Traffic Impact Analysis

BROWN BEAR
(WHITE BARN DEVELOPMENT LOTS 4 AND 5)

Prepared for:
Brown Bear

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Introduction

This traffic impact analysis (TIA) identifies potential transportation-related impacts associated with the construction of a Brown Bear Car Wash located north of Soper Hill Road and east of 87th Avenue NE in The City of Marysville. As necessary, mitigation measures are identified that would reduce or offset significant transportation related impacts that the project may have on the surrounding transportation system.

Project Description

The proposed project is located north of Soper Hill Road and west of SR 9 within the approved White Barn Development[1]. Figure 1 illustrates the site vicinity and surrounding streets. The project includes a car wash with 5 touchless bays, 1 automated tunnel, and 26 vacuuming stalls located on lots 4 and 5 within the White Barn development. No new access points are proposed as part of this project. Access to this site would be provided to the south of the project via an existing right-in/right-out (RIRO) driveway at the 89th Ave NE/Soper Hill Road intersection as well as west of the site via 87th Ave NE. Approximately 12 on-site parking spaces are proposed. A site plan is included in Figure 2. The project is anticipated to be constructed and occupied by the end of 2024.

Study Scope

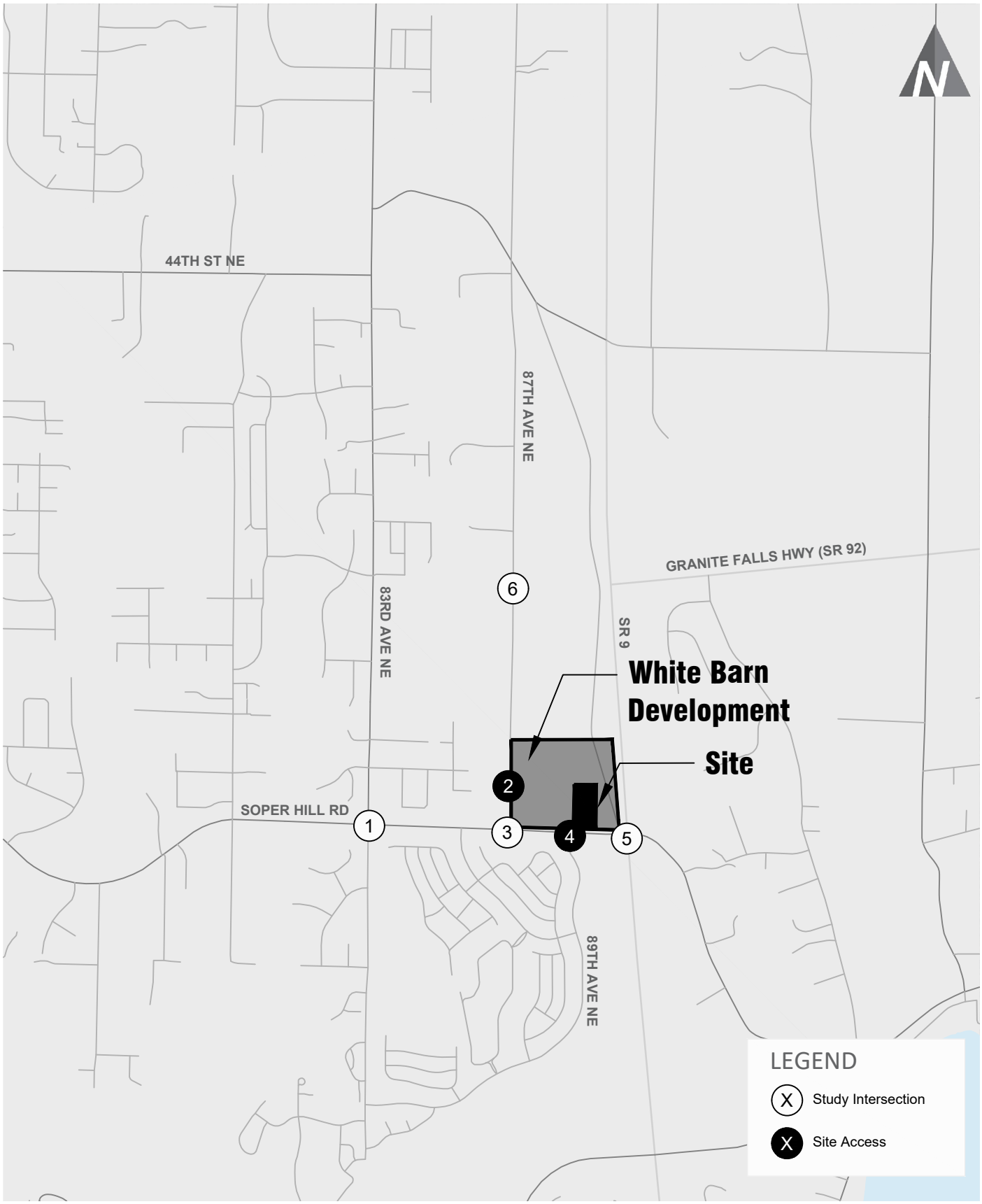
Although a TIA was prepared for the full buildout of the White Barn development, concurrency was issued for the initial phase only as part of that study. Concurrency for the individual lots has been reviewed and issued subsequent to that initial phase.

The scope of the analysis conducted for the Brown Bear project is consistent with the City's *Guidelines for the Preparation of Traffic Impact Analysis - 2017*. The scope of the analysis includes a review of existing and future without-project conditions in the vicinity of the project site under weekday PM peak hour conditions. Future analysis years include the project's opening year of 2024 as well as a horizon year of 2030 (i.e. 6 years following the project's opening year). The study intersections include those forecast to be impacted by 25 or more weekday PM peak hour trips (see Table 6). As coordinated with the City of Marysville and based on the anticipated vehicular impacts of the proposed project, the following intersections were identified for analysis:

1. 83rd Avenue NE/Soper Hill Road *(2024 analysis only)*
2. 87th Avenue NE/Northern Site Access
3. 87th Avenue NE/Soper Hill Road
4. 89th Avenue NE/Soper Hill Road
5. SR 9/Soper Hill Road
6. 87th Avenue NE/35th Street NE *(2030 analysis only)*

This report includes a review of the surrounding street system, transit service, non-motorized facilities, existing and future (2024 and 2030) without-project weekday peak hour traffic volumes, traffic operations, and traffic safety. Future (2024 and 2030) with-project conditions were estimated by adding site-generated traffic to future without-project volumes. The project's impacts on the surrounding transportation system were identified by comparing the future with-project conditions to the future without-project conditions.

[1] The full buildout of the White Barn development was previously completed and is included in the *White Barn Development Traffic Impact Analysis* (GTC, February 2021).



Site Vicinity and Study Intersections

White Barn Brown Bear - Marysville

FIGURE
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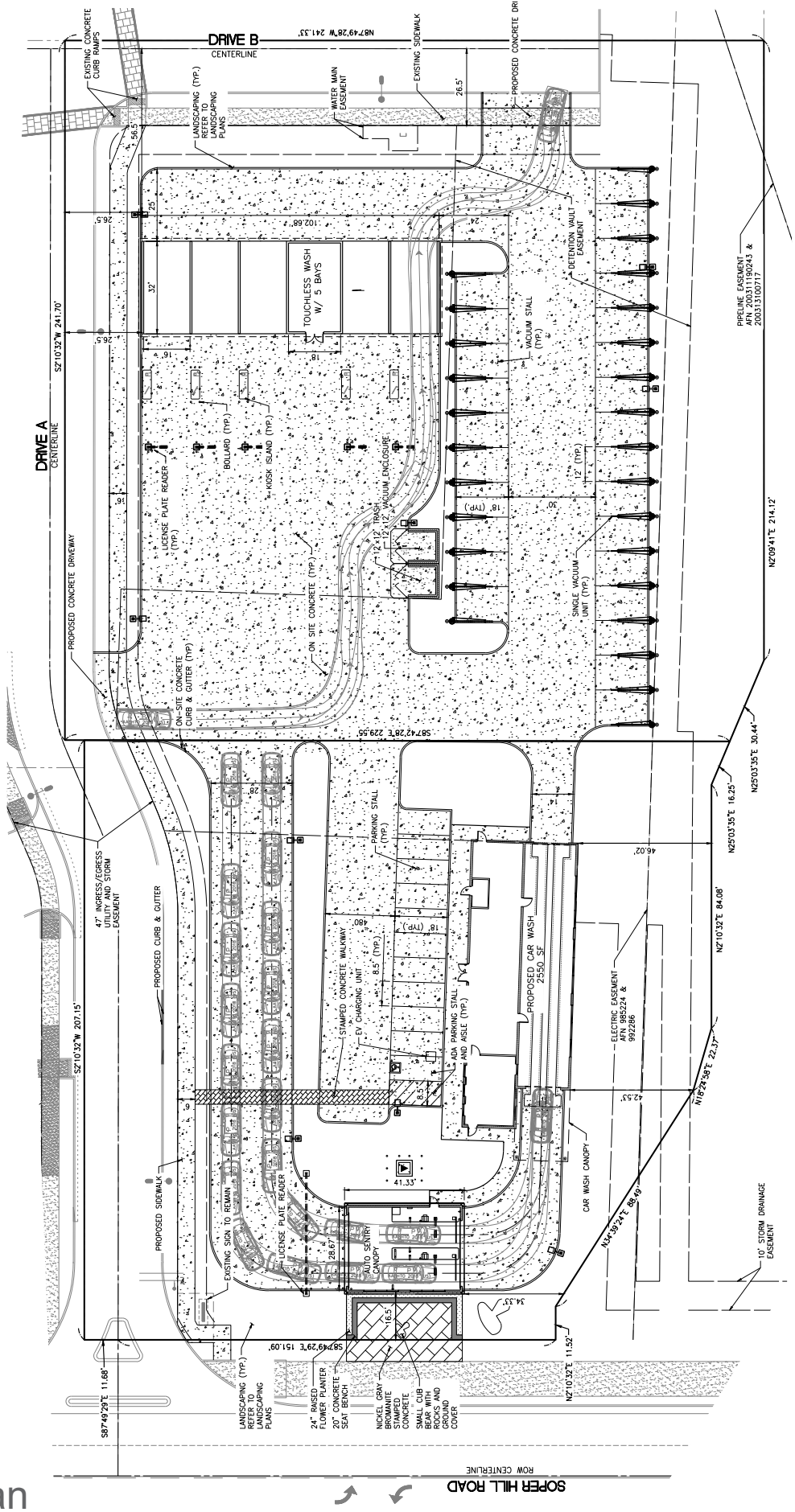

Site Plan

White Barn Brown Bear - Marysville

FIGURE 2

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Existing and Future Without-Project Conditions

This section describes both existing and future (2024 and 2030) without-project conditions within the identified study area. Characteristics are provided for the roadway network, transit service, non-motorized facilities, traffic volumes, traffic operations, and traffic safety.

Street System

The following describes the existing street network within the vicinity of the proposed project and any anticipated changes resulting from planned improvements.

Existing Inventory

Characteristics of the existing street system in the project vicinity are described in Table 1. The roadways adjacent to the project site are currently collector and minor arterials.

Table 1. Roadway Network Existing Conditions Summary

Roadway	Classification	Posted Speed Limit	# Lanes	Parking	Pedestrian Facilities	Bicycle Facilities
SR9	State Highway	55mph	3	No	No	No
SR92 (Granite Falls Hwy)	State Highway	55mph	3	No	No	No
Sunnyside Blvd	Minor Arterial	25mph	2	No	Sidewalk	No
Line Rd/44th St NE	Collector Arterial	35 mph	2	No	No	No
83rd Ave NE/ Whiskey Ridge Rd	Minor Arterial	35 mph	2	No	Sidewalk	Intermittent Bike Lane
Morgan Branch Road (40th St NE)	Minor Arterial	35 mph	2	Yes	No	No
Soper Hill Rd	Minor Arterial	35 mph	2	No	Sidewalk	No
87th Ave NE	Collector Arterial	25mph	2	Yes	No	No
79th Ave NE	Collector Arterial	35 mph	2	No	No	No

Note: mph = miles per hour

Planned Improvements

Based on a review of the Washington Department of Transportation (WSDOT) 2023-2026 Statewide Transportation Program (STIP), and the *City of Marysville 2023-2028 Transportation Improvement Plan (TIP)* there are several planned improvements in the area that would impact both capacity at study intersections and travel patterns in the area. The following improvements were funded or partially funded and assumed to be complete by the 2030 horizon year. Note that given the project's near-term year of opening (2024), planned improvement projects were only assumed for the horizon year (2030) analysis.

- **83rd Avenue NE from Soper Hill Road to SR528 (64th St NE):** Widen to three-lane roadway including bicycle lanes and sidewalks. *City of Marysville TIP Number 34.*
- **35th Street NE from 87th Avenue NE to Intersection of SR9/SR92:** New 4-5 lane roadway including pedestrian and bicycle facilities. *City of Marysville TIP Number 49.*
- **40th Street NE:** New 4-5 lane roadway from 83rd Avenue NE to 87th Avenue NE and widen to three lane roadway Sunnyside Blvd to 83rd Ave NE. Include pedestrian and bicycle facilities along entire section Sunnyside to 87th Ave NE. *City of Marysville TIP Number 50 and 35.*
- **87th Avenue NE:** Five-lane cross section between 40th and 35th Street NE; three-lane cross section south of 35th Street NE and between 40th and Sunnyside. Include

a multiuse path along entire section (Sunnyside-Soper Hill Road). *City of Marysville TIP Numbers 37-39.*

In addition to the above planned improvements that were identified through review of local documents, additional planned improvements were included in the analysis that are anticipated to be in place with continued development in the vicinity. These improvements are included in the City's comprehensive plan and traffic model and are consistent with the previous analysis of the full buildout of the White Barn development.

- **44th Street NE Extension –** New roadway connection between 83rd Avenue NE to 87th Avenue NE.
- **87th Avenue NE/35th Street NE:** New two-lane roundabout.
- **SR 9/Soper Hill Road:** Construction of an eastbound left-turn lane.

Also, the planned installation of the roundabout at the 87th Avenue NE/Soper Hill Road intersection has recently been completed and is assumed under existing conditions.

Transit Service

Transit service in the study is provided by Community Transit, route 209. The nearest bus stop to the site is located on SR 9 at Soper Hill Rd. Route 209 provides service between Lake Stevens and Smokey Point along SR 9 and SR 528 within the study area. Service along this route is offered seven days a week with headways of approximately 60 minutes daily.

Non-Motorized

Existing non-motorized facilities in the vicinity of the project are limited. There are intermittent sidewalks available surrounding the project site as well as an intermittent bicycle lane along 83rd Ave NE between Soper Hill Rd and 30th Pl NE, west of the project site. Additionally, signalized pedestrian crossings are provided across 3 legs of the adjacent SR 9/Soper Hill Road intersection located southeast of the project.

The City of Marysville has a Priority Pedestrian System Plan which identifies numerous planned additions to the pedestrian access route network within the East Sunnyside-Whiskey Ridge Subarea. Additionally, the City's Bicycle Systems Plan when completed, will provide a comprehensive network of bicycle facilities between the City's residential neighborhoods, the transit system, employment areas, schools, and parks and includes improvements to the arterials and SR 9 within the study area. Specifically, as identified in the panned improvements above, there is a substantial amount of pedestrian infrastructure planned in the vicinity of the proposed project. This includes bicycle lanes and sidewalks planned along 83rd Avenue NE between Soper Hills Road and SR 528, 35th Street NE from 87th Avenue NE to SR 9, 40th Street NE from Sunnyside to 87th Avenue NE as well as a multiuse path along 87th Avenue NE between Sunnyside-Soper Hill Road.

Traffic Volumes

The following sections summarize existing and future (2024 and 2030) without-project traffic volumes within the study area.

Existing

Existing weekday PM peak period traffic volumes were collected in August 2022. Note that a 2 percent annual growth rate was applied to the 2022 traffic counts to estimate the existing 2023 conditions, which is consistent with the growth rate utilized in the horizon year analysis. The existing weekday peak hour traffic volumes at the study intersections are shown in Figure 3. Volumes are rounded to the nearest 5 vehicles to account for the daily fluctuations in traffic volumes. Detailed traffic counts are provided in Appendix A.

Future (2024) Without-Project Traffic Volumes

Future (2024) without-project traffic volumes were forecasted by applying an annual growth rate to existing traffic volumes. An annual growth rate of 3 percent was applied to existing study intersection traffic volumes to estimate the 2024 opening year background traffic growth, consistent with previous studies. No pipeline developments were included in the opening year analysis with the exception of the remainder of the White Barn development. This project was included so that the traffic volumes at the site driveways represent full build - out of the site. The forecast future 2024 without-project weekday peak hour traffic volumes are shown in Figure 4.

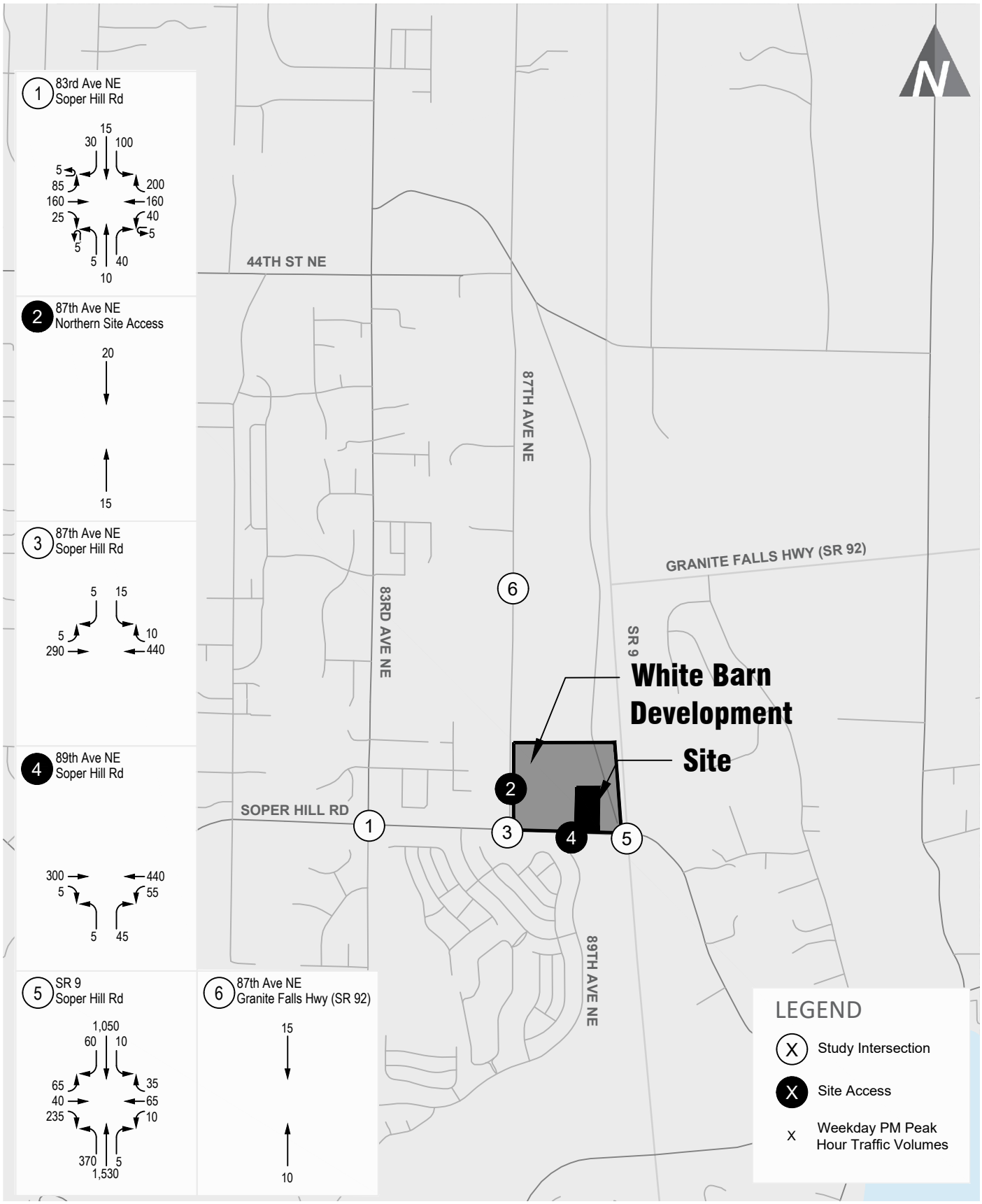
Future (2030) Without-Project Traffic Volumes

Consistent with City requirements and other studies prepared in the area, future (2030) without-project traffic volumes were forecasted by applying a 2 percent annual growth rate to existing traffic volumes and adding traffic from pipeline development projects . The following studies were included in the forecasts as pipeline projects to be completed by 2030.

- GroundHog PRD
- Nordstrom Property
- 87th Assembly
- Hunters Grove
- The Retreat
- Prospector Division 2
- Stevens Ridge
- Firerock
- Havenwood
- Village at WR
- Whiskey Ridge[3]
- White Barn development – the remainder of the project (i.e. full buildout less the proposed project)

In addition to the above pipeline projects, traffic shifts associated with the 35th Street NE connection planned improvement were also accounted for in the analysis. The forecast future 2030 without-project weekday peak hour traffic volumes are shown in Figure 5.

[3] Information included for Whiskey Ridge is based on preliminary information provided to the City of Marysville, as the applicant has not submitted a formal application or initiated the pre-application process.



Existing Weekday PM Peak Hour Traffic Volumes

FIGURE 3

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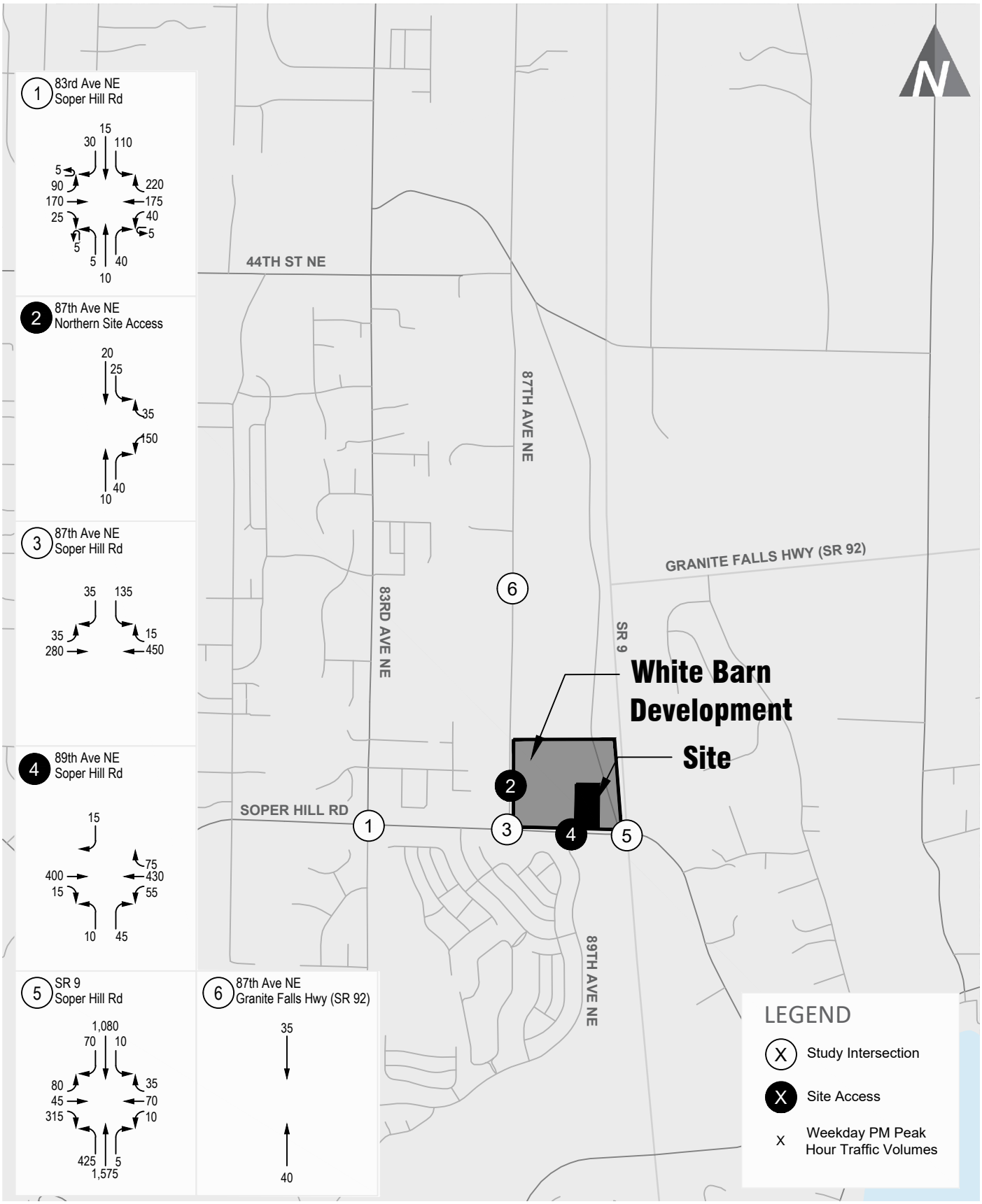

Future (2024) Without-Project PM Peak Hour Traffic Volumes

FIGURE 4

White Barn Brown Bear - Marysville

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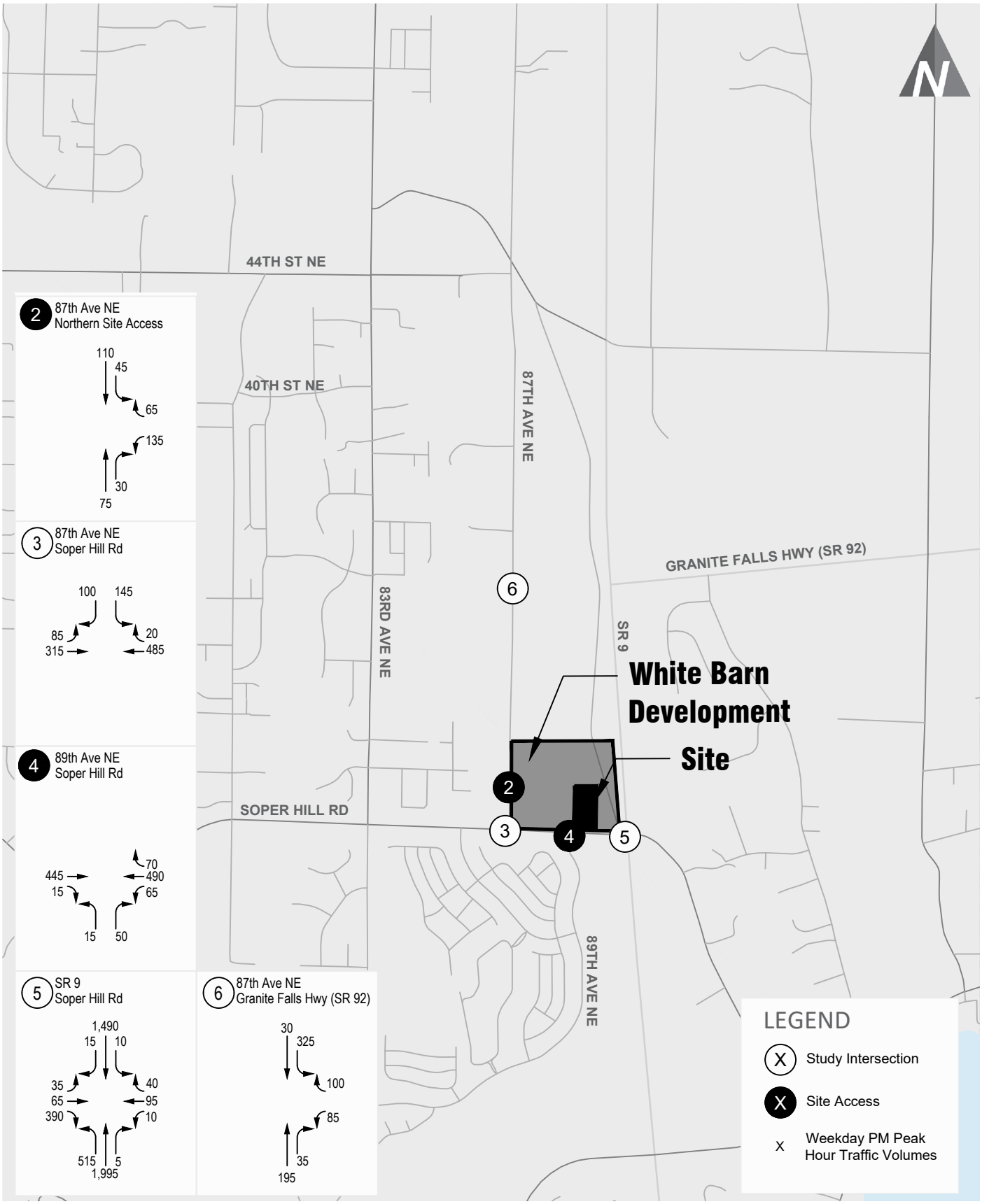

Future (2030) Without-Project PM Peak Hour Traffic Volumes

FIGURE 5

White Barn Brown Bear - Marysville

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Traffic Operations

The operational characteristics of an intersection are determined by calculating the intersection level of service (LOS). At signalized and roundabout intersections, LOS is measured in average control delay per vehicle and is typically reported using the intersection delay. At unsignalized side-street, stop-controlled intersections, LOS is measured by the average delay on the worst-movement of the intersection. Traffic operations and average vehicle delay for an intersection can be described qualitatively with a range of levels of service (LOS A through LOS F), with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and long vehicle delays. Appendix B contains a detailed explanation of LOS criteria and definitions.

The City of Marysville and WSDOT have a LOS D standard at their respective study intersections. For roundabout controlled intersections, WSDOT is targeting a v/c ratio threshold of 0.90 and LOS D.

Signal timing was provided by WSDOT. Analysis parameters such as lane channelization and signal timing were maintained for future (2024) without-project conditions from existing conditions. Under future (2030) without-project conditions, signal timing optimization was applied as well as inclusion of the planned improvements as noted above.

Weekday PM peak hour traffic operations for existing and future without-project conditions were evaluated at the study intersections based on the procedures identified in the *Highway Capacity Manual* 6th Edition for the unsignalized locations and based on HCM 2000 at the signalized study intersection due to limitations of the signal timing parameters. *Synchro 11* was used for the analysis, which is a software program that uses *HCM* methodology to evaluate intersection LOS and average vehicle delays. Roundabout controlled intersections were evaluated utilizing *Sidra 9* and the WSDOT Sidra Policy for analyzing roundabouts. Results for the existing and future without-project operations analyses are summarized in Table 2. Detailed LOS worksheets for each intersection analysis are included in Appendix C.

Table 2. Existing and Future Without-Project PM Peak Hour LOS Summary

		Existing			Future (2024) Without-Project			Future (2030) Without-Project		
Intersection	**Existing/ *Future*[5] Traffic Control**	**LOS[1]**	**Delay[2]**	**WM[3] or V/C[4]**	**LOS**	**Delay**	**WM or V/C**	**LOS**	**Delay**	**WM or V/C**
1. 83rd Ave NE/Soper Hill Rd	RAB	A	7	0.47	A	7	0.51	Not Studied		
2. 87th Ave NE/Northern Site Access	TWSC		-		B	10	WB	B	12	WB
3. 87th Ave NE/Soper Hill Rd	RAB	A	4	0.40	A	6	0.42	A	7	0.46
4. 89th Ave NE/Soper Hill Rd/ Site Access	TWSC	B	11	NB	B	13	NB	B	15	NB
5. SR 9/Soper Hill Rd	Signal	C	28	-	D	41	-	D	47	-
6. 87th Ave NE/35th St NE	- / ***RAB***	*Future Intersection*						A	8	0.39

Note: TWSC = Two-way Stop Controlled, RAB = roundabout.
1. LOS = Level of service (A-F), based on 6th Edition *Highway Capacity Manual with the exception of the traffic signal which is evaluated based on HCM 2000 due to limitations of HCM 6th edition to evaluate the exclusive phases at the SR 9/Soper Hills intersection.*
2. Delay = Average delay in seconds per vehicle, rounded to the nearest whole second
3. WM = Worst movement or approach reported for stop-controlled intersections
4. Volume-to-capacity ratio reported for signalized intersections and maximum lane group v/c ratio for roundabout intersections.
5. If a planned change in traffic control, future traffic control assumed under the future (2030) horizon year.

As shown in Table 2, all of the study intersections are currently operating at LOS C or better during the weekday PM peak hour, meeting the City's LOS standard. Under the future (2024 and 2030) without-project conditions, the study intersections are forecast to continue operating

acceptably at LOS D or better. Additionally, at the roundabout controlled intersections, the v/c ratios are forecast to operate at 0.51 or lower, meeting the recommended v/c ratio threshold.

Traffic Safety

The five most recent years of collision records (January 1, 2017 and December 31, 2021) provided by the Washington State Department of Transportation (WSDOT) were reviewed within the study area to identify any existing traffic safety issues at the study intersections. A summary of the total and average annual number of reported collisions at the study intersections to the project site are provided in Table 3.

Table 3. Five-Year Collision Summary (2017-2021)

Location[2]	Traffic Control	Number of Collisions					Total	Annual Average
		2017	2018	2019	2020	2021		
1. 83rd Ave NE/Soper Hill Rd	TWSC / RAB[1]	4	2	6	2	4	18	3.60
3. 87th Ave NE/Soper Hill Rd	TWSC	0	0	0	0	0	1	0.00
4. 89th Ave NE/Soper Hill Rd	TWSC	0	0	0	0	2	2	0.40
5. SR 9/Soper Hill Rd	Signal	6	6	5	4	7	28	5.60

Source: WSDOT 2022.
Note: TWSC = Two-Way Stop Controlled, RAB = roundabout.
1. A roundabout was installed at the 83rd Avenue NE/Soper Hill Road intersection in 2020.
2. Locations 2 and 6 do not exist during the review period.

As shown in Table 3, there was an average of less than 1 collision per year at the two-way stop-controlled (TWSC) intersections. At the signalized SR 9/Soper Hill Road intersection, there was an average of approximately 6 collisions per year with the majority being property damage only collisions resulting from rear-end collisions. The 83rd Avenue NE/Soper Hill Road intersection had an average of approximately 4 collisions per year but during the study period, the traffic control type changed from TWSC to a roundabout. Prior to the installation of the roundabout, approximately 65 percent of the collisions resulted in injury. Since the installation of the roundabout, the severity of collisions has reduced to approximately 30 percent resulting in injury, which is consistent with the benefits of a roundabout in reducing the severity of collisions.

Within the overall study area, no fatalities were reported nor did any of the collisions reported involve a pedestrian or bicyclist. Based on the collision history review in the study area, no existing safety patterns or issues requiring specific improvements were identified.

Project Impacts

The following sections summarize the proposed project's impacts on the surrounding street system. First, traffic volumes generated by the proposed project are estimated and then distributed and assigned to adjacent roadways within the study area. Next, project trips are added to future without-project traffic volumes and the potential impact to traffic operations are identified. Site-specific items are also discussed.

Trip Generation

The car wash facility includes an automated car wash tunnel, 5 touchless car wash bays, and 26 vacuuming stalls. Trip generation for the proposed project was calculated based on trip rates identified in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (11th Edition, 2021) as well as local observations. ITEs Automated Car Wash (LU #948) land use was assumed for the proposed automated tunnel car wash. However, ITE does not contain data applicable to the touchless carwash stations. Trip generation rates applied to touchless bays was based on local data collected at similar facilities as described below. The proposed project also includes vacuuming stations. This use is identified in the rates of both ITE's automated car wash tunnel land use (LU 948) as well as present and captured within the rate at the observed touchless car washes and therefore included in the overall trip generation estimate for the proposed development.

Touchless Car Wash Trip Generation - Studies were conducted at three existing touchless carwash facilities including:

- Woodinville Aloha Car Wash - 13001 NE 177th Pl, Woodinville, WA 98072
- Mill Creek Aloha Car Wash - 17818 Bothell Everett Hwy, Bothell, WA 98012
- Covington Elephant Car Wash - 27240 168th Pl SE, Covington, WA 98042

All sites are similar to the proposed project with 4-6 touchless carwash bays. Observations at the three sites were conducted during the weekday PM peak period (4-6 p.m.). The observations at the 2 Aloha Car Wash sites were conducted in August 2022 and the Covington observations were conducted in December 2022. The weekday PM peak hour observations are summarized in Table 4.

Table 4. Touchless Carwash Trip Generation Observations

Site	Date	Weekday PM Peak Hour Trips			Percent Inbound	Trip Generation Rate *(Trips per bay)*
		In	Out	Total		
Woodinville (4 bays)	Tues - 8/2/2022	35	34	69	51%	17.25
	Wed - 8/3/2022	36	33	69	52%	17.25
Mill Creek (4 bays)	Tues - 8/2/2022	32	29	61	52%	15.25
	Wed - 8/3/2022	23	26	49	47%	12.25
Covington (6 bays)	Wed – 12/14/2022	41	33	74	55%	14.80
	Thurs – 12/15/2022	31	30	61	51%	10.17
Weighted Average[1]					**51%**	**13.68**

1. Per ITE's *Trip Generation Manual 11th Edition Desk Reference* (page 16) "*the weighted average number of vehicle or person trips entering or exiting a development site per one unit of the independent variable. It is calculated by dividing the sum of all trips for all contributing data point sites by the sum of all independent variable units for all contributing data point sites. The weighted average rate is used rather than the average of the individual rates because of the variance within each data set or generating unit. Data sets with a large variance will over-influence the average rate if they are not weighted. The data plot includes a dashed line corresponding to the weighted average rate, extending between the lowest and highest independent variable values for data points.*"

Table 4 shows the observed weekday PM peak hour trips generated by the existing touchless car wash sites and the resulting weighted average trip generation rate of 13.68 trips per bay for the touchless car wash.

Consistent with gas stations and other retail services, pass-by trips are a component of the trip generation. Pass-by trips reflect traffic already on streets in the vicinity of the project site that would visit the project while driving by the site on the way to its final destination. Although, specific car wash pass-by studies were not available, pass-by rates for similar "service" and retail uses were reviewed as available in ITE's *Trip Generation Manual* (11th Edition). ITE's retail and service uses (Land Use 821 and 900's) with studies available show PM peak hour pass-by rates ranging from 35 to 98 percent. Specifically, the Gasoline/Service Station (LU 944) land use description identifies that car washes may be included within the use and has a weekday PM peak hour pass-by rate of 57 percent and Shopping Center (LU 821) which includes a range of general retail land uses has a pass-by rate of 40 percent. Based on the review of available data, the pass-by rate was assumed to be 40 percent, consistent with general retail (LU 821). The shopping center pass-by rate was assumed because it is on the lower end of the range of identified pass-by rates, is less than the pass-by rate for the Gasoline/Service Station (LU 944) land use (providing a conservative estimate as this land use specifically identifies a car wash), and the project is located within the larger White Barn commercial development.

Table 5 summarizes the weekday PM peak hour vehicle trips generated by the proposed project. The detailed trip generation calculations are included in Appendix D.

Table 5. Estimated Weekday PM Peak Hour Vehicle Trip Generation

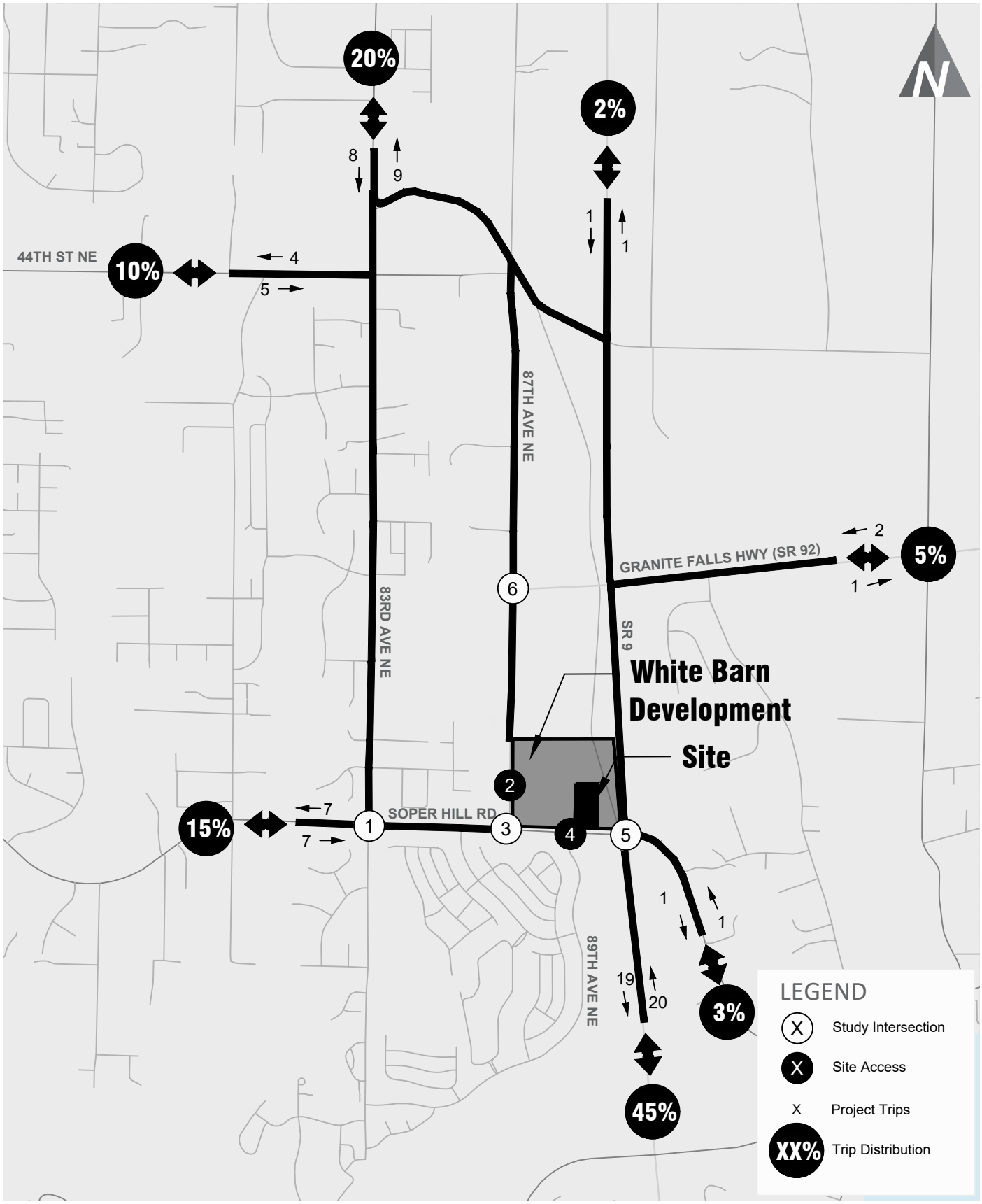
Land Use[1]	Size	Gross Trips	Pass-by		Net New Trips		
			%	Trips	In	Out	Total
Automated Car Wash (LU 948)	1 tunnel	78	40%	32	23	23	46
Touchless Car Wash[2]	5 bays	68	40%	28	21	19	40
Total		**146**		**60**	**44**	**42**	**86**

Note: sf = square feet
1. Average trip rates from ITE *Trip Generation Manual*, 11th Edition (2021).
2. Based on observations conducted at local touchless car washes with similar sizes.

As shown in Table 5, the proposed project is estimated to generate 86 new trips occurring in the PM peak hour with 146 gross trips at the project driveways.

Trip Distribution & Assignment

The weekday PM peak hour vehicular trips associated with the project were distributed to the roadway network. City of Marysville staff provided distribution patterns for the site vicinity based on their travel demand model. Their model reflected the future connections and planned improvements as identified above and therefore was assumed for the future 2030 project trip distribution. For the future (2024) opening year, the distribution was based on the City's model with local adjustments to reflect the current roadway network. The project trip distributions and weekday PM peak hour assignment are shown in Figure 6 and Figure 7 for the future 2024 and 2030 years, respectively.



Future (2024) Project Trip Distribution and Assignment

FIGURE 6

White Barn Brown Bear - Marysville

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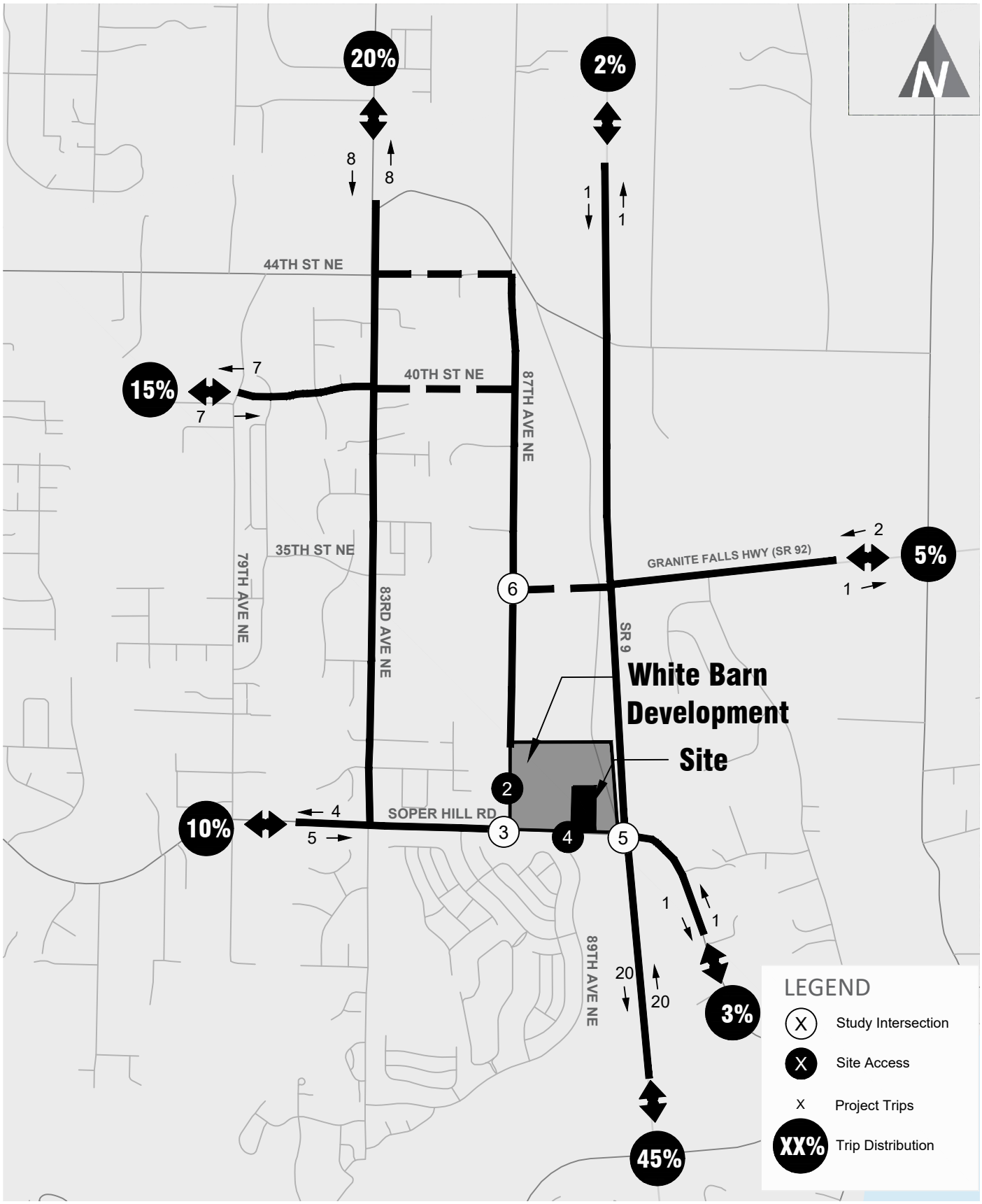

Future (2030) Project Trip Distribution and Assignment

FIGURE 7

White Barn Brown Bear - Marysville

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Traffic Volume Impact

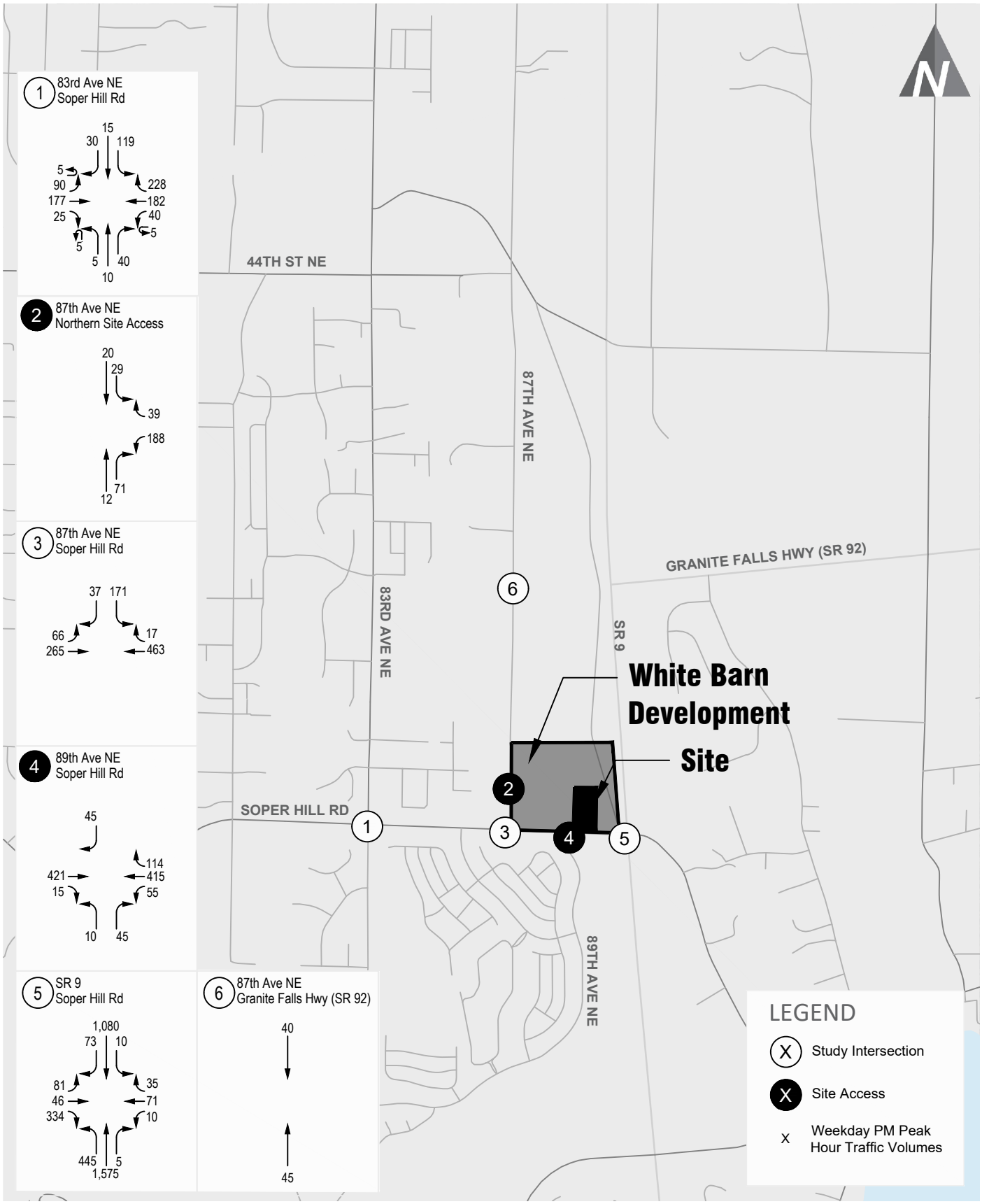
Site generated weekday peak hour traffic volumes were added to future without-project volumes at study intersections. The resulting future (2024 and 2030) with-project peak hour traffic volumes are illustrated in Figure 8 and Figure 9, respectively. Table 6 summarizes the anticipated increase in total entering traffic at the study intersections as well as the percent of future with-project traffic volumes attributable to the proposed project.

Table 6. PM Peak Hour Traffic Volume Impacts at Study Intersections

Intersection	2024 TEV			2024 Percent Project Share	2030 TEV			2030 Percent Project Share
	Without-Project	Project Trips	With-Project		Without-Project	Project Trips	With-Project	
1. 83rd Ave NE/Soper Hill Rd	945	31	976	3.2%	1,155	17	1,172	1.5%
2. 87th Ave NE/Northern Site Access	280	79	359	22.0%	460	87	547	15.9%
3. 87th Ave NE/Soper Hill Rd	950	69	1,019	6.8%	1,150	53	1,203	4.4%
4. 89th Ave NE/Soper Hill Rd/Site Access	1,045	75	1,120	6.7%	1,150	65	1,215	5.3%
5. SR 9/Soper Hill Rd	3,720	45	3,765	1.2%	4,665	42	4,707	0.9%
6. 87th Ave NE/35th St NE	75	10	85	11.8%	770	27	797	3.4%
Not Studied:								
83rd Ave NE/44th St NE	-	17	-	-	-	16	-	-

Note: TEV = Total Entering. Shading indicates not impacted by 25 trips.
1. LOS = Level of service (A-F), based on 6th Edition Highway Capacity Manual and Highway Capacity Manual 2000 methodology.
2. Delay = Average delay in seconds per vehicle, rounded to the nearest whole second
3. WM = Worst movement or approach reported for stop-controlled intersections
4. Volume-to-capacity ratio reported for signalized intersections and maximum lane group v/c ratio for roundabout intersections.

As shown in Table 6, the project generated traffic volumes are anticipated to be approximately 7 percent or less within the study area during the PM peak hour under the future (2024) opening year with the exception of the site access intersections. With continued future growth in the vicinity of the proposed project by 2030, the project generated traffic volumes are anticipated to decrease to approximately 5 percent or less within the study area during the PM peak hour at the off-site study intersections.



Future (2024) With-Project PM Peak Hour Traffic Volumes

White Barn Brown Bear - Marysville

FIGURE 8

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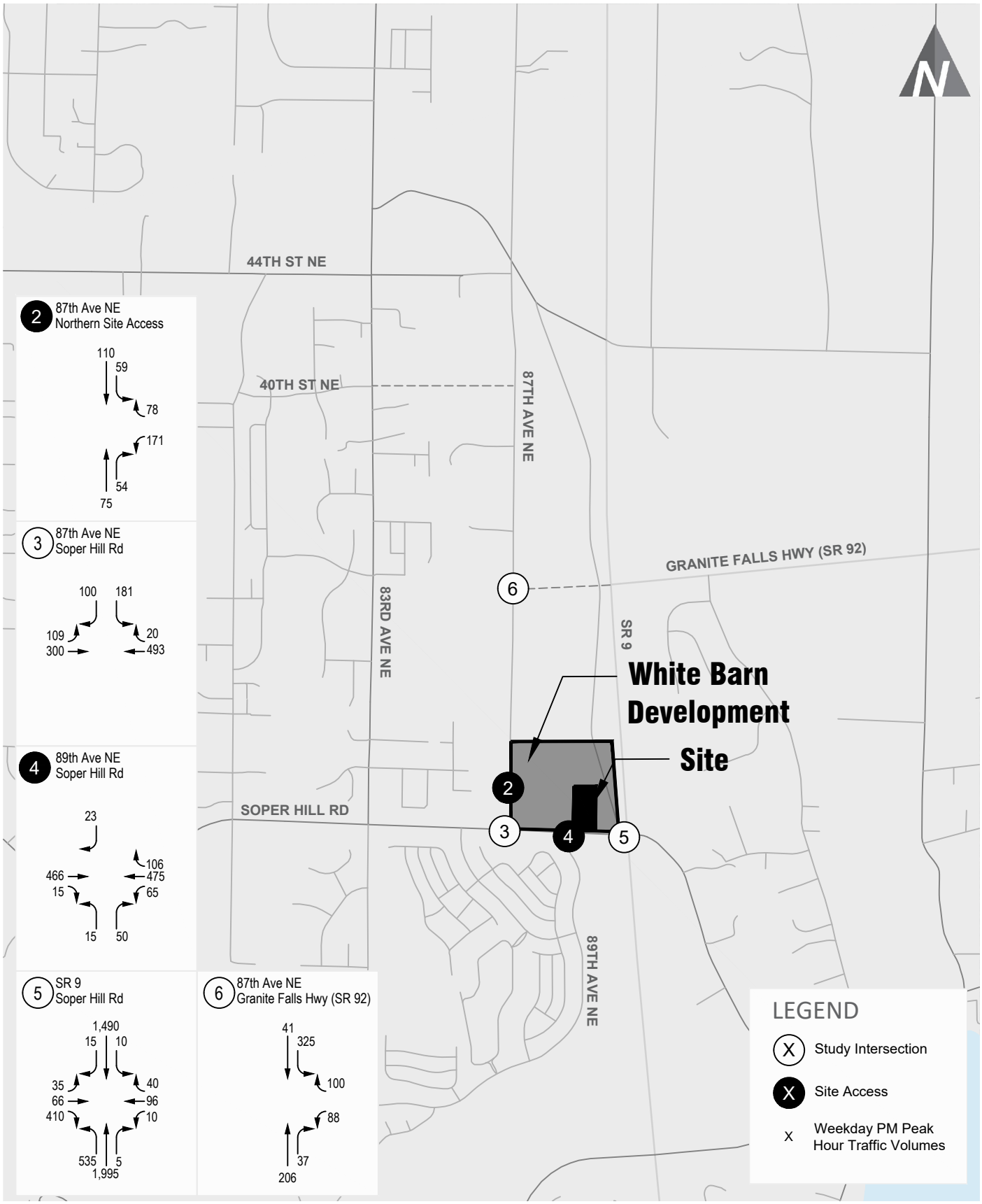

Future (2030) With-Project PM Peak Hour Traffic Volumes

White Barn Brown Bear - Marysville

FIGURE 9

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Traffic Operations Impact

The following section summarizes both the future (2024 and 2030) with-project analysis years during the weekday PM peak hour to identify traffic impacts of the proposed project.

The same methodologies were applied as described for future without-project conditions. All intersection parameters such as channelization, intersection control, and signal timing were consistent with those used in the evaluation of future without-project conditions for the respective analysis years. A comparison of future (2024) without-project and with-project weekday PM peak hour traffic operations is summarized in Table 7 and a comparison of the future (2030) without-project and with-project weekday PM peak hour traffic operations is summarized in Table 8. Detailed LOS worksheets are provided in Appendix C.

Note that based on the City's 25 project trip threshold, the 87th Avenue NE/35th Street NE intersection (study intersection 6) and 83rd Avenue NE/Soper Hill Road intersection (study intersection 1) are not evaluated under future (2024) and future (2030) conditions, respectively.

Table 7. Future (2024) Opening Year Weekday Peak Hour LOS Summary

Intersection	Traffic Control	2024 Without-Project			2024 With-Project		
		LOS[1]	Delay[2]	WM[3]	LOS	Delay	WM
1. 83rd Ave NE/Soper Hill Rd	Roundabout	A	7	0.51	A	7	0.53
2. 87th Ave NE/Northern Site Access	TWSC	B	10	WB	B	10	WB
3. 87th Ave NE/Soper Hill Rd	Roundabout	A	6	0.42	A	7	0.45
4. 89th Ave NE/Soper Hill Rd/Site Access	TWSC	B	13	NB	B	14	NB
5. SR 9/Soper Hill Rd	Traffic Signal	D	41	-	D	44	-

Note: TWSC = two-way stop control
1. LOS = Level of service (A-F), based on 6th Edition Highway Capacity Manual at unsignalized intersections and Highway Capacity Manual 2000 methodology at signalized locations.
2. Delay = Average delay in seconds per vehicle, rounded to the nearest whole second
3. WM = Worst movement or approach reported for stop-controlled intersections
4. Volume-to-capacity ratio reported for signalized intersections and maximum lane group v/c ratio for roundabout intersections.

As shown in Table 7, with the addition of project traffic, under future (2024) conditions during the weekday PM peak hour all of the study intersections are forecast to continue operating at LOS D or better and meeting the LOS D standard. Additionally, the roundabouts are forecast to operate with v/c ratios of 0.53 or lower, meeting the recommended v/c ratio.

Table 8. Future (2030) Horizon Year Weekday Peak Hour LOS Summary

Intersection	Traffic Control	2030 Without-Project			2030 With-Project		
		LOS[1]	Delay[2]	WM[3]	LOS	Delay	WM
2. 87th Ave NE/Northern Site Access	TWSC	B	12	WB	B	13	WB
3. 87th Ave NE/Soper Hill Rd	Roundabout	A	7	0.46	A	8	0.49
4. 89th Ave NE/Soper Hill Rd/Site Access	TWSC	B	15	NB	C	15	NB
5. SR 9/Soper Hill Rd	Traffic Signal	D	47	-	D	53	-
6. 87th Ave NE/35th St NE	Roundabout	A	8	0.39	A	8	0.41

Note: TWSC = two-way stop control
1. LOS = Level of service (A-F), based on 6th Edition Highway Capacity Manual and Highway Capacity Manual 2000 methodology.
2. Delay = Average delay in seconds per vehicle, rounded to the nearest whole second
3. WM = Worst movement or approach reported for stop-controlled intersections
4. Volume-to-capacity ratio reported for signalized intersections and maximum lane group v/c ratio for roundabout intersections.

As shown in Table 8, with the addition of project traffic, under future (2030) conditions during the weekday PM peak hour all of the study intersections are forecast to continue operating at LOS D or better and meeting the LOS D standard. Additionally, the roundabouts are forecast to operate with v/c ratios of 0.49 or lower, meeting the recommended v/c ratio.

Site Access Evaluation

As noted above, access for the site is provided via existing connections to Soper Hill Road and 87th Ave NE. The site access operations, on-site queueing, and parking are reviewed in the sections below.

Site Access Traffic Operations

The operations at the driveways were evaluated in the analysis above and are summarized in Tables 7 and 8 for the 2024 and 2030 conditions during the weekday PM peak hour. As shown above, the site accesses are forecast to operate at LOS C with the development of the project during the weekday PM peak hour under both future (2024 and 2030) conditions. This analysis considers full-build-out of the White Barn uses as permitted to date and future uses identified in the original TIA prepared for that project.

Queueing

Queues were evaluated for both the automated car wash tunnel as well as for the touchless car wash bays using a Poisson queuing distribution. Service times for the car wash were observed during the touchless car wash study to be 6 minutes on average. Based on discussions with Brown Bear, the service time for the automated tunnel is less than 6 minutes, such that a service time of 6 minutes for the automated tunnel provides a conservative estimate. The weekday PM peak hour inbound trips were used for the analysis. The analysis parameters assumed for each car wash type are summarized below:

- Touchless Car Wash: 35 vehicles, 5 bays (equivalent of 7 vehicles per bay) 6-minute service time
- Automated Car Wash: 39 vehicles, 1 tunnel, 6-minute service time

Based on the Poisson queuing analysis, each car wash type is estimated to have a 95th percentile queue of 8 vehicles during the PM peak hour. As shown in Figure 2, the automated car wash queuing area can accommodate that estimated queue (showing a queue of greater than 22 vehicles is able to be accommodated). The touchless queue of up to 8 vehicles would reflect 5 vehicles actively using the bays as well as 3 vehicles queued to use the bays at the pay stations. The detailed queueing analysis is provided in Appendix E.

Parking

The proposed project includes 12 on-site parking stalls; however, the parking demand for the proposed development is anticipated to be very limited and predominantly related to on-site employees. The users of the car washes are provided queueing areas as reviewed above. The users of the vacuuming stalls are provided separate stalls from the proposed parking to accommodate their service. The proposed 12 on-site parking stalls is anticipated to accommodate the project's peak parking demands.

Mitigation

The project would pay traffic impact fees to the City of Marysville. The City has identified a traffic impact fee of $2,220 per PM peak hour trip.[5] Based on the estimated trip generation above, the project is anticipated to generate 86 new weekday PM peak hour trips, which equates to an estimated traffic impact fee of $190,920. The City will calculate the final fee at time of permit issuance. The fee will be based on the impact fee rates in effect at the time of building permit issuance.

[5] Traffic impact fee per *City of Marysville Traffic Analysis and Mitigation*

Findings and Recommendations

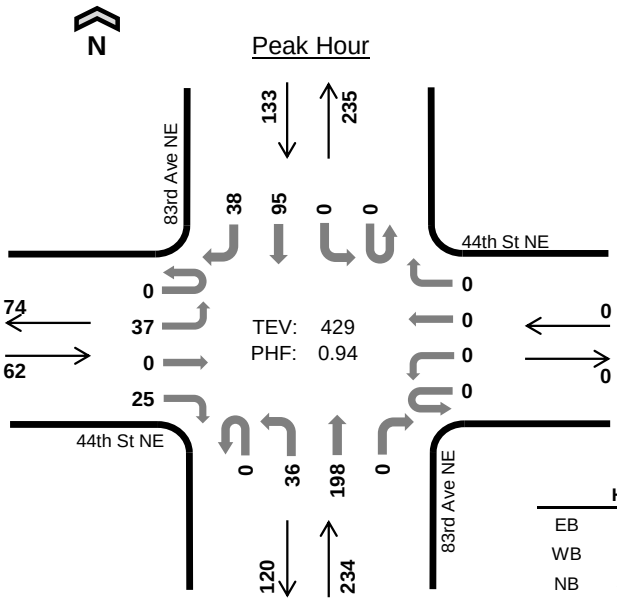
This traffic impact analysis summarizes the project traffic impacts of the proposed Brown Bear project located within the White Barn development. General findings and recommendations include:

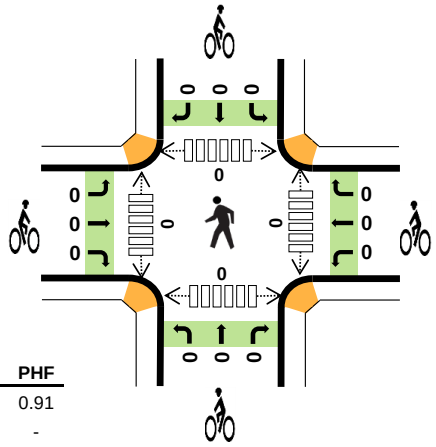
- The proposed project would construct 5 touchless car wash bays, 1 automated tunnel, and 26 vacuuming stalls.
- The development is anticipated to generate approximately 86 new trips during the PM peak hour.
- The off-site intersections and driveways are forecast to operate acceptably at LOS D or better under both existing and future (2024 and 2030) conditions during the weekday PM peak hour, meeting Marysville's LOS D standard.
- Queueing associated with the proposed car wash development is anticipated to be accommodated on-site.
- The City would calculate the final fee for the project at the time of permits being issued. The preliminary traffic fee estimate is $190,920.

Appendix A: Traffic Counts

83rd Ave NE
44th St NE

Date: 08/16/2022
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:00 PM to 5:00 PM





	HV %:	PHF
EB	3.2%	0.91
WB	-	-
NB	4.7%	0.87
SB	7.5%	0.85
TOTAL	5.4%	0.94

Two-Hour Count Summaries

Interval Start		44th St NE Eastbound				44th St NE Westbound				83rd Ave NE Northbound				83rd Ave NE Southbound				15-min Total	Rolling One Hour
		UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM		**0**	**11**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**12**	**55**	**0**	**0**	**0**	**24**	**9**	**114**	0
4:15 PM		**0**	**10**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**7**	**51**	**0**	**0**	**0**	**26**	**10**	**109**	0
4:30 PM		**0**	**8**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**8**	**48**	**0**	**0**	**0**	**28**	**11**	**112**	0
4:45 PM		**0**	**8**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**9**	**44**	**0**	**0**	**0**	**17**	**8**	**94**	**429**
5:00 PM		0	16	0	4	0	0	0	0	0	9	40	0	0	0	28	13	110	425
5:15 PM		0	4	1	5	0	0	0	0	0	2	54	0	0	0	23	6	95	411
5:30 PM		0	10	0	9	0	0	0	0	0	6	50	0	0	0	21	10	106	405
5:45 PM		0	9	0	4	0	0	0	0	0	7	33	1	0	0	23	7	84	395
Count Total		0	76	1	47	0	0	0	0	0	60	375	1	0	0	190	74	824	0
Peak Hour	**All**	**0**	**37**	**0**	**25**	**0**	**0**	**0**	**0**	**0**	**36**	**198**	**0**	**0**	**0**	**95**	**38**	**429**	**0**
	HV	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**10**	**0**	**0**	**0**	**6**	**4**	**23**	**0**
	HV%	**-**	**5%**	**-**	**0%**	**-**	**-**	**-**	**-**	**-**	**3%**	**5%**	**-**	**-**	**-**	**6%**	**11%**	**5%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	**1**	**0**	**3**	**5**	***9***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
4:15 PM	**0**	**0**	**3**	**2**	***5***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
4:30 PM	**1**	**0**	**4**	**2**	***7***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
4:45 PM	**0**	**0**	**1**	**1**	***2***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***
5:00 PM	1	0	1	2	*4*	0	0	0	0	*0*	0	0	0	0	*0*
5:15 PM	0	0	1	0	*1*	0	0	0	0	*0*	0	0	0	0	*0*
5:30 PM	0	0	1	0	*1*	0	0	0	0	*0*	0	0	0	0	*0*
5:45 PM	0	0	1	0	*1*	0	0	0	0	*0*	0	0	0	0	*0*
Count Total	3	0	15	12	*30*	0	0	0	0	*0*	0	0	0	0	*0*
Peak Hour	**2**	**0**	**11**	**10**	***23***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	44th St NE Eastbound				44th St NE Westbound				83rd Ave NE Northbound				83rd Ave NE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**3**	**2**	**9**	0
4:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**1**	**1**	**5**	0
4:30 PM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**2**	**0**	**7**	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**2**	**23**
5:00 PM	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	4	18
5:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	14
5:30 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	8
5:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	7
Count Total	0	3	0	0	0	0	0	0	0	1	14	0	0	0	7	5	30	0
Peak Hour	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**10**	**0**	**0**	**0**	**6**	**4**	**23**	**0**

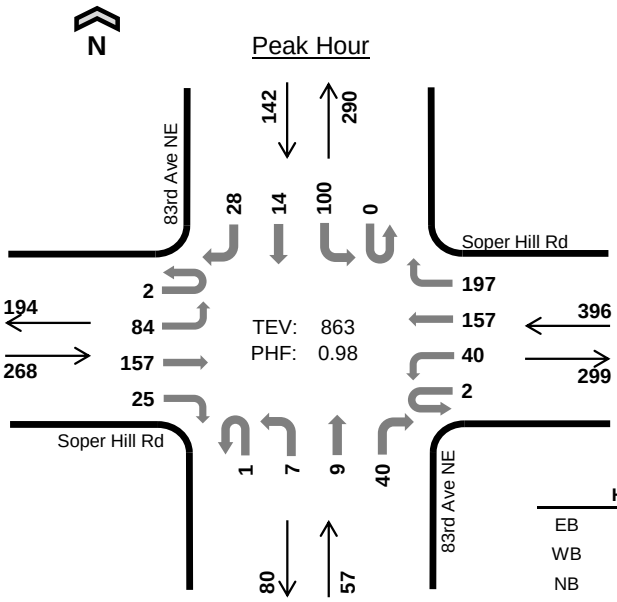
Two-Hour Count Summaries - Bikes

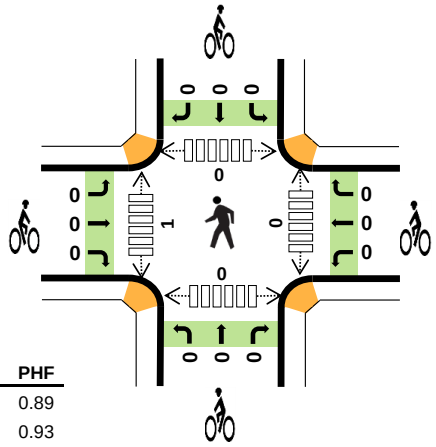
Interval Start	44th St NE Eastbound			44th St NE Westbound			83rd Ave NE Northbound			83rd Ave NE Southbound			15-min Total	Rolling One Hour
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
4:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
4:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

83rd Ave NE
Soper Hill Rd

Date: 08/16/2022
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:30 PM to 5:30 PM





	HV %:	PHF
EB	2.2%	0.89
WB	1.3%	0.93
NB	3.5%	0.89
SB	2.1%	0.91
TOTAL	1.9%	0.98

Two-Hour Count Summaries

Interval Start		Soper Hill Rd Eastbound				Soper Hill Rd Westbound				83rd Ave NE Northbound				83rd Ave NE Southbound				15-min Total	Rolling One Hour
		UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM		0	33	33	4	0	11	38	52	0	2	0	6	0	29	3	7	218	0
4:15 PM		0	18	27	5	1	6	30	49	0	5	2	6	0	20	3	9	181	0
4:30 PM		**0**	**28**	**38**	**9**	**1**	**11**	**36**	**44**	**0**	**2**	**4**	**9**	**0**	**27**	**3**	**9**	**221**	0
4:45 PM		**1**	**18**	**43**	**7**	**1**	**12**	**39**	**55**	**1**	**0**	**0**	**12**	**0**	**24**	**2**	**3**	**218**	838
5:00 PM		**0**	**16**	**43**	**7**	**0**	**7**	**36**	**47**	**0**	**1**	**4**	**8**	**0**	**25**	**3**	**8**	**205**	825
5:15 PM		**1**	**22**	**33**	**2**	**0**	**10**	**46**	**51**	**0**	**4**	**1**	**11**	**0**	**24**	**6**	**8**	**219**	**863**
5:30 PM		0	21	29	9	0	10	34	54	0	4	1	8	0	36	0	8	214	856
5:45 PM		0	23	28	8	0	8	20	37	0	2	5	5	0	34	3	7	180	818
Count Total		2	179	274	51	3	75	279	389	1	20	17	65	0	219	23	59	1,656	0
Peak Hour	**All**	**2**	**84**	**157**	**25**	**2**	**40**	**157**	**197**	**1**	**7**	**9**	**40**	**0**	**100**	**14**	**28**	**863**	**0**
	HV	**0**	**3**	**2**	**1**	**0**	**0**	**1**	**4**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**3**	**16**	**0**
	HV%	**0%**	**4%**	**1%**	**4%**	**0%**	**0%**	**1%**	**2%**	**0%**	**14%**	**0%**	**3%**	**-**	**0%**	**0%**	**11%**	**2%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	2	1	1	4	*8*	0	0	0	0	*0*	2	0	2	0	*4*
4:15 PM	1	0	0	1	*2*	0	0	0	0	*0*	2	1	0	0	*3*
4:30 PM	**3**	**1**	**0**	**2**	***6***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
4:45 PM	**2**	**2**	**0**	**0**	***4***	**0**	**0**	**0**	**0**	***0***	**0**	**1**	**0**	**0**	*1*
5:00 PM	**1**	**0**	**0**	**1**	***2***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
5:15 PM	**0**	**2**	**2**	**0**	***4***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***
5:30 PM	0	1	1	0	*2*	0	0	0	0	*0*	1	0	1	0	*2*
5:45 PM	1	0	1	0	*2*	0	0	0	0	*0*	0	0	0	0	*0*
Count Total	10	7	5	8	*30*	0	0	0	0	*0*	5	2	3	0	*10*
Peak Hour	**6**	**5**	**2**	**3**	***16***	**0**	**0**	**0**	**0**	***0***	**0**	**1**	**0**	**0**	***1***

Two-Hour Count Summaries - Heavy Vehicles

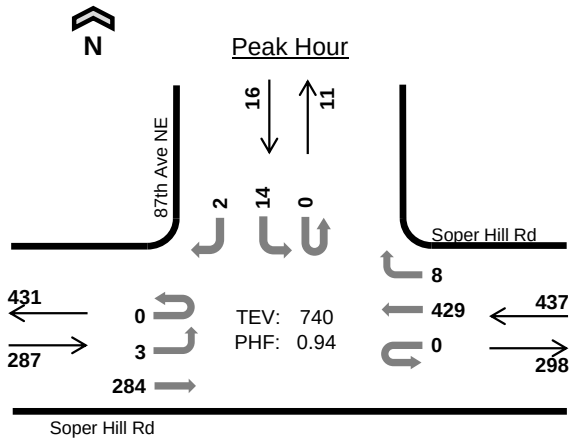
Interval Start	Soper Hill Rd				Soper Hill Rd				83rd Ave NE				83rd Ave NE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	2	0	0	0	1	0	0	0	0	0	1	0	2	0	2	8	0
4:15 PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0
4:30 PM	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**6**	0
4:45 PM	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	20
5:00 PM	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	14
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**4**	**16**
5:30 PM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	12
5:45 PM	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2	10
Count Total	0	6	3	1	0	1	1	5	0	1	0	4	0	2	0	6	30	0
Peak Hour	**0**	**3**	**2**	**1**	**0**	**0**	**1**	**4**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**3**	**16**	**0**

Two-Hour Count Summaries - Bikes

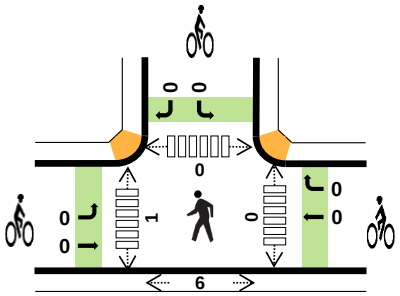
Interval Start	Soper Hill Rd			Soper Hill Rd			83rd Ave NE			83rd Ave NE			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
5:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

87th Ave NE
Soper Hill Rd



Date: 08/16/0202
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:45 PM to 5:45 PM



	HV %:	PHF
EB	1.4%	0.88
WB	1.1%	0.93
NB	-	-
SB	6.3%	0.44
TOTAL	1.4%	0.94

Two-Hour Count Summaries

Interval Start		Soper Hill Rd Eastbound				Soper Hill Rd Westbound				0 Northbound				87th Ave NE Southbound				15-min Total	Rolling One Hour
		UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM		0	0	72	0	0	0	107	5	0	0	0	0	0	3	0	0	187	0
4:15 PM		0	1	59	0	0	0	93	2	0	0	0	0	0	4	0	0	159	0
4:30 PM		0	0	76	0	0	0	96	3	0	0	0	0	0	1	0	2	178	0
4:45 PM		**0**	**1**	**81**	**0**	**0**	**0**	**111**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**1**	**197**	721
5:00 PM		**0**	**0**	**74**	**0**	**0**	**0**	**92**	**5**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**172**	706
5:15 PM		**0**	**1**	**61**	**0**	**0**	**0**	**117**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**183**	730
5:30 PM		**0**	**1**	**68**	**0**	**0**	**0**	**109**	**1**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**1**	**188**	**740**
5:45 PM		0	0	71	0	0	0	66	2	0	0	0	0	0	2	0	0	141	684
Count Total		0	4	562	0	0	0	791	20	0	0	0	0	0	24	0	4	1,405	0
Peak Hour	**All**	**0**	**3**	**284**	**0**	**0**	**0**	**429**	**8**	**0**	**0**	**0**	**0**	**0**	**14**	**0**	**2**	**740**	**0**
	HV	**0**	**1**	**3**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**10**	**0**
	HV%	**-**	**33%**	**1%**	**-**	**-**	**-**	**1%**	**0%**	**-**	**-**	**-**	**-**	**-**	**0%**	**-**	**50%**	**1%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals EB	WB	NB	SB	Total	Bicycles EB	WB	NB	SB	Total	Pedestrians (Crossing Leg) East	West	North	South	Total
4:00 PM	2	2	0	1	*5*	0	0	0	0	*0*	0	0	0	0	*0*
4:15 PM	1	0	0	2	*3*	0	0	0	0	*0*	0	0	0	1	*1*
4:30 PM	0	0	0	1	*1*	0	0	0	0	*0*	0	0	0	1	*1*
4:45 PM	**2**	**3**	**0**	**0**	***5***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**2**	*2*
5:00 PM	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**1**	*1*
5:15 PM	**1**	**2**	**0**	**0**	***3***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
5:30 PM	**1**	**0**	**0**	**1**	***2***	**0**	**0**	**0**	**0**	***0***	**0**	**1**	**0**	**3**	***4***
5:45 PM	1	0	0	0	*1*	0	0	0	0	*0*	0	0	0	0	*0*
Count Total	8	7	0	5	*20*	0	0	0	0	*0*	0	1	0	8	*9*
Peak Hr	**4**	**5**	**0**	**1**	***10***	**0**	**0**	**0**	**0**	***0***	**0**	**1**	**0**	**6**	***7***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Soper Hill Rd				Soper Hill Rd				0				87th Ave NE				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	0	2	0	0	0	2	0	0	0	0	0	0	1	0	0	5	0
4:15 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
4:45 PM	**0**	**0**	**2**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	14
5:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	9
5:15 PM	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	9
5:30 PM	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**10**
5:45 PM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
Count Total	0	1	7	0	0	0	7	0	0	0	0	0	0	4	0	1	20	0
Peak Hour	**0**	**1**	**3**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**10**	**0**

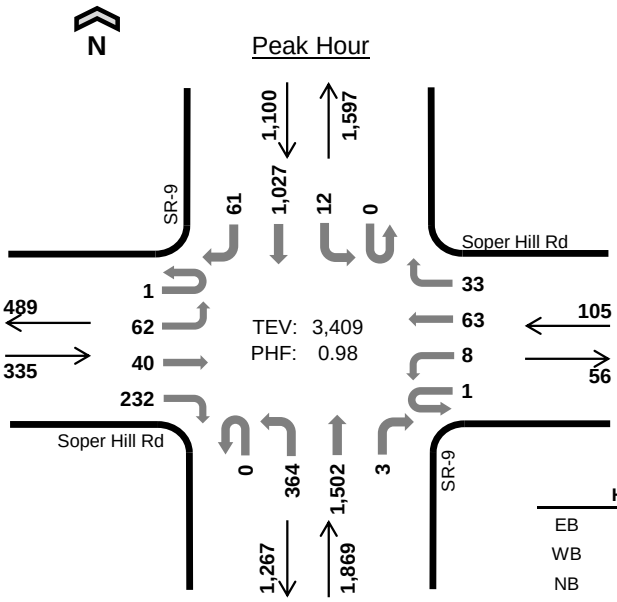
Two-Hour Count Summaries - Bikes

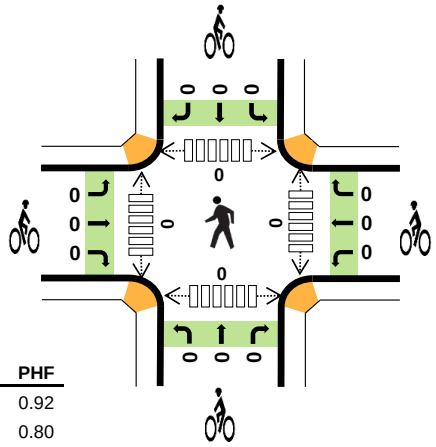
Interval Start	Soper Hill Rd			Soper Hill Rd			0			87th Ave NE			15-min Total	Rolling One Hour
	Eastbound			Westbound			Northbound			Southbound				
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
5:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
5:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
5:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

SR-9
Soper Hill Rd

Date: 08/16/2022
Count Period: 4:00 PM to 6:00 PM
Peak Hour: 4:00 PM to 5:00 PM





	HV %:	PHF
EB	3.0%	0.92
WB	1.0%	0.80
NB	2.7%	0.97
SB	4.4%	0.93
TOTAL	3.2%	0.98

Two-Hour Count Summaries

Interval Start		Soper Hill Rd Eastbound				Soper Hill Rd Westbound				SR-9 Northbound				SR-9 Southbound				15-min Total	Rolling One Hour
		UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM		**1**	**16**	**4**	**63**	**1**	**0**	**23**	**8**	**0**	**84**	**388**	**0**	**0**	**0**	**243**	**21**	**852**	0
4:15 PM		**0**	**13**	**12**	**50**	**0**	**4**	**8**	**10**	**0**	**95**	**385**	**1**	**0**	**2**	**285**	**9**	**874**	0
4:30 PM		**0**	**14**	**14**	**57**	**0**	**4**	**19**	**10**	**0**	**92**	**375**	**1**	**0**	**9**	**243**	**13**	**851**	0
4:45 PM		**0**	**19**	**10**	**62**	**0**	**0**	**13**	**5**	**0**	**93**	**354**	**1**	**0**	**1**	**256**	**18**	**832**	**3,409**
5:00 PM		0	13	11	66	0	0	15	4	0	79	385	1	0	2	248	11	835	3,392
5:15 PM		0	8	11	56	0	0	20	3	0	109	395	8	0	6	244	14	874	3,392
5:30 PM		0	6	9	64	0	1	13	2	0	89	376	2	0	4	238	12	816	3,357
5:45 PM		0	12	6	65	0	0	17	3	0	67	357	0	0	3	202	11	743	3,268
Count Total		1	101	77	483	1	9	128	45	0	708	3,015	14	0	27	1,959	109	6,677	0
Peak Hour	**All**	**1**	**62**	**40**	**232**	**1**	**8**	**63**	**33**	**0**	**364**	**1,502**	**3**	**0**	**12**	**1,027**	**61**	**3,409**	**0**
	HV	**0**	**1**	**0**	**9**	**0**	**0**	**0**	**1**	**0**	**5**	**46**	**0**	**0**	**0**	**48**	**0**	**110**	**0**
	HV%	**0%**	**2%**	**0%**	**4%**	**0%**	**0%**	**0%**	**3%**	**-**	**1%**	**3%**	**0%**	**-**	**0%**	**5%**	**0%**	**3%**	**0**

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	**4**	**0**	**19**	**14**	***37***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
4:15 PM	**3**	**0**	**14**	**20**	***37***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
4:30 PM	**1**	**1**	**11**	**8**	***21***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	*0*
4:45 PM	**2**	**0**	**7**	**6**	***15***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***
5:00 PM	0	0	10	11	*21*	0	0	0	0	*0*	0	0	0	0	*0*
5:15 PM	0	0	13	4	*17*	0	0	0	0	*0*	0	0	0	0	*0*
5:30 PM	1	0	12	6	*19*	0	0	0	0	*0*	1	0	0	0	*1*
5:45 PM	1	0	11	6	*18*	0	0	0	0	*0*	1	0	0	0	*1*
Count Total	12	1	97	75	*185*	0	0	0	0	*0*	2	0	0	0	*2*
Peak Hour	**10**	**1**	**51**	**48**	***110***	**0**	**0**	**0**	**0**	***0***	**0**	**0**	**0**	**0**	***0***

Two-Hour Count Summaries - Heavy Vehicles

Interval Start	Soper Hill Rd Eastbound				Soper Hill Rd Westbound				SR-9 Northbound				SR-9 Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	**0**	**1**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**1**	**18**	**0**	**0**	**0**	**14**	**0**	**37**	0
4:15 PM	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**2**	**12**	**0**	**0**	**0**	**20**	**0**	**37**	0
4:30 PM	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**11**	**0**	**0**	**0**	**8**	**0**	**21**	0
4:45 PM	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**5**	**0**	**0**	**0**	**6**	**0**	**15**	**110**
5:00 PM	0	0	0	0	0	0	0	0	0	0	10	0	0	0	11	0	21	94
5:15 PM	0	0	0	0	0	0	0	0	0	3	10	0	0	0	4	0	17	74
5:30 PM	0	0	0	1	0	0	0	0	0	0	12	0	0	0	6	0	19	72
5:45 PM	0	0	0	1	0	0	0	0	0	2	9	0	0	0	6	0	18	75
Count Total	0	1	0	11	0	0	0	1	0	10	87	0	0	0	75	0	185	0
Peak Hour	**0**	**1**	**0**	**9**	**0**	**0**	**0**	**1**	**0**	**5**	**46**	**0**	**0**	**0**	**48**	**0**	**110**	**0**

Two-Hour Count Summaries - Bikes

Interval Start	Soper Hill Rd Eastbound			Soper Hill Rd Westbound			SR-9 Northbound			SR-9 Southbound			15-min Total	Rolling One Hour
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
4:00 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
4:15 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
4:30 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
4:45 PM	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Count Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: U-Turn volumes for bikes are included in Left-Turn, if any.

Appendix B: LOS Definitions

Highway Capacity Manual 2010/6th Edition

Signalized intersection level of service (LOS) is defined in terms of a weighted average control delay for the entire intersection. Control delay quantifies the increase in travel time that a vehicle experiences due to the traffic signal control as well as provides a surrogate measure for driver discomfort and fuel consumption. Signalized intersection LOS is stated in terms of average control delay per vehicle (in seconds) during a specified time period (e.g., weekday PM peak hour). Control delay is a complex measure based on many variables, including signal phasing and coordination (i.e., progression of movements through the intersection and along the corridor), signal cycle length, and traffic volumes with respect to intersection capacity and resulting queues. Table 1 summarizes the LOS criteria for signalized intersections, as described in the *Highway Capacity Manual 2010* and 6th Edition (Transportation Research Board, 2010 and 2016, respectively).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F[1]	>80	Forced flow (congested and queues fail to clear)

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.

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

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

Table 2. Level of Service Criteria for Unsignalized Intersections

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

Source: *Highway Capacity Manual 2010 and 6th Edition*, Transportation Research Board, 2010 and 2016, respectively.

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

Highway Capacity Manual, 2000

Signalized intersection level of service (LOS) is defined in terms of the average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Specifically, LOS criteria are stated in terms of average delay per vehicle during a specified time period (for example, the PM peak hour). Vehicle delay is a complex measure based on many variables, including signal phasing (i.e., progression of movements through the intersection), signal cycle length, and traffic volumes with respect to intersection capacity. Table 1 shows LOS criteria for signalized intersections, as described in the *Highway Capacity Manual* (Transportation Research Board, Special Report 209, 2000).

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (sec/veh)	General Description (Signalized Intersections)
A	≤10	Free Flow
B	>10 - 20	Stable Flow (slight delays)
C	>20 - 35	Stable flow (acceptable delays)
D	>35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 - 80	Unstable flow (intolerable delay)
F	>80	Forced flow (jammed)

Source: *Highway Capacity Manual*, Transportation Research Board, Special Report 209, 2000.

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop-controlled and two-way stop-controlled. All-way, stop-controlled intersection LOS is expressed in terms of the average vehicle delay of all of the movements, much like that of a signalized intersection. Two-way, stop-controlled intersection LOS is defined in terms of the average vehicle delay of an individual movement(s). This is because the performance of a two-way, stop-controlled intersection is more closely reflected in terms of its individual movements, rather than its performance overall. For this reason, LOS for a two-way, stop-controlled intersection is defined in terms of its individual movements. With this in mind, total average vehicle delay (i.e., average delay of all movements) for a two-way, stop-controlled intersection should be viewed with discretion. Table 2 shows LOS criteria for unsignalized intersections (both all-way and two-way, stop-controlled).

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (sec/veh)
A	0 - 10
B	>10 - 15
C	>15 - 25
D	>25 - 35
E	>35 - 50
F	>50

Source: *Highway Capacity Manual*, Transportation Research Board, Special Report 209, 2000.

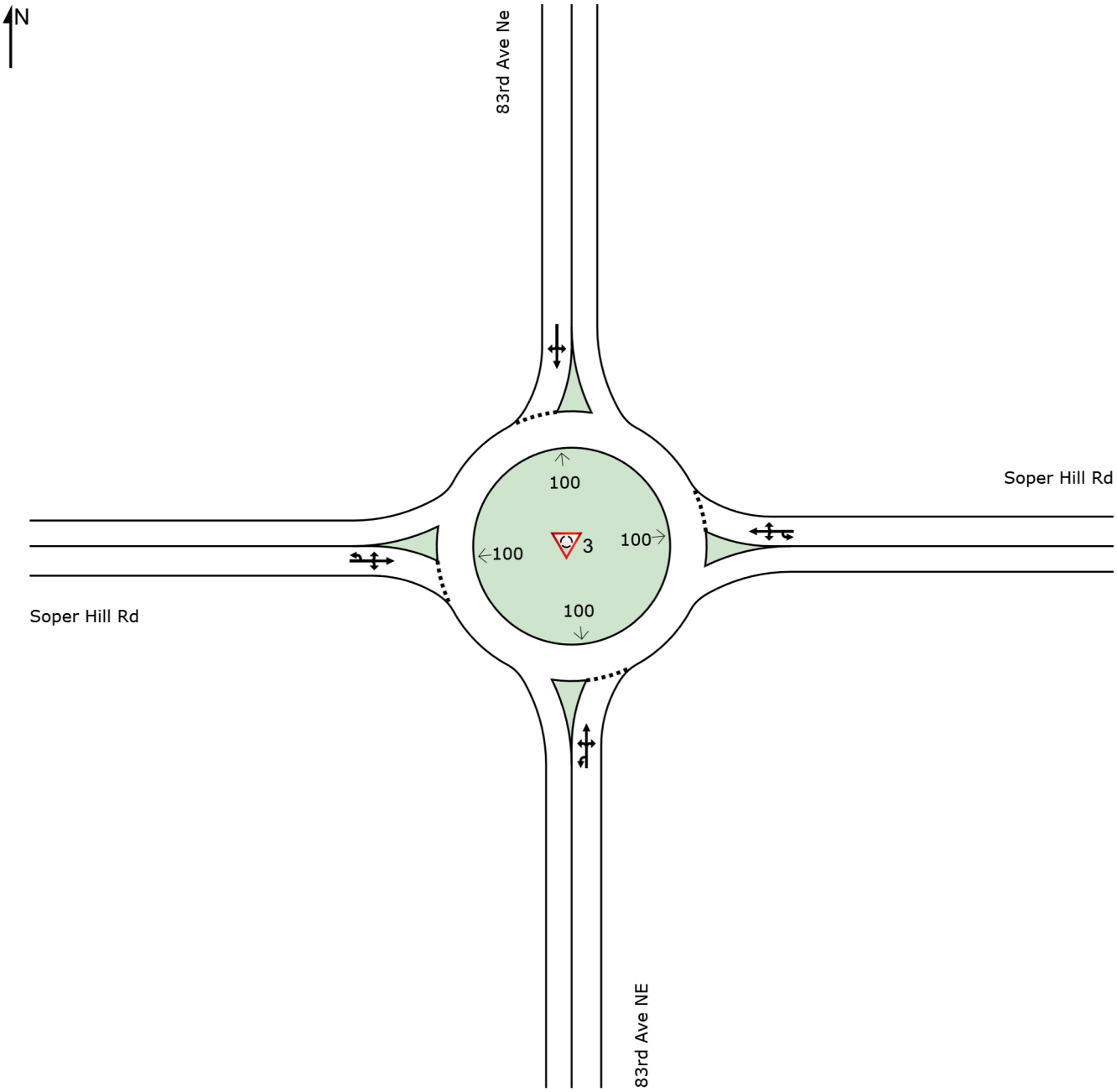
Appendix C: LOS Worksheets

SITE LAYOUT

Site: 3 [1. 83rd Ave NE/Soper Hill Rd Existing (Site Folder: Existing)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 3 [1. 83rd Ave NE/Soper Hill Rd Existing (Site Folder: Existing)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: 83rd Ave NE														
3u	U	5	4.0	5	4.0	0.091	15.0	LOS B	0.4	10.4	0.50	0.64	0.50	36.7
3	L2	5	4.0	5	4.0	0.091	12.5	LOS B	0.4	10.4	0.50	0.64	0.50	35.8
8	T1	10	4.0	10	4.0	0.091	6.6	LOS A	0.4	10.4	0.50	0.64	0.50	35.7
18	R2	40	4.0	41	4.0	0.091	6.7	LOS A	0.4	10.4	0.50	0.64	0.50	34.6
Approach		60	4.0	61	4.0	0.091	7.8	LOS A	0.4	10.4	0.50	0.64	0.50	35.1
East: Soper Hill Rd														
1u	U	5	1.0	5	1.0	0.465	13.5	LOS B	3.1	78.0	0.43	0.54	0.43	37.5
1	L2	40	1.0	41	1.0	0.465	11.1	LOS B	3.1	78.0	0.43	0.54	0.43	36.6
6	T1	160	1.0	163	1.0	0.465	5.1	LOS A	3.1	78.0	0.43	0.54	0.43	36.5
16	R2	200	1.0	204	1.0	0.465	5.2	LOS A	3.1	78.0	0.43	0.54	0.43	35.4
Approach		405	1.0	413	1.0	0.465	5.8	LOS A	3.1	78.0	0.43	0.54	0.43	35.9
North: 83rd Ave Ne														
7	L2	100	2.0	102	2.0	0.189	11.6	LOS B	0.9	23.2	0.44	0.67	0.44	34.9
4	T1	15	2.0	15	2.0	0.189	5.6	LOS A	0.9	23.2	0.44	0.67	0.44	34.8
14	R2	30	2.0	31	2.0	0.189	5.7	LOS A	0.9	23.2	0.44	0.67	0.44	33.8
Approach		145	2.0	148	2.0	0.189	9.7	LOS A	0.9	23.2	0.44	0.67	0.44	34.6
West: Soper Hill Rd														
5u	U	5	2.0	5	2.0	0.338	13.8	LOS B	1.9	47.3	0.44	0.60	0.44	36.7
5	L2	85	2.0	87	2.0	0.338	11.4	LOS B	1.9	47.3	0.44	0.60	0.44	35.8
2	T1	160	2.0	163	2.0	0.338	5.4	LOS A	1.9	47.3	0.44	0.60	0.44	35.7
12	R2	25	2.0	26	2.0	0.338	5.5	LOS A	1.9	47.3	0.44	0.60	0.44	34.6
Approach		275	2.0	281	2.0	0.338	7.4	LOS A	1.9	47.3	0.44	0.60	0.44	35.6
All Vehicles		885	1.7	903	1.7	0.465	7.1	LOS A	3.1	78.0	0.44	0.58	0.44	35.6

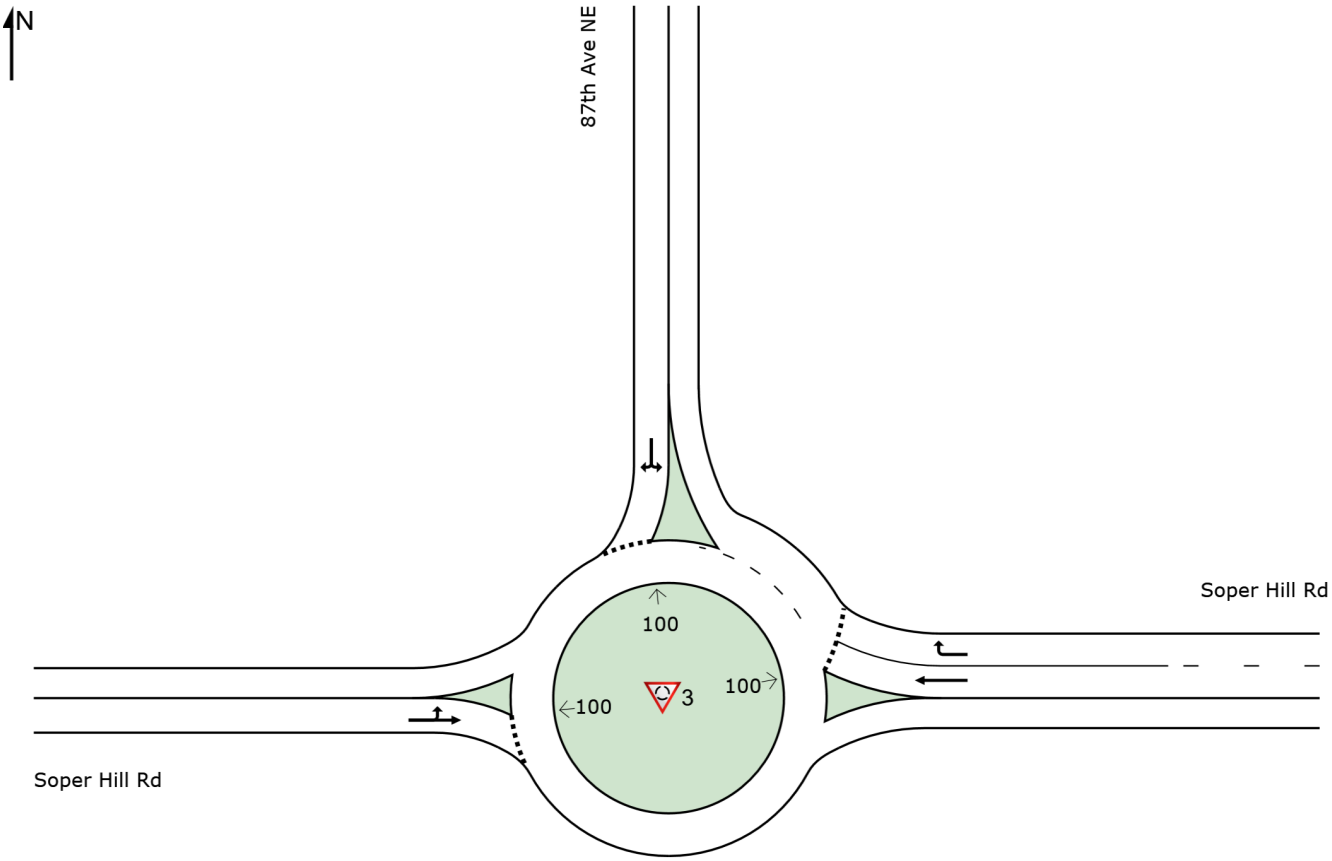
Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 3 [3. 87th Ave NE/Soper Hill Existing (Site Folder: Existing)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 3 [3. 87th Ave NE/Soper Hill Existing (Site Folder: Existing)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: Soper Hill Rd														
6	T1	440	1.0	468	1.0	0.399	3.7	LOS A	2.7	67.3	0.07	0.36	0.07	38.1
16	R2	10	1.0	11	1.0	0.015	4.0	LOS A	0.1	1.3	0.05	0.46	0.05	36.6
Approach		450	1.0	479	1.0	0.399	3.7	LOS A	2.7	67.3	0.07	0.36	0.07	38.1
North: 87th Ave NE														
7	L2	15	6.0	16	6.0	0.035	13.3	LOS B	0.1	3.8	0.52	0.70	0.52	33.7
14	R2	5	6.0	5	6.0	0.035	7.4	LOS A	0.1	3.8	0.52	0.70	0.52	32.8
Approach		20	6.0	21	6.0	0.035	11.8	LOS B	0.1	3.8	0.52	0.70	0.52	33.4
West: Soper Hill Rd														
5	L2	5	1.0	5	1.0	0.319	9.9	LOS A	2.0	49.2	0.14	0.38	0.14	37.7
2	T1	290	1.0	309	1.0	0.319	4.1	LOS A	2.0	49.2	0.14	0.38	0.14	37.5
Approach		295	1.0	314	1.0	0.319	4.2	LOS A	2.0	49.2	0.14	0.38	0.14	37.5
All Vehicles		765	1.1	814	1.1	0.399	4.1	LOS A	2.7	67.3	0.11	0.38	0.11	37.7

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

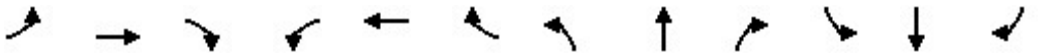
Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	300	5	55	440	0	5	0	45	0	0	0
Future Vol, veh/h	0	300	5	55	440	0	5	0	45	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	1	1	1	2	2	2	2	2	2
Mvmt Flow	0	319	5	59	468	0	5	0	48	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	324	0	0	674	908	322	-	-	234
Stage 1	-	-	-	-	-	-	322	322	-	-	-	-
Stage 2	-	-	-	-	-	-	352	586	-	-	-	-
Critical Hdwy	-	-	-	4.115	-	-	7.33	6.53	6.23	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.53	5.53	-	-	-	-
Follow-up Hdwy	-	-	-	2.2095	-	-	3.519	4.019	3.319	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	1241	-	-	354	275	718	0	0	769
Stage 1	0	-	-	-	-	-	689	650	-	0	0	-
Stage 2	0	-	-	-	-	-	639	496	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1241	-	-	341	262	718	-	-	769
Mov Cap-2 Maneuver	-	-	-	-	-	-	341	262	-	-	-	-
Stage 1	-	-	-	-	-	-	689	650	-	-	-	-
Stage 2	-	-	-	-	-	-	609	472	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.9	11.1	0
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	647	-	-	1241	-	-	-
HCM Lane V/C Ratio	0.082	-	-	0.047	-	-	-
HCM Control Delay (s)	11.1	-	-	8	-	-	0
HCM Lane LOS	B	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-	-	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	40	235	10	65	35	370	1530	5	10	1050	60
Future Volume (vph)	65	40	235	10	65	35	370	1530	5	10	1050	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1	6.1	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1789	1568	1787	1881	1599	3400	3503		1736	3471	1553
Flt Permitted		0.77	1.00	0.69	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1427	1568	1294	1881	1599	3400	3503		1736	3471	1553
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	66	41	240	10	66	36	378	1561	5	10	1071	61
RTOR Reduction (vph)	0	0	0	0	0	28	0	0	0	0	0	31
Lane Group Flow (vph)	0	107	240	10	66	8	378	1566	0	10	1071	30
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	3%	3%	3%	4%	4%	4%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA		Prot	NA	Prot
Protected Phases		4			8		5	2		1	6	6
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		24.5	24.5	25.5	25.5	25.5	14.7	71.5		1.1	57.9	57.9
Effective Green, g (s)		24.5	24.5	25.5	25.5	25.5	14.7	71.5		1.1	57.9	57.9
Actuated g/C Ratio		0.21	0.21	0.22	0.22	0.22	0.13	0.62		0.01	0.50	0.50
Clearance Time (s)		6.1	6.1	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Vehicle Extension (s)		4.0	4.0	2.0	2.0	2.0	2.0	4.5		2.0	4.5	4.5
Lane Grp Cap (vph)		300	330	283	412	350	430	2155		16	1729	773
v/s Ratio Prot					0.04		c0.11	c0.45		0.01	0.31	0.02
v/s Ratio Perm		0.07	c0.15	0.01		0.00						
v/c Ratio		0.36	0.73	0.04	0.16	0.02	0.88	0.73		0.62	0.62	0.04
Uniform Delay, d1		39.1	42.7	35.7	36.7	35.6	49.9	15.6		57.3	21.2	14.9
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.0	8.3	0.0	0.1	0.0	17.6	1.4		44.0	0.9	0.0
Delay (s)		40.1	51.0	35.7	36.8	35.6	67.5	17.0		101.4	22.0	15.0
Level of Service		D	D	D	D	D	E	B		F	C	B
Approach Delay (s)		47.7			36.3			26.8			22.3	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	116.2	Sum of lost time (s)	24.2
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

MOVEMENT SUMMARY

Site: 3 [1. 83rd Ave NE/Soper Hill Rd WoP 2024 (Site Folder: Future WoP 2024)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: 83rd Ave NE														
3u	U	5	4.0	5	4.0	0.094	15.2	LOS B	0.4	10.8	0.52	0.66	0.52	36.6
3	L2	5	4.0	5	4.0	0.094	12.8	LOS B	0.4	10.8	0.52	0.66	0.52	35.7
8	T1	10	4.0	10	4.0	0.094	6.8	LOS A	0.4	10.8	0.52	0.66	0.52	35.6
18	R2	40	4.0	41	4.0	0.094	6.9	LOS A	0.4	10.8	0.52	0.66	0.52	34.5
Approach		60	4.0	61	4.0	0.094	8.0	LOS A	0.4	10.8	0.52	0.66	0.52	35.0
East: Soper Hill Rd														
1u	U	5	1.0	5	1.0	0.508	13.6	LOS B	3.6	90.5	0.46	0.55	0.46	37.4
1	L2	40	1.0	41	1.0	0.508	11.2	LOS B	3.6	90.5	0.46	0.55	0.46	36.5
6	T1	175	1.0	179	1.0	0.508	5.3	LOS A	3.6	90.5	0.46	0.55	0.46	36.4
16	R2	220	1.0	224	1.0	0.508	5.3	LOS A	3.6	90.5	0.46	0.55	0.46	35.3
Approach		440	1.0	449	1.0	0.508	5.9	LOS A	3.6	90.5	0.46	0.55	0.46	35.8
North: 83rd Ave Ne														
7	L2	110	2.0	112	2.0	0.206	11.7	LOS B	1.0	25.7	0.46	0.68	0.46	34.7
4	T1	15	2.0	15	2.0	0.206	5.8	LOS A	1.0	25.7	0.46	0.68	0.46	34.7
14	R2	30	2.0	31	2.0	0.206	5.8	LOS A	1.0	25.7	0.46	0.68	0.46	33.7
Approach		155	2.0	158	2.0	0.206	10.0	LOS A	1.0	25.7	0.46	0.68	0.46	34.5
West: Soper Hill Rd														
5u	U	5	2.0	5	2.0	0.361	14.0	LOS B	2.0	51.6	0.46	0.61	0.46	36.6
5	L2	90	2.0	92	2.0	0.361	11.5	LOS B	2.0	51.6	0.46	0.61	0.46	35.7
2	T1	170	2.0	173	2.0	0.361	5.6	LOS A	2.0	51.6	0.46	0.61	0.46	35.6
12	R2	25	2.0	26	2.0	0.361	5.6	LOS A	2.0	51.6	0.46	0.61	0.46	34.5
Approach		290	2.0	296	2.0	0.361	7.6	LOS A	2.0	51.6	0.46	0.61	0.46	35.6
All Vehicles		945	1.7	964	1.7	0.508	7.2	LOS A	3.6	90.5	0.47	0.60	0.47	35.5

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Int Delay, s/veh	7.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	150	35	10	40	25	20
Future Vol, veh/h	150	35	10	40	25	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	6	6
Mvmt Flow	160	37	11	43	27	21

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	108	33	0	0	54	0
Stage 1	33	-	-	-	-	-
Stage 2	75	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	889	1041	-	-	1526	-
Stage 1	989	-	-	-	-	-
Stage 2	948	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	873	1041	-	-	1526	-
Mov Cap-2 Maneuver	873	-	-	-	-	-
Stage 1	989	-	-	-	-	-
Stage 2	931	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.1	0	4.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	900	1526	-
HCM Lane V/C Ratio	-	-	0.219	0.017	-
HCM Control Delay (s)	-	-	10.1	7.4	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0.1	-

MOVEMENT SUMMARY

Site: 3 [3. 87th Ave NE/Soper Hill Rd WoP 2024 (Site Folder: Future WoP 2024)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: Soper Hill Rd														
6	T1	450	1.0	479	1.0	0.423	4.0	LOS A	3.2	79.6	0.24	0.37	0.24	37.4
16	R2	15	1.0	16	1.0	0.023	4.4	LOS A	0.1	2.3	0.17	0.46	0.17	36.3
Approach		465	1.0	495	1.0	0.423	4.0	LOS A	3.2	79.6	0.23	0.38	0.23	37.4
North: 87th Ave NE														
7	L2	135	6.0	144	6.0	0.306	14.4	LOS B	1.5	40.2	0.63	0.84	0.63	33.1
14	R2	35	6.0	37	6.0	0.306	8.5	LOS A	1.5	40.2	0.63	0.84	0.63	32.2
Approach		170	6.0	181	6.0	0.306	13.2	LOS B	1.5	40.2	0.63	0.84	0.63	32.9
West: Soper Hill Rd														
5	L2	35	1.0	37	1.0	0.399	11.3	LOS B	2.5	63.5	0.47	0.55	0.47	36.2
2	T1	280	1.0	298	1.0	0.399	5.5	LOS A	2.5	63.5	0.47	0.55	0.47	36.0
Approach		315	1.0	335	1.0	0.399	6.1	LOS A	2.5	63.5	0.47	0.55	0.47	36.1
All Vehicles		950	1.9	1011	1.9	0.423	6.3	LOS A	3.2	79.6	0.38	0.52	0.38	36.1

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
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Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

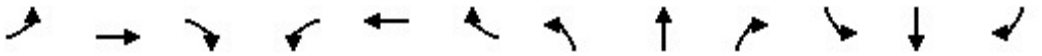
Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	400	15	55	430	75	10	0	45	0	0	15
Future Vol, veh/h	0	400	15	55	430	75	10	0	45	0	0	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	1	1	1	2	2	2	2	2	2
Mvmt Flow	0	426	16	59	457	80	11	0	48	0	0	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	442	0	0	781	1089	434	-	-	269
Stage 1	-	-	-	-	-	-	434	434	-	-	-	-
Stage 2	-	-	-	-	-	-	347	655	-	-	-	-
Critical Hdwy	-	-	-	4.115	-	-	7.33	6.53	6.23	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.53	5.53	-	-	-	-
Follow-up Hdwy	-	-	-	2.2095	-	-	3.519	4.019	3.319	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	1122	-	-	298	215	621	0	0	730
Stage 1	0	-	-	-	-	-	600	580	-	0	0	-
Stage 2	0	-	-	-	-	-	643	462	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1122	-	-	280	204	621	-	-	730
Mov Cap-2 Maneuver	-	-	-	-	-	-	280	204	-	-	-	-
Stage 1	-	-	-	-	-	-	600	580	-	-	-	-
Stage 2	-	-	-	-	-	-	596	438	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.8	13	10
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	508	-	-	1122	-	-	730
HCM Lane V/C Ratio	0.115	-	-	0.052	-	-	0.022
HCM Control Delay (s)	13	-	-	8.4	-	-	10
HCM Lane LOS	B	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.4	-	-	0.2	-	-	0.1



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	45	315	10	70	35	425	1575	5	10	1080	70
Future Volume (vph)	80	45	315	10	70	35	425	1575	5	10	1080	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1	6.1	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1787	1568	1787	1881	1599	3400	3503		1736	3471	1553
Flt Permitted		0.77	1.00	0.66	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1411	1568	1233	1881	1599	3400	3503		1736	3471	1553
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	82	46	321	10	71	36	434	1607	5	10	1102	71
RTOR Reduction (vph)	0	0	0	0	0	26	0	0	0	0	0	38
Lane Group Flow (vph)	0	128	321	10	71	10	434	1612	0	10	1102	33
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	3%	3%	3%	4%	4%	4%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA		Prot	NA	Prot
Protected Phases		4			8		5	2		1	6	6
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		33.7	33.7	34.7	34.7	34.7	14.6	72.4		1.2	59.0	59.0
Effective Green, g (s)		33.7	33.7	34.7	34.7	34.7	14.6	72.4		1.2	59.0	59.0
Actuated g/C Ratio		0.27	0.27	0.27	0.27	0.27	0.12	0.57		0.01	0.47	0.47
Clearance Time (s)		6.1	6.1	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Vehicle Extension (s)		4.0	4.0	2.0	2.0	2.0	2.0	4.5		2.0	4.5	4.5
Lane Grp Cap (vph)		376	418	338	516	438	392	2006		16	1620	724
v/s Ratio Prot					0.04		c0.13	c0.46		0.01	0.32	0.02
v/s Ratio Perm		0.09	c0.20	0.01		0.01						
v/c Ratio		0.34	0.77	0.03	0.14	0.02	1.11	0.80		0.62	0.68	0.05
Uniform Delay, d1		37.4	42.7	33.5	34.6	33.5	55.9	21.4		62.4	26.3	18.4
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.7	8.7	0.0	0.0	0.0	77.7	2.7		44.0	1.4	0.0
Delay (s)		38.1	51.5	33.5	34.6	33.5	133.6	24.1		106.4	27.7	18.4
Level of Service		D	D	C	C	C	F	C		F	C	B
Approach Delay (s)		47.7			34.2			47.3			27.8	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	40.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	126.4	Sum of lost time (s)	24.2
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	5.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	135	65	75	30	45	110
Future Vol, veh/h	135	65	75	30	45	110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	0	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	6	6
Mvmt Flow	144	69	80	32	48	117

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	293	80	0	0	112	0
Stage 1	80	-	-	-	-	-
Stage 2	213	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	698	980	-	-	1453	-
Stage 1	943	-	-	-	-	-
Stage 2	823	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	675	980	-	-	1453	-
Mov Cap-2 Maneuver	675	-	-	-	-	-
Stage 1	943	-	-	-	-	-
Stage 2	796	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	2.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	751	1453	-
HCM Lane V/C Ratio	-	-	0.283	0.033	-
HCM Control Delay (s)	-	-	11.7	7.6	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.2	0.1	-

MOVEMENT SUMMARY

Site: 3 [3. 87th Ave NE/Soper Hill Rd WoP 2030 (Site Folder: Future WoP 2030)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: Soper Hill Rd														
6	T1	485	1.0	516	1.0	0.435	4.4	LOS A	3.2	81.5	0.37	0.43	0.37	37.0
16	R2	20	1.0	21	1.0	0.029	5.0	LOS A	0.1	3.4	0.29	0.48	0.29	36.0
Approach		505	1.0	537	1.0	0.435	4.4	LOS A	3.2	81.5	0.36	0.43	0.36	36.9
North: 87th Ave NE														
7	L2	145	6.0	154	6.0	0.403	14.5	LOS B	2.4	61.6	0.70	0.86	0.72	33.5
14	R2	100	6.0	106	6.0	0.403	8.7	LOS A	2.4	61.6	0.70	0.86	0.72	32.6
Approach		245	6.0	261	6.0	0.403	12.1	LOS B	2.4	61.6	0.70	0.86	0.72	33.1
West: Soper Hill Rd														
5	L2	85	1.0	90	1.0	0.461	11.2	LOS B	3.2	80.7	0.51	0.58	0.51	35.8
2	T1	315	1.0	335	1.0	0.461	5.4	LOS A	3.2	80.7	0.51	0.58	0.51	35.7
Approach		400	1.0	426	1.0	0.461	6.6	LOS A	3.2	80.7	0.51	0.58	0.51	35.7
All Vehicles		1150	2.1	1223	2.1	0.461	6.8	LOS A	3.2	81.5	0.48	0.57	0.49	35.6

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	445	15	65	490	70	15	0	50	0	0	0
Future Vol, veh/h	0	445	15	65	490	70	15	0	50	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	1	1	1	2	2	2	2	2	2
Mvmt Flow	0	473	16	69	521	74	16	0	53	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	489	0	0	880	1214	481	-	-	298
Stage 1	-	-	-	-	-	-	481	481	-	-	-	-
Stage 2	-	-	-	-	-	-	399	733	-	-	-	-
Critical Hdwy	-	-	-	4.115	-	-	7.33	6.53	6.23	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.53	5.53	-	-	-	-
Follow-up Hdwy	-	-	-	2.2095	-	-	3.519	4.019	3.319	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	1078	-	-	254	181	584	0	0	699
Stage 1	0	-	-	-	-	-	565	553	-	0	0	-
Stage 2	0	-	-	-	-	-	599	425	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1078	-	-	235	163	584	-	-	699
Mov Cap-2 Maneuver	-	-	-	-	-	-	235	163	-	-	-	-
Stage 1	-	-	-	-	-	-	565	553	-	-	-	-
Stage 2	-	-	-	-	-	-	541	384	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	14.8	0
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	435	-	-	1078	-	-	-
HCM Lane V/C Ratio	0.159	-	-	0.064	-	-	-
HCM Control Delay (s)	14.8	-	-	8.6	0.3	-	0
HCM Lane LOS	B	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.6	-	-	0.2	-	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	65	390	10	95	40	515	1995	5	10	1490	15
Future Volume (vph)	35	65	390	10	95	40	515	1995	5	10	1490	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1	5.5	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1845	1568	1787	1881	1599	3400	3504		1736	3471	1553
Flt Permitted	0.63	1.00	1.00	0.71	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1158	1845	1568	1343	1881	1599	3400	3504		1736	3471	1553
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	36	66	398	10	97	41	526	2036	5	10	1520	15
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	0	0	0	6
Lane Group Flow (vph)	36	66	398	10	97	4	526	2041	0	10	1520	9
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	3%	3%	3%	4%	4%	4%
Turn Type	Perm	NA	pm+ov	Perm	NA	Perm	Prot	NA		Prot	NA	Prot
Protected Phases		4	5		8		5	2		1	6	6
Permitted Phases	4		4	8		8						
Actuated Green, G (s)	10.6	10.6	25.2	11.6	11.6	11.6	14.6	88.0		1.2	74.6	74.6
Effective Green, g (s)	10.6	10.6	25.2	11.6	11.6	11.6	14.6	88.0		1.2	74.6	74.6
Actuated g/C Ratio	0.09	0.09	0.21	0.10	0.10	0.10	0.12	0.74		0.01	0.63	0.63
Clearance Time (s)	6.1	6.1	5.5	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Vehicle Extension (s)	4.0	4.0	2.0	2.0	2.0	2.0	2.0	4.5		2.0	4.5	4.5
Lane Grp Cap (vph)	103	164	332	131	183	156	417	2593		17	2177	974
v/s Ratio Prot		0.04	c0.15		0.05		c0.15	c0.58		0.01	0.44	0.01
v/s Ratio Perm	0.03		0.11	0.01		0.00						
v/c Ratio	0.35	0.40	1.20	0.08	0.53	0.03	1.26	0.79		0.59	0.70	0.01
Uniform Delay, d1	50.9	51.2	46.9	48.8	51.1	48.5	52.2	9.6		58.6	14.7	8.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	2.2	114.9	0.1	1.5	0.0	135.7	1.8		29.3	1.2	0.0
Delay (s)	53.7	53.4	161.8	48.9	52.5	48.6	187.8	11.5		87.9	15.8	8.3
Level of Service	D	D	F	D	D	D	F	B		F	B	A
Approach Delay (s)		139.7			51.2			47.6			16.2	
Approach LOS		F			D			D			B	

Intersection Summary			
HCM 2000 Control Delay	47.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	118.9	Sum of lost time (s)	24.2
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

MOVEMENT SUMMARY

Site: 3 [6. 87th Ave NE/35th St NE WoP 2030 (Site Folder: Future WoP 2030)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: RoadName														
8	T1	195	2.0	207	2.0	0.249	5.3	LOS A	1.1	29.0	0.45	0.54	0.45	36.6
18	R2	35	2.0	37	2.0	0.249	5.4	LOS A	1.1	29.0	0.45	0.54	0.45	35.5
Approach		230	2.0	245	2.0	0.249	5.3	LOS A	1.1	29.0	0.45	0.54	0.45	36.4
East: 35th St NE														
1	L2	85	2.0	90	2.0	0.089	10.8	LOS B	0.4	11.3	0.39	0.64	0.39	34.0
16	R2	100	2.0	106	2.0	0.102	5.1	LOS A	0.5	13.1	0.39	0.53	0.39	35.6
Approach		185	2.0	197	2.0	0.102	7.8	LOS A	0.5	13.1	0.39	0.58	0.39	34.8
North: 87th Ave NE														
7	L2	325	6.0	346	6.0	0.393	10.7	LOS B	2.5	64.4	0.35	0.62	0.35	34.3
4	T1	30	6.0	32	6.0	0.393	4.7	LOS A	2.5	64.4	0.35	0.62	0.35	34.2
Approach		355	6.0	378	6.0	0.393	10.2	LOS B	2.5	64.4	0.35	0.62	0.35	34.3
All Vehicles		770	3.8	819	3.8	0.393	8.1	LOS A	2.5	64.4	0.39	0.59	0.39	35.0

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 3 [1. 83rd Ave NE/Soper Hill Rd WP 2024 (Site Folder: Future WP 2024)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: 83rd Ave NE														
3u	U	5	4.0	5	4.0	0.095	15.3	LOS B	0.4	11.0	0.53	0.67	0.53	36.5
3	L2	5	4.0	5	4.0	0.095	12.9	LOS B	0.4	11.0	0.53	0.67	0.53	35.6
8	T1	10	4.0	10	4.0	0.095	6.9	LOS A	0.4	11.0	0.53	0.67	0.53	35.5
18	R2	40	4.0	41	4.0	0.095	7.0	LOS A	0.4	11.0	0.53	0.67	0.53	34.5
Approach		60	4.0	61	4.0	0.095	8.2	LOS A	0.4	11.0	0.53	0.67	0.53	34.9
East: Soper Hill Rd														
1u	U	5	1.0	5	1.0	0.526	13.7	LOS B	3.8	96.3	0.48	0.55	0.48	37.4
1	L2	40	1.0	41	1.0	0.526	11.2	LOS B	3.8	96.3	0.48	0.55	0.48	36.5
6	T1	182	1.0	186	1.0	0.526	5.3	LOS A	3.8	96.3	0.48	0.55	0.48	36.4
16	R2	228	1.0	233	1.0	0.526	5.4	LOS A	3.8	96.3	0.48	0.55	0.48	35.2
Approach		455	1.0	464	1.0	0.526	5.9	LOS A	3.8	96.3	0.48	0.55	0.48	35.8
North: 83rd Ave Ne														
7	L2	119	2.0	121	2.0	0.219	11.8	LOS B	1.1	27.8	0.47	0.69	0.47	34.6
4	T1	15	2.0	15	2.0	0.219	5.8	LOS A	1.1	27.8	0.47	0.69	0.47	34.6
14	R2	30	2.0	31	2.0	0.219	5.9	LOS A	1.1	27.8	0.47	0.69	0.47	33.6
Approach		164	2.0	167	2.0	0.219	10.2	LOS B	1.1	27.8	0.47	0.69	0.47	34.4
West: Soper Hill Rd														
5u	U	5	2.0	5	2.0	0.373	14.1	LOS B	2.1	54.1	0.48	0.62	0.48	36.5
5	L2	90	2.0	92	2.0	0.373	11.6	LOS B	2.1	54.1	0.48	0.62	0.48	35.7
2	T1	177	2.0	181	2.0	0.373	5.7	LOS A	2.1	54.1	0.48	0.62	0.48	35.6
12	R2	25	2.0	26	2.0	0.373	5.7	LOS A	2.1	54.1	0.48	0.62	0.48	34.5
Approach		297	2.0	303	2.0	0.373	7.6	LOS A	2.1	54.1	0.48	0.62	0.48	35.5
All Vehicles		976	1.7	996	1.7	0.526	7.3	LOS A	3.8	96.3	0.48	0.60	0.48	35.4

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Intersection	
Int Delay, s/veh	7.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	188	39	12	71	29	20
Future Vol, veh/h	188	39	12	71	29	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	0	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	6	6
Mvmt Flow	200	41	13	76	31	21

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	96	13	0	0	89	0
Stage 1	13	-	-	-	-	-
Stage 2	83	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	903	1067	-	-	1482	-
Stage 1	1010	-	-	-	-	-
Stage 2	940	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	884	1067	-	-	1482	-
Mov Cap-2 Maneuver	884	-	-	-	-	-
Stage 1	1010	-	-	-	-	-
Stage 2	920	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	4.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	911	1482	-
HCM Lane V/C Ratio	-	-	0.265	0.021	-
HCM Control Delay (s)	-	-	10.4	7.5	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.1	0.1	-

MOVEMENT SUMMARY

Site: 3 [3. 87th Ave NE/Soper Hill Rd WP 2024 (Site Folder: Future WP 2024)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: Soper Hill Rd														
6	T1	463	1.0	493	1.0	0.452	4.3	LOS A	3.5	87.4	0.35	0.41	0.35	37.0
16	R2	17	1.0	18	1.0	0.027	4.8	LOS A	0.1	2.8	0.24	0.47	0.24	36.1
Approach		480	1.0	511	1.0	0.452	4.3	LOS A	3.5	87.4	0.34	0.42	0.34	37.0
North: 87th Ave NE														
7	L2	171	6.0	182	6.0	0.386	15.0	LOS B	2.1	55.5	0.69	0.88	0.71	32.7
14	R2	37	6.0	39	6.0	0.386	9.1	LOS A	2.1	55.5	0.69	0.88	0.71	31.8
Approach		208	6.0	221	6.0	0.386	13.9	LOS B	2.1	55.5	0.69	0.88	0.71	32.5
West: Soper Hill Rd														
5	L2	66	1.0	70	1.0	0.441	11.8	LOS B	2.9	72.1	0.54	0.62	0.54	35.7
2	T1	265	1.0	282	1.0	0.441	5.9	LOS A	2.9	72.1	0.54	0.62	0.54	35.6
Approach		331	1.0	352	1.0	0.441	7.1	LOS A	2.9	72.1	0.54	0.62	0.54	35.6
All Vehicles		1019	2.0	1084	2.0	0.452	7.2	LOS A	3.5	87.4	0.48	0.58	0.48	35.5

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

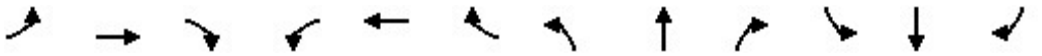
Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	421	15	55	415	114	10	0	45	0	0	45
Future Vol, veh/h	0	421	15	55	415	114	10	0	45	0	0	45
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	1	1	1	2	2	2	2	2	2
Mvmt Flow	0	448	16	59	441	121	11	0	48	0	0	48

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	464	0	0	795	1136	456	-	-	281
Stage 1	-	-	-	-	-	-	456	456	-	-	-	-
Stage 2	-	-	-	-	-	-	339	680	-	-	-	-
Critical Hdwy	-	-	-	4.115	-	-	7.33	6.53	6.23	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.53	5.53	-	-	-	-
Follow-up Hdwy	-	-	-	2.2095	-	-	3.519	4.019	3.319	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	1102	-	-	292	201	603	0	0	717
Stage 1	0	-	-	-	-	-	583	567	-	0	0	-
Stage 2	0	-	-	-	-	-	650	450	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1102	-	-	256	185	603	-	-	717
Mov Cap-2 Maneuver	-	-	-	-	-	-	256	185	-	-	-	-
Stage 1	-	-	-	-	-	-	583	567	-	-	-	-
Stage 2	-	-	-	-	-	-	559	414	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1	13.5	10.4
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	484	-	-	1102	-	-	717
HCM Lane V/C Ratio	0.121	-	-	0.053	-	-	0.067
HCM Control Delay (s)	13.5	-	-	8.4	0.3	-	10.4
HCM Lane LOS	B	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0.4	-	-	0.2	-	-	0.2



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	81	46	334	10	71	35	445	1575	5	10	1080	73
Future Volume (vph)	81	46	334	10	71	35	445	1575	5	10	1080	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1	6.1	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1788	1568	1787	1881	1599	3400	3503		1736	3471	1553
Flt Permitted		0.76	1.00	0.65	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1411	1568	1227	1881	1599	3400	3503		1736	3471	1553
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	83	47	341	10	72	36	454	1607	5	10	1102	74
RTOR Reduction (vph)	0	0	0	0	0	26	0	0	0	0	0	40
Lane Group Flow (vph)	0	130	341	10	72	10	454	1612	0	10	1102	34
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	3%	3%	3%	4%	4%	4%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA		Prot	NA	Prot
Protected Phases		4			8		5	2		1	6	6
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		34.0	34.0	35.0	35.0	35.0	14.6	72.4		1.2	59.0	59.0
Effective Green, g (s)		34.0	34.0	35.0	35.0	35.0	14.6	72.4		1.2	59.0	59.0
Actuated g/C Ratio		0.27	0.27	0.28	0.28	0.28	0.12	0.57		0.01	0.47	0.47
Clearance Time (s)		6.1	6.1	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Vehicle Extension (s)		4.0	4.0	2.0	2.0	2.0	2.0	4.5		2.0	4.5	4.5
Lane Grp Cap (vph)		378	420	338	519	441	391	2001		16	1616	723
v/s Ratio Prot					0.04		c0.13	c0.46		0.01	0.32	0.02
v/s Ratio Perm		0.09	c0.22	0.01		0.01						
v/c Ratio		0.34	0.81	0.03	0.14	0.02	1.16	0.81		0.62	0.68	0.05
Uniform Delay, d1		37.4	43.4	33.5	34.5	33.4	56.1	21.6		62.5	26.5	18.5
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.7	11.9	0.0	0.0	0.0	97.2	2.7		44.0	1.4	0.0
Delay (s)		38.1	55.3	33.5	34.6	33.4	153.3	24.3		106.5	27.9	18.5
Level of Service		D	E	C	C	C	F	C		F	C	B
Approach Delay (s)		50.5			34.1			52.7			28.0	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	44.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	126.7	Sum of lost time (s)	24.2
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	6.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	171	78	75	54	59	110
Future Vol, veh/h	171	78	75	54	59	110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	0	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	6	6
Mvmt Flow	182	83	80	57	63	117

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	323	80	0	0	137	0
Stage 1	80	-	-	-	-	-
Stage 2	243	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.16	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.254	-
Pot Cap-1 Maneuver	671	980	-	-	1423	-
Stage 1	943	-	-	-	-	-
Stage 2	797	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	641	980	-	-	1423	-
Mov Cap-2 Maneuver	641	-	-	-	-	-
Stage 1	943	-	-	-	-	-
Stage 2	762	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.9	0	2.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	719	1423	-
HCM Lane V/C Ratio	-	-	0.368	0.044	-
HCM Control Delay (s)	-	-	12.9	7.6	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	1.7	0.1	-

MOVEMENT SUMMARY

Site: 3 [3. 87th Ave NE/Soper Hill Rd WP 2030 (Site Folder: Future WP 2030)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
East: Soper Hill Rd														
6	T1	493	1.0	524	1.0	0.454	4.6	LOS A	3.4	86.9	0.43	0.46	0.43	36.7
16	R2	20	1.0	21	1.0	0.030	5.2	LOS A	0.1	3.5	0.34	0.49	0.34	35.9
Approach		513	1.0	546	1.0	0.454	4.6	LOS A	3.4	86.9	0.42	0.46	0.42	36.7
North: 87th Ave NE														
7	L2	181	6.0	193	6.0	0.470	15.5	LOS B	3.1	81.3	0.74	0.92	0.83	32.9
14	R2	100	6.0	106	6.0	0.470	9.6	LOS A	3.1	81.3	0.74	0.92	0.83	32.0
Approach		281	6.0	299	6.0	0.470	13.4	LOS B	3.1	81.3	0.74	0.92	0.83	32.6
West: Soper Hill Rd														
5	L2	109	1.0	116	1.0	0.491	11.6	LOS B	3.5	87.8	0.58	0.62	0.58	35.5
2	T1	300	1.0	319	1.0	0.491	5.8	LOS A	3.5	87.8	0.58	0.62	0.58	35.3
Approach		409	1.0	435	1.0	0.491	7.4	LOS A	3.5	87.8	0.58	0.62	0.58	35.4
All Vehicles		1203	2.2	1280	2.2	0.491	7.6	LOS A	3.5	87.8	0.55	0.62	0.57	35.2

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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	0	466	15	65	475	106	15	0	50	0	0	23
Future Vol, veh/h	0	466	15	65	475	106	15	0	50	0	0	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	1	1	1	2	2	2	2	2	2
Mvmt Flow	0	496	16	69	505	113	16	0	53	0	0	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	512	0	0	895	1260	504	-	-	309
Stage 1	-	-	-	-	-	-	504	504	-	-	-	-
Stage 2	-	-	-	-	-	-	391	756	-	-	-	-
Critical Hdwy	-	-	-	4.115	-	-	7.33	6.53	6.23	-	-	6.93
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.53	5.53	-	-	-	-
Follow-up Hdwy	-	-	-	2.2095	-	-	3.519	4.019	3.319	-	-	3.319
Pot Cap-1 Maneuver	0	-	-	1058	-	-	248	170	567	0	0	688
Stage 1	0	-	-	-	-	-	549	540	-	0	0	-
Stage 2	0	-	-	-	-	-	606	415	-	0	0	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	-	-	-	1058	-	-	221	153	567	-	-	688
Mov Cap-2 Maneuver	-	-	-	-	-	-	221	153	-	-	-	-
Stage 1	-	-	-	-	-	-	549	540	-	-	-	-
Stage 2	-	-	-	-	-	-	525	373	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	15.3	10.4
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	417	-	-	1058	-	-	688
HCM Lane V/C Ratio	0.166	-	-	0.065	-	-	0.036
HCM Control Delay (s)	15.3	-	-	8.6	0.3	-	10.4
HCM Lane LOS	C	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0.6	-	-	0.2	-	-	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	66	410	10	96	40	535	1995	5	10	1490	15
Future Volume (vph)	35	66	410	10	96	40	535	1995	5	10	1490	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1	5.5	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1845	1568	1787	1881	1599	3400	3504		1736	3471	1553
Flt Permitted	0.62	1.00	1.00	0.71	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1151	1845	1568	1342	1881	1599	3400	3504		1736	3471	1553
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	36	67	418	10	98	41	546	2036	5	10	1520	15
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	0	0	0	6
Lane Group Flow (vph)	36	67	418	10	98	4	546	2041	0	10	1520	9
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	3%	3%	3%	4%	4%	4%
Turn Type	Perm	NA	pm+ov	Perm	NA	Perm	Prot	NA		Prot	NA	Prot
Protected Phases		4	5		8		5	2		1	6	6
Permitted Phases	4		4	8		8						
Actuated Green, G (s)	10.7	10.7	25.3	11.7	11.7	11.7	14.6	88.0		1.2	74.6	74.6
Effective Green, g (s)	10.7	10.7	25.3	11.7	11.7	11.7	14.6	88.0		1.2	74.6	74.6
Actuated g/C Ratio	0.09	0.09	0.21	0.10	0.10	0.10	0.12	0.74		0.01	0.63	0.63
Clearance Time (s)	6.1	6.1	5.5	5.1	5.1	5.1	5.5	7.5		5.5	7.5	7.5
Vehicle Extension (s)	4.0	4.0	2.0	2.0	2.0	2.0	2.0	4.5		2.0	4.5	4.5
Lane Grp Cap (vph)	103	165	333	131	184	157	417	2591		17	2175	973
v/s Ratio Prot		0.04	c0.15		0.05		c0.16	c0.58		0.01	0.44	0.01
v/s Ratio Perm	0.03		0.11	0.01		0.00						
v/c Ratio	0.35	0.41	1.26	0.08	0.53	0.03	1.31	0.79		0.59	0.70	0.01
Uniform Delay, d1	50.9	51.1	46.9	48.7	51.0	48.5	52.2	9.7		58.7	14.7	8.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.8	2.2	137.1	0.1	1.5	0.0	155.6	1.9		29.3	1.2	0.0
Delay (s)	53.7	53.4	184.0	48.8	52.5	48.5	207.8	11.5		87.9	15.9	8.3
Level of Service	D	D	F	D	D	D	F	B		F	B	A
Approach Delay (s)		158.2			51.2			52.9			16.3	
Approach LOS		F			D			D			B	

Intersection Summary			
HCM 2000 Control Delay	52.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	119.0	Sum of lost time (s)	24.2
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

MOVEMENT SUMMARY

Site: 3 [6. 87th Ave NE/35th St NE WP 2030 (Site Folder: Future WP 2030)]

White Barn Brown Bear
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: 87th Ave NE														
8	T1	206	2.0	219	2.0	0.263	5.3	LOS A	1.2	31.1	0.46	0.55	0.46	36.6
18	R2	37	2.0	39	2.0	0.263	5.4	LOS A	1.2	31.1	0.46	0.55	0.46	35.5
Approach		243	2.0	259	2.0	0.263	5.3	LOS A	1.2	31.1	0.46	0.55	0.46	36.4
East: 35th St NE														
1	L2	88	2.0	94	2.0	0.092	10.9	LOS B	0.5	11.8	0.40	0.65	0.40	34.0
16	R2	100	2.0	106	2.0	0.103	5.2	LOS A	0.5	13.3	0.40	0.54	0.40	35.6
Approach		188	2.0	200	2.0	0.103	7.9	LOS A	0.5	13.3	0.40	0.59	0.40	34.8
North: 87th Ave NE														
7	L2	325	6.0	346	6.0	0.407	10.7	LOS B	2.6	67.8	0.36	0.62	0.36	34.3
4	T1	41	6.0	44	6.0	0.407	4.8	LOS A	2.6	67.8	0.36	0.62	0.36	34.3
Approach		366	6.0	389	6.0	0.407	10.1	LOS B	2.6	67.8	0.36	0.62	0.36	34.3
All Vehicles		797	3.8	848	3.8	0.407	8.1	LOS A	2.6	67.8	0.40	0.59	0.40	35.0

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix D: Detailed Trip Generation

Marysville Brown Bear - White Barn

Proposed Use

									Gross Trips			Pass-By				Total Net New		
Land Use (LU)	**ITE LU Number[1]**	**Setting**	**Size**	**Units**	**Model**	**Rate**	**Units**	**Inbound %**	**Inbound**	**Outbound**	**Subtotal**	**%**	**In**	**Out**	**Total**	**Inbound**	**Outbound**	**Total**
Automated Car Wash	**948**		**1**	tunnels														
PM Peak Hour		General Urban/Suburban			Rate	77.50	per tunnel	50%	39	39	78	40%	16	16	32	23	23	46
Touchless Car Wash	**Observations[2]**		**5**	bays														
PM Peak Hour		General Urban/Suburban			Rate	13.68	per bay	51%	35	33	68	40%	14	14	28	21	19	40
Subtotal																		
PM Peak Hour									74	72	146		30	30	60	44	42	86

Notes:

1. Trip rates based on Institute of Transportation Engineers' (ITE) *Trip Generation* 11th Edition equation and average trip rate as shown above.

2. Trip rates based on observations at existing touchless car washes in the area as touchless car washes are not consistent with uses available in ITE. Observations were completed in 2022 at 3 different facilities during the PM peak period (4-6pm) for 2 mid-weekdays.

Appendix E: Poisson Queuing Analysis

Poisson Queuing - PM Peak Hour (Tunnel)

Number of Service Channels (lanes)	1	
Hourly Flow Rate (vph)	39	per channel
Total Hourly Flow Rate	39	vehicles per hour
Average Stopped Time	6:00	(mm:ss)
Average arrival rate	3.900	vehicles per stopped time

Probability of *(n) or more* vehicles in System	***Vehicles (n)***	**50th-Percentil**	**85th-Percentil**	**95th-Percentil**
0.980	0			
0.980	1			
0.901	2			
0.747	3			
0.547	4			
0.352	5	***5 veh***		
0.199	6			
0.101	7		***7 veh***	
0.045	8			***8 veh***
0.019	9			
0.007	10			
0.002	11			
0.001	12			
0.000	13			
0.000	14			
0.000	15			
0.000	16			
0.000	17			
0.000	18			
0.000	19			
0.000	20			
0.000	21			
0.000	22			
0.000	23			
0.000	24			
0.000	25			

Poisson Queuing - PM Peak Hour (Touchless)

Number of Service Channels (lanes)	5	
Hourly Flow Rate (vph)	6.84	per channel *(INBOUND ONLY)*
Total Hourly Flow Rate	34	vehicles per hour
Average Stopped Time	6:00	(mm:ss)
Average arrival rate	3.400	vehicles per stopped time

Probability of *(n) or more* vehicles in System	***Vehicles (n)***	**50th-Percentile**	**85th-Percentil**	**95th-Percentil**
0.967	0			
0.967	1			
0.853	2			
0.660	3			
0.442	4	***4 veh***		
0.256	5			
0.129	6		***6 veh***	
0.058	7			
0.023	8			***8 veh***
0.008	9			
0.003	10			
0.001	11			
0.000	12			
0.000	13			
0.000	14			
0.000	15			
0.000	16			
0.000	17			
0.000	18			
0.000	19			
0.000	20			
0.000	21			
0.000	22			
0.000	23			
0.000	24			
0.000	25			