-	-
HCM Lane LOS	A	-	-	F	B	D	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	19.6	0.4	0.5	0.7	0	-	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM Signalized Intersection Capacity Analysis

3: SW 124th Ave & Ice Age Dr/SW Blake St

04/21/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↕	↗	↖	↗	
Traffic Volume (vph)	56	10	8	4	4	3	52	489	32	53	455	249
Future Volume (vph)	56	10	8	4	4	3	52	489	32	53	455	249
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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93		1.00	0.94		1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	1687		1719	1693		1719	3407		1719	3256	
Flt Permitted	1.00	1.00		1.00	1.00		0.31	1.00		0.43	1.00	
Satd. Flow (perm)	1810	1687		1810	1693		552	3407		786	3256	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	62	11	9	4	4	3	57	537	35	58	500	274
RTOR Reduction (vph)	0	8	0	0	3	0	0	5	0	0	77	0
Lane Group Flow (vph)	62	12	0	4	4	0	57	567	0	58	697	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	7.4	3.8		1.6	0.9		27.6	24.1		26.8	23.7	
Effective Green, g (s)	7.4	3.8		1.6	0.9		27.6	24.1		26.8	23.7	
Actuated g/C Ratio	0.14	0.07		0.03	0.02		0.53	0.47		0.52	0.46	
Clearance Time (s)	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	
Lane Grp Cap (vph)	252	123		54	29		373	1588		463	1492	
v/s Ratio Prot	c0.02	0.01		0.00	0.00		c0.01	0.17		0.01	c0.21	
v/s Ratio Perm	c0.02			0.00			0.07			0.06		
v/c Ratio	0.25	0.09		0.07	0.14		0.15	0.36		0.13	0.47	
Uniform Delay, d1	19.7	22.3		24.4	25.0		5.9	8.8		6.2	9.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.3		0.6	2.2		0.2	0.1		0.1	0.2	
Delay (s)	20.2	22.7		25.0	27.2		6.1	9.0		6.3	9.9	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		20.8			26.4			8.7			9.6	
Approach LOS		C			C			A			A	

Intersection Summary

HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	51.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

3: SW 124th Ave & Ice Age Dr/SW Blake St

04/21/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↕		↖	↗	
Traffic Volume (vph)	223	5	45	22	14	43	9	508	4	3	730	56
Future Volume (vph)	223	5	45	22	14	43	9	508	4	3	730	56
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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1719	1563		1719	1604		1719	3434		1719	3401	
Flt Permitted	0.38	1.00		0.72	1.00		0.21	1.00		0.39	1.00	
Satd. Flow (perm)	696	1563		1306	1604		388	3434		710	3401	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	245	5	49	24	15	47	10	558	4	3	802	62
RTOR Reduction (vph)	0	35	0	0	43	0	0	1	0	0	6	0
Lane Group Flow (vph)	245	19	0	24	19	0	10	561	0	3	858	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.6	16.9		6.5	5.8		23.7	23.0		23.7	23.0	
Effective Green, g (s)	22.6	16.9		6.5	5.8		23.7	23.0		23.7	23.0	
Actuated g/C Ratio	0.37	0.28		0.11	0.09		0.39	0.38		0.39	0.38	
Clearance Time (s)	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	
Lane Grp Cap (vph)	453	430		143	151		165	1288		286	1276	
v/s Ratio Prot	c0.10	0.01		0.00	0.01		c0.00	0.16		0.00	c0.25	
v/s Ratio Perm	c0.10			0.02			0.02			0.00		
v/c Ratio	0.54	0.04		0.17	0.13		0.06	0.44		0.01	0.67	
Uniform Delay, d1	14.5	16.3		24.8	25.4		12.1	14.3		11.6	16.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	0.0		0.6	0.4		0.2	0.2		0.0	1.4	
Delay (s)	15.8	16.3		25.4	25.8		12.3	14.5		11.6	17.4	
Level of Service	B	B		C	C		B	B		B	B	
Approach Delay (s)		15.9			25.7			14.5			17.4	
Approach LOS		B			C			B			B	

Intersection Summary

HCM 2000 Control Delay	16.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	61.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection												
Int Delay, s/veh	5.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	2	36	1	41	2	411	150	244	264	2
Future Vol, veh/h	2	1	2	36	1	41	2	411	150	244	264	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	11	5
Mvmt Flow	2	1	2	40	1	46	2	457	167	271	293	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1404	1464	294	1383	1382	541	295	0	0	624	0	0
Stage 1	836	836	-	545	545	-	-	-	-	-	-	-
Stage 2	568	628	-	838	837	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	115	126	738	119	142	535	1249	-	-	943	-	-
Stage 1	357	378	-	517	514	-	-	-	-	-	-	-
Stage 2	502	471	-	356	378	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	81	90	738	91	101	535	1249	-	-	943	-	-
Mov Cap-2 Maneuver	81	90	-	91	101	-	-	-	-	-	-	-
Stage 1	356	270	-	516	513	-	-	-	-	-	-	-
Stage 2	458	470	-	252	270	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	33.9	40.6	0	5
HCM LOS	D	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1249	-	-	130	91	485	943	-	-
HCM Lane V/C Ratio	0.002	-	-	0.043	0.44	0.096	0.287	-	-
HCM Control Delay (s)	7.9	-	-	33.9	72.5	13.2	10.4	-	-
HCM Lane LOS	A	-	-	D	F	B	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.8	0.3	1.2	-	-

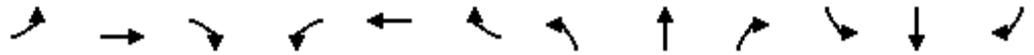
HCM Signalized Intersection Capacity Analysis
8: SW Oregon St & Ice Age Dr

04/21/2023

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	2	1	2	36	1	41	2	411	150	244	264	2	
Future Volume (vph)	2	1	2	36	1	41	2	411	150	244	264	2	
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		
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00		
Frt		0.95		1.00	0.85		1.00	1.00	0.85	1.00	1.00		
Flt Protected		0.98		0.95	1.00		0.95	1.00	1.00	0.95	1.00		
Satd. Flow (prot)		1678		1719	1544		1719	1792	1538	1719	1711		
Flt Permitted		0.86		0.75	1.00		0.58	1.00	1.00	0.34	1.00		
Satd. Flow (perm)		1478		1365	1544		1049	1792	1538	622	1711		
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Adj. Flow (vph)	2	1	2	40	1	46	2	457	167	271	293	2	
RTOR Reduction (vph)	0	2	0	0	41	0	0	0	75	0	0	0	
Lane Group Flow (vph)	0	3	0	40	6	0	2	457	92	271	295	0	
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	6%	5%	5%	11%	5%	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA		
Protected Phases		4		8	8		5	2	2	1	6		
Permitted Phases	4			8			2		2	6			
Actuated Green, G (s)		6.2		6.2	6.2		28.6	28.0	28.0	42.1	36.5		
Effective Green, g (s)		6.2		6.2	6.2		28.6	28.0	28.0	42.1	36.5		
Actuated g/C Ratio		0.11		0.11	0.11		0.49	0.48	0.48	0.72	0.63		
Clearance Time (s)		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		
Lane Grp Cap (vph)		157		145	164		521	860	738	620	1071		
v/s Ratio Prot					0.00		0.00	c0.25		c0.07	0.17		
v/s Ratio Perm		0.00		c0.03			0.00		0.06	0.25			
v/c Ratio		0.02		0.28	0.04		0.00	0.53	0.12	0.44	0.28		
Uniform Delay, d1		23.3		24.0	23.4		7.6	10.6	8.4	4.0	4.9		
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00		
Incremental Delay, d2		0.1		1.0	0.1		0.0	0.6	0.1	0.5	0.1		
Delay (s)		23.4		25.0	23.5		7.6	11.2	8.4	4.5	5.1		
Level of Service		C		C	C		A	B	A	A	A		
Approach Delay (s)		23.4			24.2			10.5			4.8		
Approach LOS		C			C			B			A		
Intersection Summary													
HCM 2000 Control Delay			8.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.48										
Actuated Cycle Length (s)			58.3									Sum of lost time (s)	15.0
Intersection Capacity Utilization			51.9%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM 6th Signalized Intersection Summary
 8: SW Oregon St & Ice Age Dr

04/16/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↖	↗		↖	↗	↖	↗	↖	↗
Traffic Volume (veh/h)	2	1	2	36	1	41	2	411	150	244	264	2
Future Volume (veh/h)	2	1	2	36	1	41	2	411	150	244	264	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1826	1826	1826	1826	1826	1826	1826	1811	1826	1826	1737	1826
Adj Flow Rate, veh/h	2	1	2	40	1	46	2	457	167	271	293	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	5	5	5	5	5	5	5	6	5	5	11	5
Cap, veh/h	171	39	48	323	3	126	590	662	566	557	864	6
Arrive On Green	0.08	0.08	0.08	0.08	0.08	0.08	0.00	0.37	0.37	0.14	0.50	0.50
Sat Flow, veh/h	392	469	574	1380	33	1519	1739	1811	1547	1739	1723	12
Grp Volume(v), veh/h	5	0	0	40	0	47	2	457	167	271	0	295
Grp Sat Flow(s),veh/h/ln	1436	0	0	1380	0	1552	1739	1811	1547	1739	0	1735
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	1.0	0.0	7.8	2.8	3.0	0.0	3.7
Cycle Q Clear(g_c), s	1.0	0.0	0.0	0.8	0.0	1.0	0.0	7.8	2.8	3.0	0.0	3.7
Prop In Lane	0.40		0.40	1.00		0.98	1.00		1.00	1.00		0.01
Lane Grp Cap(c), veh/h	258	0	0	323	0	129	590	662	566	557	0	870
V/C Ratio(X)	0.02	0.00	0.00	0.12	0.00	0.36	0.00	0.69	0.30	0.49	0.00	0.34
Avail Cap(c_a), veh/h	1243	0	0	1272	0	1196	824	1794	1533	843	0	2005
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.3	0.0	0.0	15.6	0.0	15.7	7.3	9.8	8.2	6.2	0.0	5.4
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.2	0.0	1.7	0.0	1.3	0.3	0.7	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.1	0.0	0.0	0.5	0.0	0.7	0.0	4.1	1.2	0.9	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.3	0.0	0.0	15.8	0.0	17.5	7.3	11.1	8.5	6.9	0.0	5.7
LnGrp LOS	B	A	A	B	A	B	A	B	A	A	A	A
Approach Vol, veh/h		5			87			626			566	
Approach Delay, s/veh		15.3			16.7			10.4			6.2	
Approach LOS		B			B			B			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.0	18.3		8.0	5.1	23.2		8.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	11.0	36.0		27.0	5.0	42.0		28.0				
Max Q Clear Time (g_c+I1), s	5.0	9.8		3.0	2.0	5.7		3.0				
Green Ext Time (p_c), s	0.4	3.5		0.0	0.0	1.8		0.3				

Intersection Summary

HCM 6th Ctrl Delay	9.0
HCM 6th LOS	A

Intersection												
Int Delay, s/veh	15.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	1	141	1	219	2	313	39	43	655	2
Future Vol, veh/h	2	1	1	141	1	219	2	313	39	43	655	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	4	5
Mvmt Flow	2	1	1	155	1	241	2	344	43	47	720	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1306	1206	721	1186	1186	366	722	0	0	387	0	0
Stage 1	815	815	-	370	370	-	-	-	-	-	-	-
Stage 2	491	391	-	816	816	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	135	181	422	163	186	673	866	-	-	1155	-	-
Stage 1	367	387	-	644	615	-	-	-	-	-	-	-
Stage 2	554	602	-	367	386	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	83	173	422	156	178	673	866	-	-	1155	-	-
Mov Cap-2 Maneuver	83	173	-	156	178	-	-	-	-	-	-	-
Stage 1	366	371	-	643	614	-	-	-	-	-	-	-
Stage 2	354	601	-	350	370	-	-	-	-	-	-	-

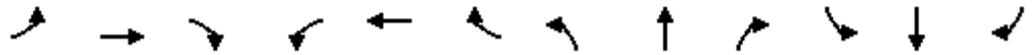
Approach	EB		WB		NB		SB	
HCM Control Delay, s	35.1		58.3		0.1		0.5	
HCM LOS	E		F					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	866	-	-	124	156	665	1155	-	-
HCM Lane V/C Ratio	0.003	-	-	0.035	0.993	0.364	0.041	-	-
HCM Control Delay (s)	9.2	-	-	35.1	128.1	13.5	8.2	-	-
HCM Lane LOS	A	-	-	E	F	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	7.6	1.7	0.1	-	-

HCM Signalized Intersection Capacity Analysis

8: SW Oregon St & Ice Age Dr

04/21/2023

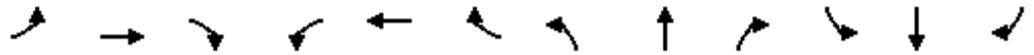


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↑	↗	↖	↕	↕
Traffic Volume (vph)	2	1	1	141	1	219	2	313	39	43	655	2
Future Volume (vph)	2	1	1	141	1	219	2	313	39	43	655	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Flt		0.97		1.00	0.85		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1706		1719	1539		1719	1792	1538	1719	1826	
Flt Permitted		0.87		0.76	1.00		0.20	1.00	1.00	0.47	1.00	
Satd. Flow (perm)		1526		1366	1539		365	1792	1538	846	1826	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	2	1	1	155	1	241	2	344	43	47	720	2
RTOR Reduction (vph)	0	1	0	0	183	0	0	0	23	0	0	0
Lane Group Flow (vph)	0	3	0	155	59	0	2	344	20	47	722	0
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	6%	5%	5%	4%	5%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		13.8		13.8	13.8		26.8	26.2	26.2	30.8	28.2	
Effective Green, g (s)		13.8		13.8	13.8		26.8	26.2	26.2	30.8	28.2	
Actuated g/C Ratio		0.24		0.24	0.24		0.47	0.45	0.45	0.53	0.49	
Clearance Time (s)		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	
Lane Grp Cap (vph)		365		327	368		183	815	699	491	893	
v/s Ratio Prot					0.04		0.00	0.19		c0.00	c0.40	
v/s Ratio Perm		0.00		c0.11			0.00		0.01	0.05		
v/c Ratio		0.01		0.47	0.16		0.01	0.42	0.03	0.10	0.81	
Uniform Delay, d1		16.7		18.8	17.3		9.6	10.6	8.7	6.6	12.4	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.0		1.1	0.2		0.0	0.4	0.0	0.1	5.4	
Delay (s)		16.7		19.9	17.5		9.7	10.9	8.7	6.7	17.9	
Level of Service		B		B	B		A	B	A	A	B	
Approach Delay (s)		16.7			18.4			10.7			17.2	
Approach LOS		B			B			B			B	

Intersection Summary		
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.69	B
Actuated Cycle Length (s)	57.6	Sum of lost time (s)
Intersection Capacity Utilization	57.9%	15.0
Analysis Period (min)	15	ICU Level of Service
c Critical Lane Group		B

HCM 6th Signalized Intersection Summary
 8: SW Oregon St & Ice Age Dr

04/16/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↖	↗		↖	↑	↗	↖	↗	↖
Traffic Volume (veh/h)	2	1	1	141	1	219	2	313	39	43	655	2
Future Volume (veh/h)	2	1	1	141	1	219	2	313	39	43	655	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1826	1826	1826	1826	1826	1826	1826	1811	1826	1826	1841	1826
Adj Flow Rate, veh/h	2	1	1	155	1	241	2	344	43	47	720	2
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	5	5	5	5	5	5	5	6	5	5	4	5
Cap, veh/h	159	77	43	424	1	343	248	785	671	518	878	2
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.00	0.43	0.43	0.05	0.48	0.48
Sat Flow, veh/h	235	346	194	1381	6	1542	1739	1811	1547	1739	1835	5
Grp Volume(v), veh/h	4	0	0	155	0	242	2	344	43	47	0	722
Grp Sat Flow(s),veh/h/ln	774	0	0	1381	0	1548	1739	1811	1547	1739	0	1840
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	7.3	0.0	6.7	0.8	0.7	0.0	17.0
Cycle Q Clear(g_c), s	7.3	0.0	0.0	5.8	0.0	7.3	0.0	6.7	0.8	0.7	0.0	17.0
Prop In Lane	0.50		0.25	1.00		1.00	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	279	0	0	424	0	344	248	785	671	518	0	881
V/C Ratio(X)	0.01	0.00	0.00	0.37	0.00	0.70	0.01	0.44	0.06	0.09	0.00	0.82
Avail Cap(c_a), veh/h	695	0	0	882	0	857	415	1503	1284	607	0	1527
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.6	0.0	0.0	17.6	0.0	18.1	10.2	10.0	8.3	7.5	0.0	11.3
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	2.6	0.0	0.4	0.0	0.1	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.1	0.0	0.0	2.8	0.0	4.7	0.0	3.9	0.4	0.4	0.0	9.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.6	0.0	0.0	18.1	0.0	20.8	10.2	10.4	8.4	7.5	0.0	13.3
LnGrp LOS	B	A	A	B	A	C	B	B	A	A	A	B
Approach Vol, veh/h		4			397			389			769	
Approach Delay, s/veh		15.6			19.7			10.2			12.9	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.4	26.9		16.2	5.1	29.2		16.2				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	5.0	42.0		27.0	5.0	42.0		28.0				
Max Q Clear Time (g_c+I1), s	2.7	8.7		9.3	2.0	19.0		9.3				
Green Ext Time (p_c), s	0.0	2.3		0.0	0.0	5.2		2.0				
Intersection Summary												
HCM 6th Ctrl Delay				14.0								
HCM 6th LOS				B								



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Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
4:30 PM	5:30 PM		354	700	4	361
2nd Highest Hour			335	663	4	342
3rd Highest Hour			330	653	4	337
4th Highest Hour			316	625	4	322
5th Highest Hour			312	616	4	318
6th Highest Hour			312	616	4	318
7th Highest Hour			297	588	3	303
8th Highest Hour			293	579	3	298
9th Highest Hour			283	560	3	289
10th Highest Hour			264	523	3	270
11th Highest Hour			255	504	3	260
12th Highest Hour			250	495	3	255
13th Highest Hour			241	476	3	245
14th Highest Hour			208	411	2	212
15th Highest Hour			165	327	2	168
16th Highest Hour			156	308	2	159
17th Highest Hour			109	215	1	111
18th Highest Hour			90	177	1	91
19th Highest Hour			47	93	1	48
20th Highest Hour			33	65	0	34
21st Highest Hour			28	56	0	29
22nd Highest Hour			19	37	0	19
23rd Highest Hour			9	19	0	10
24th Highest Hour			9	19	0	10

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 5/16/2023
File: H:\2\12\311 - Ice Age Drive Extension\traffic\signal warrants\[Signal-Warrant-Analysis-Oregon St.xlsm]Data Inout
Intersection: SW Oregon St/Ice Age Drive
Scenario: 2045 Total Traffic

Warrant Summary

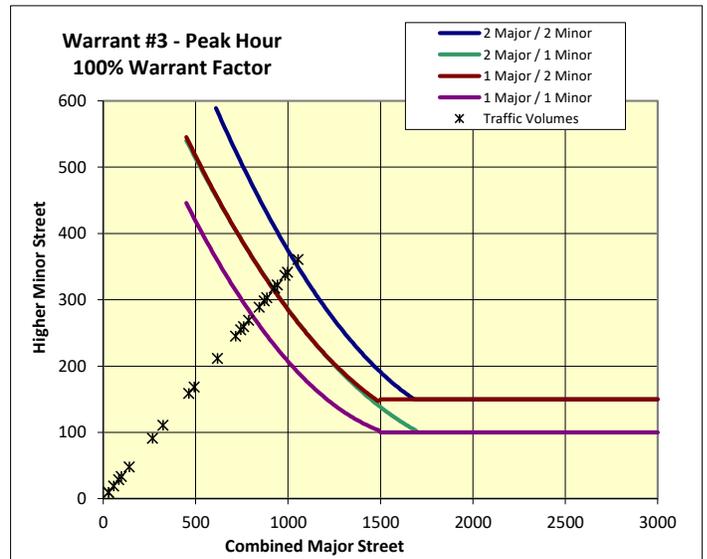
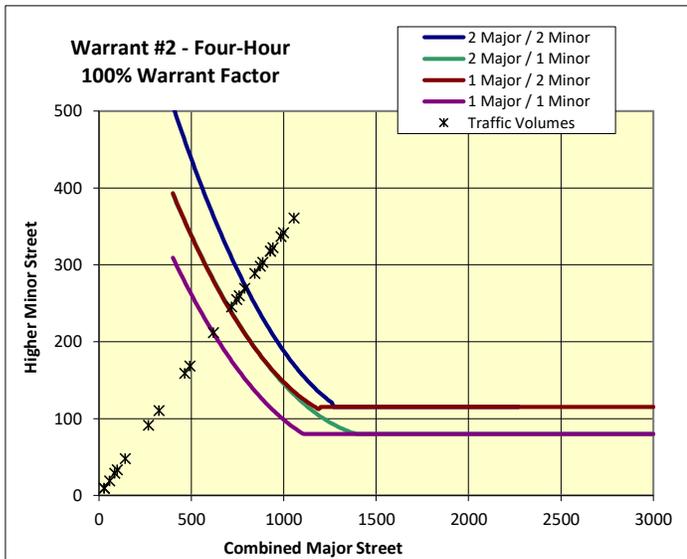
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	14	Yes	Yes
	B	750	75	11	Yes	Yes
80%	A	400	120	16	Yes	Yes
	B	600	60	14	Yes	Yes
70%	A	350	105	16	Yes	Yes
	B	525	53	14	Yes	Yes
56%	A	280	84	17	Yes	Yes
	B	420	42	16	Yes	Yes





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Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 9/15/2022
File: H:\2\1\2\311 - Ice Age Drive Extension\traffic\signal warrants\[Signal-Warrant-Analysis-SW 124th.xlsm]Data Input
Intersection: SW 124th/Ice Age Drive
Scenario: 2045 Total Traffic

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
3:25 PM	4:25 PM		521	789	223	22
2nd Highest Hour			493	747	211	21
3rd Highest Hour			486	736	208	21
4th Highest Hour			465	705	199	20
5th Highest Hour			458	694	196	19
6th Highest Hour			458	694	196	19
7th Highest Hour			438	663	187	18
8th Highest Hour			431	652	184	18
9th Highest Hour			417	631	178	18
10th Highest Hour			389	589	167	16
11th Highest Hour			375	568	161	16
12th Highest Hour			368	558	158	16
13th Highest Hour			354	537	152	15
14th Highest Hour			306	463	131	13
15th Highest Hour			243	368	104	10
16th Highest Hour			229	347	98	10
17th Highest Hour			160	242	68	7
18th Highest Hour			132	200	56	6
19th Highest Hour			69	105	30	3
20th Highest Hour			49	74	21	2
21st Highest Hour			42	63	18	2
22nd Highest Hour			28	42	12	1
23rd Highest Hour			14	21	6	1
24th Highest Hour			14	21	6	1

Warrant Summary

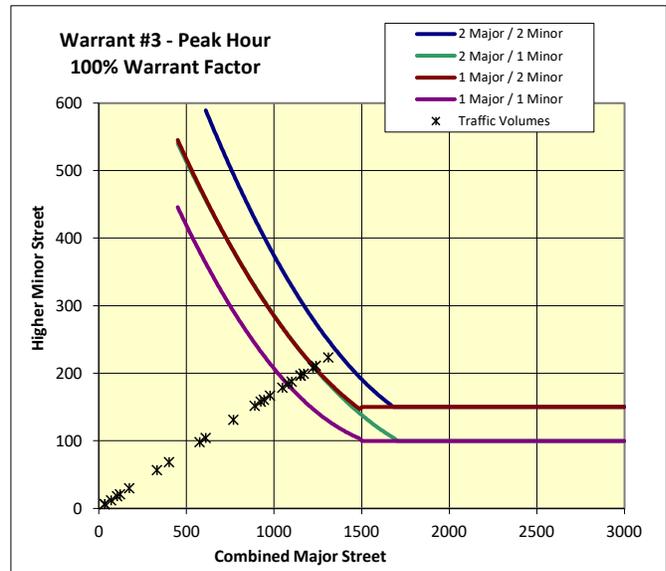
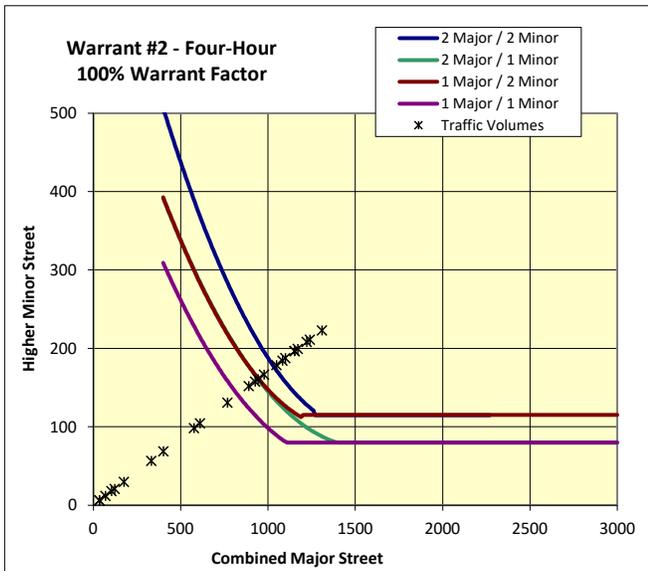
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	2
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	600	150	13	Yes	Yes
	B	900	75	12	Yes	Yes
80%	A	480	120	14	Yes	Yes
	B	720	60	14	Yes	Yes
70%	A	420	105	15	Yes	Yes
	B	630	53	14	Yes	Yes
56%	A	336	84	16	Yes	Yes
	B	504	42	16	Yes	Yes



Appendix E:
2045 Sensitivity Synchro Operations and
Signal Warrant Worksheets

Intersection												
Int Delay, s/veh	1.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	2	26	1	19	2	411	78	77	264	2
Future Vol, veh/h	2	1	2	26	1	19	2	411	78	77	264	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	11	5
Mvmt Flow	2	1	2	29	1	21	2	457	87	86	293	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	982	1014	294	973	972	501	295	0	0	544	0	0
Stage 1	466	466	-	505	505	-	-	-	-	-	-	-
Stage 2	516	548	-	468	467	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	225	236	738	229	250	564	1249	-	-	1010	-	-
Stage 1	571	557	-	544	535	-	-	-	-	-	-	-
Stage 2	536	512	-	570	557	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	201	215	738	212	228	564	1249	-	-	1010	-	-
Mov Cap-2 Maneuver	201	215	-	212	228	-	-	-	-	-	-	-
Stage 1	570	510	-	543	534	-	-	-	-	-	-	-
Stage 2	514	511	-	519	510	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	17.7		19.2		0		2	
HCM LOS	C		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1249	-	-	289	212	525	1010	-	-
HCM Lane V/C Ratio	0.002	-	-	0.019	0.136	0.042	0.085	-	-
HCM Control Delay (s)	7.9	-	-	17.7	24.6	12.2	8.9	-	-
HCM Lane LOS	A	-	-	C	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.5	0.1	0.3	-	-

Intersection												
Int Delay, s/veh	2.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	2	28	1	24	2	411	96	119	264	2
Future Vol, veh/h	2	1	2	28	1	24	2	411	96	119	264	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	11	5
Mvmt Flow	2	1	2	31	1	27	2	457	107	132	293	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1087	1126	294	1075	1074	511	295	0	0	564	0	0
Stage 1	558	558	-	515	515	-	-	-	-	-	-	-
Stage 2	529	568	-	560	559	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	191	202	738	195	217	557	1249	-	-	993	-	-
Stage 1	509	507	-	537	530	-	-	-	-	-	-	-
Stage 2	528	502	-	508	506	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	162	175	738	174	188	557	1249	-	-	993	-	-
Mov Cap-2 Maneuver	162	175	-	174	188	-	-	-	-	-	-	-
Stage 1	508	440	-	536	529	-	-	-	-	-	-	-
Stage 2	501	501	-	438	439	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	20.3		21.8		0		2.8	
HCM LOS	C		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1249	-	-	241	174	516	993	-	-
HCM Lane V/C Ratio	0.002	-	-	0.023	0.179	0.054	0.133	-	-
HCM Control Delay (s)	7.9	-	-	20.3	30.1	12.4	9.2	-	-
HCM Lane LOS	A	-	-	C	D	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.6	0.2	0.5	-	-

Intersection												
Int Delay, s/veh	3.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↵	↵		↵	↵		↵	↵	
Traffic Vol, veh/h	2	1	2	31	1	31	2	411	114	160	264	2
Future Vol, veh/h	2	1	2	31	1	31	2	411	114	160	264	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	11	5
Mvmt Flow	2	1	2	34	1	34	2	457	127	178	293	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1192	1238	294	1177	1176	521	295	0	0	584	0	0
Stage 1	650	650	-	525	525	-	-	-	-	-	-	-
Stage 2	542	588	-	652	651	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	162	173	738	166	189	550	1249	-	-	976	-	-
Stage 1	453	460	-	530	524	-	-	-	-	-	-	-
Stage 2	519	491	-	452	460	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	130	141	738	141	154	550	1249	-	-	976	-	-
Mov Cap-2 Maneuver	130	141	-	141	154	-	-	-	-	-	-	-
Stage 1	452	376	-	529	523	-	-	-	-	-	-	-
Stage 2	485	490	-	367	376	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	23.6		25.4		0		3.6	
HCM LOS	C		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1249	-	-	199	141	509	976	-	-
HCM Lane V/C Ratio	0.002	-	-	0.028	0.244	0.07	0.182	-	-
HCM Control Delay (s)	7.9	-	-	23.6	38.6	12.6	9.5	-	-
HCM Lane LOS	A	-	-	C	E	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.9	0.2	0.7	-	-

Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	2	33	1	36	2	411	132	202	264	2
Future Vol, veh/h	2	1	2	33	1	36	2	411	132	202	264	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	11	5
Mvmt Flow	2	1	2	37	1	40	2	457	147	224	293	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1297	1350	294	1279	1278	531	295	0	0	604	0	0
Stage 1	742	742	-	535	535	-	-	-	-	-	-	-
Stage 2	555	608	-	744	743	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	137	148	738	141	164	542	1249	-	-	959	-	-
Stage 1	403	418	-	524	519	-	-	-	-	-	-	-
Stage 2	511	481	-	402	418	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	103	113	738	114	125	542	1249	-	-	959	-	-
Mov Cap-2 Maneuver	103	113	-	114	125	-	-	-	-	-	-	-
Stage 1	402	320	-	523	518	-	-	-	-	-	-	-
Stage 2	472	480	-	306	320	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	28.2	30.8	0	4.3
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1249	-	-	161	114	497	959	-	-
HCM Lane V/C Ratio	0.002	-	-	0.035	0.322	0.083	0.234	-	-
HCM Control Delay (s)	7.9	-	-	28.2	50.9	12.9	9.9	-	-
HCM Lane LOS	A	-	-	D	F	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.3	0.3	0.9	-	-

Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	1	79	1	76	2	313	29	20	655	2
Future Vol, veh/h	2	1	1	79	1	76	2	313	29	20	655	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	4	5
Mvmt Flow	2	1	1	87	1	84	2	344	32	22	720	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1172	1145	721	1130	1130	360	722	0	0	376	0	0
Stage 1	765	765	-	364	364	-	-	-	-	-	-	-
Stage 2	407	380	-	766	766	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	167	197	422	178	201	678	866	-	-	1166	-	-
Stage 1	391	408	-	649	619	-	-	-	-	-	-	-
Stage 2	615	609	-	391	407	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	143	193	422	174	197	678	866	-	-	1166	-	-
Mov Cap-2 Maneuver	143	193	-	174	197	-	-	-	-	-	-	-
Stage 1	390	400	-	648	618	-	-	-	-	-	-	-
Stage 2	537	608	-	382	399	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	24.8		28.2		0.1		0.2	
HCM LOS	C		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	866	-	-	186	174	657	1166	-	-
HCM Lane V/C Ratio	0.003	-	-	0.024	0.499	0.129	0.019	-	-
HCM Control Delay (s)	9.2	-	-	24.8	44.7	11.3	8.1	-	-
HCM Lane LOS	A	-	-	C	E	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	2.4	0.4	0.1	-	-

Intersection												
Int Delay, s/veh	5.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	1	94	1	112	2	313	31	26	655	2
Future Vol, veh/h	2	1	1	94	1	112	2	313	31	26	655	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	4	5
Mvmt Flow	2	1	1	103	1	123	2	344	34	29	720	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1206	1161	721	1145	1145	361	722	0	0	378	0	0
Stage 1	779	779	-	365	365	-	-	-	-	-	-	-
Stage 2	427	382	-	780	780	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	158	193	422	174	197	677	866	-	-	1164	-	-
Stage 1	384	402	-	648	618	-	-	-	-	-	-	-
Stage 2	600	607	-	384	401	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	126	188	422	169	192	677	866	-	-	1164	-	-
Mov Cap-2 Maneuver	126	188	-	169	192	-	-	-	-	-	-	-
Stage 1	383	392	-	647	617	-	-	-	-	-	-	-
Stage 2	489	606	-	372	391	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	26.7		31.4		0.1		0.3	
HCM LOS	D		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	866	-	-	170	169	662	1164	-	-
HCM Lane V/C Ratio	0.003	-	-	0.026	0.611	0.188	0.025	-	-
HCM Control Delay (s)	9.2	-	-	26.7	55.1	11.7	8.2	-	-
HCM Lane LOS	A	-	-	D	F	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	3.4	0.7	0.1	-	-

Intersection												
Int Delay, s/veh	7.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↕	↕		↕	↕		↕	↕	
Traffic Vol, veh/h	2	1	1	110	1	148	2	313	33	32	655	2
Future Vol, veh/h	2	1	1	110	1	148	2	313	33	32	655	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	4	5
Mvmt Flow	2	1	1	121	1	163	2	344	36	35	720	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1239	1175	721	1158	1158	362	722	0	0	380	0	0
Stage 1	791	791	-	366	366	-	-	-	-	-	-	-
Stage 2	448	384	-	792	792	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	150	189	422	171	194	676	866	-	-	1162	-	-
Stage 1	378	397	-	647	617	-	-	-	-	-	-	-
Stage 2	584	606	-	378	396	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	111	183	422	166	188	676	866	-	-	1162	-	-
Mov Cap-2 Maneuver	111	183	-	166	188	-	-	-	-	-	-	-
Stage 1	377	385	-	646	616	-	-	-	-	-	-	-
Stage 2	442	605	-	365	384	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	28.9	36.6	0.1	0.4
HCM LOS	D	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	866	-	-	155	166	664	1162	-	-
HCM Lane V/C Ratio	0.003	-	-	0.028	0.728	0.247	0.03	-	-
HCM Control Delay (s)	9.2	-	-	28.9	69.7	12.2	8.2	-	-
HCM Lane LOS	A	-	-	D	F	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	4.5	1	0.1	-	-

Intersection												
Int Delay, s/veh	10.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↵	↵		↵	↵		↵	↵	
Traffic Vol, veh/h	2	1	1	125	1	184	2	313	36	38	655	2
Future Vol, veh/h	2	1	1	125	1	184	2	313	36	38	655	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	-	-	-	100	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	6	5	5	4	5
Mvmt Flow	2	1	1	137	1	202	2	344	40	42	720	2

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1275	1193	721	1174	1174	364	722	0	0	384	0	0
Stage 1	805	805	-	368	368	-	-	-	-	-	-	-
Stage 2	470	388	-	806	806	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	142	184	422	166	189	674	866	-	-	1158	-	-
Stage 1	372	391	-	646	616	-	-	-	-	-	-	-
Stage 2	568	604	-	371	391	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	96	177	422	160	182	674	866	-	-	1158	-	-
Mov Cap-2 Maneuver	96	177	-	160	182	-	-	-	-	-	-	-
Stage 1	371	377	-	645	615	-	-	-	-	-	-	-
Stage 2	396	603	-	356	377	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	31.7	45.6	0.1	0.4
HCM LOS	D	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	866	-	-	139	160	664	1158	-	-
HCM Lane V/C Ratio	0.003	-	-	0.032	0.859	0.306	0.036	-	-
HCM Control Delay (s)	9.2	-	-	31.7	94.2	12.8	8.2	-	-
HCM Lane LOS	A	-	-	D	F	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	5.9	1.3	0.1	-	-



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Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
4:30 PM	5:30 PM		344	677	4	156
2nd Highest Hour			326	641	4	148
3rd Highest Hour			321	632	4	146
4th Highest Hour			307	605	4	139
5th Highest Hour			303	596	4	137
6th Highest Hour			303	596	4	137
7th Highest Hour			289	569	3	131
8th Highest Hour			284	560	3	129
9th Highest Hour			275	542	3	125
10th Highest Hour			257	505	3	116
11th Highest Hour			248	487	3	112
12th Highest Hour			243	478	3	110
13th Highest Hour			234	460	3	106
14th Highest Hour			202	397	2	92
15th Highest Hour			161	316	2	73
16th Highest Hour			151	298	2	69
17th Highest Hour			105	208	1	48
18th Highest Hour			87	172	1	40
19th Highest Hour			46	90	1	21
20th Highest Hour			32	63	0	15
21st Highest Hour			28	54	0	12
22nd Highest Hour			18	36	0	8
23rd Highest Hour			9	18	0	4
24th Highest Hour			9	18	0	4

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 5/16/2023
File: H:\2\12\311 - Ice Age Drive extension\traffic\signal warrants\sensitivity\Signal-Warrant-Analysis-Oregon St (0%).xslm\War #3 - Peak HR
Intersection: SW Oregon St/Ice Age Drive
Scenario: 2045 Total Traffic (0% Development)

Warrant Summary

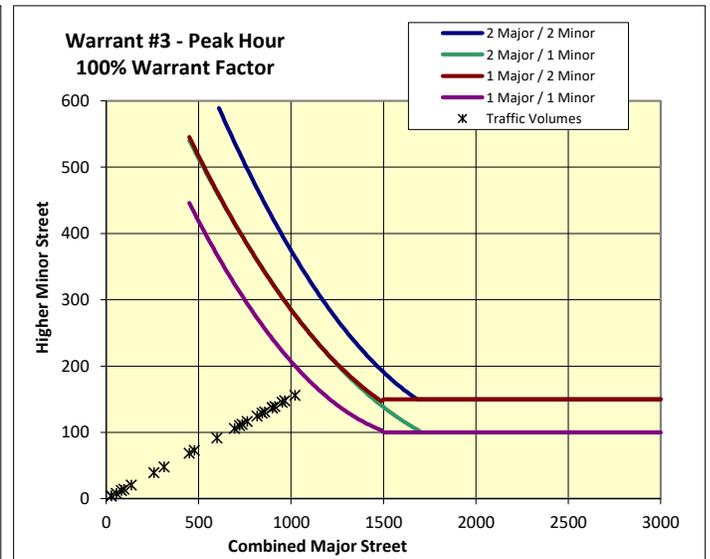
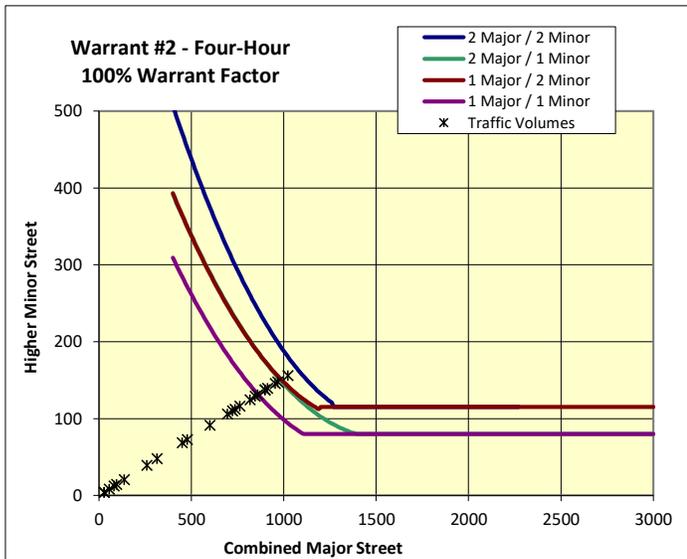
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	No
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	1	No	Yes
	B	750	75	10	Yes	Yes
80%	A	400	120	9	Yes	Yes
	B	600	60	13	Yes	Yes
70%	A	350	105	13	Yes	Yes
	B	525	53	14	Yes	Yes
56%	A	280	84	14	Yes	Yes
	B	420	42	16	Yes	Yes





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Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
4:30 PM	5:30 PM		346	683	4	207
2nd Highest Hour			328	647	4	196
3rd Highest Hour			323	637	4	193
4th Highest Hour			309	610	4	185
5th Highest Hour			304	601	4	182
6th Highest Hour			304	601	4	182
7th Highest Hour			291	574	3	174
8th Highest Hour			286	565	3	171
9th Highest Hour			277	546	3	166
10th Highest Hour			258	510	3	155
11th Highest Hour			249	492	3	149
12th Highest Hour			245	483	3	146
13th Highest Hour			235	464	3	141
14th Highest Hour			203	401	2	121
15th Highest Hour			161	319	2	97
16th Highest Hour			152	301	2	91
17th Highest Hour			106	209	1	63
18th Highest Hour			88	173	1	52
19th Highest Hour			46	91	1	28
20th Highest Hour			32	64	0	19
21st Highest Hour			28	55	0	17
22nd Highest Hour			18	36	0	11
23rd Highest Hour			9	18	0	6
24th Highest Hour			9	18	0	6

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 5/16/2023
File: H:\2\12\311 - Ice Age Drive extension\traffic\signal warrants\sensitivity\[Signal-Warrant-Analysis-Oregon St (25%).xslm]Data Input
Intersection: SW Oregon St/Ice Age Drive
Scenario: 2045 Total Traffic (25% Development)

Warrant Summary

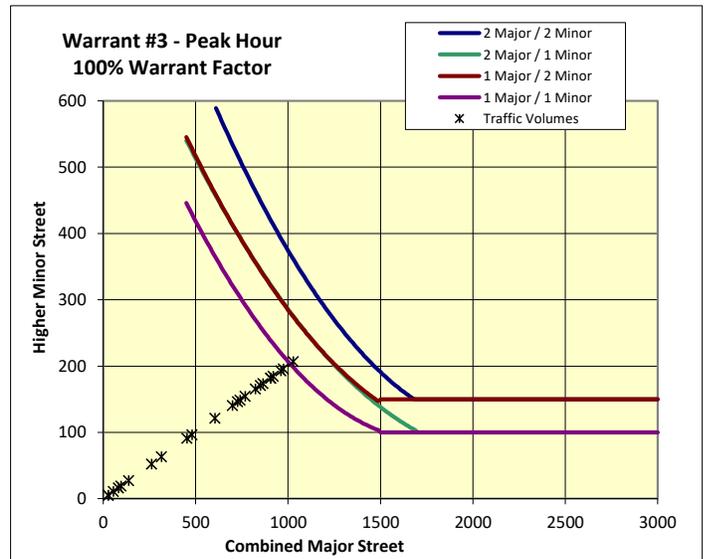
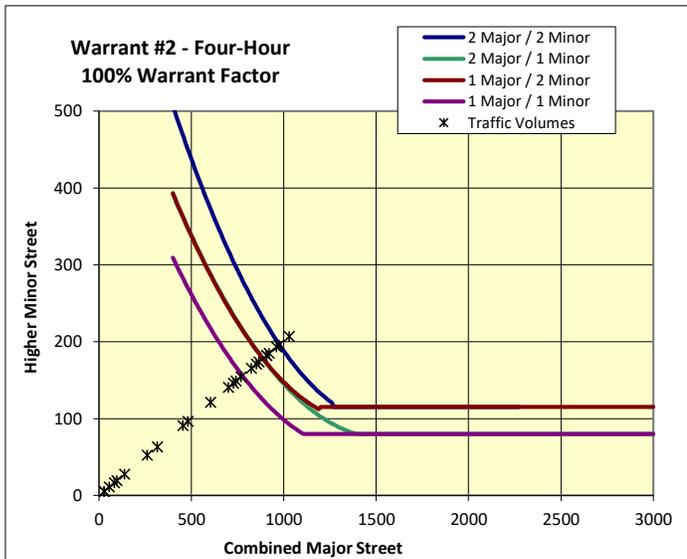
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	11	Yes	Yes
	B	750	75	10	Yes	Yes
80%	A	400	120	14	Yes	Yes
	B	600	60	14	Yes	Yes
70%	A	350	105	14	Yes	Yes
	B	525	53	14	Yes	Yes
56%	A	280	84	16	Yes	Yes
	B	420	42	16	Yes	Yes





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Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
4:30 PM	5:30 PM		348	689	4	259
2nd Highest Hour			329	652	4	245
3rd Highest Hour			325	643	4	242
4th Highest Hour			311	616	4	231
5th Highest Hour			306	606	4	228
6th Highest Hour			306	606	4	228
7th Highest Hour			292	579	3	218
8th Highest Hour			288	570	3	214
9th Highest Hour			278	551	3	207
10th Highest Hour			260	514	3	193
11th Highest Hour			251	496	3	186
12th Highest Hour			246	487	3	183
13th Highest Hour			237	469	3	176
14th Highest Hour			204	404	2	152
15th Highest Hour			162	322	2	121
16th Highest Hour			153	303	2	114
17th Highest Hour			107	211	1	79
18th Highest Hour			88	175	1	66
19th Highest Hour			46	92	1	35
20th Highest Hour			32	64	0	24
21st Highest Hour			28	55	0	21
22nd Highest Hour			19	37	0	14
23rd Highest Hour			9	18	0	7
24th Highest Hour			9	18	0	7

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 5/16/2023
File: H:\2\12\311 - Ice Age Drive extension\traffic\signal warrants\sensitivity\[Signal-Warrant-Analysis-Oregon St (50%).xslm\War #3 - Peak HR
Intersection: SW Oregon St/Ice Age Drive
Scenario: 2045 Total Traffic (50% Development)

Warrant Summary

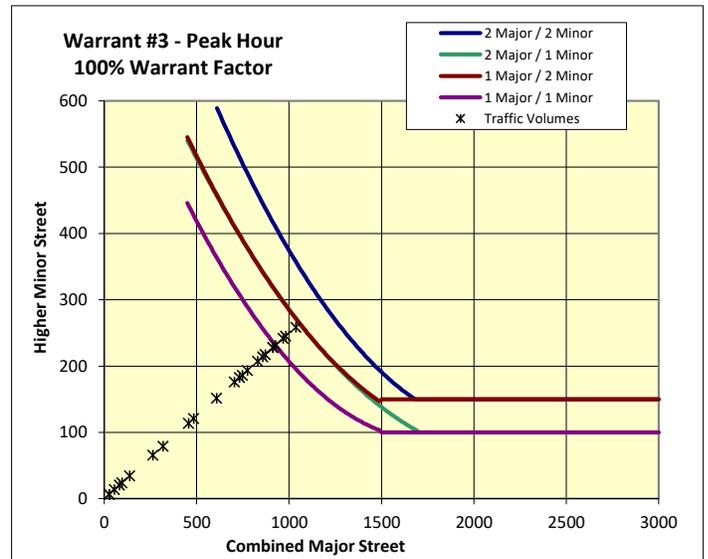
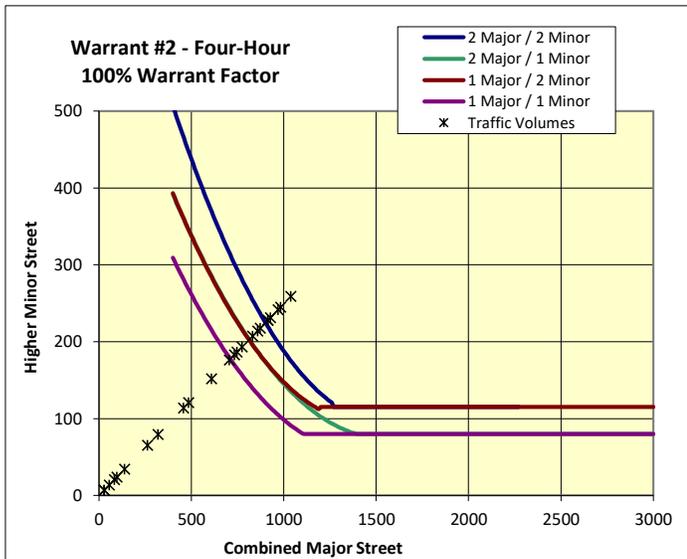
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	14	Yes	Yes
	B	750	75	10	Yes	Yes
80%	A	400	120	15	Yes	Yes
	B	600	60	14	Yes	Yes
70%	A	350	105	16	Yes	Yes
	B	525	53	14	Yes	Yes
56%	A	280	84	16	Yes	Yes
	B	420	42	16	Yes	Yes





KITTELSON & ASSOCIATES, INC.
 610 SW Alder, Suite 700
 Portland, Oregon 97205
 (503) 228-5230

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
4:30 PM	5:30 PM		351	695	4	310
2nd Highest Hour			332	658	4	293
3rd Highest Hour			328	649	4	289
4th Highest Hour			314	621	4	277
5th Highest Hour			309	612	4	273
6th Highest Hour			309	612	4	273
7th Highest Hour			295	584	3	260
8th Highest Hour			290	575	3	256
9th Highest Hour			281	556	3	248
10th Highest Hour			262	519	3	231
11th Highest Hour			253	500	3	223
12th Highest Hour			248	491	3	219
13th Highest Hour			239	473	3	211
14th Highest Hour			206	408	2	182
15th Highest Hour			164	324	2	145
16th Highest Hour			154	306	2	136
17th Highest Hour			108	213	1	95
18th Highest Hour			89	176	1	79
19th Highest Hour			47	93	1	41
20th Highest Hour			33	65	0	29
21st Highest Hour			28	56	0	25
22nd Highest Hour			19	37	0	17
23rd Highest Hour			9	19	0	8
24th Highest Hour			9	19	0	8

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 5/16/2023
File: H:\2\12\311 - Ice Age Drive extension\traffic\signal warrants\sensitivity\Signal-Warrant-Analysis-Oregon 2023 (75%).xslm\War #3 - Peak HR
Intersection: SW Oregon St/Ice Age Drive
Scenario: 2045 Total Traffic (75% Development)

Warrant Summary

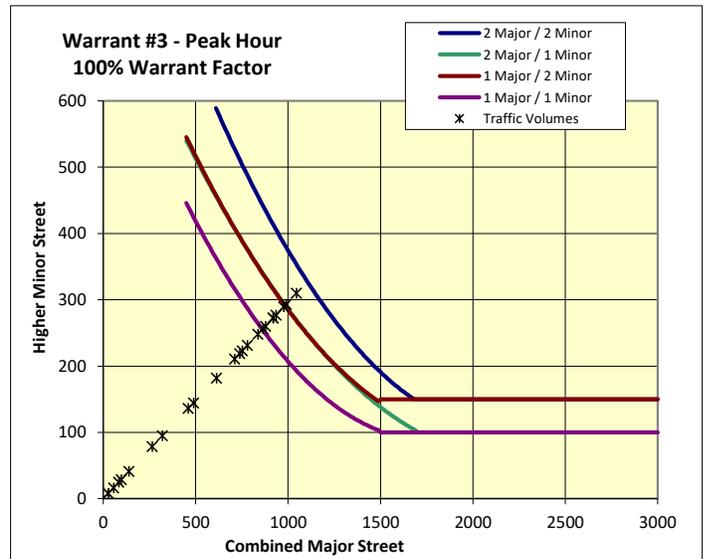
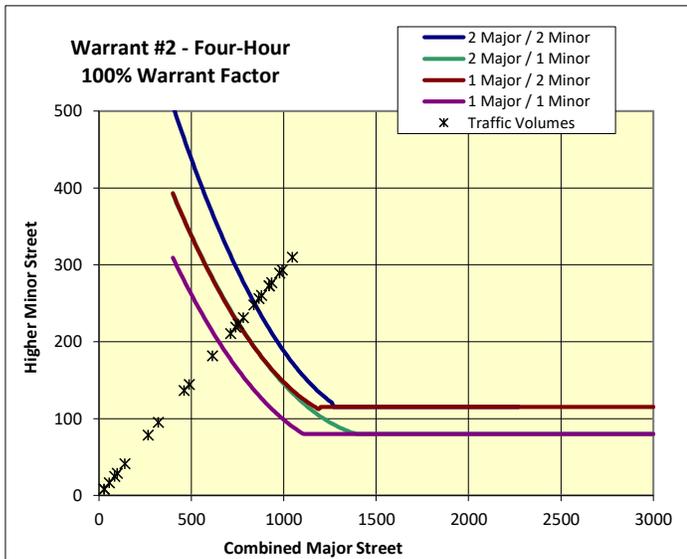
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	14	Yes	Yes
	B	750	75	11	Yes	Yes
80%	A	400	120	16	Yes	Yes
	B	600	60	14	Yes	Yes
70%	A	350	105	16	Yes	Yes
	B	525	53	14	Yes	Yes
56%	A	280	84	17	Yes	Yes
	B	420	42	16	Yes	Yes



Intersection												
Int Delay, s/veh	1.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕↕		↵	↕↕	
Traffic Vol, veh/h	29	10	2	4	4	3	4	489	32	53	455	58
Future Vol, veh/h	29	10	2	4	4	3	4	489	32	53	455	58
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	32	11	2	4	4	3	4	537	35	58	500	64

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	927	1228	282	935	1243	286	564	0	0	572	0	0
Stage 1	648	648	-	563	563	-	-	-	-	-	-	-
Stage 2	279	580	-	372	680	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	219	173	706	216	169	702	983	-	-	976	-	-
Stage 1	418	457	-	471	500	-	-	-	-	-	-	-
Stage 2	696	491	-	613	442	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	203	162	706	194	158	702	983	-	-	976	-	-
Mov Cap-2 Maneuver	203	162	-	194	158	-	-	-	-	-	-	-
Stage 1	416	430	-	469	498	-	-	-	-	-	-	-
Stage 2	684	489	-	560	416	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	25.9		21.9		0.1		0.8	
HCM LOS	D		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	983	-	-	203	186	194	237	976	-	-
HCM Lane V/C Ratio	0.004	-	-	0.157	0.071	0.023	0.032	0.06	-	-
HCM Control Delay (s)	8.7	-	-	26	25.8	24	20.7	8.9	-	-
HCM Lane LOS	A	-	-	D	D	C	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.5	0.2	0.1	0.1	0.2	-	-

Intersection												
Int Delay, s/veh	1.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕↕		↵	↕↕	
Traffic Vol, veh/h	36	10	4	4	4	3	16	489	32	53	455	106
Future Vol, veh/h	36	10	4	4	4	3	16	489	32	53	455	106
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	40	11	4	4	4	3	18	537	35	58	500	116

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	981	1282	308	963	1323	286	616	0	0	572	0	0
Stage 1	674	674	-	591	591	-	-	-	-	-	-	-
Stage 2	307	608	-	372	732	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	199	160	679	206	151	702	940	-	-	976	-	-
Stage 1	403	444	-	453	485	-	-	-	-	-	-	-
Stage 2	669	477	-	613	418	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	182	148	679	182	139	702	940	-	-	976	-	-
Mov Cap-2 Maneuver	182	148	-	182	139	-	-	-	-	-	-	-
Stage 1	395	418	-	444	476	-	-	-	-	-	-	-
Stage 2	647	468	-	558	393	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	28.9		23.6		0.3		0.8	
HCM LOS	D		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	940	-	-	182	191	182	212	976	-	-
HCM Lane V/C Ratio	0.019	-	-	0.217	0.081	0.024	0.036	0.06	-	-
HCM Control Delay (s)	8.9	-	-	30.2	25.5	25.3	22.6	8.9	-	-
HCM Lane LOS	A	-	-	D	D	D	C	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.8	0.3	0.1	0.1	0.2	-	-

Intersection												
Int Delay, s/veh	2.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕		↵	↕	
Traffic Vol, veh/h	42	10	5	4	4	3	28	489	32	53	455	154
Future Vol, veh/h	42	10	5	4	4	3	28	489	32	53	455	154
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	46	11	5	4	4	3	31	537	35	58	500	169

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1034	1335	335	989	1402	286	669	0	0	572	0	0
Stage 1	701	701	-	617	617	-	-	-	-	-	-	-
Stage 2	333	634	-	372	785	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	182	149	652	197	135	702	897	-	-	976	-	-
Stage 1	389	432	-	437	472	-	-	-	-	-	-	-
Stage 2	646	464	-	613	395	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	164	135	652	170	123	702	897	-	-	976	-	-
Mov Cap-2 Maneuver	164	135	-	170	123	-	-	-	-	-	-	-
Stage 1	375	407	-	422	455	-	-	-	-	-	-	-
Stage 2	615	448	-	556	372	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	33	25.4	0.5	0.7
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	897	-	-	164	184	170	190	976	-	-
HCM Lane V/C Ratio	0.034	-	-	0.281	0.09	0.026	0.04	0.06	-	-
HCM Control Delay (s)	9.2	-	-	35.3	26.5	26.7	24.7	8.9	-	-
HCM Lane LOS	A	-	-	E	D	D	C	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.1	0.3	0.1	0.1	0.2	-	-

HCM 6th TWSC
3: SW 124th Ave & Ice Age Dr/SW Blake St

Ice Age Drive Extension
2045 AM Peak Hour - 75% Development

Intersection												
Int Delay, s/veh	2.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕↕		↵	↕↕	
Traffic Vol, veh/h	48	10	7	4	4	3	40	489	32	53	455	202
Future Vol, veh/h	48	10	7	4	4	3	40	489	32	53	455	202
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	53	11	8	4	4	3	44	537	35	58	500	222

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1086	1387	361	1015	1481	286	722	0	0	572	0	0
Stage 1	727	727	-	643	643	-	-	-	-	-	-	-
Stage 2	359	660	-	372	838	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	167	138	627	188	121	702	856	-	-	976	-	-
Stage 1	375	420	-	421	459	-	-	-	-	-	-	-
Stage 2	624	451	-	613	373	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	148	123	627	159	108	702	856	-	-	976	-	-
Mov Cap-2 Maneuver	148	123	-	159	108	-	-	-	-	-	-	-
Stage 1	356	395	-	400	436	-	-	-	-	-	-	-
Stage 2	583	428	-	554	351	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	38.2		27.7		0.7		0.7	
HCM LOS	E		D					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	856	-	-	148	184	159	169	976	-	-
HCM Lane V/C Ratio	0.051	-	-	0.356	0.102	0.028	0.046	0.06	-	-
HCM Control Delay (s)	9.4	-	-	42.2	26.8	28.3	27.3	8.9	-	-
HCM Lane LOS	A	-	-	E	D	D	D	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	1.5	0.3	0.1	0.1	0.2	-	-

Intersection												
Int Delay, s/veh	3.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Traffic Vol, veh/h	59	5	4	22	14	43	2	508	4	3	730	29
Future Vol, veh/h	59	5	4	22	14	43	2	508	4	3	730	29
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	65	5	4	24	15	47	2	558	4	3	802	32

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1115	1390	417	974	1404	281	834	0	0	562	0	0
Stage 1	824	824	-	564	564	-	-	-	-	-	-	-
Stage 2	291	566	-	410	840	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	159	138	576	202	135	707	776	-	-	985	-	-
Stage 1	327	378	-	470	499	-	-	-	-	-	-	-
Stage 2	684	498	-	581	372	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	135	137	576	194	134	707	776	-	-	985	-	-
Mov Cap-2 Maneuver	135	137	-	194	134	-	-	-	-	-	-	-
Stage 1	326	377	-	469	498	-	-	-	-	-	-	-
Stage 2	617	497	-	566	371	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	50	20.1	0	0
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	776	-	-	135	207	194	345	985	-	-
HCM Lane V/C Ratio	0.003	-	-	0.48	0.048	0.125	0.182	0.003	-	-
HCM Control Delay (s)	9.7	-	-	54.1	23.3	26.2	17.7	8.7	-	-
HCM Lane LOS	A	-	-	F	C	D	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	2.2	0.1	0.4	0.7	0	-	-

Intersection												
Int Delay, s/veh	8.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↕↕		↵	↕↕	
Traffic Vol, veh/h	100	5	14	22	14	43	4	508	4	3	730	36
Future Vol, veh/h	100	5	14	22	14	43	4	508	4	3	730	36
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	110	5	15	24	15	47	4	558	4	3	802	40

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1123	1398	421	978	1416	281	842	0	0	562	0	0
Stage 1	828	828	-	568	568	-	-	-	-	-	-	-
Stage 2	295	570	-	410	848	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	157	136	573	201	133	707	770	-	-	985	-	-
Stage 1	325	377	-	468	497	-	-	-	-	-	-	-
Stage 2	681	496	-	581	369	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	133	135	573	188	132	707	770	-	-	985	-	-
Mov Cap-2 Maneuver	133	135	-	188	132	-	-	-	-	-	-	-
Stage 1	323	376	-	466	495	-	-	-	-	-	-	-
Stage 2	613	494	-	555	368	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	87.3		20.4		0.1		0	
HCM LOS	F		C					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	770	-	-	133	309	188	342	985	-	-
HCM Lane V/C Ratio	0.006	-	-	0.826	0.068	0.129	0.183	0.003	-	-
HCM Control Delay (s)	9.7	-	-	100.6	17.5	27	17.9	8.7	-	-
HCM Lane LOS	A	-	-	F	C	D	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	5.1	0.2	0.4	0.7	0	-	-

Intersection												
Int Delay, s/veh	20.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↗		↖	↗	
Traffic Vol, veh/h	142	5	25	22	14	43	5	508	4	3	730	42
Future Vol, veh/h	142	5	25	22	14	43	5	508	4	3	730	42
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	156	5	27	24	15	47	5	558	4	3	802	46

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1128	1403	424	980	1424	281	848	0	0	562	0	0
Stage 1	831	831	-	570	570	-	-	-	-	-	-	-
Stage 2	297	572	-	410	854	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	~ 155	135	570	200	131	707	766	-	-	985	-	-
Stage 1	324	376	-	466	496	-	-	-	-	-	-	-
Stage 2	679	495	-	581	366	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 131	134	570	183	130	707	766	-	-	985	-	-
Mov Cap-2 Maneuver	~ 131	134	-	183	130	-	-	-	-	-	-	-
Stage 1	322	375	-	463	493	-	-	-	-	-	-	-
Stage 2	610	492	-	543	365	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	171.4	20.7	0.1	0
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	766	-	-	131	370	183	338	985	-	-
HCM Lane V/C Ratio	0.007	-	-	1.191	0.089	0.132	0.185	0.003	-	-
HCM Control Delay (s)	9.7	-	-	204.3	15.7	27.6	18.1	8.7	-	-
HCM Lane LOS	A	-	-	F	C	D	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	9.4	0.3	0.4	0.7	0	-	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection												
Int Delay, s/veh	41.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↵		↵	↵		↵	↵↵		↵	↵↵	
Traffic Vol, veh/h	182	5	35	22	14	43	7	508	4	3	730	49
Future Vol, veh/h	182	5	35	22	14	43	7	508	4	3	730	49
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None									
Storage Length	100	-	-	100	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	200	5	38	24	15	47	8	558	4	3	802	54

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1138	1413	428	986	1438	281	856	0	0	562	0	0
Stage 1	835	835	-	576	576	-	-	-	-	-	-	-
Stage 2	303	578	-	410	862	-	-	-	-	-	-	-
Critical Hdwy	7.6	6.6	7	7.6	6.6	7	4.2	-	-	4.2	-	-
Critical Hdwy Stg 1	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.6	5.6	-	6.6	5.6	-	-	-	-	-	-	-
Follow-up Hdwy	3.55	4.05	3.35	3.55	4.05	3.35	2.25	-	-	2.25	-	-
Pot Cap-1 Maneuver	~ 153	133	567	198	128	707	761	-	-	985	-	-
Stage 1	322	374	-	462	493	-	-	-	-	-	-	-
Stage 2	673	492	-	581	363	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	~ 128	131	567	177	126	707	761	-	-	985	-	-
Mov Cap-2 Maneuver	~ 128	131	-	177	126	-	-	-	-	-	-	-
Stage 1	318	373	-	457	488	-	-	-	-	-	-	-
Stage 2	602	487	-	532	362	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	288.8	21.1	0.1	0
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	761	-	-	128	400	177	332	985	-	-
HCM Lane V/C Ratio	0.01	-	-	1.563	0.11	0.137	0.189	0.003	-	-
HCM Control Delay (s)	9.8	-	-	\$ 348.9	15.1	28.5	18.3	8.7	-	-
HCM Lane LOS	A	-	-	F	C	D	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	14.3	0.4	0.5	0.7	0	-	-

Notes
 ~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon



KITTELSON & ASSOCIATES, INC.
 610 SW Alder, Suite 700
 Portland, Oregon 97205
 (503) 228-5230

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 9/15/2022
File: H:\2\1\2\311 - Ice Age Drive Extension\traffic\signal warrants\sensitivity\[Signal-Warrant-Analysis-SW 124th (0%).xslm>Data Input
Intersection: SW 124th/Ice Age Drive
Scenario: 2045 Total Traffic (0% Development)

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
3:25 PM	4:25 PM		514	762	68	79
2nd Highest Hour			487	721	64	75
3rd Highest Hour			480	711	63	74
4th Highest Hour			459	681	61	71
5th Highest Hour			452	671	60	70
6th Highest Hour			452	671	60	70
7th Highest Hour			432	640	57	66
8th Highest Hour			425	630	56	65
9th Highest Hour			411	610	54	63
10th Highest Hour			384	569	51	59
11th Highest Hour			370	549	49	57
12th Highest Hour			363	538	48	56
13th Highest Hour			350	518	46	54
14th Highest Hour			302	447	40	46
15th Highest Hour			240	356	32	37
16th Highest Hour			226	335	30	35
17th Highest Hour			158	234	21	24
18th Highest Hour			130	193	17	20
19th Highest Hour			69	102	9	11
20th Highest Hour			48	71	6	7
21st Highest Hour			41	61	5	6
22nd Highest Hour			27	41	4	4
23rd Highest Hour			14	20	2	2
24th Highest Hour			14	20	2	2

Warrant Summary

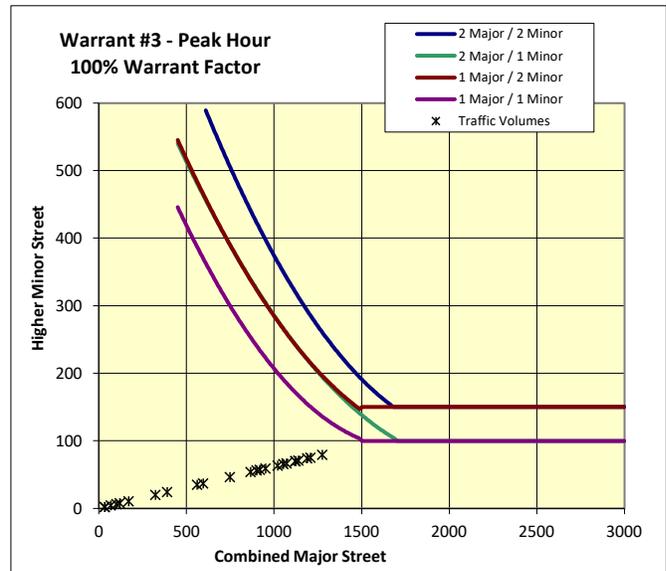
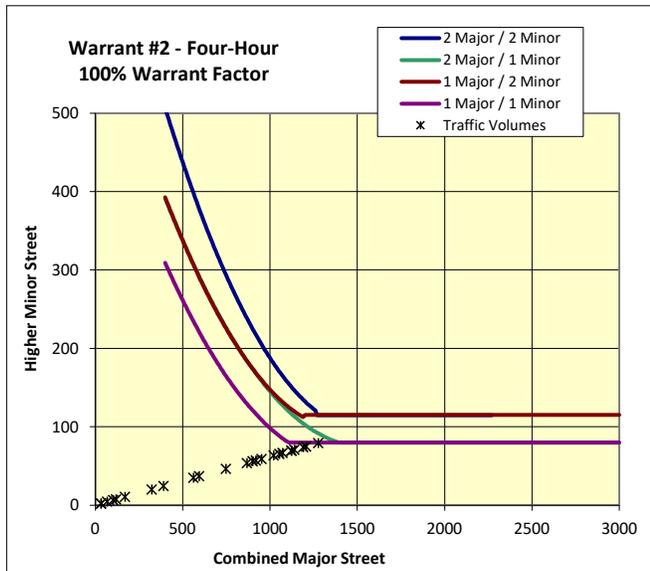
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	No
#2	Four-Hour Vehicular volume	Yes	No
#3	Peak Hour	Yes	No
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	2
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	600	150	0	No	No
	B	900	75	2	No	No
80%	A	480	120	0	No	Yes
	B	720	60	9	Yes	Yes
70%	A	420	105	0	No	Yes
	B	630	53	13	Yes	Yes
56%	A	336	84	0	No	Yes
	B	504	42	14	Yes	Yes





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Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 9/15/2022
File: H:\2\1\2\311 - Ice Age Drive Extension\traffic\signal warrants\sensitivity\Signal-Warrant-Analysis-SW 124th (25%).xslm\Data Input
Intersection: SW 124th/Ice Age Drive
Scenario: 2045 Total Traffic (25% Development)

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
3:25 PM	4:25 PM		516	769	119	79
2nd Highest Hour			488	728	113	75
3rd Highest Hour			482	718	111	74
4th Highest Hour			461	687	106	71
5th Highest Hour			454	677	105	70
6th Highest Hour			454	677	105	70
7th Highest Hour			433	646	100	66
8th Highest Hour			427	636	98	65
9th Highest Hour			413	615	95	63
10th Highest Hour			385	574	89	59
11th Highest Hour			372	554	86	57
12th Highest Hour			365	543	84	56
13th Highest Hour			351	523	81	54
14th Highest Hour			303	451	70	46
15th Highest Hour			241	359	56	37
16th Highest Hour			227	338	52	35
17th Highest Hour			158	236	36	24
18th Highest Hour			131	195	30	20
19th Highest Hour			69	103	16	11
20th Highest Hour			48	72	11	7
21st Highest Hour			41	62	10	6
22nd Highest Hour			28	41	6	4
23rd Highest Hour			14	21	3	2
24th Highest Hour			14	21	3	2

Warrant Summary

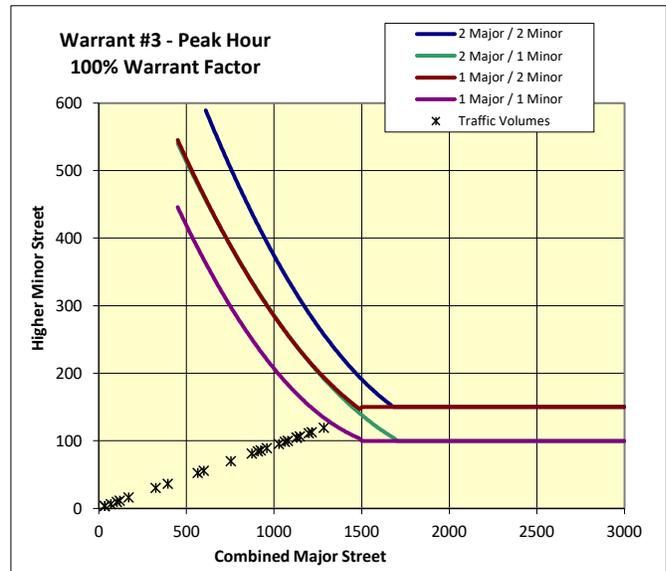
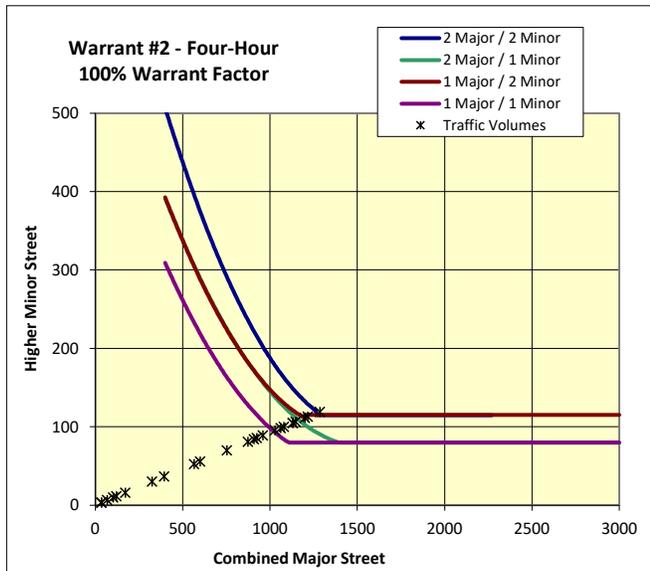
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	No
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	2
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	600	150	0	No	Yes
	B	900	75	12	Yes	Yes
80%	A	480	120	0	No	Yes
	B	720	60	14	Yes	Yes
70%	A	420	105	6	No	Yes
	B	630	53	14	Yes	Yes
56%	A	336	84	12	Yes	Yes
	B	504	42	16	Yes	Yes





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Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 9/15/2022
File: H:\2\1\2\311 - Ice Age Drive Extension\traffic\signal warrants\sensitivity\[Signal-Warrant-Analysis-SW 124th (50%).xslm>Data Input
Intersection: SW 124th/Ice Age Drive
Scenario: 2045 Total Traffic (50% Development)

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
3:25 PM	4:25 PM		517	775	172	79
2nd Highest Hour			489	734	163	75
3rd Highest Hour			483	723	161	74
4th Highest Hour			462	692	154	71
5th Highest Hour			455	682	151	70
6th Highest Hour			455	682	151	70
7th Highest Hour			434	651	144	66
8th Highest Hour			427	641	142	65
9th Highest Hour			414	620	138	63
10th Highest Hour			386	579	128	59
11th Highest Hour			372	558	124	57
12th Highest Hour			365	548	122	56
13th Highest Hour			352	527	117	54
14th Highest Hour			303	455	101	46
15th Highest Hour			241	362	80	37
16th Highest Hour			227	341	76	35
17th Highest Hour			159	238	53	24
18th Highest Hour			131	196	44	20
19th Highest Hour			69	103	23	11
20th Highest Hour			48	72	16	7
21st Highest Hour			41	62	14	6
22nd Highest Hour			28	41	9	4
23rd Highest Hour			14	21	5	2
24th Highest Hour			14	21	5	2

Warrant Summary

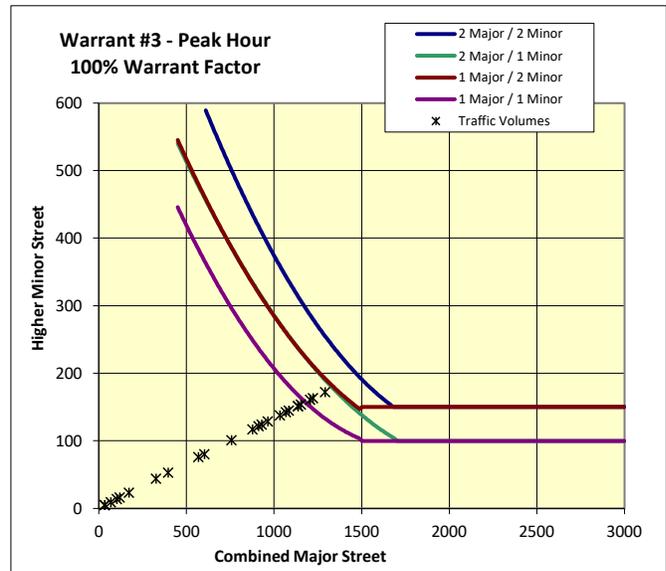
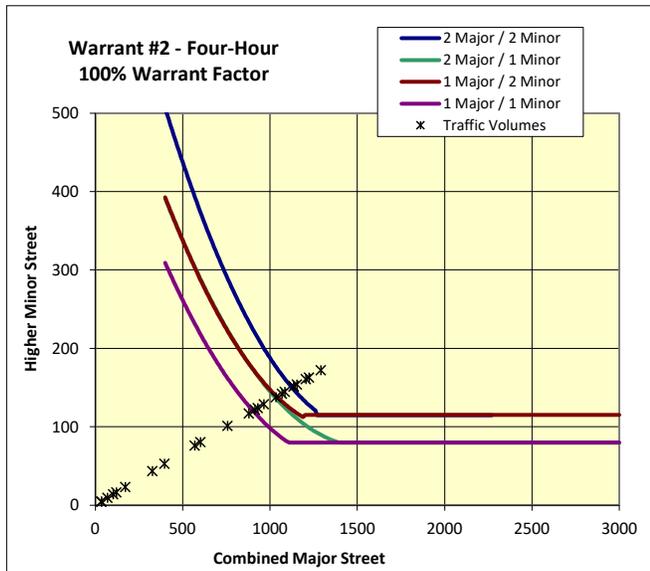
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	2
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	600	150	6	No	Yes
	B	900	75	12	Yes	Yes
80%	A	480	120	12	Yes	Yes
	B	720	60	14	Yes	Yes
70%	A	420	105	13	Yes	Yes
	B	630	53	14	Yes	Yes
56%	A	336	84	14	Yes	Yes
	B	504	42	16	Yes	Yes





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 (503) 228-5230

Project #: 27311
Project Name: Ice Age Drive
Analyst: MLM
Date: 9/15/2022
File: H:\2\1\2\311 - Ice Age Drive Extension\traffic\signal warrants\sensitivity\Signal-Warrant-Analysis-SW 124th (75%).xslm\Data Input
Intersection: SW 124th/Ice Age Drive
Scenario: 2045 Total Traffic (75% Development)

Analysis Traffic Volumes

Hour	Major Street		Minor Street			
	Begin	End	NB	SB	EB	WB
3:25 PM	4:25 PM		519	782	222	79
2nd Highest Hour			491	740	210	75
3rd Highest Hour			484	730	207	74
4th Highest Hour			464	699	198	71
5th Highest Hour			457	688	195	70
6th Highest Hour			457	688	195	70
7th Highest Hour			436	657	186	66
8th Highest Hour			429	646	184	65
9th Highest Hour			415	626	178	63
10th Highest Hour			388	584	166	59
11th Highest Hour			374	563	160	57
12th Highest Hour			367	553	157	56
13th Highest Hour			353	532	151	54
14th Highest Hour			304	459	130	46
15th Highest Hour			242	365	104	37
16th Highest Hour			228	344	98	35
17th Highest Hour			159	240	68	24
18th Highest Hour			131	198	56	20
19th Highest Hour			69	104	30	11
20th Highest Hour			48	73	21	7
21st Highest Hour			42	63	18	6
22nd Highest Hour			28	42	12	4
23rd Highest Hour			14	21	6	2
24th Highest Hour			14	21	6	2

Warrant Summary

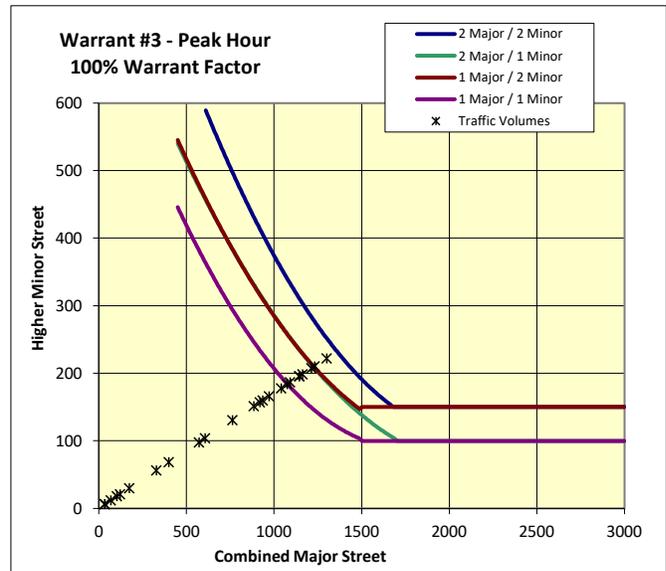
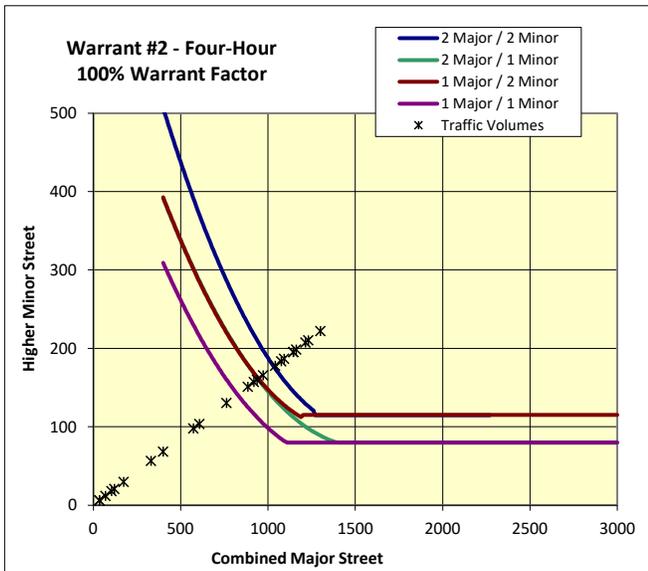
Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-
#9	Intersection Near a Grade Crossing	No	-

Input Parameters

Volume Adjustment Factor =	1.0
North-South Approach =	Major
East-West Approach =	Minor
Major Street Thru Lanes =	2
Minor Street Thru Lanes =	1
Speed > 40 mph?	No
Population < 10,000?	No
Warrant Factor	100%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	89%
Major Street: 8th-Highest Hour / Peak Hour	83%
Minor Street: 4th-Highest Hour / Peak Hour	89%
Minor Street: 8th-Highest Hour / Peak Hour	83%

Warrant #1 - Eight Hour

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	600	150	13	Yes	Yes
	B	900	75	12	Yes	Yes
80%	A	480	120	14	Yes	Yes
	B	720	60	14	Yes	Yes
70%	A	420	105	14	Yes	Yes
	B	630	53	14	Yes	Yes
56%	A	336	84	16	Yes	Yes
	B	504	42	16	Yes	Yes



Appendix F: Oregon Street Access Management Plan



TECHNICAL MEMORANDUM (DRAFT)

DATE: March 17, 2021

TO: Bob Galati | City of Sherwood

FROM: Garth Appanaitis | DKS

SUBJECT: Sherwood Oregon Street Access Management Plan (AMP)

Project #16197-037

This memorandum summarizes the findings of the transportation study to address Washington County's Access Management Plan (AMP) process (CDC 501-8.5C) to analyze the potential for future roadway connections to Oregon Street between Tonquin Road and Tualatin-Sherwood Road. Oregon Street has the functional classification of arterial and Washington County CDC 501.8.5.B(4) states that arterials only have direct access from collector or other arterial roads and with a minimum access spacing of 600 feet.

The AMP process provides the framework for analyzing the traffic safety and operations of potential exceptions to the access standard, as well as the performance of future public street connections that comply with the standard. The AMP was conducted to explore the feasibility of future street connections to the south/east side of Oregon Street between Tonquin Road and the planned future extension of an east-west collector that bisects the Tonquin Employment Area (TEA). Prior planning efforts have identified the future collector connection to Oregon Street, but have not reviewed access to individual properties within the TEA.

OVERVIEW

Three access alternatives (phases) were analyzed to determine the traffic operations and safety associated with increasing levels of development and transportation improvements. These *chronological* configurations (illustrations attached) would be implemented in phases to provide access to TEA and are assumed to include:

1. Alternative 1 – Initial, direct access to Oregon Street for the two fronting properties Taxlots 2S128C000500 and 2S128C000600 (TL 500 and TL 600). The purpose of this configuration is to provide access prior to the construction of additional public street system. Development of additional parcels within the TEA is not included in this initial configuration.

This temporary alternative would not meet Washington County access spacing requirements due to direct lot access to the Oregon Street arterial.

2. Alternative 2 – Intermediate, shared access to Oregon Street for properties via a public street connection, Tonquin Court. This alternative assumes development of remaining TEA properties, with shared access to Tonquin Court. This new street also would include additional partial direct access for TL 500 and TL 600. This temporary alternative would not meet Washington County access spacing requirements due to direct lot access, as well as a local street¹ (Tonquin Court) connection, to the Oregon Street arterial.
3. Alternative 3 – Ultimate access configuration that meets Washington County access management standards. The key element of this ultimate configuration would be the construction of the new east-west collector between Oregon Street and a point to the east (likely connecting to 124th Avenue). The extension of the new collector would provide connectivity to the east, as well as a connection for Tonquin Court to provide secondary ingress/egress for properties within the TEA.

KEY FINDINGS AND RECOMMENDATIONS

The follow describes the key findings and recommended actions and triggers related to each access configuration. The three access alternatives provide an evolving approach to providing access to properties within the TEA with progressing levels of development and access needs.

1. The initial Alternative 1 (direct access for two stop-controlled driveways) would not alter traffic flow on Oregon Street and would meet City and County mobility standards. The driveways should align with existing driveways or shift existing driveways to align, but traffic queuing at driveways along Oregon Street would be minimal.

Recommendations:

- Provide direct full access (stop-controlled) for TL 500, locating the access on Oregon Street at the future (Alternative 2) connection for Tonquin Court. The future location of Tonquin Court (and potential alignment to address the skew with Oregon Street) will dictate the location of this interim access.
- The existing driveway for TL 501 on the north side of Oregon Street may need to be relocated to be placed opposite of the TL 500 driveway. This driveway is not

¹ Local street functional classification is assumed since the stub roadway would serve local access only and would not be a through street to provide circulation for other trips. Future extension of the street to connect eastward to the east-west collector could change the function of the street (as in Alternative 3) and could affect consideration of functional class designation.

currently active² and relocation may be deferred to the construction of Tonquin Court.

- Dedicate right of way for the future extension of Tonquin Court.
 - Dedicate right of way along Oregon Street for frontage improvements including the planned shared use path and potential northbound right turn lanes at each driveway.
 - Provide direct full access (stop-controlled) for TL 600 to Oregon Street. This driveway should be located opposite of the existing driveway for TL 201 to create a 4-legged intersection. Note that this driveway may be placed in the future location of the east-west collector (location to be determined).
 - Provide direct full access (stop-controlled) for TL 700 to Oregon Street. This driveway should be located opposite of an existing driveway and may be the future alignment of the east-west collector (location to be determined). Future ROW for the east-west collector should be dedicated and TL 600 would take access from this location (and close initial TL 600 driveway)
 - Proceed to Alternative 2 access configuration as additional lots within the TEA begin to develop and require access and/or add additional traffic that requires a traffic signal on Oregon Street at Tonquin Court.
2. The Alternative 2 intermediate access configuration would install a traffic signal at Tonquin Court as a shared access location. The back-to-back vehicle queues would dictate storage needs. However, the vehicle queues should be accommodated within available storage (center turn lane on Oregon Street). Turn restrictions (converting to right-in-right-out) at the north (TL 600) driveway would increase storage distance for this movement.

Recommendations:

- Extend the initial TL 500 driveway as Tonquin Court to provide access to parcels to the south, including additional access for TL 600.
- Reconfigure access to TL 500 to connect to Tonquin Court.
- Reconfigure access for TL 600 to modify initial Oregon Street driveway to right-in-right-out condition and add full access driveway to Tonquin Court. Modification of the Oregon Street TL 600 driveway to right-in-right-out would also impact the existing driveway for TL 201, converting it to right-in-right-out.
- Convert traffic control at Tonquin Court / Oregon Street to a traffic signal (when warranted).

² Driveway is gated and is additionally blocked with parked machinery on site.

- Proceed to Alternative 3 access configuration upon completion of the east-west collector.
3. The ultimate access configuration (Alternative 3) would meet Washington County access spacing requirements and would be dependent on the completion of the new east-west collector. The specific placement of the east-west collector may vary, but would not impact the analysis findings, as long as opposite side driveways were aligned to reduce conflicts.

Recommendations:

- Connect the east-west collector to Oregon Street as a signalized intersection. The collector should intersect Oregon Street as a four-legged intersection opposite a driveway serving properties north of Oregon Street. The location of this intersection may require relocation of an existing driveway(s) north of Oregon Street.
- Extend the east-west collector to the east to connect it to the existing transportation network (assumed connection to 124th Avenue).
- Include a northbound right turn lane on Oregon Street at the east-west collector intersection.
- Extend Tonquin Court to connect it to the east-west collector, creating a through connection that would provide local access to the east or west.
- Remove the traffic signal at the Tonquin Court / Oregon Street intersection and restrict the intersection to right-in-right-out movements.
- Close Oregon Street access for TL 700 and relocate access to the east-west collector (located 300 feet or more from Oregon Street). Access should be placed opposite access to TL 600.
- Add TL 600 driveway access to the east-west collector (located 300 feet or more from Oregon Street). Access should be placed opposite access to TL 700.

ADDITIONAL CONTEXT

- Current Use and Access – Properties along both sides of Oregon Street currently have direct access to the arterial. Industrial properties on the north side of Oregon Street are generally developed, while properties on the south side have limited existing development. The existing driveways along Oregon Street generally do not meet the access spacing standard of 600 feet, and do not comply with the standard due to access type (driveway).
- Future Transportation Improvements – Several future transportation improvements have been identified in the area in Sherwood’s Transportation System Plan (TSP). These projects do not have identified funding unless noted:

- Tualatin-Sherwood Road widening to five lanes (identified funding through Washington County MSTIP) [TSP project D1]
 - New east-west collector through the TEA connecting Oregon Street to 124th Avenue [TSP project D20]
 - Traffic control (roundabout) upgrade at the intersections of Tonquin Road and Murdock Road [TSP project D3]
 - Shared use paths segments that are part of the Ice Age Tonquin Trail system [TSP projects P11, P16, P38]
- Potential TEA Land Use – The exact future land use details for each parcel are not known. However, TEA is identified as an employment/industrial area that will likely serve a range of uses. Some preliminary potential site information that has been shared with the City (type of use and estimated building area) was used to approximate overall traffic trip potential for the weekday morning and evening peak hour. While ultimately the proposed land uses and trip patterns may vary, this estimate provides an approximation of the overall level of traffic that would be served by site access configurations.
 - Trip generation estimates - Trip generation for the TEA was estimated using national rates published in Institute of Transportation Engineers (ITE). Trip generation was assumed to be general light industrial (ITE 110) for sites providing equipment storage, and industrial park (ITE 130) for the remaining general speculative industrial uses. The approximate trip generation for each alternative is:
 - Alternative 1 – Approximately 300 trips during the morning and evening peak hours.
 - Alternative 2 – Approximately 500 trips during the morning and evening peak hours.
 - Alternative 3 – Approximately 500 trips during the morning and evening peak hours. However, about 300 trips would load directly to Oregon Street with the remaining traffic (approximately 40 percent) traveling to/from the east via the new east-west collector.
 - Alternative 1 – Direct access driveways
 - Network Assumptions – No changes on Oregon Street. Both driveways would operate as full-access with two-way stop-control (TWSC) controlling the driveway traffic. The center turn lanes on Oregon Street would provide left turn access into the sites. TL 600 access should be located opposite of the existing Allied Systems driveway to reduce turning conflicts. TL 500 access may be located approximately 500 feet to the south (opposite secondary Allied Systems driveway) or both driveways may need to shift to accommodate the ultimate location for Tonquin Court.
 - Operations – The two driveways would meet the existing City of Sherwood and Washington County mobility standards operating at level of service (LOS) D or better.

- Potential Options – Consider the benefit of a secondary turn lane from TL 600 to reduce delay but may not have long-term utility depending on placement of east-west collector.
- Alternative 2 – Intermediate shared access
 - Network Assumptions – Tonquin Court would replace the southern driveway (TL 500) and would provide shared access for all lots via a traffic signal. The northern driveway for TL 600 and Allied Systems may need to convert to a right-in-right-out only with left turns prohibited. This configuration would require modification of the existing access but would provide additional vehicle queue storage for the southbound left turn movement at Tonquin Court.
 - Trigger – A conversion to the Alternative 2 configuration would be needed as additional properties without frontage along Oregon Street develop and would require access to Tonquin Court.
 - Operations – The two driveways would meet the existing City of Sherwood and Washington County mobility standards. While the southbound left turn volume during the morning would be high for Tonquin Court, it could be served by the traffic signal and the 95th percentile queue (175 feet) would not approach the northern driveway. The southbound left turn for Coast Paving may conflict with the northbound left turn for Pride Disposal, but both driveways have low traffic volumes, operating at LOS D or better.
 - Potential Options – Consider the potential access restriction for north driveway to right-in-right-out. This would provide additional southbound left turn storage for the Tonquin Court traffic signal but would shift additional traffic to this movement. In addition, this would require modification to an existing site driveway and use.
- Alternative 3 - Ultimate Configuration
 - Network Assumptions – The completion of a new east-west collector through the TEA would provide secondary access for TEA properties to/from the east. Tonquin Court would also connect to the east-west collector. Primary access to/from Oregon Street would shift from the Alternative 2 configuration (Tonquin Court) to the east-west collector.
 - The traffic signal at Tonquin Court would be removed³ and replaced with a traffic signal at the east-west collector. The specific location of the east-west

³ Removal of the traffic signal would be needed to address two mobility strategies along the corridor: 1) reduce opportunity for traffic stopped at Tonquin Court to spill back to the future roundabout at Tonquin Road, and 2) maintain southbound traffic flow on Oregon Street for a single southbound lane approach.

collector alignment is unknown, but it should be configured so that it is not offset with a driveway on the north side of Oregon Street.

- A northbound right turn lane should be added on Oregon Street approaching the east-west collector.
- Trigger – A conversion to the ultimate access configuration should be pursued based on the completion of both A) Connection of the east-west collector from Oregon Street to 124th Avenue, and B) Connection of Tonquin Court to the east-west collector.
- Operations (morning peak) – The high traffic flows during the morning peak would be the northbound traffic on Oregon Street and the northbound right turn at the east-west collector. The southbound left turn that was present in Alternative 2 would primarily shift to the “back door” via 124th Avenue and would not access via Oregon Street to avoid delay at the Oregon Street/Tualatin-Sherwood Road intersection. The traffic signal at the east-west collector would operate at LOS B, while Tonquin Court would operate at LOS D, but would be a low volume approach (due to improved TEA street connections).
- Operations (evening peak) – In the evening, the high traffic flow would be southbound along Oregon Street and from the westbound left turn from the east-west collector. The westbound left turn would have a 95th percentile queue of approximately 225 feet, so access to the collector would require adequate spacing from Oregon Street.⁴ The intersection LOS would be similar to the morning peak, with LOS B for the east-west collector and LOS D for Tonquin Court.

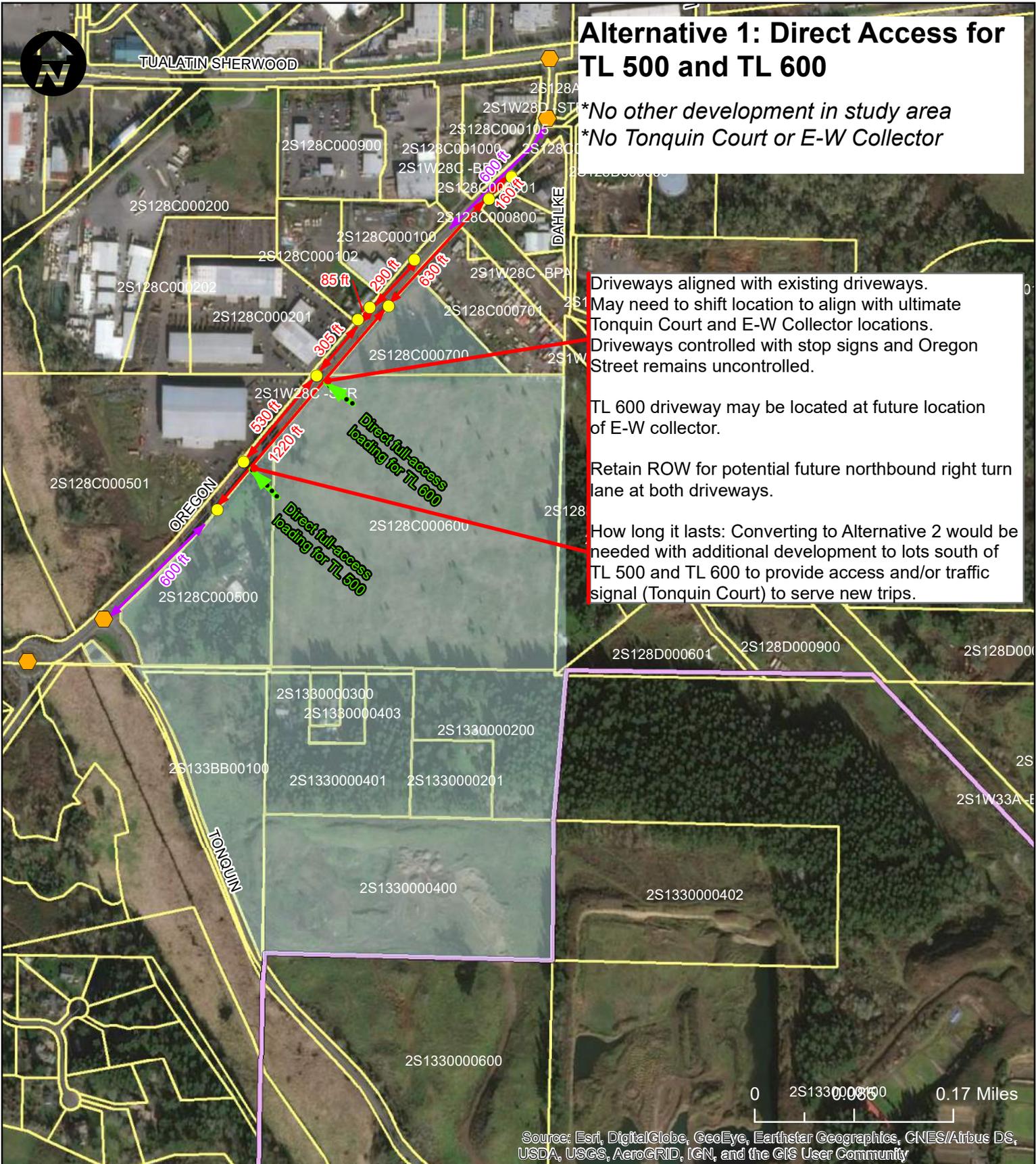
ATTACHMENTS

The following attachments are included:

1. Access Diagrams for Alternative 1, 2, 3
2. Traffic Operations and Vehicle Queuing

⁴ Preliminary site plans indicate the nearest driveway would be located approximately 400 feet from Oregon Street, which would exceed the estimated queue storage needs.

ACCESS DIAGRAMS



Alternative 1: Direct Access for TL 500 and TL 600

**No other development in study area
No Tonquin Court or E-W Collector

Driveways aligned with existing driveways.
May need to shift location to align with ultimate Tonquin Court and E-W Collector locations.
Driveways controlled with stop signs and Oregon Street remains uncontrolled.

TL 600 driveway may be located at future location of E-W collector.

Retain ROW for potential future northbound right turn lane at both driveways.

How long it lasts: Converting to Alternative 2 would be needed with additional development to lots south of TL 500 and TL 600 to provide access and/or traffic signal (Tonquin Court) to serve new trips.

- Legend**
- Study Area Measurements
 - Access Spacing Standard
 - Access
 - ⬡ Public Access
 - Private Access
 - Taxlots
 - Urban Growth Boundary
 - Potential Parcels Connected to Proposed Tonquin Court Alignment





Alternative 2: Interim Access via Tonquin Court

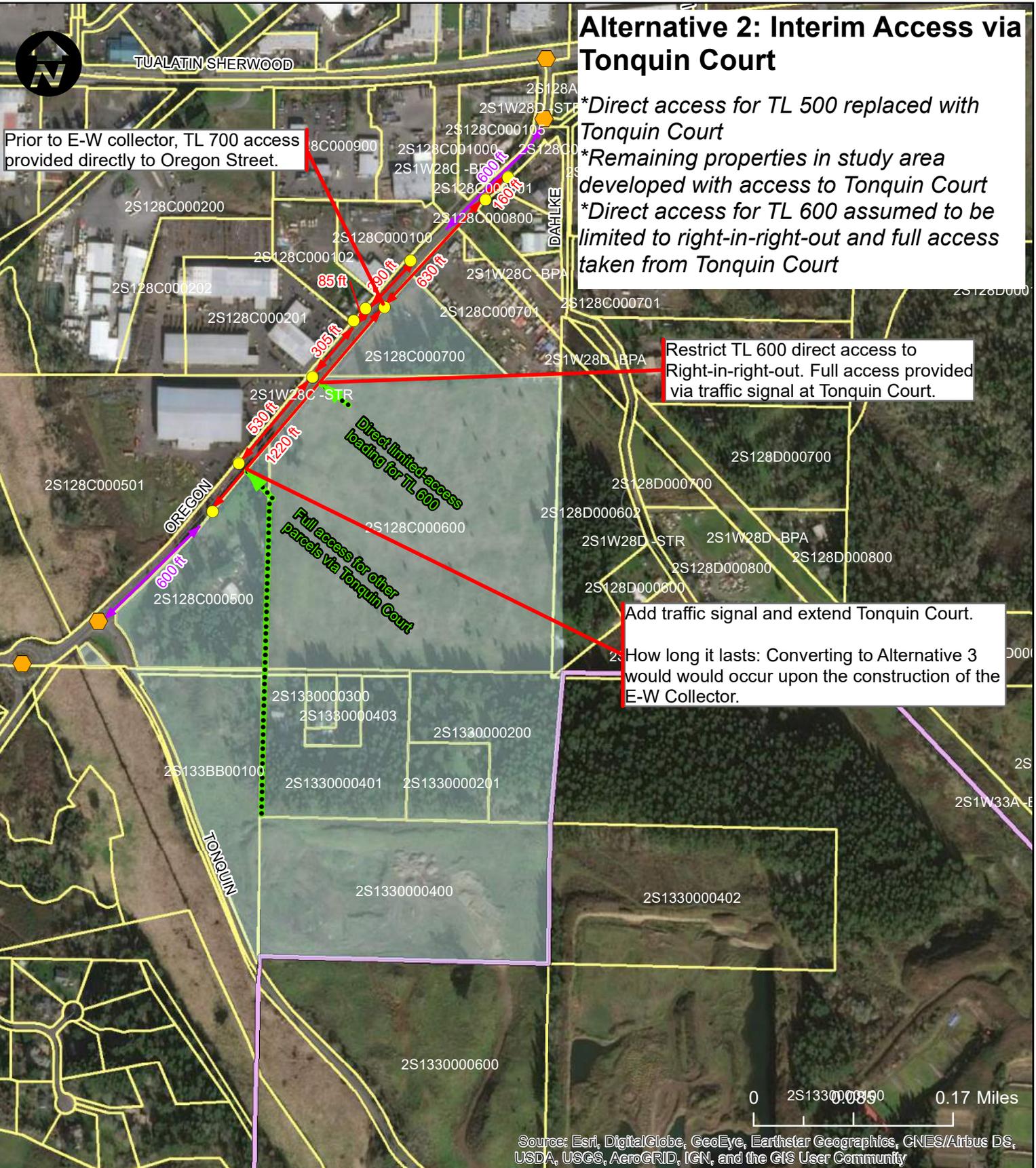
Prior to E-W collector, TL 700 access provided directly to Oregon Street.

*Direct access for TL 500 replaced with Tonquin Court
*Remaining properties in study area developed with access to Tonquin Court
*Direct access for TL 600 assumed to be limited to right-in-right-out and full access taken from Tonquin Court

Restrict TL 600 direct access to Right-in-right-out. Full access provided via traffic signal at Tonquin Court.

Add traffic signal and extend Tonquin Court.
2. How long it lasts: Converting to Alternative 3 would occur upon the construction of the E-W Collector.

Direct limited-access loading for TL 600
Full access for other parcels via Tonquin Court



0 0.085 0.17 Miles

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area Measurements
- Access Spacing Standard
- Access
- Public Access
- Private Access
- Taxlots
- Urban Growth Boundary
- Potential Parcels Connected to Proposed Tonquin Court Alignment



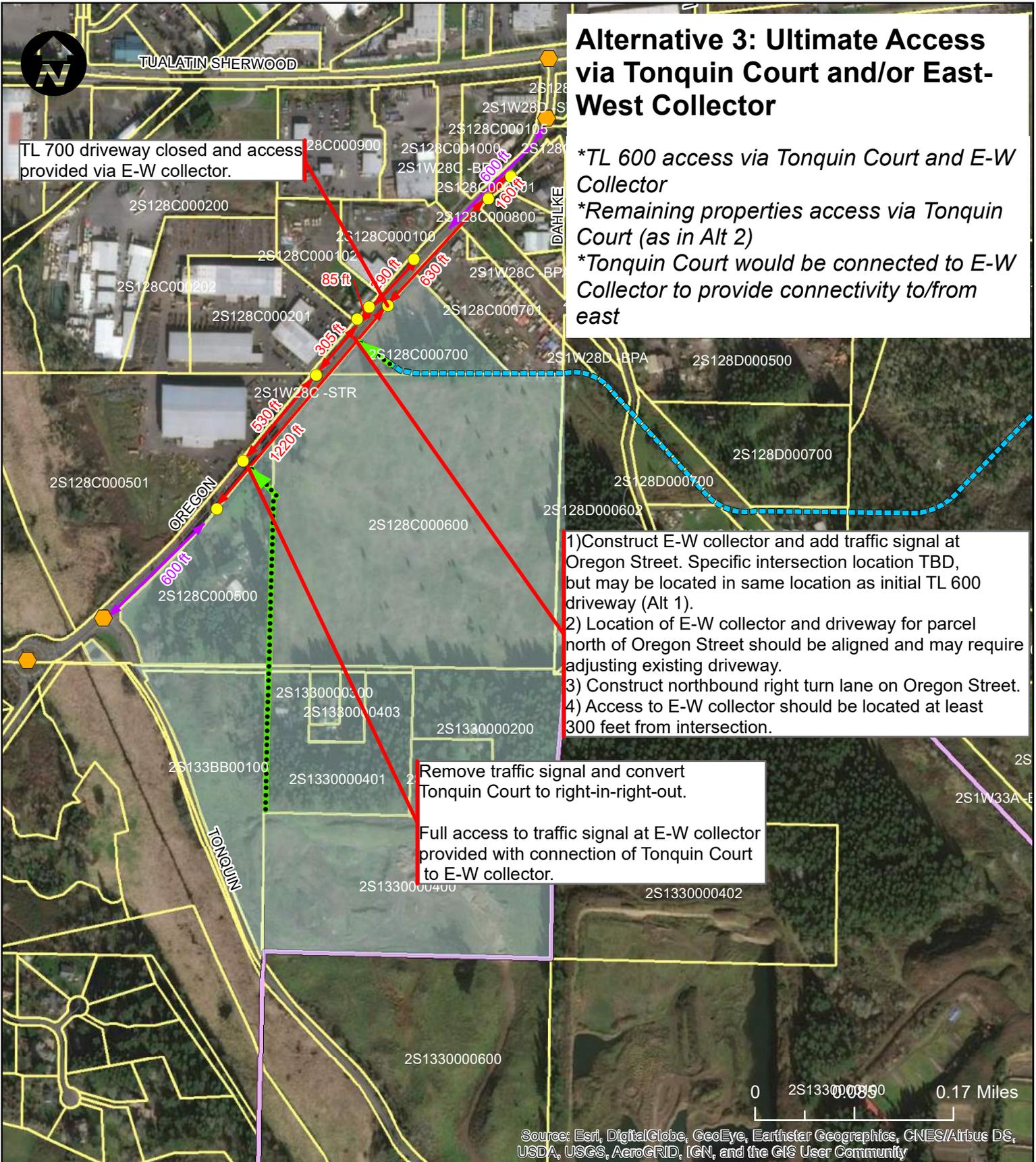


TUALATIN SHERWOOD

Alternative 3: Ultimate Access via Tonquin Court and/or East-West Collector

TL 700 driveway closed and access provided via E-W collector.

- *TL 600 access via Tonquin Court and E-W Collector
- *Remaining properties access via Tonquin Court (as in Alt 2)
- *Tonquin Court would be connected to E-W Collector to provide connectivity to/from east



- 1) Construct E-W collector and add traffic signal at Oregon Street. Specific intersection location TBD, but may be located in same location as initial TL 600 driveway (Alt 1).
- 2) Location of E-W collector and driveway for parcel north of Oregon Street should be aligned and may require adjusting existing driveway.
- 3) Construct northbound right turn lane on Oregon Street.
- 4) Access to E-W collector should be located at least 300 feet from intersection.

Remove traffic signal and convert Tonquin Court to right-in-right-out.
Full access to traffic signal at E-W collector provided with connection of Tonquin Court to E-W collector.

Legend

- Study Area
- Access Spacing Standard
- Access
- Potential TEA East/West Collector Alignment
- Public
- Private
- Taxlots
- Urban Growth Boundary
- Potential Parcels Connected to Proposed Tonquin Court Alignment



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

TRAFFIC OPERATIONS

The following tables summarize the traffic analysis conducted for each alternative.

TABLE 1: EXISTING TRAFFIC OPERATIONS – 2018 PEAK HOUR

NAME	AM Peak			PM Peak		
	Delay (s)	LOS	V/C	Delay (s)	LOS	V/C
SW Oregon St \ Heintz Excavation	8.3	A\A	0.00	0	A\A	0.00
SW Oregon St \ Pride Disposal	10.9	A\B	0.03	12.5	A\B	0.02
SW Oregon St \ Allied Systems	11.8	A\B	0.01	13.1	A\B	0.08
SW Oregon St \ Blast Cleaning	9.7	A\A	0.00	0	A\A	0.00
SW Oregon St \ Tonquin Rd	21.8	A\C	0.38	>100	A\F	>1.0

TABLE 2: ALTERNATIVE 1 TRAFFIC OPERATIONS – 2023 PEAK HOUR

NAME	AM Peak			PM Peak		
	Delay (s)	LOS	V/C	Delay (s)	LOS	V/C
SW Oregon St \ Heintz Excavation	8.7	A\A	0.00	0	A\A	0.00
SW Oregon St \ Pride Disposal	12.9	A\B	0.04	14.2	A\B	0.02
SW Oregon St \ Allied \ Lot 600	29.9	A\D	0.20	34.6	A\D	0.66
SW Oregon St \ Lot 500	15.1	A\C	0.04	15.3	A\C	0.13
SW Oregon St \ Tonquin Rd	36.2	B\E	0.55	>100	A\F	>1.0

TABLE 3: ALTERNATIVE 2 TRAFFIC OPERATIONS – 2025 PEAK HOUR

NAME	AM Peak			PM Peak		
	Delay (s)	LOS	V/C	Delay (s)	LOS	V/C
SW Oregon St \ Heintz Excavation	8.8	A\A	0.00	0	A\A	0.00
SW Oregon St \ Pride Disposal	14.4	A\B	0.04	15.3	A\C	0.02
SW Oregon St \ Allied \ Lot 600	29.1	A\D	0.07	33.5	A\D	0.25
SW Oregon St \ Lot 500 [TRAFFIC SIGNAL]	16.1	B	0.85*	8.7	A	0.69*
SW Oregon St \ Tonquin Rd	54.0	B\F	0.69	>100	A\F	>1.0

Note: * V/C listed as worst movement

TABLE 5: ALTERNATIVE 3 TRAFFIC OPERATIONS – 2035 PEAK HOUR

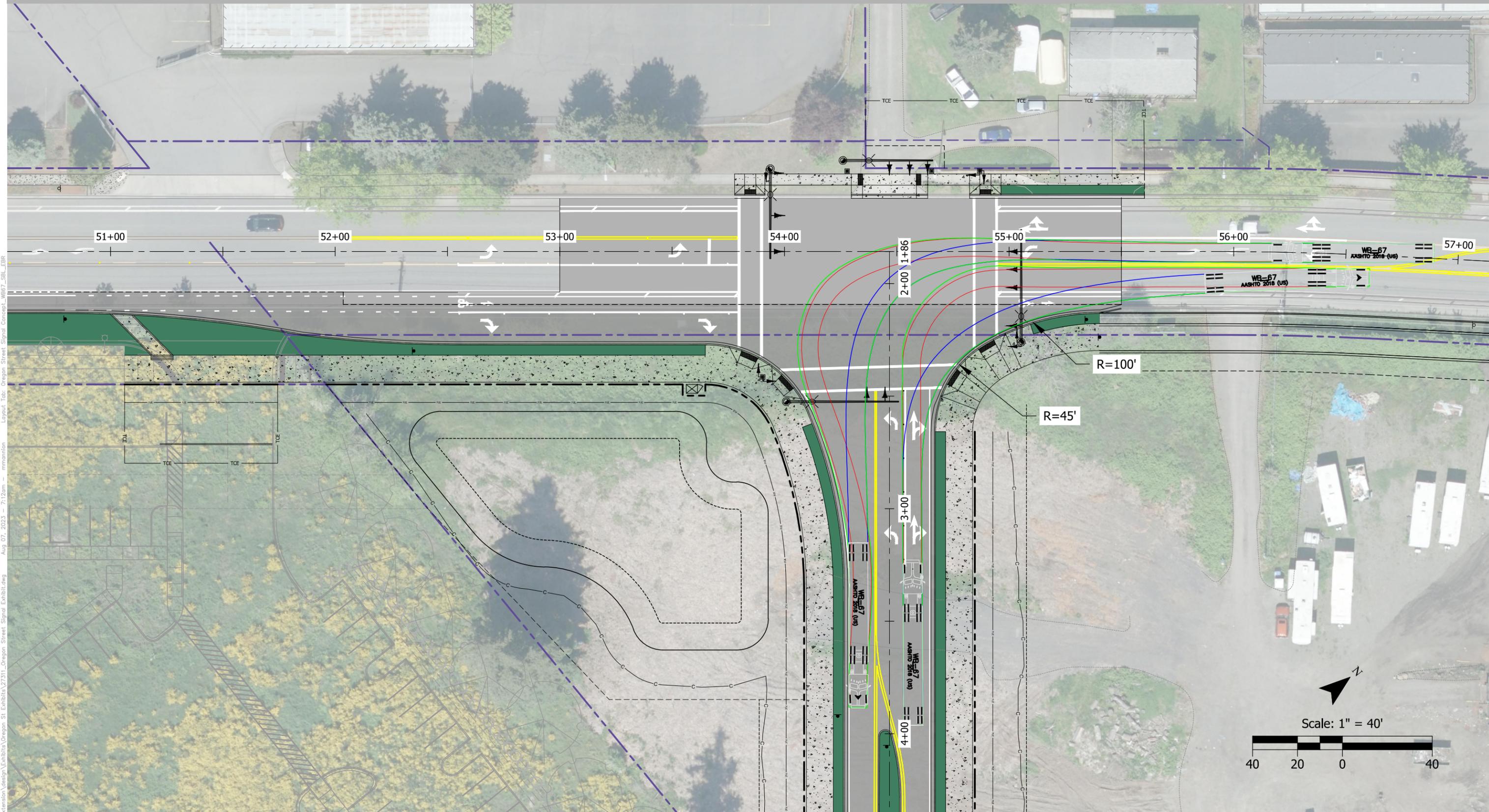
NAME	AM Peak			PM Peak		
	Delay (s)	LOS	V/C	Delay (s)	LOS	V/C
SW Oregon St \ Heintz Excavation	8.6	A\A	0.00	0	A\A	0.00
SW Oregon St \ Pride Disposal	12.5	A\B	0.03	14.6	A\B	0.02
SW Oregon St \ Allied \ E-W Collector [TRAFFIC SIGNAL]	11.2	B	0.72*	16.3	B	0.86*
SW Oregon St \ Lot 500	36.4	B/E	0.10	60.9	A\F	0.45
SW Oregon St \ Tonquin Rd	>100	C\F	>1.0	>100	A\F	>1.0

Note: * V/C listed as worst movement

Appendix G: WB-67 Truck Turning Exhibits

TRUCK TURNING EXHIBIT - WB 67 (SBL & WBR)

Preliminary Design Subject to Change
Date: August 2023



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