



CITY OF BLACK DIAMOND
April 13, 2023, Regular Work Session
Council Chambers, 25510 Lawson Street, Black Diamond, WA 98010

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6:00 P.M. – CALL TO ORDER, FLAG SALUTE, ROLL CALL

1) Transportation Model Update – Mr. Williamson

ADJOURNMENT

Transportation Model Update – per Hearing Examiner Conditions

Prepared for

City of Black Diamond

24301 Roberts Drive
Black Diamond, WA 98010

Prepared by

Parametrix

1019 39th Avenue SE, Suite 100
Puyallup, WA 98374
T. 253.604.6600 F. 1.855.542.6353
www.parametrix.com

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ACRONYMS AND ABBREVIATIONS

FEIS	final environmental impact statement
LOS	level of service
MPD	master planned development
PHF	peak hour factor
PSRC	Puget Sound Regional Council
TAZ	traffic analysis zone
TIP	transportation improvement plan
TTR	transportation technical report
WSDOT	Washington State Department of Transportation

1. EXECUTIVE SUMMARY

This report addresses the Hearing Examiner Transportation conditions for The Villages and Lawson Hills Master Planned Developments (MPDs) Responses to Conditions 10 through 17. These conditions pertain to updates of the transportation modeling conducted as part of the Final Environmental Impact Statement (FEIS) conducted for The Villages and Lawson Hills developments. This report addresses Conditions 11 through 17 by documenting the methodology, assumptions, and results of the updated modeling efforts.

The analysis addresses the requirements of the Conditions of Approval and is consistent with the methodology used in The Villages and Lawson Hills transportation technical reports (TTRs)¹ with applicable updates that have occurred since the TTRs were published.

The analysis was conducted for existing 2022 conditions. To be conservative, the 2022 analysis is based on existing traffic counts as well as trip generation estimates for Phase 1A/1B and Phase 2 of Ten Trails forecasted for the year 2022, as documented in the *Mid-Point Traffic Monitoring Report: Ten Trails and Lawson Hills Master Planned Developments: Phase 1A* (Transpo Group 2021). The Mid-Point Traffic Monitoring Report assumed 1,375 dwelling units would be constructed by the year 2022. Actual construction by the end of 2022 included approximately 1,000 dwelling units.

For the next interval of analysis, the full build-out conditions of Ten Trails and Lawson Hills MPDs were analyzed. The year 2032 was selected as it represents the full build-out of the Ten Trails and Lawson Hills developments. The development agreements for these developments end in the year 2025. Pending approval and vesting schedules, the year 2032 is a conservative assumption for full build-out to be complete.

The analysis concluded that under 2022 existing conditions, one intersection analyzed as part of the Conditions of Approval does not meet existing level of service (LOS) standards. The intersection of SR 169/SE Green Valley Road is forecast at LOS F during the 2020 PM peak hour. A signal is planned at this intersection as identified in the *City of Black Diamond Comprehensive Plan* (City of Black Diamond 2019). With this improvement, LOS at the intersection of SR 169/SE Green Valley Road would operate within LOS standards in the existing condition. It is recommended that the City of Black Diamond work with the developer to advance the timing of this proposed improvement and install a signal provided that at least one of the *Manual on Uniform Traffic Control Devices* signal warrants is met.

Under the 2032 Full Build-out conditions, multiple intersections in the City of Maple Valley are forecast to operate below current LOS D standards in both the 2032 No Build and 2032 Full Build-out conditions. The applicant previously negotiated and paid a fee for the pro-rata share of the project impacts as identified in Condition 16 of the Conditions of Approval. No additional mitigation is required.

The intersection of SE Auburn Black Diamond Road/218th Avenue SE is forecast to operate below LOS standards under the 2032 Full Build-out condition. This intersection is forecast to operate at LOS F, which is below the King County standard of LOS E. A signal or roundabout would bring the LOS up to

¹ *The Villages Transportation Technical Report* (Parametrix 2009b) was included in Technical Appendix B of The Villages MPD Final Environmental Impact Statement (FEIS), and the *Lawson Hills Transportation Technical Report* (Parametrix 2009a) was included in Technical Appendix B of the Lawson Hills MPD FEIS.

King County standards. It is recommended that this mitigation be included as a Condition of Approval for future phases of the MPDs.

The development agreements end in the year 2025. Pending approval and vesting schedules, the year 2032 is a conservative assumption for full build-out to be complete. It is recommended that the next validation/calibration/operations analyses take place as part of the City’s 2034 Comprehensive Plan Update.

2. INTRODUCTION

This report was prepared to address Conditions 11 through 17 of the Hearing Examiner’s Conditions of Approval for The Villages and Lawson Hills Master Planned Developments (d). These conditions pertain to updates of the transportation modeling conducted as part of the Final Environmental Impact Statement (FEIS) conducted for The Villages and Lawson Hills developments. This report addresses Conditions 11 through 17, one by one, and documents the methodology, assumptions, and results of the updated modeling efforts. The Conditions of Approval are included in Appendix A. The report documents the language from each Condition of Approval the beginning of the chapter, with the text highlighted as shown below.

Language from the Conditions of Approval will appear at the beginning of each section, as shown here.

Figure 2 shows the a flow chart of the steps laid on in the Conditions of Approval related to updated to the transportation modeling

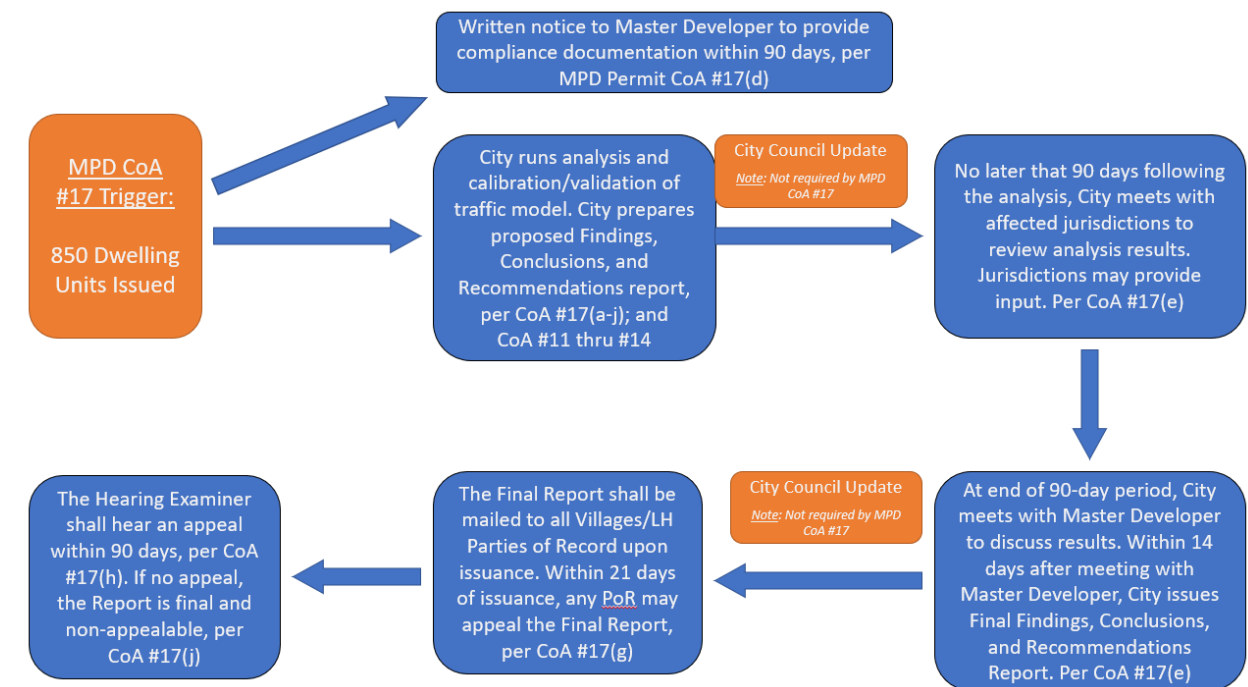


Figure 1. Conditions of Approval – Transportation Modeling Flow Chart

3. DEFINITIONS

Internal capture rate – The percentage of trips generated by a development that are made between different land uses within a mixed-use development site. These internal trips do not use the major street system. Developments with only one type of land use do not have internal capture rates.

Level of service – The operational characteristics of an intersection are determined by calculating the intersection's LOS. An intersection as a whole and its individual turning movements can be described alphabetically with a range of LOSs (A through F); LOS A indicates free-flow traffic and LOS F indicates congestion and long vehicle delays. LOS is measured in average delay per vehicle and is typically reported for the intersection as a whole at signalized intersections and for the approach or turning movement that experiences the most delay at unsignalized intersections. Appendix B provides a detailed explanation of intersection LOS.

Pass-by rate trip – Pass-by trips are not new to the roadway system. A pass-by trip is made as an intermediate stop on the way from an origin to a primary trip destination without a route diversion. Pass-by trips are attracted from traffic passing the site on an adjacent street or roadway that offers direct access to the generator.

Peak hour factor – The *Highway Capacity Manual 6th Edition* (TRB 2016) recommends evaluating traffic conditions during the worst 15 minutes of a typical weekday peak hour. The PHF is used to convert the hourly volume into the volume representing the busiest 15 minutes of the hour. The PHF is the PM peak hour volume divided by the highest 15-minute volume multiplied by four. A PHF of 1.0 means traffic levels are evenly spread out over the whole hour. A PHF of 0.80 or less means traffic spikes for a short period (usually near a factory, school, or some other use with a surge in traffic).

Traffic operations model – Analytical computer model that predicts capacity, delay, and queuing on a variety of transportation facilities. These models implement procedures of the *Highway Capacity Manual 6th Edition*.

Travel demand model – Mathematical computer model used to forecast long-term future travel demand based on current conditions and future projections of household and employment characteristics. Travel demand models have limited capabilities to accurately estimate changes in operational characteristics (such as speed, delay, and queuing) resulting from implementation of operational strategies.

4. CONDITION 11

“The City shall create, at the expense of the Applicant, a new transportation demand model for this project for use in validating the distribution of the project traffic at intervals specified in Condition No. 17. The new model shall incorporate, at an appropriately fine level of detail, and at a minimum, the transportation network from the northern boundary of the City of Enumclaw on SR 169 through the City of Maple Valley to the northern limits of the that city. The new model shall include the intersections studied in the FEIS, with the following additions: all existing and principal and minor arterials in Black Diamond, Covington and Maple Valley and the unincorporated areas between these cities and specifically including the Kent-Black Diamond Road; additional study intersections at SE 231st/SR 18 westbound ramps, SR 169/SE 271st Streets and SR 169/SE 280th Street in Maple Valley External trips may be captured by any valid methodology including overlaying the new model onto the existing Puget Sound Regional Council transportation model.”

Two types of transportation models were used to support this model update: a travel demand model and a traffic operations model. Travel demand models are typically used for systemwide multimodal complex forecasting; Emme, TransCad, and VISUM software platforms were used as the primary tools. For intersection operations analysis, traffic operations models including Synchro, SIDRA, Rodel, and HCS were the primary analytic tools used.

The starting point for transportation demand modeling (known as the DEMAND model for this analysis) work in support of this model update for the City of Black Diamond is the Puget Sound Regional Council (PSRC) 4K Trip-Based Travel Demand Model developed for the current(at the time of the analysis conducted for this report) Regional Transportation Plan 2018. This transportation demand model uses Inro’s Emme software. This version of the model uses a base year of 2014 and includes horizon years of 2025 and 2040. The PSRC is currently updating the Regional Transportation Plan to extend to the year 2050, but that model was not available for use when this work began in early 2022.

The roadway network included in the new DEMAND model includes the requirements above and is documented in the March 4, 2022, technical memorandum (see Appendix C).

To evaluate intersection LOS, per Condition 17B, a separate traffic operations model (known as the OPERATIONS model for this analysis) was created using Synchro software and SIDRA software. The OPERATIONS model included all the intersections studied in the FEIS and the additional intersections listed in Condition 11 above.

“The new model must be validated with existing traffic, based on actual traffic counts no more than two years prior to model creation.”

Existing traffic volumes for the study area were obtained from the Cities of Black Diamond, Covington, and Maple Valley, and the Washington State Department of Transportation (WSDOT). Traffic counts collected in the years 2019, 2020 and 2022 were used in this study.

The COVID pandemic resulted in decreased traffic volumes and travel patterns between March 2020 and July 2021. Traffic counts collected during this time were adjusted to pre-COVID conditions using data from Washington State Department of Transportation (WSDOT) COVID-19 Multimodal Transportation

System Performance Dashboard.² The dashboard summarizes daily differences between 2020 volumes and 2019 volumes for select transportation facilities throughout the state of Washington.

Overall, statewide traffic volumes are stabilized and are close to pre-COVID traffic volumes. Therefore, volumes collected in 2022 are not considered as COVID-affected. Additionally, due to the change in travel patterns during COVID, 2019 traffic volumes are still considered valid for use in this study.

Turn movement counts for the PM peak period were collected in November 2019 at 14 locations in Black Diamond and at 3 locations in Maple Valley. The locations of the intersection counts are shown in Figure 4 in Appendix C (see the March 4, 2022, memo). Seventy-two-hour average daily traffic counts were taken at 15 locations in Black Diamond in the fall of 2020 and at 3 locations in Maple Valley. Locations of the average daily traffic counts are shown in Figure 5 in Appendix C (see the March 4, 2022, memo).

PM peak period turning movement counts were also collected in May 2022 at 27 additional intersections in Covington, Maple Valley, and unincorporated King County. Additional discussion about the existing traffic counts used to validate the DEMAND model is documented in the March 4, 2022, technical memorandum in Appendix C.

Key to the success of the new model is a well-coordinated effort and cooperation among the cities of Black Diamond, Maple Valley, and Covington, the Applicant, King County, and the Washington State Department of Transportation...The City Council therefore directs staff in preparing the model to work in the spirit of openness and cooperation with these other agencies...."

We are working with City of Black Diamond staff to determine the need and timing of contacting Maple Valley, Covington, King County, and WSDOT.

5. CONDITION 12

"The new demand model must take into account recent traffic counts, current and proposed land uses as defined in the applicable Comprehensive Plans areas covered in the study area, and existing speed limits on all roadway links included in the model's roadway network."

Land use assumptions for the DEMAND model are documented in the March 4, 2022, travel demand model technical memorandum and the April 29, 2022, travel demand model technical memorandum; both are included as Appendix C.

"The model must be run with currently funded transportation projects for each affected jurisdiction as shown in the applicable 6-year Transportation Improvement Plans and with transportation projects shown in the applicable 20-year Transportation Improvement Plans which are not funded but are determined to have a reasonable likelihood of obtaining funding based on consultation with each jurisdiction."

² WSDOT. COVID-19 Multimodal Transportation System Performance Dashboard, <https://www.wsdot.wa.gov/about/covid-19-transportation-report/>

The existing year DEMAND and OPERATIONS models included all capacity projects identified in the applicable 6-year Transportation Improvement Plans (TIPs) for the City of Black Diamond, City of Covington, City of Maple Valley, King County, and WSDOT. The projects are listed in Table 1. Appendix D includes information from the TIPs and Comprehensive Plans.

Table 1. 6-Year Transportation Improvement Projects Included in Analysis

Jurisdiction	Study Intersection	Improvements
Black Diamond	SR 169 and Lawson Road ^a	Signal
Black Diamond	SR 169 and Baker Road ^a	Signal
Black Diamond	SR 169 and Ravensdale ^a	Right-in/right-out
Black Diamond	SR 169 and Roberts Drive ^a	Roundabout
Black Diamond	SR 169 and Pipeline Road ^a	Roundabout
Black Diamond	Morgan Street/Roberts Drive ^a	Roundabout
King County	SR 169 and SE 288th Street ^a	Signal
Maple Valley	SR 169 (240th to 244th)	Widen to two lanes in each direction

^a Developer-funded project

Several projects listed in the City of Black Diamond 2022–2027 TIP were not included in the existing year models. These include the Pipeline Road, North Connector Road, and Lawson Connector/Lawson Parkway. These projects are developer-funded projects that are required as part of mitigation, but they will not be constructed prior to 2026.

Table 2 shows projects listed in the applicable 20-year Transportation Improvement Plan that were included in the future year DEMAND and OPERATIONS models. Figure 2 shows the new roadways that were included in both the DEMAND and OPERATIONS models.

Table 2. 20-Year Transportation Improvement Project Included In Analysis

Jurisdiction	Study Intersection	Improvements
Black Diamond	SR 169 and Green Valley Road	Signal
Black Diamond	SR 169 and Jones Lake Road	Signal, add WBLT, NBLT and SBLT turn pockets
Black Diamond	SE 288th and 232nd Ave SE	Channelization improvements
Black Diamond	SE 288th and 216th Ave SE	Signal
Black Diamond	SE Covington and 216th Ave	Rechannelization
Maple Valley	SR 169 and 280th Street	Add second SB and NB lane
Maple Valley	SR 169 and SE 271st (SE Tahoma)	Add second NB lane
Maple Valley	SR 169 and SE 240th	Add second SB lane and second NB lane; Add second WB LT lane and EB RT lane; NB/SB include LT, TH, TH/RT lanes
Maple Valley	SR 169 and Witte Road	Add second SB and NB lane
Maple Valley	SR 169 and SE Wax Road	Add second SB and NB lane
Maple Valley	SR 169 and SE 231st	Add second WB TH at intersection

Jurisdiction	Study Intersection	Improvements
Maple Valley	SR 169 and Witte Road	Widen to three lanes, LT lanes were warranted
King County	Kent-Kangley Road and Landsburg Road	Signal
King County	SE Auburn Black Diamond Road and SE Green Valley Road	Signal
Covington	SR 516 and 164th Avenue	160th to 164th – signal modifications and turn lanes
Covington	SR 516 and Covington Way SE	160th to 164th – signal modifications and turn lanes
Covington	Covington Way and SE Wax Road	Add SB LT lane

EB = eastbound; LT = left-turn; NB = northbound; NBLT = northbound left-turn; RT = right-turn; SB = southbound; SBLT = southbound left-turn; TH = through-lane; WB = westbound; WBLT = westbound left-turn



Figure 2. Planned New Roadways Included in the Travel Demand Model

6. CONDITION 13

“The new model must contain a mode split analysis that reflects the transit service plans of Sound Transit, King County Metro and any other transit provider likely to provide service in the study area. This mode split analysis should include an estimate of the number of project residents likely to use the Sounder and to which stations these trips might be attributed. This analysis must be presented to the city, the applicable transit agencies, and the jurisdictions in which trips are likely to use park and ride, Sound Transit parking garages and other facilities.”

As documented in the March 4, 2022, travel demand model technical memorandum, transit mode shares for Black Diamond were calculated using the regional model. Daily transit shares for trips to and from Black Diamond increase slightly in 2025 (1.7%) as compared to the base year model (1.5%). The model estimated approximately 20 boardings on Sounder in the AM peak period and approximately 28 boardings in the PM peak period.

7. CONDITION 14

“The new model must include a reasonable internal trip capture rate assumption. The assumed internal trip capture rate must be based on and justified by an analysis of the internal trip capture rates suggested by the currently applicable ITE publication as well as information concerning actual trip capture rates in other master planned developments with similar land use mixes in Western Washington. Any subsequent revisions to the model should include the realized trip capture rates for the project, if available.”

For the OPERATIONS model, internal trips were included in the overall trip generation assumptions. Weekday PM peak hour trip generation was estimated based on the size and type of development and assumptions outlined in the *Trip Generation Manual 11th Edition*, (ITE 2021) and the *Trip Generation Handbook, 3rd Edition*, (Hooper 2017). This methodology is consistent with that used in the TTRs³ but incorporates updates to the *Trip Generation Manual* that have occurred since the TTRs were published.

No information concerning actual trip capture rates in other master planned development with similar land use mixes in Western Washington is available at this time. More details about trip generation and analysis are included in Chapter 10, Condition 17.

³ The *Villages Transportation Technical Report* (Parametrix 2009b) was included in Technical Appendix B of The Villages MPD FEIS, and the *Lawson Hills Transportation Technical Report* (Parametrix 2009a) was included in Technical Appendix B of the Lawson Hills MPD FEIS.

8. CONDITION 15

*“Intersection improvements outside the City limits many be mitigated through measures set forth in the a agreement between the developer and the applicable agency. Where agreement is possible, the developer shall enter into traffic mitigation agreements with impacted agencies outside the city that have projects under their jurisdiction in the list below....**Any agreement so incorporated supersedes all other conditions and processes that may set mitigation measures and that are contained in the MPD Conditions or Development Agreement.**”*

In October 2010, Oakpointe and the City of Maple Valley agreed to and executed a transportation mitigation agreement (“Maple Valley Mitigation Agreement”), which requires Oakpointe to contribute a defined percentage of the costs of a list of various transportation mitigation projects within Maple Valley’s city limits that will be affected by build-out of the MPDs. Exhibit B to the Maple Valley Mitigation Agreement provides the list of projects that Oakpointe is obligated to fund and the cost-sharing percentage assigned to Oakpointe for each project. The timing of Oakpointe’s payment obligations is tied to dwelling-unit triggers listed in the agreement, and the payments are specifically required to be used by Maple Valley for design, ROW acquisition, and construction costs for the projects listed in Exhibit B. The Maple Valley Mitigation Agreement was incorporated into the Villages and Lawson Hills MPD Development Agreements as Exhibit Q thereto and was specifically referenced in Section 11.5(C) of the Development Agreements.

As noted in Condition 15 of the MPD Permit Approval, the Maple Valley Mitigation Agreement supersedes all other conditions and processes that may set mitigation measures for transportation impacts resulting from the MPDs.

In December 2010, Oakpointe and the City of Covington entered into a transportation mitigation settlement agreement (“Covington Mitigation Agreement”) to address the impacts on Covington’s transportation facilities as a result of build-out of the Villages and Lawson Hills MPDs. The Covington Mitigation Agreement provides that Oakpointe shall pay a total of \$800,000 to Covington, with that amount payable in installments upon Oakpointe’s achieving the dwelling-unit triggers specified therein. As stated in Section 7 of the Covington Mitigation Agreement, “the parties acknowledge and agree that [Oakpointe’s] performance of the obligations set forth in this Agreement shall constitute full, sufficient, and complete mitigation of the transportation impacts occurring within Covington as a result of full build-out of the [MPDs].” The Covington Mitigation Agreement was incorporated into the Villages and Lawson Hills MPD Development Agreements as Exhibit R thereto and was specifically referenced in Section 11.5(C) of the Development Agreements.

9. CONDITION 16

“If (a) the City of Maple Valley does not appeal or challenge MPD Approval for the Villages MPD, (b) the City of Maple Valley does not appeal or challenge the MPD Approval for the Lawson Hills MPD, (c) City of Maple Valley does not appeal or challenge the Development Agreement for the Villages MPD, (d) the City of Maple Valley does not appeal or challenge the Development Agreement for the Lawson Hills MPD, the Applicant shall provide the following mitigation for the City of Maple Valley, which as to the identified mitigation supersedes the mitigation projects listed for the City of Maple Valley in Condition 15 above....(see Appendix X for more details).”

See discussion of the Maple Valley Mitigation Agreement referenced under Condition 15, above. Execution of the Maple Valley Mitigation Agreement avoided Maple Valley’s need and desire to appeal the City’s approval of the two MPD Permits and Development Agreements. The Maple Valley Mitigation Agreement supersedes all other conditions and processes that may set mitigation measures for transportation impacts resulting from the MPDs.

The City of Maple Valley’s 2015 Comprehensive Plan (page T-53) states “Developer mitigation associated with the new master planned communities in Black Diamond also has been incorporated, consistent with the negotiated mitigation agreement between Maple Valley and Black Diamond.”

10. CONDITION 17

10.1 Condition 17a

“At the point where building permits have been issued for 850 dwelling units at the Villages and Lawson Hills together, and again at such phase or interval determined by the City Council following completion of the review called for by this condition, the City shall validate and calibrate the new transportation demand model created pursuant to Condition 11 above for then-existing traffic from the Villages and Lawson Hills together. The calibration may include an assumption for internal trip capture rates as set forth in Condition 14 above, rather than actual internal trip capture rates, if an insufficient amount of commercial development has been constructed at the time of the validation/calibration required herein. “The City shall run the model to estimate the trip distribution percentages that will result from the next upcoming phase or interval of MPD development, and to assign the estimated trips from that phase or interval to the intersections identified in Condition 11 above.”

10.1.1 Analysis Years

The “then-existing” year assumed in the analysis is the year 2022. The year 2032 was assumed for the next phase of analysis. The year 2032 was selected as it represents the full build-out of the Ten Trails and Lawson Hills developments. The development agreements for these developments end in the year 2025. Pending approval and vesting schedules, the year 2032 is a conservative assumption for full build-out to be complete.

10.1.2 Existing Year Models

10.1.2.1 DEMAND Model

The DEMAND model for the existing condition was calibrated and validated for the year 2014, and then forecasts were created for the years 2025 and 2032. As noted earlier, the PSRC demand model uses a 2014 base year, and includes horizon years of 2025 and 2040. Details about calibration and validation is documented in the March 4, 2022 travel demand technical memorandum (see Appendix C).

The existing year demand model was used to estimate trip distribution patterns on development to date and as the basis for estimating the expected growth by 2032.

Year 2025 was used to estimate trip distribution in the 2022 existing condition in the updated analysis because 2025 is consistent with one of PSRC's horizon years; the year 2025 is also consistent with the analysis year in the EIS; and finally, the year 2025 incorporates the 6-year TIP projects and is sufficient to cover Phase 1A/1B and Phase 2 of the Ten Trails and Lawson Hills MPDs.

10.1.2.2 OPERATIONS Model

A Synchro model was created for the year 2022; it included all the intersections identified in Condition 11. Intersections and roadways were coded into the model to reflect existing conditions, as of 2022, as well as projects from the appropriate 6-year TIPs (as shown in Table 1). Signal timing information was collected from the City of Black Diamond, the City of Maple Valley, and the City of Covington and included in the OPERATIONS model.

To estimate the PM peak hour traffic volumes for the 2022 OPERATIONS model, the following methodology was used. Existing weekday PM peak hour traffic volumes, collected as part of Condition 11 above, were used as the baseline volumes. Next, trip generation estimates for Phase 1A/1B and Phase 2 of Ten Trails forecast for the year 2022, as documented in the *Mid-Point Traffic Monitoring Report: Ten Trails and Lawson Hills Master Planned Developments: Phase 1A* (Transpo Group 2021), were assigned to study area intersections based on the trip distribution as described below.

Weekday PM peak hour trip generation was estimated based on the size and type of development and assumptions outlined in the *Trip Generation Manual 11th Edition* (ITE 2021) and the *Trip Generation Handbook, 3rd Edition* (Hooper 2017). This methodology is consistent with that used in the TTRs⁴ but incorporates updates to the *Trip Generation Manual* that have occurred since the TTRs were published.

Weekday PM peak hour trip regression equations from the most recent edition of the *Trip Generation Manual* were used for all land uses in estimating vehicle trip generation; this is consistent with the approach and methodology used in the TTRs.

For the year 2022, trips were estimated based on the development forecast to occur by 2022 as documented in the *Phase 1A Mid-Point Traffic Monitoring Report: Ten Trails and Lawson Hills MPDs* (Transpo Group 2021).

Table 3 summarizes weekday PM peak hour trip generation estimates for the Ten Trails development forecast by the year 2022. No internal capture rates were included in the 2022 trip generation calculations, as only residential development is expected to be built. Table 3 summarizes weekday PM peak hour trip generation, which includes development from Phase 1A/1B and Phase 2 of Ten Trails. More detailed trip generation calculations are included in Appendix E.

⁴ *The Villages Transportation Technical Report* (Parametrix 2009b) was included in Technical Appendix B of The Villages MPD FEIS, and the *Lawson Hills Transportation Technical Report* (Parametrix 2009a) was included in Technical Appendix B of the Lawson Hills MPD FEIS.

Table 3. 2022 PM Peak Hour Trip Generation Estimates – Phase 1A/1B and Phase 2

Weekday PM Peak	Ten Trails: 1A/1B/2			Gross Trips		
Land Use	ITE LU	Size	Units	Total	In	Out
Single Family	210	993	units	875	551	324
Senior Adult Housing	251	237	units	37	23	14
Multifamily	221	145	units	119	73	46
				1,031	646	385

PM peak hour trips were assigned to the study area intersection in the OPERATIONS model based on the trip distribution output from the DEMAND model. To calculate existing year 2022 trip distribution, a flag in the DEMAND model was coded in and out of TAZs that include the Ten Trails development, and trips on the network were captured through a select link analysis. This model relied on trip generation rates in the PSRC model as estimated from regional household travel surveys. Separate post-processing using ITE trip generation for the Ten Trails area in 2022 was not developed in this effort. This analysis provides path details for the trips in and out of the study area showing where they travel along the network. The locations where these trips were captured for analysis generally capture movements in and out of Black Diamond, as well as trips that travel between the MPD areas. Figure 3 and Figure 4 show distribution patterns for the PM peak in the year 2022.

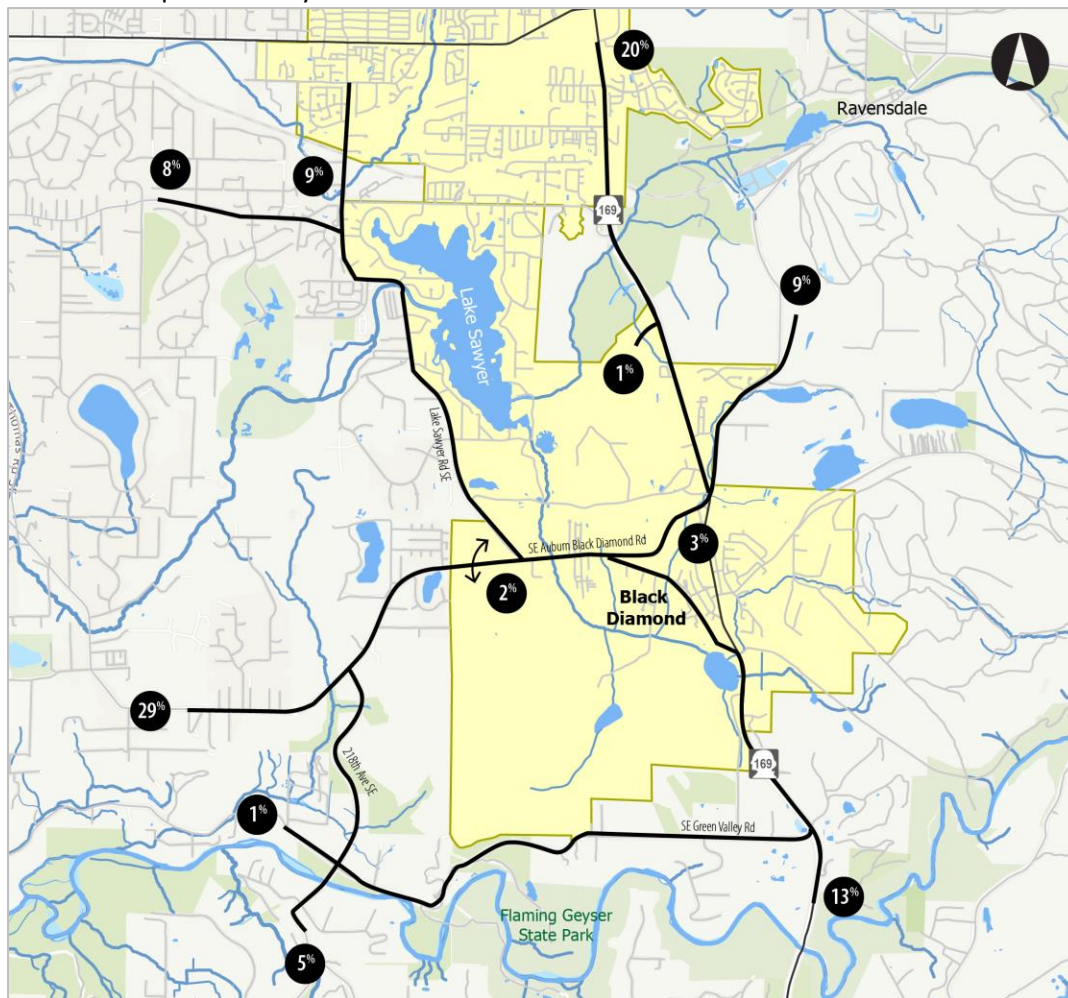


Figure 3. 2022 PM Peak Travel Demand Model MPD Trip Distribution in Black Diamond

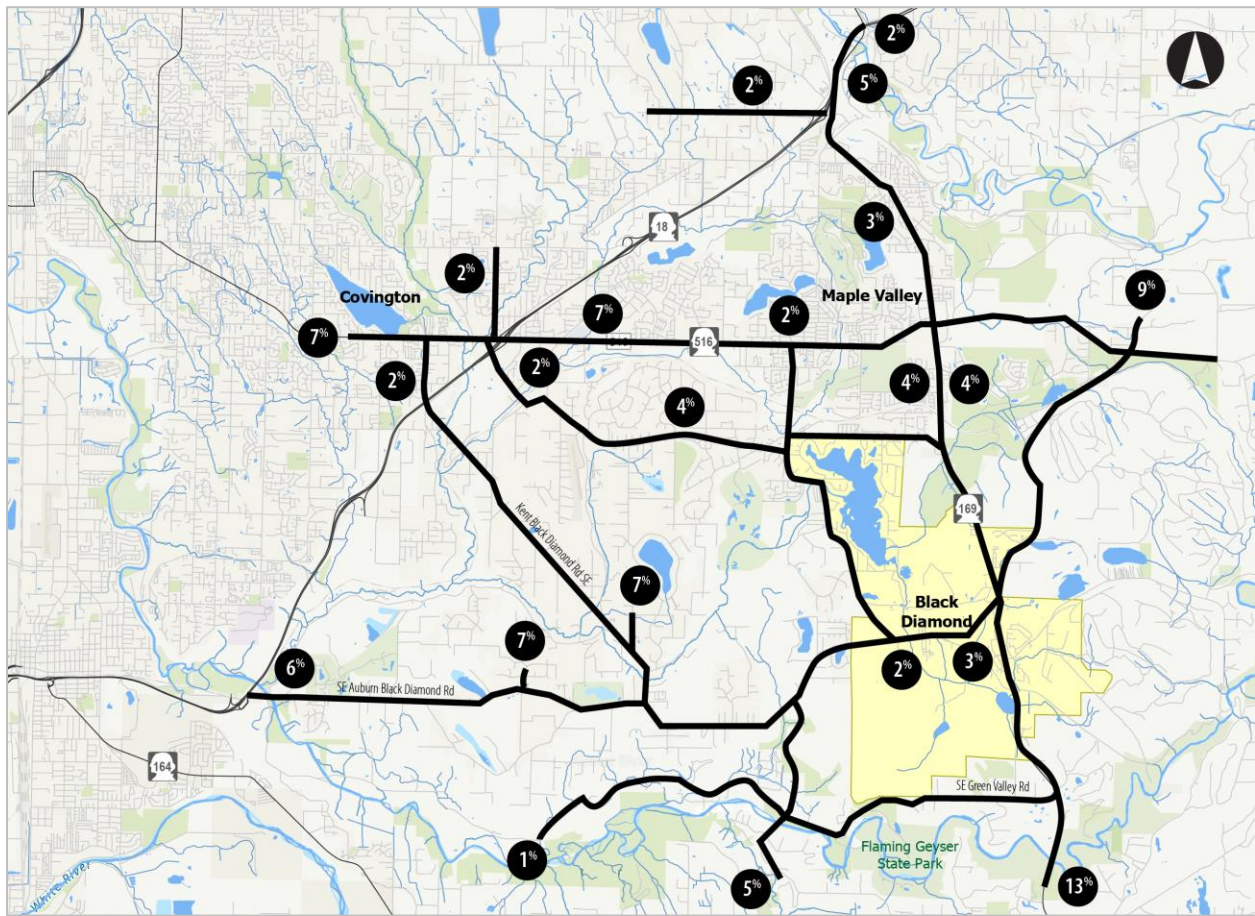


Figure 4. 2022 PM Peak Travel Demand Model MPD Trip Distribution outside Black Diamond

10.1.3 2032 Models

10.1.3.1 DEMAND Model

The DEMAND model for the existing condition was calibrated and validated for the year 2014, and then forecasts were created for the years 2025 and 2032.

Similar to work completed for year 2025, the starting point for 2032 was an established horizon year from the PSRC regional travel demand model. In this case, a 2032 model was not available, so a starting point was taken from a 2030 model that was available and was adjusted to arrive at a 2032 forecast for the Black Diamond area. This approach ensured that the land use associated with a full build-out of the Ten Trails and Lawson Hills developments was accounted for as were anticipated roadway projects in the greater study area (Black Diamond, Covington, Maple Valley). For the remainder of the region outside of the Black Diamond area, which had more detailed information for 2032, the 2030 land use and network were taken directly from the PSRC model.

10.1.3.2 OPERATIONS Model

2032 PM peak hour volumes were estimated by applying an annual growth rate to the 2022 baseline volumes (no development included) at study intersections and adding future trips generated by the full build-out of the Ten Trails and Lawson Hills developments. An annual growth rate of 1.4% was applied to the existing 2022 baseline conditions for 10 years. This growth rate is based on output from the DEMAND model.

Full build-out weekday PM peak hour trip generation was estimated based on the size and type of development, which was provided by the developer, and on assumptions outlined in the *Trip Generation Manual 11th Edition* (ITE 2021) and the *Trip Generation Handbook, 3rd Edition* (Hooper 2017). Table 4 summarizes the weekday PM peak hour trip generation estimates for full build-out. Trip generation calculations are included in Appendix E.

Table 4. 2032 PM Peak Hour Trip Generation Estimates – Full Build Out

Weekday PM Peak	Ten Trails: 1A/1B/2/3			Gross Trips			Internal Trips			Pass-By Trips			Net New Trips		
Land Use	ITE LU	Size	Units	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out
Single Family	210	3303	units	2,692	1,696	996	233	136	97	0	0	0	2,460	1,560	899
Senior Adult Housing	251	401	units	131	80	51	8	5	3	0	0	0	123	75	48
Multifamily	221	1096	units	428	261	167	65	41	25	0	0	0	363	221	142
Elementary School	520	600	students	96	46	50	29	15	14	0	0	0	67	31	36
Office	710	450	ksf	644	109	535	133	61	72	0	0	0	511	48	463
Retail	820	325	ksf	1,599	768	831	300	127	173	304	152	152	995	489	507
				5,590	2,960	2,630	768	384	384	304	152	152	4,519	2,424	2,094

Weekday PM Peak	Lawson Hills: 1B/2			Gross Trips			Internal Trips			Pass-By Trips			Net New Trips		
Land Use	ITE LU	Size	Units	Total	In	Out	Total	In	Out	Total	In	Out	Total	In	Out
Single Family	210	961	units	834	525	309	25	12	13	0	0	0	809	513	296
Multifamily	221	289	units	113	69	44	4	2	2	0	0	0	109	67	42
Elementary School	520	600	students	96	46	50	29	14	15	0	0	0	67	32	35
Office	710	200	ksf	295	50	245	43	9	34	0	0	0	252	41	211
Retail	820	190	ksf	896	430	466	43	34	9	170	85	85	683	311	372
				2,234	1,121	1,113	144	72	72	170	85	85	1,920	964	956

Ten Trails and Lawson Hills Full Buildout				7,824	4,081	3,743	911	455	456	474	237	237	6,439	3,388	3,050
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PM peak hour trips were assigned to the study area intersection in the OPERATIONS model based on the trip distribution output from the DEMAND model. To calculate the 2032 trip distribution, a flag in the DEMAND model was coded in and out of TAZs that include the Ten Trails development, and trips on the network were captured through a select link analysis. This model relied on trip generation rates in the PSRC model as estimated from regional household travel surveys. Separate post-processing using ITE trip generation for the Ten Trails area in 2022 was not developed in this effort. This analysis provides path details for the trips in and out of the study area showing where they travel along the network. The locations where these trips were captured for analysis generally capture movements in and out of Black Diamond, as well as trips between the MPD areas. Figure 5 and Figure 6 show distribution patterns for the PM peak in the year 2032.

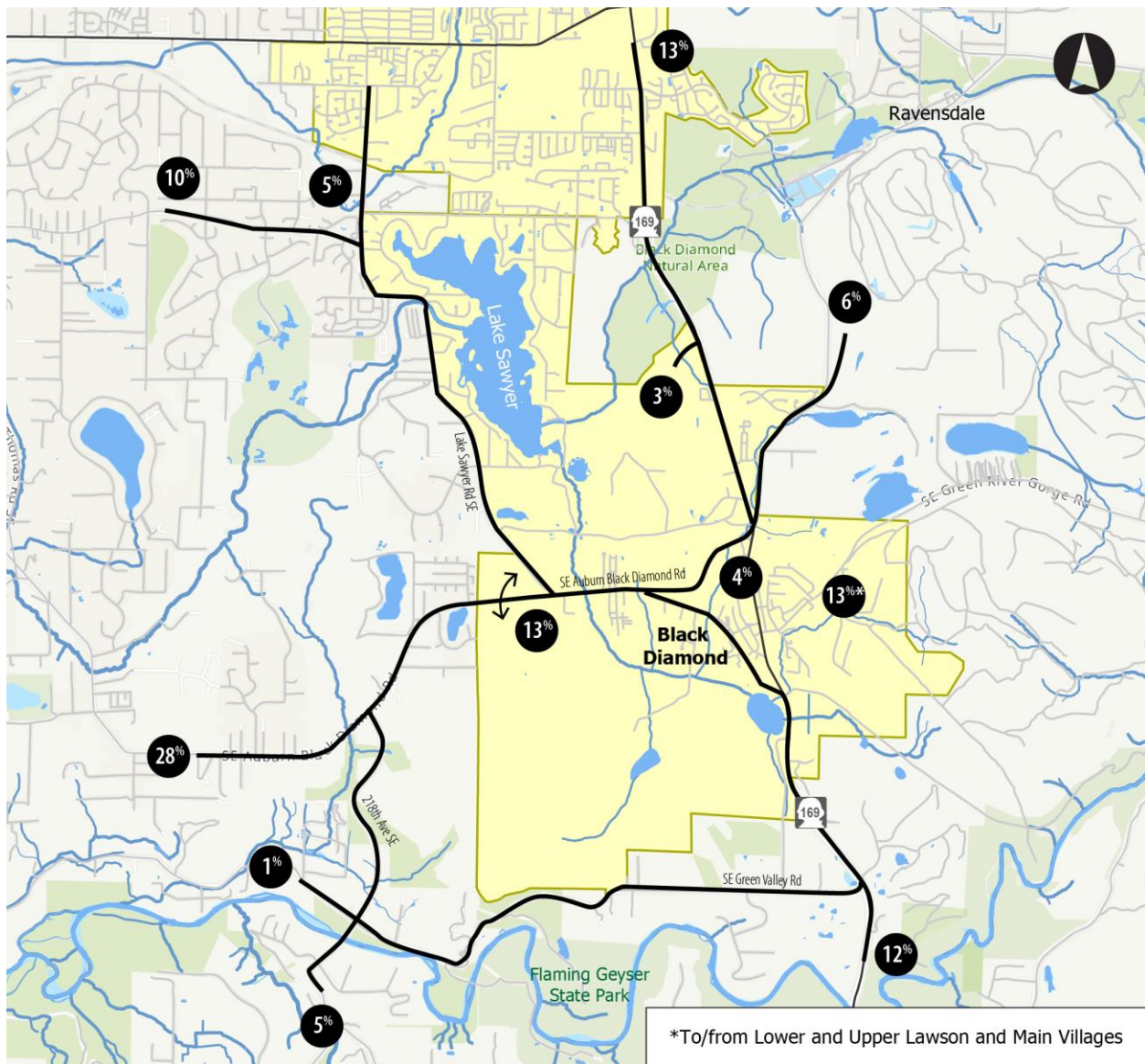


Figure 5. 2032 PM Peak Travel Demand Model MPD Trip Distribution in Black Diamond

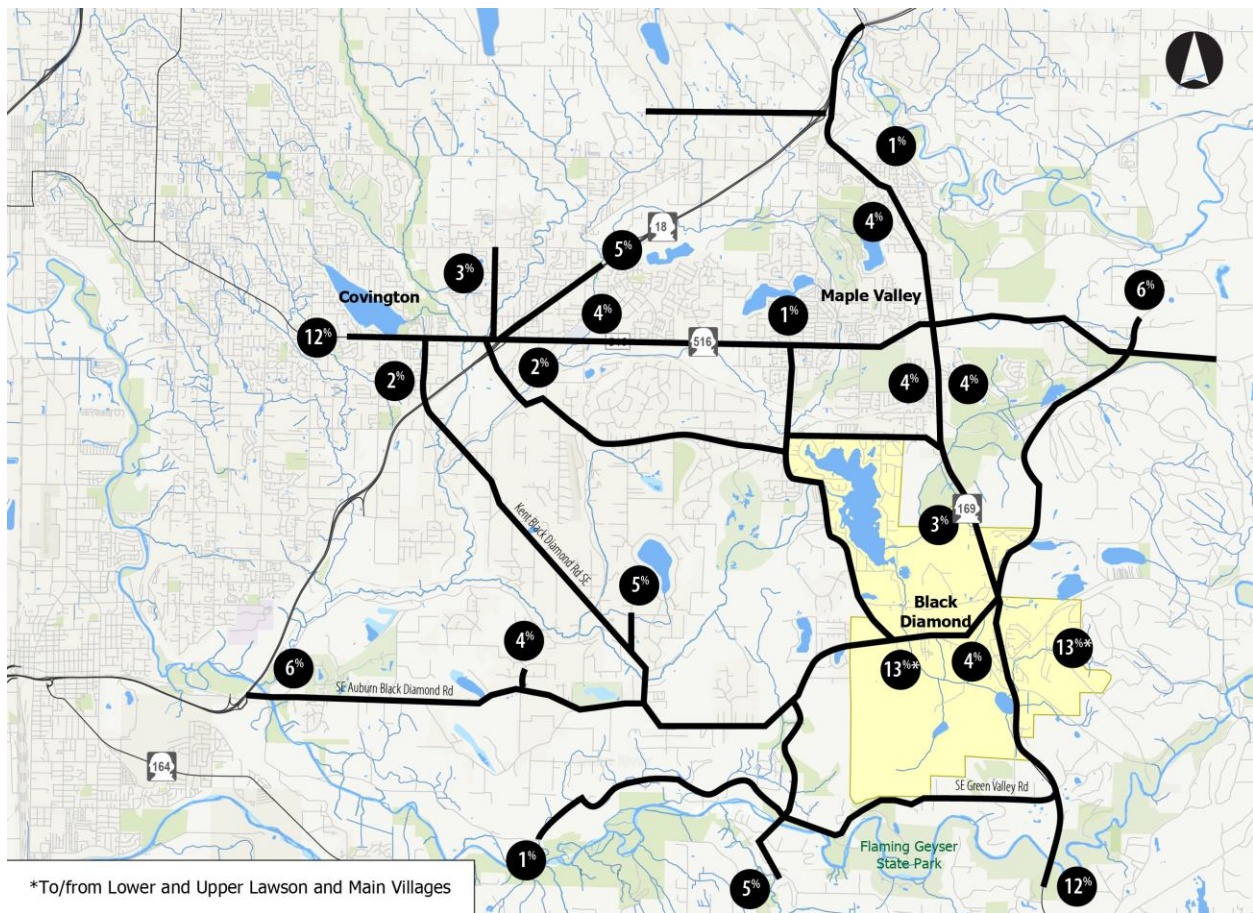


Figure 6. 2032 PM Peak Travel Demand Model MPD Trip Distribution outside Black Diamond

10.2 Condition 17b

"Using the trip distribution and assignment yielded by the transportation demand model validation and calibration required in subsection (a) above, the City shall conduct an intersection operations analysis of the transportation levels of service (LOS) for the intersections identified in Condition 11 above, and shall issue findings, conclusions and a recommendation as provided below. The intersection operations analysis shall determine whether the then-existing, adopted PM peak hour intersection levels of service are met.... The intersections operations analysis must take into account the then-existing peak hour factor;"

10.2.1 Level of Service Standards

The City of Black Diamond's LOS standard is LOS C or better for intersections not on SR 169. For intersections on SR 169, the City's standard is LOS D or better; this is consistent with the standard set by the WSDOT.

The City of Covington’s adopted LOS standard is LOS D or better for signalized, roundabout-controlled, and all-way stop-controlled intersections not on SE 272nd Street (SR 516). For intersections on SE 272nd Street, the LOS standard is LOS D or better, until an ultimate capacity of five lanes (two travel lanes in each direction plus a center left-turn lane) plus sidewalks on both sides is reached for SR 272nd Street. Once ultimate capacity is reached, vehicle operation worse than LOS D is acceptable.

The City of Maple Valley’s adopted LOS standard is divided into two parts. The first part is based on the weighted average LOS of key intersections along the two state highway SR 169 and SR 516. The standard is LOS D, which is based on the weighted average delay per vehicle. LOS standards for all other intersections in the city are as follows:

- LOS D for all signalized, roundabout-controlled, and all-way stop-controlled intersections.
- LOS D or better for all two-way stop-controlled intersections, except for two-way stop-controlled intersections with SR 169, SR 516, or Witte Road, which is LOS E for the side-street approaches.

The LOS standard for intersections in unincorporated King County is LOS E or better.

10.2.2 2022 Level of Service Results

Existing PM peak hour LOS, delays, and as applicable, volume-to-capacity ratios were calculated at study intersections based on existing PHFs and methodologies contained in the *Highway Capacity Manual 6th Edition* (TRB 2016). Existing conditions are summarized in Table 5. Appendix F contains detailed LOS worksheets for all study intersections.

Table 5. 2022 PM Peak Level of Service Results

ID	Intersection	Jurisdiction	Control Type	Standard	Delay	LOS	Weighted Average	
					Delay	LOS	Delay	LOS
1	SE Green Valley Rd & SR 169	Black Diamond	Stop	D	53.1	F	-	-
2	SE 332nd St & SR 169	Black Diamond	Stop	D	-	-	-	-
3	Jones Lake Rd & SR 169	Black Diamond	Stop	D	16.8	C	-	-
4	Lawson Rd & SR 169	Black Diamond	Signal	D	2.9	A	-	-
5	Baker St & SR 169	Black Diamond	Signal	D	5.8	A	-	-
6	Newcastle Dr & Lawson Rd	Black Diamond	Stop	C	8.5	A	-	-
7,8	Roberts Dr & SR 169	Black Diamond	Roundabout	D	6.8	A	-	-
9	Black Diamond Ravensdale Rd & SR 169	Black Diamond	Stop	D	15.4	C	-	-
10	SE 288 St & SR 169	King County	Signal	E	6.3	A	-	-
11	SE 280th St & SR 169	Maple Valley	Signal	D	12.2	B	-	-
12	SE Tahoma Way (SE 271st) & SR 169	Maple Valley	Signal	D	42.6	D	-	-
13	SR 516 & SR 169	Maple Valley	Signal	D	64.2	E	49.2	D
14	SE 240th St & SR 169	Maple Valley	Signal	D	24.0	C	48.4	D
15	SR 169 & Witte Rd	Maple Valley	Signal	D	47.9	D		
16	SE Wax Rd & SR 169	Maple Valley	Signal	D	74.0	E		
17	SE 231st St & SR 169	Maple Valley	Signal	D	41.1	D		
18	SE 231st St & SR 18 EB Ramp	Maple Valley	Signal	D	17.3	B	-	-
19	SE 231st St & SR 18 WB Ramp	Maple Valley	Signal	D	23.3	C	-	-
20	Kent Kangley Rd & Landsburg Rd	King County	Stop	-	15.3	C	-	-
21	SR 516 & Witte Rd	Maple Valley	Signal	D	48.4	D	49.2	D
22	SR 516 & 216th Ave SE	Covington	Signal	D	28.3	C		
23	SR 516 & SE Wax Rd	Covington	Signal	D	54.8	D	-	-
24	SR 516 & 172nd Ave	Covington	Signal	D	54.1	D	-	-
25	SR 516 & 168th Pl	Covington	Signal	D	46.6	D	-	-
26	SR 516 & SR 18 EB Ramp	Covington	Signal	D	32	C	-	-
27	SR 516 & SR 18 WB Ramp	Covington	Signal	D	24.9	C	-	-
28	SR 516 & 164th Ave	Covington	Signal	D	35.5	D	-	-
29	SR 516 & Covington Way SE	Covington	Signal	D	44.9	D	-	-
30	SR 516 & 156th Pl SE	Covington	Stop	-	>500	F	-	-
31	165th Pl & Covington Way SE	Covington	Signal	D	22.1	C	-	-
32	Covington Way SE & SE Wax Rd	Covington	Signal	D	27.1	C	-	-
33	SE 288 St & 232nd Ave SE	Black Diamond	Stop	C	10.8	B	-	-
34	SE 288 St & 216th Ave SE	Black Diamond	Signal	C	4.4	A	-	-
35	SE Covington & 216th Ave	Black Diamond	Signal	C	16.8	B	-	-
36	SE 296th St & 219th Ave SE	Black Diamond	Signal	C	10.1	B	-	-
37	SE Auburn Black Diamond & 218th Ave SE	King County	Stop	E	21.5	C	-	-
38	Ten Trails Pkwy/SE Auburn-Black Diamond Rd	Black Diamond	Roundabout	C	6.5	A	-	-
39	Lake Sawyer Rd/SE Auburn-Black Diamond Rd	Black Diamond	Roundabout	C	13.9	B	-	-
40	Morgan St & Roberts Dr	Black Diamond	Roundabout	C	5.7	A	-	-
41	Railroad Ave & Baker St	Black Diamond	Stop	C	10.2	B	-	-
42	SE Green Valley Rd & 218th St	King County	Stop	E	9.6	A	-	-
43	SE Auburn Black Diamond Rd & SE Green Valley Rd	King County	Stop	E	34.5	D	-	-
201	SR 169 & Pipeline Road	Black Diamond	Roundabout	-	7.7	A	-	-

As shown in Table 5, all but one of the study area intersections operates within current level of service standards. The unsignalized intersection of SR 169/SE Green Valley Road (ID 1 in Table 5) is forecast at LOS F during the 2022 PM peak hour. A signal is planned at this intersection as identified in Black Diamond’s Comprehensive Plan. With this improvement, LOS at the intersection of SR 169/SE Green Valley Road would be within LOS standards in the existing condition. It is recommended that the City of Black Diamond work with the developer to move the timing of this proposed improvement and install a signal provided that at least one of the *Manual on Uniform Traffic Control Devices* signal warrants is met.

10.2.3 2032 Level of Service Results

2032 PM peak hour LOSs, delays, and as applicable, volume-to-capacity ratios were calculated at study intersections based on existing PHFs. 2032 Full Build-out PM peak hour conditions are summarized in Table 6. 2032 No Build PM peak hour conditions are shown side-by-side as a comparison. 2032 No Build conditions assume background growth and only MPD consistent with what is assumed in the 2022 conditions. All intersection capacity projects identified in the 20-year plans are included in the 2032 No Build, but the new Pipeline Road, North Connector, South Connector, and Lawson Parkway roadways are not included as those are assumed to be driven by needs related to the full build-out of the MPD. Appendix F contains detailed LOS worksheets for all study intersections.

Table 6. 2032 PM Peak Level of Service Results

Intersection	Jurisdiction	Control Type	2032 No Build				2032 Full Buildout			
			Delay		LOS		Weighted Average		Delay	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
SE Green Valley Rd & SR 169	Black Diamond	Signal	4.2	A	-	-	30.3	C	-	-
SE 333rd St & SR 169	Black Diamond	Stop	-	-	-	-	-	-	-	-
Jones Lake Rd & SR 169	Black Diamond	Signal	6.4	A	-	-	32.5	C	-	-
Lawson Rd & SR 169	Black Diamond	Signal	2.5	A	-	-	3.0	A	-	-
Baker St & SR 169	Black Diamond	Signal	8.6	A	-	-	18.3	B	-	-
Newcastle Dr & Lawson Rd	Black Diamond	Stop	-	-	-	-	19.4	C	-	-
Roberts Dr & SR 169	Black Diamond	Roundabout	5.5	A	-	-	11.7	B	-	-
Black Diamond Ravensdale Rd & SR 169	Black Diamond	Stop	18.5	C	-	-	32.9	D	-	-
SE 288 St & SR 169	King County	Signal	7.6	A	-	-	7.3	A	-	-
SE 280th St & SR 169	Maple Valley	Signal	15.6	B	-	-	53.0	D	-	-
SE Tahoma Way (SE 271st) & SR 169	Maple Valley	Signal	49.1	D	-	-	69.2	E	-	-
SR 516 & SR 169	Maple Valley	Signal	89.8	F	67.3	E	134	F	85.8	F
SE 240th St & SR 169	Maple Valley	Signal	25.3	C	-	-	29.4	C	-	-
SR 169 & Witte Rd	Maple Valley	Signal	74.8	E	67.5	E	78.6	E	71.8	E
SE Wax Rd & SR 169	Maple Valley	Signal	108.3	F	-	-	112.3	F	-	-
SE 231st St & SR 169	Maple Valley	Signal	49.8	D	-	-	56.1	E	-	-
SE 231st St & SR 18 EB Ramp	Maple Valley	Signal	19.4	B	-	-	19.1	B	-	-
SE 231st St & SR 18 WB Ramp	Maple Valley	Signal	25.9	C	-	-	25.9	C	-	-
Kent Kangley Rd & Landsburg Rd	King County	Signal	7.2	A	-	-	7.1	A	-	-
SR 516 & Witte Rd	Maple Valley	Signal	57.8	E	67.3	E	50.6	D	85.8	F
SR 516 & 216th Ave SE	Maple Valley	Signal	45.2	D	-	-	46.6	D	-	-
SR 516 & SE Wax Rd	Covington	Signal	86.7	F	-	-	46.9	D	-	-
SR 516 & 172nd Ave	Covington	Signal	80.4	F	-	-	79.6	E	-	-
SR 516 & 168th Pl	Covington	Signal	60.5	F	-	-	60.8	E	-	-
SR 516 & SR 18 EB Ramp	Covington	Signal	36.4	D	-	-	38.2	D	-	-
SR 516 & SR 18 WB Ramp	Covington	Signal	26.5	C	-	-	31.9	C	-	-
SR 516 & 164th Ave	Covington	Signal	37.4	D	-	-	38.4	D	-	-
SR 516 & Covington Way SE	Covington	Signal	57.6	E	-	-	95.2	F	-	-
SR 516 & 156th Pl SE	Covington	Stop	>500	F	-	-	>500	F	-	-
165th Pl & Covington Way SE	Covington	Signal	29.8	C	-	-	31.5	C	-	-
Covington Way SE & SE Wax Rd	Covington	Signal	29	C	-	-	46.0	D	-	-
SE 288 St & 232nd Ave SE	Black Diamond	Stop	11.6	B	-	-	13.4	B	-	-
SE 288 St & 216th Ave SE	Black Diamond	Signal	4.6	A	-	-	6.4	A	-	-
SE Covington & 216th Ave	Black Diamond	Signal	17	B	-	-	24.0	C	-	-
SE 296th St & 219th Ave SE	Black Diamond	Signal	10.6	B	-	-	10.5	B	-	-
SE Auburn Black Diamond & 218th Ave SE	King County	Stop	27	D	-	-	182.0	F	-	-
Ten Trails Pkwy/SE Auburn-Black Diamond Rd	Black Diamond	Roundabout	5.9	A	-	-	21.3	C	-	-
Lake Sawyer Rd/SE Auburn-Black Diamond Rd	Black Diamond	Roundabout	8.9	A	-	-	15.9	B	-	-
Morgan St & Roberts Dr	Black Diamond	Roundabout	5.7	A	-	-	7	A	-	-
Railroad Ave & Baker St	Black Diamond	Stop	10.2	B	-	-	18.0	C	-	-
SE Green Valley Rd & 218th St	King County	Stop	10.3	B	-	-	12.3	B	-	-
SE Auburn Black Diamond Rd & SE Green Valley Rd	King County	Signal	4.9	A	-	-	7.4	A	-	-
Ten Trails Place & Roberts Drive	Black Diamond	Signal	1.4	A	-	-	15.8	B	-	-
SR 169 / North Connector	Black Diamond	Roundabout	-	-	-	-	8.5	A	-	-
SR 169 / Pipeline Road	Black Diamond	Roundabout	-	-	-	-	16.9	B	-	-
North Connector / Pipeline Road	Black Diamond	Roundabout	-	-	-	-	7.2	A	-	-
Lake Sawyer Rd / Pipeline Road	Black Diamond	Roundabout	-	-	-	-	10.1	B	-	-
SR 169 / South Connector	Black Diamond	Roundabout	-	-	-	-	6.1	A	-	-

As shown in Table 6, multiple intersections in the City of Maple Valley are forecast to operate below current LOS D standards in both the 2032 No Build and 2032 Full Build-out conditions. The applicant previously negotiated and paid a fee for the pro-rata share of the project impacts as identified in Condition 16 of the Conditions of Approval.. No additional mitigation is required.

All other intersections are forecast to operate with LOS standards under the 2032 Full Build-out condition with the exception of SE Auburn Black Diamond Road/218th Avenue SE. This intersection is forecast to operate at LOS F, which is below the King County standard of LOS E. A signal or roundabout would bring the LOS back up to King County standards.

11. CONCLUSIONS AND RECOMMENDATIONS

This analysis concluded that under 2022 existing conditions, one intersection analyzed as part of the Conditions of Approval does not meet existing LOS standards. The intersection of SR 169/SE Green Valley Road is forecast at LOS F during the 2022 PM peak hour. As signal is planned at this intersection as identified in Black Diamond's Comprehensive Plan. With this improvement, LOS at the intersection of SR 169/SE Green Valley Road would be within the LOS standards in the existing condition. It is recommended that the City of Black Diamond work with the developer to advance the timing of this proposed improvement and install a signal provided that at least one of the *Manual on Uniform Traffic Control Devices* signal warrants is met.

Under the 2032 Full Build-out conditions, multiple intersections in the City of Maple Valley are forecast to operate below current LOS D standards in both the 2032 No Build and 2032 Full build-out conditions. The applicant previously negotiated and paid a fee for the pro-rata share of the project impacts as identified in Condition 16 of the Conditions of Approval.. No additional mitigation is required.

The intersection of SE Auburn Black Diamond Road/218th Avenue SE is forecast to operate below LOS standards under the 2032 Full Build-out condition. This intersection is forecast to operate at LOS F, which is below the King County standard of LOS E. A signal or roundabout would bring the LOS back up to King County standards. It is recommended that this mitigation be included as a Condition of Approval of future phases of the MPD.

The development agreements end in the year 2025. Pending approval and vesting schedules, the year 2032 is a conservative assumption for full build-out to be complete. It is recommended that the next validation/calibration/operations analyses take place as part of the City's 2034 Comprehensive Plan Update.

12. REFERENCES

- City of Black Diamond. 2019. City of Black Diamond Comprehensive Plan. Available at: https://www.blackdiamondwa.gov/sites/g/files/vyhliif306/f/uploads/2019_comp_plan_adopted_cl_ean.pdf. Accessed December 15, 2022.
- Hooper, K. G. 2017. Trip Generation Handbook. Institute of Transportation Engineers.
- ITE (Institute of Transportation Engineers). 2021. Trip Generation Manual, 11th Edition. Institute of Transportation Engineers.
- Parametrix. 2009a. Lawson Hills Transportation Technical Report. Technical Appendix B of Lawson Hills Master Planned Development Final Environmental Impact Statement. Prepared for the City of Black Diamond.
- Parametrix. 2009b. Villages Transportation Technical Report. Technical Appendix B of The Villages Master Planned Development Final Environmental Impact Statement. Prepared for the City of Black Diamond.
- Transpo Group. 2021. Mid-Point Traffic Monitoring Report: Ten Trails and Lawson Hills Master Planned Developments: Phase 1A. Prepared for CCD Black Diamond Partners LLC, Kirkland, WA.
- TRB (Transportation Research Board). 2016. Highway Capacity Manual 6th Edition: A Guide for Multimodal Mobility Analysis. Transportation Research Board.

Appendix A

Conditions of Approval



EXHIBIT C
CONDITIONS OF APPROVAL
The Villages MPD

GENERAL

1. Approval of the MPD is limited to the terms and conditions set forth in the City Council's written decision, and does not include approval of any other portion of the MPD set forth in the application.

2. After approval by the City Council at an open public meeting and after a public hearing as required by law, a Development Agreement shall be signed by the Mayor and all property owners and lien holders within the MPD boundaries, and recorded, before the City shall approve any subsequent implementing permits or approvals. Any requirements deferred to the Development Agreement in this decision shall be integrated into the Agreement prior to any approval of subsequent implementing permits or approvals.

3. The Phasing Plan of Chapter 9 of the MPD application is approved, with the exception of the bonding proposal at p. 9-3 and the proposal for off-site trails at p. 9-2 (to the extent not already considered a regional facility) and parks at p. 9-10, and except as otherwise noted in these conditions of approval.

4. The Development Agreement shall specify which infrastructure projects the applicant will build; which projects the City will build; and for which projects the applicant will be eligible for either credits or cost recovery and by what mechanisms this shall occur.

5. The Development Agreement shall specifically describe when the various components of permitting and construction must be approved, completed or terminated (e.g., when must open space be dedicated, plats recorded, and utility improvements be accepted by the City).

6. The Development Agreement shall include language that defines and identifies a "Master Developer." A single Master Developer shall be maintained through the life of the Development Agreement. The duties of the Master Developer shall include at least the following: a) function as a single point of contact for City billing purposes; b) function as a single authority for Development Agreement revisions and modifications; c) provide proof of approval of all permit applications (except building permits) by other parties prior to their submittal to the City; and d) assume responsibility for distributing Development Agreement entitlements and obligations and administering such.

7. The City shall have the ability but not the obligation to administratively approve off-site projects that would otherwise be compromised if they cannot be completed prior to approval and execution of the Development Agreement. In these instances, the applicant shall acknowledge in

writing that the approval of any such applicable projects does not in any way obligate the City to incur obligations other than those specifically identified in the approved permits for the applicable project.

8. The applicant shall submit a construction waste management plan for inclusion in the Development Agreement.

9. Homeowners Association(s) conditions, covenants and restrictions (CCRs) and/or the proposed Architectural Review Committee shall be required to allow the use of green technologies (such as solar panels) in all buildings. In addition, the CCRs shall include provisions, to be enforced by the HOA, prohibiting washing of cars in driveways or other paved surfaces, except for commercial car washes, and limiting the use of phosphorous fertilizers in common areas, so as to limit phosphorous loading in stormwater.

TRANSPORTATION

10. Over the course of project build out, construct any new roadway alignment or intersection improvement that is: (a) depicted in the 2025 Transportation Element of the adopted 2009 City Comprehensive Plan and in the City's reasonable discretion is (i) necessary to maintain the City's then-applicable, adopted levels of service to the extent that project traffic would cause or contribute to any level of service deficiency as determined by the City's adopted level of service standard, or (ii) to provide access to or circulation within the project; (b) functionally equivalent to any said alignment or improvement; or (c) otherwise necessary to maintain the City's then-applicable, adopted levels of service to the extent that project traffic would cause or contribute to any level of service failure as determined by the City's adopted level of service standard, or to provide access to or circulation within the project, as determined by the City in its reasonable discretion based on the monitoring and modeling provided for in Conditions 25 and 20 below. The Development Agreement shall specify for which projects the applicant will be eligible for either credits or cost recovery and by what mechanisms this shall occur. Any "functionally equivalent" realignment that results in a connection of MPD roads to Green Valley Road shall be processed as a major amendment to the MPD.

11. The City shall create, at the expense of the Applicant, a new transportation demand model for this project for use in validating the distribution of project traffic at the intervals specified in Condition No. 17. The new model shall incorporate, at an appropriately fine level of detail, and at a minimum, the transportation network from the northern boundary of the City of Enumclaw on SR 169 through the City of Maple Valley to the northern limits of that city. The new model shall include the intersections studied in the FEIS, together with the following additions: all existing principal and minor arterials in Black Diamond, Covington and Maple Valley and the unincorporated areas between these cities and specifically including the Kent-Black Diamond Road; additional study intersections at SE 231st Street/SR 18 westbound ramps, SR 169/SE 271st Street and SR 169/SE 280th Street in Maple Valley. External trips may be captured by any valid methodology including overlaying the new model onto the existing Puget Sound Regional Council transportation model. The new model must be validated for existing traffic, based on actual traffic counts collected no more than two years prior to model creation. Key to the success of the new model is a well-coordinated effort and cooperation among the

cities of Black Diamond, Maple Valley and Covington, the Applicant, King County and the Washington State Department of Transportation. Although the specific assumptions ultimately made in the model may be the subject of differences in professional judgment, the City Council's goal is that, notwithstanding these differences in judgment, the model will be comprehensive and therefore acceptable to all parties. The City Council therefore directs staff in preparing the model to work within the spirit of openness and cooperation with these other agencies and the Applicant, and similarly requests that other agencies and the Applicant join with the City of Black Diamond staff in working together in the same spirit for the common good.

12. The new demand model must take into account recent traffic counts, current and proposed land uses as defined in the applicable Comprehensive Plans areas covered in the study area, and existing speed limits on all roadway links included in the model's roadway network. The model must be run with currently funded transportation projects for each affected jurisdiction as shown in the applicable 6-year Transportation Improvement Plans and with transportation projects shown in the applicable 20-year Transportation Improvement Plans which projects are not funded but are determined to have a reasonable likelihood of obtaining funding based on consultation with each jurisdiction.

13. The new model must contain a mode split analysis that reflects the transit service plans of Sound Transit, King County Metro and any other transit provider likely to provide service in the study area. This mode split analysis should include an estimate of the number of project residents likely to use the Sounder and to which stations these trips might be attributed. This analysis must be presented to the City, the applicable transit agencies, and the jurisdictions in which trips are likely to use park and ride, Sound Transit parking garages or other facilities.

14. The new model must include a reasonable internal trip capture rate assumption. The assumed internal trip capture rate must be based upon and justified by an analysis of the internal trip capture rates suggested by the currently applicable ITE publication as well as information concerning actual internal trip capture rates in other master planned developments with similar land use mixes in Western Washington. Any subsequent revisions to the model should include the realized trip capture rates for the project, if available.

15. Intersection improvements outside the City limits may be mitigated through measures set forth in an agreement between the developer and the applicable agency. Where agreement is possible, the developer shall enter into traffic mitigation agreements with impacted agencies outside the city that have projects under their jurisdiction in the list below, and the agreement shall be incorporated as part of the Development Agreement, or as an addendum to an adopted Development Agreement. Any agreement so incorporated supersedes all other conditions and processes that may set mitigation measures and that are contained in the MPD Conditions or Development Agreement. If an agreement is not reached, the projects identified below shall be added to the regional project list and included as part of the Development Agreement, and the developer and the City shall agree on reasonable time frames for construction (for projects located within the City of Black Diamond and subject to Condition No. 10), or Applicant payment of its proportional costs toward construction of projects located outside of the City of Black Diamond.

Exhibit 6-1
Intersection Improvements

Study Intersection	Jurisdiction	Mitigation
SE 288th Street/216th Avenue SE	Black Diamond	Signalize. Add NBR turn pocket.
SE 288th Street/232nd Avenue SE	Black Diamond	Add NBR turn pocket and provide a refuge for NBL turning vehicles on EB approach.
SR 169/SE 288th Street	WSDOT	Signalize. Add NBL turn pocket. Add second SBT lane (SBTR).
SE Covington Sawyer Road/ 216th Avenue SE	Black Diamond	Add EBL, NBL and SBR turn pockets.
SE Auburn Black Diamond Road/ 218th Avenue SE	King County	Provide a refuge for NBL turning vehicles on EB approach.
SE Auburn Black Diamond Road/ Lake Sawyer Road SE	Black Diamond	Signalize. Add WBL turn pocket.
SE Auburn Black Diamond Road/ Morgan Street	Black Diamond	Roundabout.
SR 169/Roberts Drive	Black Diamond/WSDOT	Add second SBT and NBT lanes. Add SBL and NBL turn pockets.
SR 169/SE Black Diamond Ravensdale Road (Pipeline Road)	Black Diamond/WSDOT	Add second SBT and NBT lanes. Add SBL turn pocket.
SR 169/Baker Street	Black Diamond/WSDOT	Signalize.
SR 169/Lawson Road	Black Diamond/WSDOT	Signalize. Add SBL turn pocket.
SR 169/Jones Lake Road (SE Loop Connector)	Black Diamond/WSDOT	Signalize. Add WBL, NBL, and SBL turn pockets.
SR 169/SR 516	Maple Valley/WSDOT	Add second NBL turn pocket.
SR 169/SE 240th Street	Maple Valley/WSDOT	Add additional SBT lane on SR 169 from north of 231st Street to Witte Road. Add second NBT lane at SR
SR 169/Witte Road	Maple Valley/WSDOT	

SR 169/SE Wax Road	Maple Valley/WSDOT	169/240th Street.
SR 169/SE 231st Street	Maple Valley/WSDOT	
SR 169/SR 18 EB Ramps	Maple Valley/WSDOT	
SR 516/SE Wax Road	Covington/WSDOT	Add second SBL, WBR, and NBL turn pockets.
SR 516/168th Pl SE	Covington/WSDOT	Add NBL and EBR turn pockets.
SR 516/Covington Way SE	Covington/WSDOT	Optimize signal timings.
SE 272nd Street/160th Avenue SE	Covington/WSDOT	Signalize.
SE Kent Kangley Road/ Landsburg Road SE	Maple Valley/King County	Add SBL turn pocket and provide a refuge on WB approach for SBL turning vehicles.
SR 169/SE Green Valley Road	WSDOT	Signalize.
SE Auburn-Black Diamond Road/ SE Green Valley Road	King County	Provide a refuge on EB approach for NBL turning vehicles.
SR 169/North Connector	Black Diamond/WSDOT	Signalize. Add second SBT and NBT lane. Add EBL, EBR, SBR, and NBL turn pockets. End additional NBT lane 1,000 feet north of intersection.
Lake Sawyer Road/Pipeline Road	Black Diamond	Signalize. Add EBL, WBL, NBL, and SBR turn pockets.
SE Auburn Black Road/Annexation Road	Black Diamond	Signalize. Add EBL, EBR, WBL, NBL, and SBR turn pockets.
SR 169/South Connector	Black Diamond/WSDOT	Signalize. Add SBR and NBL turn pockets.

16. If (a) the City of Maple Valley does not appeal or challenge the MPD Approval for the Villages MPD, (b) the City of Maple Valley does not appeal or challenge the MPD Approval for the Lawson Hills MPD, (c) the City of Maple Valley does not appeal or challenge the Development Agreement for the Villages MPD, (d) the City of Maple Valley does not appeal or challenge the Development Agreement for the Lawson Hills MPD, the Applicant shall provide the following mitigation for the City of Maple Valley, which as to the identified mitigation supercedes the mitigation projects listed for the City of Maple Valley in Condition 15 above.

For purposes of this condition, the percentage of the mitigation project to be contributed by the Applicant to the City of Maple Valley is shown for each project. All references to percentages constitute the combined contribution share of the Villages and Lawson Hills projects.

Project A: Contribute 25.3 percent toward one additional southbound through lane on SR 169 from SE 231st Street to Witte Road. Add a second eastbound to southbound right-turn lane on SE Wax Road (double right turn lanes). Upgrade signal equipment to be able to run the eastbound right turn phase with northbound protected left turn phase at the same time.

Project B: Contribute 26.1 percent toward one additional southbound through lane on SR 169 from SE Wax Road through the intersection at SR 169/Witte Road SE. The curb lane will become a right turn lane. The southbound approach to this intersection will be one right turn lane and two through lanes.

Project C: Contribute 66.6 percent toward a second northbound to westbound left-turn lane (300 ft) on SR 169 and a second westbound to southbound left-turn lane (400 ft) on SE 240th Street. Widen SE 240th Street west of SR 169 to add a second westbound lane (500 ft).

Project E: Contribute 37.2 percent toward a second southbound lane on SR 169 from Witte Road SE to SE 244th Street and a second northbound lane on SR 169 from 1,000 feet south of SE 240th Street to Witte Road SE.

Project F: Contribute 63.2 percent toward installation of a traffic signal at the intersection of SR 169/SE 244th Street.

Project G: Contribute 50.8 percent toward a second southbound lane on SR 169 from SE 244th Street to SE 264th Street. Construct a second northbound lane on SR 169 from SE 264th Street to 1,000 feet north of SE 264th Street.

Project H: Contribute 59 percent toward a second southbound lane on SR 169 from south of SR 516 to SE 271st Street.

Project I: Contribute 54.6 percent toward a signal equipment upgrade at the intersections of SR 169/SE 264th Street, SR 169/SR516, and SR 169/SE 271st Street to be able to coordinate these three signals, and set the signal cycle length at 140 seconds.

Project J: Contribute 61.25 percent toward a second southbound lane on SR 169 from SE 271st Street to SE 280th Street and a second northbound lane on SR 169 from 1,000 feet south of SE 271st Street to SE 271st Street.

Project K: Contribute 58.4 percent toward a second southbound lane on SR 169 from SE 280th Street to Maple Valley's south City limit.

Project L: Contribute 6.8 percent toward a new three-lane road (one eastbound and two westbound lanes) on the SE 271st Street alignment between SR 169 and SR 516. Add a

second northbound to westbound left turn lane (200 ft) on SR 169 and a signal at SR 516/SE 271st intersection.

Project W: Contribute 29.9 percent toward widening SR 516 to 4/5 lanes from 216th Ave SE to the west City limits of Maple Valley. Add a second westbound lane on SR 516 to 1,000 feet east of 216th Ave SE.

Project X: Contribute 29.9 percent toward reconfiguration of the northbound approach to SR 516/216th Ave SE to include one left-turn lane and one left and right-turn share lane. Increase the left turn pocket length to 270 feet. Modify signal to accommodate eastbound right-turn phase overlapping with northbound phase.

Project Y: Contribute 13.5 percent toward a second westbound lane on SE 240th from 500 feet west of SR 169 (see Project C) to Witte Road if and when the City of Maple Valley obtains all the remaining funding necessary for completion of Project Y (except for the contribution of the Applicant).

Project Z: Contribute 13.5 percent toward a 2-to-3 lane extension of SE 240th Street between Wax Road and Witte Road if and when the City of Maple Valley obtains all the remaining funding necessary for completion of Project Z (except for the contribution of the Applicant).

17. a. At the point where building permits have been issued for 850 dwelling units at the Villages and Lawson Hills together, and again at such phase or interval determined by the City Council following completion of the review called for by this condition, the City shall validate and calibrate the new transportation demand model created pursuant to Condition 11 above for the then-existing traffic from the Villages and Lawson Hills together. The calibration may include an assumption for internal trip capture rates as set forth in Condition 14 above, rather than actual internal trip capture rates, if an insufficient amount of commercial development has been constructed at the time of the validation/calibration required herein. The City shall then run the model to estimate the trip distribution percentages that will result from the next upcoming phase or interval of MPD development, and to assign the estimated trips from that phase or interval to the intersections identified in Condition 11 above.

b. Using the trip distribution and trip assignment yielded by the transportation demand model validation and calibration required in subsection (a) above, the City shall conduct an intersection operations analysis of the transportation levels of service (LOS) for the intersections identified in Condition 11 above, and shall issue findings, conclusions and a recommendation as provided below. The intersection operations analysis shall determine whether then-existing, adopted PM peak hour intersection levels of service are met, and whether the then-existing, adopted PM peak hour intersection levels of service are projected to be met by the time of the next validation/calibration/operations analysis identified by the City Council pursuant to subsection (a) above. The intersection operations analysis for existing conditions must take into account the then-existing peak hour factor; the analysis for the next identified phase or interval of development must be based on a reasonable assumption (justified by reasonable traffic engineering practice) as to the future peak hour

factor, and contain a sensitivity analysis to identify the effect of such peak hour factor assumption. If the findings and conclusions determine that the then-existing, adopted PM peak hour LOS will not be met, they shall also determine whether the projects set forth in Conditions 15 and 16 above adequately mitigate the impacts resulting from the failure to meet the adopted LOS. If the findings and conclusions determine that failure to meet adopted transportation LOS will not be adequately mitigated, they shall also recommend such additional measures necessary to adequately mitigate the impacts reasonably attributable to the MPD projects' failure to meet the adopted LOS.

c. The review identified in subsections (a) and (b) above, may be performed concurrent with a preliminary plat application held on either the Villages or Lawson Hills implementing plat, and the City review may incorporate relevant portions of any SEPA documents prepared for the implementing plat which analyze cumulative MPD impacts.

d. When the review thresholds identified in subparagraph a above have been reached, the City shall issue written notice to the Master Developer(s) to each submit within 90 days review documentation summarizing their respective project impacts and compliance with mitigations and conditions to date, as well as any additional information the City deems necessary to perform the transportation demand model validation/calibration and/or intersection operations analysis. In addition, the Master Developer(s) shall each pay a proportionate share of the validation/calibration/operations analysis costs incurred by the City. If a Master Developer fails to submit satisfactory periodic review documentation regarding its project within the 90-day period after notice has been issued as required herein, further permits shall not be approved for that MPD until the required documentation has been submitted.

e. Not later than 90 days following the City's completion of the validation/calibration/operations analysis, the City Director of Community Development shall consult with other affected jurisdictions as to the review analysis results, obtain any input such jurisdictions wish to provide, issue the City's proposed findings, conclusions and recommendation, and at the close of the 90-day period, the City shall meet with the Master Developer(s) to review the proposed findings, conclusions and recommendation and identify what improvements the Master Developer(s) plans to construct. Within 14 days of the City meeting with the Master Developer(s), the City shall finalize its findings, conclusions and recommendation and shall provide mailed notice to all Parties of Record on the Villages MPD and/or the Lawson Hills MPD that the review has been issued.

f. The City's demand model validation and calibration called for by subsection (a) above, and the intersection operations analysis called for by subsection (b) above, (the "periodic review analysis") shall result in written findings and conclusions plus a recommendation for new future permit conditions and mitigations for the Villages and/or Lawson Hills, as required. Proposed conditions and mitigations applicable to future permits and associated mitigation within either or both projects shall be revised if the City finds that the conditions or mitigation measures imposed pursuant to the City's standards in effect at the time of MPD approval have resulted in an unsatisfactory level of mitigation, either because the degree of mitigation is

inadequate or the quantity of impact demonstrated to be attributable to MPD development exceeds levels predicted. New permit conditions and mitigations imposed for cumulative impacts through the periodic review process shall comply with the following standards and limitations:

i. No new standards or requirements shall be imposed upon property in any plat recorded within 60 months of MPD approval to the extent that such standards or requirements would affect infrastructure serving said property also constructed within the 60-month timeframe.

ii. Performance standards more stringent than those contained in the original MPD permit shall not be imposed.

iii. No retrofitting or major modification shall be required for facilities properly installed in accordance with MPD permits unless such is determined necessary to avoid a threat to public health or safety or a new significant adverse environmental impact, and such impact or threat cannot be mitigated by requirements imposed upon or downsizing of MPD development yet to be constructed.

iv. New conditions and mitigations shall be limited to those shown to be necessary as a direct result of the MPD development, and such mitigation must be reasonable and achievable without compromising other MPD permit requirements.

v. Conditions and mitigations applicable to a MPD shall be modified only to the extent that cumulative impacts are demonstrated to be the result of development of such project. If cumulative impacts have been demonstrated to exist but cannot be attributed solely to the MPDs, or allocated between the two MPDs, responsibility for mitigation shall be apportioned equitably in a proportionate or pro-rata share. For purposes of this condition, "proportionate share" shall mean the ratio of the combined Villages and Lawson Hills MPD project PM peak hour trips projected to use the intersection compared to the total number of PM peak hour trips expected to use the intersection. Any mitigations or conditions imposed shall specify clearly which project and which portion thereof to which they apply.

g. The Villages Master Developer, the Lawson Hills Master Developer, or any other party of record may appeal the periodic review analysis within 21 days of the date of its issuance by filing an appeal statement with the Community Development Director, plus a fee in the amount then applicable to an administrative appeal of a SEPA threshold determination. The appeal statement shall specify in detail the errors alleged to exist in the periodic review analysis and any appeal proceedings shall be limited to analysis of such allegations.

h. If one or more timely appeals are filed of the City's periodic review analysis, they shall be heard and decided by the Hearing Examiner within 90 days of the date the appeal is filed. The hearing shall be limited to the issues included within the written appeal statement. Participation in the appeal shall be strictly limited to the City, the Applicant and parties who timely filed complete written appeal statements and paid the appeal fee. The

appellant shall bear the burden of proof in the appeal. The periodic review analysis shall be upheld on appeal unless found to be clearly erroneous based on the record as a whole.

i. The Hearing Examiner's decision on the periodic review analysis shall be a final decision appealable under the Land Use Petition Act, Chapter 36.70C RCW.

j. If no timely appeal of the periodic review analysis is received, its findings, conclusions, and recommendation shall become final and non-appealable 21 days after issuance. If an appeal is filed, the time required for determination of such appeal shall be excluded from the approval period for any MPD permit and preliminary plat in effect on the date of issuance of the periodic review analysis.

18. The responsibilities and pro-rata shares of the cumulative transportation mitigation projects shall be established in the two Development Agreements, which must cover the complete mitigation list and be consistent with one another. (Traffic impacts were studied based on the cumulative impacts of The Villages and the Lawson Hills MPDs. These various projects have a mutual benefit and need crossing over between them.)

19. For each potential signal, first consider and present a conceptual design for a roundabout as the City's preferred method of intersection control. [FEIS Mitigation Measure]

20. A transportation monitoring plan shall be established as part of the Development Agreement using the projects identified in the list included in Condition 15 (and as that list is modified as a result of the periodic review process), and including trigger mechanisms acceptable to the City. The monitoring plan shall ensure that construction of improvements commences before the impacted street or intersection falls below the applicable level of service, provided that for projects within the State right-of-way, the monitoring plan shall establish timing for commencement of only engineering and design of improvement and shall not including deadlines for commencement of construction.

21. Implementing projects shall be designed to foster the development of a street grid system throughout the project.

22. In order to balance the impact of the added street maintenance and the proposed street standards with higher maintenance costs, all auto courts serving 20 units or less, and all alleys shall be private and maintained by the Applicant or future Homeowners' Association(s). The Development Agreement shall provide that, in the event that the Applicant or future Homeowners' Association(s) fails to maintain such auto courts and/or alleys, the City may enter onto the property, repair or maintain the alleys or autocourts as the City determines in its reasonable discretion is necessary, and collect the costs of such repair or maintenance from the Applicant or Homeowners' Association(s), as applicable. The Development Agreement shall also provide that, to secure repayment, the City may lien the individual lots within the subdivision in which the alley or autocourt is located.

23. The applicant or future Homeowners' Association(s) shall be required to maintain all street side landscaping, unless otherwise agreed upon by the City, and the Applicant or future Homeowners' Association(s). The Development Agreement shall provide that, in the event that

the Applicant or future Homeowners' Association(s) fails to maintain such street-side landscaping, the City may enter onto the property, repair or maintain the landscaping as the City determines in its reasonable discretion is necessary, and collect the costs of such maintenance from the Applicant or Homeowners' Association(s), as applicable. The Development Agreement shall also provide that, to secure repayment, the City may lien the individual lots within the subdivision in which the street-side landscaping is located.

24. Traffic calming measures shall be explored with each implementing development action and implemented at the discretion of the Public Works Director.

25. The monitoring plan required by these conditions shall require the applicant to model the traffic impacts of a development phase before submitting land use applications for that phase, in order to determine at what point a street or intersection is likely to drop below the City's adopted level of service. The monitoring plan shall provide for the timing of commencement of construction of projects identified in Condition 15, as well as the amendments to the scope of said projects and/or additions to Condition 15's project list as determined by the City in its reasonable discretion as necessary to maintain the City's adopted levels of service in effect at the time of the modeling, to the extent that project traffic would cause or contribute to any level of service failure as determined by the City's adopted level of service standard. In the event of a disagreement between the applicant and the City about the timing of construction of a transportation project under the monitoring plan, and if the monitoring plan does not already include period modeling, the applicant shall also monitor traffic levels midway through each phase to determine if the traffic generation, trip distribution and assignment patterns are developing as expected.

26. Reserve a site within the commercial area on either the north or south side of Auburn-Black Diamond Road for a future park and ride lot. [FEIS Mitigation Measure] The site shall be of sufficient size to accommodate parking for the number of vehicles identified in the mode-split analysis in the new transportation demand model as set forth in Condition No. 14 above.

27. No more than 150 residential units shall be permitted with a single point of access. 300 units may be allowed on an interim basis, provided that a secondary point of access is provided.

28. The Development Agreement shall define a development parcel(s) beyond which no further development will be allowed without complete construction of the South Connector.

29. Prior to the first implementing project of any one phase being approved, a more detailed implementation schedule of the regional infrastructure projects supporting that phase shall be submitted for approval. The timing of the projects should be tied to the number of residential units and/or square feet of commercial projects.

30. The applicant shall apply road design speed control and traffic calming measures so that inappropriate speeds are avoided on neighborhood streets.

31. The timing of the design and alignment of the Pipeline Road shall be included as part of the Development Agreement.

32. Provided a study confirms engineering feasibility and reasonable and customary construction costs, a connecting sidewalk and safe pedestrian connection to the programmed sidewalk in the Morganville area shall be required along Roberts Drive. Construction timing should be specified in the Development Agreement. The City and applicant shall work in good faith to seek grants and other funding mechanisms to construct the improvement. The applicant shall otherwise be responsible for construction costs to the extent authorized by law.

33. a. The City shall commission a study, at the Applicant's expense, on how to limit MPD traffic from using Green Valley Road, and which shall include an assessment of traffic calming devices within the existing improved right-of-way. The study shall also include an analysis and recommended mitigation ensuring safety and compatibility of the various uses of the road. All reasonable measures identified in the study shall be incorporated into the Development Agreement together with a description of the process and timing required for the Applicant to seek permits from King County should King County allow installation of the improvements, and with a proviso that none of the measures need to be implemented if not agreed to by the Green Valley Road Review committee.

b. A Green Valley Road Review Committee shall be formed. The committee shall consist of two representatives of the Applicant, one representative of the City, and two representatives of the community. If additional community members or representatives of King County desire to participate, they may do so, but only two community members shall have a vote on the committee regarding any matter. The Committee shall meet as needed, and specifically shall meet to review the study required by Condition 33(a) and attempt to reach agreement on whether any suggested traffic calming devices should be provided. If the community members of the Green Valley Road Review Committee decide against the traffic calming measures, then the Applicant need not construct them. The Committee shall also meet to review the plan to prohibit or discourage the use of Plass Road. The Applicant shall be responsible, at its expense, for drafting a report to the City Council regarding the Committee's findings on the traffic calming devices and on Plass Road.

34. a. The Development Agreement shall address which traffic projects will be built by the developer, which projects will be built by the City and what projects will qualify for cost recovery.

b. The Applicant agrees to work in good faith with the City, King County and residents on Plass Road to develop a plan to prohibit or discourage the use of Plass Road as a connection to Green Valley Road. The Applicant will agree to vacate a portion of Plass Road through the Villages property to assure no connectivity to the South Connector roadway towards Green Valley Road, provided the City, King County and Plass Road residents support the road vacation.

NOISE

35. Each implementing development shall include a plan for reducing short term construction noise by employing the best management practices such as minimizing construction noise with properly sized and maintained mufflers, engine intake silencers, engine enclosures, and turning off equipment when not in use. [FEIS Mitigation Measure]

36. Stationary construction equipment shall be located distant from sensitive receiving properties whenever possible. Where this is infeasible, or where noise impacts would still be likely to occur, portable noise barriers shall be placed around the equipment (pumps, compressors, welding machines, etc.) with the opening directed away from the sensitive receiving property. [FEIS Mitigation Measure]

37. Ensure that all equipment required to use backup alarms utilizes ambient-sensing alarms that broadcast a warning sound loud enough to be heard over background noise, but without having to use a preset, maximum volume. Alternatively, use broadband backup alarms instead of typical pure tone alarms. [FEIS Mitigation Measure]

38. Require operators to lift, rather than drag materials wherever feasible. [FEIS Mitigation Measure]

39. Substitute hydraulic or electric models for impact tools such as jackhammers, rock drills and pavement breakers, wherever feasible. [FEIS Mitigation Measure]

40. Electric pumps shall be specified whenever pumps are required. [FEIS Mitigation Measure]

41. The developer shall establish a noise control "hotline" to allow neighbors affected by noise to contact the City and the construction contractor to ask questions or to complain about violations of the noise reduction program. The noise reduction program is established by conditions 35 through 40 and 42-43. Whether the noise reduction program has been violated shall be determined by the City in its reasonable discretion. Failure to comply with the noise reduction program shall result first in a warning and one or more continuing failures may result in cessation of construction activities until the developer provides an acceptable solution to the City that will reasonably achieve the intent of the noise reduction program and allow construction to continue. Nothing in this condition shall be construed as limiting or altering the City's authority to enforce its noise regulations.

42. If pile driving becomes necessary, impact pile-driving shall be minimized in favor of less noisy pile installation methods. If impact pile driving is required, the potential for noise impacts shall be minimized by strict adherence to daytime only. [FEIS Mitigation Measure]

43. Work hours of operation shall be established and made part of the Development Agreement

44. To provide construction noise attenuation for existing residents adjoining the Villages development, the following condition shall apply to Villages development parcels V1, V2, V10, V13, V15, V20, V49, V57, V60, and V71. For each of the designated parcels, the Applicant shall:

a. offer to meet with the affected existing resident(s) to seek a mutual agreement about mitigation to be provided, or if mutual agreement cannot be reached, then,

b. the Applicant shall have the choice to provide either:

i. mitigation consisting of a buffer, trail easement or other separator between the edge of the development parcel and the property boundary that is 100-feet wide, provided that trails, recreational facilities, stormwater facilities and similar uses otherwise permitted for the MPD are allowed inside the 100-foot area, or

ii. mitigation consisting of all of the following:

(A) a construction noise attenuation barrier (i.e., a berm, wall, or combination of the two) on the development parcel, provided that if a buffer or trail easement less than 100-feet wide adjoins the development parcel, the barrier may be placed within that area;

(B) design, sizing and placement of the noise attenuation barrier in a manner intended to reduce noise from long-term construction activities (i.e., activities lasting 6 months or longer, such as construction hauling and including the loading/unloading of dump trucks);

(C) payment to the City for its costs in commissioning a study to evaluate the noise barrier design and placement shall be prepared by the Applicant, at its expense, and submitted for review and approval by the City;

(D) the noise study shall evaluate whether noise from long-term construction activities will comply with the environmental noise limits in WAC 173-060-040, and if the noise study concludes that an on-site noise barrier cannot effectively control long-term construction noise to the degree that it complies with the WAC noise limits outside the adjoining existing homes, additional mitigation measures intended to reduce interior sound levels will be evaluated,

(E) any additional noise mitigation measures determined to be effective at reducing interior sound levels (i.e., providing a reduction of exterior-to-interior noise transmission at least 7 dBA more than provided by the existing building envelope) shall be implemented so long as the adjoining owner provides permission if the mitigation requires work on their property, and

(F) at the Applicant's discretion, the noise barrier may be temporary (i.e., removed after construction on one of the designated parcels is complete) or permanent.

Mitigation under section (b)(ii) shall be installed before construction activities begin on the designated development parcel. In the event that lands adjacent to any of the

designated development parcels are acquired by the developer of the MPD, this condition shall not apply as to the acquired lands.

45. A Noise Review committee shall be formed. The committee shall consist of two representatives of the Applicant, one representative of the City, and two representatives of the community. If additional community members desire to participate, they may do so, but only two members shall have a vote on the committee regarding the annual report. The Committee shall meet at least once a year, and no more than six times per year. The Noise Review committee shall review and evaluate compliance with the noise conditions imposed upon the Villages MPD. The Committee shall endeavor to reach mutual agreement (i.e., a 5-0 vote) on the contents of an annual report to be filed with the City Council. The Applicant shall be responsible, at its expense, for drafting the annual report. The annual report will summarize the Committee's findings regarding compliance, and shall include recommendations, if any, for improved performance. If the Committee is unable to reach mutual agreement, then the Applicant shall prepare the annual report summarizing the matters for which agreement is reached, as well as the matters still under debate, and shall allow the other members of the community to provide comments on the report prior to submittal to the City Council. The City Council shall review the report and respond as appropriate under applicable City Codes, or the provisions of the Development Agreement.

PUBLIC UTILITIES – WATER

46. Comply with the terms of the Water Services Future Funding Agreement (WSFFA).

47. Utilize the Tacoma Intertie, in addition to the Spring Supply per the WSFFA. [FEIS Mitigation Measure]

48. Construct an appropriately sized reservoir in 850 Zone or construct an 850 Zone loop back to the existing system in the vicinity of Railroad Avenue. [FEIS Mitigation Measure]

49. Construct a 750 Zone loop back to the existing system, or propose a functionally equivalent alternative as allowed in the MPD code. [FEIS Mitigation Measure]

50. Complete the 850 loop in the North Property and the 850 loop in Pipeline Road with a pressure reducing station to the 750 Zone water main within the North Property. [FEIS Mitigation Measure]

51. Construct needed water supply and storage improvements in accordance with the City's Comprehensive Plan and necessary to serve the proposed development. Alternatively, a functionally equivalent improvement to the facilities above may be approved by City staff within the MPD. [FEIS Mitigation Measure]

52. Should new water distribution alternatives be desired by the applicant that are not consistent with the recently adopted Water Comprehensive Plan, the applicant shall be responsible for the cost of updating the Plan if needed.

53. The Water Conservation Plan included in the Chapter 8 of the MPD Application is approved. The Development Agreement shall include details about the responsibility for water conservation, the basis and methods for measuring conservation savings, and the impacts if the required savings targets of 10% less than the average water use in the City by residential uses at the time the MPD was submitted are not achieved.

54. The proposed water conservation plan shall be evaluated for its effectiveness in light of the City's available water resources after the first 500 units have been constructed. At that time, additional measures may be required if goals are not being achieved.

PUBLIC UTILITIES – SEWER

55. King County will be constructing a sewer flow equalization storage reservoir in a location to serve the needs of the City. [FEIS Mitigation Measure]

56. Construct trunk lines Nos. 1 and 4. [FEIS Mitigation Measure]

57. Construct pump station 1 and force main 1 to equalization tank. [FEIS Mitigation Measure]

58. Collection of sewage shall occur as presented in City's Comprehensive Plan, consistent with King County sewage storage site selection, and as necessary to serve the proposed development. Alternatively, a functionally equivalent improvement to the facilities above may be approved in the future if determined appropriate by City staff and consistent with King County's sewage storage site selection process. [FEIS Mitigation Measure]

59. An interim sewer pump station is accepted, provided that:

- a. Routing of the gravity sewer mains is consistent with the City's ultimate plan for routing sewage.
- b. No capital facility charge credit will be considered for interim improvements.

PUBLIC UTILITIES – STORMWATER AND WATER QUALITY

60. Stormwater runoff that is collected from impervious surfaces shall be mitigated in accordance with the *2005 Stormwater Management Manual for Western Washington*, and stormwater designs shall include low impact development techniques wherever practical and feasible. [FEIS Mitigation Measure]. Homeowner associations should bear the cost of landscape maintenance associated with the low impact development techniques.

61. Preserve the volume of stormwater for the groundwater area tributary to Black Diamond Lake and associated wetlands. [FEIS Mitigation Measure]

62. Implement the stormwater program described in Appendix D to The Villages FEIS in order to match total runoff volume discharges via surface and subsurface conveyance routes to Horseshoe Lake. [FEIS Mitigation Measure]

63. Provide mitigation facilities within the project limits, expansion parcels or provide an agreement with King County for long term City ownership and/or maintenance of off-site facilities not within City limits. [FEIS Mitigation Measure]

64. Native plants shall be primarily used as part of the planting palette within the MPD. Lawn planting shall be reduced wherever practical. [FEIS Mitigation Measure]

65. Where point discharges to streams must occur, design the outfall to minimize impacts to the stream channel and avoid areas of significant vegetation. [FEIS Mitigation Measure]

66. Construct stormwater treatment and storage improvements as presented in City's Comprehensive Plan and as necessary to serve the proposed development. Alternatively, a functionally equivalent improvement to the facilities above may be approved with the MPD. [FEIS Mitigation Measure]

67. Mechanisms shall be identified to integrate Low Impact Development technologies into the overall design of the MPD and incorporated into the Development Agreement. Future Homeowners' Associations shall bear any increased cost of landscape maintenance.

68. The Development Agreement shall include restrictions on roof types (no galvanized, copper, etc.) and roof treatments (no chemical moss killers, etc) to ensure that stormwater discharged from roof downspouts is suitable for direct entry into wetlands and streams without treatment. This condition does not constitute approval for direct discharge of roof drainage into wetlands, streams or their buffers; any such direct discharge is authorized only if approved by the Public Works Director as in compliance with Black Diamond Municipal Code Ch. 14.04 and the standards adopted therein. The applicant shall develop related public education materials that will be readily available to all homeowners and implement a process that can be enforced by future homeowners associations.

69. Stormwater facilities to be considered as part of required open space shall be designed as an amenity per the Public Works and Natural Resources Directors. Factors to be considered by the Directors in determining whether the facilities are designed as an amenity include, but shall not be limited to, whether the facilities are safe for general public access (*i.e.*, do not have steeply sloped banks requiring fencing), are suitable for active recreational use during at least 3 months per year, are suitable for passive recreational use such as walking, hiking, or bird or other wildlife viewing, and/or provide wildlife habitat. If approved, future Homeowners Association(s) shall be required to provide landscape maintenance of these facilities, unless otherwise agreed upon by the City, and the Applicant or future Homeowners' Association(s).

70. The Development Agreement shall include language that binds future developers and contractors to a requirement to comply with any NPDES permits issued by the Washington State Department of Ecology and acknowledge that although permit conditions imposed by NPDES

permits are not administered by the City, staff reserves the right to enforce the conditions of the NPDES permit. Since the city has a high interest in protecting receiving waters under the city storm water permit, the developer shall fund necessary costs for training related to inspection services.

71. Develop a proactive temporary erosion and sediment control plan to prevent erosion and sediment transport and provide a response plan to protect receiving waters during the construction phase.

72. Construct a storm water system that does not burden the city with excessive maintenance costs; assist the city with maintenance of landscape features in storm water facilities. The City shall have the right to reject higher cost of maintenance facilities when lower cost options may be available.

73. Include a tabular list of stormwater monitoring requirements. The list should include the term of the monitoring, the allowable deviation from design objectives or standards, and the action items necessary as a result of excess deviations.

74. The stormwater plan shall include the ability to adaptively manage detention and discharge rates and redirect stormwater overflows when environmental advantages become apparent.

75. The size of storm ponds for hydraulic purposes shall vest on a phase by phase basis to the extent allowed by the City's DOE discharge permit and state law.

76. In the event that new phosphorus treatment technology is discovered and is either certified by the State Department of Ecology as authorized for use in meeting requirements of the Stormwater Management Manual for Western Washington, or is in use such that it is considered by the stormwater engineering community as constituting part of the set of measures described as "All known available, and reasonable methods of prevention, control, and treatment" ("AKART") as defined in WAC 173-201A-020, then the Applicant shall incorporate that new phosphorus treatment technology in all new ponds and facilities applied for as part of an implementing project, such as a preliminary plat, even if the Applicant's ponds and facilities would otherwise be vested to a lower standard.

77. The Development Agreement shall include language to allow deviations from the stormwater facilities listed in the FEIS when justified by a technical analysis and risk assessment.

78. The applicant shall obtain all necessary permits from King County for both construction, including any necessary approval or agreement providing the City ability to perform maintenance of the large regional storm pond proposed to the west of the project. The Applicant shall submit engineering plans to the City for approval, which shall not be unreasonably withheld or delayed, prior to submitting such plans to the County.

79. The City shall determine whether the Applicant's reasonable proportionate share participation in any watershed-wide implementation measures identified in Exhibit H-9 would be of significant benefit in protecting Lake Sawyer water quality. If so, those measures shall be incorporated into the Development Agreement. The Development Agreement shall also integrate the phosphorous monitoring plan proposed by the Applicant in Ex. NR-TV-7 as well as a temperature monitoring plan identical to the plan proposed for the Lawson Hills project in Exhibit NR-LH-5.

80. Runoff from basins tributary to Lake Sawyer shall provide water quality treatment in accordance with the phosphorous control menu in the 2005 Stormwater Management Manual for Western Washington. [FEIS Mitigation Measure]

81. Prior to approval of the Development Agreement, the Applicant shall identify to the City the estimated maximum annual volume of total phosphorus (Tp) that will be discharged in runoff from the MPD site and that will comply with the TMDL established by the State Department of Ecology for Lake Sawyer. If monitoring conducted pursuant to the phosphorus monitoring plan proposed by the Applicant in Ex. NR-TV-7 and integrated into the Development Agreement pursuant to Condition No. 78 above indicates that the MPD site is discharging more than the identified annual maximum volume of Tp, the Master Developer shall modify existing practices or facilities, modify the design any proposed new stormwater treatment facilities, and/or implement a project within the Lake Sawyer basin that collectively provide an offsetting reduction in Tp so as to bring the discharge below the annual maximum identified pursuant to this Condition.

82. Enhanced water quality treatment shall be provided as required by the 2005 Stormwater Management Manual for Western Washington. [FEIS Mitigation Measure]

83. When the Applicant builds improvements to existing public road right-of-way inside the City of Black Diamond and which road right-of-way drains to Lake Sawyer, the Applicant is required to treat the stormwater from those improvements to the then current and applicable phosphorus treatment standard, and the Applicant shall also treat the existing stormwater that runs off the existing right-of-way in the immediate vicinity of the improvement.

84. The Applicant agrees to work cooperatively with the City to identify opportunities where the City can reduce phosphorus sources or improve phosphorus treatment on existing City lands and for existing City owned or maintained stormwater facilities.

85. A Water Quality Review committee shall be formed. The committee shall consist of two representatives of the Applicant, one representative of the City, and two representatives of the community. If additional community members desire to participate, they may do so, but only two members shall have a vote on the committee regarding the annual report. The Committee shall meet at least once a year, and no more than six times per year. The Water Quality Review committee shall review and evaluate compliance with the stormwater conditions imposed upon the Villages MPD. The Committee shall endeavor to reach mutual agreement (i.e., a 5-0 vote) on the contents of an annual report to be filed with the City Council. The Applicant shall be responsible, at its expense, for drafting the annual report. The annual report will summarize the

Committee's findings regarding compliance, and shall include recommendations, if any, for improved performance. If the Committee is unable to reach mutual agreement, then the Applicant shall prepare the annual report summarizing the matters for which agreement is reached, as well as the matters still under debate, and shall allow the other members of the community to provide comments on the report prior to submittal to the City Council. The City Council shall review the report and respond as appropriate under applicable City Codes, or the provisions of the Development Agreement.

VISUAL AND AESTHETICS

86. The Development Agreement shall include a narrative of the process and basis for selectively removing hazard trees within sensitive areas. The intent of this section will be to leave the majority of the sensitive areas as designated passive open space but to have it appear and function as native forest.

87. The Development Agreement shall define when and under what conditions a development parcel may be logged for timber revenue, how that parcel must be secured to minimize the impacts on the community and how long the parcel may remain undeveloped before it must be reforested.

PUBLIC SERVICES – PARKS AND RECREATION

88. If a school site is developed and the proponent proposes to build a joint-use facility, the proponent shall provide one or more youth/adult baseball/softball fields, soccer fields, tennis courts, or basketball courts in conjunction with the school site(s) or at an alternative location. [FEIS Mitigation Measure]

89. The details of the park and recreation facilities to serve the new demand from the MPD shall be set in the required Development Agreement, including whether such facilities may be constructed on- or off-site. [FEIS Mitigation Measure]

90. The cost of such facilities, including a proportionate share of facilities not fully warranted by the MPD build out, could be provided by payment of fees. [FEIS Mitigation Measure]

91. As part of the Development Agreement, the fee-in-lieu values for park facilities shall be re-evaluated to ensure appropriate levels of funding and to include a mechanism to account for inflationary rises in construction costs and potentially, the costs of maintaining these types of facilities in the future. The City shall maintain discretion concerning when and if a lump sum payment will be accepted in lieu of constructing off-site recreational facilities

92. The details regarding the timing of construction and optional off-site construction or payment of fee in lieu of construction included in Table 5.2 of the MPD application (Recreation Facilities) shall be specified in the Development Agreement.

93. Dependant on the availability of land, the adequacy of funds to construct City-approved recreational facilities and an ability to maintain these facilities, the City shall retain the sole discretion to determine when and if the applicant will be allowed to provide a lump sum payment in lieu of constructing off-site recreational facilities. This condition may be further defined within the Development Agreement.

94. The Development Agreement shall include language authorizing public access to parks and trails facilities.

95. As proposed in the Master Plan Application, on-site trails (i.e. on the site of the implementing project) shall be constructed or bonded prior to occupancy, final site plan or final plat approval, whichever occurs first. Off-site trail connections shall meet the same standard to the extent authorized by law.

96. Parks within each phase of development shall be constructed or bonded prior to occupancy, final site plan or final plat approval of any portion of the phase, whichever occurs first, to the extent necessary to meet park level of service standards for the implementing project.

97. The Development Agreement shall include a tabular list of the characteristics of passive open space and active open space and permitted activities thereon so that future land use applications can accurately track the type and character of open space that is provided.

PUBLIC SERVICES – SCHOOLS

98. The Applicant shall enter into a separate school mitigation agreement, with substantially the same key terms as the agreement in the record as Exhibit 6, so long as such agreement is approved by the City and the Enumclaw School District which approval provides adequate mitigation of impacts to school facilities. If approved, such agreement shall be incorporated into the Development Agreement by reference. Alternatively, school mitigation may be addressed in the Development Agreement, using terms similar to those contained in Exhibit 6, or through a combination of (1) school impact fees under a City-wide school impact fee program for new development or a voluntary mitigation fees agreement and (2) the dedication of land for school facilities (subject to credit under State impact fee laws). The agreed number of school sites and associated minimum acreage, both as set forth in Exhibit 6, shall be used to guide any school mitigation alternative. To the extent reasonable and practical, elementary schools shall be located within a half-mile walk of residential areas. All school sites shall be located either within the MPDs or within one mile of the MPDs.

99. An updated fiscal analysis shall be required for any proposal to locate a high school within any lands designated on Figure 3-1 (Land Use Plan) for commercial/office/retail use.

PUBLIC SERVICES – PUBLIC SAFETY

100. The Development Agreement shall include specific provisions for providing fire mitigation to ensure protection concurrent with project build out. Fire mitigation may include

fire impact fees under a City-wide fire impact fee program for new development, a voluntary fire mitigation agreement, and/or the dedication of land for fire facilities (subject to credit under State impact fee laws).

101. All Fire Department access roads must meet International Fire Code, specifically Section 503 Fire Department Access Roads and Appendix D Fire Department Access Roads, except to the extent modifications or exceptions are approved by the designated official as authorized by applicable regulations

102. Auto courts shall meet the requirements of the International Fire Code 2006 ed. Per IFC Section 503, specifically 503.2.1, except to the extent modifications or exceptions are approved by the designated official as authorized by applicable regulations.

103. Separation of combustible structures and vegetation shall be provided to prevent wildland fires from the east and south from spreading to buildings. This shall be determined at the time of implementing projects.

EROSION HAZARDS

104. Major earth moving and grading may be limited to the “dry season,” between April and September, to avoid water quality impacts from erosion due to wet soils. Construction during the “wet season” may occur as allowed by the Engineering Design and Construction Standards Section 2.2.05. [FEIS Mitigation Measure]

105. In cases where vegetation is an effective means of stabilizing stream banks, stream banks shall be protected from disturbance to reduce the adverse impacts to stream erosion. [FEIS Mitigation Measure]

106. Bridges or appropriately sized box culverts shall be used for roadway crossings of streams to allow peak flow high-water events to pass unimpeded and to preserve some normal stream processes. [FEIS Mitigation Measure]

107. Design stormwater facilities to avoid discharging concentrated stormwater flows on moderate and steep slopes in order to avoid severe land erosion. [FEIS Mitigation Measure]

108. Utilize stormwater detention facilities that avoid increases in peak stream flows. [FEIS Mitigation Measure]

109. The Applicant shall submit a Temporary Erosion and Sedimentation Control (TESC) plan meeting City standards that will mitigate the potential for construction run-off from the site prior to grading or land clearing activities. The best management practices in the TESC plan shall include standby storage of emergency erosion and sediment control materials; a limit to the amount of property that may be disturbed in the winter months; and guaranteed time frames for the establishment of wet weather erosion and site protection measures.

110. Prior to approval of the first implementing plat or site development permit within a phase, the applicant shall submit an overall grading plan that will balance the cut or fill so that the amount of cut or fill does not exceed the other by more than 20%.

LANDSLIDE HAZARDS

111. Development of landslide hazard areas shall be avoided. Sufficient setbacks shall be required to assure or increase the safety of nearby uses, or where feasible grade out the landslide hazard area to eliminate the hazard in compliance with the city's Sensitive Areas Ordinance BDMC 19.10. [FEIS Mitigation Measure]

112. Stormwater and groundwater shall be managed to avoid increases in overland flow or infiltration in areas of potential slope failure to avoid water-induced landslides. [FEIS Mitigation Measure]

113. Geologically hazardous areas shall be designated as open space and roads and utilities routed to avoid such areas. Where avoidance is impossible, utilize the process in the Sensitive Areas Ordinance (supplied with adequate information as defined in code) and Engineering Design and Construction Standards (ED&CS) to build roads and utilities through these areas.

MINE HAZARDS

114. Development within the moderate mine hazard area may require additional mitigation measures, which shall be evaluated with future implementing development proposals.

115. All proposed development within mine hazard areas shall occur in conformance with BDMC 19.10.

116. All houses that are sold in classified or declassified coal mine hazard areas shall require a liability release from the homeowner to the City. The release must recognize that the City is not liable for actual or perceived damage or impact from the coal mine hazard area. The release form shall be developed and included in the Development Agreement.

VEGETATION AND WETLANDS

117. Structural measures such as silt fences and temporary sediment ponds shall be used to avoid discharging sediment into wetlands and other critical areas. [FEIS Mitigation Measure]

118. Implementing projects shall provide "on the ground" protection measures such as wetland buffers or root protection zones for significant trees. [FEIS Mitigation Measure]

119. New stormwater outfalls shall be located to avoid impacts to any stream and adjacent wetlands, riparian buffers, unstable slopes, significant trees, and instream habitat. Where all

practical and feasible avoidance measures have been employed, provide mitigation in the form of outfall energy dissipaters and/or vegetation restoration and slope stabilization as necessary. [FEIS Mitigation Measure]

120. A tree inventory shall be required prior to the development of implementing projects so that other opportunities to preserve trees may be realized.

121. The Development Agreement shall include text that defines when and under what conditions a parcel may be logged for timber revenue, how that parcel must be secured to minimize the impacts on the community and how long the parcel may remain un-worked before it must be reforested.

122. The use of native vegetation in street landscaping and in parks shall be required.

FISH AND WILDLIFE

123. Wildlife forage preferences shall be of primary consideration in plant species selection for enhancement areas. [FEIS Mitigation Measure]

124. Mast-producing species (such as hazelnut) and such other native, preferred vegetation as may be specified by the Development Agreement shall be used to mitigate for reduced food sources resulting from habitat reductions when designing landscape plans for development parcels adjoining wetland buffers, or for wetland buffer enhancement plantings. [FEIS Mitigation Measure] The Development Agreement shall specify a process by which such landscape plans are to be reviewed and approved by the Director of Natural Resources and Parks for compliance with the mitigation requirement herein.

125. Provide a 300-foot-wide wildlife corridor from the western edge of the Core Complex to the City's western boundary. The corridor should be located within areas of contiguous open space that form a network. [FEIS Mitigation Measure]

CLIMATE CHANGE

126. Building design guidelines shall allow the use of solar, wind, and other renewable sources. [FEIS Mitigation Measure]

127. Should a large employer (100+ employees) or a group of similar employers locate in the commercial areas of the MPD, a Transportation Management Association shall be implemented to reduce vehicle trips. [FEIS Mitigation Measure]

LAND USE

128. Approval of the design concept and land use plan (Chapter 3) shall be limited to the Land Use plan map (Figure 3-1, as updated July 8, 2010); description of categories (beginning

on page 3-18); a maximum of 4,800 total residential units and 775,000 square feet of commercial space; and target densities (Table 3.2), except as modified herein. Corner store-style neighborhood commercial uses within residential land use categories shall be defined in the Development Agreement and shall only be allowed through minor amendment of the MPD. All other specifics shall be resolved through the Development Agreement process.

129. The project shall provide a mix of housing types in conformance with the MPD Design Guidelines. The Development agreement shall set targets for various types of housing for each phase of development.

130. Identification of specific areas where live/work units can be permitted shall be done as part of the Development Agreement or through an MPD minor amendment.

131. A minimum density of 4 du/per net acre for residential development shall be required for implementing projects, and shall be calculated for each development parcel using the boundaries of that parcel (or the portion thereof to be developed) as shown on the Land Use plan map (Figure 3-1, as updated July 8, 2010).

132. If the applicant requests to increase a residential category that abuts the perimeter of the MPD, it shall be processed as a Major Amendment to the MPD. Residential land use categories can otherwise be adjusted one category up or down through an administrative approval process provided they also otherwise meet the requirements for minor amendments outlined in BDMC 18.98.100.

133. The Development Agreement shall limit the frequency of proposed reclassification of development parcels to no more frequently than once per calendar year.

134. The Expansion Area process shall be clarified in the Development Agreement.

135. Project specific design standards shall be incorporated into the Development Agreement. These design guidelines must comply with the Master Planned Development Framework Design Standards and Guidelines. All MPD construction shall comply with the Master Planned Development Framework Design Standards and Guidelines, whether or not required by the Development Agreement.

136. A unit split (percentages of single family and multifamily) and commercial use split (commercial, office and industrial) shall be incorporated into the Development Agreement.

137. All commercial/office uses (other than home occupations and identified live/work areas) shall only occur on lands so designated. Additional commercial areas shall be identified on the Land Use Plan through future amendment to the MPD.

138. The project shall include a mix of housing types that contribute to the affordable housing goals of the City. The Development Agreement shall provide for a phase-by-phase analysis of affordable housing Citywide to ensure that housing is being provided at affordable

prices. Specifications for affordable housing needs within the project shall be determined as a result of the phase-by-phase analysis.

139. Exact specifications for the housing described in paragraph 122 shall be included within the Development Agreement.

140. A distinct land use category shall be created to recognize potential light industrial uses or the “office” category shall be renamed to properly indicate the range of potential uses. Areas intended to have light industrial type uses shall be identified on the Land Use Map that is made part of the Development Agreement.

141. The high density residential (18-30 du/ac) supplemental design standards and guidelines (MPD application Appendix E) shall become part of the Development Agreement.

142. Detached single family dwelling units shall be alley loaded, except where site conditions prevent alley loading or cause alleys to be impractical as determined by the City, in its reasonable discretion.

143. Homeowners Association conditions, covenants and restrictions (CCRs) or the Architectural Review Committee shall review, but shall not preclude, the use of green technologies such as solar panels.

144. Front yard setbacks and other specific lot standards shall be determined as part of the Development Agreement.

145. A FAR standard shall be established through the Development Agreement process.

146. No more than two floors of residential uses above ground floor commercial/office uses shall be allowed.

147. The orientation of public building sites and parks shall preserve and enhance views of Mt. Rainier and other views identified in the comprehensive plan. There are tailing piles located on property near Parcel B. The Applicant is not responsible for removal of those tailing piles, but future site and building design for Parcel B should consider the nature of the views to Mt. Rainier that may be possible if those piles are later removed.

148. The Applicant’s requests for reduced parking standards in the Mixed Use Town Center as identified at p. 13-4 of the MPD application is granted. All other requests for deviation in the Chapter 13 of the MPD application are denied except for those deviations, mostly utility and street standards, that are identified in the recommendation as amenable to further review in the development agreement process. Any MPD deviations to the Sensitive Areas Ordinance are denied, because BDMC 18.98.155(A) provides that the Sensitive Areas Ordinance shall be the minimum standards for protection of sensitive areas within MPDs.

SENSITIVE AREAS/OPEN SPACE

149. The use of sensitive areas including but not limited to wetlands, landslide and mine hazard areas and their associated buffers for development including trails, stormwater management, etc. shall be regulated by BDMC Chapter 19.10. Appropriate mitigation, if required, for impacts as well as other required measures shall be evaluated on a case-by-case basis at the time of implementing project application.

150. Areas shown as natural open space in the figure on Page 5-7 of the application are required to remain natural with the possibility for vegetation enhancement. Modifications to these areas may be approved by the City in its reasonable discretion, on a case-by-case basis, only if necessary for construction of required infrastructure such as roads, trails or stormwater facilities. Any areas disturbed pursuant to such approval shall be replanted with native plants. Nothing in this condition shall allow grading or modifications in the sensitive areas and buffers, except as provided in the Sensitive Areas Ordinance.

151. The Development Agreement shall include a tabular list of the types of activities and the characteristics of passive open space and active open space so that future land applications can accurately track the type and character of open space that is provided.

152. The Development Agreement shall include language that specifically defines when the various components of permitting and construction must be approved, completed or terminated. For example; when must open space be dedicated, plats recorded, and utility improvements be accepted by the City.

153. Specific details on which open space shall be dedicated to the city, protected by conservation easements or protected and maintained by other mechanisms shall be established as part of the Development Agreement.

154. Once acreages have been finalized, phasing of open space (which includes parks and is identified within the MPD application) shall be defined and articulated for timing of final designation within the Development Agreement.

155. Once the mapped boundaries of sensitive areas have been agreed to, the Development Agreement shall include text that identifies that these areas are fixed. If during construction it is discovered that the actual boundary is smaller or larger than what was mapped, the mapped boundary shall prevail. The applicant shall neither benefit nor be penalized by errors or changes in the sensitive area boundaries as the projects are developed.

ADMINISTRATION

156. The proposed project shall have no adverse financial impact upon the city, as determined after each phase of development and at full build-out. The required fiscal analysis shall include the costs to the city for operating, maintaining and replacing public facilities required to be constructed as a condition of MPD approval or any implementing approvals related thereto. The fiscal analysis shall ensure that revenues from the project are sufficient to

maintain the project's proportionate share of adopted City staffing levels of service. The fiscal analysis shall be updated to show continued compliance with this criterion, in accordance with the following schedule:

- a. Within five years, a new fiscal analysis shall be completed to determine the long-term fiscal impact to the City. If necessary, additional project conditions may be required.
- b. Prior to commencing a new phase, including the first phase of construction.

The exact terms and process for performing the fiscal analysis and evaluating fiscal impacts shall be outlined in the Development Agreement, and shall include a specific "MPD Funding Agreement," which shall replace the existing City of Black Diamond Staff and Facilities Funding Agreement. The applicant shall be responsible for addressing any projected city fiscal shortfall that is identified in the fiscal projections required by this condition. This shall include provisions for interim funding of necessary service and maintenance costs (staff and equipment) between the time of individual project entitlements and off-setting tax revenues; provided, however, that in the event that the fiscal projection prepared prior to the commencement of Phase III indicates a likelihood of significant ongoing deficits in the city's general fund associated with operations or maintenance for properties within the MPD, the applicant must address the projected shortfalls by means other than interim funding..

157. The Applicant and other property owners may petition for the formation of a Community Facilities District to provide a mechanism for funding the costs of "facilities" as defined in Section 501 of SSB 6241. The City Council will review the petition as provided in SSB 6241 and, as set forth in Section 205, determine in its sole discretion whether the petitioners will benefit from the proposed district and whether the formation of a district will be in the best interest of the City and comply with the requirements of the Growth Management Act, Ch. 36.70A RCW.

The Development Agreement shall include language that specifically defines when the various components of permitting and construction must be approved, completed or terminated. For example: when must open space be dedicated, plats recorded, and utility improvements be accepted by the City.

158. The Development Agreement shall document a collaborative design/review/permitting process that allows City staff to participate in the conceptual stage of project planning in order to provide input on designs and choices that benefit the City as well as the applicant.

159. The Development Agreement shall specifically identify which rights and entitlements are vested with each level of permitting, including but not limited to the MPD Application approval, the Development Agreement approval, and Utility Permit approvals.

160. Reclassification of development parcels shall occur no more frequently than once per calendar year.

161. Proposed reclassification of development parcels located at the project perimeter to a higher density shall only occur through a Major Amendment to the MPD.

162. A process for including lands identified as “Expansion Areas” in the application shall be defined in the Development Agreement.

163. The Development Agreement shall define the proposed phasing plan for the various matters (utility and street infrastructure, parks, transferred development rights, etc.) subject to phasing standards.

164. Prior to the approval of the first implementing project of a defined phase, a detailed implementation schedule of the regional projects supporting that phase shall be submitted to the City for approval. The timing of the projects shall be tied to the number of residential units and/or square feet of commercial projects.

Appendix B

Level of Service Description



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.

Appendix C

Technical Memoranda



TECHNICAL MEMORANDUM

DATE: March 4, 2022
TO: Andy Williamson, City of Black Diamond
FROM: Jennifer John
SUBJECT: Task 40 – Build and Calibrate Model UPDATE
CC: Austin Fisher, PE
John Perlic, PE
PROJECT NUMBER: 214-3043-028
PROJECT NAME: Transportation Model Update

SUMMARY

This Technical Memorandum addresses Hearing Examiner conditions for The Villages and Lawson Hills MPDs.

- I. The accuracy of the PM peak hour forecasts have been verified through the demand model calibration and trip distribution verification process. Current volumes are generally lower than forecasted year 2025 volumes in the EIS's.
- II. Levels of PM peak hour traffic generated from the 2 MPD's has been verified through the demand model calibration and trip distribution verification process.
- III. Accuracy of regional trip distribution forecasts were also verified.
- IV. The identification of any intersections not meeting the applicable LOS standard is addressed through the phased development review process requiring updated traffic impact studies for approval of each phase.

As a result of our review, there is no reason to consider new permit requirements or conditions. Based on this evaluation, the EIS analysis for the Ten Trails (formerly The Villages) and Lawson Hills MPD's continues to provide a valid basis for determining future transportation impacts and mitigation.

The following summarizes the technical work tasks and information contained in the report.

TASK 3 – EXISTING TRAFFIC VOLUMES— Existing Counts section and Tables 2 and 3 (pp 5-9).

TASK 4 – BUILD AND CALIBRATE MODEL — Demand Model Calibration section (pp 9-10)

TASK 5 –TRIP DISTRIBUTION AND ASSIGNMENT EVALUATION — Trip Distribution and Assignment evaluation section (pp.10-14)

TASK 6 – DRAFT AND FINAL REPORTS — This document is the final report.

TASK 7 – PUBLIC HEARING/MEETING SUPPORT— Task is ongoing.

TRAVEL DEMAND MODEL

The starting point for demand modeling work in support of this model update for the City of Black Diamond is the Puget Sound Regional Council (PSRC) 4K Trip-Based Travel Demand Model developed for the current Regional Transportation Plan 2018 (RTP). This version of the model uses a base year of 2014 and includes horizon years to the year 2040. The Puget Sound Regional Council (PSRC) is currently updating the RTP to extend out to the year 2050 but that model was not available in for use in this work.

Highway Network

The base highway network used for this model is from the PSRC regional model which in addition to all existing and planned principal and minor arterials within Black Diamond, Covington, and Maple Valley as shown in Figure 1 includes extents that cover the required study boundaries south to the City of Enumclaw and west to SR 167 in Auburn. Because the regional model is being used, external trips to this area are captured as part of the regional modeling process.

The only planned connection included in the future model is a new east-west connection between 204th Avenue SE and 256th Street at SR 18. In addition to including all principal and minor arterials, additional detail was added within Black Diamond to reflect new arterials and collector roads that support the added development in the future-year networks. These additions include the North Connector, Pipeline Road, Lake Sawyer Connection, Annexation Road, South Connector, SE Loop Connector, and the Lawson Connector. A representation of the model network is shown below with these new roadways highlighted in Figure 2.

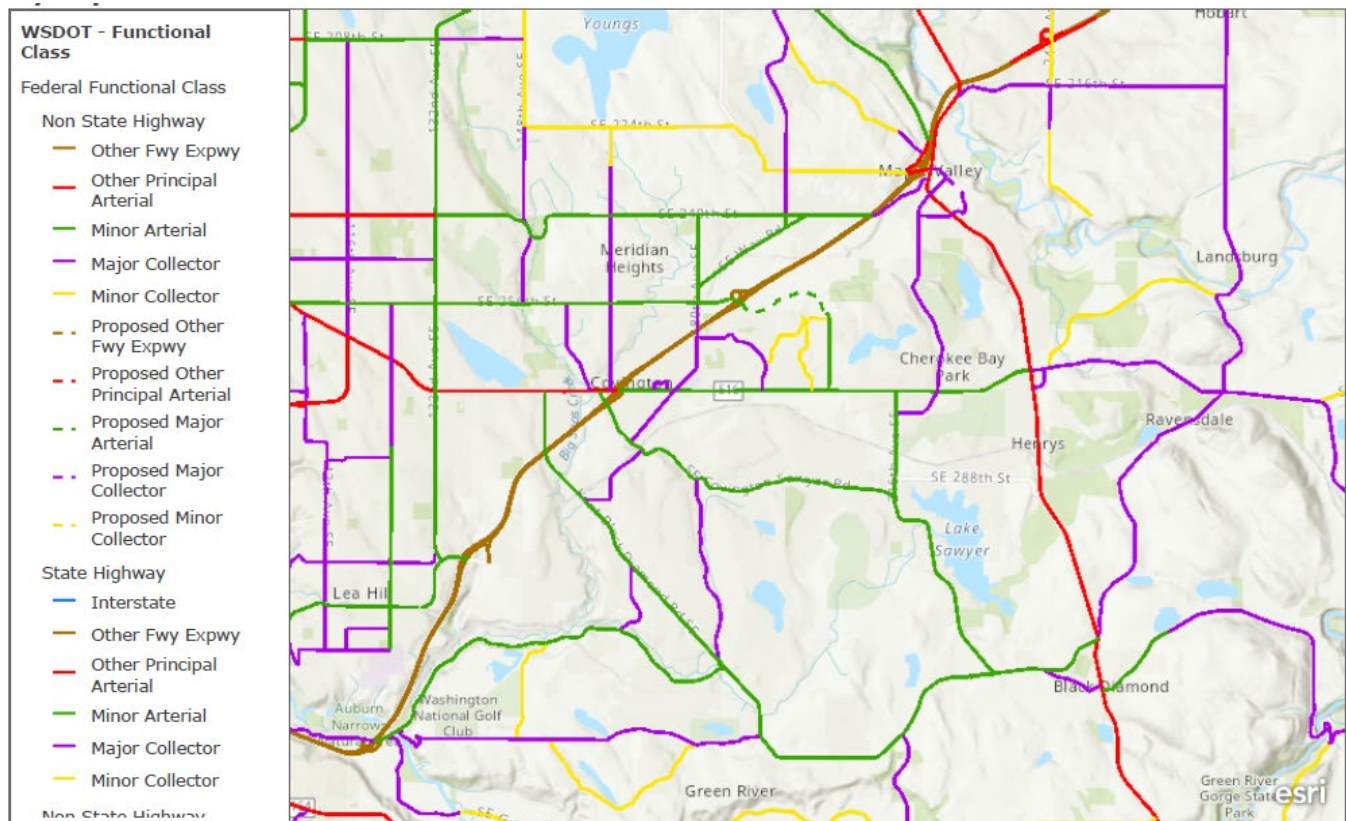


Figure 1. Functional Classification of Roads Included in Travel Demand Model



Figure 2. Planned New Roadways Included in the Travel Demand Model

To reflect additional detail in and around Black Diamond, several transportation analysis zones (TAZs) were split to better capture travel movements and land use information at a more precise level than the original TAZs in the model were able to do. Figure 3 shows the original and new TAZ structure. In total 19, TAZs were added to the Black Diamond area to better reflect development areas and loadings based on existing and planned land use.



Figure 3. Puget Sound Regional Council Transportation Analysis Zones and Splits in the Black Diamond Area

Land Use

The land use assumptions that were the starting point for this model development were from the PSRC Land Use Vision used in the RTP. The land use allocation by TAZ was reviewed with the City of Black Diamond and refined to account for both base year adjustments and planned growth related to the approved master plan developments (Lawson Hills and Ten Trails) that were not captured in the PSRC assumptions. In addition, because the PSRC land use totals were provided at the aggregate TAZ level, adjustments were made to allocate those totals down to the split TAZ level using development and zoning information available from the City. Table 1 shows the original and revised land use that was used in the modeling work for the area in and around Black Diamond. The land use is summarized by a larger area as shown above in Figure 3 as well as for the Master Development Plan area zones only.

Table 1. Land Use Assumptions

	PRSC Forecasts				PSRC Forecasts + MDP ¹			
	2014	2025	Growth	Percent Change	2014	2025	Growth	Percent Change
Larger Study Area								
Households	6,103	7,418	1,315	22%	6,917	8,825	1,908	28%
Employment	2,114	3,065	951	45%	2,449	4,173	1,724	70%
MDP Zones Only								
Households	524	549	25	5%	1,301	1,850	550	42%
Employment	121	150	29	24%	585	1,155	571	98%

¹ Assumes the following major development: Ten Trails Phase 1A & Phase 2, Ten Trails/Plat A (Phase 1B), Lawson Hills (Phase 2), Black Diamond Mixed Use, Black Diamond Retail South

MDP = Master Development Plan

EXISTING COUNTS

Existing traffic volumes for the study area were obtained from the City of Black Diamond, Covington, Maple Valley and the Washington State Department of Transportation (WSDOT). Turn movement counts for the PM peak period were collected in November 2019 at 14 locations in the City of Black Diamond and at 3 locations in Maple Valley as shown below in Figure 4 and Table 2. In addition, 72-hour average daily traffic (ADT) counts were taken at 15 locations in Black Diamond in the fall of 2020 and at 3 locations in Maple Valley as shown below in Figure 5 and Table 3.

In response to the COVID-19 pandemic, WSDOT created the COVID-19 Multimodal Transportation System Performance Dashboard.¹ The dashboard summarizes daily differences between 2020 volumes and 2019 volumes for select transportation facilities throughout the state of Washington.

Data for SR 169 is not provided in the COVID-19 Multimodal Transportation System Performance Dashboard, so daily volumes for 2019 and 2020 were downloaded from the dashboard for the count station located along SR 410 in Sumner, Washington. SR 410 and SR 169 are both urban principal arterials and traverse rural zones within King County, Washington. A comparison of weekday (*Tuesday, Wednesday, and Thursday*) 2019 volumes to 2020 volumes for dates corresponding to traffic count collection reveals that daily 2020 volumes are approximately 20 percent lower than 2019 volumes. In addition to this information, a comparison of locations within the study area that counts were available for both 2019 and 2020 confirmed the use of this adjustment factor to arrive at 2019 volumes for other locations as well. To approximate a common 2019 base for all locations in the study, daily traffic volumes from 2020 were adjusted by a daily COVID-19 factor of 1.20. Locations that used this factor are denoted by an asterisk (*) in Table 3.

¹ WSDOT. COVID-19 Multimodal Transportation System Performance Dashboard, <https://www.wsdot.wa.gov/about/covid-19-transportation-report/>

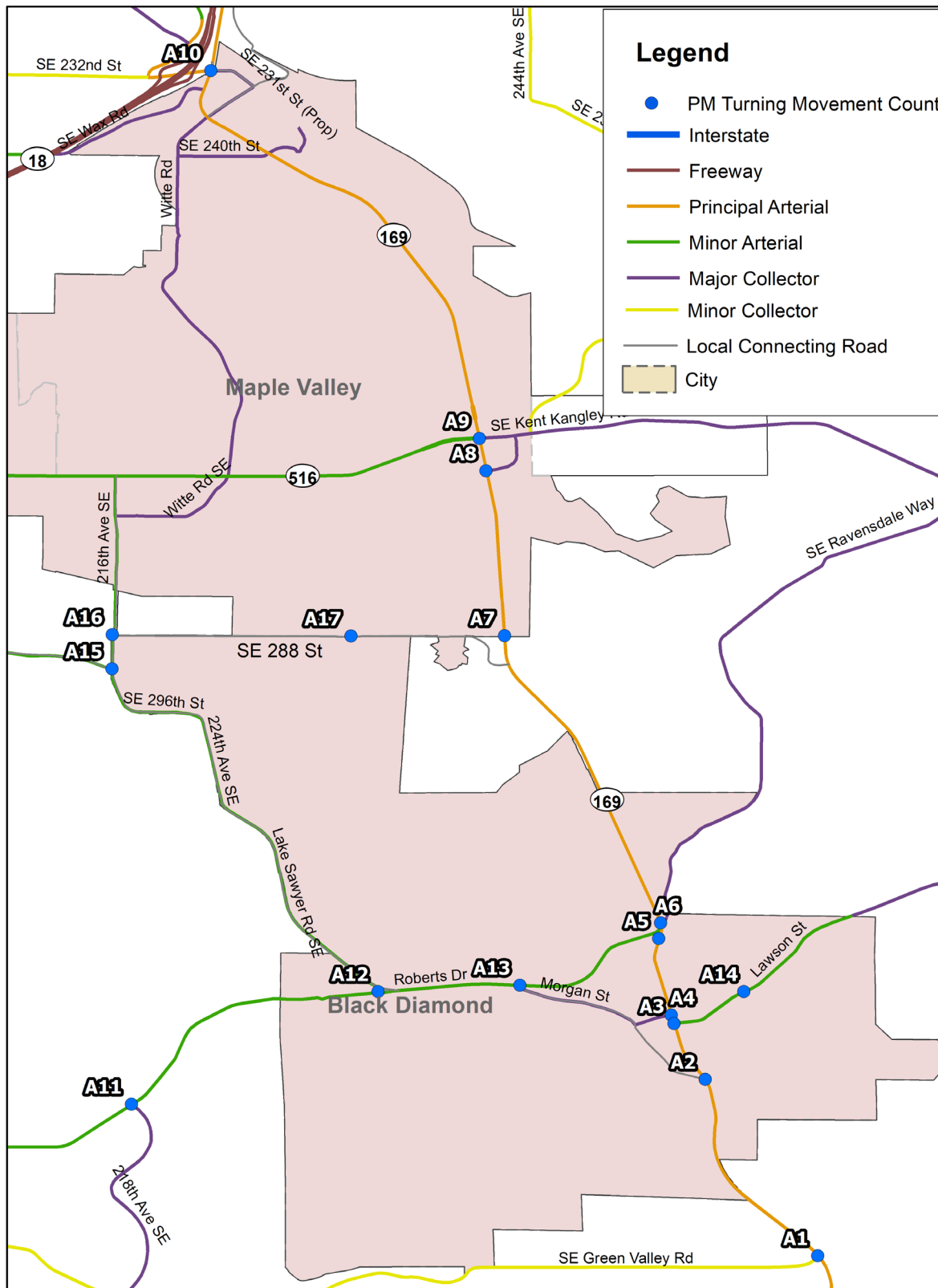


Figure 4. 2019 PM Peak Turning Movement Count Locations

Table 2. 2019 PM Peak Turning Movement Counts Entering Intersection

ID	Study Intersection	Count
A1	SR 169 and SE Green Valley Road	1,028
A2	SR 169 and Jones Lake Road	997
A3	SR 169 and Lawson Road	1,088
A4	SR 169 and Baker Street	1,295
A5	SR 169 and Roberts Drive	1,307
A6	SR 169 and SE Black Diamond-Ravensdale Road	1,319
A7	SR 169 and SE 288th Street	1,322
A8	SR 169 and SE 271st Pl	1,913
A9	SR 169 and SR 516	2,831
A10	SR 169 and SE 231st Avenue	2,299
A11	SE Auburn-Black Diamond Road and 218th Avenue SE	778
A12	SE Auburn-Black Diamond Road and Lake Sawyer Road SE	658
A13	Roberts Drive and Morgan Street	458
A14	Lawson Road and Newcastle Drive	123
A15	SE Covington-Sawyer Road and 216th Avenue SE	1,199
A16	SE 288th Street and 216th Avenue SE	1,049
A17	SE 288th Street and 232nd Avenue SE	451

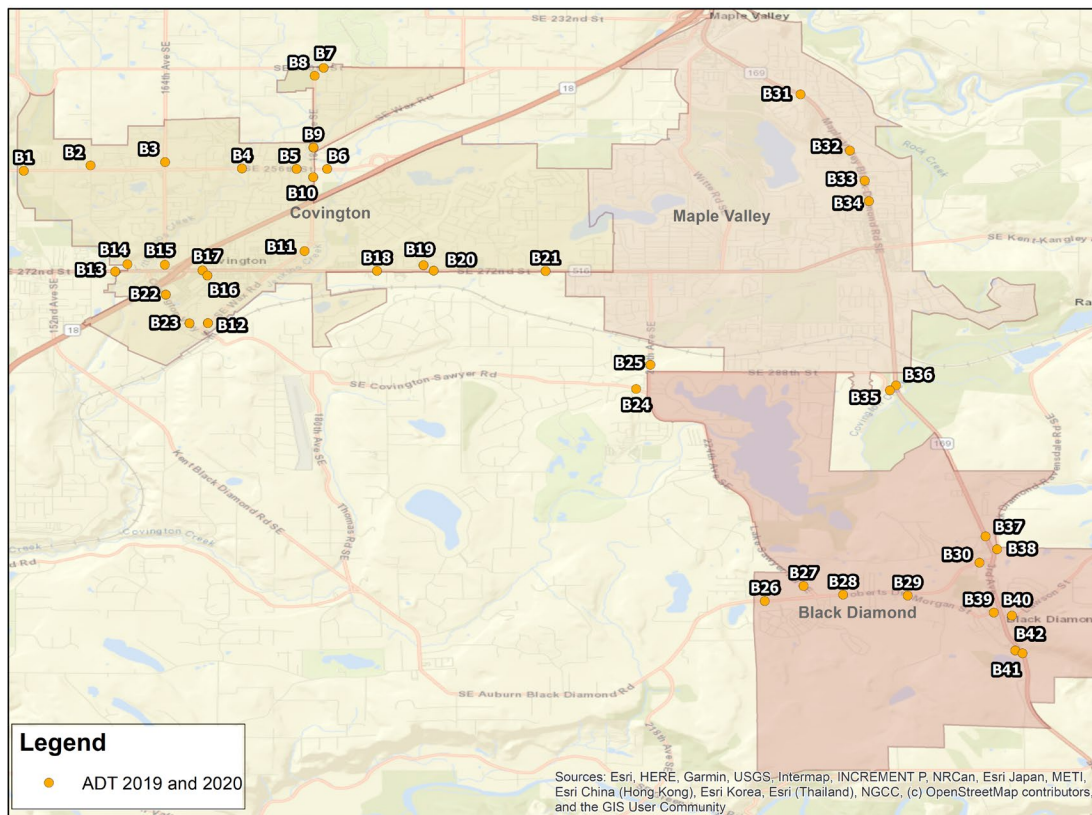


Figure 5. ADT Count Locations

Table 3. Existing ADT Counts

ID	Location	2019	2020	City
B1	On SE 256th St east of intersection 148th Ave SE	15,108	11,372	Covington
B2	On 156th Ave SE north of intersection SE 256th St	3,669	N/A	Covington
B3	On 164th Ave SE north of intersection SE 256th St	7,017	N/A	Covington
B4	On SE 256th St west of 173rd Ave SE	12,539	9,022	Covington
B5	On SE 256th St west of intersection 180th Ave SE	11,836	8,798	Covington
B6	On SE 256th St east of intersection 180th Ave SE	9,130	7,010	Covington
B7	On SE 240th St between 180th Ave SE & Tahoma H.S. D/W	5,029	3,366	Covington
B8	On 180th Ave SE south of SE 240th St	4,083	N/A	Covington
B9	On 180th Ave SE north of intersection SE 256th St	9,816	7,481	Covington
B10	On 180th Ave SE south of intersection SE 256th St	18,073	13,798	Covington
B11	On SE Wax Road south of intersection SE 267th Pl	13,210	N/A	Covington
B12	On SE Wax Road northeast of Covington Way SE	7,263	6,529	Covington
B13	On SR 516 west of intersection 156th Pl SE	30,373	26,382	Covington
B14	On 156th Ave SE north of SE 272nd St	5,251	N/A	Covington
B15	On 164th Ave SE north of SE 272nd St	8,921	N/A	Covington
B16	On SR 516 east of SR-18 EB on & off ramps	38,854	35,090	Covington
B17	On 168th Pl SE north leg of roundabout south of SE 272nd St	9,641	9,454	Covington
B18	On SR 516 east of Jenkins Creek	27,882	25,502	Covington
B19	On 192nd Ave SE north of SR 516	5,675	4,440	Covington
B20	On SR 516 east of 192nd Ave SE	25,406	21,435	Covington
B21	On SR 516 east of 204th Ave SE	23,883	19,993	Covington
B22	On Covington Way SE south of SR-18	15,596	13,249	Covington
B23	On Covington Way SE northwest of SE Wax Rd	12,887	10,637	Covington
B24	On SE Covington Sawyer Rd west of 216th Ave SE	8,039*	6,699	Black Diamond
B25	On 216th Ave SE north of SE 288th St	9,988*	8,323	Black Diamond
B26	On SE Auburn Black Diamond Rd west of Lake Sawyer Rd SE	5,840*	4,867	Black Diamond
B27	On Lake Sawyer Rd SE north of Roberts Dr	3,752*	3,127	Black Diamond
B28	On Roberts Dr west of Buckners Way	6,562*	5,468	Black Diamond
B29	On Morgan St south of Roberts Dr	2,777*	2,314	Black Diamond
B30	On Roberts Dr west of SR 169	4,445*	3,704	Black Diamond
B31	On SR 169 between 231st Ave and SE 244th St	23,400	N/A	Maple Valley
B32	On SR 169 north of SE 253rd Pl	25,403	N/A	Maple Valley
B33	On SR 169 between Rock Creek Elementary Driveway and SE 260th St	25,509	N/A	Maple Valley
B34	On SR 169 south of SE 260th St	25,363	N/A	Maple Valley
B35	On SR 169 north of SE 288th St	17,912*	14,927	Black Diamond
B36	On SE 288th St west of SR 169	5,771*	4,809	Black Diamond
B37	On 3rd Ave north of summit Dr	14,761*	12,301	Black Diamond
B38	On Black Diamond Ravensdale Rd east of SR 169	4,347*	3,618	Black Diamond
B39	On Baker St west of SR 169	2,071*	1,726	Black Diamond
B40	On Lawson St west of 5th Ave	2,843*	2,369	Black Diamond

ID	Location	2019	2020	City
B41	On Jones Lake Rd west of SR 169	1,154*	962	Black Diamond
B42	On SR 169 south of JonesLake Rd	13,122*	10,935	Black Diamond

* The volume is calculated using the COVID-19 factor. See the beginning of this section for more information.

DEMAND MODEL CALIBRATION

As noted, the demand model uses a 2014 base year. While existing traffic counts were collected for 2019 and 2020, in order to compare against the base year model, counts that were not available were estimated by factoring back to 2014 based on growth for other available counts in the area. Figure 6 below shows the screenlines used to compare against the demand model to validate the general distribution of travel in the study area. Comparisons to the model for each screenline are shown in Table 4. The differences between the model and counts fall within acceptable ranges based on FHWA literature. Several connectors were adjusted in the areas to the north of Black Diamond in the model to better reflect loading onto the highway network as part of this calibration effort. In addition, zone splits to better reflect loadings and development areas were also included in this model.

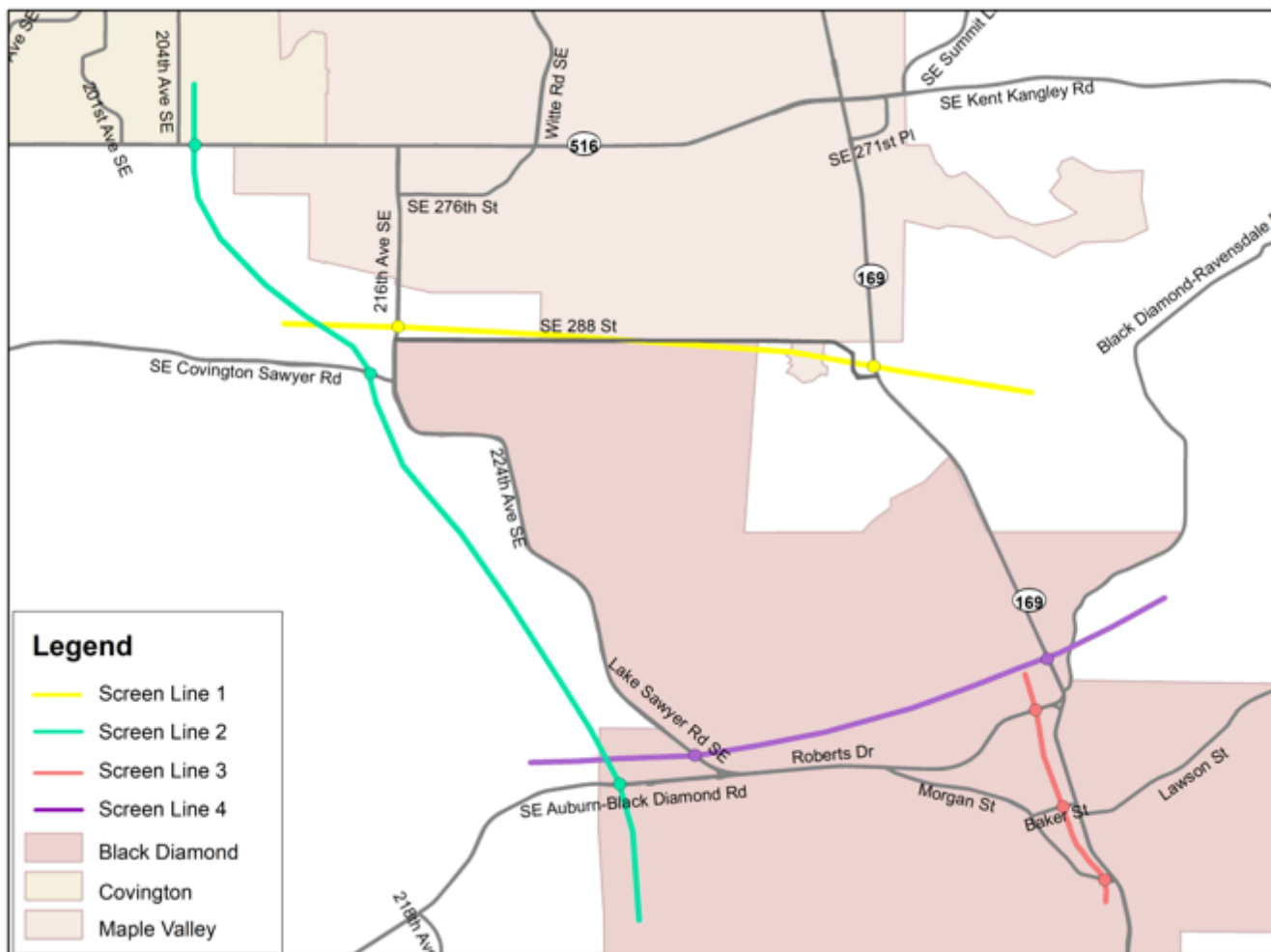


Figure 6. Screenline Locations for Model and Count Comparisons

Table 4. Screenline Model vs. Count Comparison

Screenline ID	Count Location	2014 Model Daily	2014 Count	2019 Count	2014 Model vs. 2014 Count	2019 Count vs. 2014 Model
1	On 216th Ave SE north of SE 288th St	9,828	8,589	9,988		
	On SR 169 north of SE 288th St	15,648	17,375	17,912		
	Total	25,477	25,964	27,900	98%	110%
2	On SR 516 east of 204th Ave SE	20,250	22,557	23,992		
	On SE Covington Sawyer Rd west of 216th Ave SE	6,529	6,913	8,039		
	On SE Auburn Black Diamond Rd west of Lake Sawyer Rd SE	4,250	5,023	5,840		
	Total	31,029	34,493	37,871	90%	122%
3	On Roberts Dr west of SR 169	4,628	3,823	4,445		
	On Baker St west of SR 169	536	1,781	2,071		
	On Jones Lake Rd west of SR 169	1,226	993	1,154		
	Total	6,390	6,597	7,670	97%	120%
4	On Lake Sawyer Rd SE north of Roberts Dr	4,619	3,227	3,752		
	On 3rd Ave north of summit Dr	13,527	14,318	14,761		
	Total	18,145	17,545	18,514	103%	102%

Growth Rates

Growth rates for vehicle volumes in the demand model were calculated using links on facilities in and out of Black Diamond at locations generally corresponding to those being summarized in the distribution and assignment evaluation. These growth rates are shown below in Table 5.

Table 5. Growth Rates for Study Area Corridor Facilities

Location	2014 Model	2025 Model	Annual Growth
SR 169 south of Green Valley Rd	3,273	3,447	0.5%
Black Diamond Ravensdale Rd. north of Roberts	1,715	1,840	0.6%
Auburn Black Diamond Rd. east of 218th	1,645	1,989	1.7%
SR 169 north of 288th	3,268	3,454	0.5%
Lake Sawyer Rd. north of Roberts	1,480	1,740	1.5%

Trip Distribution and Assignment Evaluation

The following section provides details on how the travel demand model performs at the regional distribution of trips related to the MDP areas. Final model assignments for both the PM peak and AM peak were used as the starting point for this analysis. The PSRC model includes calculations that estimate the number of trips that travel in different time periods throughout the day as part of its time of day model procedures. These time of day results for the AM and PM Peak periods were used for this analysis without additional adjustments outside of the model. Results presented as part of this evaluation include the full peak period. Sensitivity testing around more

specific peak hour factor impacts would need to be completed as part of more detailed traffic analysis separate from the work done using the model to estimate trip distributions and would not be expected to change the distribution results.

In addition to estimating auto trips, transit mode shares for Black Diamond were calculated using the regional model. Daily transit shares for trips to and from Black Diamond increase slightly in 2025 (1.7%) as compared to the base year model (1.5%). The model estimated approximately 20 boardings on Sounder in the AM Peak period and approximately 28 boardings in the PM Peak period.

To calculate trip distribution a flag was coded on links in and out of TAZs that include the MDP areas, and trips on the network were captured through a select link analysis. This model relied on trip generation rates in the PSRC model as estimated from regional household travel surveys. Separate post-processing using ITE trip generation for the MDP area was not developed in this effort. This analysis provides path details for the trips in and out of the study area showing where they travel along the network. The locations where these trips were captured for analysis generally capture movements in and out of Black Diamond, as well as trips that travel between the MDP areas. These locations include travel to/from the following:

1. Covington along SR 516 and 216th Avenue SE
2. Maple Valley along SR 169
3. SE Covington Sawyer Rd.
4. Areas north of Lake Sawyer along 232nd Avenue SE
5. Ravensdale along Black Diamond Ravensdale Road
6. North Triangle/Parcel B
7. Main Villages
8. Black Diamond west of SR169 and south of Roberts Drive
9. Auburn Black Diamond Road
10. SE Green Valley Road
11. 216th Ave SE
12. SR 169 south of Black Diamond

Figure 7 and Figure 8 show these distribution patterns for the PM peak and AM peak for the year 2025. In addition, comparisons to previous analysis are included in Table 6 for the same locations that were analyzed.

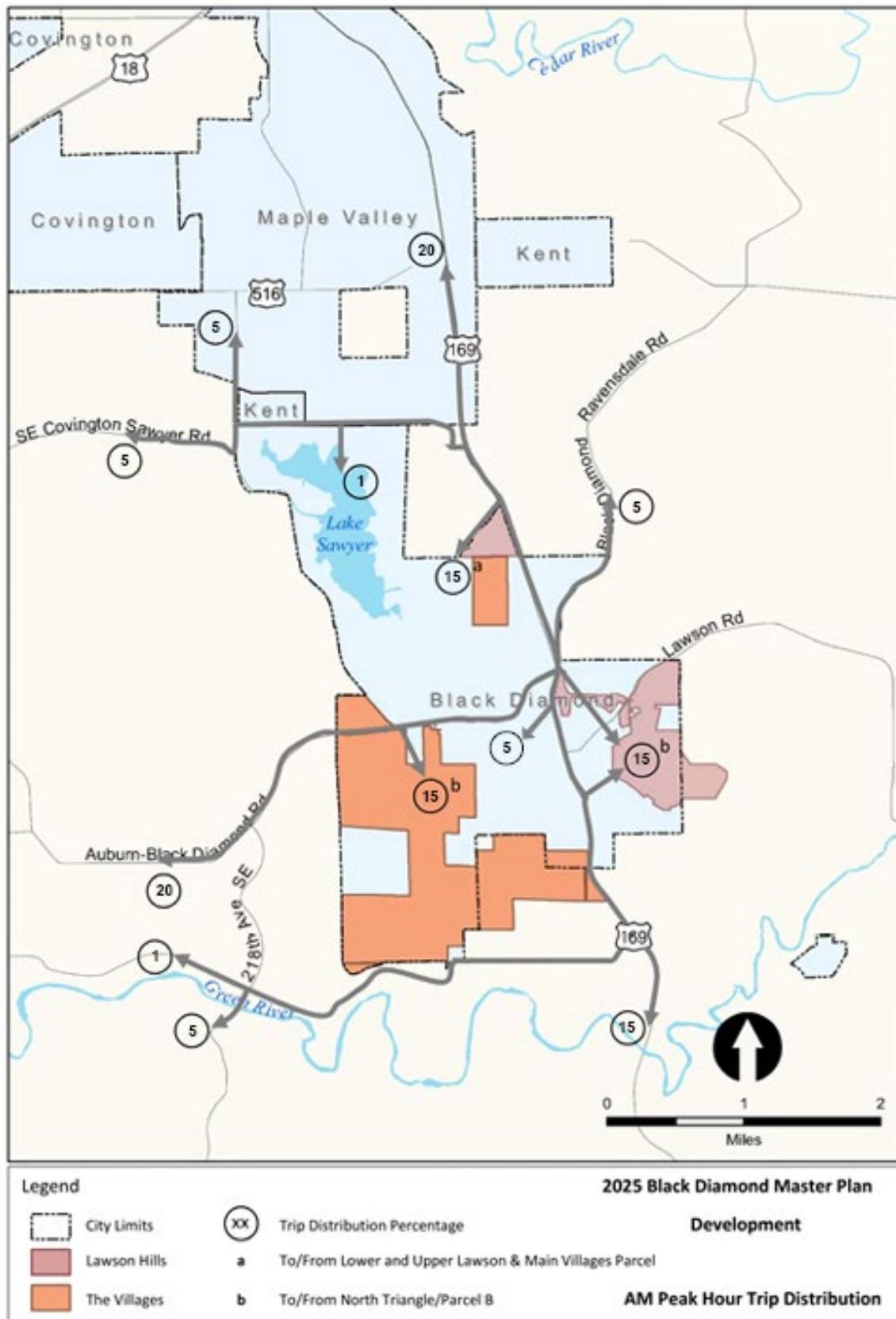


Figure 7. AM Peak Travel Demand Model MDP Trip Distribution

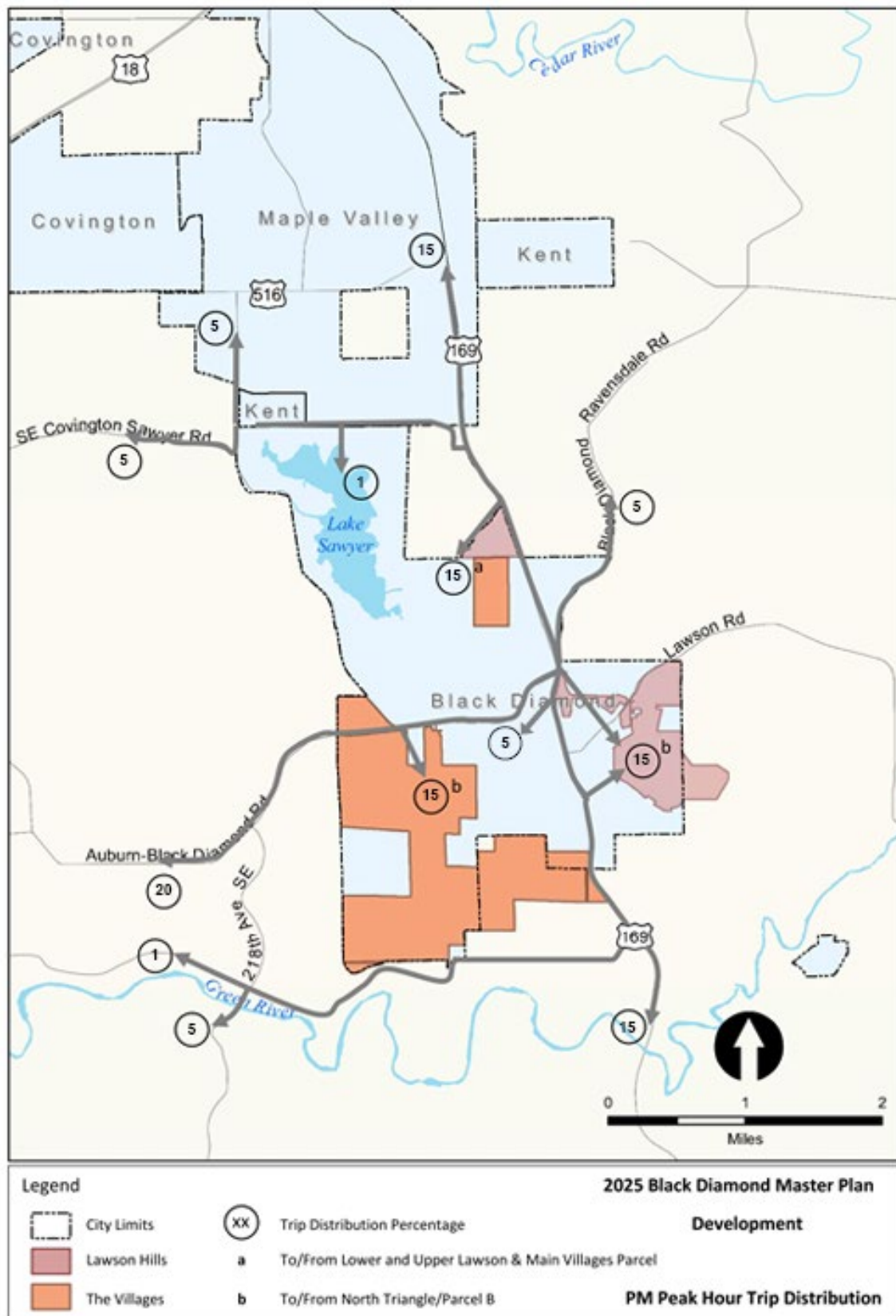


Figure 8. PM Peak Travel Demand Model MDP Trip Distribution

Table 6. AM/PM Peak Travel Demand Model MDP Trip Distribution with Comparison to Previous EIS Estimates

ID Number	To/From Location	2009 EIS 2025 Distribution		2025 Demand Model Update	
		AM Peak Hour ¹	PM Peak Hour ²	AM Peak Hour	PM Peak Hour
1	Covington along SR 516 and 216th Ave SE	15%	15%	5%	5%
2	To/from Maple Valley along SR169	20%	20%	20%	15%
3	SE Covington Sawyer Rd	5%	5%	5%	5%
4	Area north of Lake Sawyer along 232nd Ave SE	5%	5%	1%	1%
5	Ravensdale along Black Diamond Ravensdale Rd	5%	5%	5%	5%
6	North Triangle	10%	10%	15%	15%
7	Lower/Upper Lawson/The Villages	10%	10%	15%	15%
8	Black Diamond west of SR169 and south of Roberts Drive	5%	5%	5%	5%
9	Auburn-Black Diamond Rd	10%	10%	20%	20%
10	SE Green Valley Rd	3%	3%	1%	1%
11	216th Ave SE	2%	2%	5%	5%
12	SR169 south of Black Diamond	10%	10%	15%	15%
To/From Lower and Upper Lawson & Main Villages Parcel					
To/From North Triangle Parcel B					

¹ Figure 10 Final Villages Transportation Technical Report November 2009, for Cumulative Alternative 2.

² Figure 11 Final Villages Transportation Technical Report November 2009, for Cumulative Alternative 2.

EIS = environmental impact statement

The trip distribution in the current model is consistent with the distribution of trips to/from locations outside of the Black Diamond area from The Villages and Lawson Hills Environmental Impact Statements. Some of the main differences in the distribution of trips between the original environmental impact statement work and the current travel demand model run include small increases in the share of trips to/from both the west and south from the MPD locations and a reduction in overall trips to the north into Covington and Maple Valley. This reflects the continued growth and traffic congestion increases in areas north of Black Diamond compared to the west and south. Based on this evaluation, the EIS analysis for the Ten Trails (formerly The Villages) and Lawson Hills MPD's continues to provide a valid basis for determining future transportation impacts and mitigation.

MEMORANDUM

DATE: April 29, 2022
TO: Andy Williamson, City of Black Diamond
FROM: Jennifer John
SUBJECT: Task 40 – Build and Calibrate Model Response to Comments
CC: Austin Fisher, PE
John Perlic, PE
PROJECT NUMBER: 214-3043-028
PROJECT NAME: Transportation Model Update

RESPONSE TO COMMENTS

This Memorandum provides responses to the summary of concerns and recommendations outlined in the March 28, 2022, dated letter from Peter Rimbos and Mike Birdsall commenting on the Transportation Model Update Technical Memorandum. The goal of the Transportation Model Update work was to utilize the PSRC regional travel model as a starting point with updates in the City of Black Diamond area (network and land use) to evaluate trip distribution and assignment of project trips from The Villages (Ten Trails) and Lawson Hills Master Plan Developments (MPDs). This information was compared to the EIS work in 2009. The updated travel demand model responds to Conditions of Approval 11, 12, 13, 14 and 17a for The Villages (Ten Trails) MPD and was not intended to be a detailed traffic operational analysis as many of the comments suggest should have been done to make the analysis complete.

Detailed traffic operations analyses have been completed for every phase of Ten Trails to monitor transportation mitigation needs. Required updates to traffic operations analysis will be conducted as part of Conditions of Approval 17b and 17d.

Comment: Interagency Coordination—King County was not contacted.

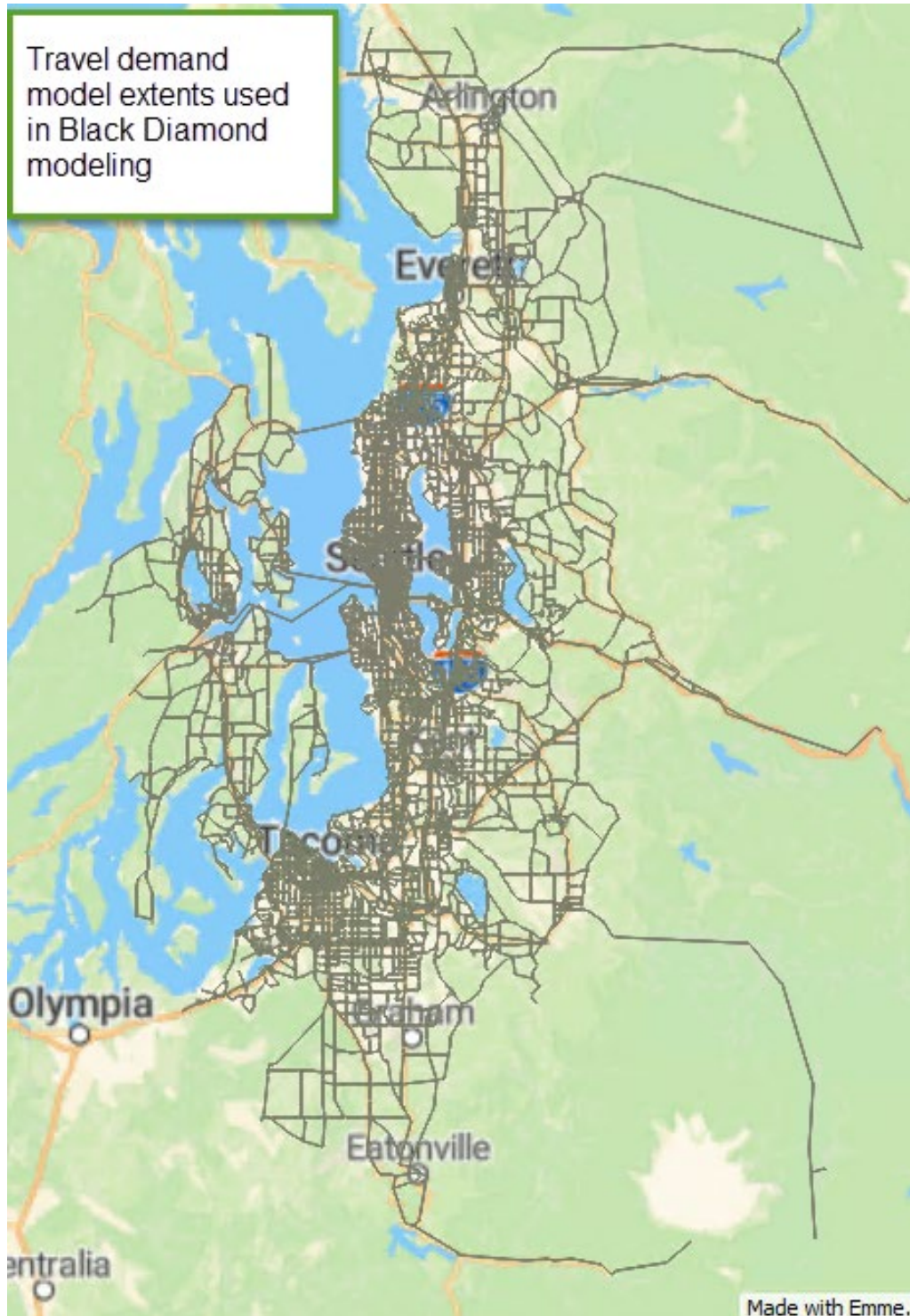
Response: We are working with City of Black Diamond staff to determine the need and timing of contacting King County

Comment: Traffic Analysis Zones (TAZ)—The 19 additional traffic zones are not sufficient to produce accurate turning movements at monitored intersections. More zone-splitting is necessary.

Response: The intent of this work was not detailed traffic or operations analysis. The TAZ splits were developed in a manner to capture development areas and allow for the more accurate loading of trips onto the network for analyzing regional traffic distribution patterns for traffic generated from Ten Trails.

Comment: External Trips—How “external trips ... are captured” needs more explanation.

Response: Noted. The PSRC model was used for this work with updates to the Black Diamond area. The figure in the report zoomed in to the area where adjustments were made but the model included the full PSRC modeling area for developing travel demand as shown in the figure on the next page. Land use and network assumptions for areas outside of Black Diamond for the remainder of the region were not changed from what was provided by PSRC for the forecast year.

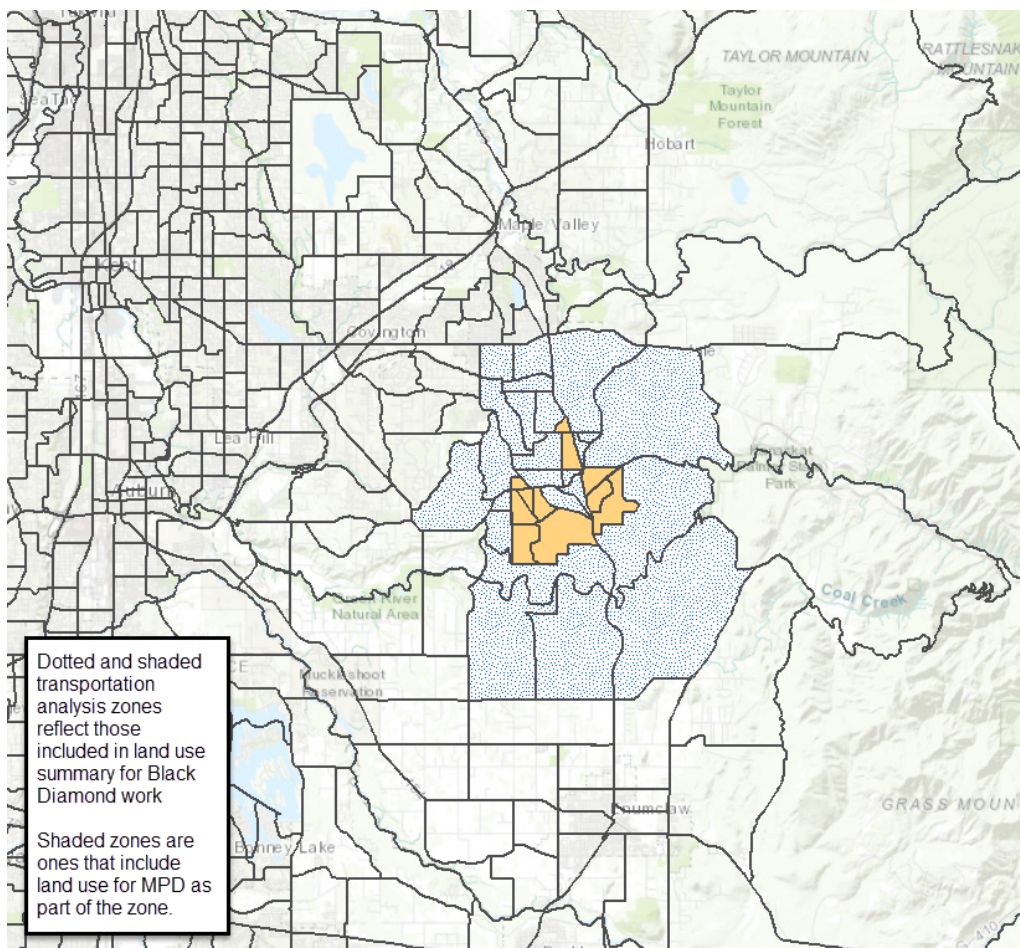


Comment: Calibration Accuracy—Calibration is not established by the limited data provided.

Response: For evaluating the distribution of trips related to the MPD, we have used the calibrated PSRC regional model with a review of overall trips in/out of the Black Diamond area at a screenline level to assess reasonableness of these movements. Detailed traffic calibration as described in the comments was not required for this distribution analysis since we started with the calibrated regional model.

Comment: Land Use Assumptions—Table 1 does not make sense and should be reconstructed.

Response: Land use assumptions were developed in coordination with City staff. The zones summarized in the table for the PSRC Forecasts “Larger Study Area” are shown in the image below with blue dot background. The zones that include MPD development land use have solid fill in the image below. Within the larger zones that capture the MPD areas there was other development besides the MPD that would be reflected in the original numbers from PSRC is shown in the right side of Table 1. Trip distribution was evaluated for both MPDs combined to provide direct comparison with the 2009 EIS information.



Comment: 2040 Forecasts —“Year 2040 ... traffic volume forecasts...,” are not presented.

Response: Because comparisons were primarily needed to compare to the EIS work which reflected a 2025 forecast year, this was the focus of the work to date. The 2025 forecast year is sufficient to cover Phase 1A/1B and Phase 2 of Ten Trails and Lawson Hills.

Comment: Trip-Generation Rates—The difference between trip rates in the PSRC TDM and those published by the Institute of Transportation Engineers (ITE) needs reconciliation.

Response: We reviewed the trip generation rates in the PSRC model based on the household numbers for the TAZs in the study area and the rate is approximately 10 trips per household. This falls within the range of ITE trip generation rates for single family/multi-family households in the Trip Generation Manual, 11th Edition.

Comment: Trip Distributions—Figures 7 and 8 and Table 6 have serious numerical errors.

Response: The method for calculation of internal trips between North Triangle and Lower/Upper Lawson/The Villages were separate from the regional external trips outside of Black Diamond and resulted in values that totaled more than 100% in the original table. These calculations have been revised to reflect all travel to/from the development areas in a consistent manner. Numbers in the table below have not been rounded to provide added detail but for the purpose of our analysis the rounded numbers would not result in a different conclusion.

ID Number	To/From Location	2009 EIS 2025 Distribution		2025 Demand Model Update 4/26/2022	
		Cumulative Alternative 2 AM Peak Hour Trip Distribution ¹	Cumulative Alternative 2 PM Peak Hour Trip Distribution ²	Cumulative Master Plan Development AM Peak Hour Trip Distribution	Cumulative Master Plan Development PM Peak Hour Trip Distribution
1	Covington along SR 516 and 216th Ave SE	15%	15%	4%	4%
2	to/from Maple Valley along SR169	20%	20%	16%	13%
3	SE Covington Sawyer Rd	5%	5%	3%	5%
4	area north of Lake Sawyer along 232nd Ave SE	5%	5%	0%	0%
5	Ravensdale along Black Diamond Ravensdale Rd	5%	5%	5%	7%
6	North Triangle	10%	10%	11%	11%
7	Lower/Upper Lawson/The Villages	10%	10%	14%	14%
8	Black Diamond west of SR169 and south of Roberts Drive	5%	5%	5%	6%
9	Auburn-Black Diamond Rd	10%	10%	21%	19%
10	SE Green Valley Rd	3%	3%	1%	1%
11	216th Ave SE	2%	2%	7%	7%
12	SR169 south of Black Diamond	10%	10%	12%	13%

To/From Lower and Upper Lawson & Main Villages Parcel

To/From North Triangle Parcel B

¹ Figure 10 Final Villages Transportation Technical Report November 2009

² Figure 11 Final Villages Transportation Technical Report November 2009

Concern/Recommendation: Final Conclusion—This is plainly contradicted by the facts presented.

Response: We disagree that the information presented is contradictory. The intent is to show trip distribution within and to other areas outside of Black Diamond for the MPD. While some of the individual locations do not align exactly with the previous analysis, the overall trip distribution to areas outside of Black Diamond is consistent in terms of travel movements to the west/east/north and south as well as for trips that travel between the development areas within Black Diamond. Trip distribution to areas in Covington and Maple Valley are lower in the current model. Trip distribution increases are primarily to the west on Auburn-Black Diamond Rd.

Appendix D

Transportation Improvement Projects and Comprehensive Plan Project



RESOLUTION NO. 22-1489

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF
BLACK DIAMOND, KING COUNTY, WASHINGTON
APPROVING THE 2023-2028 SIX YEAR
TRANSPORTATION IMPROVEMENT PROGRAM

WHEREAS, per RCW 35.77.010, the City is required to annually update its Six Year Transportation Improvement Program (TIP) before July 1st of each year and file the updated Transportation Improvement Program with the Washington State Department of Transportation within thirty days of adoption; and

WHEREAS, per RCW 35.77.010, the purpose of the requirement for annual updates is to assure that each city and town shall perpetually have available advanced plans looking to the future for not less than six years as a guide in carrying out a coordinated transportation program; and

WHEREAS, it is an eligibility requirement of many grant programs that the City update its Transportation Improvement Program as required by RCW 35.77.010; and

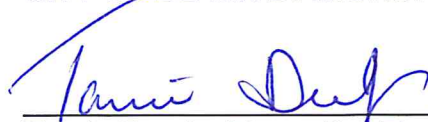
WHEREAS, in accordance with RCW 35.77.010, a public hearing was held on the proposed updates to the Transportation Improvement Program;

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF BLACK DIAMOND, WASHINGTON, DOES RESOLVE AS FOLLOWS:

Section 1. The City Council does hereby approve the 2023-2028 Six Year Transportation Improvement Program, a copy of which is attached at Exhibit "A" and incorporated herein by reference.

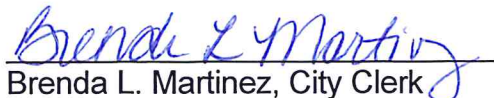
PASSED BY THE CITY COUNCIL OF THE CITY OF BLACK DIAMOND, WASHINGTON, AT A REGULAR MEETING THEREOF, THIS 16TH DAY OF JUNE, 2022.

CITY OF BLACK DIAMOND:



Tamie Deady, Mayor Pro-Tem

Attest:



Brenda L. Martinez, City Clerk

City of Black Diamond 6 Year
Transportation Improvement Plan
2023 - 2028



SUMMARY OF PROJECTS

Project Name	Location	Cost	Year
1. General Street Improvements	N/A	\$35,000/year; \$210,000 total	2023
2. Grant Matching for Street Projects	N/A	\$40,000/year; \$240,000 total	2023
3. Covington Creek Bridge	224 th Ave SE, South of SE 297 th St.	\$2,293,500	2023
*4. SR 169 Roundabouts	Roberts Dr./SR 169/BD Ravensdale Rd./Pipeline Rd.	\$10,000,000	2023
5. Downtown Public Parking	Railroad Ave.	\$145,000	2023
6. Rock Creek Bridge Rehab	Roberts Dr.	\$75,000	2023
7. Morgan Creek Neighborhood Roads Preservation	Morgan Creek Neighborhood	\$75,000	2023
8. Roberts Drive Reconstruction, City Hall to SR 169	City Hall to SR 169	\$4,500,000	2024
9. Sawyer Woods Sidewalk, Ph. I	228 th Ave. SE from SE 312 th St. to SE 307 th Pl.	\$2,300,000	2024
10. SR 169 & Park Street Crossing	SR 169 & Park St.	\$160,000	2024
11. Lawson Street Overlay	SR 169 to Newcastle Dr.	\$300,000	2024
12. 5th Avenue Overlay	Lawson St. to Baker St.	\$ 150,000	2024
13. SR 169 Sidewalk, Roberts Drive to James Street	Roberts Dr. to James St.	\$750,000	2026
14. Sawyer Woods Sidewalk, Ph. II	224 th Ave. SE from SE 307 th Pl. to SE 304 th St.	\$2,100,000	2025
15. 232nd Avenue/Place SE Overlay	Pavement change at 29615 to End of Public Road (302 nd)	\$150,000	2025
16. Downtown Pedestrian & Bicycle Link Study	James St. to Jones Lake Rd.	\$30,000	2025
17. Diamond Glen Neighborhood Improvements	Diamond Glen Neighborhood	\$150,000	2025
*18. Morgan Street & Roberts Drive Roundabout	Morgan St./Roberts Dr.	\$400,000	2026
*19. Pipeline Road	New east/west road between Lake Sawyer Rd. SE & SR 169	\$11,600,000	2026
20. Baker Street Sidewalk	Railroad Ave. to Lawson St.	\$700,000	2026

*21. Lawson Street Sidewalk, Ph. II	6 th Ave. to Newcastle Dr.	\$600,000	2026
22. 216 th Avenue SE Overlay	SE 288 th St. to SE 296 th St.	\$165,000	2026
23. Northeast Lake Sawyer Road Improvements	228 th Ave. SE to 232 nd Ave. SE	\$200,000	2026
*24. North Connector	SR 169 in north triangle south to Pipeline Rd. and Roberts Dr.	\$4,500,000	2027
25. Rainer View Roadway Improvements	Baker St. to SR 169	\$150,000	2027
26. SE 288 th Street Sidewalk, Ph. I	216 th Ave. SE to 224 th Ave. SE	\$1,550,000	2027
*27. Lawson Street & SR 169 Intersection Improvements	Lawson St./SR 169	\$1,000,000	2028
*28. Baker Street & SR 169 Intersection	Baker St./SR 169	\$700,000	2028
*29. Lawson Connector/Lawson Parkway	SR 169 to Lawson St.	\$10,000,000	2028
*30. Lawson Street/Botts Drive Intersection Improvements	Lawson St./Botts Dr.	\$500,000	2028
31. 216 th Avenue SE Pedestrian Improvements	SE 288 th St. to SE 292 nd St.	\$750,000	2028
	TOTAL	\$56,443,500	

**Developer-funded project*

General Street Improvement (#1)

Projected Year: 2023

Location: N/A

Distance: N/A

Type of Improvement: Use for opportunities to leverage private funds, short overlays, chip sealing, crack sealing, patch work, addressing minor safety problems.

Estimated Cost: \$35,000/year; \$210,000 total

Fund Source: Local City Funds



Grant Matching for Street Projects (#2)

Projected Year: 2023

Location: N/A

Distance: N/A

Type of Improvement: Use for grant applications to provide the required match.

Estimated Cost: \$40,000/year; \$240,000 total

Fund Source: Local City Funds

What is a matching grant?



A matching grant is a contingent grant awarded only if the receiving entity is able to put up (or independently raise) a sum equal to the amount provided by the granting entity.



Covington Creek Bridge (#3)

Projected Year: 2023

Location: 228th Ave. SE from approximately 225' south of SE 297th St. to SE 296th St.

Distance: 0.07 miles

Type of Improvement: Replaces three failing culverts at Covington Creek with a prestressed girder bridge, along with associated grading and road improvements to match up roadways on the north and south.

Estimated Cost: \$2,293,500

Fund Source: King County Flood Control District Funds



SR 169 Roundabouts (#4)

Projected Year: 2023

Location: intersections of SR 169/Roberts Dr. and SR 169/Black Diamond-Ravensdale Rd. for one roundabout, intersection of SR 169/Pipeline Rd. for the second.

Distance: N/A

Type of Improvement: Roundabout[s] addressing the intersections of SR 169/Roberts Dr. and SR 169/Black Diamond-Ravensdale Rd.

Estimated Cost: \$10,000,000

Fund Source: Developer Mitigation



Roberts Dr. & BD-Ravensdale



Pipeline Rd.

Downtown Public Parking (#5)

Projected Year: 2023

Location: Railroad Ave. and Baker St., and nearby streets

Distance: N/A

Type of Improvement: Explore parking options for the historic downtown area of Black Diamond.

Estimated Cost: \$145,000

Fund Source: Local City Funds/Grants



Rock Creek Bridge Rehab (#6)

Projected Year: 2023

Location: Roberts Dr. Rock Creek Bridge (between 236th Ave. SE & Bruckners Way)

Distance: 20'

Type of Improvement: Sealing and painting underside of the Rock Creek Bridge.

Estimated Cost: \$75,000

Fund Source: Local City Funds



Morgan Creek Neighborhood Roads Preservation (#7)

Projected Year: 2023

Location: Morgan Creek neighborhood streets off of the Black Diamond-Ravensdale Rd.

Distance: 1.19 miles

Type of Improvement: Seal Coat, chip seal, or crack seal

Estimated Cost: \$75,000

Fund Source: Local City Funds



Roberts Drive Reconstruction, City Hall to SR 169 (#8)

Projected Year: 2024

Location: City Hall to SR 169

Distance: .77 miles

Type of Improvement: Widening and overlay to accommodate shared bicycle path, sidewalk from library to SR 169, street lighting, and stormwater improvements.

Estimated Cost: \$4,500,000

Fund Source: TIB Grant, Local City Funds



Sawyer Woods Sidewalk, Ph. I (#9)

Projected Year: 2024

Location: 228th Ave. SE from SE 312th St. to SE 307th Pl.

Distance: 0.30 miles

Type of Improvement: New sidewalk on the east side of 228th Ave. SE along with stormwater facilities, pedestrian lighting, and block walls.

Estimated Cost: \$2,300,000

Fund Source: Safe Routes to School Grant; local city funds



SR 169 & Park Street Crossing (#10)

Projected Year: 2024

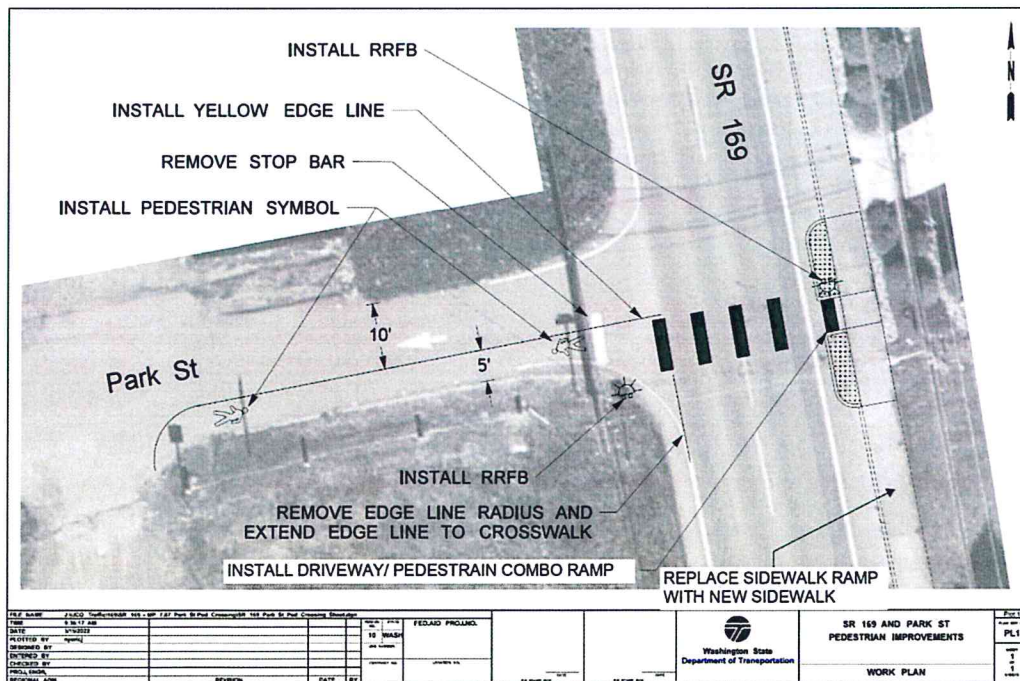
Location: SR 169 & Park St.

Distance: N/A

Type of Improvement: Crosswalk, Designated pedestrian path on Park St., and Rectangular Rapid-Flashing Beacons (RRFBs)

Estimated Cost: \$160,000

Fund Source: WSDOT Pedestrian & Bicycle Program Grant



Lawson Street Overlay (#11)

Projected Year: 2024

Location: SR 169 to Newcastle Dr

Distance: .19 miles

Type of Improvement: Surface grinding, select panel replacement, shoulder widening, asphalt overlay.

Estimated Cost: \$300,000

Fund Source: Local City Funds



5th Avenue Overlay (#12)

Projected Year: 2024

Location: Lawson St. to Baker St

Distance: 0.15 miles

Type of Improvement: Overlay and potential widening of 5th Ave. from Lawson St. to Baker St.

Estimated Cost: \$ 150,000

Fund Source: Local City Funds



SR 169 Sidewalk, Roberts Drive to James Street (#13)

Projected Year: 2024

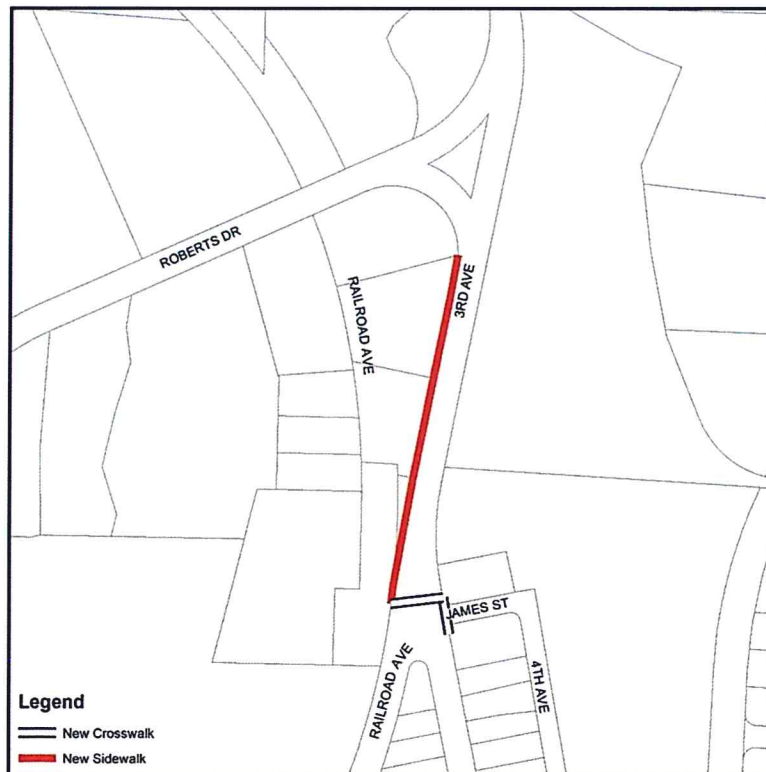
Location: SR 169 from Roberts Dr. to James St.

Distance: .20 miles

Type of Improvement: 6-foot wide sidewalk on the west side of SR 169 between the future roundabout and James St.

Estimated Cost: \$750,000

Fund Source: TIB Grant, Local City Funds



Sawyer Woods Sidewalk, Ph. II (#14)

Projected Year: 2025

Location: 224th Ave. SE from SE 307th Pl. to SE 304th St.

Distance: 0.27 miles

Type of Improvement: New sidewalk on the east side of 224th Ave. SE along with stormwater facilities, block walls, and regrading portions of 224th to accommodate steep slopes on driveways.

Estimated Cost: \$2,100,000

Fund Source: Safe Routes to School Grant; TIB Grant; local city funds



232nd Avenue/Place SE Overlay (#15)

Projected Year: 2025

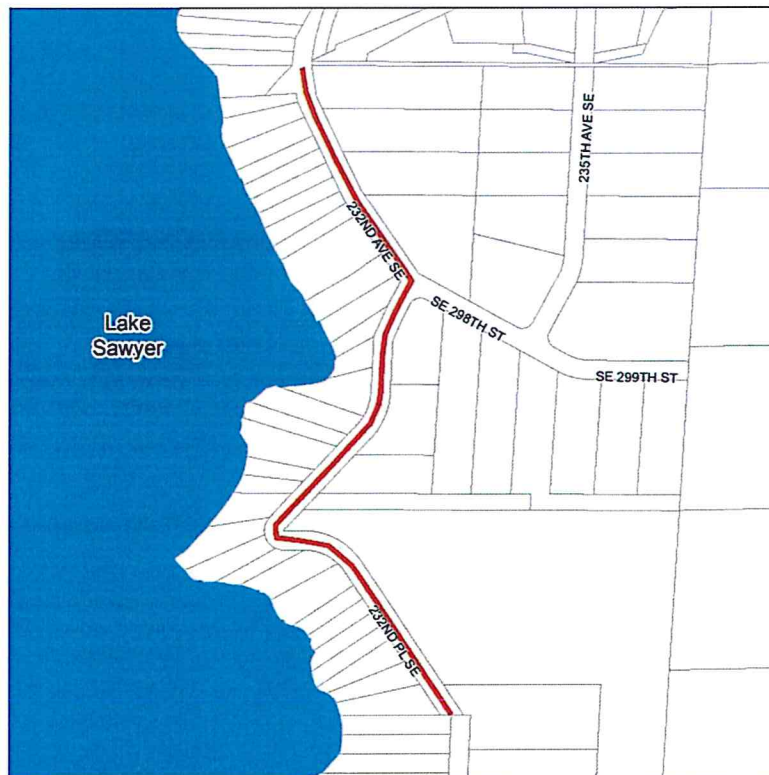
Location: Pavement change at 29615 to End of Public Road (302nd)

Distance: .44 miles

Type of Improvement: Asphalt patching and overlay

Estimated Cost: \$200,000

Fund Source: Local City Funds



Downtown Pedestrian & Bicycle Link Study (#16)

Projected Year: 2025

Location: James St. to Jones Lake Rd.

Distance: 0.88 miles

Type of Improvement: Study to identify best routes for pedestrians to bypass SR 169 through the downtown area

Estimated Cost: \$30,000

Fund Source: Grant/Local City Funds



Diamond Glen Neighborhood Improvements (#17)

Projected Year: 2025

Location: Diamond Glen neighborhood off of SR 169

Distance: .25 miles

Type of Improvement: Patching, crack sealing, and overlay

Estimated Cost: \$150,000

Fund Source: Local City Funds



Morgan Street & Roberts Drive Intersection Improvements (#18)

Projected Year: 2026

Location: Intersection of Roberts Dr. & Morgan St.

Distance: N/A

Type of Improvement: New roundabout, potentially completed as part of the Roberts Drive Reconstruction, City Hall to SR 169 project (#8)

Estimated Cost: \$400,000

Fund Source: Developer Mitigation, TIB grant



Pipeline Road (#19)

Projected Year: 2026

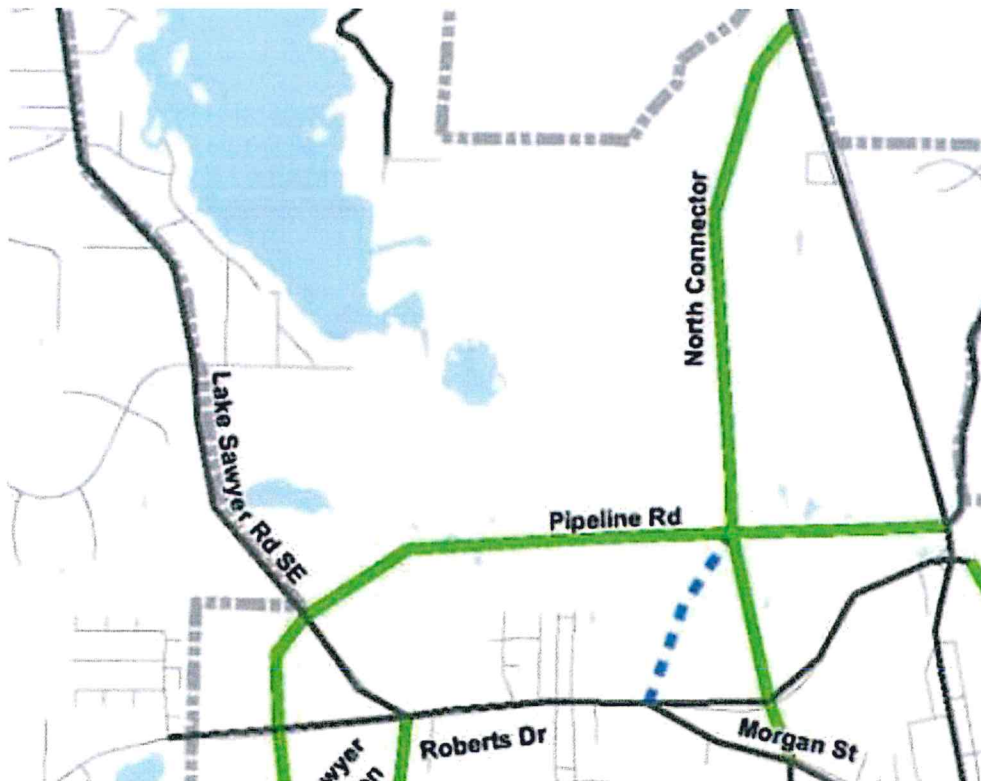
Location: Construction of new Pipeline Rd. between Lake Sawyer Rd. & SR 169

Distance: 1.5 miles

Type of Improvement: Construction of a new roadway with pedestrian facilities between SR 169 and Lake Sawyer Rd. SE.

Estimated Cost: \$11,600,000

Fund Source: Developer Mitigation



Baker Street Sidewalk (#20)

Projected Year: 2026

Location: Railroad Ave. to Lawson St.

Distance: .21 mi

Type of Improvement: Sidewalk on the south side of Baker St. between Railroad and SR 169, then on the west side of SR 169 between Baker and Lawson

Estimated Cost: \$700,000

Fund Source: Grant, Local City Funds, Developer frontage improvements



Lawson Street Sidewalk, Ph. II (#21)

Projected Year: 2026

Location: 6th Ave. to Newcastle Dr.

Distance: .19 miles

Type of Improvement: 6-foot wide sidewalk on the south side of Lawson St. along with crosswalks at 6th Ave. and Newcastle Dr.

Estimated Cost: \$600,000

Fund Source: Developer Mitigation; Grant funds



216th Avenue SE Overlay (#22)

Projected Year: 2026

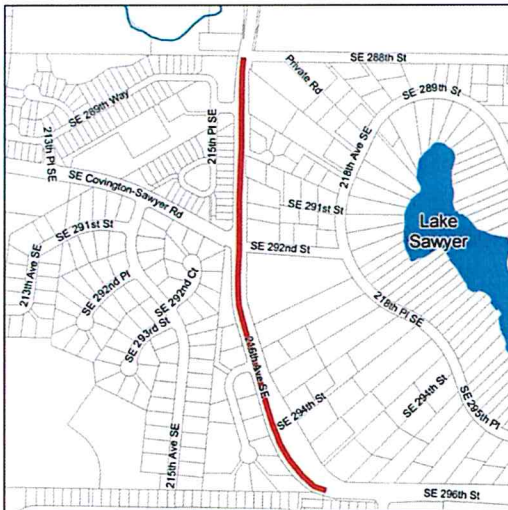
Location: SE 288th St. to SE 296th St.

Distance: 0.50 miles

Type of Improvement: Patch and overlay

Estimated Cost: \$165,000

Fund Source: Local City Funds



Northeast Lake Sawyer Roadway Improvements (#23)

Projected Year: 2026

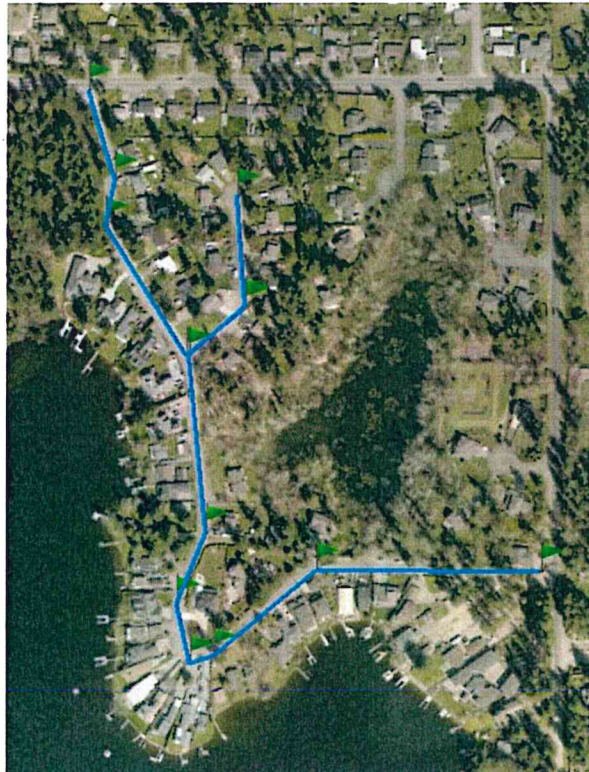
Location: 228th Ave SE/229th Ave. SE/229th Pl. SE/SE 292nd Pl.

Distance: .62 mi

Type of Improvement: Grind and overlay

Estimated Cost: \$200,000

Fund Source: Local City Funds



North Connector (#24)

Projected Year: 2027

Location: SR 169 connection in the north triangle south to Roberts Dr.

Distance: .25 miles

Type of Improvement: New minor arterial connection to SR 169 with potential roundabout

Estimated Cost: \$4,500,000

Fund Source: Developer Funded



Rainier View Roadway Improvements (#25)

Projected Year: 2027

Location: Baker St to SR 169 (1st Ave. & 2nd Ave.)

Distance: .41 miles

Type of Improvement: Patch and overlay in the Rainier View Senior Housing Neighborhood

Estimated Cost: \$200,000

Fund Source: CDBG Grant; Developer Mitigation; Local City Funds



SE 288th Street Sidewalk, Ph. I (#26)

Projected Year: 2027

Location: SE 288th St. from 216th Ave. SE to 224th Ave. SE

Distance: 0.49 miles

Type of Improvement: New concrete sidewalk on the south side of the road.

Estimated Cost: \$1,550,000

Fund Source: Local City Funds



Lawson Street & SR 169 Intersection Improvements (#27)

Projected Year: 2028

Location: Intersection of Lawson St. & SR 169

Distance: N/A

Type of Improvement: New signal to facilitate turning movements and pedestrian crossing.

Estimated Cost: \$1,000,000

Fund Source: Developer Mitigation



Baker Street & SR 169 Intersection Improvements (#28)

Projected Year: 2027

Location: Intersection of Baker St. & SR 169

Distance: N/A

Type of Improvement: New signal and turn lane(s) to facilitate turning movements and pedestrian crossing

Estimated Cost: \$700,000

Fund Source: Developer Mitigation



Lawson Connector/Lawson Parkway (#29)

Projected Year: 2028

Location: SR 169 to Lawson St.

Type of Improvement: New 36' wide minor arterial connection to SR 169 with pedestrian facilities, bike lanes, and street lighting.

Estimated Cost: \$10,000,000

Fund Source: Developer Funded



Lawson Street/Botts Drive Intersection Improvements (#30)

Projected Year: 2028

Location: Intersection of Lawson St. & Botts Dr.

Type of Improvement: Intersection controls for new intersection, including stop controls.

Estimated Cost: \$500,000

Fund Source: Grant Funds/Developer Mitigation



216th Avenue SE Pedestrian Improvements (#31)

Projected Year: 2028

Location: SE 288th St. to SE 292nd St.

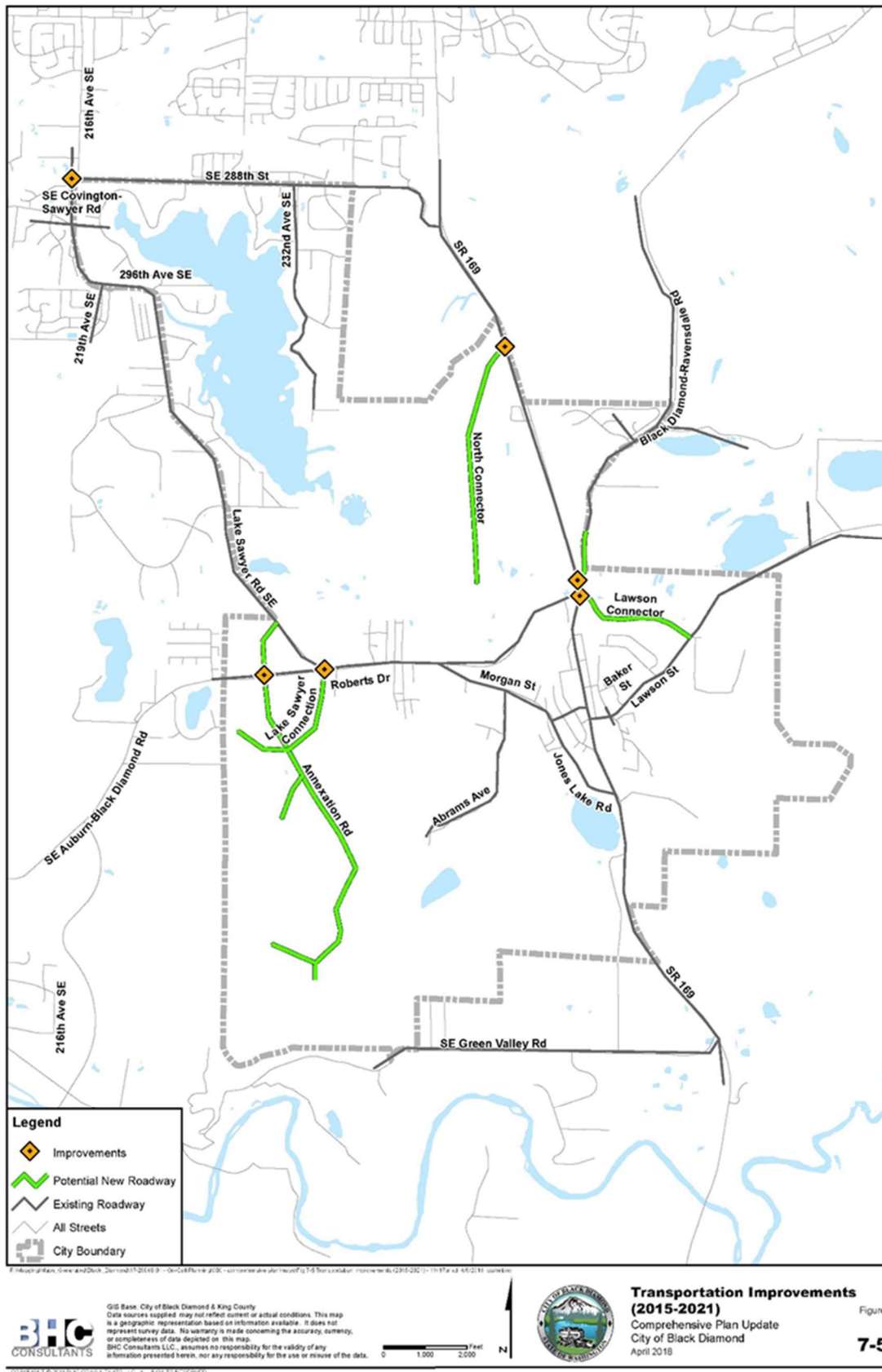
Distance: 0.20 miles

Type of Improvement: Sidewalk, curb, gutter, stormwater, and striping to designate pedestrian facilities and preserve parking at businesses.

Estimated Cost: \$750,000

Fund Source: Local City Funds, TIB Grant





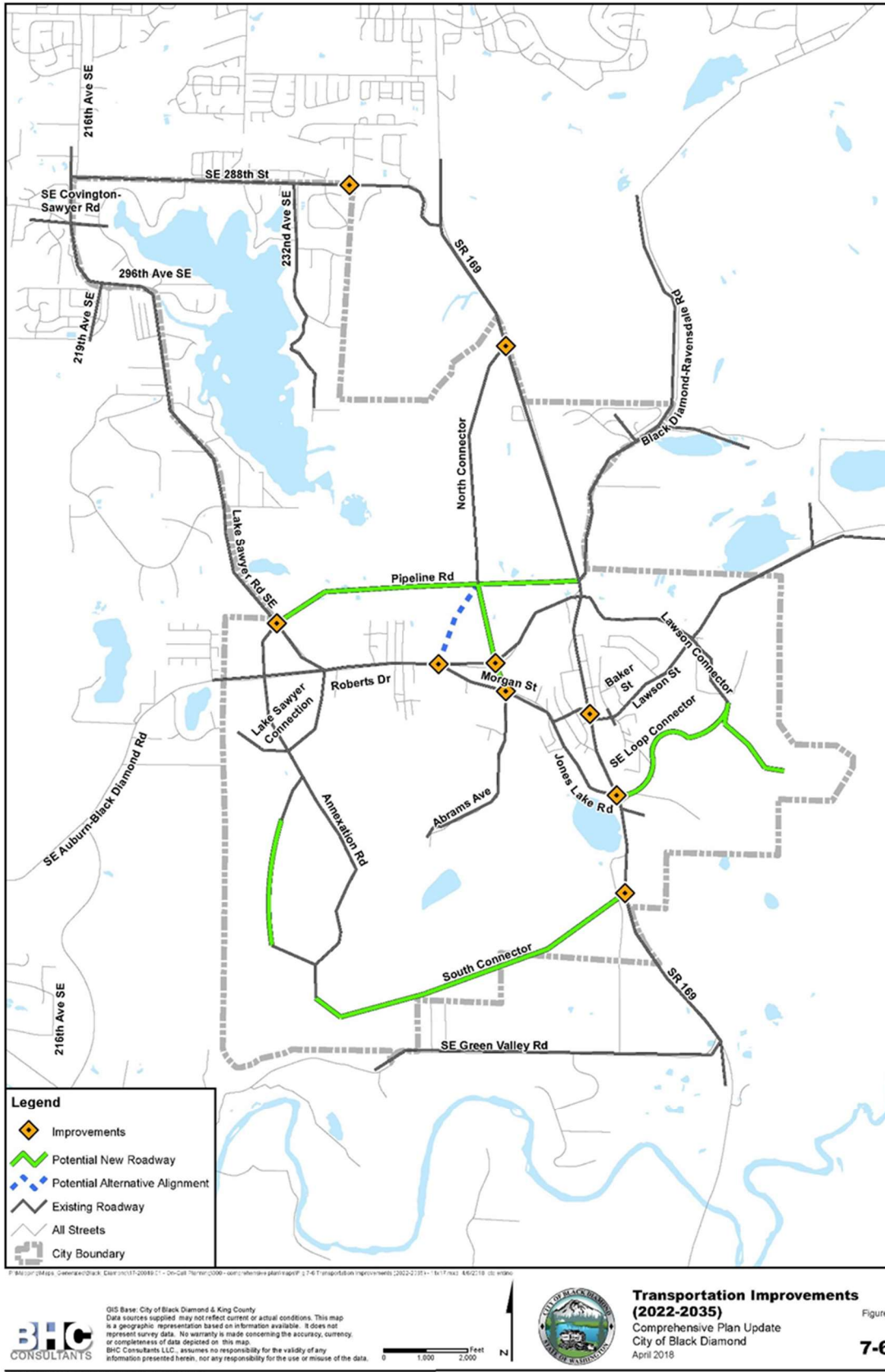
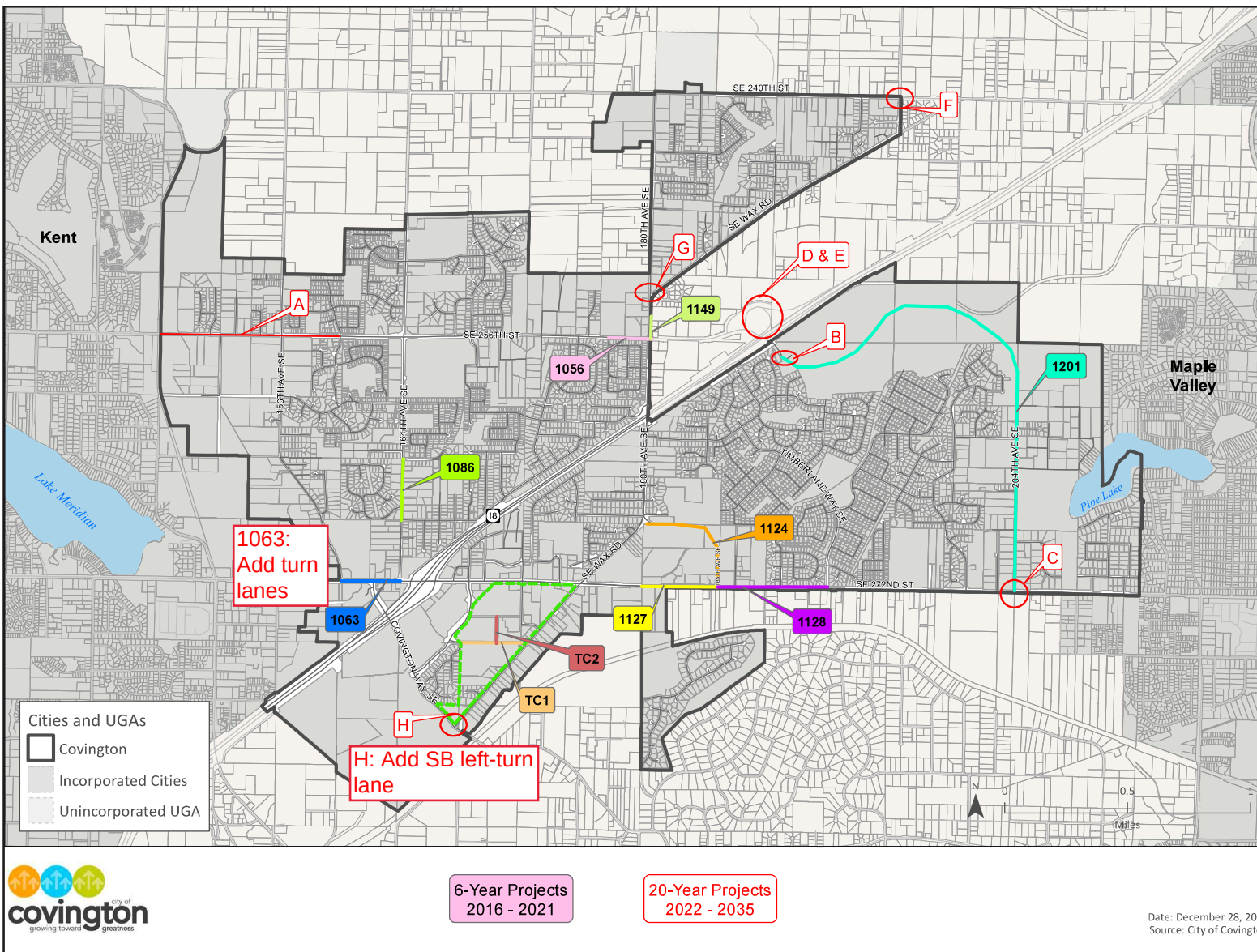


Exhibit T-10. Six and 20-Year Street Improvement Projects



**City of Maple Valley
6 Year
Transportation Improvement Program
2022 – 2027**





Project: T-23 Annual Asphalt Overlay Program

Beginning Termini: City Wide

Ending Termini:

Project Length: Varies

TIP Ranking: 1

Potential Funding Sources:

City: \$ 300,000 (Annual)

Other:

Est Project Timeline:

PE:

ROW:

CONS: 2022-2027

Existing Conditions:

Traffic Count: Varies

No. of Lanes Varies

Lane Widths: 10-12 feet

Sidewalk: Varies

Sidewalk Width:

Bike Lanes: Varies

Shoulder Widths:

Basis for Project: This project provides annual funding for the City's pavement management program. Based on an annual review of the condition of the City's roadways, a road segment or segments are selected for repair or overlay to maintain the integrity of the City's street system. In 2012, the City adopted a Transportation Benefit District (TBD) to fund various transportation improvements; funded by a \$20 vehicle license fee. The City started collecting the fee mid 2013 monthly with a distribution from the State of Washington. The annual collection amounts are typically \$400,000.

For 2022-2023, the overlay program is planned for streets in the Forest At Springhaven neighborhood.

For 2024-2027, the overlay program is planned for streets in Cedar Down neighborhood.



Project: T-24 Miscellaneous Street Improvements

Beginning Termini: City Wide

Ending Termini:

Project Length: Varies

TIP Ranking: 2

Potential Funding Sources:

City: \$200,000 (2022)
 \$100,000 (23-27 Annual)
 Grant:

Est Project Timeline:

PE:
 ROW:
 CONS: 2022-2027

Existing Conditions:

Traffic Count: Varies
 No. of Lanes Varies
 Lane Widths: 10-12 feet
 Sidewalk: Varies
 Sidewalk Width:
 Bike Lanes: Varies
 Shoulder Widths:

Basis for Project: This project provides annual funding for small projects. The focus of the project for the last few years has been neighborhood traffic enhancements, intersection improvements, school zone safety enhancements. The program, based on an annual review of near-term needs and opportunities, may fund improvements to sidewalks, street connections, crosswalk flashing beacons, and minor reconstruction. Given the limited funding available, priority will be given to improvement projects that are supported through partnerships or where the investment can be combined with other City projects.

The City has been actively applied for WSDOT funding to implement projects identified in the Local Roads Safety Plan. Funding to construct these projects is identified every other year based on grant awards.

The City applied and was successfully awarded 2020 Highway Safety Improvement Program grant for \$484,200 for the High Reflectivity Roadway Delineation Project, identifies as T27d project in the TIP.



Project: T-27 Non-Motorized Plan Implementation

Beginning Termini: City Wide

Ending Termini:

Project Length: Varies

TIP Ranking: 3

Potential Funding Sources:

City: \$100,000 (Annual)

Other:

Est Project Timeline:

PE:

ROW:

CONS: 2022-2027

Existing Conditions:

Traffic Count: Varies

No. of Lanes Varies

Lane Widths: 10-12 feet

Sidewalk: Varies

Sidewalk Width:

Bike Lanes: Varies

Shoulder Widths:

Basis for Project: This line item provides funding to implement the projects identified in the non-motorized transportation plan adopted in 2012. Projects include improvements to short sections of sidewalks, trails, bikeways, and wayfinding signage. Funds may also be used as the local match for grants.

The City continues to apply for WSDOT funding to implement non-motorized projects identified in the Local Roads Safety Plan, T27a, T27b, and T27c.



Project: T-28b Witte Road Improvements – Phase 3 South Corridor -254th Roundabout

Beginning Termini: SE 256th Street

Ending Termini: North of 254th Pl

Project Length: 1000 feet

TIP Ranking: 4

Potential Funding Sources:

City: \$ 700K
Grants: \$ 4.61M
Other: \$175K

Est Project Timeline:

PE: 2020-2021
ROW: 2021-2022
CONS: 2022

Existing Conditions:

Traffic Count: 14,700 ADT
No. of Lanes: 2
Lane Widths: 11 feet
Sidewalk: None
Sidewalk Width:
Bike Lanes: None
Shoulder Widths: 2 feet

3 Yr Collision History:

Property: 2
Injuries: 5
Fatalities: 0

Basis for Project: Extending improvements on Witte Road south of the 248th roundabout, Phase 3 project rehabilitates the road surface and adds pedestrian and bicycle facilities to the corridor serving the neighborhoods north of Pipe Lake and Lake Lucerne. Improvements include roadway widening to provide sidewalks on west side and bike lanes for both directions to a complete streets level of service. The Witte Rd Phase 3 South corridor project includes a roundabout at the intersection of SE 254th Pl, intersection improvements at 256th intersection, and installation of fish passage culvert at 254th.

Undergrounding of overhead utilities and relocated watermain was completed in Phase 2 in 2020, and Phase 3 North Corridor Improvement project will be completed in 2021.

Project Budget

Design:	\$0 (Completed in 2021)
ROW Acquisition	\$100K
Construction Management	\$673K
Construction	\$4.712M
TOTAL PROJECT COST:	\$5.485M



Project: T-48 SE 231st Street Extension

Beginning Termini: East end of SE 231st St

Ending Termini: North of 228th PI SE

Project Length: 700 feet

TIP Ranking: 5

Potential Funding Sources:

City: \$ 200K

Developer:

Grants: \$ 1.8M

Est Project Timeline:

PE: 2021

ROW: 2021

CONS: 2022

Existing Conditions:

Traffic Count: N/A

No. of Lanes: N/A

Lane Widths: N/A

Sidewalk: N/A

Sidewalk Width: N/A

Bike Lanes: N/A

Shoulder Widths: N/A

3 Yr Collision History:

Property: N/A

Injuries: N/A

Fatalities: N/A

Basis for Project: This project completes an urban collector arterial connection through the former Hayes Gravel pit, slated for development of Amazon fulfillment center, providing a direct access to the SR 18 interchange. This arterial connection will provide one lane in each direction with a center lane in the industrial area, include sidewalk and bicycle lanes, and street lighting.

The Amazon Fulfillment Center is currently under construction and will construct the new segment of 231st along development frontage. The City will be completing the gap segment from east end of 231st St to 228th PI SE.

This project will also evaluate the feasibility of providing an option for future project to provide for nonnotarized connection to Cedar River Pipeline Trail from the new 231st Street.

Project Budget

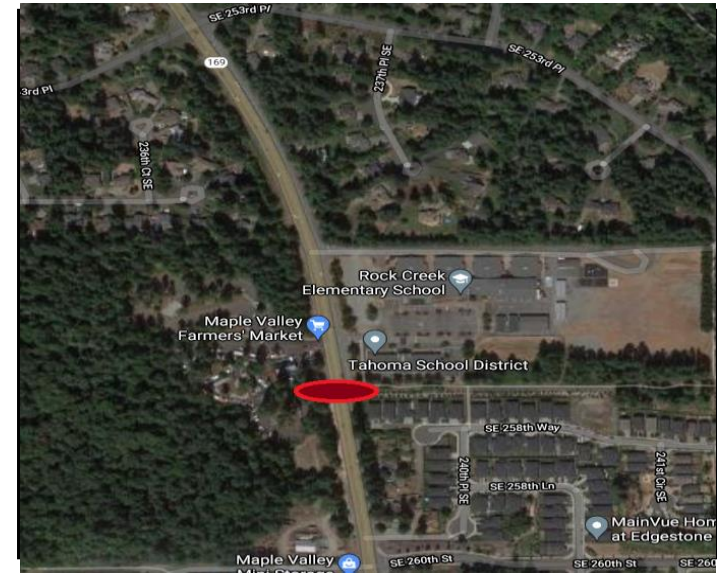
Design: \$250K (2021)

ROW Acquisition \$600K (2021)

Construction Management \$250K

Construction \$1.750M

TOTAL PROJECT COST: \$2.850M



Project: T-57 SR 169 Pedestrian Bridge

Beginning Termini: Rock Creek Elementary School

Ending Termini: Legacy Site

Project Length: 290 ft

TIP Ranking: 6

Potential Funding Sources:

City: \$0 M
Grants: \$7.6 M

Est Project Timeline:

PE: 2022
ROW: N/A
CONS: 2023

Existing Conditions:

Traffic Count: 21,000 ADT
No. of Lanes: 2-3
Lane Widths: 12 feet
Sidewalk: None
Sidewalk Width:
Bike Lanes: None
Shoulder Widths: 4-8 feet

3 Yr Collision History:

Property: 7
Injuries: 3
Fatalities: 2

Basis for Project:

The T-57 project includes the design and construction of a pedestrian bridge on SR 169 in the vicinity of SE 258th Street. SR 169, a classified State Highway of Significance, has developed from a rural highway to a freight and commuter highway, serving 21,000 vehicles per day. The pedestrian bridge would be designed to connect communities east and west of SR 169. It would serve as a gateway into the City's future downtown development and Legacy Site public amenities, the King County Regional Cedar to Green River Trail, and the Maple Valley Farmers' Market. It would connect parking lots on the Legacy Site and Rock Creek Elementary School as well as reduce the SR 169 traffic flow during event days by encouraging non-motorized access from adjacent neighborhoods.

Project Budget

Design	\$1.02M
ROW Acquisition	
Construction Management	\$ 760K
Construction	\$ 5.84M
TOTAL PROJECT COST:	\$ 7.62M



Project: T-45 SR 169 Widening- 4

Beginning Termini: SE 253rd Place

Ending Termini: SE 260th Street

Project Length: 2300 feet

TIP Ranking: 7

Potential Funding Sources:

City: \$1.8M

Grants: \$9.9M -TIB/CERB

Est Project Timeline:

PE: 2021-2022

ROW: 2022

CONS: 2023-2024

Existing Conditions:

Traffic Count: 21,000 ADT

No. of Lanes	2-3
--------------	-----

Lane Widths: 12 feet

Sidewalk: None

Sidewalk Width:

Bike Lanes: None

Shoulder Widths: 4-8 feet

3 Yr Collision History:

Property: 7

Injuries: 3

Fatalities: 2

Basis for Project: This SR 169 corridor project will improve traffic operation, safety, access management, and non-motorized amenities in the vicinity of the Legacy Site between SE 260th Street and SE 253rd Place. Proposed improvements include widening SR 169, sidewalks and bicycle lanes on both sides of the highway, street lighting, surface water enhancements, and intersection improvements at SR 169/SE 260th St and SR 169/SE 253rd Place. Access improvements at Rock Creek Elementary school and the Legacy Site will also be evaluated.

Project Budget

Design: \$900K

ROW Acquisition	\$100K
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Construction Management \$1.375M

Construction	\$9.635M
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TOTAL PROJECT COST:	\$12M
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Project: T-36 SR 169 Widening - 2

Beginning Termini: SE 240th Street

Ending Termini: SE 244th Street

Project Length: 2700 feet

TIP Ranking: 8

Potential Funding Sources:

City \$1.885M
Grants: \$9.540M -TIB

Est Project Timeline:

PE: 2022
ROW: 2023
CONS: 2025-2026

Existing Conditions:

Traffic Count: 24,000 ADT
No. of Lanes 3+
Lane Widths: 12 feet
Sidewalk: One side Partial
Sidewalk Width: 5 feet
Bike Lanes: None
Shoulder Widths: 4 feet +

3 Yr Collision History:

Property: 18
Injuries: 3
Fatalities: 0

Basis for Project: The second segment in the series of capacity improvements on the SR 169 corridor; this project adds an additional lane in both directions to include center turn lanes, sidewalks, bicycle lanes, improved transit stops, street lighting, and enhanced storm drainage. This eliminates a bottleneck for traffic traveling to and from SR 18 and Wilderness Village shopping area.

Project Budget

Design:	\$800K
ROW Acquisition	\$125K
Construction Management	\$1.325M
Construction	\$9.275M
TOTAL PROJECT COST:	\$11.525M



Project: T-33c SE 283rd Street Gap Improvement

Beginning Termini: 228th Avenue SE

Ending Termini: 350 feet west of 228th Avenue

Project Length: 350 feet

TIP Ranking: 9

Potential Funding Sources:

City: \$ 100K

Est Project Timeline:

PE:

ROW: 2021

CONS: 2023

Existing Conditions:

Traffic Count: > 1,000 ADT

No. of Lanes 2

Lane Widths: 10 feet

Sidewalk: None

Sidewalk Width:

Bike Lanes: None

Shoulder Widths: None

3 Yr Collision History:

Property: 0

Injuries: 0

Fatalities:0

Basis for Project: The southern portion of right of way (ROW) on this section of SE 283rd is in private ownership and was not completed as part of past development. It is a gap in the full width street section. Potential development on north side will be required to install frontage and roadway improvements on this section of 283rd. The City is acquiring the existing 30 ft easement for public usage after development frontage improvements are completed, and complete the remaining improvements for roadway connection.

Project Budget

Design:

ROW Acquisition	\$150K (2021)
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Construction	\$100K
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TOTAL PROJECT COST: \$250K



Project: T-27d High Reflectivity Roadway Delineation Project

Beginning Termini: Various

Ending Termini:

Project Length: Varies

TIP Ranking: 10

Potential Funding Sources:

City: \$50,800

Grant: \$484,200 (HSIP)

Est Project Timeline:

PE: 2021

ROW:

CONS: 2021-2022

Existing Conditions:

Traffic Count: Varies

No. of Lanes: Varies

Lane Widths: 10-12 feet

Sidewalk: Varies

Sidewalk Width:

Bike Lanes: Varies

Shoulder Widths:

Basis for Project: This line item provides funding to implement the projects identified in the Local Roads Safety Plan. Projects receiving state funds must be included in the local TIP.

This project provides For installation of high reflectivity pavement marking and signage in areas without streetlights where fixed objects are present and could present a future risk of crashes. Work elements include:

- Install 8" profiled retroreflective edge striping on both sides of the street, replacing existing striping, if present.
- Install reflective raised pavement markers at utility poles and large trees. Install RPMs on center medians and roundabout/traffic circle curbing at the top of curb.
- Install MUTCD Type OM2 reflective signage on utility poles and large trees
- Install reflective signpost wraps on existing stop signs, speed limit signs and warning signs.

The City applied for 2020 Highway Safety Improvement Program (HSIP) for this project and was successfully awarded \$484,200. The City will start design in 2021 and plan for construction in 2021 and 2022.



Project: T-53 SR 516 Multi-Modal Improvements - 1
(south side)

Beginning Termini: Witte Road

Ending Termini: 228th Avenue SE

Project Length: 1300 feet

TIP Ranking: 11

Potential Funding Sources:

City: \$ 1.467M

Grants: \$

Est Project Timeline:

PE: 2025

ROW:

CONS: 2027

Existing Conditions:

Traffic Count: 19,500 ADT

No. of Lanes 2-3

Lane Widths: 12 feet

Sidewalk: One side

Sidewalk Width: 5 feet

Bike Lanes:

Shoulder Widths: 3-10 feet

3 Yr Collision History:

Property: 0

Injuries: 0

Fatalities: 0

Basis for Project: This project completes a gap in the sidewalk on the south side of Kent-Kangley Road (SR 516) between Witte Road and 228th Ave SE. This project, coupled with a phase 2 multi-modal project, will provide continuous sidewalk facilities, both sides, on SR 516 from Witte Road to SR 169 and the east City Limits.

Project Budget

Design: \$250K

ROW

Construction \$1.217M

TOTAL PROJECT COST: \$1.467M



Project: T-54 SR 516 Multi-Modal Improvements - 2

Beginning Termini: 850 feet East of 228th Avenue SE

Ending Termini: 238th Ave SE/236th Place SE

Project Length: 3000

TIP Ranking: 12

Potential Funding Sources:

City: \$2.143M

Grants: \$

Est Project Timeline:

PE: 2026

ROW:

CONS: 2027

Existing Conditions:

Traffic Count: 18,800 ADT

No. of Lanes 2-3

Lane Widths: 12 feet

Sidewalk: None

Sidewalk Width:

Bike Lanes: none

Shoulder Widths: 3-5 feet

3 Yr Collision History:

Property: 4

Injuries: 1

Fatalities: 0

(No Ped collisions)

Basis for Project: A significant gap in the sidewalk alignment exists on both sides of the road (5,850 feet of sidewalk length). Since the recreational amenities provided by the high school, and now Summit Park, were constructed, pedestrian activity on these marginally improved shoulders has increased. This project would complete the gap in bicycle and pedestrian facilities in this corridor. Pedestrian crossing facilities are not included at this time.

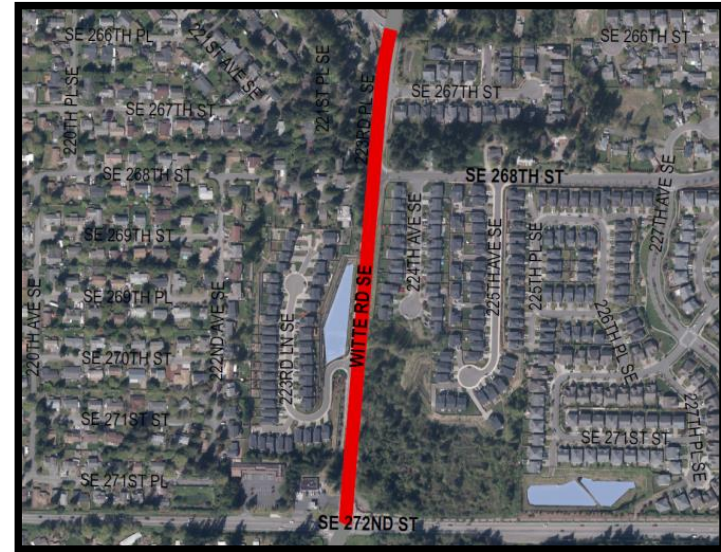
Project Budget

Design: \$400K

ROW

Construction \$1.743M

TOTAL PROJECT COST: \$2.143M



Project: T-28c Witte Road Improvements - 5

Beginning Termini: 222nd Avenue SE

Ending Termini: SR 516 (Kent-Kangley Road)

Project Length: 1870 feet

TIP Ranking: 13

Potential Funding Sources:

City: \$600K

Grants:

Est Project Timeline:

PE: 2027

ROW:

CONS: TBD

Existing Conditions:

Traffic Count: 12,000 ADT

No. of Lanes 2-3

Lane Widths: 12 feet

Sidewalk: Partial – One side

Sidewalk Width: 5 feet

Bike Lanes: None

Shoulder Widths:3-8 feet

3 Yr Collision History:

Property: 6

Injuries: 2

Fatalities: 0

Basis for Project: This improvement to the southern portion of the Witte Road corridor between SR 169 and SR 516 serves several large neighborhood access points. Project will improve sight distance, add sidewalks and bicycle lanes, enhanced stormwater facilities, and provide improved channelization to SR 516.

Project Budget

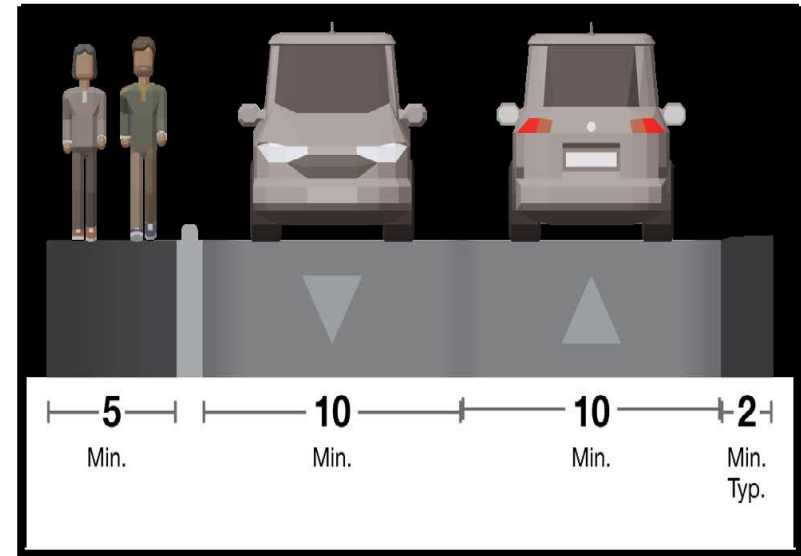
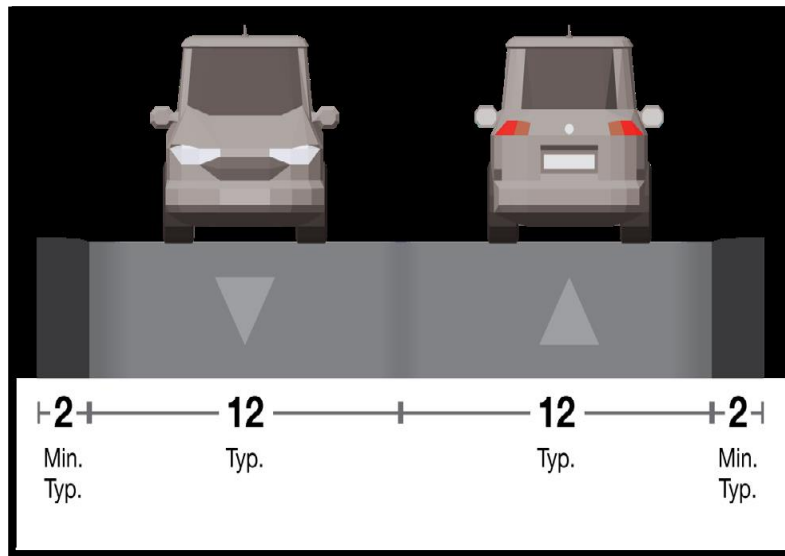
Design: \$600K

ROW Acquisition **\$100K**

Construction Management \$500K

Construction **\$5M**

TOTAL PROJECT COST: \$6.2M



Project: T-27a Curbed Walkway Improvements

Beginning Termini: Various, see TIP Location Map

Ending Termini:

Project Length: Varies

TIP Ranking: 15

Potential Funding Sources:

City: \$115K

Grant: \$450K

Est Project Timeline:

PE: 2022

ROW:

CONS: 2022-2027

Existing Conditions:

Traffic Count: Varies

No. of Lanes: Varies

Lane Widths: 10-12 feet

Sidewalk: Varies

Sidewalk Width:

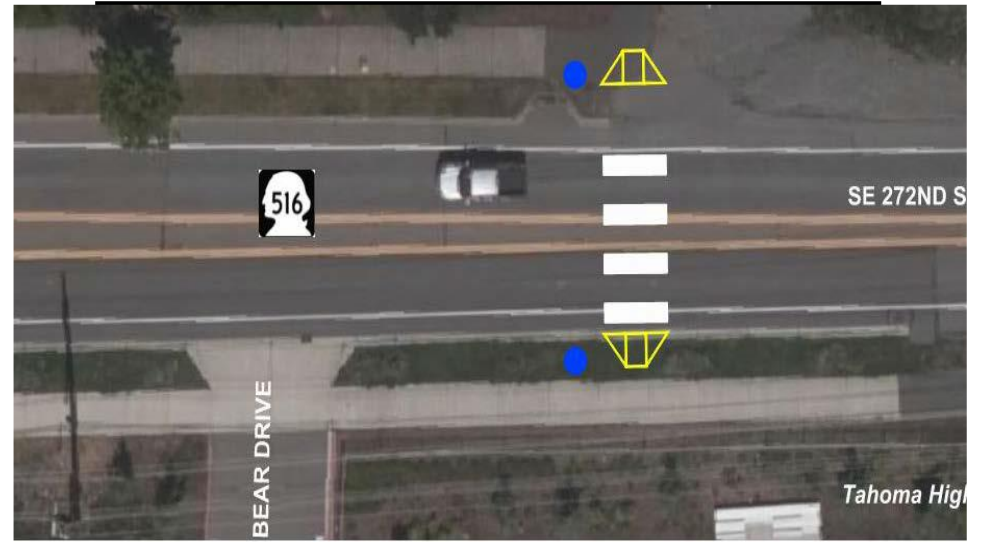
Bike Lanes: Varies

Shoulder Widths:

Basis for Project: This line item provides funding to implement the projects identified in the Local Roads Safety Plan. Projects receiving state funds must be included in the local TIP.

To bridge gaps between existing pedestrian facilities and limit the locations where pedestrians must use the roadway, asphalt pathways will be constructed within the existing right of way. In some of these locations, an existing wide roadway shoulder will be repurposed as the walkway, narrowing vehicle lanes, with concrete curbing, painted white and enhanced with vertical markers for visibility, will provide a physical barrier between the walkway and travel lanes. Some locations may require widening of the shoulder or paving of currently unpaved paths to provide the pedestrian connection. This project provides for separated walkways in various locations in the City.

Design and construction would be completed as grant funding becomes available.



Project: T-27b Crossing Enhancements

Beginning Termini: Various, see TIP Location Map

Ending Termini:

Project Length: Varies

TIP Ranking: 16

Potential Funding Sources:

City: \$53,000

Grant: \$402,000

Est Project Timeline:

PE:

ROW:

CONS: 2024-2027

Existing Conditions:

Traffic Count: Varies

No. of Lanes: Varies

Lane Widths: 10-12 feet

Sidewalk: Varies

Sidewalk Width:

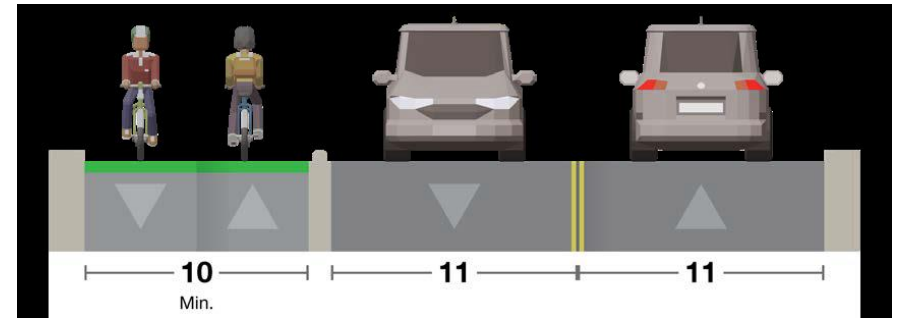
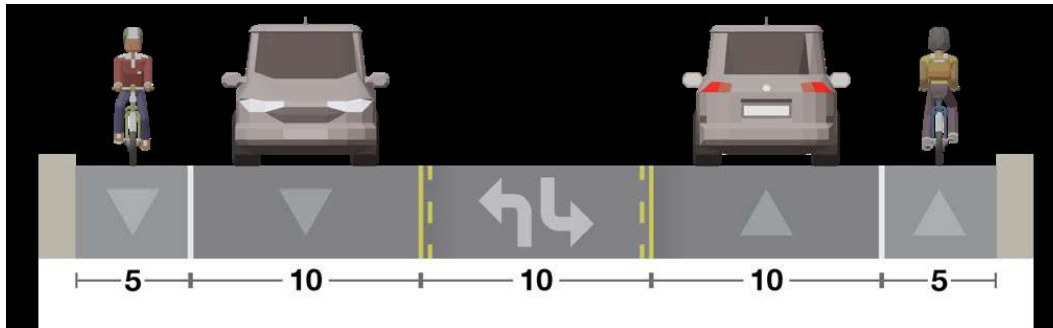
Bike Lanes: Varies

Shoulder Widths:

Basis for Project: This line item provides funding to implement the projects identified in the Local Roads Safety Plan. Projects receiving state funds must be included in the local TIP. This project provides for crossing enhancements in various locations in the City.

The project improves several crossings in the southern part of the City, including some identified in the 2013 Non-motorized Transportation Plan. The crossing enhancements create pedestrian network connections and help to limit the use of unprotected roadway facilities by pedestrians. The crossing improvements will include, as necessary, crosswalk markings, signage, curb ramp replacements and RRFBs.

Design and construction would be completed as grant funding becomes available.



Project: T-27c Cedar to Green River Trail Access

Beginning Termini: SE 264th Street

Ending Termini:

Project Length: Varies

TIP Ranking: 17

Potential Funding Sources:

City: \$26,000

Grant: \$196,000

Est Project Timeline:

PE:

ROW:

CONS: 2026-2027

Existing Conditions:

Traffic Count: Varies

No. of Lanes: Varies

Lane Widths: 10-12 feet

Sidewalk: Varies

Sidewalk Width:

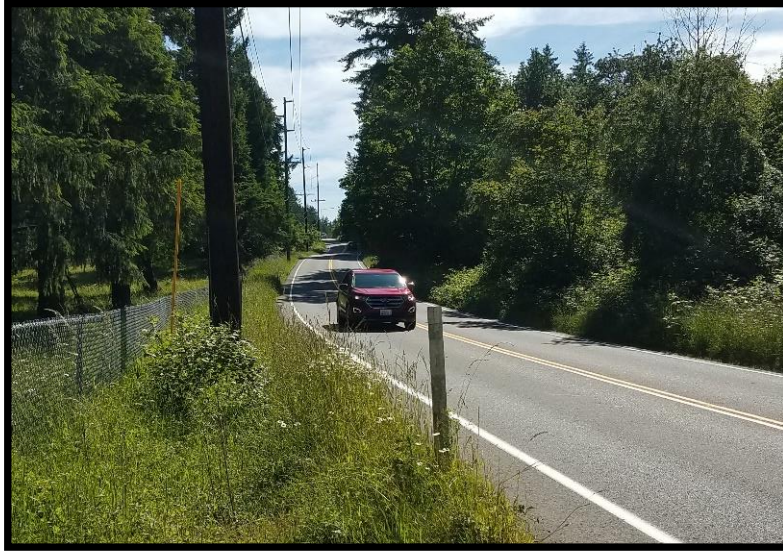
Bike Lanes: Varies

Shoulder Widths:

Basis for Project: This line item provides funding to implement the projects identified in the Local Roads Safety Plan. Projects receiving state funds must be included in the local TIP.

This project would extend existing bike lanes at the intersection of SE 264th Street and SR-169 to the intersection with 238th Ave SE. On the west side of 238th Ave SE, an RRFB protected crossing, marked for cyclists and pedestrians, would cross all active transportation traffic to the south side of the road. A crosswalk at the west side of the 238th Ave SE intersection will align with an access point for an under construction multifamily residential neighborhood north of SE 264th Street. From the crossing point, a two-way active transportation facility, separated by a physical barrier will provide bicycle and pedestrian connections to the trail access point, 400 feet west of 238th Ave SE.

Design and construction would be completed as grant funding becomes available.



Project: T-27e Wax Road Shoulder Widening and Utility Undergrounding

Beginning Termini: SE 237th Street

Ending Termini: City Limits

Project Length: 1,350 feet

TIP Ranking: 14

Potential Funding Sources:

City: \$ 125,000

Grants: \$ 495,000

Est Project Timeline:

PE: 2026

ROW: N/A

CONS: 2027

Existing Conditions:

Traffic Count: 25,900 ADT

No. of Lanes 2

Lane Widths: 11 feet

Sidewalk: None

Sidewalk Width:

Bike Lanes: None

Shoulder Widths: 2 feet

3 Yr Collision History:

Property: 1

Injuries: 1

Fatalities:

Basis for Project: Roadway shoulder significantly narrows from SE 237th street to the City Limits on both sides of the road and sight distance is limited. Pedestrians and bicyclists routinely traverse this section from the end of the City sidewalks to the widened paved shoulder at the City limits. Undergrounding utilities and widening paved shoulder to five feet on both sides will help provide a higher level of safety.

Item No	Description	Item Cost
1	Mobilization & Site Prep	\$34,000
2	Earthwork & Subgrade	\$185,000
3	Road way Surfacing	\$72,000
4	Sidewalk Elements	\$30,000
5	Storm Drainage	\$30,000
6	Bridge/Walls/Structures	\$0
7	Environmental Mitigation	\$0
8	Street Lights	\$0
9	Traffic Elements	\$35,000
10	Misc. Construction Elements	\$71,000
	Construction SUBTOTAL	\$457,000
	Contingency	\$68,000
	Construction Management	\$25,000
	Project SUBTOTAL	\$550,000
	Design Engineering	\$70,000
	ROW Acquisition	\$0
	Project Total Cost	\$620,000



Element 4

TRANSPORTATION

Support Analysis

114	SR 169 Widening (from SE 280th St to South City Limit) <i>Phase J</i>	Construct second SB lane on SR 169 from SE 280th St to south city limit. This will convert SB approach at SE 280th St intersection to through lane and through/right-turn shared lane. Provide curb, gutter, bike lane, and sidewalk on the west side.	\$3,210
115	SR 169 Intelligent Transportation System Implementation (SE 231st St to SE 280th St)	Upgrade signal controllers, install fiber, and ITS equipment along the SR 169 corridor between SE 231st St and SE 280th St. Equipment includes new controllers and closed circuit video cameras.	\$0 (funded by WSDOT)
SR 516 Improvements (SE Kent-Kangley Road)			
117	SR 516 (207th Ave SE to 216th Ave SE) <i>Phase B</i>	Construct second EB lane on SR 516 from west city limit to 216th Ave SE. Construct second WB lane on SR 516 from 1,000 ft east of 216th Ave SE to west city limit. Include curb, gutter, bike lanes, and sidewalks. Provide center left turn lane/pockets where warranted. Improve 216th Ave SE intersection.	\$4,320
118	SR 516 (218th Ave SE to 228th Ave SE) <i>Phase C</i>	Widen to 3 lanes. Install new curb, gutter, bike lane, and sidewalk on the south side for the entire length and the north side west of Witte Road. Construct center left turn lane/pockets, where warranted. Construct NB right-turn lane. Left-turn signal pockets and signal phasing provided at each approach.	\$4,860
119	SR 516 (228th Ave SE to 236th PI SE) <i>Phase D</i>	Widen to 3 lanes. Install new curb, gutter, bike lane, and sidewalk on both sides. Construct center left-turn lane/pockets, where warranted.	\$3,870
Local Arterial Improvements			
120	Witte Rd SE (SE 254th PI to SE 256th PI)	Construct 3 lane roadway (center median/turn lane) from north of SE 254th PI to the south of SE 256th PI. Close direct access from 220th Ave SE to Witte Rd. Realign SE 256th St for improved intersection angle. Install traffic signal at SE 254th PI/Witte Rd SE, when warranted.	\$1,520
121	Witte Rd/SE 268th St Intersection	Construct center turn/merge lane along with curb, gutter, and sidewalks.	\$480
122	216th Ave SE (SR 516 to South City Limit)	Widen to 3 lanes. Install new curb, gutter, bike lane, and sidewalk on both sides. Construct center left turn lane/pockets where warranted.	\$2,250
123	SE 240th St (Witte Rd to 224th Ave SE)	Widen to 3 lanes through frontage improvements on north side of street. Install new curb, gutter, bike lane and sidewalks. Construct center left turn lane.	\$1,940
124	Witte Rd SE (SR 169 to SE 240th St)	Reconstruct roadways to 3 lanes. Install new curb, gutter, bike lanes, street lights, and sidewalk on the east side. May include retaining wall to the west.	\$2,720
125	SE 276th St (SE 216th St to SR 516)	Reconstruct roadway. Install new curb, gutter, bike lanes, street lights, and sidewalks.	\$9,610



Element 4

TRANSPORTATION

Support Analysis

126	SE 231st St (SR 169 to Witte Rd) <i>Phase A</i>	Reconstruct roadway to 3 lanes (one NB lane, one SB lane, and center median/turn lane) between SR 169/SE 231st St intersection and SE Witte Rd. At SR 169 intersection: construct second WB through lane on east leg; WB approach would have left-turn lane, through lane, and through/right-turn shared lane. Provide curb, gutter, bike lanes, and sidewalks.	\$1,480
New Local Roadway Projects			
127	SE 231st St Connection (Witte Rd to SE 240th St) <i>Phase B</i>	Construct 3 lane roadway (one NB lane, one SB lane, and center median/turn lane) between SE Witte Road and SR 169/SE 240th Street intersection vicinity. Provide curb, gutter, bike lanes, and sidewalks.	\$10,140
128	SE 240th St Extension (Witte Rd to Wax Rd)	Construct 2/3 lane extension of SE 240th St between SE Wax Road and Witte Rd SE. Provide center left turn lane/pocket where left turns are likely. Install signal or roundabout at new SE Wax Rd intersection. Reconfigure Witte Rd SE intersection: On EB approach, add right-turn lane, through-lane, and left-turn lane. Provide left-turn pockets on all approaches. Provide curb, gutter, bike lanes, and sidewalks.	\$10,910
129	SE 264th St Extension (SE 242nd Ave to Summit-Landsburg Rd)	Construct 2 lane roadway with curb, gutter and sidewalks between 242nd Ave SE to SE Summit-Landsburg Rd to promote improved circulation in the Four Corners subarea.	\$2,880
130	SE 271st St Extension (SR 169 to 236th PI SE)	Construct new 3 lane road with curb, gutter, bike lanes, and sidewalks (one EB lane, one WB lane and center turn lane) on the new alignment between SE 271st PI/SR 169 intersection and 236th PI SE/SR 516 intersection. Future development would provide a connection between the Extension and the Summit Place development area. At 236th PI SE/SR 516 intersection, install traffic signal or roundabout and provide turn lanes.	\$6,420
131	240th Ave SE Connection (SE 277th PI to SE 279th St)	Connect 240th Ave SE together to provide a local access connection between SE 276th St and SE 280th St.	\$790
132	228th Ave SE Connection (SE 283rd St to SE 286th St)	Construct 2-lane roadway across the railroad corridor. Railroad crossing will be at-grade with signals. Provide curb, gutter, bike lanes, and sidewalks.	\$2,220
133	SE Kent-Kangley Rd/ 242nd Ave SE	Install traffic signal or roundabout to provide for improved operations and better local circulation.	\$470

1. Costs in \$1,000s of dollars (2011\$).

2. EB=eastbound; WB=westbound; NB=northbound; SB=southbound.

Figure 4.20 - Transportation Improvement Projects



Element 4

TRANSPORTATION

Support Analysis

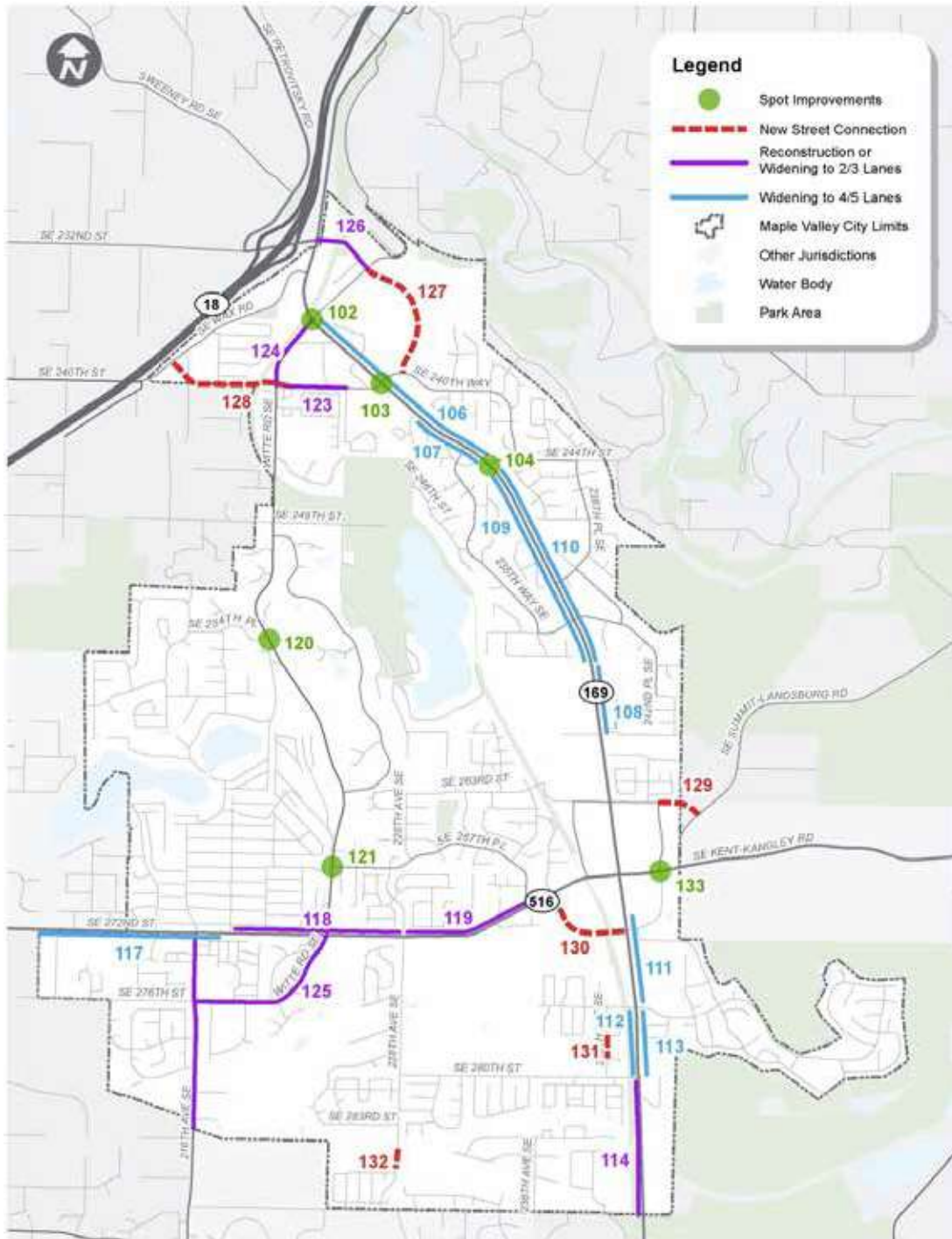


Figure 4.21 - Transportation Improvement Projects



TRANSPORTATION

Support Analysis

SR 169 Improvements (Maple Valley – Black Diamond Road SE)

SR 169 is a critical highway for the region and for each local community along the corridor. It is the primary route for Cities such as Maple Valley and Black Diamond. Improvements are needed within the City of Maple Valley to increase capacity, improve safety, enhance peak hour traffic operations, and to upgrade the facilities to urban design standards. The future analysis indicates that SR 169 should be widened to four or five lane cross-sections to accommodate the anticipated land use growth in the City and the surrounding communities. The improvements are consistent with the needs identified in WSDOT's SR 169 Route Development Plan completed in 2007. The widening will be accomplished in phases with separate projects listed along SR 169 in Figure 4.21 and shown in Figure 4.22. Since SR 169 is designated a Highway of Statewide Significance, implementation of the improvements will depend on funding by WSDOT or other outside sources as the City does not have the financial means to implement projects along this important regional highway.

Projects 102 through 104 focus on improving traffic operations at key intersections in the northern section of the City. Traffic volumes at these intersections are sensitive to major new roadway projects in the area, and the specific improvements will be confirmed based on results of a recommended Wilderness Village circulation and feasibility study that will need to be conducted at the outset of any of these new roadway improvements. Intersection improvements at SR 169/SE 260th Street (added traffic signal) are included as Project 108.

Projects 106 through 113 reflect widening only along one side of the highway at a time due to funding and timing constraints. Project 115 is intended to improve traffic signal operations, coordination, and management from SE 231st Street to SE 280th Street. WSDOT is leading and funding the signal and Intelligent Transportation System project. The widening projects would add curb, gutter, and sidewalk.

SR 516 Improvements (SE Kent-Kangley Road)

Anticipated future development in the southern areas of Maple Valley and in the City of Black Diamond will require additional capacity improvements along SR 516 between the west city limits and SR 169 to support forecast travel demand. A total of three projects have been identified Figure 4.20 and are shown in Figure 4.21. Implementation of the improvements will depend on funding by WSDOT or other outside sources as the City does not have the financial means to implement projects along this important regional highway.

West of 218th Avenue SE, SR 516 would be widened to five lanes (Project 117). This includes providing additional lanes to the SR 516/216th Avenue SE intersection. It was assumed that SR 516 would be widened to five lanes through the City of Covington before five lanes are needed in this section of Maple Valley. The City should evaluate interim improvement options along the segment of SR 516 between 216th Avenue SE and 218th Avenue SE to address existing safety and operational issues related to access into and out of the Cherokee Bay neighborhood.

East of 218th Avenue SE, SR 516 would be widened to three lanes (Projects 118 and 119). With additional local circulation roadways within the southern parts of the City, this section of SR 516 operated acceptably at three lanes. However, improvements to intersection of SR 516 and Witte



TRANSPORTATION

Support Analysis

Road SE would be needed (See Project 118). The SE 271st Street Extension (Project 130) plays a key role in reducing traffic volumes along SR 516.

Local Arterial Improvements

This category of projects includes capacity, safety, and road standard improvements along other City arterials and streets. A total of seven projects have been identified along City roadways and are listed in Figure 4.21 and shown in Figure 4.22.

Projects 120 and 121 would better manage access between Witte Road SE and side streets. This would improve safety in the area, and improve capacity along Witte Road SE. The addition of traffic signals would likely not be warranted due to lower side street volumes.

Projects 122 and 123 would widen roadways to three lanes reflecting their transition from rural to urban arterials. The widening projects would add curb, gutter, and sidewalk.

Street preservation and rehabilitation projects along Witte Road, Projects 124 and 125, would add curb, gutter, and sidewalk. SE 231st Street would also be upgraded to a three lane roadway between SR 169 and Witte Road as the roadway is extended south to SE 240th Street (Project 126).

New Local Roadway Projects

Seven new arterial roadways were identified to support future development within the City. The SE 231st Street Connection (Project 127) is a new roadway that will serve future commercial development east of SR 169 in the Wilderness Village Subarea. Another project will extend SE 240th Street west from Witte Road to Wax Road. The new SE 240th Street Extension (Project 128) is estimated to reduce delays along SR 169 within Wilderness Village and provide better access for vehicles headed to/from areas west of the City.

In order to improve circulation in the southern part of the City and the SR 169/SR 516 intersection in the Four Corners Subarea, the SE 271st Street Extension (Project 130) is to be built between SR 516 and SR 169. The new roadway, along with extension of SE 264th Street (Project 129) and a new signal or roundabout at SE Kent-Kangley Road/242nd Avenue SE (Project 133), will provide improved operations and better circulation within Four Corners and reduce the need to widen the SR 169/SR 516 intersection beyond the five lane cross-section. The SE 271st Street Extension allows SR 516 to remain at three lanes by providing an internal connection to the Summit Place area. Project 132 will allow City residents south of the railroad corridor to connect to the City of Maple Valley without using (and without contributing to) the congested corridors of SR 169 and 216th Avenue SE. To reduce construction costs, the crossing is anticipated to be at-grade with signals. However, approval of a new at-grade railroad crossing may be difficult.

Local Streets

Improvement to or construction of new local streets are not explicitly defined in the long-range plan and are assumed to be built through developer mitigation requirements or Local Improvement Districts (LIDs) based on community support. Local street system plans may be prepared as part of future neighborhood or subarea studies. For example, increased commercial and residential

Most King County offices will be closed on January 2 for New Year's Day. >



SE Kent-Kangley Intersection Improvement Project

Construction is underway and will continue through October



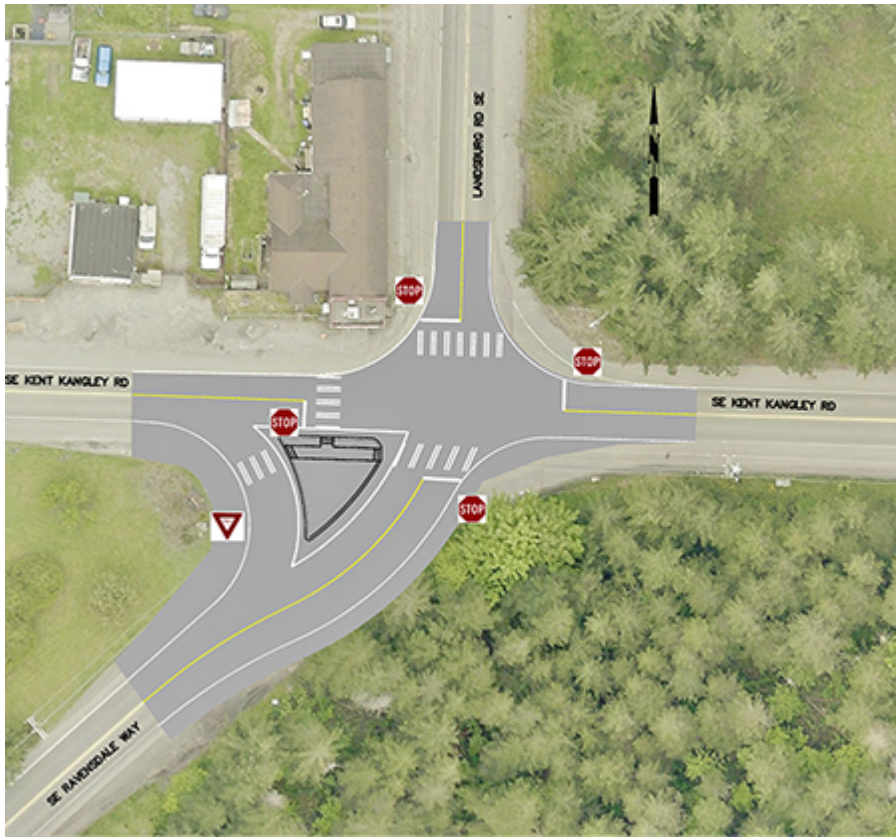
One of two stop signs with flashing, LED lights installed in spring 2021 to address safety concerns at SE Kent-Kangley Road and Landsburg Road SE/SE Ravensdale Way.

Status update

October 6, 2022

Crews continue to work to grind and pave the new right-turn "slip lane" through Friday, October 7. Flaggers will direct traffic through the work area.

Fall 2022 traffic safety improvements



Changes coming to SE Kent-Kangley Road/SE Ravensdale Way intersection in fall 2022. [Larger view](#)  [JPG 3MB](#)

- Installation of a right-turn "slip lane" for eastbound drivers on SE Kent-Kangley Road to turn south onto SE Ravensdale Way. A traffic island will help separate vehicles that are turning right from vehicles headed in the east direction.
- Realigning SE Ravensdale Way to give northbound vehicles an additional 9 feet to turn left onto westbound SE Kent-Kangley Road.
- Adding a new crosswalk and improving existing crosswalks. This will allow residents to park and safely access Ravensdale Park and other natural areas, the Ravensdale Market, etc.

These improvements will not affect the memorial for the Ravensdale Mine Explosion, nor will they affect access to the Ravensdale Market.

On this page

- [Status update](#)
- [Fall 2022 traffic safety improvements](#)
- [Overview](#)
- [What has King County done so far?](#)
- [Stop signs installed in spring 2021](#)

Contact us

Brent Champaco, Community Relations Planner

Desk 206-477-9094 📞

Email

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Overview

In fall 2022, King County will make additional temporary improvements to SE Kent-Kangley Road at the intersection of Landsburg Road SE/SE Ravensdale Way. These temporary improvements are intended to improve the turning ability of large vehicles on SE Kent-Kangley Road onto southbound SE Ravensdale Way, as well as for large vehicles traveling on SE Ravensdale Way turning west onto SE Kent-Kangley Road.

The fall 2022 improvements are scheduled nearly 1.5 years after King County turned this high-collision location into a four-way stop. This approach of making safety upgrades in stages is necessary until the county secures funding to install a permanent traffic calming

safety improvement, such as a roundabout or traffic signal, at this intersection.

What has King County done so far?

In 2019, our Road Services Division conducted a study to improve traffic flow and reduce the high number of collisions at this intersection. The study identified two options to improve safety at this high-traffic intersection - installation of a roundabout or a traffic signal.

The study revealed the cost estimates for the two options are significantly higher than anticipated. Due to budget constraints, the county cannot afford either of these long-term options (roundabout or traffic signal) at this time.

In spring 2021, Road Services added two new stop signs with flashing, LED lights as a temporary measure to address safety concerns. LED lights were not installed at the two existing stop signs at SE Ravensdale Way and Landsburg Road SE because our study indicated those signs are effective in getting drivers to stop at the intersection.

In fall 2022, we will add additional improvements including a "slip lane" to allow eastbound drivers on SE Kent-Kangley Road to turn south onto SE Ravensdale Way, a traffic island and a new crosswalk.

This approach of making safety upgrades in stages is necessary until the county secures funding to install a permanent traffic calming safety improvement, such as a roundabout or traffic signals, at this intersection.

Stop signs installed in spring 2021



SE Kent-Kangley Road at Landsburg Road SE/SE Ravensdale Way, westbound

[Larger view](#)  JPG 4MB



SE Kent-Kangley Road, eastbound, in front of the store
[Larger view](#)  JPG 4MB



SE Kent-Kangley Road, westbound
Larger view  JPG 2MB



Road Services Division

201 S Jackson Street
M/S: KSC-LS-0313
Seattle, WA 98104

Contact us



Email: Maint.roads@kingcounty.gov



24/7 Road Helpline: [206-477-8100](tel:206-477-8100) or [1-800-527-6237](tel:1-800-527-6237)



TTY Relay: 711



Twitter: [@KCRoads](https://twitter.com/KCRoads)

Last Updated October 6, 2022

Appendix E

Trip Generation Calculations



From: Transpogroup. 2021. Mid-Point Traffic Monitoring Report: Ten Trails and Lawson Hills Master Planned Developments: Phase 1A. Prepared for CCD Black Diamond Partners LLC, Kirkland, WA.

2022 PM Peak Hour Trip Generation – Phase 1A/1B/2 Summary

Land Use	Unit	Size	Gross Trips			Internal Trips			Pass-by Trips			Net New Trips		
			In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total
Ten Trails														
Single-Family Residential	DUs	993	580	340	920	0	0	0	0	0	0	580	340	920
Multi-Family Residential	DUs	302	78	50	128	0	0	0	0	0	0	78	50	128
Age-Qualified Residential	DUs	80	24	16	40	0	0	0	0	0	0	24	16	40
Elementary School	Students	0	0	0	0	0	0	0	0	0	0	0	0	0
Office	KSF	0	0	0	0	0	0	0	0	0	0	0	0	0
Retail	KSF	0	0	0	0	0	0	0	0	0	0	0	0	0
Total			682	406	1088	0	0	0	0	0	0	682	406	1088

2022 PM Peak Hour Trip Generation Calculations – Ten Trails (Phase 1A/2)

Weekday PM Peak Hour - Cumulative Phase 1A and 2					Gross Trips ¹				Internal Trips ²			Pass-By Trips ³				Net Trips ⁴		
Land Use	ITE LU ⁵	Size ⁶	Ave or Egn	Trip Rate ⁷	Total Trips	Inbound ⁸	In	Out	In	Out	Total	Rate	Total	In	Out	Total	In	Out
Single Family	210	918 DUs	Egn	0.93	853	63%	537	316	0	0	0	0%	0	0	0	853	537	316
Multifamily	221	237 DUs	Egn	0.43	101	61%	62	39	0	0	0	0%	0	0	0	101	62	39
Senior Adult Housing	251	80 DUs	Egn	0.50	40	61%	24	16	0	0	0	0%	0	0	0	40	24	16
Elementary School	520	Students	Ave	0.17	0	48%	0	0	0	0	0	0%	0	0	0	0	0	0
Office	710	SF	Egn	0.00	0	16%	0	0	0	0	0	0%	0	0	0	0	0	0
Retail	820	SF	Egn	0.00	0	48%	0	0	0	0	0	20%	0	0	0	0	0	0
Total					994		623	371	0	0	0		0	0	0	994	623	371

2022 PM Peak Hour Trip Generation Calculations – Ten Trails (Phase 1B)

Weekday PM Peak Hour - Phase 1B					Gross Trips ¹				Internal Trips ²			Pass-By Trips ³				Net Trips ⁴		
Land Use	ITE LU ⁵	Size ⁶			Total Trips	Inbound ⁸	In	Out	In	Out	Total	Rate	Total	In	Out	Total	In	Out
Single Family	210	75 DUs			67	63%	42	25	0	0	0	0%	0	0	0	67	42	25
Multifamily	221	65 DUs			27	61%	16	11	0	0	0	0%	0	0	0	27	16	11
Senior Adult Housing	251	DUs			0	61%	0	0	0	0	0	0%	0	0	0	0	0	0
Elementary School	520	Students			0	48%	0	0	0	0	0	0%	0	0	0	0	0	0
Office	710	SF			0	16%	0	0	0	0	0	0%	0	0	0	0	0	0
Retail	820	SF			0	48%	0	0	0	0	0	20%	0	0	0	0	0	0
Total					94		58	36	0	0	0		0	0	0	94	58	36

Year 2022 PM Peak Hour Trips - Rates Based on ITE 11th edition

Phase 1A

Land Use	ITE LU	Size	Avg or Equ	Trip Rate	Total Trips	In	Out
Singe Fam	210	463	Equ	0.91	420	265	155
Multifamil	221	237	Equ	0.39	93	57	36
					513	321	192

1) ITE Trip Generation 11th edition

Phase 2

Land Use	ITE LU	Size	Avg or Equ	Trip Rate	Total Trips	In	Out
Singe Family	210	455	Equ	0.91	413	260	153
Multifamily	221	0	Equ	0.00	0	0	0
Senior Adult Housing	251	80	Equ	0.46	37	23	14
					450	283	167

Phase 1A/2

Land Use	ITE LU	Size	Avg or Equ	Trip Rate	Total Trips	In	Out
Singe Family	210	918	Equ	0.87	799	503	296
Multifamily	221	237	Equ	0.39	93	57	36
Senior Adult Housing	251	80	Equ	0.46	37	23	14
					929	583	346

Phase 1B

Land Use	ITE LU	Size	Avg or Equ	Trip Rate	Total Trips	In	Out
Singe Fam	210	75	Equ	1.01	76	48	28
Multifamil	221	65	Equ	0.40	26	16	10
					102	64	38

TOTAL TRIPS in 2022		
Total	In	Out
1031	646	385

Year 2032

Weekday PM Peak	Ten Trail Phase 1B					Gross Trips ²				Internal Trips ³			Pass-By Trips ⁴				Net New Trips ⁵		
Land Use	ITE LU	Size	Units	Avg or Eqn ¹	Trip Rate	Total Trips	% Inbound	In	Out	Total	In	Out	Rate	Total	In	Out	Total	In	Out
Single Family	210	150	units	eqn	0.97	145	63%	91	54	51	33	19	0%	0	0	0	94	59	35
Senior Adult Housing	251	0	units	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Multifamily	221	125	units	eqn	0.39	49	61%	30	19	43	27	15	0%	0	0	0	6	3	4
Elementary School	520	0	students	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Office	710	143	ksf	eqn	1.56	223	17%	38	185	49	12	37	0%	0	0	0	174	26	148
Retail	820	180	ksf	eqn	4.79	862	48%	414	448	129	64	65	19%	164	82	82	569	268	301
						1279		573	706	272	136	136		164	82	82	843	355	488

1) Regression equations used, consistent with approach used in the TTR

2) Total vehicle trips based on rates/equations from ITE Trip Generation Manual (11th edition)

3) Trips that would remain internal to the project site and would not use external roads, based on rates from Trip Generation Handbook and NCHRP report 685

4) Trips already on the adjacent street system that make a stop at the project site before continuing to final destination; rate based on ITE Trip Generation Manual (2021 rates); included as turning movements at project access points

5) Overall new trips that would travel externally to the proposed project

Year 2032

Weekday PM Peak	Ten Trail Phase 1A/Phase 2/Phase 3					Gross Trips ²				Internal Trips ³			Pass-By Trips ⁴				Net New Trips		
Land Use	ITE LU	Size	Units	Avg or Eqn ¹	Trip Rate	Total Trips	% Inbound	In	Out	Total	In	Out	Rate	Total	In	Out	Total	In	Out
Single Family	210	3153	units	eqn	0.81	2547	63%	1605	942	181	103	78	0%	0	0	0	2366	1502	864
Senior Adult Housing	251	401	units	eqn	0.33	131	61%	80	51	8	5	3	0%	0	0	0	123	75	48
Multifamily	221	971	units	eqn	0.39	379	61%	231	148	23	13	9	0%	0	0	0	356	218	138
Elementary School	520	600	students	avg	0.16	96	48%	46	50	29	15	14	0%	0	0	0	67	31	36
Office	710	307	ksf	eqn	1.37	421	17%	72	349	84	49	35	0%	0	0	0	337	23	314
Retail	820	145	ksf	eqn	5.08	737	48%	354	383	171	63	108	19%	140	70	70	426	221	205
						4311		2387	1924	496	248	248		140	70	70	3676	2069	1606

1) Regression equations used, consistent with approach used in the TTR

2) Total vehicle trips based on rates/equations from ITE Trip Generation Manual (11th edition)

3) Trips that would remain internal to the project site and would not use external roads, based on rates from Trip Generation Handbook and NCHRP report 685; 30% for schools consistent with The Villages TTR

4) Trips already on the adjacent street system that make a stop at the project site before continuing to final destination; rate based on ITE Trip Generation Manual (2021 rates); included as turning movements at project access points

5) Overall new trips that would travel externally to the proposed project

Year 2032

Weekday PM Peak	Lawson Hills Phase 1B (North Triangle)					Gross Trips ²				Internal Trips ³			Pass-By Trips ⁴				Net New Trips ⁵		
Land Use	ITE LU	Size	Units	Avg or Eqn ¹	Trip Rate	Total Trips	% Inbound	In	Out	Total	In	Out	Rate	Total	In	Out	Total	In	Out
Single Family	210	0	units	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Senior Adult Housing	251	0	units	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Multifamily	221	0	units	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Elementary School	520	0	students	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Office	710	200	ksf	eqn	1.48	295	17%	50	245	43	9	34	0%	0	0	0	252	41	211
Retail	820	190	ksf	eqn	4.72	896	48%	430	466	43	34	9	19%	170	85	85	683	311	372
						1191		480	711	86	43	43		170	85	85	935	352	583

1) Regression equations used, consistent with approach used in the TTR

2) Total vehicle trips based on rates/equations from ITE Trip Generation Manual (11th edition)

3) Trips that would remain internal to the project site and would not use external roads, based on rates from Trip Generation Handbook and NCHRP report 685

4) Trips already on the adjacent street system that make a stop at the project site before continuing to final destination; rate based on ITE Trip Generation Manual (2021 rates); included as turning movements at project access points

5) Overall new trips that would travel externally to the proposed project

Year 2032

Weekday PM Peak	Lawson Hills Phase 2					Gross Trips ²				Internal Trips ³			Pass-By Trips ⁴				Net New Trips ⁵		
Land Use	ITE LU	Size	Units	Avg or Eqn ¹	Trip Rate	Total Trips	% Inbound	In	Out	Total	In	Out	Rate	Total	In	Out	Total	In	Out
Single Family	210	961	units	eqn	0.87	834	63%	525	309	25	12	13	0%	0	0	0	809	513	296
Senior Adult Housing	251	0	units	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Multifamily	221	289	units	eqn	0.39	113	61%	69	44	4	2	2	0%	0	0	0	109	67	42
Elementary School	520	600	students	-	0	96	48%	46	50	29	14	15	0%	0	0	0	67	32	35
Office	710	0	ksf	-	0	0	0%	0	0	0	0	0	0%	0	0	0	0	0	0
Retail	820	0	ksf	-	0	0	0%	0	0	0	0	0	19%	0	0	0	0	0	0
						1043		640	403	58	29	29		0	0	0	985	612	373

1) Regression equations used, consistent with approach used in the TTR

2) Total vehicle trips based on rates/equations from ITE Trip Generation Manual (11th edition)

3) Trips that would remain internal to the project site and would not use external roads, based on rates from Trip Generation Handbook and NCHRP report 685; 30% for schools consistent with The Villages TTR

4) Trips already on the adjacent street system that make a stop at the project site before continuing to final destination; rate based on ITE Trip Generation Manual (2021 rates); included as turning movements at project access points

5) Overall new trips that would travel externally to the proposed project

NCHRP 8-51 Internal Trip Capture Estimation Tool					
Project Name:	MDRT Modeling Update			Organization:	City of Black Diamond
Project Location:	Black Diamond			Performed By:	Parametrix
Scenario Description:	Ten Trails Phase 1 B			Date:	7/14/2022
Analysis Year:	2032			Checked By:	
Analysis Period:	PM Street Peak Hour			Date:	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips		
	ITE LUCs ¹	Quantity	Units	Total	Entering	Exiting
Office				223	38	185
Retail				862	414	448
Restaurant				0		
Cinema/Entertainment				0		
Residential				194	121	73
Hotel				0		
All Other Land Uses ²				0		
Total				1279	573	706

Table 2-P: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office	1.00	0%	0%	1.00	0%	0%
Retail	1.00	0%	0%	1.00	0%	0%
Restaurant	1.00	0%	0%	1.00	0%	0%
Cinema/Entertainment	1.00	0%	0%	1.00	0%	0%
Residential	1.00	0%	0%	1.00	0%	0%
Hotel	1.00	0%	0%	1.00	0%	0%
All Other Land Uses ²	1.00	0%	0%	1.00	0%	0%

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		33	0	0	4	0
Retail	9		0	0	56	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	3	31	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	1,279	573	706
Internal Capture Percentage	21%	24%	19%
External Vehicle-Trips ³	1,007	437	570
External Transit-Trips ⁴	0	0	0
External Non-Motorized Trips ⁴	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	32%	20%
Retail	15%	15%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	50%	47%
Hotel	N/A	N/A

¹Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.

²Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

³Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

⁴Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Project Name:	MDRT Modeling Update
Analysis Period:	PM Street Peak Hour

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends						
Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	38	38	1.00	185	185
Retail	1.00	414	414	1.00	448	448
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	121	121	1.00	73	73
Hotel	1.00	0	0	1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		37	7	0	4	0
Retail	9		130	18	116	22
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	3	31	15	0		2
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		33	0	0	5	0
Retail	12		0	0	56	0
Restaurant	11	207		0	19	0
Cinema/Entertainment	2	17	0		5	0
Residential	22	41	0	0		0
Hotel	0	8	0	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)						
Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	12	26	38	26	0	0
Retail	64	350	414	350	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	60	61	121	61	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses ³	0	0	0	0	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)						
Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	37	148	185	148	0	0
Retail	65	383	448	383	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	34	39	73	39	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses ³	0	0	0	0	0	0

¹Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

²Person-Trips

³Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

NCHRP 8-51 Internal Trip Capture Estimation Tool					
Project Name:	MDRT Modeling Update			Organization:	City of Black Diamond
Project Location:	Black Diamond			Performed By:	Parametrix
Scenario Description:	Ten Trails Phase 1A, 2 and 3			Date:	7/14/2022
Analysis Year:	2032			Checked By:	
Analysis Period:	PM Street Peak Hour			Date:	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips		
	ITE LUCs ¹	Quantity	Units	Total	Entering	Exiting
Office				421	72	349
Retail				737	354	383
Restaurant				0		
Cinema/Entertainment				0		
Residential				3057	1916	1141
Hotel				0		
All Other Land Uses ²				0		
Total				4215	2342	1873

Table 2-P: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office	1.00	0%	0%	1.00	0%	0%
Retail	1.00	0%	0%	1.00	0%	0%
Restaurant	1.00	0%	0%	1.00	0%	0%
Cinema/Entertainment	1.00	0%	0%	1.00	0%	0%
Residential	1.00	0%	0%	1.00	0%	0%
Hotel	1.00	0%	0%	1.00	0%	0%
All Other Land Uses ²	1.00	0%	0%	1.00	0%	0%

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		28	0	0	7	0
Retail	8		0	0	100	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	41	35	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	4,215	2,342	1,873
Internal Capture Percentage	10%	9%	12%
External Vehicle-Trips ³	3,777	2,123	1,654
External Transit-Trips ⁴	0	0	0
External Non-Motorized Trips ⁴	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	68%	10%
Retail	18%	28%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	6%	7%
Hotel	N/A	N/A

¹Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.

²Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

³Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

⁴Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Project Name:	MDRT Modeling Update
Analysis Period:	PM Street Peak Hour

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends						
Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	72	72	1.00	349	349
Retail	1.00	354	354	1.00	383	383
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	1916	1916	1.00	1141	1141
Hotel	1.00	0	0	1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		70	14	0	7	0
Retail	8		111	15	100	19
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	46	479	240	0		34
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		28	0	0	77	0
Retail	22		0	0	881	0
Restaurant	22	177		0	307	0
Cinema/Entertainment	4	14	0		77	0
Residential	41	35	0	0		0
Hotel	0	7	0	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)						
Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	49	23	72	23	0	0
Retail	63	291	354	291	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	107	1809	1916	1809	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses ³	0	0	0	0	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)						
Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	35	314	349	314	0	0
Retail	108	275	383	275	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	76	1065	1141	1065	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses ³	0	0	0	0	0	0

¹Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

²Person-Trips

³Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

NCHRP 8-51 Internal Trip Capture Estimation Tool					
Project Name:	MDRT Modeling Update			Organization:	City of Black Diamond
Project Location:	Black Diamond			Performed By:	Parametrix
Scenario Description:	Lawson Hills Phase 1 B			Date:	7/14/2022
Analysis Year:	2032			Checked By:	
Analysis Period:	PM Street Peak Hour			Date:	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips		
	ITE LUCs ¹	Quantity	Units	Total	Entering	Exiting
Office				295	50	245
Retail				896	430	466
Restaurant				0		
Cinema/Entertainment				0		
Residential				0		
Hotel				0		
All Other Land Uses ²				0		
Total				1191	480	711

Table 2-P: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office	1.00	0%	0%	1.00	0%	0%
Retail	1.00	0%	0%	1.00	0%	0%
Restaurant	1.00	0%	0%	1.00	0%	0%
Cinema/Entertainment	1.00	0%	0%	1.00	0%	0%
Residential	1.00	0%	0%	1.00	0%	0%
Hotel	1.00	0%	0%	1.00	0%	0%
All Other Land Uses ²	1.00	0%	0%	1.00	0%	0%

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		34	0	0	0	0
Retail	9		0	0	0	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	1,191	480	711
Internal Capture Percentage	7%	9%	6%
External Vehicle-Trips ³	1,105	437	668
External Transit-Trips ⁴	0	0	0
External Non-Motorized Trips ⁴	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	18%	14%
Retail	8%	2%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	N/A	N/A
Hotel	N/A	N/A

¹Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.

²Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

³Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

⁴Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Project Name:	MDRT Modeling Update
Analysis Period:	PM Street Peak Hour

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends						
Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	50	50	1.00	245	245
Retail	1.00	430	430	1.00	466	466
Restaurant	1.00	0	0	1.00	0	0
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	0	0	1.00	0	0
Hotel	1.00	0	0	1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		49	10	0	5	0
Retail	9		135	19	121	23
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	0	0		0
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		34	0	0	0	0
Retail	16		0	0	0	0
Restaurant	15	215		0	0	0
Cinema/Entertainment	3	17	0		0	0
Residential	29	43	0	0		0
Hotel	0	9	0	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)						
Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	9	41	50	41	0	0
Retail	34	396	430	396	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	0	0	0	0	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses ³	0	0	0	0	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)						
Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles ¹	Transit ²	Non-Motorized ²
Office	34	211	245	211	0	0
Retail	9	457	466	457	0	0
Restaurant	0	0	0	0	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	0	0	0	0	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses ³	0	0	0	0	0	0

¹Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

²Person-Trips

³Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

Appendix F

Level of Service Worksheets



HCM 6th Signalized Intersection Summary

1: SR 169 & SE Green Valley Rd

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	0	15	5	0	0	10	420	5	5	795	55
Future Volume (veh/h)	55	0	15	5	0	0	10	420	5	5	795	55
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1900	1900	1900	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	65	0	18	6	0	0	12	494	6	6	935	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	0	0	0	2	2	2	2	2	2
Cap, veh/h	301	0	22	368	0	0	134	1185	14	126	1223	
Arrive On Green	0.07	0.00	0.07	0.07	0.00	0.00	0.66	0.66	0.66	0.66	0.66	0.00
Sat Flow, veh/h	1148	0	318	1727	0	0	12	1808	22	3	1865	0
Grp Volume(v), veh/h	83	0	0	6	0	0	512	0	0	941	0	0
Grp Sat Flow(s),veh/h/ln	1466	0	0	1727	0	0	1841	0	0	1867	0	0
Q Serve(g_s), s	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	1.6	0.0	0.0	0.1	0.0	0.0	3.8	0.0	0.0	10.2	0.0	0.0
Prop In Lane	0.78		0.22	1.00		0.00	0.02		0.01	0.01		0.00
Lane Grp Cap(c), veh/h	323	0	0	368	0	0	1333	0	0	1349	0	
V/C Ratio(X)	0.26	0.00	0.00	0.02	0.00	0.00	0.38	0.00	0.00	0.70	0.00	
Avail Cap(c_a), veh/h	1016	0	0	1044	0	0	2359	0	0	2420	0	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	13.4	0.0	0.0	12.7	0.0	0.0	2.4	0.0	0.0	3.5	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.8	0.0	0.0	12.7	0.0	0.0	2.6	0.0	0.0	4.1	0.0	0.0
LnGrp LOS	B	A	A	B	A	A	A	A	A	A	A	
Approach Vol, veh/h	83			6			512			941		
Approach Delay, s/veh	13.8			12.7			2.6			4.1		
Approach LOS	B			B			A			A		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	23.2			6.1			23.2			6.1		
Change Period (Y+Rc), s	4.0			4.0			4.0			4.0		
Max Green Setting (Gmax), s	36.0			16.0			36.0			16.0		
Max Q Clear Time (g_c+I1), s	5.8			3.6			12.2			2.1		
Green Ext Time (p_c), s	3.1			0.2			7.0			0.0		
Intersection Summary												
HCM 6th Ctrl Delay	4.2											
HCM 6th LOS	A											

HCM 6th TWSC
2: SR 169 & SE 332nd St

01/12/2023

Intersection

Int Delay, s/veh 0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	480	0	0	790
Future Vol, veh/h	0	0	480	0	0	790
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	91	91	91	91	91	91
Heavy Vehicles, %	0	0	2	0	0	3
Mvmt Flow	0	0	527	0	0	868

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	1395	527	0
Stage 1	527	-	-
Stage 2	868	-	-
Critical Hdwy	6.4	6.2	4.1
Critical Hdwy Stg 1	5.4	-	-
Critical Hdwy Stg 2	5.4	-	-
Follow-up Hdwy	3.5	3.3	2.2
Pot Cap-1 Maneuver	157	555	1050
Stage 1	596	-	-
Stage 2	414	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	157	555	1050
Mov Cap-2 Maneuver	157	-	-
Stage 1	596	-	-
Stage 2	414	-	-

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

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	1050	-
HCM Lane V/C Ratio	-	-	-	-
HCM Control Delay (s)	-	0	0	-
HCM Lane LOS	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	-

HCM 6th Signalized Intersection Summary

3: SR 169 & Jones Lake Rd

01/12/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	145	165	290	735	0
Future Volume (veh/h)	0	145	165	290	735	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1894	1894	1870	1870	1856	1856
Adj Flow Rate, veh/h	0	153	174	305	774	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	0	2	2	3	3
Cap, veh/h	0	201	301	457	1128	0
Arrive On Green	0.00	0.13	0.61	0.61	0.61	0.00
Sat Flow, veh/h	0	1596	227	751	1856	0
Grp Volume(v), veh/h	0	154	479	0	774	0
Grp Sat Flow(s),veh/h/ln	0	1607	978	0	1856	0
Q Serve(g_s), s	0.0	2.8	4.7	0.0	8.4	0.0
Cycle Q Clear(g_c), s	0.0	2.8	13.2	0.0	8.4	0.0
Prop In Lane	0.00	0.99	0.36			0.00
Lane Grp Cap(c), veh/h	0	202	758	0	1128	0
V/C Ratio(X)	0.00	0.76	0.63	0.00	0.69	0.00
Avail Cap(c_a), veh/h	0	856	1635	0	2532	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	12.7	4.3	0.0	4.0	0.0
Incr Delay (d2), s/veh	0.0	5.9	0.9	0.0	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	1.1	0.3	0.0	0.2	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.0	18.6	5.2	0.0	4.7	0.0
LnGrp LOS	A	B	A	A	A	A
Approach Vol, veh/h	154			479	774	
Approach Delay, s/veh	18.6			5.2	4.7	
Approach LOS	B			A	A	
Timer - Assigned Phs	2		4		6	
Phs Duration (G+Y+Rc), s	22.3		7.8		22.3	
Change Period (Y+Rc), s	4.0		4.0		4.0	
Max Green Setting (Gmax), s	41.0		16.0		41.0	
Max Q Clear Time (g_c+l1), s	15.2		4.8		10.4	
Green Ext Time (p_c), s	3.1		0.4		3.5	
Intersection Summary						
HCM 6th Ctrl Delay			6.4			
HCM 6th LOS			A			

HCM 6th Signalized Intersection Summary

4: SR 169 & Lawson Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕		↖	↗	
Traffic Volume (veh/h)	0	0	5	15	0	60	10	320	10	115	875	5
Future Volume (veh/h)	0	0	5	15	0	60	10	320	10	115	875	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	0.98		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	0	0	5	16	0	63	11	337	11	121	921	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	3	3	3	2	2	2
Cap, veh/h	0	0	124	130	3	96	103	1260	40	975	1342	7
Arrive On Green	0.00	0.00	0.08	0.08	0.00	0.08	0.72	0.72	0.72	1.00	1.00	1.00
Sat Flow, veh/h	0	0	1586	277	35	1231	15	1745	56	1031	1858	10
Grp Volume(v), veh/h	0	0	5	79	0	0	359	0	0	121	0	926
Grp Sat Flow(s),veh/h/ln	0	0	1586	1544	0	0	1815	0	0	1031	0	1869
Q Serve(g_s), s	0.0	0.0	0.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.1	2.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0
Prop In Lane	0.00		1.00	0.20		0.80	0.03		0.03	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	124	229	0	0	1403	0	0	975	0	1349
V/C Ratio(X)	0.00	0.00	0.04	0.35	0.00	0.00	0.26	0.00	0.00	0.12	0.00	0.69
Avail Cap(c_a), veh/h	0	0	634	723	0	0	1403	0	0	975	0	1349
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	0.86	0.00	0.00	0.48	0.00	0.48
Uniform Delay (d), s/veh	0.0	0.0	17.1	17.9	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.9	0.0	0.0	0.4	0.0	0.0	0.1	0.0	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.7	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	17.2	18.8	0.0	0.0	2.3	0.0	0.0	0.1	0.0	1.4
LnGrp LOS	A	A	B	B	A	A	A	A	A	A	A	A
Approach Vol, veh/h	5		79			359			1047			
Approach Delay, s/veh	17.2		18.8			2.3			1.2			
Approach LOS	B		B			A			A			
Timer - Assigned Phs	2		4			6			8			
Phs Duration (G+Y+Rc), s	32.9		7.1			32.9			7.1			
Change Period (Y+Rc), s	4.0		4.0			4.0			4.0			
Max Green Setting (Gmax), s	16.0		16.0			16.0			16.0			
Max Q Clear Time (g_c+I1), s	4.7		2.1			2.0			4.0			
Green Ext Time (p_c), s	1.2		0.0			5.1			0.2			
Intersection Summary												
HCM 6th Ctrl Delay			2.5									
HCM 6th LOS			A									

HCM 6th Signalized Intersection Summary

5: SR 169 & Baker St

01/12/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	LT	RT	LT	TH	TH	LT
Traffic Volume (veh/h)	35	95	35	345	900	45
Future Volume (veh/h)	35	95	35	345	900	45
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	0.99	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1811	1856	1856	1870	1870
Adj Flow Rate, veh/h	37	101	37	367	957	48
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	6	3	3	2	2
Cap, veh/h	50	135	349	1264	1203	60
Arrive On Green	0.12	0.12	1.00	1.00	0.68	0.68
Sat Flow, veh/h	417	1139	556	1856	1766	89
Grp Volume(v), veh/h	139	0	37	367	0	1005
Grp Sat Flow(s), veh/h/ln	1568	0	556	1856	0	1854
Q Serve(g_s), s	3.4	0.0	1.6	0.0	0.0	15.1
Cycle Q Clear(g_c), s	3.4	0.0	16.7	0.0	0.0	15.1
Prop In Lane	0.27	0.73	1.00			0.05
Lane Grp Cap(c), veh/h	186	0	349	1264	0	1263
V/C Ratio(X)	0.75	0.00	0.11	0.29	0.00	0.80
Avail Cap(c_a), veh/h	627	0	349	1264	0	1263
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.98	0.98	0.00	1.00
Uniform Delay (d), s/veh	17.0	0.0	4.6	0.0	0.0	4.4
Incr Delay (d2), s/veh	5.9	0.0	0.6	0.6	0.0	5.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	0.0	0.1	0.2	0.0	3.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	22.9	0.0	5.2	0.6	0.0	9.7
LnGrp LOS	C	A	A	A	A	A
Approach Vol, veh/h	139			404	1005	
Approach Delay, s/veh	22.9			1.0	9.7	
Approach LOS	C			A	A	
Timer - Assigned Phs	2			4		6
Phs Duration (G+Y+Rc), s	31.3			8.7		31.3
Change Period (Y+Rc), s	4.0			4.0		4.0
Max Green Setting (Gmax), s	16.0			16.0		16.0
Max Q Clear Time (g_c+l1), s	18.7			5.4		17.1
Green Ext Time (p_c), s	0.0			0.4		0.0
Intersection Summary						
HCM 6th Ctrl Delay			8.6			
HCM 6th LOS			A			

Notes

User approved volume balancing among the lanes for turning movement.

Intersection

Int Delay, s/veh 2.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	30	55	30	0	0	10
Future Vol, veh/h	30	55	30	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	60	33	0	0	11

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	33	0	0 159 33
Stage 1	-	-	- 33 -
Stage 2	-	-	- 126 -
Critical Hdwy	4.12	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.218	-	- 3.518 3.318
Pot Cap-1 Maneuver	1579	-	- 832 1041
Stage 1	-	-	- 989 -
Stage 2	-	-	- 900 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1579	-	- 814 1041
Mov Cap-2 Maneuver	-	-	- 814 -
Stage 1	-	-	- 967 -
Stage 2	-	-	- 900 -

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	8.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1579	-	-	-	1041
HCM Lane V/C Ratio	0.021	-	-	-	0.01
HCM Control Delay (s)	7.3	0	-	-	8.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0

MOVEMENT SUMMARY

 **Site: 101 [7.Roberts Dr (Site Folder: 2032-No Build)]**

Roberts Dr and SR 169

Site Category: Future No Build - 2032

Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: SR 169														
3	L2	15	2.0	15	2.0	0.015	10.7	LOS B	0.1	1.9	0.39	0.60	0.39	34.0
8	T1	355	2.0	355	2.0	0.243	4.5	LOS A	1.6	40.9	0.42	0.45	0.42	36.6
Approach		370	2.0	370	2.0	0.243	4.8	LOS A	1.6	40.9	0.42	0.45	0.42	36.5
North: SR 169														
4	T1	845	2.0	845	2.0	0.502	3.9	LOS A	4.3	109.2	0.13	0.36	0.13	37.7
14	R2	350	2.0	350	2.0	0.263	4.2	LOS A	1.6	40.6	0.11	0.45	0.11	36.4
Approach		1195	2.0	1195	2.0	0.502	4.0	LOS A	4.3	109.2	0.12	0.39	0.12	37.3
West: Roberts Dr														
5	L2	200	2.0	200	2.0	0.285	15.1	LOS B	1.8	45.5	0.76	0.85	0.76	32.7
12	R2	30	2.0	30	2.0	0.285	9.2	LOS A	1.8	45.5	0.76	0.85	0.76	31.7
Approach		230	2.0	230	2.0	0.285	14.3	LOS B	1.8	45.5	0.76	0.85	0.76	32.6
All Vehicles		1795	2.0	1795	2.0	0.502	5.5	LOS A	4.3	109.2	0.26	0.46	0.26	36.5

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.

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Project: U:\PSO\Projects\Clients\3043-BlackDiamondCityof\214-3043-028 2018 MDRT Traffic Eng\02WBS\Ph40 Transportation Model Dev
Task4_Build_and_Calibrate_Model\SynchroModel\SIDRA\Roundabouts-2032.sip9

HCM 6th TWSC
9: SR 169 & Black Diamond-Ravensdale Rd

01/12/2023

Intersection

Int Delay, s/veh 2.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	270	455	100	35	1195
Future Vol, veh/h	0	270	455	100	35	1195
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Free	-	Free
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	1	1	2	2	1	1
Mvmt Flow	0	303	511	112	39	1343

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	-	511	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.21	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.309	-
Pot Cap-1 Maneuver	0	565	-
Stage 1	0	-	-
Stage 2	0	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	565	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.5	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBTWBLn1	SBL	SBT
Capacity (veh/h)	-	565	1059
HCM Lane V/C Ratio	-	0.537	0.037
HCM Control Delay (s)	-	18.5	8.5
HCM Lane LOS	-	C	A
HCM 95th %tile Q(veh)	-	3.2	0.1

HCM 6th Signalized Intersection Summary

10: SR 169 & SE 288th St

01/12/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	85	30	15	435	975	160
Future Volume (veh/h)	85	30	15	435	975	160
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1841	1841	1856	1856	1841	1841
Adj Flow Rate, veh/h	96	34	17	489	1096	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	3	3	4	4
Cap, veh/h	142	126	78	1398	1446	
Arrive On Green	0.08	0.08	0.79	0.79	0.79	0.00
Sat Flow, veh/h	1753	1560	21	1780	1841	1560
Grp Volume(v), veh/h	96	34	506	0	1096	0
Grp Sat Flow(s),veh/h/ln	1753	1560	1800	0	1841	1560
Q Serve(g_s), s	3.2	1.2	0.0	0.0	18.9	0.0
Cycle Q Clear(g_c), s	3.2	1.2	4.8	0.0	18.9	0.0
Prop In Lane	1.00	1.00	0.03			1.00
Lane Grp Cap(c), veh/h	142	126	1476	0	1446	
V/C Ratio(X)	0.68	0.27	0.34	0.00	0.76	
Avail Cap(c_a), veh/h	467	416	1476	0	1446	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	26.8	25.9	1.9	0.0	3.4	0.0
Incr Delay (d2), s/veh	5.5	1.1	0.6	0.0	3.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.5	0.3	0.0	1.5	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	32.3	27.0	2.5	0.0	7.2	0.0
LnGrp LOS	C	C	A	A	A	
Approach Vol, veh/h	130			506	1096	A
Approach Delay, s/veh	30.9			2.5	7.2	
Approach LOS	C			A	A	
Timer - Assigned Phs	2		4		6	
Phs Duration (G+Y+Rc), s	51.1		8.9		51.1	
Change Period (Y+Rc), s	4.0		4.0		4.0	
Max Green Setting (Gmax), s	36.0		16.0		36.0	
Max Q Clear Time (g_c+11), s	6.8		5.2		20.9	
Green Ext Time (p_c), s	2.2		0.3		5.4	
Intersection Summary						
HCM 6th Ctrl Delay			7.6			
HCM 6th LOS			A			

Notes

Unsignalized Delay for [SBR] is excluded from calculations of the approach delay and intersection delay.

HCM Signalized Intersection Capacity Analysis

11: SR 169 & 280th St

01/12/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	70	50	35	575	1070	130
Future Volume (vph)	70	50	35	575	1070	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.1	5.1	5.5	6.7	6.7	6.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1568	1805	1863	1881	1599
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1568	1805	1863	1881	1599
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	53	37	605	1126	137
RTOR Reduction (vph)	0	49	0	0	0	17
Lane Group Flow (vph)	74	4	37	605	1126	120
Heavy Vehicles (%)	2%	3%	0%	2%	1%	1%
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	11.2	11.2	7.2	117.0	104.3	104.3
Effective Green, g (s)	11.2	11.2	7.2	117.0	104.3	104.3
Actuated g/C Ratio	0.08	0.08	0.05	0.84	0.74	0.74
Clearance Time (s)	5.1	5.1	5.5	6.7	6.7	6.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	141	125	92	1556	1401	1191
v/s Ratio Prot	c0.04		0.02	c0.32	c0.60	
v/s Ratio Perm		0.00				0.07
v/c Ratio	0.52	0.03	0.40	0.39	0.80	0.10
Uniform Delay, d1	61.8	59.4	64.3	2.8	11.3	4.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	0.1	2.9	0.7	5.0	0.2
Delay (s)	65.3	59.5	67.2	3.5	16.3	5.1
Level of Service	E	E	E	A	B	A
Approach Delay (s)	62.9			7.2	15.1	
Approach LOS	E			A	B	
Intersection Summary						
HCM 2000 Control Delay			15.6		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.76			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	17.3
Intersection Capacity Utilization			70.0%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM 6th Signalized Intersection Summary

12: SR 169 & SE Tahoma Way/SE 271st PI

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations													
Traffic Volume (veh/h)	40	15	25	260	15	65	25	740	120	5	120	1120	65
Future Volume (veh/h)	40	15	25	260	15	65	25	740	120	5	120	1120	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0		0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		1.00		1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Work Zone On Approach	No			No			No				No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1870	1900		1900	1870	1900
Adj Flow Rate, veh/h	42	16	26	274	16	68	26	779	126		126	1179	68
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95		0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	0	2	0		0	2	0
Cap, veh/h	55	49	79	193	48	203	33	1775	287		151	2202	127
Arrive On Green	0.03	0.08	0.08	0.11	0.15	0.15	0.02	0.58	0.58		0.08	0.64	0.64
Sat Flow, veh/h	1810	641	1042	1810	313	1329	1810	3062	495		1810	3415	197
Grp Volume(v), veh/h	42	0	42	274	0	84	26	452	453		126	613	634
Grp Sat Flow(s),veh/h/ln	1810	0	1683	1810	0	1642	1810	1777	1781		1810	1777	1835
Q Serve(g_s), s	3.2	0.0	3.3	14.9	0.0	6.4	2.0	20.1	20.1		9.6	26.2	26.3
Cycle Q Clear(g_c), s	3.2	0.0	3.3	14.9	0.0	6.4	2.0	20.1	20.1		9.6	26.2	26.3
Prop In Lane	1.00		0.62	1.00		0.81	1.00		0.28		1.00		0.11
Lane Grp Cap(c), veh/h	55	0	128	193	0	250	33	1030	1032		151	1146	1183
V/C Ratio(X)	0.77	0.00	0.33	1.42	0.00	0.34	0.78	0.44	0.44		0.83	0.54	0.54
Avail Cap(c_a), veh/h	167	0	371	193	0	386	252	1030	1032		252	1146	1183
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Uniform Delay (d), s/veh	67.4	0.0	61.3	62.6	0.0	53.0	68.4	16.6	16.6		63.2	13.5	13.5
Incr Delay (d2), s/veh	19.8	0.0	1.5	217.7	0.0	0.8	32.2	1.4	1.4		11.3	1.8	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	1.5	18.6	0.0	2.7	1.2	8.3	8.3		4.8	10.4	10.7
Unsig. Movement Delay, s/veh													
LnGrp Delay(d),s/veh	87.2	0.0	62.7	280.3	0.0	53.8	100.6	17.9	17.9		74.5	15.3	15.2
LnGrp LOS	F	A	E	F	A	D	F	B	B		E	B	B
Approach Vol, veh/h	84			358			931				1373		
Approach Delay, s/veh	75.0			227.1			20.3				20.7		
Approach LOS	E			F			C				C		
Timer - Assigned Phs	1	2	3	4	5	6	7	8					
Phs Duration (G+Y+Rc), s	7.2	87.1	20.0	15.8	8.1	96.2	9.3	26.4					
Change Period (Y+Rc), s	5.5	5.9	5.1	5.1	5.5	5.9	5.1	5.1					
Max Green Setting (Gmax), s	19.5	53.1	14.9	30.9	19.5	53.1	12.9	32.9					
Max Q Clear Time (g_c+I1), s	11.6	22.1	16.9	5.3	4.0	28.3	5.2	8.4					
Green Ext Time (p_c), s	0.2	6.1	0.0	0.2	0.0	8.9	0.0	0.4					

Intersection Summary

HCM 6th Ctrl Delay 49.1

HCM 6th LOS D

Notes

User approved ignoring U-Turning movement.

HCM 6th Signalized Intersection Summary

13: SR 169 & SR 516

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations													
Traffic Volume (veh/h)	195	380	140	200	380	160	310	545	45	1	290	890	100
Future Volume (veh/h)	195	380	140	200	380	160	310	545	45	1	290	890	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0		0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00		1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Work Zone On Approach	No			No			No				No		
Adj Sat Flow, veh/h/ln	1870	1885	1885	1885	1870	1841	1885	1856	1826		1841	1870	1885
Adj Flow Rate, veh/h	203	396	146	208	396	167	323	568	47		302	927	104
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	0.96
Percent Heavy Veh, %	2	1	1	1	2	4	1	3	5		4	2	1
Cap, veh/h	101	482	176	189	443	367	351	1031	85		331	974	109
Arrive On Green	0.06	0.19	0.19	0.11	0.24	0.24	0.20	0.31	0.31		0.19	0.30	0.30
Sat Flow, veh/h	1781	2565	934	1795	1870	1550	1795	3296	272		1753	3219	361
Grp Volume(v), veh/h	203	275	267	208	396	167	323	303	312		302	512	519
Grp Sat Flow(s),veh/h/ln	1781	1791	1708	1795	1870	1550	1795	1763	1805		1753	1777	1804
Q Serve(g_s), s	6.5	16.9	17.3	12.1	23.6	10.6	20.3	16.4	16.5		19.4	32.4	32.4
Cycle Q Clear(g_c), s	6.5	16.9	17.3	12.1	23.6	10.6	20.3	16.4	16.5		19.4	32.4	32.4
Prop In Lane	1.00		0.55	1.00		1.00	1.00		0.15		1.00		0.20
Lane Grp Cap(c), veh/h	101	337	321	189	443	367	351	552	565		331	538	546
V/C Ratio(X)	2.02	0.82	0.83	1.10	0.89	0.46	0.92	0.55	0.55		0.91	0.95	0.95
Avail Cap(c_a), veh/h	101	380	362	189	488	404	351	552	565		373	541	549
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Uniform Delay (d), s/veh	54.3	44.8	44.9	51.4	42.5	37.5	45.4	32.8	32.8		45.7	39.3	39.3
Incr Delay (d2), s/veh	490.4	11.8	13.8	95.1	17.7	0.9	28.7	3.9	3.9		24.6	28.5	28.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.5	8.4	8.3	10.3	12.6	4.0	11.6	7.4	7.6		10.5	17.9	18.1
Unsig. Movement Delay, s/veh													
LnGrp Delay(d),s/veh	544.6	56.6	58.7	146.6	60.2	38.4	74.1	36.7	36.7		70.3	67.8	67.5
LnGrp LOS	F	E	E	F	E	D	E	D	D		E	E	E
Approach Vol, veh/h	745			771			938				1333		
Approach Delay, s/veh	190.3			78.8			49.6				68.3		
Approach LOS	F			E			D				E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8					
Phs Duration (G+Y+Rc), s	27.2	41.9	17.6	28.3	28.4	40.7	12.0	33.9					
Change Period (Y+Rc), s	5.5	5.9	5.5	6.7	5.9	* 5.9	5.5	6.7					
Max Green Setting (Gmax), s	24.5	30.4	12.1	24.4	19.9	* 35	6.5	30.0					
Max Q Clear Time (g_c+0.1), s	21.4	18.5	14.1	19.3	22.3	34.4	8.5	25.6					
Green Ext Time (p_c), s	0.3	2.7	0.0	1.4	0.0	0.4	0.0	1.2					

Intersection Summary

HCM 6th Ctrl Delay 89.8

HCM 6th LOS F

Notes

User approved ignoring U-Turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM Signalized Intersection Capacity Analysis

14: SR 169 & SE 240th Blvd

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	55	35	160	60	35	90	140	825	25	10	110	1460
Future Volume (vph)	55	35	160	60	35	90	140	825	25	10	110	1460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.1	5.1	4.0	5.1	5.1		5.5	5.9			5.5	5.9
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.89		1.00	1.00			1.00	0.99
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.95	1.00
Satd. Flow (prot)	1770	1900	1583	3502	1683		1805	3460			1805	3487
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.95	1.00
Satd. Flow (perm)	1770	1900	1583	3502	1683		1805	3460			1805	3487
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	37	168	63	37	95	147	868	26	11	116	1537
RTOR Reduction (vph)	0	0	168	0	80	0	0	1	0	0	0	1
Lane Group Flow (vph)	58	37	0	63	52	0	147	893	0	0	127	1594
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	2%	0%	2%	0%	0%	1%	0%	4%	0%	0%	0%	3%
Turn Type	Prot	NA	NA	Prot	NA		Prot	NA		Prot	Prot	NA
Protected Phases	7	4		3	8		5	2		1	1	6
Permitted Phases												
Actuated Green, G (s)	8.7	12.0	0.0	6.7	10.0		17.2	84.4			15.3	82.5
Effective Green, g (s)	8.7	12.0	0.0	6.7	10.0		17.2	84.4			15.3	82.5
Actuated g/C Ratio	0.06	0.09	0.00	0.05	0.07		0.12	0.60			0.11	0.59
Clearance Time (s)	5.1	5.1		5.1	5.1		5.5	5.9			5.5	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	109	162	0	167	120		221	2085			197	2054
v/s Ratio Prot	c0.03	0.02		0.02	c0.03		c0.08	0.26			0.07	c0.46
v/s Ratio Perm												
v/c Ratio	0.53	0.23	0.00	0.38	0.43		0.67	0.43			0.64	0.78
Uniform Delay, d1	63.7	59.7	70.0	64.6	62.3		58.6	14.9			59.7	21.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.29	0.49
Incremental Delay, d2	4.9	0.7	0.0	1.4	2.5		7.3	0.6			0.7	0.3
Delay (s)	68.6	60.4	70.0	66.1	64.8		66.0	15.5			77.5	10.8
Level of Service	E	E	E	E	E		E	B			E	B
Approach Delay (s)		68.3			65.2			22.7				15.7
Approach LOS		E			E			C				B
Intersection Summary												
HCM 2000 Control Delay			25.3			HCM 2000 Level of Service					C	
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)				21.6		
Intersection Capacity Utilization			79.4%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

14: SR 169 & SE 240th Blvd

01/12/2023

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	55
Future Volume (vph)	55
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.95
Adj. Flow (vph)	58
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Heavy Vehicles (%)	2%
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM 6th Signalized Intersection Summary

15: SR 169 & Witte Rd SE

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	450	50	15	70	45	10	15	900	20	5	1595	785
Future Volume (veh/h)	450	50	15	70	45	10	15	900	20	5	1595	785
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1796	1900	1826	1900	1900	1900	1870	1737	1900	1870	1885
Adj Flow Rate, veh/h	464	52	15	72	46	10	15	928	21	5	1644	809
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	7	0	5	0	0	0	2	11	0	2	1
Cap, veh/h	515	199	58	91	79	17	29	2223	50	11	1464	664
Arrive On Green	0.15	0.15	0.15	0.05	0.05	0.05	0.02	0.63	0.63	0.01	0.62	0.62
Sat Flow, veh/h	3456	1339	386	1739	1510	328	1810	3552	80	1810	2375	1077
Grp Volume(v), veh/h	464	0	67	72	0	56	15	464	485	5	1195	1258
Grp Sat Flow(s),veh/h/ln	1728	0	1726	1739	0	1839	1810	1777	1856	1810	1777	1675
Q Serve(g_s), s	18.5	0.0	4.8	5.7	0.0	4.2	1.2	18.5	18.5	0.4	86.3	86.3
Cycle Q Clear(g_c), s	18.5	0.0	4.8	5.7	0.0	4.2	1.2	18.5	18.5	0.4	86.3	86.3
Prop In Lane	1.00		0.22	1.00		0.18	1.00		0.04	1.00		0.64
Lane Grp Cap(c), veh/h	515	0	257	91	0	96	29	1112	1161	11	1095	1033
V/C Ratio(X)	0.90	0.00	0.26	0.79	0.00	0.58	0.53	0.42	0.42	0.44	1.09	1.22
Avail Cap(c_a), veh/h	555	0	419	242	0	407	123	1112	1161	123	1095	1033
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.09	0.09	0.09
Uniform Delay (d), s/veh	58.5	0.0	52.7	65.6	0.0	64.8	68.4	13.3	13.3	69.3	26.9	26.9
Incr Delay (d2), s/veh	17.0	0.0	0.5	13.9	0.0	5.4	14.1	1.2	1.1	2.4	42.8	99.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.3	0.0	2.1	2.9	0.0	2.1	0.6	7.4	7.7	0.2	46.1	59.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	75.6	0.0	53.3	79.4	0.0	70.3	82.5	14.4	14.4	71.7	69.6	125.9
LnGrp LOS	E	A	D	E	A	E	F	B	B	E	F	F
Approach Vol, veh/h	531			128			964			2458		
Approach Delay, s/veh	72.8			75.4			15.5			98.4		
Approach LOS	E			E			B			F		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.4	93.9	12.9	26.9	7.7	92.6	26.4	13.3				
Change Period (Y+Rc), s	5.5	6.3	5.5	6.0	5.5	6.3	5.5	6.0				
Max Green Setting (Gmax), s	9.5	53.7	19.5	34.0	9.5	53.7	22.5	31.0				
Max Q Clear Time (g_c+I), s	12.4	20.5	7.7	6.8	3.2	88.3	20.5	6.2				
Green Ext Time (p_c), s	0.0	6.5	0.1	0.3	0.0	0.0	0.4	0.2				

Intersection Summary

HCM 6th Ctrl Delay 74.8

HCM 6th LOS E

HCM 6th Signalized Intersection Summary

16: SR 169 & SE Wax Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	10	410	50	25	50	275	1050	30	50	1910	130
Future Volume (veh/h)	115	10	410	50	25	50	275	1050	30	50	1910	130
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1885	1737	1885	1900	1900	1900	1885	1870	1900	1900	1885	1885
Adj Flow Rate, veh/h	119	10	423	52	26	52	284	1082	31	52	1969	134
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	11	1	0	0	0	1	2	0	0	1	1
Cap, veh/h	102	383	350	65	112	225	221	1936	55	67	1657	739
Arrive On Green	0.06	0.22	0.22	0.04	0.20	0.20	0.12	0.55	0.55	0.04	0.46	0.46
Sat Flow, veh/h	1795	1737	1587	1810	562	1125	1795	3528	101	1810	3582	1598
Grp Volume(v), veh/h	119	10	423	52	0	78	284	545	568	52	1969	134
Grp Sat Flow(s),veh/h/ln	1795	1737	1587	1810	0	1687	1795	1777	1852	1810	1791	1598
Q Serve(g_s), s	8.5	0.7	33.1	4.3	0.0	5.8	18.5	29.9	29.9	4.3	69.4	7.4
Cycle Q Clear(g_c), s	8.5	0.7	33.1	4.3	0.0	5.8	18.5	29.9	29.9	4.3	69.4	7.4
Prop In Lane	1.00		1.00	1.00		0.67	1.00		0.05	1.00		1.00
Lane Grp Cap(c), veh/h	102	383	350	65	0	337	221	975	1017	67	1657	739
V/C Ratio(X)	1.17	0.03	1.21	0.80	0.00	0.23	1.28	0.56	0.56	0.77	1.19	0.18
Avail Cap(c_a), veh/h	102	383	350	65	0	337	221	975	1017	118	1657	739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	0.80	0.80	0.80	0.49	0.49	0.49
Uniform Delay (d), s/veh	70.7	45.8	58.5	71.8	0.0	50.3	65.8	22.0	22.0	71.6	40.3	23.6
Incr Delay (d2), s/veh	141.9	0.0	117.4	48.7	0.0	0.3	151.9	1.9	1.8	8.9	87.9	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.9	0.3	24.7	2.9	0.0	2.5	17.7	12.7	13.2	2.1	49.6	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	212.7	45.8	175.9	120.4	0.0	50.7	217.6	23.9	23.8	80.5	128.2	23.9
LnGrp LOS	F	D	F	F	A	D	F	C	C	F	F	C
Approach Vol, veh/h	552		130			1397			2155			
Approach Delay, s/veh	181.5		78.6			63.2			120.6			
Approach LOS	F		E			E			F			
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	11.1	88.2	10.9	39.8	24.0	75.3	14.0	36.7				
Change Period (Y+Rc), s	5.5	5.9	5.5	6.7	5.5	5.9	5.5	6.7				
Max Green Setting (Gmax), s	9.8	78.1	5.4	33.1	18.5	69.4	8.5	30.0				
Max Q Clear Time (g_c+10), s	16.3	31.9	6.3	35.1	20.5	71.4	10.5	7.8				
Green Ext Time (p_c), s	0.0	8.6	0.0	0.0	0.0	0.0	0.0	0.4				
Intersection Summary												
HCM 6th Ctrl Delay	108.3											
HCM 6th LOS	F											

HCM 6th Signalized Intersection Summary

17: SR 169 & SE 231st St

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	50	965	10	65	20	575	600	25	15	1145	155
Future Volume (veh/h)	175	50	965	10	65	20	575	600	25	15	1145	155
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1707	1885	1574	1767	1811	1870	1885	1841	1678	1870	1870
Adj Flow Rate, veh/h	182	52	1005	10	68	21	599	625	26	16	1193	161
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	13	1	22	9	6	2	1	4	15	2	2
Cap, veh/h	178	512	1319	14	271	84	585	1818	76	22	1290	575
Arrive On Green	0.10	0.30	0.30	0.01	0.21	0.21	0.17	0.52	0.52	0.01	0.36	0.36
Sat Flow, veh/h	1781	1707	2812	1499	1295	400	3456	3504	146	1598	3554	1585
Grp Volume(v), veh/h	182	52	1005	10	0	89	599	319	332	16	1193	161
Grp Sat Flow(s),veh/h/ln	1781	1707	1406	1499	0	1695	1728	1791	1859	1598	1777	1585
Q Serve(g_s), s	13.0	2.9	38.4	0.9	0.0	5.7	22.0	13.6	13.6	1.3	41.9	9.4
Cycle Q Clear(g_c), s	13.0	2.9	38.4	0.9	0.0	5.7	22.0	13.6	13.6	1.3	41.9	9.4
Prop In Lane	1.00		1.00	1.00		0.24	1.00		0.08	1.00		1.00
Lane Grp Cap(c), veh/h	178	512	1319	14	0	355	585	929	964	22	1290	575
V/C Ratio(X)	1.02	0.10	0.76	0.72	0.00	0.25	1.02	0.34	0.34	0.74	0.92	0.28
Avail Cap(c_a), veh/h	178	512	1319	46	0	391	585	929	964	74	1290	575
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.83	0.83	0.83	1.00	0.00	1.00	0.75	0.75	0.75	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.5	32.9	28.5	64.2	0.0	42.9	54.0	18.3	18.3	63.9	39.7	29.4
Incr Delay (d2), s/veh	67.2	0.1	2.2	50.2	0.0	0.4	38.5	0.8	0.7	38.8	12.5	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.1	1.2	12.8	0.5	0.0	2.4	12.5	5.6	5.9	0.8	19.9	3.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	125.7	32.9	30.7	114.4	0.0	43.3	92.5	19.1	19.1	102.7	52.2	30.6
LnGrp LOS	F	C	C	F	A	D	F	B	B	F	D	C
Approach Vol, veh/h	1239			99			1250			1370		
Approach Delay, s/veh	44.8			50.4			54.3			50.3		
Approach LOS	D			D			D			D		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	5.8	73.3	5.2	45.7	26.0	53.1	17.0	33.9				
Change Period (Y+Rc), s	4.0	5.9	4.0	6.7	4.0	5.9	4.0	6.7				
Max Green Setting (Gmax), s	60.4	60.4	4.0	39.0	22.0	44.4	13.0	30.0				
Max Q Clear Time (g_c+I), s	13.3	15.6	2.9	40.4	24.0	43.9	15.0	7.7				
Green Ext Time (p_c), s	0.0	4.1	0.0	0.0	0.0	0.4	0.0	0.4				

Intersection Summary

HCM 6th Ctrl Delay 49.8

HCM 6th LOS D

HCM Signalized Intersection Capacity Analysis

18: SE 231st St & SR 18 EB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	110	785	0	0	725	115	100	0	420	0	0	0
Future Volume (vph)	110	785	0	0	725	115	100	0	420	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.3	6.3			6.3	6.3		5.9	5.9			
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1787	3539			3505	1599		1770	1583			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1787	3539			3505	1599		1770	1583			
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	111	793	0	0	732	116	101	0	424	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	71	0	0	103	0	0	0
Lane Group Flow (vph)	111	793	0	0	732	45	0	101	321	0	0	0
Heavy Vehicles (%)	1%	2%	0%	0%	3%	1%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	7.7	43.1			29.1	29.1		19.7	19.7			
Effective Green, g (s)	7.7	43.1			29.1	29.1		19.7	19.7			
Actuated g/C Ratio	0.10	0.57			0.39	0.39		0.26	0.26			
Clearance Time (s)	6.3	6.3			6.3	6.3		5.9	5.9			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	183	2033			1359	620		464	415			
v/s Ratio Prot	c0.06	0.22			c0.21							
v/s Ratio Perm						0.03		0.06	c0.20			
v/c Ratio	0.61	0.39			0.54	0.07		0.22	0.77			
Uniform Delay, d1	32.2	8.7			17.8	14.5		21.6	25.6			
Progression Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Incremental Delay, d2	5.6	0.6			1.5	0.2		0.2	8.7			
Delay (s)	37.8	9.3			19.3	14.7		21.9	34.3			
Level of Service	D	A			B	B		C	C			
Approach Delay (s)		12.8			18.7			31.9			0.0	
Approach LOS		B			B			C			A	
Intersection Summary												
HCM 2000 Control Delay			19.4				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			75.0				Sum of lost time (s)			18.5		
Intersection Capacity Utilization			68.7%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

19: SE 231st St & SR 18 WB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑	↑↑						↑	↑
Traffic Volume (vph)	0	610	230	415	445	0	0	0	0	255	0	115
Future Volume (vph)	0	610	230	415	445	0	0	0	0	255	0	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.3	6.3	5.5	6.3						5.9	5.9
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3574	1568	1752	3312						1736	1455
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		3574	1568	1752	3312						1736	1455
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)	0	622	235	423	454	0	0	0	0	260	0	117
RTOR Reduction (vph)	0	0	125	0	0	0	0	0	0	0	0	91
Lane Group Flow (vph)	0	622	110	423	454	0	0	0	0	0	260	26
Heavy Vehicles (%)	0%	1%	3%	3%	9%	0%	0%	0%	0%	4%	0%	11%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		19.0	19.0	25.6	50.1						17.7	17.7
Effective Green, g (s)		19.0	19.0	25.6	50.1						17.7	17.7
Actuated g/C Ratio		0.24	0.24	0.32	0.63						0.22	0.22
Clearance Time (s)		6.3	6.3	5.5	6.3						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		848	372	560	2074						384	321
v/s Ratio Prot		c0.17		c0.24	0.14							
v/s Ratio Perm			0.07								0.15	0.02
v/c Ratio		0.73	0.30	0.76	0.22						0.68	0.08
Uniform Delay, d1		28.2	25.0	24.4	6.5						28.5	24.7
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		5.6	2.0	5.8	0.2						4.7	0.1
Delay (s)		33.7	27.0	30.1	6.7						33.2	24.8
Level of Service		C	C	C	A						C	C
Approach Delay (s)		31.9			18.0			0.0			30.6	
Approach LOS		C			B			A			C	
Intersection Summary												
HCM 2000 Control Delay			25.9			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)				17.7		
Intersection Capacity Utilization			68.7%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM 6th Signalized Intersection Summary

20: SE Ravensdale Way/Landsburg Rd SE & SE Kent Kangley Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	30	270	5	15	180	40	0	85	25	120	290	45
Future Volume (veh/h)	30	270	5	15	180	40	0	85	25	120	290	45
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1885	1885	1885	1856	1856	1856
Adj Flow Rate, veh/h	32	284	5	16	189	42	0	89	26	126	305	47
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	2	2	2	1	1	1	3	3	3
Cap, veh/h	191	467	8	173	394	84	0	552	161	314	468	65
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.00	0.39	0.39	0.39	0.39	0.39
Sat Flow, veh/h	102	1686	28	55	1423	303	0	1402	410	321	1190	165
Grp Volume(v), veh/h	321	0	0	247	0	0	0	0	115	478	0	0
Grp Sat Flow(s),veh/h/ln	1816	0	0	1781	0	0	0	0	1811	1677	0	0
Q Serve(g_s), s	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.3	0.0	0.0
Cycle Q Clear(g_c), s	3.7	0.0	0.0	2.8	0.0	0.0	0.0	0.0	1.0	5.7	0.0	0.0
Prop In Lane	0.10		0.02	0.06		0.17	0.00		0.23	0.26		0.10
Lane Grp Cap(c), veh/h	666	0	0	651	0	0	0	0	713	847	0	0
V/C Ratio(X)	0.48	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.16	0.56	0.00	0.00
Avail Cap(c_a), veh/h	1342	0	0	1314	0	0	0	0	1194	1279	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	7.7	0.0	0.0	7.3	0.0	0.0	0.0	0.0	4.8	6.1	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	8.2	0.0	0.0	7.7	0.0	0.0	0.0	0.0	4.9	6.7	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	A	A	A	A	A	A
Approach Vol, veh/h	321			247			115			478		
Approach Delay, s/veh	8.2			7.7			4.9			6.7		
Approach LOS	A			A			A			A		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	13.6			10.7			13.6			10.7		
Change Period (Y+Rc), s	4.0			4.0			4.0			4.0		
Max Green Setting (Gmax), s	16.0			16.0			16.0			16.0		
Max Q Clear Time (g_c+I1), s	3.0			5.7			7.7			4.8		
Green Ext Time (p_c), s	0.4			1.2			1.8			0.9		

Intersection Summary

HCM 6th Ctrl Delay	7.2
HCM 6th LOS	A

HCM Signalized Intersection Capacity Analysis

21: Witte Rd SE & SR 516

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	225	725	0	75	695	125	5	45	95	165	95	335
Future Volume (vph)	225	725	0	75	695	125	5	45	95	165	95	335
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	6.8		5.5	6.8	6.8		5.1			5.9	5.9
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.91			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00			0.97	1.00
Satd. Flow (prot)	1805	1863		1805	1863	1615		1713			1830	1599
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00			0.97	1.00
Satd. Flow (perm)	1805	1863		1805	1863	1615		1713			1830	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	234	755	0	78	724	130	5	47	99	172	99	349
RTOR Reduction (vph)	0	0	0	0	0	75	0	57	0	0	0	194
Lane Group Flow (vph)	234	755	0	78	724	55	0	94	0	0	271	155
Confl. Peds. (#/hr)			3	3			1					1
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	3%	0%	1%	0%	1%
Turn Type	Prot	NA		Prot	NA	Perm	Split	NA		Split	NA	pt+ov
Protected Phases	5	2		1	6		3	3		4	4	4 5
Permitted Phases						6						
Actuated Green, G (s)	15.8	66.0		6.9	56.7	56.7		12.5			26.3	42.1
Effective Green, g (s)	15.8	66.0		6.9	56.7	56.7		12.5			26.3	42.1
Actuated g/C Ratio	0.12	0.49		0.05	0.42	0.42		0.09			0.19	0.31
Clearance Time (s)	5.9	6.8		5.5	6.8	6.8		5.1			5.9	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	211	910		92	782	678		158			356	498
v/s Ratio Prot	c0.13	0.41		0.04	c0.39			c0.05			c0.15	0.10
v/s Ratio Perm						0.03						
v/c Ratio	1.11	0.83		0.85	0.93	0.08		0.59			0.76	0.31
Uniform Delay, d1	59.6	29.7		63.5	37.2	23.5		58.8			51.4	35.4
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	94.2	8.7		47.8	18.5	0.2		5.9			9.3	0.4
Delay (s)	153.8	38.3		111.3	55.6	23.7		64.7			60.6	35.8
Level of Service	F	D		F	E	C		E			E	D
Approach Delay (s)		65.7			55.9			64.7			46.6	
Approach LOS		E			E			E			D	
Intersection Summary												
HCM 2000 Control Delay			57.8				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			135.0				Sum of lost time (s)			23.7		
Intersection Capacity Utilization			91.6%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

22: 216th Ave SE & SR 516

01/12/2023

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	795	240	290	720	275	235
Future Volume (vph)	795	240	290	720	275	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	4.0	7.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1881	1540	1805	1845	1787	1599
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1881	1540	1805	1845	1787	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	828	250	302	750	286	245
RTOR Reduction (vph)	0	149	0	0	0	194
Lane Group Flow (vph)	828	101	302	750	286	51
Confl. Peds. (#/hr)		4	4			3
Heavy Vehicles (%)	1%	2%	0%	3%	1%	1%
Turn Type	NA	Perm	Prot	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases	2	2				8
Actuated Green, G (s)	36.2	36.2	18.4	58.6	18.9	18.9
Effective Green, g (s)	36.2	36.2	18.4	58.6	18.9	18.9
Actuated g/C Ratio	0.40	0.40	0.20	0.65	0.21	0.21
Clearance Time (s)	7.0	7.0	4.0	7.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	756	619	369	1201	375	335
v/s Ratio Prot	c0.44		c0.17	0.41	c0.16	0.03
v/s Ratio Perm		0.07				
v/c Ratio	1.10	0.16	0.82	0.62	0.76	0.15
Uniform Delay, d1	26.9	17.2	34.2	9.2	33.4	29.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	61.8	0.6	13.2	2.5	8.9	0.2
Delay (s)	88.7	17.8	47.4	11.7	42.3	29.2
Level of Service	F	B	D	B	D	C
Approach Delay (s)	72.3			21.9	36.3	
Approach LOS	E			C	D	
Intersection Summary						
HCM 2000 Control Delay			45.2		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.94			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	16.5
Intersection Capacity Utilization			87.3%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

23: SE Wax Rd & SR 516

01/12/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	45	210	1005	45	25	105	835	95	150	130	105	225
Future Volume (vph)	45	210	1005	45	25	105	835	95	150	130	105	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9			5.9	5.9		5.5	5.9		5.5
Lane Util. Factor		1.00	0.95			1.00	0.95		1.00	1.00		1.00
Frt		1.00	0.99			1.00	0.98		1.00	0.93		1.00
Flt Protected		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1761	3548			1791	3488		1770	1765		1805
Flt Permitted		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1761	3548			1791	3488		1770	1765		1805
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	46	216	1036	46	26	108	861	98	155	134	108	232
RTOR Reduction (vph)	0	0	2	0	0	0	5	0	0	25	0	0
Lane Group Flow (vph)	0	262	1080	0	0	134	954	0	155	217	0	232
Heavy Vehicles (%)	0%	3%	1%	3%	0%	1%	2%	1%	2%	0%	1%	0%
Turn Type	Prot	Prot	NA		Prot	Prot	NA		Prot	NA		Prot
Protected Phases	7	7	4		3	3	8		5	2		1
Permitted Phases												
Actuated Green, G (s)		37.6	55.6			17.2	35.2		18.4	38.5		15.5
Effective Green, g (s)		37.6	55.6			17.2	35.2		18.4	38.5		15.5
Actuated g/C Ratio		0.25	0.37			0.11	0.23		0.12	0.26		0.10
Clearance Time (s)		5.9	5.9			5.9	5.9		5.5	5.9		5.5
Vehicle Extension (s)		3.0	3.0			3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		441	1315			205	818		217	453		186
v/s Ratio Prot		c0.15	c0.30			0.07	c0.27		0.09	c0.12		c0.13
v/s Ratio Perm												
v/c Ratio		0.59	0.82			0.65	1.17		0.71	0.48		1.25
Uniform Delay, d1		49.5	42.7			63.5	57.4		63.3	47.3		67.2
Progression Factor		1.63	0.84			1.00	1.00		1.00	1.00		1.00
Incremental Delay, d2		1.1	2.2			7.3	87.8		10.6	3.6		148.0
Delay (s)		81.5	37.8			70.8	145.2		73.9	50.9		215.2
Level of Service		F	D			E	F		E	D		F
Approach Delay (s)			46.4				136.1			59.9		
Approach LOS			D				F			E		
Intersection Summary												
HCM 2000 Control Delay			86.7				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			23.2		
Intersection Capacity Utilization			85.3%				ICU Level of Service			E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

23: SE Wax Rd & SR 516

01/12/2023



Movement	SBT	SBR
Lane Configurations	↑	↑
Traffic Volume (vph)	245	265
Future Volume (vph)	245	265
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.9	5.9
Lane Util. Factor	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	1900	1568
Flt Permitted	1.00	1.00
Satd. Flow (perm)	1900	1568
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	253	273
RTOR Reduction (vph)	0	201
Lane Group Flow (vph)	253	72
Heavy Vehicles (%)	0%	3%
Turn Type	NA	Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	35.6	35.6
Effective Green, g (s)	35.6	35.6
Actuated g/C Ratio	0.24	0.24
Clearance Time (s)	5.9	5.9
Vehicle Extension (s)	3.0	3.0
Lane Grp Cap (vph)	450	372
v/s Ratio Prot	c0.13	
v/s Ratio Perm		0.05
v/c Ratio	0.56	0.19
Uniform Delay, d1	50.3	45.7
Progression Factor	1.00	1.00
Incremental Delay, d2	5.0	1.2
Delay (s)	55.4	46.9
Level of Service	E	D
Approach Delay (s)	101.2	
Approach LOS	F	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

24: 172nd Ave SE & SR 516

01/12/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	10	270	1095	115	15	195	1015	50	140	75	140	100
Future Volume (vph)	10	270	1095	115	15	195	1015	50	140	75	140	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.1	5.1			5.1	5.1		5.9	5.9		5.9
Lane Util. Factor		1.00	0.95			1.00	0.95		1.00	1.00		1.00
Frpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	0.98		1.00
Flpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	1.00		1.00
Frt		1.00	0.99			1.00	0.99		1.00	0.90		1.00
Flt Protected		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1805	3523			1788	3513		1805	1668		1805
Flt Permitted		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1805	3523			1788	3513		1805	1668		1805
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	284	1153	121	16	205	1068	53	147	79	147	105
RTOR Reduction (vph)	0	0	4	0	0	0	2	0	0	68	0	0
Lane Group Flow (vph)	0	295	1270	0	0	221	1119	0	147	158	0	105
Confl. Peds. (#/hr)	3	2			10			2	3		10	10
Heavy Vehicles (%)	0%	0%	1%	1%	0%	1%	2%	0%	0%	0%	1%	0%
Turn Type	Prot	Prot	NA		Prot	Prot	NA		Prot	NA		Prot
Protected Phases	7	7	4		3	3	8		5	2		1
Permitted Phases												
Actuated Green, G (s)		46.9	56.4			34.3	43.8		16.0	23.5		13.8
Effective Green, g (s)		46.9	56.4			34.3	43.8		16.0	23.5		13.8
Actuated g/C Ratio		0.31	0.38			0.23	0.29		0.11	0.16		0.09
Clearance Time (s)		5.1	5.1			5.1	5.1		5.9	5.9		5.9
Vehicle Extension (s)		3.0	3.0			3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		564	1324			408	1025		192	261		166
v/s Ratio Prot		c0.16	c0.36			0.12	c0.32		c0.08	c0.09		0.06
v/s Ratio Perm												
v/c Ratio		0.52	0.96			0.54	1.09		0.77	0.60		0.63
Uniform Delay, d1		42.4	45.7			50.9	53.1		65.2	58.9		65.7
Progression Factor		0.44	1.24			0.99	1.44		1.00	1.00		1.00
Incremental Delay, d2		0.3	7.6			0.6	48.6		16.5	10.0		7.6
Delay (s)		19.0	64.1			51.1	125.1		81.7	68.9		73.3
Level of Service		B	E			D	F		F	E		E
Approach Delay (s)			55.6				112.9			73.9		
Approach LOS			E				F			E		
Intersection Summary												
HCM 2000 Control Delay			80.4				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.0		
Intersection Capacity Utilization			87.8%				ICU Level of Service			E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

24: 172nd Ave SE & SR 516

01/12/2023



Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	85	100
Future Volume (vph)	85	100
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.9	
Lane Util. Factor	1.00	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.92	
Flt Protected	1.00	
Satd. Flow (prot)	1726	
Flt Permitted	1.00	
Satd. Flow (perm)	1726	
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	89	105
RTOR Reduction (vph)	44	0
Lane Group Flow (vph)	150	0
Confl. Peds. (#/hr)		3
Heavy Vehicles (%)	0%	0%
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	21.3	
Effective Green, g (s)	21.3	
Actuated g/C Ratio	0.14	
Clearance Time (s)	5.9	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	245	
v/s Ratio Prot	0.09	
v/s Ratio Perm		
v/c Ratio	0.61	
Uniform Delay, d1	60.5	
Progression Factor	1.00	
Incremental Delay, d2	11.0	
Delay (s)	71.4	
Level of Service	E	
Approach Delay (s)	72.1	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

25: 168th PI & SR 516

01/12/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	10	235	1345	270	5	215	1100	20	365	55	170	40
Future Volume (vph)	10	235	1345	270	5	215	1100	20	365	55	170	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9	5.9		5.9	5.9		5.1	5.1		5.1
Lane Util. Factor		1.00	0.95	1.00		1.00	0.95		0.97	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00		1.00	1.00		1.00	0.99		1.00
Flpb, ped/bikes		1.00	1.00	1.00		1.00	1.00		1.00	1.00		1.00
Frt		1.00	1.00	0.85		1.00	1.00		1.00	0.89		1.00
Flt Protected		0.95	1.00	1.00		0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1788	3574	1615		1788	3529		3502	1653		1805
Flt Permitted		0.95	1.00	1.00		0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1788	3574	1615		1788	3529		3502	1653		1805
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	11	270	1546	310	6	247	1264	23	420	63	195	46
RTOR Reduction (vph)	0	0	0	94	0	0	1	0	0	76	0	0
Lane Group Flow (vph)	0	281	1546	216	0	253	1286	0	420	182	0	46
Confl. Peds. (#/hr)	1	2		3	2	3		2	1		2	2
Heavy Vehicles (%)	0%	1%	1%	0%	0%	1%	2%	0%	0%	0%	1%	0%
Turn Type	Prot	Prot	NA	custom	Prot	Prot	NA		Prot	NA		Prot
Protected Phases	5	5	2	2	1	1	6		3	8		7
Permitted Phases				2								
Actuated Green, G (s)		22.0	64.1	64.1		21.0	63.1		26.2	35.2		7.7
Effective Green, g (s)		22.0	64.1	64.1		21.0	63.1		26.2	35.2		7.7
Actuated g/C Ratio		0.15	0.43	0.43		0.14	0.42		0.17	0.23		0.05
Clearance Time (s)		5.9	5.9	5.9		5.9	5.9		5.1	5.1		5.1
Vehicle Extension (s)		3.0	3.0	3.0		3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		262	1527	690		250	1484		611	387		92
v/s Ratio Prot		c0.16	c0.43	0.13		0.14	0.36		c0.12	0.11		0.03
v/s Ratio Perm												
v/c Ratio		1.07	1.01	0.31		1.01	0.87		0.69	0.47		0.50
Uniform Delay, d1		64.0	43.0	28.4		64.5	39.6		58.1	49.4		69.3
Progression Factor		0.89	1.02	1.06		1.12	0.74		1.00	1.00		1.00
Incremental Delay, d2		70.7	23.9	1.0		44.0	3.8		3.2	0.9		4.2
Delay (s)		127.6	67.6	31.0		115.9	33.1		61.3	50.3		73.5
Level of Service		F	E	C		F	C		E	D		E
Approach Delay (s)			70.2				46.7			57.1		
Approach LOS			E				D			E		
Intersection Summary												
HCM 2000 Control Delay			60.5				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.92									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.0		
Intersection Capacity Utilization			86.7%				ICU Level of Service			E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

25: 168th PI & SR 516

01/12/2023



Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	70	70
Future Volume (vph)	70	70
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.1	
Lane Util. Factor	1.00	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.93	
Flt Protected	1.00	
Satd. Flow (prot)	1746	
Flt Permitted	1.00	
Satd. Flow (perm)	1746	
Peak-hour factor, PHF	0.87	0.87
Adj. Flow (vph)	80	80
RTOR Reduction (vph)	27	0
Lane Group Flow (vph)	133	0
Confl. Peds. (#/hr)		1
Heavy Vehicles (%)	0%	0%
Turn Type	NA	
Protected Phases	4	
Permitted Phases		
Actuated Green, G (s)	16.7	
Effective Green, g (s)	16.7	
Actuated g/C Ratio	0.11	
Clearance Time (s)	5.1	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	194	
v/s Ratio Prot	c0.08	
v/s Ratio Perm		
v/c Ratio	0.69	
Uniform Delay, d1	64.1	
Progression Factor	1.00	
Incremental Delay, d2	9.7	
Delay (s)	73.8	
Level of Service	E	
Approach Delay (s)	73.8	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

26: SR 516 & SR 18 EB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	1300	0	0	1410	195	225	0	815	0	0	0
Future Volume (vph)	115	1300	0	0	1410	195	225	0	815	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Lane Util. Factor	0.97	0.95			0.95		1.00	0.95	0.95			
Frpb, ped/bikes	1.00	1.00			1.00		1.00	0.99	0.99			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.98		1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (prot)	3303	3574			3507		1787	1499	1499			
Flt Permitted	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (perm)	3303	3574			3507		1787	1499	1499			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	120	1354	0	0	1469	203	234	0	849	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	295	295	0	0	0
Lane Group Flow (vph)	120	1354	0	0	1668	0	234	130	129	0	0	0
Confl. Peds. (#/hr)	2		4	4		2			1	1		
Heavy Vehicles (%)	6%	1%	0%	0%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			3				
Permitted Phases							3		3			
Actuated Green, G (s)	10.6	108.7			92.6		29.5	29.5	29.5			
Effective Green, g (s)	10.6	108.7			92.6		29.5	29.5	29.5			
Actuated g/C Ratio	0.07	0.72			0.62		0.20	0.20	0.20			
Clearance Time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	233	2589			2164		351	294	294			
v/s Ratio Prot	0.04	c0.38			c0.48			0.09				
v/s Ratio Perm							c0.13		0.09			
v/c Ratio	0.52	0.52			0.77		0.67	0.44	0.44			
Uniform Delay, d1	67.2	9.2			21.0		55.7	53.0	53.0			
Progression Factor	1.29	2.17			1.52		1.00	1.00	1.00			
Incremental Delay, d2	1.4	0.5			1.6		4.7	1.1	1.1			
Delay (s)	87.8	20.4			33.4		60.4	54.1	54.0			
Level of Service	F	C			C		E	D	D			
Approach Delay (s)		25.9			33.4			55.4			0.0	
Approach LOS		C			C			E			A	
Intersection Summary												
HCM 2000 Control Delay			36.4			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.77									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			22.8			
Intersection Capacity Utilization			79.9%			ICU Level of Service			D			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

27: SR 516 & SR 18 WB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↗↗	↑↑↑						↕	↗
Traffic Volume (vph)	0	1245	410	450	1135	0	0	0	0	160	5	280
Future Volume (vph)	0	1245	410	450	1135	0	0	0	0	160	5	280
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Lane Util. Factor		0.95	1.00	0.97	0.91						0.95	0.95
Frpb, ped/bikes		1.00	0.98	1.00	1.00						1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						0.96	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (prot)		3539	1543	3467	5136						1628	1475
Flt Permitted		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (perm)		3539	1543	3467	5136						1628	1475
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1311	432	474	1195	0	0	0	0	168	5	295
RTOR Reduction (vph)	0	0	70	0	0	0	0	0	0	0	11	93
Lane Group Flow (vph)	0	1311	362	474	1195	0	0	0	0	0	233	131
Confl. Peds. (#/hr)	3		2	2		3						
Heavy Vehicles (%)	0%	2%	3%	1%	1%	0%	0%	0%	0%	1%	33%	4%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						3	
Permitted Phases			2							3		3
Actuated Green, G (s)		81.1	81.1	25.3	111.9						26.3	26.3
Effective Green, g (s)		81.1	81.1	25.3	111.9						26.3	26.3
Actuated g/C Ratio		0.54	0.54	0.17	0.75						0.18	0.18
Clearance Time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		1913	834	584	3831						285	258
v/s Ratio Prot		c0.37		c0.14	0.23							
v/s Ratio Perm			0.23								0.14	0.09
v/c Ratio		0.69	0.43	0.81	0.31						0.82	0.51
Uniform Delay, d1		25.1	20.7	60.1	6.3						59.6	56.0
Progression Factor		0.70	0.61	0.74	2.17						1.00	1.00
Incremental Delay, d2		1.6	1.3	5.6	0.1						16.5	1.6
Delay (s)		19.1	14.0	50.3	13.8						76.0	57.5
Level of Service		B	B	D	B						E	E
Approach Delay (s)		17.8			24.2			0.0			67.2	
Approach LOS		B			C			A			E	
Intersection Summary												
HCM 2000 Control Delay			26.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)				17.3		
Intersection Capacity Utilization			79.9%			ICU Level of Service				D		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

28: SR 516 & 164th Ave SE

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	1165	10	20	1025	365	5	5	5	485	10	210
Future Volume (vph)	115	1165	10	20	1025	365	5	5	5	485	10	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9		5.5	5.9	5.9		5.5		5.9	5.9	5.9
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1752	3535		1703	3539	1615		1785		1698	1706	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.70		0.75	0.72	1.00
Satd. Flow (perm)	1752	3535		1703	3539	1615		1273		1336	1294	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	120	1214	10	21	1068	380	5	5	5	505	10	219
RTOR Reduction (vph)	0	0	0	0	0	142	0	5	0	0	0	106
Lane Group Flow (vph)	120	1224	0	21	1068	238	0	10	0	258	257	113
Heavy Vehicles (%)	3%	2%	0%	6%	2%	0%	0%	0%	0%	1%	0%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		9	6			7			4	
Permitted Phases						6	7	7		4		4
Actuated Green, G (s)	15.5	80.8		5.0	70.3	70.3		3.8		37.6	37.6	37.6
Effective Green, g (s)	15.5	80.8		5.0	70.3	70.3		3.8		37.6	37.6	37.6
Actuated g/C Ratio	0.10	0.54		0.03	0.47	0.47		0.03		0.25	0.25	0.25
Clearance Time (s)	5.5	5.9		5.5	5.9	5.9		5.5		5.9	5.9	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	181	1904		56	1658	756		32		334	324	396
v/s Ratio Prot	c0.07	c0.35		0.01	0.30							
v/s Ratio Perm						0.15		c0.01		0.19	c0.20	0.07
v/c Ratio	0.66	0.64		0.38	0.64	0.31		0.32		0.77	0.79	0.29
Uniform Delay, d1	64.7	24.4		71.0	30.3	24.8		71.8		52.2	52.6	45.4
Progression Factor	1.22	0.51		0.60	1.29	1.85		1.00		1.00	1.00	1.00
Incremental Delay, d2	5.8	1.1		4.0	1.8	1.0		5.6		10.6	12.5	0.4
Delay (s)	84.9	13.5		46.8	40.9	47.0		77.5		62.8	65.1	45.8
Level of Service	F	B		D	D	D		E		E	E	D
Approach Delay (s)		19.8			42.6			77.5			58.5	
Approach LOS		B			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			37.4				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.8		
Intersection Capacity Utilization			70.9%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

29: Covington Way SE & SR 516

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	870	465	255	925	25	490	5	355	15	10	30
Future Volume (vph)	25	870	465	255	925	25	490	5	355	15	10	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9		5.5	5.9		6.0	6.0	6.0		5.9	5.9
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.95	1.00		0.97	1.00
Satd. Flow (prot)	1805	3347		1770	3525		1681	1688	1583		1843	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.74	0.71	1.00		0.38	1.00
Satd. Flow (perm)	1805	3347		1770	3525		1310	1259	1583		722	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	906	484	266	964	26	510	5	370	16	10	31
RTOR Reduction (vph)	0	50	0	0	1	0	0	0	250	0	0	29
Lane Group Flow (vph)	26	1340	0	266	989	0	255	260	120	0	26	2
Confl. Peds. (#/hr)	1		2	2		1						
Heavy Vehicles (%)	0%	1%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			3	
Permitted Phases							4		4	3	3	3
Actuated Green, G (s)	5.3	67.8		20.5	83.0		29.9	29.9	29.9		8.5	8.5
Effective Green, g (s)	5.3	67.8		20.5	83.0		29.9	29.9	29.9		8.5	8.5
Actuated g/C Ratio	0.04	0.45		0.14	0.55		0.20	0.20	0.20		0.06	0.06
Clearance Time (s)	5.5	5.9		5.5	5.9		6.0	6.0	6.0		5.9	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	63	1512		241	1950		261	250	315		40	91
v/s Ratio Prot	0.01	c0.40		c0.15	0.28							
v/s Ratio Perm							0.19	c0.21	0.08		c0.04	0.00
v/c Ratio	0.41	0.89		1.10	0.51		0.98	1.04	0.38		0.65	0.02
Uniform Delay, d1	70.8	37.6		64.8	20.8		59.7	60.1	52.0		69.3	66.8
Progression Factor	1.00	1.00		1.17	0.77		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.3	8.0		83.2	0.8		48.8	67.7	0.8		32.0	0.1
Delay (s)	75.2	45.6		159.0	16.8		108.5	127.8	52.8		101.3	66.9
Level of Service	E	D		F	B		F	F	D		F	E
Approach Delay (s)		46.1			46.9			90.9			82.6	
Approach LOS		D			D			F			F	
Intersection Summary												
HCM 2000 Control Delay			57.9			HCM 2000 Level of Service			E			
HCM 2000 Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			23.3			
Intersection Capacity Utilization			97.9%			ICU Level of Service			F			
Analysis Period (min)			15									

c Critical Lane Group

Intersection												
Int Delay, s/veh	148.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	65	1255	0	0	1135	210	0	0	0	115	0	90
Future Vol, veh/h	65	1255	0	0	1135	210	0	0	0	115	0	90
Conflicting Peds, #/hr	1	0	3	3	0	1	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	150	-	-	-	-	-	-	-	-	-	-	-
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, %	0	1	0	0	3	2	0	0	0	3	0	1
Mvmt Flow	69	1335	0	0	1207	223	0	0	0	122	0	96

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1431	0	0	1338	0	0	2080	2907	671	2126	2796	716
Stage 1	-	-	-	-	-	-	1476	1476	-	1320	1320	-
Stage 2	-	-	-	-	-	-	604	1431	-	806	1476	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.56	6.5	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.56	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.56	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.53	4	3.31
Pot Cap-1 Maneuver	481	-	-	522	-	-	31	16	404	~ 28	19	375
Stage 1	-	-	-	-	-	-	135	192	-	164	228	-
Stage 2	-	-	-	-	-	-	457	202	-	340	192	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	481	-	-	521	-	-	20	14	403	~ 25	16	375
Mov Cap-2 Maneuver	-	-	-	-	-	-	20	14	-	~ 25	16	-
Stage 1	-	-	-	-	-	-	115	164	-	140	228	-
Stage 2	-	-	-	-	-	-	340	202	-	291	164	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0	0	\$ 2078.1
HCM LOS			A	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	481	-	-	521	-	-	42
HCM Lane V/C Ratio	-	0.144	-	-	-	-	-	5.193
HCM Control Delay (s)	0	13.7	-	-	0	-	-	\$ 2078.1
HCM Lane LOS	A	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	-	0.5	-	-	0	-	-	25.2

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

HCM Signalized Intersection Capacity Analysis

31: Covington Way SE & 165th PI SE

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	25	5	15	330	0	190	5	435	125	120	220	370
Future Volume (vph)	25	5	15	330	0	190	5	435	125	120	220	370
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0		5.0	4.0	5.0			4.0	5.0
Lane Util. Factor	1.00	1.00		1.00		1.00	1.00	0.95			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00		1.00	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00		1.00	1.00	1.00			1.00	1.00
Frt	1.00	0.89		1.00		0.85	1.00	0.97			1.00	1.00
Flt Protected	0.95	1.00		0.95		1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1388	1510		1787		1599	1357	3391			1805	1881
Flt Permitted	0.76	1.00		0.74		1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1107	1510		1399		1599	1357	3391			1805	1881
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	27	5	16	351	0	202	5	463	133	128	234	394
RTOR Reduction (vph)	0	11	0	0	0	137	0	34	0	0	0	0
Lane Group Flow (vph)	27	10	0	351	0	65	5	562	0	0	362	394
Confl. Peds. (#/hr)									3		3	
Heavy Vehicles (%)	30%	0%	15%	1%	0%	1%	33%	3%	0%	0%	0%	1%
Turn Type	Perm	NA		Perm		Perm	Prot	NA		Prot	Prot	NA
Protected Phases		4			8		5	2		1	1	6
Permitted Phases	4			8		8						
Actuated Green, G (s)	27.7	27.7		27.7		27.7	0.9	21.0			27.3	47.4
Effective Green, g (s)	27.7	27.7		27.7		27.7	0.9	21.0			27.3	47.4
Actuated g/C Ratio	0.31	0.31		0.31		0.31	0.01	0.23			0.30	0.53
Clearance Time (s)	5.0	5.0		5.0		5.0	4.0	5.0			4.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	340	464		430		492	13	791			547	990
v/s Ratio Prot		0.01					0.00	c0.17			c0.20	0.21
v/s Ratio Perm	0.02			c0.25		0.04						
v/c Ratio	0.08	0.02		0.82		0.13	0.38	0.71			0.66	0.40
Uniform Delay, d1	22.1	21.7		28.8		22.5	44.3	31.7			27.3	12.8
Progression Factor	1.00	1.00		1.00		1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	0.1	0.0		11.4		0.1	17.9	5.4			3.0	1.2
Delay (s)	22.2	21.7		40.2		22.6	62.2	37.1			30.3	14.0
Level of Service	C	C		D		C	E	D			C	B
Approach Delay (s)		22.0			33.8			37.3				21.6
Approach LOS		C			C			D				C
Intersection Summary												
HCM 2000 Control Delay			29.8									
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			90.0									
Intersection Capacity Utilization			80.5%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Covington Way SE & 165th PI SE

01/12/2023

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	10
Future Volume (vph)	10
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.0
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1077
Flt Permitted	1.00
Satd. Flow (perm)	1077
Peak-hour factor, PHF	0.94
Adj. Flow (vph)	11
RTOR Reduction (vph)	5
Lane Group Flow (vph)	6
Confl. Peds. (#/hr)	
Heavy Vehicles (%)	50%
Turn Type	Perm
Protected Phases	
Permitted Phases	6
Actuated Green, G (s)	47.4
Effective Green, g (s)	47.4
Actuated g/C Ratio	0.53
Clearance Time (s)	5.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	567
v/s Ratio Prot	
v/s Ratio Perm	0.01
v/c Ratio	0.01
Uniform Delay, d1	10.1
Progression Factor	1.00
Incremental Delay, d2	0.0
Delay (s)	10.2
Level of Service	B
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM 6th Signalized Intersection Summary

32: Covington Way SE & SE Wax Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	415	0	110	0	435	245	65	665	0
Future Volume (veh/h)	0	0	0	415	0	110	0	435	245	65	665	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1885	1900	1870	1900	1870	1900	1870	1885	1900
Adj Flow Rate, veh/h	0	0	0	441	0	117	0	463	261	69	707	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	0	0	0	1	0	2	0	2	0	2	1	0
Cap, veh/h	0	916	0	632	0	149	0	761	654	234	767	0
Arrive On Green	0.00	0.00	0.00	0.48	0.00	0.48	0.00	0.41	0.41	0.41	0.41	0.00
Sat Flow, veh/h	0	1900	0	1164	0	309	0	1870	1606	730	1885	0
Grp Volume(v), veh/h	0	0	0	558	0	0	0	463	261	69	707	0
Grp Sat Flow(s),veh/h/ln	0	1900	0	1472	0	0	0	1870	1606	730	1885	0
Q Serve(g_s), s	0.0	0.0	0.0	28.5	0.0	0.0	0.0	17.6	10.4	7.4	32.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	28.5	0.0	0.0	0.0	17.6	10.4	25.0	32.0	0.0
Prop In Lane	0.00		0.00	0.79		0.21	0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	0	916	0	781	0	0	0	761	654	234	767	0
V/C Ratio(X)	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.61	0.40	0.29	0.92	0.00
Avail Cap(c_a), veh/h	0	916	0	781	0	0	0	831	714	262	838	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	19.4	0.0	0.0	0.0	21.0	18.9	30.9	25.3	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	5.5	0.0	0.0	0.0	1.1	0.4	0.7	14.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	10.0	0.0	0.0	0.0	7.4	3.7	1.3	16.4	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	25.0	0.0	0.0	0.0	22.2	19.3	31.6	40.0	0.0
LnGrp LOS	A	A	A	C	A	A	A	C	B	C	D	A
Approach Vol, veh/h	0		558			724			776			
Approach Delay, s/veh	0.0		25.0			21.1			39.3			
Approach LOS			C			C			D			
Timer - Assigned Phs	2		4			6			8			
Phs Duration (G+Y+Rc), s	48.4		41.6			48.4			41.6			
Change Period (Y+Rc), s	5.0		5.0			5.0			5.0			
Max Green Setting (Gmax), s	40.0		40.0			40.0			40.0			
Max Q Clear Time (g_c+I1), s	0.0		19.6			30.5			34.0			
Green Ext Time (p_c), s	0.0		3.7			2.5			2.6			
Intersection Summary												
HCM 6th Ctrl Delay			29.0									
HCM 6th LOS			C									

Intersection

Int Delay, s/veh 1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	195	35	35	215	20	15
Future Vol, veh/h	195	35	35	215	20	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	212	38	38	234	22	16

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	250
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1316
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1316
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	11.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	585	-	-	1316	-
HCM Lane V/C Ratio	0.065	-	-	0.029	-
HCM Control Delay (s)	11.6	-	-	7.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

HCM 6th Signalized Intersection Summary

34: 216th Ave SE & SE 288th St

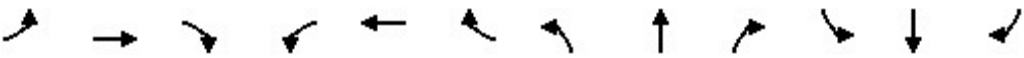
01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	0	125	0	100	0	365	135	140	420	0
Future Volume (veh/h)	5	0	0	125	0	100	0	365	135	140	420	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1856	1856	1856	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	5	0	0	130	0	0	0	380	0	146	438	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	0	0	3	3	3	0	0	0	1	1	1
Cap, veh/h	578	0	0	542	0	0	0	873	0	717	866	0
Arrive On Green	0.11	0.00	0.00	0.11	0.00	0.00	0.00	0.46	0.00	0.46	0.46	0.00
Sat Flow, veh/h	1748	0	0	1415	0	1572	0	1900	1610	1011	1885	0
Grp Volume(v), veh/h	5	0	0	130	0	0	0	380	0	146	438	0
Grp Sat Flow(s),veh/h/ln	1748	0	0	1415	0	1572	0	1900	1610	1011	1885	0
Q Serve(g_s), s	0.0	0.0	0.0	1.6	0.0	0.0	0.0	2.5	0.0	2.1	3.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	1.7	0.0	0.0	0.0	2.5	0.0	4.6	3.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	578	0	0	542	0	0	0	873	0	717	866	0
V/C Ratio(X)	0.01	0.00	0.00	0.24	0.00	0.00	0.00	0.44	0.00	0.20	0.51	0.00
Avail Cap(c_a), veh/h	1668	0	0	1607	0	0	0	1644	0	1127	1631	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	7.4	0.0	0.0	8.1	0.0	0.0	0.0	3.4	0.0	4.9	3.5	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.1	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	7.4	0.0	0.0	8.3	0.0	0.0	0.0	3.7	0.0	5.1	4.0	0.0
LnGrp LOS	A	A	A	A	A		A	A		A	A	A
Approach Vol, veh/h	5			130		A		380		A		584
Approach Delay, s/veh	7.4			8.3				3.7				4.3
Approach LOS	A			A				A				A
Timer - Assigned Phs	2			4		6		8				
Phs Duration (G+Y+Rc), s	12.5			6.0		12.5		6.0				
Change Period (Y+Rc), s	4.0			4.0		4.0		4.0				
Max Green Setting (Gmax), s	16.0			16.0		16.0		16.0				
Max Q Clear Time (g_c+I1), s	4.5			2.0		6.6		3.7				
Green Ext Time (p_c), s	1.2			0.0		1.9		0.3				
Intersection Summary												
HCM 6th Ctrl Delay	4.6											
HCM 6th LOS	A											

HCM Signalized Intersection Capacity Analysis

35: SE 296th St/216th Ave SE & SE Covington-Sawyer Rd/292nd St

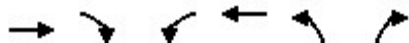
01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↱			↰	↱
Traffic Volume (vph)	245	15	215	10	20	25	170	225	10	20	280	245
Future Volume (vph)	245	15	215	10	20	25	170	225	10	20	280	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	5.0		4.0		5.0	4.0			4.0	5.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00			1.00	1.00
Frt		1.00	0.85		0.94		1.00	0.99			1.00	0.85
Flt Protected		0.95	1.00		0.99		0.95	1.00			1.00	1.00
Satd. Flow (prot)		1797	1568		1729		1752	1852			1859	1615
Flt Permitted		0.75	1.00		0.93		0.41	1.00			0.97	1.00
Satd. Flow (perm)		1407	1568		1626		754	1852			1813	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	269	16	236	11	22	27	187	247	11	22	308	269
RTOR Reduction (vph)	0	0	171	0	19	0	0	2	0	0	0	150
Lane Group Flow (vph)	0	285	65	0	41	0	187	256	0	0	330	119
Heavy Vehicles (%)	1%	0%	3%	0%	0%	5%	3%	2%	0%	0%	2%	0%
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		8			4		5	2			6	
Permitted Phases	8		8	4			2			6		6
Actuated Green, G (s)		21.9	21.9		21.9		48.1	48.1			35.0	35.0
Effective Green, g (s)		22.9	21.9		22.9		48.1	49.1			36.0	35.0
Actuated g/C Ratio		0.29	0.27		0.29		0.60	0.61			0.45	0.44
Clearance Time (s)		5.0	5.0		5.0		5.0	5.0			5.0	5.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)		402	429		465		554	1136			815	706
v/s Ratio Prot							0.03	0.14				
v/s Ratio Perm		0.20	0.04		0.03		0.17				0.18	0.07
v/c Ratio		0.71	0.15		0.09		0.34	0.23			0.40	0.17
Uniform Delay, d1		25.6	22.0		20.9		8.0	6.9			14.8	13.7
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		4.6	0.1		0.0		0.1	0.5			1.5	0.5
Delay (s)		30.2	22.1		20.9		8.2	7.4			16.3	14.2
Level of Service		C	C		C		A	A			B	B
Approach Delay (s)		26.5			20.9			7.7			15.3	
Approach LOS		C			C			A			B	
Intersection Summary												
HCM 2000 Control Delay			17.0									
HCM 2000 Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			80.0									
Intersection Capacity Utilization			59.3%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM 6th Signalized Intersection Summary

36: 219th Ave SE & SE 296th St

01/12/2023



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	290	160	10	265	195	20
Future Volume (veh/h)	290	160	10	265	195	20
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1870	1900	1885	1870	1900
Adj Flow Rate, veh/h	362	200	12	331	244	25
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	1	2	0	1	2	0
Cap, veh/h	1195	1005	589	1331	320	290
Arrive On Green	0.63	0.63	0.01	0.71	0.18	0.18
Sat Flow, veh/h	1885	1585	1810	1885	1781	1610
Grp Volume(v), veh/h	362	200	12	331	244	25
Grp Sat Flow(s), veh/h/ln	1885	1585	1810	1885	1781	1610
Q Serve(g_s), s	6.1	3.7	0.2	4.4	9.1	0.9
Cycle Q Clear(g_c), s	6.1	3.7	0.2	4.4	9.1	0.9
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1195	1005	589	1331	320	290
V/C Ratio(X)	0.30	0.20	0.02	0.25	0.76	0.09
Avail Cap(c_a), veh/h	1195	1005	717	1331	662	598
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.92	0.92	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	5.8	5.4	4.5	3.7	27.3	23.9
Incr Delay (d2), s/veh	0.6	0.4	0.0	0.4	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	1.0	0.0	1.2	3.9	0.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	6.4	5.8	4.5	4.1	28.7	24.0
LnGrp LOS	A	A	A	A	C	C
Approach Vol, veh/h	562			343	269	
Approach Delay, s/veh	6.2			4.1	28.3	
Approach LOS	A			A	C	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	5.0	48.4		16.6		53.4
Change Period (Y+Rc), s	4.0	5.0		5.0		5.0
Max Green Setting (Gmax), s	6.0	25.0		25.0		35.0
Max Q Clear Time (g_c+I2, s)	12.2	8.1		11.1		6.4
Green Ext Time (p_c), s	0.0	1.2		0.5		0.7
Intersection Summary						
HCM 6th Ctrl Delay			10.6			
HCM 6th LOS			B			

Intersection

Int Delay, s/veh 3.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	
Traffic Vol, veh/h	460	265	40	290	90	45
Future Vol, veh/h	460	265	40	290	90	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	479	276	42	302	94	47

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	755
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	855
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	855
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	27
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	301	-	-	855	-
HCM Lane V/C Ratio	0.467	-	-	0.049	-
HCM Control Delay (s)	27	-	-	9.4	0
HCM Lane LOS	D	-	-	A	A
HCM 95th %tile Q(veh)	2.4	-	-	0.2	-

MOVEMENT SUMMARY

 **Site: 101 [38.Ten Trails Pkwy - 1 Lane (Site Folder: 2032-No Build)]**

Ten Trails Pkwy and SE Auburn Black Diamond Rd
Site Category: Future No Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Ten Trails Pkwy														
3	L2	50	8.0	50	8.0	0.120	12.5	LOS B	0.7	17.2	0.59	0.68	0.59	34.9
8	T1	40	0.0	40	0.0	0.120	6.2	LOS A	0.7	17.2	0.59	0.68	0.59	35.1
18	R2	25	0.0	25	0.0	0.120	6.2	LOS A	0.7	17.2	0.59	0.68	0.59	34.1
Approach		115	3.5	115	3.5	0.120	8.9	LOS A	0.7	17.2	0.59	0.68	0.59	34.8
East: SE Auburn Black Diamond Rd														
1	L2	30	0.0	30	0.0	0.287	10.4	LOS B	1.7	43.9	0.36	0.48	0.36	36.8
6	T1	285	2.0	285	2.0	0.287	4.5	LOS A	1.7	43.9	0.36	0.48	0.36	36.7
16	R2	55	0.0	55	0.0	0.287	4.6	LOS A	1.7	43.9	0.36	0.48	0.36	35.6
Approach		370	1.5	370	1.5	0.287	5.0	LOS A	1.7	43.9	0.36	0.48	0.36	36.5
North: Ten Trails Pkwy														
7	L2	60	0.0	60	0.0	0.139	11.3	LOS B	0.8	18.9	0.49	0.63	0.49	35.7
4	T1	35	0.0	35	0.0	0.139	5.4	LOS A	0.8	18.9	0.49	0.63	0.49	35.6
14	R2	60	2.0	60	2.0	0.139	5.5	LOS A	0.8	18.9	0.49	0.63	0.49	34.5
Approach		155	0.8	155	0.8	0.139	7.7	LOS A	0.8	18.9	0.49	0.63	0.49	35.2
West: SE Auburn Black Diamond Rd														
5	L2	55	0.0	55	0.0	0.394	10.4	LOS B	2.7	68.6	0.37	0.48	0.37	36.7
2	T1	405	3.0	405	3.0	0.394	4.6	LOS A	2.7	68.6	0.37	0.48	0.37	36.5
12	R2	50	4.0	50	4.0	0.394	4.6	LOS A	2.7	68.6	0.37	0.48	0.37	35.4
Approach		510	2.8	510	2.8	0.394	5.2	LOS A	2.7	68.6	0.37	0.48	0.37	36.4
All Vehicles		1150	2.2	1150	2.2	0.394	5.9	LOS A	2.7	68.6	0.41	0.52	0.41	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.

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.

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MOVEMENT SUMMARY

 **Site: 101 [39.Lake Sawyer Rd - 1 Lane (Site Folder: 2032-No Build)]**

Lake Sawyer Rd and SE Auburn Black Diamond Rd
Site Category: Future No Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total HV] veh/h %		DEMAND FLOWS [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. Dist] veh ft		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Lake Sawyer Rd														
3	L2	150	6.0	150	6.0	0.438	12.2	LOS B	3.1	81.2	0.67	0.71	0.67	35.2
8	T1	75	6.0	75	6.0	0.438	6.2	LOS A	3.1	81.2	0.67	0.71	0.67	35.2
18	R2	215	6.0	215	6.0	0.438	6.3	LOS A	3.1	81.2	0.67	0.71	0.67	34.1
Approach		440	6.0	440	6.0	0.438	8.3	LOS A	3.1	81.2	0.67	0.71	0.67	34.7
East: SE Auburn Black Diamond Rd														
1	L2	330	2.0	330	2.0	0.537	12.0	LOS B	4.2	105.7	0.67	0.71	0.67	34.7
6	T1	160	2.0	160	2.0	0.537	6.1	LOS A	4.2	105.7	0.67	0.71	0.67	34.6
16	R2	105	2.0	105	2.0	0.537	6.1	LOS A	4.2	105.7	0.67	0.71	0.67	33.7
Approach		595	2.0	595	2.0	0.537	9.4	LOS A	4.2	105.7	0.67	0.71	0.67	34.5
North: Lake Sawyer Rd														
7	L2	70	1.0	70	1.0	0.279	13.4	LOS B	1.9	47.0	0.74	0.77	0.74	34.9
4	T1	110	1.0	110	1.0	0.279	7.4	LOS A	1.9	47.0	0.74	0.77	0.74	34.8
14	R2	60	1.0	60	1.0	0.279	7.5	LOS A	1.9	47.0	0.74	0.77	0.74	33.8
Approach		240	1.0	240	1.0	0.279	9.2	LOS A	1.9	47.0	0.74	0.77	0.74	34.6
West: SE Auburn Black Diamond Rd														
5	L2	95	1.0	95	1.0	0.500	13.4	LOS B	3.9	98.6	0.75	0.79	0.80	35.2
2	T1	215	1.0	215	1.0	0.500	7.4	LOS A	3.9	98.6	0.75	0.79	0.80	35.1
12	R2	180	1.0	180	1.0	0.500	7.5	LOS A	3.9	98.6	0.75	0.79	0.80	34.1
Approach		490	1.0	490	1.0	0.500	8.6	LOS A	3.9	98.6	0.75	0.79	0.80	34.7
All Vehicles		1765	2.6	1765	2.6	0.537	8.9	LOS A	4.2	105.7	0.70	0.74	0.72	34.6

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.

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MOVEMENT SUMMARY

Site: 40 [40.Roberts Dr Morgan St (Site Folder: 2032-No Build)]

Roberts Dr and Morgan St
Site Category: Future No Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Morgan St														
3	L2	220	2.0	220	2.0	0.178	10.7	LOS B	0.9	21.6	0.36	0.66	0.36	34.1
Approach		220	2.0	220	2.0	0.178	10.7	LOS B	0.9	21.6	0.36	0.66	0.36	34.1
East: Roberts Dr														
1	L2	10	2.0	10	2.0	0.284	10.8	LOS B	1.6	40.9	0.41	0.48	0.41	36.7
6	T1	340	2.0	340	2.0	0.284	4.8	LOS A	1.6	40.9	0.41	0.48	0.41	36.6
Approach		350	2.0	350	2.0	0.284	5.0	LOS A	1.6	40.9	0.41	0.48	0.41	36.6
West: Roberts Dr														
2	T1	235	2.0	235	2.0	0.324	3.9	LOS A	2.0	51.4	0.08	0.40	0.08	37.9
12	R2	230	2.0	230	2.0	0.324	3.9	LOS A	2.0	51.4	0.08	0.40	0.08	36.7
Approach		465	2.0	465	2.0	0.324	3.9	LOS A	2.0	51.4	0.08	0.40	0.08	37.3
All Vehicles		1035	2.0	1035	2.0	0.324	5.7	LOS A	2.0	51.4	0.25	0.48	0.25	36.3

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.

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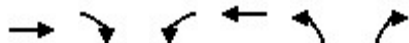
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HCM 6th Signalized Intersection Summary

40: Morgan St & SE Auburn-Black Diamond Rd/Roberts Dr

01/12/2023



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	EBT	EBR	WBL	WBT	NBL	NBR
Traffic Volume (veh/h)	235	230	10	340	220	0
Future Volume (veh/h)	235	230	10	340	220	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1885	1870	1870	1900	1900
Adj Flow Rate, veh/h	255	0	11	370	331	197156
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	1	2	2	0	0
Cap, veh/h	622		215	604	2020	9999
Arrive On Green	0.33	0.00	0.33	0.33	0.22	0.22
Sat Flow, veh/h	1885	0	25	1829	2620	2757248
Grp Volume(v), veh/h	255	0	381	0	331	197156
Grp Sat Flow(s),veh/h/ln	1885	0	1854	0	1810	1610
Q Serve(g_s), s	1.9	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	1.9	0.0	3.1	0.0	0.0	0.0
Prop In Lane		0.00	0.03		1.00	1.00
Lane Grp Cap(c), veh/h	622		819	0	5262	192384
V/C Ratio(X)	0.41		0.47	0.00	0.00	0.00
Avail Cap(c_a), veh/h	1684		1852	0	234686	69536
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	4.6	0.0	5.0	0.0	5.4	5.4
Incr Delay (d2), s/veh	0.4	0.0	0.4	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.1	0.0	0.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	5.1	0.0	5.5	0.0	5.4	5.4
LnGrp LOS	A		A	A	A	A
Approach Vol, veh/h	255	A		331	197160	
Approach Delay, s/veh	5.1			5.5	5.4	
Approach LOS	A			A	A	
Timer - Assigned Phs		2		4		8
Phs Duration (G+Y+Rc), s		8.0		9.9		9.9
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		16.0		16.0		16.0
Max Q Clear Time (g_c+I1), s		2.0		3.9		5.1
Green Ext Time (p_c), s		1.1		0.7		1.1

Intersection Summary

HCM 6th Ctrl Delay	5.4
HCM 6th LOS	A

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
41: Railroad Ave/Morgan St & Baker St

01/12/2023

Intersection

Int Delay, s/veh 3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	60	170	15	90	125
Future Vol, veh/h	10	60	170	15	90	125
Conflicting Peds, #/hr	0	1	0	10	10	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	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	1	2
Mvmt Flow	11	65	185	16	98	136

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	535	204	0
Stage 1	203	-	-
Stage 2	332	-	-
Critical Hdwy	6.4	6.2	-
Critical Hdwy Stg 1	5.4	-	-
Critical Hdwy Stg 2	5.4	-	-
Follow-up Hdwy	3.5	3.3	-
Pot Cap-1 Maneuver	510	842	-
Stage 1	836	-	-
Stage 2	731	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	467	834	-
Mov Cap-2 Maneuver	467	-	-
Stage 1	829	-	-
Stage 2	674	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.3	0	3.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	750	1355
HCM Lane V/C Ratio	-	-	0.101	0.072
HCM Control Delay (s)	-	-	10.3	7.9
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0.2

Intersection

Intersection Delay, s/veh	10.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	10	15	115	10	15	30	30	130	10	25	290	10
Future Vol, veh/h	10	15	115	10	15	30	30	130	10	25	290	10
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	0	0	13	33	0	0	2	0	0	1	0
Mvmt Flow	11	16	125	11	16	33	33	141	11	27	315	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

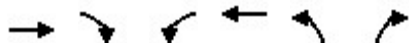
Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9	8.9	9.5	11.6
HCM LOS	A	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	18%	7%	18%	8%
Vol Thru, %	76%	11%	27%	89%
Vol Right, %	6%	82%	55%	3%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	170	140	55	325
LT Vol	30	10	10	25
Through Vol	130	15	15	290
RT Vol	10	115	30	10
Lane Flow Rate	185	152	60	353
Geometry Grp	1	1	1	1
Degree of Util (X)	0.248	0.201	0.088	0.455
Departure Headway (Hd)	4.828	4.752	5.292	4.633
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	737	749	670	774
Service Time	2.898	2.825	3.38	2.693
HCM Lane V/C Ratio	0.251	0.203	0.09	0.456
HCM Control Delay	9.5	9	8.9	11.6
HCM Lane LOS	A	A	A	B
HCM 95th-tile Q	1	0.7	0.3	2.4

HCM 6th Signalized Intersection Summary

43: SE Green Valley Rd & SE Auburn Black Diamond Rd

01/12/2023



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	605	255	5	430	100	0
Future Volume (veh/h)	605	255	5	430	100	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1885	1856	1856	1885	1885
Adj Flow Rate, veh/h	672	0	6	478	111	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	3	3	1	1
Cap, veh/h	1017		549	1001	162	144
Arrive On Green	0.54	0.00	0.54	0.54	0.09	0.00
Sat Flow, veh/h	1885	1598	760	1856	1795	1598
Grp Volume(v), veh/h	672	0	6	478	111	0
Grp Sat Flow(s), veh/h/ln	1885	1598	760	1856	1795	1598
Q Serve(g_s), s	5.5	0.0	0.1	3.5	1.3	0.0
Cycle Q Clear(g_c), s	5.5	0.0	5.6	3.5	1.3	0.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1017		549	1001	162	144
V/C Ratio(X)	0.66		0.01	0.48	0.69	0.00
Avail Cap(c_a), veh/h	2271		1055	2235	1331	1184
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	3.6	0.0	5.6	3.1	9.5	0.0
Incr Delay (d2), s/veh	0.7	0.0	0.0	0.4	5.1	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	0.2	0.0	0.0	0.1	0.6	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	4.3	0.0	5.6	3.4	14.6	0.0
LnGrp LOS	A		A	A	B	A
Approach Vol, veh/h	672	A		484	111	
Approach Delay, s/veh	4.3			3.5	14.6	
Approach LOS	A			A	B	
Timer - Assigned Phs	2		6		8	
Phs Duration (G+Y+Rc), s	15.6		15.6		5.9	
Change Period (Y+Rc), s	4.0		4.0		4.0	
Max Green Setting (Gmax), s	26.0		26.0		16.0	
Max Q Clear Time (g_c+I1), s	7.5		7.6		3.3	
Green Ext Time (p_c), s	4.1		2.7		0.2	

Intersection Summary

HCM 6th Ctrl Delay	4.9
HCM 6th LOS	A

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary

44: Ten Trails Place SE & SE Auburn-Black Diamond Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	490	0	0	370	0	0	0	0	0	0	0
Future Volume (veh/h)	0	490	0	0	370	0	0	0	0	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	533	0	0	402	0	0	0	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	760	1080	0	760	1080	0	0	20	0	0	20	0
Arrive On Green	0.00	0.58	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sat Flow, veh/h	983	1870	0	871	1870	0	0-74814		0	0-74814		0
Grp Volume(v), veh/h	0	533	0	0	402	0	0	0	0	0	0	0
Grp Sat Flow(s),veh/h/ln	983	1870	0	871	1870	0	0	1870	0	0	1870	0
Q Serve(g_s), s	0.0	1.6	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	1.6	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.00	1.00		0.00	0.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h	760	1080	0	760	1080	0	0	20	0	0	20	0
V/C Ratio(X)	0.00	0.49	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avail Cap(c_a), veh/h	1854	3161	0	1729	3161	0	0	3161	0	0	3161	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	1.2	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	1.5	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LnGrp LOS	A	A	A	A	A	A	A	A	A	A	A	A
Approach Vol, veh/h	533				402		0				0	
Approach Delay, s/veh	1.5				1.3		0.0				0.0	
Approach LOS	A				A							
Timer - Assigned Phs												
	2		4		6		8					
Phs Duration (G+Y+Rc), s	0.0		9.5		0.0		9.5					
Change Period (Y+Rc), s	4.0		4.0		4.0		4.0					
Max Green Setting (Gmax), s	16.0		16.0		16.0		16.0					
Max Q Clear Time (g_c+I1), s	0.0		3.6		0.0		3.1					
Green Ext Time (p_c), s	0.0		2.4		0.0		2.1					
Intersection Summary												
HCM 6th Ctrl Delay			1.4									
HCM 6th LOS			A									

HCM 6th Signalized Intersection Summary

1: SR 169 & SE Green Valley Rd

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	220	0	15	5	0	0	10	745	5	5	1115	215
Future Volume (veh/h)	220	0	15	5	0	0	10	745	5	5	1115	215
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1900	1900	1900	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	259	0	18	6	0	0	12	876	6	6	1312	253
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	0	0	0	2	2	2	2	2	2
Cap, veh/h	326	0	19	412	0	0	32	961	7	32	1361	1162
Arrive On Green	0.20	0.00	0.20	0.20	0.00	0.00	0.73	0.73	0.73	0.73	0.73	0.73
Sat Flow, veh/h	1339	0	93	1762	0	0	3	1310	9	2	1857	1585
Grp Volume(v), veh/h	277	0	0	6	0	0	894	0	0	1318	0	253
Grp Sat Flow(s),veh/h/ln	1432	0	0	1762	0	0	1322	0	0	1859	0	1585
Q Serve(g_s), s	22.7	0.0	0.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	6.1
Cycle Q Clear(g_c), s	23.0	0.0	0.0	0.3	0.0	0.0	88.0	0.0	0.0	77.4	0.0	6.1
Prop In Lane	0.94		0.06	1.00		0.00	0.01		0.01	0.00		1.00
Lane Grp Cap(c), veh/h	344	0	0	412	0	0	1000	0	0	1393	0	1162
V/C Ratio(X)	0.80	0.00	0.00	0.01	0.00	0.00	0.89	0.00	0.00	0.95	0.00	0.22
Avail Cap(c_a), veh/h	344	0	0	412	0	0	1000	0	0	1393	0	1162
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	47.6	0.0	0.0	38.5	0.0	0.0	18.0	0.0	0.0	14.5	0.0	5.1
Incr Delay (d2), s/veh	13.0	0.0	0.0	0.0	0.0	0.0	12.1	0.0	0.0	14.3	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.2	0.0	0.0	0.1	0.0	0.0	17.3	0.0	0.0	28.3	0.0	1.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	60.5	0.0	0.0	38.5	0.0	0.0	30.1	0.0	0.0	28.7	0.0	5.5
LnGrp LOS	E	A	A	D	A	A	C	A	A	C	A	A
Approach Vol, veh/h	277			6			894			1571		
Approach Delay, s/veh	60.5			38.5			30.1			25.0		
Approach LOS	E			D			C			C		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	92.0			28.0			92.0			28.0		
Change Period (Y+Rc), s	4.0			4.0			4.0			4.0		
Max Green Setting (Gmax), s	88.0			24.0			88.0			16.0		
Max Q Clear Time (g_c+I1), s	90.0			25.0			79.4			2.3		
Green Ext Time (p_c), s	0.0			0.0			6.5			0.0		
Intersection Summary												
HCM 6th Ctrl Delay	30.3											
HCM 6th LOS	C											

HCM 6th TWSC
2: SR 169 & SE 332nd St

01/12/2023

Intersection						
Int Delay, s/veh	0					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	0	1020	0	0	1325
Future Vol, veh/h	0	0	1020	0	0	1325
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	91	91	91	91	91	91
Heavy Vehicles, %	0	0	2	0	0	3
Mvmt Flow	0	0	1121	0	0	1456
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	2577	1121	0	0	1121	0
Stage 1	1121	-	-	-	-	-
Stage 2	1456	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	29	253	-	-	631	-
Stage 1	314	-	-	-	-	-
Stage 2	216	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	29	253	-	-	631	-
Mov Cap-2 Maneuver	29	-	-	-	-	-
Stage 1	314	-	-	-	-	-
Stage 2	216	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	0	0		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-		631	-	
HCM Lane V/C Ratio	-	-		-	-	
HCM Control Delay (s)	-	0		0	-	
HCM Lane LOS	-	A		A	-	
HCM 95th %tile Q(veh)	-	-		0	-	

HCM 6th Signalized Intersection Summary

3: SR 169 & Jones Lake Rd

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	260	270	65	5	5	105	355	110	75	900	5
Future Volume (veh/h)	5	260	270	65	5	5	105	355	110	75	900	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1894	1864	1894	1870	1870	1870	1870	1870	1870	1870	1856	1856
Adj Flow Rate, veh/h	5	283	284	71	5	5	111	374	120	82	947	5
Peak Hour Factor	0.95	0.92	0.95	0.92	0.92	0.92	0.95	0.95	0.92	0.92	0.95	0.95
Percent Heavy Veh, %	0	2	0	2	2	2	2	2	2	2	3	3
Cap, veh/h	48	415	359	160	192	192	141	400	128	555	972	5
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.08	0.29	0.29	0.31	0.53	0.53
Sat Flow, veh/h	9	1853	1605	844	858	858	1781	1357	435	1781	1844	10
Grp Volume(v), veh/h	288	0	284	71	0	10	111	0	494	82	0	952
Grp Sat Flow(s),veh/h/ln	1861	0	1605	844	0	1716	1781	0	1792	1781	0	1854
Q Serve(g_s), s	0.0	0.0	13.3	6.5	0.0	0.4	4.9	0.0	21.3	2.6	0.0	39.7
Cycle Q Clear(g_c), s	11.3	0.0	13.3	17.8	0.0	0.4	4.9	0.0	21.3	2.6	0.0	39.7
Prop In Lane	0.02		1.00	1.00		0.50	1.00		0.24	1.00		0.01
Lane Grp Cap(c), veh/h	463	0	359	160	0	384	141	0	528	555	0	977
V/C Ratio(X)	0.62	0.00	0.79	0.44	0.00	0.03	0.79	0.00	0.93	0.15	0.00	0.97
Avail Cap(c_a), veh/h	463	0	359	160	0	384	661	0	1792	555	0	1380
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.3	0.0	29.1	36.6	0.0	24.1	35.9	0.0	27.3	19.8	0.0	18.3
Incr Delay (d2), s/veh	1.9	0.0	10.4	0.7	0.0	0.0	3.6	0.0	3.5	0.0	0.0	13.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	6.0	1.4	0.0	0.1	2.2	0.0	9.0	1.0	0.0	16.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.2	0.0	39.5	37.3	0.0	24.1	39.6	0.0	30.8	19.8	0.0	32.0
LnGrp LOS	C	A	D	D	A	C	D	A	C	B	A	C
Approach Vol, veh/h	572			81			605			1034		
Approach Delay, s/veh	34.8			35.7			32.4			31.0		
Approach LOS	C			D			C			C		
Timer - Assigned Phs	1	2	4		5	6	8					
Phs Duration (G+Y+Rc), s	29.3	27.9	22.3		10.8	46.4	22.3					
Change Period (Y+Rc), s	4.5	4.5	4.5		4.5	4.5	4.5					
Max Green Setting (Gmax), s	9.2	79.5	17.8		29.5	59.2	17.8					
Max Q Clear Time (g_c+l1), s	4.6	23.3	15.3		6.9	41.7	19.8					
Green Ext Time (p_c), s	0.0	0.1	0.2		0.0	0.2	0.0					
Intersection Summary												
HCM 6th Ctrl Delay				32.5								
HCM 6th LOS				C								

HCM 6th Signalized Intersection Summary

4: SR 169 & Lawson Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕		↕	↕	
Traffic Volume (veh/h)	0	0	35	15	0	90	25	375	10	145	1000	5
Future Volume (veh/h)	0	0	35	15	0	90	25	375	10	145	1000	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	0.99		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	0	0	37	16	0	95	26	395	11	153	1053	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	3	3	3	2	2	2
Cap, veh/h	0	0	180	120	8	152	122	1145	31	926	1277	6
Arrive On Green	0.00	0.00	0.11	0.11	0.00	0.11	0.69	0.69	0.69	1.00	1.00	1.00
Sat Flow, veh/h	0	0	1589	154	71	1339	38	1668	45	978	1860	9
Grp Volume(v), veh/h	0	0	37	111	0	0	432	0	0	153	0	1058
Grp Sat Flow(s),veh/h/ln	0	0	1589	1565	0	0	1751	0	0	978	0	1869
Q Serve(g_s), s	0.0	0.0	0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.8	2.7	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0
Prop In Lane	0.00		1.00	0.14		0.86	0.06		0.03	1.00		0.00
Lane Grp Cap(c), veh/h	0	0	180	280	0	0	1298	0	0	926	0	1283
V/C Ratio(X)	0.00	0.00	0.21	0.40	0.00	0.00	0.33	0.00	0.00	0.17	0.00	0.82
Avail Cap(c_a), veh/h	0	0	636	723	0	0	1298	0	0	926	0	1283
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	0.74	0.00	0.00	0.20	0.00	0.20
Uniform Delay (d), s/veh	0.0	0.0	16.1	16.9	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.6	0.9	0.0	0.0	0.5	0.0	0.0	0.1	0.0	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.3	0.9	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	16.7	17.8	0.0	0.0	3.1	0.0	0.0	0.1	0.0	1.3
LnGrp LOS	A	A	B	B	A	A	A	A	A	A	A	A
Approach Vol, veh/h		37			111			432			1211	
Approach Delay, s/veh		16.7			17.8			3.1			1.1	
Approach LOS		B			B			A			A	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		31.5		8.5		31.5		8.5				
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0				
Max Green Setting (Gmax), s		16.0		16.0		16.0		16.0				
Max Q Clear Time (g_c+I1), s		5.8		2.8		2.0		4.7				
Green Ext Time (p_c), s		1.5		0.1		6.3		0.3				
Intersection Summary												
HCM 6th Ctrl Delay			3.0									
HCM 6th LOS			A									

HCM 6th Signalized Intersection Summary

5: SR 169 & Baker St

01/12/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	35	175	40	425	975	45
Future Volume (veh/h)	35	175	40	425	975	45
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	0.99	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1811	1856	1856	1870	1870
Adj Flow Rate, veh/h	37	186	43	452	1037	48
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	6	3	3	2	2
Cap, veh/h	48	243	213	1134	1084	50
Arrive On Green	0.19	0.19	1.00	1.00	0.61	0.61
Sat Flow, veh/h	257	1290	516	1856	1773	82
Grp Volume(v), veh/h	224	0	43	452	0	1085
Grp Sat Flow(s), veh/h/ln	1554	0	516	1856	0	1855
Q Serve(g_s), s	5.5	0.0	2.6	0.0	0.0	21.9
Cycle Q Clear(g_c), s	5.5	0.0	24.5	0.0	0.0	21.9
Prop In Lane	0.17	0.83	1.00			0.04
Lane Grp Cap(c), veh/h	293	0	213	1134	0	1134
V/C Ratio(X)	0.76	0.00	0.20	0.40	0.00	0.96
Avail Cap(c_a), veh/h	622	0	213	1134	0	1134
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.95	0.95	0.00	1.00
Uniform Delay (d), s/veh	15.4	0.0	11.2	0.0	0.0	7.3
Incr Delay (d2), s/veh	4.1	0.0	2.0	1.0	0.0	18.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%), veh/ln	2.0	0.0	0.4	0.3	0.0	10.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	19.5	0.0	13.3	1.0	0.0	25.4
LnGrp LOS	B	A	B	A	A	C
Approach Vol, veh/h	224			495	1085	
Approach Delay, s/veh	19.5			2.1	25.4	
Approach LOS	B			A	C	
Timer - Assigned Phs	2			4		6
Phs Duration (G+Y+Rc), s	28.5			11.5		28.5
Change Period (Y+Rc), s	4.0			4.0		4.0
Max Green Setting (Gmax), s	16.0			16.0		16.0
Max Q Clear Time (g_c+I1), s	26.5			7.5		23.9
Green Ext Time (p_c), s	0.0			0.6		0.0
Intersection Summary						
HCM 6th Ctrl Delay			18.3			
HCM 6th LOS			B			

Intersection												
Int Delay, s/veh	13.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	35	60	60	0	30	0	65	275	0	0	205	10
Future Vol, veh/h	35	60	60	0	30	0	65	275	0	0	205	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	38	65	65	0	33	0	71	299	0	0	223	11
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	33	0	0	130	0	0	324	207	98	356	239	33
Stage 1	-	-	-	-	-	-	174	174	-	33	33	-
Stage 2	-	-	-	-	-	-	150	33	-	323	206	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1579	-	-	1455	-	-	629	690	958	599	662	1041
Stage 1	-	-	-	-	-	-	828	755	-	983	868	-
Stage 2	-	-	-	-	-	-	853	868	-	689	731	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1579	-	-	1455	-	-	447	672	958	383	645	1041
Mov Cap-2 Maneuver	-	-	-	-	-	-	447	672	-	383	645	-
Stage 1	-	-	-	-	-	-	806	735	-	957	868	-
Stage 2	-	-	-	-	-	-	627	868	-	398	712	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	1.7			0			19.4			13.5		
HCM LOS							C			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	613	1579	-	-	1455	-	-	657				
HCM Lane V/C Ratio	0.603	0.024	-	-	-	-	-	0.356				
HCM Control Delay (s)	19.4	7.3	0	-	0	-	-	13.5				
HCM Lane LOS	C	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	4	0.1	-	-	0	-	-	1.6				

MOVEMENT SUMMARY

 **Site: 101 [7.Roberts Dr (Site Folder: 2032-Build)]**

Roberts Dr and SR 169
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %	v/c	sec		[Veh. veh	Dist] ft				mph
South: SR 169														
3u	U	50	2.0	50	2.0	0.245	13.4	LOS B	1.6	39.5	0.49	0.67	0.49	34.3
3	L2	220	2.0	220	2.0	0.245	11.0	LOS B	1.6	39.5	0.49	0.67	0.49	33.6
8	T1	545	2.0	545	2.0	0.387	4.8	LOS A	3.0	76.2	0.53	0.48	0.53	36.2
Approach		815	2.0	815	2.0	0.387	7.0	LOS A	3.0	76.2	0.52	0.54	0.52	35.3
North: SR 169														
7u	U	25	3.0	25	3.0	0.801	16.1	LOS B	12.0	304.1	0.83	0.73	0.94	36.0
4	T1	1105	2.0	1105	2.0	0.801	7.6	LOS A	12.0	304.1	0.83	0.73	0.94	35.1
14	R2	180	2.0	180	2.0	0.186	5.7	LOS A	1.0	25.7	0.48	0.59	0.48	35.5
Approach		1310	2.0	1310	2.0	0.801	7.5	LOS A	12.0	304.1	0.78	0.71	0.88	35.2
West: Roberts Dr														
5	L2	210	2.0	210	2.0	0.772	45.6	LOS D	10.2	257.9	1.00	1.31	1.83	23.0
12	R2	80	2.0	80	2.0	0.772	39.7	LOS D	10.2	257.9	1.00	1.31	1.83	22.5
Approach		290	2.0	290	2.0	0.772	44.0	LOS D	10.2	257.9	1.00	1.31	1.83	22.9
All Vehicles		2415	2.0	2415	2.0	0.801	11.7	LOS B	12.0	304.1	0.72	0.72	0.87	33.1

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.

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.

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Project: U:\PSO\Projects\Clients\3043-BlackDiamondCityof\214-3043-028 2018 MDRT Traffic Eng\02WBS\Ph40 Transportation Model Dev
\Task4_Build_and_Calibrate_Model\SynchroModel\SIDRA\Roundabouts-2032.sip9

HCM 6th TWSC
9: SR 169 & Black Diamond-Ravensdale Rd

01/12/2023

Intersection

Int Delay, s/veh 5.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	350	530	250	35	1310
Future Vol, veh/h	0	350	530	250	35	1310
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Free	-	Free
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	1	1	2	2	1	1
Mvmt Flow	0	393	596	281	39	1472

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	-	596	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.21	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.309	-
Pot Cap-1 Maneuver	0	505	-
Stage 1	0	-	-
Stage 2	0	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	505	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	32.9	0	0.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBTWBLn1	SBL	SBT
Capacity (veh/h)	-	505	985
HCM Lane V/C Ratio	-	0.779	0.04
HCM Control Delay (s)	-	32.9	8.8
HCM Lane LOS	-	D	A
HCM 95th %tile Q(veh)	-	7	0.1

HCM 6th Signalized Intersection Summary

10: SR 169 & SE 288th St

01/12/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	85	115	120	755	1390	160
Future Volume (veh/h)	85	115	120	755	1390	160
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1841	1841	1856	1856	1841	1841
Adj Flow Rate, veh/h	96	129	135	848	1562	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	3	3	4	4
Cap, veh/h	210	186	298	1386	2613	
Arrive On Green	0.12	0.12	0.75	0.75	0.75	0.00
Sat Flow, veh/h	1753	1560	327	1856	3681	0
Grp Volume(v), veh/h	96	129	135	848	1562	0
Grp Sat Flow(s),veh/h/ln	1753	1560	327	1856	1749	0
Q Serve(g_s), s	3.1	4.8	19.3	12.8	12.2	0.0
Cycle Q Clear(g_c), s	3.1	4.8	31.5	12.8	12.2	0.0
Prop In Lane	1.00	1.00	1.00			0.00
Lane Grp Cap(c), veh/h	210	186	298	1386	2613	
V/C Ratio(X)	0.46	0.69	0.45	0.61	0.60	
Avail Cap(c_a), veh/h	467	416	298	1386	2613	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	24.6	25.4	10.7	3.5	3.5	0.0
Incr Delay (d2), s/veh	1.6	4.5	4.9	2.0	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	1.9	1.3	1.8	1.3	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	26.2	29.9	15.6	5.6	4.5	0.0
LnGrp LOS	C	C	B	A	A	
Approach Vol, veh/h	225			983	1562	A
Approach Delay, s/veh	28.3			6.9	4.5	
Approach LOS	C			A	A	
Timer - Assigned Phs	2			4		6
Phs Duration (G+Y+Rc), s	48.8			11.2		48.8
Change Period (Y+Rc), s	4.0			4.0		4.0
Max Green Setting (Gmax), s	36.0			16.0		36.0
Max Q Clear Time (g_c+I1), s	33.5			6.8		14.2
Green Ext Time (p_c), s	1.5			0.6		8.7

Intersection Summary

HCM 6th Ctrl Delay	7.3
HCM 6th LOS	A

Notes

Unsignalized Delay for [SBR] is excluded from calculations of the approach delay and intersection delay.

HCM Signalized Intersection Capacity Analysis

11: SR 169 & 280th St

01/12/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	70	110	90	910	1405	130
Future Volume (vph)	70	110	90	910	1405	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.1	5.1	5.5	6.7	6.7	6.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1568	1805	1863	1881	1599
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1568	1805	1863	1881	1599
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	116	95	958	1479	137
RTOR Reduction (vph)	0	107	0	0	0	15
Lane Group Flow (vph)	74	9	95	958	1479	122
Heavy Vehicles (%)	2%	3%	0%	2%	1%	1%
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	11.2	11.2	13.3	117.0	98.2	98.2
Effective Green, g (s)	11.2	11.2	13.3	117.0	98.2	98.2
Actuated g/C Ratio	0.08	0.08	0.10	0.84	0.70	0.70
Clearance Time (s)	5.1	5.1	5.5	6.7	6.7	6.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	141	125	171	1556	1319	1121
v/s Ratio Prot	c0.04		0.05	c0.51	c0.79	
v/s Ratio Perm		0.01				0.08
v/c Ratio	0.52	0.07	0.56	0.62	1.12	0.11
Uniform Delay, d1	61.8	59.6	60.5	3.9	20.9	6.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.5	0.3	3.9	1.8	65.2	0.2
Delay (s)	65.3	59.9	64.4	5.7	86.1	7.0
Level of Service	E	E	E	A	F	A
Approach Delay (s)	62.0			11.0	79.3	
Approach LOS	E			B	E	
Intersection Summary						
HCM 2000 Control Delay			53.0		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			1.03			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	17.3
Intersection Capacity Utilization			90.6%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

HCM 6th Signalized Intersection Summary

12: SR 169 & SE Tahoma Way/SE 271st PI

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Lane Configurations													
Traffic Volume (veh/h)	40	15	25	330	15	65	85	1030	120	10	120	1480	65
Future Volume (veh/h)	40	15	25	330	15	65	85	1030	120	10	120	1480	65
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0		0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		1.00		1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Work Zone On Approach	No			No			No				No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1870	1900		1900	1870	1900
Adj Flow Rate, veh/h	42	16	26	347	16	68	89	1084	126		126	1558	68
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95		0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	0	2	0		0	2	0
Cap, veh/h	55	49	79	193	48	203	112	1859	216		151	2086	91
Arrive On Green	0.03	0.08	0.08	0.11	0.15	0.15	0.06	0.58	0.58		0.08	0.60	0.60
Sat Flow, veh/h	1810	641	1042	1810	313	1329	1810	3207	372		1810	3469	151
Grp Volume(v), veh/h	42	0	42	347	0	84	89	600	610		126	795	831
Grp Sat Flow(s),veh/h/ln	1810	0	1683	1810	0	1642	1810	1777	1803		1810	1777	1843
Q Serve(g_s), s	3.2	0.0	3.3	14.9	0.0	6.4	6.8	30.0	30.1		9.6	45.2	45.8
Cycle Q Clear(g_c), s	3.2	0.0	3.3	14.9	0.0	6.4	6.8	30.0	30.1		9.6	45.2	45.8
Prop In Lane	1.00		0.62	1.00		0.81	1.00		0.21		1.00		0.08
Lane Grp Cap(c), veh/h	55	0	128	193	0	250	112	1030	1045		151	1069	1108
V/C Ratio(X)	0.77	0.00	0.33	1.80	0.00	0.34	0.80	0.58	0.58		0.83	0.74	0.75
Avail Cap(c_a), veh/h	167	0	371	193	0	386	252	1030	1045		252	1069	1108
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Uniform Delay (d), s/veh	67.4	0.0	61.3	62.6	0.0	53.0	64.8	18.7	18.7		63.2	20.1	20.2
Incr Delay (d2), s/veh	19.8	0.0	1.5	380.7	0.0	0.8	12.1	2.4	2.4		11.3	4.7	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	1.5	27.3	0.0	2.7	3.5	12.5	12.7		4.8	18.9	19.9
Unsig. Movement Delay, s/veh													
LnGrp Delay(d),s/veh	87.2	0.0	62.7	443.3	0.0	53.8	76.9	21.1	21.1		74.5	24.9	24.9
LnGrp LOS	F	A	E	F	A	D	E	C	C		E	C	C
Approach Vol, veh/h	84		431			1299			1752				
Approach Delay, s/veh	75.0		367.4			24.9			28.4				
Approach LOS	E		F			C			C				
Timer - Assigned Phs	1	2	3	4	5	6	7	8					
Phs Duration (G+Y+Rc), s	7.2	87.1	20.0	15.8	14.1	90.1	9.3	26.4					
Change Period (Y+Rc), s	5.5	5.9	5.1	5.1	5.5	5.9	5.1	5.1					
Max Green Setting (Gmax), s	19.5	53.1	14.9	30.9	19.5	53.1	12.9	32.9					
Max Q Clear Time (g_c+I1), s	11.6	32.1	16.9	5.3	8.8	47.8	5.2	8.4					
Green Ext Time (p_c), s	0.2	8.0	0.0	0.2	0.1	4.1	0.0	0.4					

Intersection Summary

HCM 6th Ctrl Delay 69.2

HCM 6th LOS E

Notes

User approved ignoring U-Turning movement.

HCM 6th Signalized Intersection Summary

13: SR 169 & SR 516

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT	SBR			
Lane Configurations																
Traffic Volume (veh/h)	195	380	165	370	380	160	335	630	75	1	290	955	100			
Future Volume (veh/h)	195	380	165	370	380	160	335	630	75	1	290	955	100			
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0		0	0	0			
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99		1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00			
Work Zone On Approach	No			No			No			No						
Adj Sat Flow, veh/h/ln	1870	1885	1885	1885	1870	1841	1885	1856	1826		1841	1870	1885			
Adj Flow Rate, veh/h	203	396	172	385	396	167	349	656	78		302	995	104			
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	0.96			
Percent Heavy Veh, %	2	1	1	1	2	4	1	3	5		4	2	1			
Cap, veh/h	99	377	317	271	277	117	379	1136	135		332	1082	113			
Arrive On Green	0.06	0.20	0.20	0.08	0.22	0.22	0.21	0.36	0.36		0.19	0.33	0.33			
Sat Flow, veh/h	1781	1885	1586	3483	1246	525	1795	3171	377		1753	3246	339			
Grp Volume(v), veh/h	203	396	172	385	0	563	349	364	370		302	545	554			
Grp Sat Flow(s),veh/h/ln	1781	1885	1586	1742	0	1772	1795	1763	1785		1753	1777	1808			
Q Serve(g_s), s	7.5	27.0	8.1	10.5	0.0	30.0	25.7	22.6	22.6		22.8	39.8	39.8			
Cycle Q Clear(g_c), s	7.5	27.0	8.1	10.5	0.0	30.0	25.7	22.6	22.6		22.8	39.8	39.8			
Prop In Lane	1.00		1.00	1.00		0.30	1.00		0.21		1.00		0.19			
Lane Grp Cap(c), veh/h	99	377	317	271	0	394	379	631	639		332	592	602			
V/C Ratio(X)	2.05	1.05	0.54	1.42	0.00	1.43	0.92	0.58	0.58		0.91	0.92	0.92			
Avail Cap(c_a), veh/h	99	377	317	271	0	394	379	631	639		539	627	637			
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00			
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00			
Uniform Delay (d), s/veh	63.8	54.0	18.6	62.2	0.0	52.5	52.1	35.1	35.1		53.6	43.3	43.3			
Incr Delay (d2), s/veh	506.3	60.1	1.9	209.8	0.0	207.7	27.3	3.8	3.8		12.9	21.7	21.5			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	7.3	18.8	3.1	12.4	0.0	35.7	14.2	10.2	10.3		11.1	20.6	20.9			
Unsig. Movement Delay, s/veh																
LnGrp Delay(d),s/veh	570.0	114.1	20.5	272.0	0.0	260.2	79.4	38.9	38.9		66.5	65.0	64.8			
LnGrp LOS	F	F	C	F	A	F	E	D	D		E	E	E			
Approach Vol, veh/h	771			948			1083			1401						
Approach Delay, s/veh	213.3			265.0			51.9			65.3						
Approach LOS	F			F			D			E						
Timer - Assigned Phs	1	2	3	4	5	6	7	8								
Phs Duration (G+Y+Rc), s	31.1	54.2	16.0	33.7	34.4	50.9	13.0	36.7								
Change Period (Y+Rc), s	5.5	5.9	5.5	6.7	5.9	* 5.9	5.5	6.7								
Max Green Setting (Gmax), s	41.5	32.4	10.5	27.0	26.3	* 48	7.5	30.0								
Max Q Clear Time (g_c+Q), s	24.8	24.6	12.5	29.0	27.7	41.8	9.5	32.0								
Green Ext Time (p_c), s	0.8	2.6	0.0	0.0	0.0	3.2	0.0	0.0								

Intersection Summary

HCM 6th Ctrl Delay 134.0

HCM 6th LOS F

Notes

User approved ignoring U-Turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM Signalized Intersection Capacity Analysis

14: SR 169 & SE 240th Blvd

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	55	35	140	60	35	90	190	830	25	10	110	1455
Future Volume (vph)	55	35	140	60	35	90	190	830	25	10	110	1455
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.1	5.1		5.1	5.1		5.5	5.9	4.0		5.5	5.9
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00		1.00	0.95
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.88		1.00	0.89		1.00	1.00	0.85		1.00	0.99
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1628		1805	1683		1805	3471	1615		1805	3487
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1628		1805	1683		1805	3471	1615		1805	3487
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	37	147	63	37	95	200	874	26	11	116	1532
RTOR Reduction (vph)	0	120	0	0	79	0	0	0	26	0	0	1
Lane Group Flow (vph)	58	64	0	63	53	0	200	874	0	0	127	1589
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	2%	0%	2%	0%	0%	1%	0%	4%	0%	0%	0%	3%
Turn Type	Prot	NA		Prot	NA		Prot	NA	NA	Prot	Prot	NA
Protected Phases	7	4		3	8		5	2		1	1	6
Permitted Phases												
Actuated Green, G (s)	8.7	11.1		9.0	11.4		25.3	83.0	0.0		15.3	73.0
Effective Green, g (s)	8.7	11.1		9.0	11.4		25.3	83.0	0.0		15.3	73.0
Actuated g/C Ratio	0.06	0.08		0.06	0.08		0.18	0.59	0.00		0.11	0.52
Clearance Time (s)	5.1	5.1		5.1	5.1		5.5	5.9			5.5	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	109	129		116	137		326	2057	0		197	1818
v/s Ratio Prot	0.03	c0.04		c0.03	0.03		c0.11	0.25			0.07	c0.46
v/s Ratio Perm												
v/c Ratio	0.53	0.50		0.54	0.39		0.61	0.42	0.00		0.64	0.87
Uniform Delay, d1	63.7	61.8		63.5	61.0		52.8	15.5	70.0		59.7	29.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.26	0.63
Incremental Delay, d2	4.9	3.0		5.1	1.8		3.4	0.6	0.0		0.7	0.6
Delay (s)	68.6	64.8		68.6	62.8		56.2	16.2	70.0		76.1	19.1
Level of Service	E	E		E	E		E	B	E		E	B
Approach Delay (s)		65.7			64.7			24.7				23.3
Approach LOS		E			E			C				C
Intersection Summary												
HCM 2000 Control Delay			29.4				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			140.0				Sum of lost time (s)		21.6			
Intersection Capacity Utilization			85.6%				ICU Level of Service		E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

14: SR 169 & SE 240th Blvd

01/12/2023

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	55
Future Volume (vph)	55
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.95
Adj. Flow (vph)	58
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Heavy Vehicles (%)	2%
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM 6th Signalized Intersection Summary

15: SR 169 & Witte Rd SE

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	450	50	15	70	45	10	15	875	20	5	1555	785
Future Volume (veh/h)	450	50	15	70	45	10	15	875	20	5	1555	785
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1796	1900	1826	1900	1900	1900	1870	1737	1900	1870	1885
Adj Flow Rate, veh/h	464	52	15	72	46	10	15	902	21	5	1603	809
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	7	0	5	0	0	0	2	11	0	2	1
Cap, veh/h	515	199	58	91	79	17	29	2221	52	11	1452	674
Arrive On Green	0.15	0.15	0.15	0.05	0.05	0.05	0.02	0.63	0.63	0.00	0.41	0.41
Sat Flow, veh/h	3456	1339	386	1739	1510	328	1810	3550	83	1810	2355	1094
Grp Volume(v), veh/h	464	0	67	72	0	56	15	452	471	5	1175	1237
Grp Sat Flow(s),veh/h/ln	1728	0	1726	1739	0	1839	1810	1777	1855	1810	1777	1672
Q Serve(g_s), s	18.5	0.0	4.8	5.7	0.0	4.2	1.2	17.8	17.8	0.4	86.3	86.3
Cycle Q Clear(g_c), s	18.5	0.0	4.8	5.7	0.0	4.2	1.2	17.8	17.8	0.4	86.3	86.3
Prop In Lane	1.00		0.22	1.00		0.18	1.00		0.04	1.00		0.65
Lane Grp Cap(c), veh/h	515	0	257	91	0	96	29	1112	1161	11	1095	1031
V/C Ratio(X)	0.90	0.00	0.26	0.79	0.00	0.58	0.53	0.41	0.41	0.44	1.07	1.20
Avail Cap(c_a), veh/h	555	0	419	242	0	407	123	1112	1161	123	1095	1031
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.09	0.09	0.09
Uniform Delay (d), s/veh	58.5	0.0	52.7	65.6	0.0	64.8	68.4	13.1	13.1	69.5	41.1	41.1
Incr Delay (d2), s/veh	17.0	0.0	0.5	13.9	0.0	5.4	14.1	1.1	1.1	2.4	34.9	90.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.3	0.0	2.1	2.9	0.0	2.1	0.6	7.1	7.4	0.2	49.1	62.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	75.6	0.0	53.3	79.4	0.0	70.3	82.5	14.2	14.2	71.8	76.0	132.0
LnGrp LOS	E	A	D	E	A	E	F	B	B	E	F	F
Approach Vol, veh/h	531		128			938			2417			
Approach Delay, s/veh	72.8		75.4			15.3			104.7			
Approach LOS	E		E			B			F			
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.4	93.9	12.9	26.9	7.7	92.6	26.4	13.3				
Change Period (Y+Rc), s	5.5	6.3	5.5	6.0	5.5	6.3	5.5	6.0				
Max Green Setting (Gmax), s	9.5	53.7	19.5	34.0	9.5	53.7	22.5	31.0				
Max Q Clear Time (g_c+I), s	12.4	19.8	7.7	6.8	3.2	88.3	20.5	6.2				
Green Ext Time (p_c), s	0.0	6.3	0.1	0.3	0.0	0.0	0.4	0.2				
Intersection Summary												
HCM 6th Ctrl Delay	78.6											
HCM 6th LOS	E											

HCM 6th Signalized Intersection Summary 16: SR 169 & SE Wax Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	10	410	45	20	45	275	1025	30	50	1870	130
Future Volume (veh/h)	115	10	410	45	20	45	275	1025	30	50	1870	130
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1885	1737	1885	1900	1900	1900	1885	1870	1900	1900	1885	1885
Adj Flow Rate, veh/h	119	10	423	46	21	46	284	1057	31	52	1928	134
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	11	1	0	0	0	1	2	0	0	1	1
Cap, veh/h	144	364	332	60	86	187	289	1943	57	68	1534	684
Arrive On Green	0.08	0.21	0.21	0.03	0.16	0.16	0.16	0.55	0.55	0.04	0.43	0.43
Sat Flow, veh/h	1795	1737	1586	1810	526	1153	1795	3525	103	1810	3582	1598
Grp Volume(v), veh/h	119	10	423	46	0	67	284	533	555	52	1928	134
Grp Sat Flow(s),veh/h/ln	1795	1737	1586	1810	0	1680	1795	1777	1852	1810	1791	1598
Q Serve(g_s), s	9.1	0.6	29.3	3.5	0.0	4.9	22.1	26.9	26.9	4.0	59.9	7.3
Cycle Q Clear(g_c), s	9.1	0.6	29.3	3.5	0.0	4.9	22.1	26.9	26.9	4.0	59.9	7.3
Prop In Lane	1.00		1.00	1.00		0.69	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	144	364	332	60	0	273	289	979	1021	68	1534	684
V/C Ratio(X)	0.83	0.03	1.27	0.76	0.00	0.25	0.98	0.54	0.54	0.76	1.26	0.20
Avail Cap(c_a), veh/h	276	364	332	291	0	364	289	979	1021	381	1534	684
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	0.81	0.81	0.81	0.42	0.42	0.42
Uniform Delay (d), s/veh	63.4	44.0	55.3	67.1	0.0	51.1	58.6	20.1	20.1	66.7	40.0	25.0
Incr Delay (d2), s/veh	11.3	0.0	144.9	17.8	0.0	0.5	43.3	1.8	1.7	7.2	118.1	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	0.3	25.1	1.9	0.0	2.1	13.3	11.2	11.7	2.0	50.5	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.7	44.0	200.2	85.0	0.0	51.6	101.9	21.9	21.8	74.0	158.2	25.3
LnGrp LOS	E	D	F	F	A	D	F	C	C	E	F	C
Approach Vol, veh/h	552			113			1372			2114		
Approach Delay, s/veh	170.3			65.2			38.4			147.7		
Approach LOS	F			E			D			F		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	80.8	83.1	10.2	36.0	28.0	65.8	16.7	29.4				
Change Period (Y+Rc), s	5.5	5.9	5.5	6.7	5.5	5.9	5.5	6.7				
Max Green Setting (Gmax), s	29.5	35.1	22.5	29.3	22.5	42.1	21.5	30.3				
Max Q Clear Time (g_c+10), s	16.0	28.9	5.5	31.3	24.1	61.9	11.1	6.9				
Green Ext Time (p_c), s	0.1	3.3	0.1	0.0	0.0	0.0	0.2	0.3				

Intersection Summary

HCM 6th Ctrl Delay	112.3
HCM 6th LOS	F

HCM 6th Signalized Intersection Summary

17: SR 169 & SE 231st St

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	50	955	10	65	20	575	580	25	15	1115	155
Future Volume (veh/h)	175	50	955	10	65	20	575	580	25	15	1115	155
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1707	1885	1574	1767	1811	1870	1885	1841	1678	1870	1870
Adj Flow Rate, veh/h	182	52	995	10	68	21	599	604	26	16	1161	161
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	13	1	22	9	6	2	1	4	15	2	2
Cap, veh/h	162	542	1327	14	306	94	534	1650	71	22	1177	525
Arrive On Green	0.09	0.32	0.32	0.01	0.24	0.24	0.15	0.47	0.47	0.01	0.33	0.33
Sat Flow, veh/h	1781	1707	2812	1499	1295	400	3456	3499	150	1598	3554	1585
Grp Volume(v), veh/h	182	52	995	10	0	89	599	309	321	16	1161	161
Grp Sat Flow(s),veh/h/ln	1781	1707	1406	1499	0	1695	1728	1791	1858	1598	1777	1585
Q Serve(g_s), s	10.0	2.4	31.8	0.7	0.0	4.7	17.0	12.1	12.1	1.1	35.7	8.3
Cycle Q Clear(g_c), s	10.0	2.4	31.8	0.7	0.0	4.7	17.0	12.1	12.1	1.1	35.7	8.3
Prop In Lane	1.00		1.00	1.00		0.24	1.00		0.08	1.00		1.00
Lane Grp Cap(c), veh/h	162	542	1327	14	0	400	534	845	876	22	1177	525
V/C Ratio(X)	1.12	0.10	0.75	0.70	0.00	0.22	1.12	0.37	0.37	0.71	0.99	0.31
Avail Cap(c_a), veh/h	162	559	1355	55	0	462	534	845	876	58	1177	525
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.83	0.83	0.83	1.00	0.00	1.00	0.85	0.85	0.85	1.00	1.00	1.00
Uniform Delay (d), s/veh	50.0	26.4	23.7	54.3	0.0	33.9	46.5	18.6	18.6	54.0	36.5	27.4
Incr Delay (d2), s/veh	101.7	0.1	1.9	46.5	0.0	0.3	74.2	1.0	1.0	33.9	23.2	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.9	0.9	10.2	0.5	0.0	1.9	12.6	5.0	5.2	0.6	18.5	3.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	151.7	26.5	25.7	100.8	0.0	34.1	120.7	19.6	19.6	87.9	59.8	28.9
LnGrp LOS	F	C	C	F	A	C	F	B	B	F	E	C
Approach Vol, veh/h	1229			99			1229			1338		
Approach Delay, s/veh	44.4			40.9			68.9			56.4		
Approach LOS	D			D			E			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	57.8	5.1	41.6	21.0	42.3	14.0	32.7					
Change Period (Y+Rc), s	4.0	5.9	4.0	6.7	4.0	5.9	4.0	6.7				
Max Green Setting (Gmax), s	45.4	4.0	36.0	17.0	32.4	10.0	30.0					
Max Q Clear Time (g_c+I), s	14.1	2.7	33.8	19.0	37.7	12.0	6.7					
Green Ext Time (p_c), s	0.0	3.8	0.0	1.1	0.0	0.0	0.4					

Intersection Summary

HCM 6th Ctrl Delay	56.1
HCM 6th LOS	E

HCM Signalized Intersection Capacity Analysis

18: SE 231st St & SR 18 EB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	110	785	0	0	725	110	100	0	410	0	0	0
Future Volume (vph)	110	785	0	0	725	110	100	0	410	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.3	6.3			6.3	6.3		5.9	5.9			
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1787	3539			3505	1599		1770	1583			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1787	3539			3505	1599		1770	1583			
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	111	793	0	0	732	111	101	0	414	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	67	0	0	104	0	0	0
Lane Group Flow (vph)	111	793	0	0	732	44	0	101	310	0	0	0
Heavy Vehicles (%)	1%	2%	0%	0%	3%	1%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	7.7	43.5			29.5	29.5		19.3	19.3			
Effective Green, g (s)	7.7	43.5			29.5	29.5		19.3	19.3			
Actuated g/C Ratio	0.10	0.58			0.39	0.39		0.26	0.26			
Clearance Time (s)	6.3	6.3			6.3	6.3		5.9	5.9			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	183	2052			1378	628		455	407			
v/s Ratio Prot	c0.06	0.22			c0.21							
v/s Ratio Perm						0.03		0.06	c0.20			
v/c Ratio	0.61	0.39			0.53	0.07		0.22	0.76			
Uniform Delay, d1	32.2	8.5			17.4	14.2		21.9	25.7			
Progression Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Incremental Delay, d2	5.6	0.6			1.5	0.2		0.2	8.2			
Delay (s)	37.8	9.1			18.9	14.4		22.2	33.9			
Level of Service	D	A			B	B		C	C			
Approach Delay (s)		12.6			18.3			31.6			0.0	
Approach LOS		B			B			C			A	
Intersection Summary												
HCM 2000 Control Delay			19.1				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.62									
Actuated Cycle Length (s)			75.0				Sum of lost time (s)			18.5		
Intersection Capacity Utilization			68.7%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

19: SE 231st St & SR 18 WB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑	↑↑						↑	↑
Traffic Volume (vph)	0	610	230	415	445	0	0	0	0	255	0	115
Future Volume (vph)	0	610	230	415	445	0	0	0	0	255	0	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.3	6.3	5.5	6.3						5.9	5.9
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3574	1568	1752	3312						1736	1455
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		3574	1568	1752	3312						1736	1455
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)	0	622	235	423	454	0	0	0	0	260	0	117
RTOR Reduction (vph)	0	0	125	0	0	0	0	0	0	0	0	91
Lane Group Flow (vph)	0	622	110	423	454	0	0	0	0	0	260	26
Heavy Vehicles (%)	0%	1%	3%	3%	9%	0%	0%	0%	0%	4%	0%	11%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		19.0	19.0	25.6	50.1						17.7	17.7
Effective Green, g (s)		19.0	19.0	25.6	50.1						17.7	17.7
Actuated g/C Ratio		0.24	0.24	0.32	0.63						0.22	0.22
Clearance Time (s)		6.3	6.3	5.5	6.3						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		848	372	560	2074						384	321
v/s Ratio Prot		c0.17		c0.24	0.14							
v/s Ratio Perm			0.07								0.15	0.02
v/c Ratio		0.73	0.30	0.76	0.22						0.68	0.08
Uniform Delay, d1		28.2	25.0	24.4	6.5						28.5	24.7
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		5.6	2.0	5.8	0.2						4.7	0.1
Delay (s)		33.7	27.0	30.1	6.7						33.2	24.8
Level of Service		C	C	C	A						C	C
Approach Delay (s)		31.9			18.0			0.0			30.6	
Approach LOS		C			B			A			C	
Intersection Summary												
HCM 2000 Control Delay			25.9			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)				17.7		
Intersection Capacity Utilization			68.7%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM 6th Signalized Intersection Summary

20: SE Ravensdale Way/Landsburg Rd SE & SE Kent Kangley Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (veh/h)	30	270	5	15	215	40	0	240	25	120	440	110
Future Volume (veh/h)	30	270	5	15	215	40	0	240	25	120	440	110
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1885	1885	1885	1870	1870	1870	1885	1885	1885	1856	1856	1856
Adj Flow Rate, veh/h	32	284	5	16	226	42	0	253	26	126	463	116
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	1	1	1	2	2	2	1	1	1	3	3	3
Cap, veh/h	138	415	7	120	364	65	0	887	91	232	620	144
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.00	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	102	1697	28	47	1489	267	0	1681	173	210	1176	273
Grp Volume(v), veh/h	321	0	0	284	0	0	0	0	279	705	0	0
Grp Sat Flow(s),veh/h/ln	1828	0	0	1802	0	0	0	0	1854	1659	0	0
Q Serve(g_s), s	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	6.9	0.0	0.0
Cycle Q Clear(g_c), s	5.5	0.0	0.0	4.9	0.0	0.0	0.0	0.0	2.9	11.9	0.0	0.0
Prop In Lane	0.10		0.02	0.06		0.15	0.00		0.09	0.18		0.16
Lane Grp Cap(c), veh/h	559	0	0	549	0	0	0	0	978	996	0	0
V/C Ratio(X)	0.57	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.29	0.71	0.00	0.00
Avail Cap(c_a), veh/h	934	0	0	921	0	0	0	0	1641	1571	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	12.1	0.0	0.0	11.8	0.0	0.0	0.0	0.0	4.6	6.6	0.0	0.0
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.2	0.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.5	1.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.0	0.0	0.0	12.6	0.0	0.0	0.0	0.0	4.8	7.5	0.0	0.0
LnGrp LOS	B	A	A	B	A	A	A	A	A	A	A	A
Approach Vol, veh/h	321			284			279			705		
Approach Delay, s/veh	13.0			12.6			4.8			7.5		
Approach LOS	B			B			A			A		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	22.5			12.6			22.5			12.6		
Change Period (Y+Rc), s	4.0			4.0			4.0			4.0		
Max Green Setting (Gmax), s	31.0			16.0			31.0			16.0		
Max Q Clear Time (g_c+I1), s	4.9			7.5			13.9			6.9		
Green Ext Time (p_c), s	1.6			1.1			4.6			1.0		

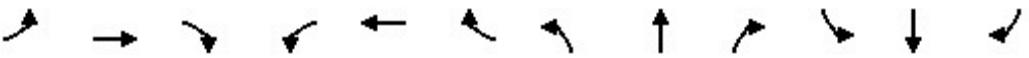
Intersection Summary

HCM 6th Ctrl Delay	9.1
HCM 6th LOS	A

HCM Signalized Intersection Capacity Analysis

21: Witte Rd SE & SR 516

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	225	725	0	75	720	155	5	45	95	175	95	335
Future Volume (vph)	225	725	0	75	720	155	5	45	95	175	95	335
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	6.8		5.5	6.8	6.8		5.1			5.9	5.9
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.91			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00			0.97	1.00
Satd. Flow (prot)	1805	1863		1805	1863	1615		1713			1829	1599
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00			0.97	1.00
Satd. Flow (perm)	1805	1863		1805	1863	1615		1713			1829	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	234	755	0	78	750	161	5	47	99	182	99	349
RTOR Reduction (vph)	0	0	0	0	0	94	0	57	0	0	0	185
Lane Group Flow (vph)	234	755	0	78	750	67	0	94	0	0	281	164
Confl. Peds. (#/hr)			3	3			1					1
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	3%	0%	1%	0%	1%
Turn Type	Prot	NA		Prot	NA	Perm	Split	NA		Split	NA	pt+ov
Protected Phases	5	2		1	6		3	3		4	4	4 5
Permitted Phases						6						
Actuated Green, G (s)	15.8	65.3		6.7	55.8	55.8		12.5			27.2	43.0
Effective Green, g (s)	15.8	65.3		6.7	55.8	55.8		12.5			27.2	43.0
Actuated g/C Ratio	0.12	0.48		0.05	0.41	0.41		0.09			0.20	0.32
Clearance Time (s)	5.9	6.8		5.5	6.8	6.8		5.1			5.9	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	211	901		89	770	667		158			368	509
v/s Ratio Prot	c0.13	0.41		0.04	c0.40			c0.05			c0.15	0.10
v/s Ratio Perm						0.04						
v/c Ratio	1.11	0.84		0.88	0.97	0.10		0.59			0.76	0.32
Uniform Delay, d1	59.6	30.3		63.7	38.9	24.2		58.8			50.9	34.9
Progression Factor	1.00	1.00		0.96	0.60	0.74		1.00			1.00	1.00
Incremental Delay, d2	94.2	9.2		20.1	10.9	0.1		5.9			9.1	0.4
Delay (s)	153.8	39.4		81.6	34.1	18.0		64.7			59.9	35.3
Level of Service	F	D		F	C	B		E			E	D
Approach Delay (s)		66.5			35.3			64.7			46.3	
Approach LOS		E			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			50.6				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			135.0				Sum of lost time (s)			23.7		
Intersection Capacity Utilization			93.4%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

22: 216th Ave SE & SR 516

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗	↖	↑		↖		↗		↕	
Traffic Volume (vph)	0	790	260	290	740	0	325	0	235	15	0	0
Future Volume (vph)	0	790	260	290	740	0	325	0	235	15	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	4.0	7.0		5.5		5.5		4.0	
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00		1.00		1.00	
Frpb, ped/bikes		1.00	0.97	1.00	1.00		1.00		0.97		1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00		1.00		1.00	
Frt		1.00	0.85	1.00	1.00		1.00		0.85		1.00	
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00		0.95	
Satd. Flow (prot)		1881	1540	1805	1845		1787		1558		1770	
Flt Permitted		1.00	1.00	0.95	1.00		0.95		1.00		0.95	
Satd. Flow (perm)		1881	1540	1805	1845		1787		1558		1770	
Peak-hour factor, PHF	0.92	0.96	0.96	0.96	0.96	0.92	0.96	0.92	0.96	0.92	0.92	0.92
Adj. Flow (vph)	0	823	271	302	771	0	339	0	245	16	0	0
RTOR Reduction (vph)	0	0	162	0	0	0	0	0	189	0	0	0
Lane Group Flow (vph)	0	823	109	302	771	0	339	0	56	0	16	0
Confl. Peds. (#/hr)			4	4					3			
Heavy Vehicles (%)	2%	1%	2%	0%	3%	2%	1%	2%	1%	2%	2%	2%
Turn Type		NA	Perm	Prot	NA		Prot		Perm	Prot	NA	
Protected Phases		2		1	6		8			8		
Permitted Phases		2	2						8			
Actuated Green, G (s)		36.1	36.1	16.7	56.8		20.7		20.7		20.7	
Effective Green, g (s)		36.1	36.1	16.7	56.8		20.7		20.7		20.7	
Actuated g/C Ratio		0.40	0.40	0.19	0.63		0.23		0.23		0.23	
Clearance Time (s)		7.0	7.0	4.0	7.0		5.5		5.5			
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0			
Lane Grp Cap (vph)		754	617	334	1164		411		358		407	
v/s Ratio Prot		c0.44		c0.17	0.42		c0.19				0.01	
v/s Ratio Perm			0.07						0.04			
v/c Ratio		1.09	0.18	0.90	0.66		0.82		0.16		0.04	
Uniform Delay, d1		26.9	17.4	35.9	10.5		32.9		27.7		26.9	
Progression Factor		1.00	1.00	1.00	1.00		1.00		1.00		1.00	
Incremental Delay, d2		60.5	0.6	26.5	3.0		12.7		0.2		0.0	
Delay (s)		87.5	18.0	62.3	13.5		45.6		27.9		27.0	
Level of Service		F	B	E	B		D		C		C	
Approach Delay (s)		70.3			27.2			38.2			27.0	
Approach LOS		E			C			D			C	
Intersection Summary												
HCM 2000 Control Delay			46.6			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			16.5			
Intersection Capacity Utilization			87.0%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

23: SE Wax Rd & SR 516

01/12/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	45	210	995	80	25	105	830	95	180	130	105	260
Future Volume (vph)	45	210	995	80	25	105	830	95	180	130	105	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9			5.9	5.9	5.9	5.5	5.9		5.5
Lane Util. Factor		1.00	0.95			1.00	0.95	1.00	1.00	1.00		0.97
Frt		1.00	0.99			1.00	1.00	0.85	1.00	0.93		1.00
Flt Protected		0.95	1.00			0.95	1.00	1.00	0.95	1.00		0.95
Satd. Flow (prot)		1761	3529			1791	3539	1599	1770	1765		3502
Flt Permitted		0.95	1.00			0.95	1.00	1.00	0.95	1.00		0.95
Satd. Flow (perm)		1761	3529			1791	3539	1599	1770	1765		3502
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	46	216	1026	82	26	108	856	98	186	134	108	268
RTOR Reduction (vph)	0	0	5	0	0	0	0	71	0	27	0	0
Lane Group Flow (vph)	0	262	1103	0	0	134	856	27	186	215	0	268
Heavy Vehicles (%)	0%	3%	1%	3%	0%	1%	2%	1%	2%	0%	1%	0%
Turn Type	Prot	Prot	NA		Prot	Prot	NA	Perm	Prot	NA		Prot
Protected Phases	7	7	4		3	3	8		5	2		1
Permitted Phases							8					
Actuated Green, G (s)		19.1	38.9			10.9	30.7	30.7	15.0	24.2		12.8
Effective Green, g (s)		19.1	38.9			10.9	30.7	30.7	15.0	24.2		12.8
Actuated g/C Ratio		0.17	0.35			0.10	0.28	0.28	0.14	0.22		0.12
Clearance Time (s)		5.9	5.9			5.9	5.9	5.9	5.5	5.9		5.5
Vehicle Extension (s)		3.0	3.0			3.0	3.0	3.0	3.0	3.0		3.0
Lane Grp Cap (vph)		305	1247			177	987	446	241	388		407
v/s Ratio Prot		c0.15	c0.31			0.07	0.24		c0.11	0.12		0.08
v/s Ratio Perm								0.02				
v/c Ratio		0.86	0.88			0.76	0.87	0.06	0.77	0.56		0.66
Uniform Delay, d1		44.1	33.4			48.3	37.7	29.1	45.8	38.1		46.5
Progression Factor		1.00	1.00			1.00	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2		20.6	7.8			16.8	8.1	0.1	14.2	5.6		3.8
Delay (s)		64.8	41.2			65.0	45.9	29.1	60.0	43.8		50.3
Level of Service		E	D			E	D	C	E	D		D
Approach Delay (s)			45.7				46.7			50.8		
Approach LOS			D				D			D		
Intersection Summary												
HCM 2000 Control Delay			46.9				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			110.0				Sum of lost time (s)			23.2		
Intersection Capacity Utilization			82.8%				ICU Level of Service			E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

23: SE Wax Rd & SR 516

01/12/2023



Movement	SBT	SBR
Lane Configurations	↑	↑
Traffic Volume (vph)	245	265
Future Volume (vph)	245	265
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.9	5.9
Lane Util. Factor	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	1900	1568
Flt Permitted	1.00	1.00
Satd. Flow (perm)	1900	1568
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	253	273
RTOR Reduction (vph)	0	151
Lane Group Flow (vph)	253	122
Heavy Vehicles (%)	0%	3%
Turn Type	NA	Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	22.0	22.0
Effective Green, g (s)	22.0	22.0
Actuated g/C Ratio	0.20	0.20
Clearance Time (s)	5.9	5.9
Vehicle Extension (s)	3.0	3.0
Lane Grp Cap (vph)	380	313
v/s Ratio Prot	c0.13	
v/s Ratio Perm		0.08
v/c Ratio	0.67	0.39
Uniform Delay, d1	40.6	38.2
Progression Factor	1.00	1.00
Incremental Delay, d2	8.9	3.6
Delay (s)	49.5	41.8
Level of Service	D	D
Approach Delay (s)	47.1	
Approach LOS	D	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

24: 172nd Ave SE & SR 516

01/12/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	10	270	1115	115	15	195	1040	50	140	75	140	100
Future Volume (vph)	10	270	1115	115	15	195	1040	50	140	75	140	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.1	5.1			5.1	5.1		5.9	5.9		5.9
Lane Util. Factor		1.00	0.95			1.00	0.95		1.00	1.00		1.00
Frpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	0.98		1.00
Flpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	1.00		1.00
Frt		1.00	0.99			1.00	0.99		1.00	0.90		1.00
Flt Protected		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1805	3524			1788	3514		1805	1668		1805
Flt Permitted		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1805	3524			1788	3514		1805	1668		1805
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	284	1174	121	16	205	1095	53	147	79	147	105
RTOR Reduction (vph)	0	0	4	0	0	0	2	0	0	68	0	0
Lane Group Flow (vph)	0	295	1291	0	0	221	1146	0	147	158	0	105
Confl. Peds. (#/hr)	3	2			10			2	3		10	10
Heavy Vehicles (%)	0%	0%	1%	1%	0%	1%	2%	0%	0%	0%	1%	0%
Turn Type	Prot	Prot	NA		Prot	Prot	NA		Prot	NA		Prot
Protected Phases	7	7	4		3	3	8		5	2		1
Permitted Phases												
Actuated Green, G (s)		46.9	56.4			34.3	43.8		16.0	23.5		13.8
Effective Green, g (s)		46.9	56.4			34.3	43.8		16.0	23.5		13.8
Actuated g/C Ratio		0.31	0.38			0.23	0.29		0.11	0.16		0.09
Clearance Time (s)		5.1	5.1			5.1	5.1		5.9	5.9		5.9
Vehicle Extension (s)		3.0	3.0			3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		564	1325			408	1026		192	261		166
v/s Ratio Prot		c0.16	c0.37			0.12	c0.33		c0.08	c0.09		0.06
v/s Ratio Perm												
v/c Ratio		0.52	0.97			0.54	1.12		0.77	0.60		0.63
Uniform Delay, d1		42.4	46.1			50.9	53.1		65.2	58.9		65.7
Progression Factor		0.46	1.22			1.00	1.00		1.00	1.00		1.00
Incremental Delay, d2		0.3	10.1			1.5	65.9		16.5	10.0		7.6
Delay (s)		19.9	66.3			52.4	119.0		81.7	68.9		73.3
Level of Service		B	E			D	F		F	E		E
Approach Delay (s)			57.7				108.3			73.9		
Approach LOS			E				F			E		
Intersection Summary												
HCM 2000 Control Delay			79.6				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.0		
Intersection Capacity Utilization			88.3%				ICU Level of Service			E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

24: 172nd Ave SE & SR 516

01/12/2023



Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	85	100
Future Volume (vph)	85	100
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.9	
Lane Util. Factor	1.00	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.92	
Flt Protected	1.00	
Satd. Flow (prot)	1726	
Flt Permitted	1.00	
Satd. Flow (perm)	1726	
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	89	105
RTOR Reduction (vph)	44	0
Lane Group Flow (vph)	150	0
Confl. Peds. (#/hr)		3
Heavy Vehicles (%)	0%	0%
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	21.3	
Effective Green, g (s)	21.3	
Actuated g/C Ratio	0.14	
Clearance Time (s)	5.9	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	245	
v/s Ratio Prot	0.09	
v/s Ratio Perm		
v/c Ratio	0.61	
Uniform Delay, d1	60.5	
Progression Factor	1.00	
Incremental Delay, d2	11.0	
Delay (s)	71.4	
Level of Service	E	
Approach Delay (s)	72.1	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

25: 168th PI & SR 516

01/12/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	10	235	1335	270	5	215	1105	50	365	55	170	60
Future Volume (vph)	10	235	1335	270	5	215	1105	50	365	55	170	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9	5.9		5.9	5.9		5.1	5.1		5.1
Lane Util. Factor		1.00	0.95	1.00		1.00	0.95		0.97	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00		1.00	1.00		1.00	0.99		1.00
Flpb, ped/bikes		1.00	1.00	1.00		1.00	1.00		1.00	1.00		1.00
Frt		1.00	1.00	0.85		1.00	0.99		1.00	0.89		1.00
Flt Protected		0.95	1.00	1.00		0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1788	3574	1615		1788	3515		3502	1653		1805
Flt Permitted		0.95	1.00	1.00		0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1788	3574	1615		1788	3515		3502	1653		1805
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	11	270	1534	310	6	247	1270	57	420	63	195	69
RTOR Reduction (vph)	0	0	0	95	0	0	2	0	0	76	0	0
Lane Group Flow (vph)	0	281	1534	215	0	253	1325	0	420	182	0	69
Confl. Peds. (#/hr)	1	2		3	2	3		2	1		2	2
Heavy Vehicles (%)	0%	1%	1%	0%	0%	1%	2%	0%	0%	0%	1%	0%
Turn Type	Prot	Prot	NA	custom	Prot	Prot	NA		Prot	NA		Prot
Protected Phases	5	5	2	2	1	1	6		3	8		7
Permitted Phases				2								
Actuated Green, G (s)		22.0	64.1	64.1		21.0	63.1		26.2	34.5		8.4
Effective Green, g (s)		22.0	64.1	64.1		21.0	63.1		26.2	34.5		8.4
Actuated g/C Ratio		0.15	0.43	0.43		0.14	0.42		0.17	0.23		0.06
Clearance Time (s)		5.9	5.9	5.9		5.9	5.9		5.1	5.1		5.1
Vehicle Extension (s)		3.0	3.0	3.0		3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		262	1527	690		250	1478		611	380		101
v/s Ratio Prot		c0.16	c0.43	0.13		0.14	0.38		c0.12	0.11		0.04
v/s Ratio Perm												
v/c Ratio		1.07	1.00	0.31		1.01	0.90		0.69	0.48		0.68
Uniform Delay, d1		64.0	43.0	28.4		64.5	40.4		58.1	50.0		69.5
Progression Factor		0.86	1.05	1.08		1.12	0.75		1.00	1.00		1.00
Incremental Delay, d2		70.8	21.9	1.0		43.0	4.7		3.2	1.0		17.4
Delay (s)		126.0	67.1	31.6		115.1	34.9		61.3	50.9		86.9
Level of Service		F	E	C		F	C		E	D		F
Approach Delay (s)			69.7				47.8			57.3		
Approach LOS			E				D			E		
Intersection Summary												
HCM 2000 Control Delay			60.8				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.92									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.0		
Intersection Capacity Utilization			86.4%				ICU Level of Service			E		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

25: 168th PI & SR 516

01/12/2023



Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	70	70
Future Volume (vph)	70	70
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.1	
Lane Util. Factor	1.00	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.93	
Flt Protected	1.00	
Satd. Flow (prot)	1746	
Flt Permitted	1.00	
Satd. Flow (perm)	1746	
Peak-hour factor, PHF	0.87	0.87
Adj. Flow (vph)	80	80
RTOR Reduction (vph)	27	0
Lane Group Flow (vph)	133	0
Confl. Peds. (#/hr)		1
Heavy Vehicles (%)	0%	0%
Turn Type	NA	
Protected Phases	4	
Permitted Phases		
Actuated Green, G (s)	16.7	
Effective Green, g (s)	16.7	
Actuated g/C Ratio	0.11	
Clearance Time (s)	5.1	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	194	
v/s Ratio Prot	c0.08	
v/s Ratio Perm		
v/c Ratio	0.69	
Uniform Delay, d1	64.1	
Progression Factor	1.00	
Incremental Delay, d2	9.7	
Delay (s)	73.8	
Level of Service	E	
Approach Delay (s)	77.8	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

26: SR 516 & SR 18 EB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	1290	0	0	1400	205	225	0	815	0	0	0
Future Volume (vph)	140	1290	0	0	1400	205	225	0	815	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Lane Util. Factor	0.97	0.95			0.95		1.00	0.95	0.95			
Frpb, ped/bikes	1.00	1.00			1.00		1.00	0.99	0.99			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.98		1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (prot)	3303	3574			3503		1787	1499	1499			
Flt Permitted	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (perm)	3303	3574			3503		1787	1499	1499			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	146	1344	0	0	1458	214	234	0	849	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	296	296	0	0	0
Lane Group Flow (vph)	146	1344	0	0	1668	0	234	129	128	0	0	0
Confl. Peds. (#/hr)	2		4	4		2			1	1		
Heavy Vehicles (%)	6%	1%	0%	0%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			3				
Permitted Phases							3		3			
Actuated Green, G (s)	11.8	108.7			91.4		29.5	29.5	29.5			
Effective Green, g (s)	11.8	108.7			91.4		29.5	29.5	29.5			
Actuated g/C Ratio	0.08	0.72			0.61		0.20	0.20	0.20			
Clearance Time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	259	2589			2134		351	294	294			
v/s Ratio Prot	0.04	c0.38			c0.48			0.09				
v/s Ratio Perm							c0.13		0.09			
v/c Ratio	0.56	0.52			0.78		0.67	0.44	0.44			
Uniform Delay, d1	66.6	9.1			21.9		55.7	53.0	52.9			
Progression Factor	1.36	2.43			1.51		1.00	1.00	1.00			
Incremental Delay, d2	1.9	0.5			1.6		4.7	1.1	1.0			
Delay (s)	92.7	22.6			34.7		60.4	54.0	54.0			
Level of Service	F	C			C		E	D	D			
Approach Delay (s)		29.5			34.7			55.4			0.0	
Approach LOS		C			C			E			A	
Intersection Summary												
HCM 2000 Control Delay			38.2				HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio			0.77									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)		22.8			
Intersection Capacity Utilization			80.6%				ICU Level of Service		D			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

27: SR 516 & SR 18 WB Ramps

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑↑						↑↓	↑
Traffic Volume (vph)	0	1230	410	450	1160	0	0	0	0	160	5	450
Future Volume (vph)	0	1230	410	450	1160	0	0	0	0	160	5	450
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Lane Util. Factor		0.95	1.00	0.97	0.91						0.95	0.95
Frpb, ped/bikes		1.00	0.98	1.00	1.00						1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						0.93	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.98	1.00
Satd. Flow (prot)		3539	1543	3467	5136						1587	1475
Flt Permitted		1.00	1.00	0.95	1.00						0.98	1.00
Satd. Flow (perm)		3539	1543	3467	5136						1587	1475
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1295	432	474	1221	0	0	0	0	168	5	474
RTOR Reduction (vph)	0	0	77	0	0	0	0	0	0	0	23	84
Lane Group Flow (vph)	0	1295	355	474	1221	0	0	0	0	0	311	229
Confl. Peds. (#/hr)	3		2	2		3						
Heavy Vehicles (%)	0%	2%	3%	1%	1%	0%	0%	0%	0%	1%	33%	4%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						3	
Permitted Phases			2							3		3
Actuated Green, G (s)		74.8	74.8	25.3	105.6						32.6	32.6
Effective Green, g (s)		74.8	74.8	25.3	105.6						32.6	32.6
Actuated g/C Ratio		0.50	0.50	0.17	0.70						0.22	0.22
Clearance Time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		1764	769	584	3615						344	320
v/s Ratio Prot		c0.37		c0.14	0.24							
v/s Ratio Perm			0.23								0.20	0.16
v/c Ratio		0.73	0.46	0.81	0.34						0.90	0.72
Uniform Delay, d1		29.7	24.5	60.1	8.6						57.2	54.4
Progression Factor		0.69	0.58	0.77	2.03						1.00	1.00
Incremental Delay, d2		2.2	1.6	5.5	0.2						26.0	7.4
Delay (s)		22.8	15.9	51.8	17.7						83.2	61.9
Level of Service		C	B	D	B						F	E
Approach Delay (s)		21.0			27.2			0.0			72.9	
Approach LOS		C			C			A			E	
Intersection Summary												
HCM 2000 Control Delay			31.9			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)				17.3		
Intersection Capacity Utilization			80.6%			ICU Level of Service				D		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

28: SR 516 & 164th Ave SE

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	1165	10	20	1230	360	5	5	5	470	10	220
Future Volume (vph)	115	1165	10	20	1230	360	5	5	5	470	10	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9		5.5	5.9	5.9		5.5		5.9	5.9	5.9
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1752	3535		1703	3539	1615		1785		1698	1706	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.70		0.75	0.72	1.00
Satd. Flow (perm)	1752	3535		1703	3539	1615		1273		1336	1294	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	120	1214	10	21	1281	375	5	5	5	490	10	229
RTOR Reduction (vph)	0	0	0	0	0	115	0	5	0	0	0	107
Lane Group Flow (vph)	120	1224	0	21	1281	260	0	10	0	250	250	122
Heavy Vehicles (%)	3%	2%	0%	6%	2%	0%	0%	0%	0%	1%	0%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		9	6			7			4	
Permitted Phases						6	7	7		4		4
Actuated Green, G (s)	15.8	81.9		5.1	71.2	71.2		3.8		36.4	36.4	36.4
Effective Green, g (s)	15.8	81.9		5.1	71.2	71.2		3.8		36.4	36.4	36.4
Actuated g/C Ratio	0.11	0.55		0.03	0.47	0.47		0.03		0.24	0.24	0.24
Clearance Time (s)	5.5	5.9		5.5	5.9	5.9		5.5		5.9	5.9	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	184	1930		57	1679	766		32		324	314	384
v/s Ratio Prot	c0.07	c0.35		0.01	c0.36							
v/s Ratio Perm						0.16		c0.01		0.19	c0.19	0.08
v/c Ratio	0.65	0.63		0.37	0.76	0.34		0.32		0.77	0.80	0.32
Uniform Delay, d1	64.5	23.6		70.9	32.4	24.7		71.8		52.9	53.3	46.6
Progression Factor	1.23	0.51		0.66	1.29	1.65		1.00		1.00	1.00	1.00
Incremental Delay, d2	4.8	0.9		3.6	3.0	1.1		5.6		10.8	13.1	0.5
Delay (s)	84.4	13.0		50.6	44.9	41.7		77.5		63.8	66.4	47.1
Level of Service	F	B		D	D	D		E		E	E	D
Approach Delay (s)		19.3			44.3			77.5			59.4	
Approach LOS		B			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			38.4				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.8		
Intersection Capacity Utilization			77.2%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

29: Covington Way SE & SR 516

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	870	500	410	925	25	490	5	380	15	10	35
Future Volume (vph)	25	870	500	410	925	25	490	5	380	15	10	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9		5.5	5.9		6.0	6.0	6.0		5.9	5.9
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.95	1.00		0.97	1.00
Satd. Flow (prot)	1805	3336		1770	3525		1681	1688	1583		1843	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.74	0.71	1.00		0.39	1.00
Satd. Flow (perm)	1805	3336		1770	3525		1310	1259	1583		740	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	906	521	427	964	26	510	5	396	16	10	36
RTOR Reduction (vph)	0	58	0	0	1	0	0	0	251	0	0	34
Lane Group Flow (vph)	26	1369	0	427	989	0	255	260	145	0	26	2
Confl. Peds. (#/hr)	1		2	2		1						
Heavy Vehicles (%)	0%	1%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			3	
Permitted Phases							4		4	3	3	3
Actuated Green, G (s)	5.3	68.6		20.5	83.8		29.3	29.3	29.3		8.3	8.3
Effective Green, g (s)	5.3	68.6		20.5	83.8		29.3	29.3	29.3		8.3	8.3
Actuated g/C Ratio	0.04	0.46		0.14	0.56		0.20	0.20	0.20		0.06	0.06
Clearance Time (s)	5.5	5.9		5.5	5.9		6.0	6.0	6.0		5.9	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	63	1525		241	1969		255	245	309		40	89
v/s Ratio Prot	0.01	c0.41		c0.24	0.28							
v/s Ratio Perm							0.19	c0.21	0.09		c0.04	0.00
v/c Ratio	0.41	0.90		1.77	0.50		1.00	1.06	0.47		0.65	0.02
Uniform Delay, d1	70.8	37.5		64.8	20.3		60.4	60.4	53.5		69.4	67.0
Progression Factor	1.00	1.00		1.22	0.92		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.3	8.7		359.2	0.7		56.4	74.6	1.1		32.0	0.1
Delay (s)	75.2	46.2		438.4	19.4		116.7	134.9	54.6		101.4	67.1
Level of Service	E	D		F	B		F	F	D		F	E
Approach Delay (s)		46.7			145.6			94.9			81.5	
Approach LOS		D			F			F			F	
Intersection Summary												
HCM 2000 Control Delay	95.2			HCM 2000 Level of Service					F			
HCM 2000 Volume to Capacity ratio	1.06											
Actuated Cycle Length (s)	150.0			Sum of lost time (s)					23.3			
Intersection Capacity Utilization	109.1%			ICU Level of Service					H			
Analysis Period (min)	15											
c Critical Lane Group												

Intersection												
Int Delay, s/veh	235.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	65	1255	0	35	1135	210	0	0	0	115	0	90
Future Vol, veh/h	65	1255	0	35	1135	210	0	0	0	115	0	90
Conflicting Peds, #/hr	1	0	3	3	0	1	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	150	-	-	-	-	-	-	-	-	-	-	-
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, %	0	1	0	0	3	2	0	0	0	3	0	1
Mvmt Flow	69	1335	0	37	1207	223	0	0	0	122	0	96
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1431	0	0	1338	0	0	2154	2981	671	2200	2870	716
Stage 1	-	-	-	-	-	-	1476	1476	-	1394	1394	-
Stage 2	-	-	-	-	-	-	678	1505	-	806	1476	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.56	6.5	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.56	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.56	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.53	4	3.31
Pot Cap-1 Maneuver	481	-	-	522	-	-	28	14	404	~ 25	17	375
Stage 1	-	-	-	-	-	-	135	192	-	148	210	-
Stage 2	-	-	-	-	-	-	413	186	-	340	192	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	481	-	-	521	-	-	13	7	403	~ 16	9	375
Mov Cap-2 Maneuver	-	-	-	-	-	-	13	7	-	~ 16	9	-
Stage 1	-	-	-	-	-	-	115	164	-	127	127	-
Stage 2	-	-	-	-	-	-	186	113	-	291	164	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.7			0.3			0			\$ 3329.5		
HCM LOS							A			F		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	-	481	-	-	521	-	-	28				
HCM Lane V/C Ratio	-	0.144	-	-	0.071	-	-	7.789				
HCM Control Delay (s)	0	13.7	-	-	12.4	-	-	\$ 3329.5				
HCM Lane LOS	A	B	-	-	B	-	-	F				
HCM 95th %tile Q(veh)	-	0.5	-	-	0.2	-	-	26.8				
Notes												
~: Volume exceeds capacity		\$: Delay exceeds 300s				+: Computation Not Defined				*: All major volume in platoon		

HCM Signalized Intersection Capacity Analysis

31: Covington Way SE & 165th PI SE

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	25	5	15	365	0	190	5	490	155	120	220	560
Future Volume (vph)	25	5	15	365	0	190	5	490	155	120	220	560
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0		5.0	4.0	5.0			4.0	5.0
Lane Util. Factor	1.00	1.00		1.00		1.00	1.00	0.95			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00		1.00	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00		1.00	1.00	1.00			1.00	1.00
Frt	1.00	0.89		1.00		0.85	1.00	0.96			1.00	1.00
Flt Protected	0.95	1.00		0.95		1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1388	1510		1787		1599	1357	3382			1805	1881
Flt Permitted	0.76	1.00		0.74		1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1107	1510		1399		1599	1357	3382			1805	1881
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	27	5	16	388	0	202	5	521	165	128	234	596
RTOR Reduction (vph)	0	11	0	0	0	114	0	38	0	0	0	0
Lane Group Flow (vph)	27	10	0	388	0	88	5	648	0	0	362	596
Confl. Peds. (#/hr)									3		3	
Heavy Vehicles (%)	30%	0%	15%	1%	0%	1%	33%	3%	0%	0%	0%	1%
Turn Type	Perm	NA		Perm		Perm	Prot	NA		Prot	Prot	NA
Protected Phases		4			8		5	2		1	1	6
Permitted Phases	4			8		8						
Actuated Green, G (s)	29.1	29.1		29.1		29.1	0.8	23.2			23.7	46.1
Effective Green, g (s)	29.1	29.1		29.1		29.1	0.8	23.2			23.7	46.1
Actuated g/C Ratio	0.32	0.32		0.32		0.32	0.01	0.26			0.26	0.51
Clearance Time (s)	5.0	5.0		5.0		5.0	4.0	5.0			4.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	357	488		452		517	12	871			475	963
v/s Ratio Prot		0.01					0.00	c0.19			c0.20	0.32
v/s Ratio Perm	0.02			c0.28		0.05						
v/c Ratio	0.08	0.02		0.86		0.17	0.42	0.74			0.76	0.62
Uniform Delay, d1	21.1	20.7		28.5		21.8	44.4	30.7			30.6	15.7
Progression Factor	1.00	1.00		1.00		1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	0.1	0.0		14.9		0.2	21.8	5.7			7.1	3.0
Delay (s)	21.2	20.8		43.4		22.0	66.1	36.4			37.7	18.7
Level of Service	C	C		D		C	E	D			D	B
Approach Delay (s)		21.0			36.1			36.6				25.7
Approach LOS		C			D			D				C
Intersection Summary												
HCM 2000 Control Delay			31.5									
HCM 2000 Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			90.0									
Intersection Capacity Utilization			82.4%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Covington Way SE & 165th PI SE

01/12/2023

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	10
Future Volume (vph)	10
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.0
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1077
Flt Permitted	1.00
Satd. Flow (perm)	1077
Peak-hour factor, PHF	0.94
Adj. Flow (vph)	11
RTOR Reduction (vph)	5
Lane Group Flow (vph)	6
Confl. Peds. (#/hr)	
Heavy Vehicles (%)	50%
Turn Type	Perm
Protected Phases	
Permitted Phases	6
Actuated Green, G (s)	46.1
Effective Green, g (s)	46.1
Actuated g/C Ratio	0.51
Clearance Time (s)	5.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	551
v/s Ratio Prot	
v/s Ratio Perm	0.01
v/c Ratio	0.01
Uniform Delay, d1	10.8
Progression Factor	1.00
Incremental Delay, d2	0.0
Delay (s)	10.8
Level of Service	B
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM 6th Signalized Intersection Summary 32: Covington Way SE & SE Wax Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↕		↗	↖	↖
Traffic Volume (veh/h)	0	0	0	445	0	110	0	515	270	65	850	0
Future Volume (veh/h)	0	0	0	445	0	110	0	515	270	65	850	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1885	1900	1870	1900	1870	1900	1870	1885	1900
Adj Flow Rate, veh/h	0	0	0	473	0	117	0	548	287	69	904	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	0	0	0	1	0	2	0	2	0	2	1	0
Cap, veh/h	0	844	0	596	0	130	0	831	714	221	838	0
Arrive On Green	0.00	0.00	0.00	0.44	0.00	0.44	0.00	0.44	0.44	0.44	0.44	0.00
Sat Flow, veh/h	0	1900	0	1179	0	292	0	1870	1607	658	1885	0
Grp Volume(v), veh/h	0	0	0	590	0	0	0	548	287	69	904	0
Grp Sat Flow(s),veh/h/ln	0	1900	0	1471	0	0	0	1870	1607	658	1885	0
Q Serve(g_s), s	0.0	0.0	0.0	33.5	0.0	0.0	0.0	20.7	10.9	8.3	40.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	33.5	0.0	0.0	0.0	20.7	10.9	29.0	40.0	0.0
Prop In Lane	0.00		0.00	0.80		0.20	0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	0	844	0	726	0	0	0	831	714	221	838	0
V/C Ratio(X)	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.66	0.40	0.31	1.08	0.00
Avail Cap(c_a), veh/h	0	844	0	726	0	0	0	831	714	221	838	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	23.2	0.0	0.0	0.0	19.6	16.9	31.0	25.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	9.7	0.0	0.0	0.0	1.9	0.4	0.8	54.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	12.6	0.0	0.0	0.0	8.8	3.8	1.3	29.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	32.9	0.0	0.0	0.0	21.6	17.3	31.8	79.6	0.0
LnGrp LOS	A	A	A	C	A	A	A	C	B	C	F	A
Approach Vol, veh/h												
0												
Approach Delay, s/veh												
0.0												
Approach LOS												
C												
C												
E												
Timer - Assigned Phs												
2												
4												
6												
8												
Phs Duration (G+Y+Rc), s												
45.0												
45.0												
45.0												
45.0												
Change Period (Y+Rc), s												
5.0												
5.0												
5.0												
5.0												
Max Green Setting (Gmax), s												
40.0												
40.0												
40.0												
40.0												
Max Q Clear Time (g_c+I1), s												
0.0												
22.7												
35.5												
42.0												
Green Ext Time (p_c), s												
0.0												
4.2												
1.5												
0.0												
Intersection Summary												
HCM 6th Ctrl Delay												
46.0												
HCM 6th LOS												
D												

Intersection

Int Delay, s/veh 1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	275	35	35	320	20	15
Future Vol, veh/h	275	35	35	320	20	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	299	38	38	348	22	16

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	337
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1222
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1222
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	13.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	466	-	-	1222	-
HCM Lane V/C Ratio	0.082	-	-	0.031	-
HCM Control Delay (s)	13.4	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

HCM 6th Signalized Intersection Summary

34: 216th Ave SE & SE 288th St

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	0	185	0	145	0	440	170	185	485	0
Future Volume (veh/h)	5	0	0	185	0	145	0	440	170	185	485	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1856	1856	1856	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	5	0	0	193	0	0	0	458	0	193	505	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	0	0	3	3	3	0	0	0	1	1	1
Cap, veh/h	529	0	0	476	0	0	0	1081	0	325	669	0
Arrive On Green	0.17	0.00	0.00	0.17	0.00	0.00	0.00	0.57	0.00	0.57	0.57	0.00
Sat Flow, veh/h	1722	0	0	1411	0	1572	0	1900	1610	310	1175	0
Grp Volume(v), veh/h	5	0	0	193	0	0	0	458	0	698	0	0
Grp Sat Flow(s),veh/h/ln	1722	0	0	1411	0	1572	0	1900	1610	1485	0	0
Q Serve(g_s), s	0.0	0.0	0.0	4.0	0.0	0.0	0.0	4.2	0.0	7.5	0.0	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	4.0	0.0	0.0	0.0	4.2	0.0	11.7	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		1.00	0.28		0.00
Lane Grp Cap(c), veh/h	529	0	0	476	0	0	0	1081	0	994	0	0
V/C Ratio(X)	0.01	0.00	0.00	0.41	0.00	0.00	0.00	0.42	0.00	0.70	0.00	0.00
Avail Cap(c_a), veh/h	1028	0	0	963	0	0	0	2216	0	1876	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	10.6	0.0	0.0	12.3	0.0	0.0	0.0	3.8	0.0	5.2	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.3	0.0	0.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.4	0.0	0.9	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.6	0.0	0.0	12.8	0.0	0.0	0.0	4.0	0.0	6.2	0.0	0.0
LnGrp LOS	B	A	A	B	A		A	A		A	A	A
Approach Vol, veh/h	5			193			A			698		
Approach Delay, s/veh	10.6			12.8			4.0			6.2		
Approach LOS	B			B			A			A		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	21.6			9.3			21.6			9.3		
Change Period (Y+Rc), s	4.0			4.0			4.0			4.0		
Max Green Setting (Gmax), s	36.0			16.0			36.0			16.0		
Max Q Clear Time (g_c+I1), s	6.2			2.1			13.7			6.0		
Green Ext Time (p_c), s	1.9			0.0			3.8			0.4		

Intersection Summary

HCM 6th Ctrl Delay	6.4
HCM 6th LOS	A

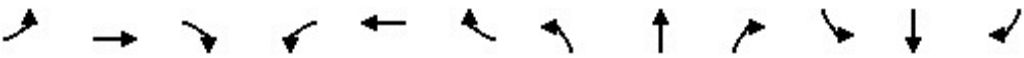
Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM Signalized Intersection Capacity Analysis

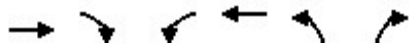
35: SE 296th St/216th Ave SE & SE Covington-Sawyer Rd/292nd St

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↱			↰	↱
Traffic Volume (vph)	280	15	465	10	20	25	390	300	10	20	345	305
Future Volume (vph)	280	15	465	10	20	25	390	300	10	20	345	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	5.0		4.0		5.0	4.0			4.0	5.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00			1.00	1.00
Frt		1.00	0.85		0.94		1.00	1.00			1.00	0.85
Flt Protected		0.95	1.00		0.99		0.95	1.00			1.00	1.00
Satd. Flow (prot)		1797	1568		1729		1752	1855			1860	1615
Flt Permitted		0.74	1.00		0.93		0.20	1.00			0.97	1.00
Satd. Flow (perm)		1384	1568		1622		376	1855			1807	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	308	16	511	11	22	27	429	330	11	22	379	335
RTOR Reduction (vph)	0	0	338	0	19	0	0	1	0	0	0	195
Lane Group Flow (vph)	0	324	173	0	41	0	429	340	0	0	401	140
Heavy Vehicles (%)	1%	0%	3%	0%	0%	5%	3%	2%	0%	0%	2%	0%
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		8			4		5	2			6	
Permitted Phases	8		8	4			2			6		6
Actuated Green, G (s)		23.9	23.9		23.9		46.1	46.1			22.9	22.9
Effective Green, g (s)		24.9	23.9		24.9		46.1	47.1			23.9	22.9
Actuated g/C Ratio		0.31	0.30		0.31		0.58	0.59			0.30	0.29
Clearance Time (s)		5.0	5.0		5.0		5.0	5.0			5.0	5.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)		430	468		504		529	1092			539	462
v/s Ratio Prot							c0.18	0.18				
v/s Ratio Perm		c0.23	0.11		0.03		c0.28				0.22	0.09
v/c Ratio		0.75	0.37		0.08		0.81	0.31			0.74	0.30
Uniform Delay, d1		24.8	22.1		19.5		14.7	8.3			25.3	22.3
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		6.5	0.2		0.0		8.7	0.7			9.0	1.7
Delay (s)		31.3	22.3		19.5		23.4	9.0			34.3	24.0
Level of Service		C	C		B		C	A			C	C
Approach Delay (s)		25.8			19.5			17.0			29.6	
Approach LOS		C			B			B			C	
Intersection Summary												
HCM 2000 Control Delay			24.0				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			13.0		
Intersection Capacity Utilization			73.8%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

36: 219th Ave SE & SE 296th St

01/12/2023



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	580	160	10	585	195	20
Future Volume (veh/h)	580	160	10	585	195	20
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1870	1900	1885	1870	1900
Adj Flow Rate, veh/h	725	200	12	731	244	25
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	1	2	0	1	2	0
Cap, veh/h	1195	1005	370	1331	320	290
Arrive On Green	0.63	0.63	0.01	0.71	0.18	0.18
Sat Flow, veh/h	1885	1585	1810	1885	1781	1610
Grp Volume(v), veh/h	725	200	12	731	244	25
Grp Sat Flow(s), veh/h/ln	1885	1585	1810	1885	1781	1610
Q Serve(g_s), s	16.0	3.7	0.2	13.0	9.1	0.9
Cycle Q Clear(g_c), s	16.0	3.7	0.2	13.0	9.1	0.9
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1195	1005	370	1331	320	290
V/C Ratio(X)	0.61	0.20	0.03	0.55	0.76	0.09
Avail Cap(c_a), veh/h	1195	1005	498	1331	662	598
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.67	0.67	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	7.6	5.4	6.4	4.9	27.3	23.9
Incr Delay (d2), s/veh	1.5	0.3	0.0	1.6	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	1.0	0.0	3.7	3.9	0.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	9.2	5.7	6.4	6.6	28.7	24.0
LnGrp LOS	A	A	A	A	C	C
Approach Vol, veh/h	925			743	269	
Approach Delay, s/veh	8.4			6.6	28.3	
Approach LOS	A			A	C	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	5.0	48.4		16.6		53.4
Change Period (Y+Rc), s	4.0	5.0		5.0		5.0
Max Green Setting (Gmax), s	6.0	25.0		25.0		35.0
Max Q Clear Time (g_c+I2, s)	12.2	18.0		11.1		15.0
Green Ext Time (p_c), s	0.0	1.6		0.5		1.7

Intersection Summary

HCM 6th Ctrl Delay	10.5
HCM 6th LOS	B

HCM 6th TWSC
37: 218th Ave SE & SE Auburn-Black Diamond Rd

01/12/2023

Intersection

Int Delay, s/veh 9.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1225	265	40	1035	90	45
Future Vol, veh/h	1225	265	40	1035	90	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1276	276	42	1078	94	47

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1552
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	427
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	427
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	182.3
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	126	-	-	427	-
HCM Lane V/C Ratio	1.116	-	-	0.098	-
HCM Control Delay (s)	182.3	-	-	14.3	0
HCM Lane LOS	F	-	-	B	A
HCM 95th %tile Q(veh)	8.2	-	-	0.3	-

Notes

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

MOVEMENT SUMMARY

 **Site: 101 [38.Ten Trails Pkwy - Reduced (Site Folder: 2032-Build)]**

Ten Trails Pkwy and SE Auburn Black Diamond Rd
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %	v/c	sec		[Veh. veh	Dist] ft				mph
South: Ten Trails Pkwy														
3	L2	285	8.0	285	8.0	0.781	34.8	LOS C	8.4	224.5	1.00	1.23	1.65	25.5
8	T1	390	0.0	390	0.0	0.984	54.6	LOS E	23.6	590.4	1.00	1.68	2.77	20.7
18	R2	130	0.0	130	0.0	0.984	57.4	LOS E	23.6	590.4	1.00	1.68	2.77	20.3
Approach		805	2.8	805	2.8	0.984	48.0	LOS D	23.6	590.4	1.00	1.52	2.37	22.1
East: SE Auburn Black Diamond Rd														
1	L2	35	0.0	35	0.0	0.726	14.7	LOS B	6.5	165.2	0.87	0.95	1.14	34.9
6	T1	810	2.0	810	2.0	0.726	9.5	LOS A	6.5	165.2	0.84	0.91	1.05	34.9
16	R2	65	0.0	65	0.0	0.367	7.3	LOS A	1.9	47.0	0.71	0.74	0.74	34.5
Approach		910	1.8	910	1.8	0.726	9.5	LOS A	6.5	165.2	0.83	0.90	1.04	34.9
North: Ten Trails Pkwy														
7	L2	65	0.0	65	0.0	0.131	15.1	LOS B	0.6	15.9	0.75	0.91	0.75	32.6
4	T1	505	0.0	505	0.0	0.761	15.4	LOS B	8.4	210.2	0.98	1.19	1.55	32.2
14	R2	65	2.0	65	2.0	0.761	19.2	LOS B	8.4	210.2	0.98	1.19	1.55	31.2
Approach		635	0.2	635	0.2	0.761	15.7	LOS B	8.4	210.2	0.95	1.16	1.47	32.1
West: SE Auburn Black Diamond Rd														
5	L2	135	0.0	135	0.0	0.936	23.4	LOS D	18.5	472.9	1.00	1.34	1.89	31.0
2	T1	810	3.0	810	3.0	0.936	17.7	LOS D	18.5	472.9	1.00	1.34	1.89	30.8
12	R2	350	4.0	350	4.0	0.490	8.1	LOS A	3.1	79.6	0.73	0.89	0.82	34.5
Approach		1295	3.0	1295	3.0	0.936	15.7	LOS B	18.5	472.9	0.93	1.22	1.60	31.7
All Vehicles		3645	2.2	3645	2.2	0.984	21.3	LOS C	23.6	590.4	0.92	1.20	1.61	29.6

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.

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MOVEMENT SUMMARY

 **Site: 101 [39.Lake Sawyer Rd - Reduced (Site Folder: 2032-Build)]**

Lake Sawyer Rd and SE Auburn Black Diamond Rd
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %	v/c	sec		[Veh. veh	Dist] ft				mph
South: Lake Sawyer Rd														
3	L2	165	6.0	165	6.0	0.681	16.2	LOS B	5.5	145.2	0.89	1.05	1.19	33.5
8	T1	340	6.0	340	6.0	0.681	10.4	LOS B	5.5	145.2	0.89	1.05	1.19	33.5
18	R2	335	6.0	335	6.0	0.582	10.7	LOS B	3.8	98.9	0.84	0.99	1.06	33.0
Approach		840	6.0	840	6.0	0.681	11.7	LOS B	5.5	145.2	0.87	1.03	1.14	33.3
East: SE Auburn Black Diamond Rd														
1	L2	160	2.0	160	2.0	0.815	29.4	LOS C	12.6	319.9	1.00	1.33	1.84	28.3
6	T1	240	2.0	240	2.0	0.815	23.3	LOS C	12.6	319.9	1.00	1.33	1.84	28.2
16	R2	155	2.0	155	2.0	0.815	23.5	LOS C	12.6	319.9	1.00	1.33	1.84	27.5
Approach		555	2.0	555	2.0	0.815	25.1	LOS C	12.6	319.9	1.00	1.33	1.84	28.0
North: Lake Sawyer Rd														
7	L2	260	1.0	260	1.0	0.639	14.6	LOS B	7.4	186.1	0.90	0.89	1.06	34.2
4	T1	470	1.0	470	1.0	0.639	8.5	LOS A	7.4	186.1	0.90	0.89	1.06	34.1
14	R2	610	1.0	610	1.0	0.692	11.5	LOS B	8.2	206.0	0.94	1.02	1.22	32.8
Approach		1340	1.0	1340	1.0	0.692	11.0	LOS B	8.2	206.0	0.92	0.95	1.14	33.5
West: SE Auburn Black Diamond Rd														
5	L2	345	1.0	345	1.0	0.603	21.5	LOS C	6.1	154.2	1.00	1.12	1.32	29.7
2	T1	455	1.0	455	1.0	0.782	20.7	LOS C	13.0	326.5	1.00	1.23	1.68	29.7
12	R2	155	1.0	155	1.0	0.782	20.8	LOS C	13.0	326.5	1.00	1.23	1.68	28.9
Approach		955	1.0	955	1.0	0.782	21.0	LOS C	13.0	326.5	1.00	1.19	1.55	29.6
All Vehicles		3690	2.3	3690	2.3	0.815	15.9	LOS B	13.0	326.5	0.94	1.09	1.35	31.5

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.

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MOVEMENT SUMMARY

Site: 40 [40.Roberts Dr Morgan St (Site Folder: 2032-Build)]

Roberts Dr and Morgan St
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Morgan St														
3	L2	540	2.0	540	2.0	0.503	12.6	LOS B	3.5	89.8	0.66	0.79	0.68	33.4
Approach		540	2.0	540	2.0	0.503	12.6	LOS B	3.5	89.8	0.66	0.79	0.68	33.4
East: Roberts Dr														
1	L2	10	2.0	10	2.0	0.465	13.3	LOS B	3.5	89.1	0.78	0.75	0.81	35.4
6	T1	415	2.0	415	2.0	0.465	7.4	LOS A	3.5	89.1	0.78	0.75	0.81	35.3
Approach		425	2.0	425	2.0	0.465	7.5	LOS A	3.5	89.1	0.78	0.75	0.81	35.3
West: Roberts Dr														
5	L2	30	2.0	30	2.0	0.778	9.9	LOS A	14.1	358.8	0.23	0.39	0.23	37.4
2	T1	405	2.0	405	2.0	0.778	4.0	LOS A	14.1	358.8	0.23	0.39	0.23	37.4
12	R2	680	2.0	680	2.0	0.778	4.0	LOS A	14.1	358.8	0.23	0.39	0.23	36.2
Approach		1115	2.0	1115	2.0	0.778	4.2	LOS A	14.1	358.8	0.23	0.39	0.23	36.6
All Vehicles		2080	2.0	2080	2.0	0.778	7.0	LOS A	14.1	358.8	0.45	0.57	0.47	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.

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HCM 6th TWSC
41: Railroad Ave/Morgan St & Baker St

01/12/2023

Intersection						
Int Delay, s/veh	2.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	75	465	15	175	505
Future Vol, veh/h	10	75	465	15	175	505
Conflicting Peds, #/hr	0	1	0	10	10	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	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	1	2
Mvmt Flow	11	82	505	16	190	549
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	1452	524	0	0	531	0
Stage 1	523	-	-	-	-	-
Stage 2	929	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.209	-
Pot Cap-1 Maneuver	145	557	-	-	1042	-
Stage 1	599	-	-	-	-	-
Stage 2	388	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	106	552	-	-	1033	-
Mov Cap-2 Maneuver	106	-	-	-	-	-
Stage 1	594	-	-	-	-	-
Stage 2	285	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	18	0		2.4		
HCM LOS	C					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	369	1033	-	
HCM Lane V/C Ratio	-	-	0.25	0.184	-	
HCM Control Delay (s)	-	-	18	9.3	0	
HCM Lane LOS	-	-	C	A	A	
HCM 95th %tile Q(veh)	-	-	1	0.7	-	

Intersection

Intersection Delay, s/veh	12.3
Intersection LOS	B

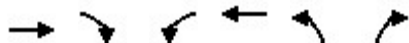
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	10	15	115	10	15	50	30	180	10	15	370	10
Future Vol, veh/h	10	15	115	10	15	50	30	180	10	15	370	10
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	0	0	13	33	0	0	2	0	0	1	0
Mvmt Flow	11	16	125	11	16	54	33	196	11	16	402	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.8	9.6	10.8	14.6
HCM LOS	A	A	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	7%	13%	4%
Vol Thru, %	82%	11%	20%	94%
Vol Right, %	5%	82%	67%	3%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	220	140	75	395
LT Vol	30	10	10	15
Through Vol	180	15	15	370
RT Vol	10	115	50	10
Lane Flow Rate	239	152	82	429
Geometry Grp	1	1	1	1
Degree of Util (X)	0.341	0.221	0.129	0.585
Departure Headway (Hd)	5.127	5.231	5.69	4.904
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	701	685	629	738
Service Time	3.159	3.275	3.738	2.904
HCM Lane V/C Ratio	0.341	0.222	0.13	0.581
HCM Control Delay	10.8	9.8	9.6	14.6
HCM Lane LOS	B	A	A	B
HCM 95th-tile Q	1.5	0.8	0.4	3.8

HCM 6th Signalized Intersection Summary 43: SE Green Valley Rd & SE Auburn Black Diamond Rd

01/12/2023



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	605	530	5	430	260	0
Future Volume (veh/h)	605	530	5	430	260	0
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1885	1856	1856	1885	1885
Adj Flow Rate, veh/h	672	0	6	478	289	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	1	1	3	3	1	1
Cap, veh/h	962		427	947	389	346
Arrive On Green	0.51	0.00	0.51	0.51	0.22	0.00
Sat Flow, veh/h	1885	0	760	1856	1795	1598
Grp Volume(v), veh/h	672	0	6	478	289	0
Grp Sat Flow(s), veh/h/ln	1885	0	760	1856	1795	1598
Q Serve(g_s), s	8.0	0.0	0.2	5.0	4.4	0.0
Cycle Q Clear(g_c), s	8.0	0.0	8.1	5.0	4.4	0.0
Prop In Lane		0.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	962		427	947	389	346
V/C Ratio(X)	0.70		0.01	0.50	0.74	0.00
Avail Cap(c_a), veh/h	4244		1750	4177	980	872
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	5.5	0.0	8.6	4.7	10.7	0.0
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.4	2.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	0.5	1.6	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	6.4	0.0	8.6	5.2	13.5	0.0
LnGrp LOS	A		A	A	B	A
Approach Vol, veh/h	672	A		484	289	
Approach Delay, s/veh	6.4			5.2	13.5	
Approach LOS	A			A	B	
Timer - Assigned Phs	2		6		8	
Phs Duration (G+Y+Rc), s	19.0		19.0		10.4	
Change Period (Y+Rc), s	4.0		4.0		4.0	
Max Green Setting (Gmax), s	66.0		66.0		16.0	
Max Q Clear Time (g_c+I1), s	10.0		10.1		6.4	
Green Ext Time (p_c), s	5.0		3.2		0.6	

Intersection Summary

HCM 6th Ctrl Delay	7.4
HCM 6th LOS	A

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary

44: Ten Trails Place SE & SE Auburn-Black Diamond Rd

01/12/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	860	145	0	1035	0	115	0	205	0	135	0
Future Volume (veh/h)	0	860	145	0	1035	0	115	0	205	0	135	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	0	935	158	0	1125	0	125	0	223	0	147	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	102	1072	181	102	1286	0	265	0	316	0	373	0
Arrive On Green	0.00	0.69	0.69	0.00	0.69	0.00	0.20	0.00	0.20	0.00	0.20	0.00
Sat Flow, veh/h	501	1559	264	516	1870	0	1241	0	1585	0	1870	0
Grp Volume(v), veh/h	0	0	1093	0	1125	0	125	0	223	0	147	0
Grp Sat Flow(s),veh/h/ln	501	0	1823	516	1870	0	1241	0	1585	0	1870	0
Q Serve(g_s), s	0.0	0.0	33.2	0.0	33.4	0.0	6.9	0.0	9.3	0.0	4.8	0.0
Cycle Q Clear(g_c), s	0.0	0.0	33.2	0.0	33.4	0.0	11.7	0.0	9.3	0.0	4.8	0.0
Prop In Lane	1.00		0.14	1.00		0.00	1.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h	102	0	1253	102	1286	0	265	0	316	0	373	0
V/C Ratio(X)	0.00	0.00	0.87	0.00	0.87	0.00	0.47	0.00	0.70	0.00	0.39	0.00
Avail Cap(c_a), veh/h	223	0	1696	227	1741	0	297	0	358	0	422	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	8.6	0.0	8.7	0.0	29.8	0.0	26.4	0.0	24.7	0.0
Incr Delay (d2), s/veh	0.0	0.0	4.0	0.0	4.1	0.0	1.3	0.0	5.3	0.0	0.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	7.9	0.0	11.3	0.0	2.1	0.0	3.8	0.0	2.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	12.7	0.0	12.7	0.0	31.1	0.0	31.8	0.0	25.3	0.0
LnGrp LOS	A	A	B	A	B	A	C	A	C	A	C	A
Approach Vol, veh/h	1093		1125			348			147			
Approach Delay, s/veh	12.7		12.7			31.5			25.3			
Approach LOS	B		B			C			C			
Timer - Assigned Phs	2		4			6			8			
Phs Duration (G+Y+Rc), s	18.2		52.8			18.2			52.8			
Change Period (Y+Rc), s	4.0		4.0			4.0			4.0			
Max Green Setting (Gmax), s	16.0		66.0			16.0			66.0			
Max Q Clear Time (g_c+I1), s	13.7		35.2			6.8			35.4			
Green Ext Time (p_c), s	0.4		10.2			0.4			13.3			
Intersection Summary												
HCM 6th Ctrl Delay	15.8											
HCM 6th LOS	B											

Intersection						
Int Delay, s/veh	4.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	305	510	0	215	1020
Future Vol, veh/h	0	305	510	0	215	1020
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	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	332	554	0	234	1109
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	-	554	0	0	554	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	4.12	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	0	532	-	-	1016	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	532	-	-	1016	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	22.3	0		1.7		
HCM LOS	C					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	- 532		1016	-	
HCM Lane V/C Ratio	-	- 0.623		0.23	-	
HCM Control Delay (s)	-	- 22.3		9.6	-	
HCM Lane LOS	-	- C		A	-	
HCM 95th %tile Q(veh)	-	- 4.2		0.9	-	

MOVEMENT SUMMARY

 **Site: 101 [200.North Connector (Site Folder: 2032-Build)]**

SR 169 and North Connector
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: SR 169														
8	L2	95	2.0	95	2.0	0.093	10.6	LOS B	0.5	13.2	0.39	0.63	0.39	34.0
8	T1	700	2.0	700	2.0	0.474	4.6	LOS A	4.2	106.7	0.51	0.45	0.51	36.3
Approach		795	2.0	795	2.0	0.474	5.3	LOS A	4.2	106.7	0.49	0.48	0.49	36.0
North: SR 169														
4	T1	1310	2.0	1310	2.0	0.824	4.9	LOS A	13.6	346.2	0.63	0.46	0.63	35.8
14	R2	100	2.0	100	2.0	0.090	4.6	LOS A	0.4	11.3	0.26	0.48	0.26	36.0
Approach		1410	2.0	1410	2.0	0.824	4.9	LOS A	13.6	346.2	0.61	0.46	0.61	35.9
West: North Connector														
5	L2	165	2.0	165	2.0	0.578	43.8	LOS D	5.7	143.6	1.00	1.17	1.48	23.2
12	R2	165	2.0	165	2.0	0.389	18.8	LOS B	3.7	94.5	1.00	0.93	1.00	29.5
Approach		330	2.0	330	2.0	0.578	31.3	LOS C	5.7	143.6	1.00	1.05	1.24	25.9
All Vehicles		2535	2.0	2535	2.0	0.824	8.5	LOS A	13.6	346.2	0.62	0.54	0.65	34.2

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.

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MOVEMENT SUMMARY

 **Site: 101 [201.Pipeline Rd (Site Folder: 2032-Build)]**

SR 169 and Pipeline Rd
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: SR 169														
3u	U	195	2.0	195	2.0	0.405	12.7	LOS B	3.4	86.8	0.39	0.61	0.39	34.4
3	L2	430	2.0	430	2.0	0.405	10.2	LOS B	3.4	86.8	0.39	0.61	0.39	33.7
8	T1	250	2.0	250	2.0	0.210	4.4	LOS A	1.3	34.2	0.35	0.43	0.35	36.9
Approach		875	2.0	875	2.0	0.405	9.1	LOS A	3.4	86.8	0.38	0.56	0.38	34.7
North: SR 169														
4	T1	950	2.0	950	2.0	0.852	16.6	LOS D	16.8	425.5	1.00	1.21	1.70	31.5
14	R2	25	2.0	25	2.0	0.032	7.4	LOS A	0.2	4.4	0.63	0.63	0.63	34.8
Approach		975	2.0	975	2.0	0.852	16.3	LOS B	16.8	425.5	0.99	1.20	1.67	31.6
West: Pipeline Rd														
5	L2	110	2.0	110	2.0	0.793	44.8	LOS D	10.8	274.8	1.00	1.32	1.85	23.5
12	R2	200	2.0	200	2.0	0.793	38.9	LOS D	10.8	274.8	1.00	1.32	1.85	23.0
Approach		310	2.0	310	2.0	0.793	41.0	LOS D	10.8	274.8	1.00	1.32	1.85	23.2
All Vehicles		2160	2.0	2160	2.0	0.852	16.9	LOS B	16.8	425.5	0.74	0.96	1.18	31.1

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.

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.

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MOVEMENT SUMMARY

 **Site: 101 [202.North Connector and Pipeline Rd (Site Folder: 2032-Build)]**

North Connector and Pipeline Rd
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: North Connector														
3	L2	10	2.0	10	2.0	0.147	11.8	LOS B	0.8	20.4	0.56	0.60	0.56	36.1
8	T1	130	2.0	130	2.0	0.147	5.9	LOS A	0.8	20.4	0.56	0.60	0.56	36.0
18	R2	10	2.0	10	2.0	0.147	5.9	LOS A	0.8	20.4	0.56	0.60	0.56	34.9
Approach		150	2.0	150	2.0	0.147	6.3	LOS A	0.8	20.4	0.56	0.60	0.56	35.9
East: Pipeline Rd														
1	L2	50	2.0	50	2.0	0.429	12.3	LOS B	2.8	70.4	0.65	0.66	0.65	35.7
6	T1	350	2.0	350	2.0	0.429	6.4	LOS A	2.8	70.4	0.65	0.66	0.65	35.6
16	R2	50	2.0	50	2.0	0.429	6.5	LOS A	2.8	70.4	0.65	0.66	0.65	34.5
Approach		450	2.0	450	2.0	0.429	7.1	LOS A	2.8	70.4	0.65	0.66	0.65	35.5
North: North Connector														
7	L2	10	2.0	10	2.0	0.390	11.9	LOS B	2.6	66.6	0.64	0.66	0.64	36.3
4	T1	100	2.0	100	2.0	0.390	5.9	LOS A	2.6	66.6	0.64	0.66	0.64	36.2
14	R2	300	2.0	300	2.0	0.390	6.0	LOS A	2.6	66.6	0.64	0.66	0.64	35.1
Approach		410	2.0	410	2.0	0.390	6.1	LOS A	2.6	66.6	0.64	0.66	0.64	35.4
West: Pipeline Rd														
5	L2	325	2.0	325	2.0	0.380	10.6	LOS B	2.4	61.5	0.40	0.61	0.40	35.0
2	T1	150	2.0	150	2.0	0.380	4.6	LOS A	2.4	61.5	0.40	0.61	0.40	34.9
12	R2	10	2.0	10	2.0	0.380	4.7	LOS A	2.4	61.5	0.40	0.61	0.40	33.9
Approach		485	2.0	485	2.0	0.380	8.6	LOS A	2.4	61.5	0.40	0.61	0.40	35.0
All Vehicles		1495	2.0	1495	2.0	0.429	7.2	LOS A	2.8	70.4	0.55	0.64	0.55	35.3

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.

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MOVEMENT SUMMARY

 **Site: 101 [203.Lake Sawyer Rd and Pipeline Rd - All Movements (Site Folder: 2032-Build)]**

Lake Sawyer Rd and Pipeline Rd
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Lake Sawyer Rd														
3	L2	440	2.0	440	2.0	0.367	10.8	LOS B	2.7	68.5	0.48	0.65	0.48	33.8
8	T1	455	2.0	455	2.0	0.557	4.9	LOS A	5.4	137.3	0.56	0.50	0.56	36.3
18	R2	385	2.0	385	2.0	0.557	4.9	LOS A	5.4	137.3	0.56	0.50	0.56	35.1
Approach		1280	2.0	1280	2.0	0.557	6.9	LOS A	5.4	137.3	0.53	0.55	0.53	35.1
East: Pipeline Rd														
1	L2	465	2.0	465	2.0	0.491	12.9	LOS B	2.9	72.8	0.71	0.92	0.82	33.3
6	T1	325	2.0	325	2.0	0.441	8.0	LOS A	2.3	57.7	0.70	0.78	0.79	35.3
16	R2	5	2.0	5	2.0	0.441	8.0	LOS A	2.3	57.7	0.70	0.78	0.79	34.2
Approach		795	2.0	795	2.0	0.491	10.9	LOS B	2.9	72.8	0.71	0.86	0.81	34.1
North: Lake Sawyer Rd														
7	L2	5	2.0	5	2.0	0.645	16.6	LOS B	4.3	109.7	0.82	0.99	1.13	34.4
4	T1	375	2.0	375	2.0	0.645	10.7	LOS B	4.3	109.7	0.82	0.99	1.13	34.3
14	R2	55	2.0	55	2.0	0.645	10.8	LOS B	4.3	109.7	0.82	0.99	1.13	33.2
Approach		435	2.0	435	2.0	0.645	10.8	LOS B	4.3	109.7	0.82	0.99	1.13	34.1
West: Pipeline Rd														
5	L2	75	2.0	75	2.0	0.675	21.6	LOS C	7.8	199.0	0.97	1.15	1.42	31.7
2	T1	90	2.0	90	2.0	0.675	15.3	LOS B	7.8	199.0	0.97	1.15	1.42	31.6
12	R2	345	2.0	345	2.0	0.675	15.5	LOS B	7.8	199.0	0.97	1.15	1.42	30.7
Approach		510	2.0	510	2.0	0.675	16.4	LOS B	7.8	199.0	0.97	1.15	1.42	31.0
All Vehicles		3020	2.0	3021	2.0	0.675	10.1	LOS B	7.8	199.0	0.69	0.80	0.84	33.9

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.

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MOVEMENT SUMMARY

 Site: 101 [204.SR 169 and South Connector (Site Folder: 2032-Build)]

SR 169 and South Connector
Site Category: Future Build - 2032
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: SR 169														
3	L2	370	2.0	370	2.0	0.285	9.9	LOS A	2.0	49.6	0.16	0.61	0.16	34.6
8	T1	965	2.0	965	2.0	0.580	4.0	LOS A	6.3	160.2	0.22	0.36	0.22	37.4
Approach		1335	2.0	1335	2.0	0.580	5.6	LOS A	6.3	160.2	0.20	0.43	0.20	36.5
North: SR 169														
4	T1	1305	2.0	1305	2.0	0.538	6.3	LOS A	4.1	103.6	0.64	0.61	0.65	35.7
14	R2	25	2.0	25	2.0	0.538	6.1	LOS A	4.1	103.6	0.63	0.57	0.63	34.6
Approach		1330	2.0	1330	2.0	0.538	6.3	LOS A	4.1	103.6	0.64	0.61	0.65	35.7
West: South Connector														
5	L2	25	2.0	25	2.0	0.238	13.4	LOS B	1.1	27.7	0.73	0.87	0.73	35.6
12	R2	120	2.0	120	2.0	0.238	7.4	LOS A	1.1	27.7	0.73	0.87	0.73	34.5
Approach		145	2.0	145	2.0	0.238	8.5	LOS A	1.1	27.7	0.73	0.87	0.73	34.6
All Vehicles		2810	2.0	2810	2.0	0.580	6.1	LOS A	6.3	160.2	0.44	0.54	0.44	36.0

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.

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HCM 6th TWSC
1: SR 169 & SE Green Valley Rd

01/11/2023

Intersection												
Int Delay, s/veh	3.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	55	0	15	5	0	0	10	380	5	5	705	50
Future Vol, veh/h	55	0	15	5	0	0	10	380	5	5	705	50
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	Free
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	85	85	85	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	0	0	0	2	2	2	2	2	2
Mvmt Flow	65	0	18	6	0	0	12	447	6	6	829	59
Major/Minor	Minor2		Minor1			Major1			Major2			
Conflicting Flow All	1315	1318	829	1324	1315	450	829	0	0	453	0	0
Stage 1	841	841	-	474	474	-	-	-	-	-	-	-
Stage 2	474	477	-	850	841	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.5	6.2	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	135	157	370	134	159	613	803	-	-	1108	-	0
Stage 1	359	380	-	575	561	-	-	-	-	-	-	0
Stage 2	571	556	-	358	383	-	-	-	-	-	-	0
Platoon blocked, %								-	-		-	
Mov Cap-1 Maneuver	132	152	370	125	154	613	803	-	-	1108	-	-
Mov Cap-2 Maneuver	132	152	-	125	154	-	-	-	-	-	-	-
Stage 1	352	376	-	564	550	-	-	-	-	-	-	-
Stage 2	560	545	-	338	379	-	-	-	-	-	-	-
Approach	EB		WB			NB			SB			
HCM Control Delay, s	53.1		35.2			0.2			0.1			
HCM LOS	F		E									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT					
Capacity (veh/h)	803	-	-	153	125	1108	-					
HCM Lane V/C Ratio	0.015	-	-	0.538	0.047	0.005	-					
HCM Control Delay (s)	9.6	0	-	53.1	35.2	8.3	0					
HCM Lane LOS	A	A	-	F	E	A	A					
HCM 95th %tile Q(veh)	0	-	-	2.7	0.1	0	-					

HCM 6th TWSC
3: SR 169 & Jones Lake Rd

01/11/2023

Intersection						
Int Delay, s/veh	3.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	135	185	290	645	0
Future Vol, veh/h	0	135	185	290	645	0
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, %	1	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	2	2	3	3
Mvmt Flow	0	142	195	305	679	0
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1374	679	679	0	-	0
Stage 1	679	-	-	-	-	-
Stage 2	695	-	-	-	-	-
Critical Hdwy	6.6	6.3	4.12	-	-	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.218	-	-	-
Pot Cap-1 Maneuver	150	447	913	-	-	-
Stage 1	489	-	-	-	-	-
Stage 2	480	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	111	447	913	-	-	-
Mov Cap-2 Maneuver	111	-	-	-	-	-
Stage 1	363	-	-	-	-	-
Stage 2	480	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	16.8	3.9		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	913	-	447	-	-	
HCM Lane V/C Ratio	0.213	-	0.318	-	-	
HCM Control Delay (s)	10	0	16.8	-	-	
HCM Lane LOS	B	A	C	-	-	
HCM 95th %tile Q(veh)	0.8	-	1.4	-	-	

HCM 6th Signalized Intersection Summary

4: SR 169 & Lawson Rd

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	5	15	0	55	10	295	10	105	750	5
Future Volume (veh/h)	0	0	5	15	0	55	10	295	10	105	750	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	0.98		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1856	1856	1856	1870	1870	1870
Adj Flow Rate, veh/h	0	0	5	16	0	58	11	311	11	111	789	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	3	3	3	2	2	2
Cap, veh/h	0	0	117	132	2	89	104	1264	44	207	1163	7
Arrive On Green	0.00	0.00	0.07	0.07	0.00	0.07	0.73	0.73	0.73	1.00	1.00	1.00
Sat Flow, veh/h	0	0	1586	307	25	1206	16	1741	60	145	1601	10
Grp Volume(v), veh/h	0	0	5	74	0	0	333	0	0	905	0	0
Grp Sat Flow(s),veh/h/ln	0	0	1586	1538	0	0	1817	0	0	1756	0	0
Q Serve(g_s), s	0.0	0.0	0.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.1	1.9	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0
Prop In Lane	0.00		1.00	0.22		0.78	0.03		0.03	0.12		0.01
Lane Grp Cap(c), veh/h	0	0	117	223	0	0	1412	0	0	1376	0	0
V/C Ratio(X)	0.00	0.00	0.04	0.33	0.00	0.00	0.24	0.00	0.00	0.66	0.00	0.00
Avail Cap(c_a), veh/h	0	0	634	722	0	0	1412	0	0	1376	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	0.73	0.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	17.2	18.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.1	0.9	0.0	0.0	0.4	0.0	0.0	1.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.6	0.0	0.0	0.3	0.0	0.0	0.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	17.4	18.9	0.0	0.0	2.2	0.0	0.0	1.8	0.0	0.0
LnGrp LOS	A	A	B	B	A	A	A	A	A	A	A	A
Approach Vol, veh/h	5			74			333			905		
Approach Delay, s/veh	17.4			18.9			2.2			1.8		
Approach LOS	B			B			A			A		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	33.0			7.0			33.0			7.0		
Change Period (Y+Rc), s	4.0			4.0			4.0			4.0		
Max Green Setting (Gmax), s	16.0			16.0			16.0			16.0		
Max Q Clear Time (g_c+I1), s	4.4			2.1			2.0			3.9		
Green Ext Time (p_c), s	1.1			0.0			4.5			0.2		
Intersection Summary												
HCM 6th Ctrl Delay	2.9											
HCM 6th LOS	A											

HCM 6th Signalized Intersection Summary

5: SR 169 & Baker St

01/11/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	W			W	W	
Traffic Volume (veh/h)	30	60	30	320	800	40
Future Volume (veh/h)	30	60	30	320	800	40
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	0.99	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1811	1856	1856	1870	1870
Adj Flow Rate, veh/h	32	64	32	340	851	43
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	6	3	3	2	2
Cap, veh/h	43	85	143	1196	1267	64
Arrive On Green	0.08	0.08	1.00	1.00	0.72	0.72
Sat Flow, veh/h	521	1042	63	1666	1765	89
Grp Volume(v), veh/h	97	0	372	0	0	894
Grp Sat Flow(s),veh/h/ln	1579	0	1729	0	0	1854
Q Serve(g_s), s	2.4	0.0	0.0	0.0	0.0	10.5
Cycle Q Clear(g_c), s	2.4	0.0	0.0	0.0	0.0	10.5
Prop In Lane	0.33	0.66	0.09			0.05
Lane Grp Cap(c), veh/h	129	0	1339	0	0	1331
V/C Ratio(X)	0.75	0.00	0.28	0.00	0.00	0.67
Avail Cap(c_a), veh/h	632	0	1339	0	0	1331
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.98	0.00	0.00	1.00
Uniform Delay (d), s/veh	18.0	0.0	0.0	0.0	0.0	3.1
Incr Delay (d2), s/veh	8.4	0.0	0.5	0.0	0.0	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.2	0.0	0.0	1.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	26.4	0.0	0.5	0.0	0.0	5.8
LnGrp LOS	C	A	A	A	A	A
Approach Vol, veh/h	97			372	894	
Approach Delay, s/veh	26.4			0.5	5.8	
Approach LOS	C			A	A	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		32.7		7.3		32.7
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		16.0		16.0		16.0
Max Q Clear Time (g_c+I1), s		2.0		4.4		12.5
Green Ext Time (p_c), s		1.5		0.2		1.7
Intersection Summary						
HCM 6th Ctrl Delay			5.8			
HCM 6th LOS			A			

Notes

User approved volume balancing among the lanes for turning movement.

Intersection

Int Delay, s/veh 2.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	30	55	30	0	0	10
Future Vol, veh/h	30	55	30	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	60	33	0	0	11

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	33	0	0 159 33
Stage 1	-	-	- 33 -
Stage 2	-	-	- 126 -
Critical Hdwy	4.12	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.218	-	- 3.518 3.318
Pot Cap-1 Maneuver	1579	-	- 832 1041
Stage 1	-	-	- 989 -
Stage 2	-	-	- 900 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1579	-	- 814 1041
Mov Cap-2 Maneuver	-	-	- 814 -
Stage 1	-	-	- 967 -
Stage 2	-	-	- 900 -

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	8.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1579	-	-	-	1041
HCM Lane V/C Ratio	0.021	-	-	-	0.01
HCM Control Delay (s)	7.3	0	-	-	8.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0

HCM 6th TWSC
9: SR 169 & Black Diamond-Ravensdale Rd

01/11/2023

Intersection

Int Delay, s/veh 2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	230	410	95	30	1080
Future Vol, veh/h	0	230	410	95	30	1080
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Free	-	Free
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	1	1	2	2	1	1
Mvmt Flow	0	258	461	107	34	1213

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	-	461	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.21	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.309	-
Pot Cap-1 Maneuver	0	603	-
Stage 1	0	-	-
Stage 2	0	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	603	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.4	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBTWBLn1	SBL	SBT
Capacity (veh/h)	-	603	1105
HCM Lane V/C Ratio	-	0.429	0.031
HCM Control Delay (s)	-	15.4	8.4
HCM Lane LOS	-	C	A
HCM 95th %tile Q(veh)	-	2.1	0.1

HCM 6th Signalized Intersection Summary

10: SR 169 & SE 288th St

01/11/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	75	30	10	385	875	140
Future Volume (veh/h)	75	30	10	385	875	140
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1841	1841	1856	1856	1841	1841
Adj Flow Rate, veh/h	84	34	11	433	983	0
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	4	4	3	3	4	4
Cap, veh/h	127	113	72	1440	1462	
Arrive On Green	0.07	0.07	0.79	0.79	0.79	0.00
Sat Flow, veh/h	1753	1560	13	1813	1841	1560
Grp Volume(v), veh/h	84	34	444	0	983	0
Grp Sat Flow(s),veh/h/ln	1753	1560	1826	0	1841	1560
Q Serve(g_s), s	2.8	1.2	0.0	0.0	14.2	0.0
Cycle Q Clear(g_c), s	2.8	1.2	3.9	0.0	14.2	0.0
Prop In Lane	1.00	1.00	0.02			1.00
Lane Grp Cap(c), veh/h	127	113	1511	0	1462	
V/C Ratio(X)	0.66	0.30	0.29	0.00	0.67	
Avail Cap(c_a), veh/h	467	416	1511	0	1462	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	27.1	26.4	1.7	0.0	2.7	0.0
Incr Delay (d2), s/veh	5.7	1.5	0.5	0.0	2.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.5	0.2	0.0	1.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	32.8	27.8	2.2	0.0	5.2	0.0
LnGrp LOS	C	C	A	A	A	
Approach Vol, veh/h	118			444	983	A
Approach Delay, s/veh	31.4			2.2	5.2	
Approach LOS	C			A	A	
Timer - Assigned Phs	2		4		6	
Phs Duration (G+Y+Rc), s	51.6		8.4		51.6	
Change Period (Y+Rc), s	4.0		4.0		4.0	
Max Green Setting (Gmax), s	36.0		16.0		36.0	
Max Q Clear Time (g_c+l1), s	5.9		4.8		16.2	
Green Ext Time (p_c), s	1.8		0.3		5.0	

Intersection Summary

HCM 6th Ctrl Delay	6.3
HCM 6th LOS	A

Notes

Unsignalized Delay for [SBR] is excluded from calculations of the approach delay and intersection delay.

HCM Signalized Intersection Capacity Analysis

11: SR 169 & 280th St

01/11/2023



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	60	45	30	510	950	115
Future Volume (vph)	60	45	30	510	950	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.1	5.1	5.5	6.7	6.7	6.7
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1568	1805	1863	1881	1599
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1568	1805	1863	1881	1599
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	47	32	537	1000	121
RTOR Reduction (vph)	0	44	0	0	0	9
Lane Group Flow (vph)	63	3	32	537	1000	112
Heavy Vehicles (%)	2%	3%	0%	2%	1%	1%
Turn Type	Prot	Perm	Prot	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	9.1	9.1	5.5	119.1	108.1	108.1
Effective Green, g (s)	9.1	9.1	5.5	119.1	108.1	108.1
Actuated g/C Ratio	0.06	0.06	0.04	0.85	0.77	0.77
Clearance Time (s)	5.1	5.1	5.5	6.7	6.7	6.7
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	115	101	70	1584	1452	1234
v/s Ratio Prot	c0.04		0.02	c0.29	c0.53	
v/s Ratio Perm		0.00				0.07
v/c Ratio	0.55	0.03	0.46	0.34	0.69	0.09
Uniform Delay, d1	63.5	61.3	65.8	2.2	7.8	3.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.3	0.1	4.7	0.6	2.7	0.1
Delay (s)	68.7	61.4	70.5	2.8	10.5	4.1
Level of Service	E	E	E	A	B	A
Approach Delay (s)	65.6			6.6	9.8	
Approach LOS	E			A	A	
Intersection Summary						
HCM 2000 Control Delay			12.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.67			
Actuated Cycle Length (s)			140.0		Sum of lost time (s)	17.3
Intersection Capacity Utilization			63.2%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM 6th Signalized Intersection Summary

12: SR 169 & SE Tahoma Way/SE 271st PI

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	35	15	25	230	15	55	20	655	105	5	105	990
Future Volume (veh/h)	35	15	25	230	15	55	20	655	105	5	105	990
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0		0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		1.00		1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1870	1900		1900	1870
Adj Flow Rate, veh/h	37	16	26	242	16	58	21	689	111		111	1042
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95		0.95	0.95
Percent Heavy Veh, %	0	0	0	0	0	0	0	2	0		0	2
Cap, veh/h	48	49	79	193	55	200	26	1100	946		135	2220
Arrive On Green	0.03	0.08	0.08	0.11	0.16	0.16	0.01	0.59	0.59		0.07	0.65
Sat Flow, veh/h	1810	641	1042	1810	354	1285	1810	1870	1609		1810	3422
Grp Volume(v), veh/h	37	0	42	242	0	74	21	689	111		111	541
Grp Sat Flow(s),veh/h/ln	1810	0	1683	1810	0	1639	1810	1870	1609		1810	1777
Q Serve(g_s), s	2.8	0.0	3.3	14.9	0.0	5.6	1.6	33.6	4.3		8.5	21.5
Cycle Q Clear(g_c), s	2.8	0.0	3.3	14.9	0.0	5.6	1.6	33.6	4.3		8.5	21.5
Prop In Lane	1.00		0.62	1.00		0.78	1.00		1.00		1.00	
Lane Grp Cap(c), veh/h	48	0	128	193	0	256	26	1100	946		135	1152
V/C Ratio(X)	0.77	0.00	0.33	1.26	0.00	0.29	0.80	0.63	0.12		0.82	0.47
Avail Cap(c_a), veh/h	167	0	371	193	0	385	252	1100	946		252	1152
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00		1.00	1.00
Uniform Delay (d), s/veh	67.7	0.0	61.3	62.6	0.0	52.2	68.8	18.8	12.7		63.8	12.4
Incr Delay (d2), s/veh	22.3	0.0	1.5	150.6	0.0	0.6	40.8	2.7	0.3		11.5	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	1.5	15.0	0.0	2.4	1.0	14.6	1.7		4.3	8.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	90.0	0.0	62.7	213.1	0.0	52.8	109.6	21.5	13.0		75.3	13.8
LnGrp LOS	F	A	E	F	A	D	F	C	B		E	B
Approach Vol, veh/h	79			316			821			1211		
Approach Delay, s/veh	75.5			175.6			22.6			19.4		
Approach LOS	E			F			C			B		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	16.0	88.3	20.0	15.8	7.5	96.7	8.8	26.9				
Change Period (Y+Rc), s	5.5	5.9	5.1	5.1	5.5	5.9	5.1	5.1				
Max Green Setting (Gmax), s	19.5	53.1	14.9	30.9	19.5	53.1	12.9	32.9				
Max Q Clear Time (g_c+I1), s	10.5	35.6	16.9	5.3	3.6	23.5	4.8	7.6				
Green Ext Time (p_c), s	0.2	4.6	0.0	0.2	0.0	7.9	0.0	0.4				

Intersection Summary

HCM 6th Ctrl Delay 42.6

HCM 6th LOS D

Notes

User approved ignoring U-Turning movement.

HCM 6th Signalized Intersection Summary
12: SR 169 & SE Tahoma Way/SE 271st PI

01/11/2023

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	55
Future Volume (veh/h)	55
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	1.00
Parking Bus, Adj	1.00
Work Zone On Approach	
Adj Sat Flow, veh/h/ln	1900
Adj Flow Rate, veh/h	58
Peak Hour Factor	0.95
Percent Heavy Veh, %	0
Cap, veh/h	124
Arrive On Green	0.65
Sat Flow, veh/h	190
Grp Volume(v), veh/h	559
Grp Sat Flow(s),veh/h/ln	1836
Q Serve(g_s), s	21.5
Cycle Q Clear(g_c), s	21.5
Prop In Lane	0.10
Lane Grp Cap(c), veh/h	1191
V/C Ratio(X)	0.47
Avail Cap(c_a), veh/h	1191
HCM Platoon Ratio	1.00
Upstream Filter(l)	1.00
Uniform Delay (d), s/veh	12.4
Incr Delay (d2), s/veh	1.3
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	8.7
Unsig. Movement Delay, s/veh	
LnGrp Delay(d),s/veh	13.8
LnGrp LOS	B
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer - Assigned Phs	

HCM 6th Signalized Intersection Summary

13: SR 169 & SR 516

01/11/2023

												
Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	5	175	335	125	175	335	140	275	485	40	255	790
Future Volume (veh/h)	5	175	335	125	175	335	140	275	485	40	255	790
Initial Q (Qb), veh		0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00		0.99	1.00		0.99	1.00		1.00	1.00	
Parking Bus, Adj		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No				No
Adj Sat Flow, veh/h/ln		1870	1885	1885	1885	1870	1841	1885	1856	1826	1841	1870
Adj Flow Rate, veh/h		182	349	130	182	349	146	286	505	42	266	823
Peak Hour Factor		0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %		2	1	1	1	2	4	1	3	5	4	2
Cap, veh/h		207	524	192	208	381	316	410	1136	94	292	900
Arrive On Green		0.12	0.20	0.20	0.12	0.20	0.20	0.23	0.34	0.34	0.17	0.28
Sat Flow, veh/h		1781	2561	938	1795	1870	1548	1795	3295	273	1753	3212
Grp Volume(v), veh/h		182	242	237	182	349	146	286	270	277	266	455
Grp Sat Flow(s),veh/h/ln		1781	1791	1708	1795	1870	1548	1795	1763	1805	1753	1777
Q Serve(g_s), s		14.1	17.4	17.9	14.0	25.6	11.6	20.5	16.6	16.7	20.9	34.7
Cycle Q Clear(g_c), s		14.1	17.4	17.9	14.0	25.6	11.6	20.5	16.6	16.7	20.9	34.7
Prop In Lane		1.00		0.55	1.00		1.00	1.00		0.15	1.00	
Lane Grp Cap(c), veh/h		207	366	349	208	381	316	410	608	623	292	498
V/C Ratio(X)		0.88	0.66	0.68	0.88	0.91	0.46	0.70	0.44	0.45	0.91	0.91
Avail Cap(c_a), veh/h		274	375	357	289	405	335	410	608	623	369	534
HCM Platoon Ratio		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh		60.9	51.2	51.4	60.9	54.5	49.0	49.6	35.5	35.5	57.3	48.8
Incr Delay (d2), s/veh		21.5	4.2	4.9	19.2	24.3	1.1	5.2	2.3	2.3	22.8	23.8
Initial Q Delay(d3),s/veh		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln		7.5	8.1	8.0	7.4	14.3	4.5	9.7	7.4	7.7	11.0	18.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh		82.4	55.4	56.3	80.2	78.9	50.0	54.8	37.8	37.8	80.1	72.6
LnGrp LOS		F	E	E	F	E	D	D	D	D	F	E
Approach Vol, veh/h			661			677			833			1183
Approach Delay, s/veh			63.2			73.0			43.6			74.2
Approach LOS			E			E			D			E
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	28.8	54.2	21.7	35.3	37.8	45.1	21.8	35.3				
Change Period (Y+Rc), s	5.5	5.9	5.5	6.7	5.9	* 5.9	5.5	6.7				
Max Green Setting (Gmax), s	29.5	35.1	22.5	29.3	22.5	* 42	21.5	30.3				
Max Q Clear Time (g_c+I1), s	22.9	18.7	16.0	19.9	22.5	36.7	16.1	27.6				
Green Ext Time (p_c), s	0.4	2.8	0.2	1.8	0.0	2.5	0.2	0.7				
Intersection Summary												
HCM 6th Ctrl Delay			64.2									
HCM 6th LOS			E									
Notes												
User approved ignoring U-Turning movement.												
* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.												

HCM 6th Signalized Intersection Summary

13: SR 169 & SR 516

01/11/2023

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	90
Future Volume (veh/h)	90
Initial Q (Qb), veh	0
Ped-Bike Adj(A_pbT)	1.00
Parking Bus, Adj	1.00
Work Zone On Approach	
Adj Sat Flow, veh/h/ln	1885
Adj Flow Rate, veh/h	94
Peak Hour Factor	0.96
Percent Heavy Veh, %	1
Cap, veh/h	103
Arrive On Green	0.28
Sat Flow, veh/h	367
Grp Volume(v), veh/h	462
Grp Sat Flow(s),veh/h/ln	1802
Q Serve(g_s), s	34.7
Cycle Q Clear(g_c), s	34.7
Prop In Lane	0.20
Lane Grp Cap(c), veh/h	505
V/C Ratio(X)	0.91
Avail Cap(c_a), veh/h	542
HCM Platoon Ratio	1.00
Upstream Filter(l)	1.00
Uniform Delay (d), s/veh	48.8
Incr Delay (d2), s/veh	23.6
Initial Q Delay(d3),s/veh	0.0
%ile BackOfQ(50%),veh/ln	18.6
Unsig. Movement Delay, s/veh	
LnGrp Delay(d),s/veh	72.3
LnGrp LOS	E
Approach Vol, veh/h	
Approach Delay, s/veh	
Approach LOS	
Timer - Assigned Phs	

HCM Signalized Intersection Capacity Analysis

14: SR 169 & SE 240th Blvd

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	50	30	140	50	30	80	125	725	20	10	100	1285
Future Volume (vph)	50	30	140	50	30	80	125	725	20	10	100	1285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.1	5.1		5.1	5.1		5.5	5.9	4.0		5.5	5.9
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00		1.00	0.95
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.88		1.00	0.89		1.00	1.00	0.85		1.00	0.99
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1621		1805	1681		1805	3471	1615		1805	3486
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1621		1805	1681		1805	3471	1615		1805	3486
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	32	147	53	32	84	132	763	21	11	105	1353
RTOR Reduction (vph)	0	137	0	0	78	0	0	0	21	0	0	1
Lane Group Flow (vph)	53	42	0	53	38	0	132	763	0	0	116	1405
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	2%	0%	2%	0%	0%	1%	0%	4%	0%	0%	0%	3%
Turn Type	Prot	NA		Prot	NA		Prot	NA	NA	Prot	Prot	NA
Protected Phases	7	4		3	8		5	2		1	1	6
Permitted Phases												
Actuated Green, G (s)	8.4	9.6		8.3	9.5		15.8	86.3	0.0		14.2	84.7
Effective Green, g (s)	8.4	9.6		8.3	9.5		15.8	86.3	0.0		14.2	84.7
Actuated g/C Ratio	0.06	0.07		0.06	0.07		0.11	0.62	0.00		0.10	0.61
Clearance Time (s)	5.1	5.1		5.1	5.1		5.5	5.9			5.5	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	106	111		107	114		203	2139	0		183	2109
v/s Ratio Prot	c0.03	c0.03		0.03	0.02		c0.07	0.22			0.06	c0.40
v/s Ratio Perm												
v/c Ratio	0.50	0.38		0.50	0.33		0.65	0.36	0.00		0.63	0.67
Uniform Delay, d1	63.8	62.3		63.8	62.2		59.5	13.2	70.0		60.4	18.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.30	0.43
Incremental Delay, d2	3.7	2.2		3.6	1.7		7.2	0.5	0.0		2.3	0.5
Delay (s)	67.4	64.5		67.4	63.9		66.7	13.7	70.0		81.1	8.5
Level of Service	E	E		E	E		E	B	E		F	A
Approach Delay (s)		65.2			65.0			22.6				14.0
Approach LOS		E			E			C				B
Intersection Summary												
HCM 2000 Control Delay			24.0			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			140.0			Sum of lost time (s)			21.6			
Intersection Capacity Utilization			76.8%			ICU Level of Service			D			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

14: SR 169 & SE 240th Blvd

01/11/2023

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	50
Future Volume (vph)	50
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.95
Adj. Flow (vph)	53
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Heavy Vehicles (%)	2%
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM 6th Signalized Intersection Summary

15: SR 169 & Witte Rd SE

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	395	40	15	65	40	10	15	795	20	5	1405	690
Future Volume (veh/h)	395	40	15	65	40	10	15	795	20	5	1405	690
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1796	1900	1826	1900	1900	1900	1870	1737	1900	1870	1885
Adj Flow Rate, veh/h	407	41	15	67	41	10	15	820	21	5	1448	711
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	7	0	5	0	0	0	2	11	0	2	1
Cap, veh/h	464	169	62	85	73	18	29	2277	58	11	1506	682
Arrive On Green	0.13	0.13	0.13	0.05	0.05	0.05	0.02	0.64	0.64	0.00	0.42	0.42
Sat Flow, veh/h	3456	1254	459	1739	1473	359	1810	3540	91	1810	2376	1076
Grp Volume(v), veh/h	407	0	56	67	0	51	15	412	429	5	1052	1107
Grp Sat Flow(s),veh/h/ln	1728	0	1712	1739	0	1833	1810	1777	1854	1810	1777	1676
Q Serve(g_s), s	16.2	0.0	4.1	5.3	0.0	3.8	1.2	15.1	15.1	0.4	79.0	88.7
Cycle Q Clear(g_c), s	16.2	0.0	4.1	5.3	0.0	3.8	1.2	15.1	15.1	0.4	79.0	88.7
Prop In Lane	1.00		0.27	1.00		0.20	1.00		0.05	1.00		0.64
Lane Grp Cap(c), veh/h	464	0	231	85	0	91	29	1143	1193	11	1126	1062
V/C Ratio(X)	0.88	0.00	0.24	0.78	0.00	0.56	0.53	0.36	0.36	0.44	0.93	1.04
Avail Cap(c_a), veh/h	555	0	416	242	0	406	123	1143	1193	123	1126	1062
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.26	0.26	0.26
Uniform Delay (d), s/veh	59.5	0.0	54.2	65.8	0.0	65.0	68.4	11.6	11.6	69.5	37.5	40.3
Incr Delay (d2), s/veh	13.0	0.0	0.5	14.4	0.0	5.3	14.1	0.9	0.8	6.7	5.0	26.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.9	0.0	1.8	2.7	0.0	1.9	0.6	5.9	6.2	0.2	36.7	45.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	72.5	0.0	54.7	80.2	0.0	70.3	82.5	12.5	12.4	76.2	42.5	67.1
LnGrp LOS	E	A	D	F	A	E	F	B	B	E	D	F
Approach Vol, veh/h	463			118			856			2164		
Approach Delay, s/veh	70.3			75.9			13.7			55.2		
Approach LOS	E			E			B			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.4	96.4	12.4	24.9	7.7	95.0	24.3	13.0				
Change Period (Y+Rc), s	5.5	6.3	5.5	6.0	5.5	6.3	5.5	6.0				
Max Green Setting (Gmax), s	9.5	53.7	19.5	34.0	9.5	53.7	22.5	31.0				
Max Q Clear Time (g_c+l1), s	2.4	17.1	7.3	6.1	3.2	90.7	18.2	5.8				
Green Ext Time (p_c), s	0.0	5.6	0.1	0.2	0.0	0.0	0.6	0.2				
Intersection Summary												
HCM 6th Ctrl Delay	47.9											
HCM 6th LOS	D											

HCM 6th Signalized Intersection Summary 16: SR 169 & SE Wax Rd

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	10	360	45	20	45	240	925	25	40	1680	115
Future Volume (veh/h)	100	10	360	45	20	45	240	925	25	40	1680	115
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1885	1737	1885	1900	1900	1900	1885	1870	1900	1900	1885	1885
Adj Flow Rate, veh/h	103	10	371	46	21	46	247	954	26	41	1732	119
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	11	1	0	0	0	1	2	0	0	1	1
Cap, veh/h	127	364	332	60	91	198	270	1976	54	54	1570	700
Arrive On Green	0.07	0.21	0.21	0.03	0.17	0.17	0.15	0.56	0.56	0.03	0.44	0.44
Sat Flow, veh/h	1795	1737	1586	1810	527	1154	1795	3534	96	1810	3582	1598
Grp Volume(v), veh/h	103	10	371	46	0	67	247	480	500	41	1732	119
Grp Sat Flow(s),veh/h/ln	1795	1737	1586	1810	0	1680	1795	1777	1853	1810	1791	1598
Q Serve(g_s), s	7.9	0.6	29.3	3.5	0.0	4.8	19.0	22.8	22.8	3.1	61.4	6.3
Cycle Q Clear(g_c), s	7.9	0.6	29.3	3.5	0.0	4.8	19.0	22.8	22.8	3.1	61.4	6.3
Prop In Lane	1.00		1.00	1.00		0.69	1.00		0.05	1.00		1.00
Lane Grp Cap(c), veh/h	127	364	332	60	0	289	270	994	1036	54	1570	700
V/C Ratio(X)	0.81	0.03	1.12	0.76	0.00	0.23	0.91	0.48	0.48	0.76	1.10	0.17
Avail Cap(c_a), veh/h	276	364	332	291	0	364	289	994	1036	381	1570	700
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	0.85	0.85	0.85	0.64	0.64	0.64
Uniform Delay (d), s/veh	64.1	44.0	55.3	67.1	0.0	50.0	58.6	18.6	18.6	67.4	39.3	23.9
Incr Delay (d2), s/veh	11.6	0.0	85.0	17.8	0.0	0.4	27.2	1.4	1.4	13.3	53.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.3	19.5	1.9	0.0	2.1	10.5	9.5	9.9	1.6	37.5	2.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	75.7	44.0	140.4	85.0	0.0	50.4	85.8	20.1	20.0	80.7	92.6	24.2
LnGrp LOS	E	D	F	F	A	D	F	C	C	F	F	C
Approach Vol, veh/h	484			113			1227			1892		
Approach Delay, s/veh	124.6			64.5			33.3			88.1		
Approach LOS	F			E			C			F		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	9.7	84.2	10.2	36.0	26.6	67.3	15.4	30.8				
Change Period (Y+Rc), s	5.5	5.9	5.5	6.7	5.5	5.9	5.5	6.7				
Max Green Setting (Gmax), s	29.5	35.1	22.5	29.3	22.5	42.1	21.5	30.3				
Max Q Clear Time (g_c+I1), s	5.1	24.8	5.5	31.3	21.0	63.4	9.9	6.8				
Green Ext Time (p_c), s	0.1	4.2	0.1	0.0	0.1	0.0	0.2	0.3				
Intersection Summary												
HCM 6th Ctrl Delay	74.0											
HCM 6th LOS	E											

HCM 6th Signalized Intersection Summary

17: SR 169 & SE 231st St

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	45	845	10	55	15	510	525	25	15	1010	140
Future Volume (veh/h)	150	45	845	10	55	15	510	525	25	15	1010	140
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1707	1885	1574	1767	1811	1870	1885	1841	1678	1870	1870
Adj Flow Rate, veh/h	156	47	880	10	57	16	531	547	26	16	1052	146
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	13	1	22	9	6	2	1	4	15	2	2
Cap, veh/h	162	497	1254	14	279	78	534	1733	82	22	1270	566
Arrive On Green	0.09	0.29	0.29	0.01	0.21	0.21	0.15	0.50	0.50	0.01	0.36	0.36
Sat Flow, veh/h	1781	1707	2812	1499	1327	373	3456	3481	165	1598	3554	1585
Grp Volume(v), veh/h	156	47	880	10	0	73	531	281	292	16	1052	146
Grp Sat Flow(s),veh/h/ln	1781	1707	1406	1499	0	1700	1728	1791	1855	1598	1777	1585
Q Serve(g_s), s	9.6	2.2	27.8	0.7	0.0	3.9	16.9	10.3	10.3	1.1	29.7	7.2
Cycle Q Clear(g_c), s	9.6	2.2	27.8	0.7	0.0	3.9	16.9	10.3	10.3	1.1	29.7	7.2
Prop In Lane	1.00		1.00	1.00		0.22	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	162	497	1254	14	0	357	534	891	924	22	1270	566
V/C Ratio(X)	0.96	0.09	0.70	0.70	0.00	0.20	0.99	0.32	0.32	0.71	0.83	0.26
Avail Cap(c_a), veh/h	162	559	1355	55	0	464	534	891	924	58	1270	566
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.87	0.87	0.87	1.00	0.00	1.00	0.89	0.89	0.89	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.8	28.4	24.6	54.3	0.0	35.9	46.5	16.5	16.5	54.0	32.3	25.0
Incr Delay (d2), s/veh	55.2	0.1	1.3	46.5	0.0	0.3	35.2	0.8	0.8	33.9	6.3	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.7	0.9	8.9	0.5	0.0	1.6	9.7	4.2	4.4	0.6	13.3	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	105.0	28.5	25.9	100.8	0.0	36.1	81.7	17.3	17.3	87.9	38.6	26.1
LnGrp LOS	F	C	C	F	A	D	F	B	B	F	D	C
Approach Vol, veh/h	1083			83			1104			1214		
Approach Delay, s/veh	37.4			43.9			48.2			37.8		
Approach LOS	D			D			D			D		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	5.5	60.7	5.1	38.7	21.0	45.2	14.0	29.8				
Change Period (Y+Rc), s	4.0	5.9	4.0	6.7	4.0	5.9	4.0	6.7				
Max Green Setting (Gmax), s	4.0	45.4	4.0	36.0	17.0	32.4	10.0	30.0				
Max Q Clear Time (g_c+l1), s	3.1	12.3	2.7	29.8	18.9	31.7	11.6	5.9				
Green Ext Time (p_c), s	0.0	3.4	0.0	2.3	0.0	0.5	0.0	0.3				
Intersection Summary												
HCM 6th Ctrl Delay	41.1											
HCM 6th LOS	D											

HCM Signalized Intersection Capacity Analysis

18: SE 231st St & SR 18 EB Ramps

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	95	690	0	0	635	100	90	0	370	0	0	0
Future Volume (vph)	95	690	0	0	635	100	90	0	370	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.3	6.3			6.3	6.3		5.9	5.9			
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (prot)	1787	3539			3505	1599		1770	1583			
Flt Permitted	0.95	1.00			1.00	1.00		0.95	1.00			
Satd. Flow (perm)	1787	3539			3505	1599		1770	1583			
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	96	697	0	0	641	101	91	0	374	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	58	0	0	123	0	0	0
Lane Group Flow (vph)	96	697	0	0	641	43	0	91	251	0	0	0
Heavy Vehicles (%)	1%	2%	0%	0%	3%	1%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	7.6	45.9			32.0	32.0		16.9	16.9			
Effective Green, g (s)	7.6	45.9			32.0	32.0		16.9	16.9			
Actuated g/C Ratio	0.10	0.61			0.43	0.43		0.23	0.23			
Clearance Time (s)	6.3	6.3			6.3	6.3		5.9	5.9			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	181	2165			1495	682		398	356			
v/s Ratio Prot	c0.05	0.20			c0.18							
v/s Ratio Perm						0.03		0.05	c0.16			
v/c Ratio	0.53	0.32			0.43	0.06		0.23	0.70			
Uniform Delay, d1	32.0	7.0			15.1	12.7		23.7	26.8			
Progression Factor	1.00	1.00			1.00	1.00		1.00	1.00			
Incremental Delay, d2	3.0	0.4			0.9	0.2		0.3	6.2			
Delay (s)	35.0	7.4			16.0	12.8		24.0	33.0			
Level of Service	C	A			B	B		C	C			
Approach Delay (s)		10.8			15.6			31.2			0.0	
Approach LOS		B			B			C			A	
Intersection Summary												
HCM 2000 Control Delay			17.3				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			75.0				Sum of lost time (s)			18.5		
Intersection Capacity Utilization			62.2%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

19: SE 231st St & SR 18 WB Ramps

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑	↑↑						↑	↑
Traffic Volume (vph)	0	535	200	365	390	0	0	0	0	225	0	105
Future Volume (vph)	0	535	200	365	390	0	0	0	0	225	0	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.3	6.3	5.5	6.3						5.9	5.9
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (prot)		3574	1568	1752	3312						1736	1455
Flt Permitted		1.00	1.00	0.95	1.00						0.95	1.00
Satd. Flow (perm)		3574	1568	1752	3312						1736	1455
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)	0	546	204	372	398	0	0	0	0	230	0	107
RTOR Reduction (vph)	0	0	114	0	0	0	0	0	0	0	0	86
Lane Group Flow (vph)	0	546	90	372	398	0	0	0	0	0	230	21
Heavy Vehicles (%)	0%	1%	3%	3%	9%	0%	0%	0%	0%	4%	0%	11%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2							4		4
Actuated Green, G (s)		23.9	23.9	22.4	51.8						16.0	16.0
Effective Green, g (s)		23.9	23.9	22.4	51.8						16.0	16.0
Actuated g/C Ratio		0.30	0.30	0.28	0.65						0.20	0.20
Clearance Time (s)		6.3	6.3	5.5	6.3						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		1067	468	490	2144						347	291
v/s Ratio Prot		c0.15		c0.21	0.12							
v/s Ratio Perm			0.06								0.13	0.01
v/c Ratio		0.51	0.19	0.76	0.19						0.66	0.07
Uniform Delay, d1		23.2	20.9	26.3	5.6						29.5	26.0
Progression Factor		1.00	1.00	1.00	1.00						1.00	1.00
Incremental Delay, d2		1.8	0.9	6.7	0.2						4.7	0.1
Delay (s)		25.0	21.8	33.0	5.8						34.2	26.1
Level of Service		C	C	C	A						C	C
Approach Delay (s)		24.1			19.0			0.0			31.6	
Approach LOS		C			B			A			C	
Intersection Summary												
HCM 2000 Control Delay			23.3			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)				17.7		
Intersection Capacity Utilization			62.2%			ICU Level of Service				B		
Analysis Period (min)			15									
c Critical Lane Group												

Intersection

Intersection Delay, s/veh 15.3

Intersection LOS C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	25	235	5	10	160	35	0	80	20	105	260	40
Future Vol, veh/h	25	235	5	10	160	35	0	80	20	105	260	40
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	1	1	1	2	2	2	1	1	1	3	3	3
Mvmt Flow	26	247	5	11	168	37	0	84	21	111	274	42
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	13.8	12.3	10.5	19
HCM LOS	B	B	B	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	0%	9%	5%	26%
Vol Thru, %	80%	89%	78%	64%
Vol Right, %	20%	2%	17%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	100	265	205	405
LT Vol	0	25	10	105
Through Vol	80	235	160	260
RT Vol	20	5	35	40
Lane Flow Rate	105	279	216	426
Geometry Grp	1	1	1	1
Degree of Util (X)	0.177	0.455	0.354	0.662
Departure Headway (Hd)	6.059	5.874	5.914	5.59
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	586	608	604	644
Service Time	4.156	3.953	4	3.656
HCM Lane V/C Ratio	0.179	0.459	0.358	0.661
HCM Control Delay	10.5	13.8	12.3	19
HCM Lane LOS	B	B	B	C
HCM 95th-tile Q	0.6	2.4	1.6	5

HCM Signalized Intersection Capacity Analysis

21: Witte Rd SE & SR 516

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	635	0	65	610	110	5	40	85	145	85	290
Future Volume (vph)	200	635	0	65	610	110	5	40	85	145	85	290
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	6.8		5.5	6.8	6.8		5.1			5.9	5.9
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.91			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00			0.97	1.00
Satd. Flow (prot)	1805	1863		1805	1863	1615		1713			1831	1599
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00			0.97	1.00
Satd. Flow (perm)	1805	1863		1805	1863	1615		1713			1831	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	208	661	0	68	635	115	5	42	89	151	89	302
RTOR Reduction (vph)	0	0	0	0	0	63	0	58	0	0	0	195
Lane Group Flow (vph)	208	661	0	68	635	52	0	78	0	0	240	107
Confl. Peds. (#/hr)			3	3			1					1
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	3%	0%	1%	0%	1%
Turn Type	Prot	NA		Prot	NA	Perm	Split	NA		Split	NA	pt+ov
Protected Phases	5	2		1	6		3	3		4	4	4 5
Permitted Phases						6						
Actuated Green, G (s)	15.8	61.3		15.4	60.5	60.5		11.4			23.6	39.4
Effective Green, g (s)	15.8	61.3		15.4	60.5	60.5		11.4			23.6	39.4
Actuated g/C Ratio	0.12	0.45		0.11	0.45	0.45		0.08			0.17	0.29
Clearance Time (s)	5.9	6.8		5.5	6.8	6.8		5.1			5.9	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	211	845		205	834	723		144			320	466
v/s Ratio Prot	c0.12	c0.35		0.04	0.34			c0.05			c0.13	0.07
v/s Ratio Perm						0.03						
v/c Ratio	0.99	0.78		0.33	0.76	0.07		0.54			0.75	0.23
Uniform Delay, d1	59.5	31.2		55.1	31.2	21.2		59.3			52.9	36.3
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	57.4	7.1		1.0	6.5	0.2		4.1			9.5	0.3
Delay (s)	116.9	38.3		56.0	37.7	21.4		63.5			62.4	36.5
Level of Service	F	D		E	D	C		E			E	D
Approach Delay (s)		57.1			36.9			63.5			48.0	
Approach LOS		E			D			E			D	
Intersection Summary												
HCM 2000 Control Delay			48.4				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			135.0				Sum of lost time (s)			23.7		
Intersection Capacity Utilization			83.3%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

22: 216th Ave SE & SR 516

01/11/2023

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	695	210	255	630	240	205
Future Volume (vph)	695	210	255	630	240	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	4.0	7.0	5.5	5.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1881	1540	1805	1845	1787	1599
Flt Permitted	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1881	1540	1805	1845	1787	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	724	219	266	656	250	214
RTOR Reduction (vph)	0	125	0	0	0	172
Lane Group Flow (vph)	724	94	266	656	250	42
Confl. Peds. (#/hr)		4	4			3
Heavy Vehicles (%)	1%	2%	0%	3%	1%	1%
Turn Type	NA	Perm	Prot	NA	Prot	Prot
Protected Phases	2		1	6	8	8
Permitted Phases	2	2				8
Actuated Green, G (s)	38.8	38.8	17.1	59.9	17.6	17.6
Effective Green, g (s)	38.8	38.8	17.1	59.9	17.6	17.6
Actuated g/C Ratio	0.43	0.43	0.19	0.67	0.20	0.20
Clearance Time (s)	7.0	7.0	4.0	7.0	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	810	663	342	1227	349	312
v/s Ratio Prot	c0.38		c0.15	0.36	c0.14	0.03
v/s Ratio Perm		0.06				
v/c Ratio	0.89	0.14	0.78	0.53	0.72	0.13
Uniform Delay, d1	23.7	15.5	34.6	7.8	33.9	29.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.4	0.5	10.6	1.7	6.8	0.2
Delay (s)	38.1	16.0	45.3	9.5	40.7	30.1
Level of Service	D	B	D	A	D	C
Approach Delay (s)	32.9			19.8	35.8	
Approach LOS	C			B	D	
Intersection Summary						
HCM 2000 Control Delay			28.3		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.82			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	16.5
Intersection Capacity Utilization			78.3%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

23: SE Wax Rd & SR 516

01/11/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	40	185	880	40	20	95	730	85	130	110	90	195
Future Volume (vph)	40	185	880	40	20	95	730	85	130	110	90	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9			5.9	5.9		5.5	5.9		5.5
Lane Util. Factor		1.00	0.95			1.00	0.95		1.00	1.00		1.00
Frt		1.00	0.99			1.00	0.98		1.00	0.93		1.00
Flt Protected		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1761	3548			1790	3487		1770	1763		1805
Flt Permitted		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1761	3548			1790	3487		1770	1763		1805
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	41	191	907	41	21	98	753	88	134	113	93	201
RTOR Reduction (vph)	0	0	2	0	0	0	6	0	0	26	0	0
Lane Group Flow (vph)	0	232	946	0	0	119	835	0	134	180	0	201
Heavy Vehicles (%)	0%	3%	1%	3%	0%	1%	2%	1%	2%	0%	1%	0%
Turn Type	Prot	Prot	NA		Prot	Prot	NA		Prot	NA		Prot
Protected Phases	7	7	4		3	3	8		5	2		1
Permitted Phases												
Actuated Green, G (s)		33.1	60.1			15.5	42.5		16.7	35.7		15.5
Effective Green, g (s)		33.1	60.1			15.5	42.5		16.7	35.7		15.5
Actuated g/C Ratio		0.22	0.40			0.10	0.28		0.11	0.24		0.10
Clearance Time (s)		5.9	5.9			5.9	5.9		5.5	5.9		5.5
Vehicle Extension (s)		3.0	3.0			3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		388	1421			184	987		197	419		186
v/s Ratio Prot		c0.13	c0.27			0.07	c0.24		0.08	0.10		c0.11
v/s Ratio Perm												
v/c Ratio		0.60	0.67			0.65	0.85		0.68	0.43		1.08
Uniform Delay, d1		52.5	36.7			64.6	50.7		64.1	48.5		67.2
Progression Factor		1.64	0.54			1.00	1.00		1.00	1.00		1.00
Incremental Delay, d2		1.8	0.9			7.6	6.8		9.3	3.2		89.1
Delay (s)		87.7	20.7			72.2	57.5		73.4	51.7		156.4
Level of Service		F	C			E	E		E	D		F
Approach Delay (s)			33.8				59.3			60.2		
Approach LOS			C				E			E		
Intersection Summary												
HCM 2000 Control Delay			54.8				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			23.2		
Intersection Capacity Utilization			76.8%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

23: SE Wax Rd & SR 516

01/11/2023



Movement	SBT	SBR
Lane Configurations	↑	↑
Traffic Volume (vph)	215	235
Future Volume (vph)	215	235
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.9	5.9
Lane Util. Factor	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	1900	1568
Flt Permitted	1.00	1.00
Satd. Flow (perm)	1900	1568
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	222	242
RTOR Reduction (vph)	0	186
Lane Group Flow (vph)	222	56
Heavy Vehicles (%)	0%	3%
Turn Type	NA	Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	34.5	34.5
Effective Green, g (s)	34.5	34.5
Actuated g/C Ratio	0.23	0.23
Clearance Time (s)	5.9	5.9
Vehicle Extension (s)	3.0	3.0
Lane Grp Cap (vph)	437	360
v/s Ratio Prot	c0.12	
v/s Ratio Perm		0.04
v/c Ratio	0.51	0.15
Uniform Delay, d1	50.4	46.1
Progression Factor	1.00	1.00
Incremental Delay, d2	4.2	0.9
Delay (s)	54.5	47.0
Level of Service	D	D
Approach Delay (s)	82.6	
Approach LOS	F	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

24: 172nd Ave SE & SR 516

01/11/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	5	235	960	100	10	175	890	45	120	65	120	90
Future Volume (vph)	5	235	960	100	10	175	890	45	120	65	120	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.1	5.1			5.1	5.1		5.9	5.9		5.9
Lane Util. Factor		1.00	0.95			1.00	0.95		1.00	1.00		1.00
Frpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	0.98		1.00
Flpb, ped/bikes		1.00	1.00			1.00	1.00		1.00	1.00		1.00
Frt		1.00	0.99			1.00	0.99		1.00	0.90		1.00
Flt Protected		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1805	3524			1788	3513		1805	1668		1805
Flt Permitted		0.95	1.00			0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1805	3524			1788	3513		1805	1668		1805
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	247	1011	105	11	184	937	47	126	68	126	95
RTOR Reduction (vph)	0	0	4	0	0	0	2	0	0	69	0	0
Lane Group Flow (vph)	0	252	1112	0	0	195	982	0	126	125	0	95
Confl. Peds. (#/hr)	3	2			10			2	3		10	10
Heavy Vehicles (%)	0%	0%	1%	1%	0%	1%	2%	0%	0%	0%	1%	0%
Turn Type	Prot	Prot	NA		Prot	Prot	NA		Prot	NA		Prot
Protected Phases	7	7	4		3	3	8		5	2		1
Permitted Phases												
Actuated Green, G (s)		42.2	64.0			29.3	51.1		15.1	21.5		13.2
Effective Green, g (s)		42.2	64.0			29.3	51.1		15.1	21.5		13.2
Actuated g/C Ratio		0.28	0.43			0.20	0.34		0.10	0.14		0.09
Clearance Time (s)		5.1	5.1			5.1	5.1		5.9	5.9		5.9
Vehicle Extension (s)		3.0	3.0			3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		507	1503			349	1196		181	239		158
v/s Ratio Prot		0.14	c0.32			c0.11	c0.28		c0.07	c0.08		0.05
v/s Ratio Perm												
v/c Ratio		0.50	0.74			0.56	0.82		0.70	0.52		0.60
Uniform Delay, d1		45.0	36.0			54.5	45.3		65.2	59.5		65.9
Progression Factor		0.43	1.34			0.98	1.21		1.00	1.00		1.00
Incremental Delay, d2		0.4	1.1			1.4	3.4		11.0	8.0		6.3
Delay (s)		19.9	49.4			54.6	58.0		76.3	67.5		72.2
Level of Service		B	D			D	E		E	E		E
Approach Delay (s)			43.9				57.5			71.0		
Approach LOS			D				E			E		
Intersection Summary												
HCM 2000 Control Delay			54.1				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.0		
Intersection Capacity Utilization			81.6%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

24: 172nd Ave SE & SR 516

01/11/2023



Movement	SBT	SBR
Lane Configurations	P	
Traffic Volume (vph)	75	85
Future Volume (vph)	75	85
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.9	
Lane Util. Factor	1.00	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.92	
Flt Protected	1.00	
Satd. Flow (prot)	1730	
Flt Permitted	1.00	
Satd. Flow (perm)	1730	
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	79	89
RTOR Reduction (vph)	43	0
Lane Group Flow (vph)	125	0
Confl. Peds. (#/hr)		3
Heavy Vehicles (%)	0%	0%
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	19.6	
Effective Green, g (s)	19.6	
Actuated g/C Ratio	0.13	
Clearance Time (s)	5.9	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	226	
v/s Ratio Prot	0.07	
v/s Ratio Perm		
v/c Ratio	0.55	
Uniform Delay, d1	61.1	
Progression Factor	1.00	
Incremental Delay, d2	9.5	
Delay (s)	70.6	
Level of Service	E	
Approach Delay (s)	71.2	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

25: 168th PI & SR 516

01/11/2023

												
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	10	210	1180	240	5	185	965	15	320	45	150	35
Future Volume (vph)	10	210	1180	240	5	185	965	15	320	45	150	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9	5.9		5.9	5.9		5.1	5.1		5.1
Lane Util. Factor		1.00	0.95	1.00		1.00	0.95		0.97	1.00		1.00
Frpb, ped/bikes		1.00	1.00	1.00		1.00	1.00		1.00	0.99		1.00
Flpb, ped/bikes		1.00	1.00	1.00		1.00	1.00		1.00	1.00		1.00
Frt		1.00	1.00	0.85		1.00	1.00		1.00	0.88		1.00
Flt Protected		0.95	1.00	1.00		0.95	1.00		0.95	1.00		0.95
Satd. Flow (prot)		1788	3574	1615		1788	3531		3502	1649		1805
Flt Permitted		0.95	1.00	1.00		0.95	1.00		0.95	1.00		0.95
Satd. Flow (perm)		1788	3574	1615		1788	3531		3502	1649		1805
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	11	241	1356	276	6	213	1109	17	368	52	172	40
RTOR Reduction (vph)	0	0	0	97	0	0	1	0	0	85	0	0
Lane Group Flow (vph)	0	252	1356	179	0	219	1125	0	368	139	0	40
Confl. Peds. (#/hr)	1	2		3	2	3		2	1		2	2
Heavy Vehicles (%)	0%	1%	1%	0%	0%	1%	2%	0%	0%	0%	1%	0%
Turn Type	Prot	Prot	NA	custom	Prot	Prot	NA		Prot	NA		Prot
Protected Phases	5	5	2		1	1	6		3	8		7
Permitted Phases				2								
Actuated Green, G (s)		29.6	63.3	63.3		27.3	61.0		22.6	30.0		7.4
Effective Green, g (s)		29.6	63.3	63.3		27.3	61.0		22.6	30.0		7.4
Actuated g/C Ratio		0.20	0.42	0.42		0.18	0.41		0.15	0.20		0.05
Clearance Time (s)		5.9	5.9	5.9		5.9	5.9		5.1	5.1		5.1
Vehicle Extension (s)		3.0	3.0	3.0		3.0	3.0		3.0	3.0		3.0
Lane Grp Cap (vph)		352	1508	681		325	1435		527	329		89
v/s Ratio Prot		c0.14	c0.38	0.11		0.12	0.32		c0.11	0.08		0.02
v/s Ratio Perm												
v/c Ratio		0.72	0.90	0.26		0.67	0.78		0.70	0.42		0.45
Uniform Delay, d1		56.3	40.4	28.2		57.2	38.8		60.5	52.4		69.3
Progression Factor		0.88	0.96	1.12		1.00	0.79		1.00	1.00		1.00
Incremental Delay, d2		6.0	7.9	0.8		4.2	3.4		4.0	0.9		3.6
Delay (s)		55.3	46.5	32.3		61.1	34.2		64.5	53.3		72.9
Level of Service		E	D	C		E	C		E	D		E
Approach Delay (s)			45.6				38.6			60.3		
Approach LOS			D				D			E		
Intersection Summary												
HCM 2000 Control Delay			46.6				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.0		
Intersection Capacity Utilization			78.1%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

25: 168th PI & SR 516

01/11/2023



Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	60	60
Future Volume (vph)	60	60
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.1	
Lane Util. Factor	1.00	
Frpb, ped/bikes	0.99	
Flpb, ped/bikes	1.00	
Frt	0.93	
Flt Protected	1.00	
Satd. Flow (prot)	1746	
Flt Permitted	1.00	
Satd. Flow (perm)	1746	
Peak-hour factor, PHF	0.87	0.87
Adj. Flow (vph)	69	69
RTOR Reduction (vph)	27	0
Lane Group Flow (vph)	111	0
Confl. Peds. (#/hr)		1
Heavy Vehicles (%)	0%	0%
Turn Type	NA	
Protected Phases	4	
Permitted Phases		
Actuated Green, G (s)	14.8	
Effective Green, g (s)	14.8	
Actuated g/C Ratio	0.10	
Clearance Time (s)	5.1	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	172	
v/s Ratio Prot	c0.06	
v/s Ratio Perm		
v/c Ratio	0.65	
Uniform Delay, d1	65.1	
Progression Factor	1.00	
Incremental Delay, d2	8.0	
Delay (s)	73.1	
Level of Service	E	
Approach Delay (s)	73.1	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

26: SR 516 & SR 18 EB Ramps

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	1140	0	0	1235	170	200	0	715	0	0	0
Future Volume (vph)	105	1140	0	0	1235	170	200	0	715	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Lane Util. Factor	0.97	0.95			0.95		1.00	0.95	0.95			
Frpb, ped/bikes	1.00	1.00			1.00		1.00	0.99	0.99			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.98		1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (prot)	3303	3574			3507		1787	1498	1498			
Flt Permitted	0.95	1.00			1.00		0.95	1.00	1.00			
Satd. Flow (perm)	3303	3574			3507		1787	1498	1498			
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	109	1188	0	0	1286	177	208	0	745	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	308	307	0	0	0
Lane Group Flow (vph)	109	1188	0	0	1459	0	208	65	65	0	0	0
Confl. Peds. (#/hr)	2		4	4		2			1	1		
Heavy Vehicles (%)	6%	1%	0%	0%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type	Prot	NA			NA		Perm	NA	Perm			
Protected Phases	5	2			6			3				
Permitted Phases							3		3			
Actuated Green, G (s)	10.3	111.9			96.1		26.3	26.3	26.3			
Effective Green, g (s)	10.3	111.9			96.1		26.3	26.3	26.3			
Actuated g/C Ratio	0.07	0.75			0.64		0.18	0.18	0.18			
Clearance Time (s)	5.5	5.9			5.9		5.9	5.9	5.9			
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0			
Lane Grp Cap (vph)	226	2666			2246		313	262	262			
v/s Ratio Prot	0.03	c0.33			c0.42			0.04				
v/s Ratio Perm							c0.12		0.04			
v/c Ratio	0.48	0.45			0.65		0.66	0.25	0.25			
Uniform Delay, d1	67.3	7.2			16.6		57.7	53.3	53.3			
Progression Factor	1.16	1.86			1.61		1.00	1.00	1.00			
Incremental Delay, d2	1.3	0.4			1.0		5.2	0.5	0.5			
Delay (s)	79.2	14.0			27.7		63.0	53.8	53.8			
Level of Service	E	B			C		E	D	D			
Approach Delay (s)		19.4			27.7			55.8			0.0	
Approach LOS		B			C			E			A	
Intersection Summary												
HCM 2000 Control Delay			32.0				HCM 2000 Level of Service		C			
HCM 2000 Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)		22.8			
Intersection Capacity Utilization			72.2%				ICU Level of Service		C			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

27: SR 516 & SR 18 WB Ramps

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑↑	↑↑↑						↑↓	↑
Traffic Volume (vph)	0	1090	360	395	995	0	0	0	0	140	5	245
Future Volume (vph)	0	1090	360	395	995	0	0	0	0	140	5	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Lane Util. Factor		0.95	1.00	0.97	0.91						0.95	0.95
Frpb, ped/bikes		1.00	0.98	1.00	1.00						1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						0.96	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (prot)		3539	1543	3467	5136						1627	1475
Flt Permitted		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (perm)		3539	1543	3467	5136						1627	1475
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1147	379	416	1047	0	0	0	0	147	5	258
RTOR Reduction (vph)	0	0	66	0	0	0	0	0	0	0	11	127
Lane Group Flow (vph)	0	1147	313	416	1047	0	0	0	0	0	203	69
Confl. Peds. (#/hr)	3		2	2		3						
Heavy Vehicles (%)	0%	2%	3%	1%	1%	0%	0%	0%	0%	1%	33%	4%
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						3	
Permitted Phases			2							3		3
Actuated Green, G (s)		85.3	85.3	23.2	114.0						24.2	24.2
Effective Green, g (s)		85.3	85.3	23.2	114.0						24.2	24.2
Actuated g/C Ratio		0.57	0.57	0.15	0.76						0.16	0.16
Clearance Time (s)		5.9	5.9	5.5	5.9						5.9	5.9
Vehicle Extension (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Grp Cap (vph)		2012	877	536	3903						262	237
v/s Ratio Prot		c0.32		c0.12	0.20							
v/s Ratio Perm			0.20								0.12	0.05
v/c Ratio		0.57	0.36	0.78	0.27						0.78	0.29
Uniform Delay, d1		20.6	17.5	60.9	5.4						60.3	55.4
Progression Factor		0.73	0.66	0.75	2.35						1.00	1.00
Incremental Delay, d2		1.0	1.0	5.4	0.1						13.4	0.7
Delay (s)		16.1	12.6	51.4	12.9						73.6	56.1
Level of Service		B	B	D	B						E	E
Approach Delay (s)		15.2			23.8			0.0			65.2	
Approach LOS		B			C			A			E	
Intersection Summary												
HCM 2000 Control Delay			24.9			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)				17.3		
Intersection Capacity Utilization			72.2%			ICU Level of Service				C		
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

28: SR 516 & 164th Ave SE

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	1020	10	15	900	320	5	5	5	425	10	185
Future Volume (vph)	100	1020	10	15	900	320	5	5	5	425	10	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9		5.5	5.9	5.9		5.5		5.9	5.9	5.9
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1752	3535		1703	3539	1615		1785		1698	1706	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.70		0.75	0.72	1.00
Satd. Flow (perm)	1752	3535		1703	3539	1615		1273		1336	1296	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	104	1062	10	16	938	333	5	5	5	443	10	193
RTOR Reduction (vph)	0	0	0	0	0	131	0	5	0	0	0	110
Lane Group Flow (vph)	104	1073	0	16	938	202	0	10	0	226	227	83
Heavy Vehicles (%)	3%	2%	0%	6%	2%	0%	0%	0%	0%	1%	0%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	5	2		9	6			7			4	
Permitted Phases						6	7	7		4		4
Actuated Green, G (s)	14.2	87.3		3.3	76.4	76.4		3.8		32.8	32.8	32.8
Effective Green, g (s)	14.2	87.3		3.3	76.4	76.4		3.8		32.8	32.8	32.8
Actuated g/C Ratio	0.09	0.58		0.02	0.51	0.51		0.03		0.22	0.22	0.22
Clearance Time (s)	5.5	5.9		5.5	5.9	5.9		5.5		5.9	5.9	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	165	2057		37	1802	822		32		292	283	346
v/s Ratio Prot	c0.06	c0.30		0.01	0.27							
v/s Ratio Perm						0.13		c0.01		0.17	c0.18	0.05
v/c Ratio	0.63	0.52		0.43	0.52	0.25		0.32		0.77	0.80	0.24
Uniform Delay, d1	65.4	18.8		72.4	24.6	20.6		71.8		55.1	55.5	48.3
Progression Factor	1.23	0.48		0.62	1.35	2.43		1.00		1.00	1.00	1.00
Incremental Delay, d2	5.9	0.7		7.7	1.0	0.7		5.6		12.0	15.0	0.4
Delay (s)	86.5	9.7		52.8	34.2	50.9		77.5		67.2	70.5	48.7
Level of Service	F	A		D	C	D		E		E	E	D
Approach Delay (s)		16.5			38.8			77.5			62.8	
Approach LOS		B			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			35.5				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			22.8		
Intersection Capacity Utilization			65.0%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

29: Covington Way SE & SR 516

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	760	405	220	810	25	430	5	310	15	5	30
Future Volume (vph)	20	760	405	220	810	25	430	5	310	15	5	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.9		5.5	5.9		6.0	6.0	6.0		5.9	5.9
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.95	1.00		0.96	1.00
Satd. Flow (prot)	1805	3347		1770	3523		1681	1688	1583		1830	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.74	0.72	1.00		0.41	1.00
Satd. Flow (perm)	1805	3347		1770	3523		1316	1267	1583		788	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	21	792	422	229	844	26	448	5	323	16	5	31
RTOR Reduction (vph)	0	52	0	0	1	0	0	0	251	0	0	29
Lane Group Flow (vph)	21	1162	0	229	869	0	228	225	72	0	21	2
Confl. Peds. (#/hr)	1		2	2		1						
Heavy Vehicles (%)	0%	1%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			4			3	
Permitted Phases							4		4	3	3	3
Actuated Green, G (s)	5.0	64.4		20.5	79.9		33.3	33.3	33.3		8.5	8.5
Effective Green, g (s)	5.0	64.4		20.5	79.9		33.3	33.3	33.3		8.5	8.5
Actuated g/C Ratio	0.03	0.43		0.14	0.53		0.22	0.22	0.22		0.06	0.06
Clearance Time (s)	5.5	5.9		5.5	5.9		6.0	6.0	6.0		5.9	5.9
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	60	1436		241	1876		292	281	351		44	91
v/s Ratio Prot	0.01	c0.35		c0.13	0.25							
v/s Ratio Perm							0.17	c0.18	0.05		c0.03	0.00
v/c Ratio	0.35	0.81		0.95	0.46		0.78	0.80	0.20		0.48	0.02
Uniform Delay, d1	70.9	37.4		64.2	21.7		54.9	55.2	47.6		68.6	66.8
Progression Factor	1.00	1.00		1.24	0.54		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.5	5.0		41.2	0.7		12.7	15.0	0.3		7.9	0.1
Delay (s)	74.4	42.5		121.1	12.5		67.6	70.2	47.8		76.5	66.9
Level of Service	E	D		F	B		E	E	D		E	E
Approach Delay (s)		43.0			35.1			60.1			70.8	
Approach LOS		D			D			E			E	
Intersection Summary												
HCM 2000 Control Delay			44.9			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			23.3			
Intersection Capacity Utilization			88.2%			ICU Level of Service			E			
Analysis Period (min)			15									

c Critical Lane Group

Intersection												
Int Delay, s/veh	69.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	55	1100	0	0	995	185	0	0	0	100	0	80
Future Vol, veh/h	55	1100	0	0	995	185	0	0	0	100	0	80
Conflicting Peds, #/hr	1	0	3	3	0	1	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	150	-	-	-	-	-	-	-	-	-	-	-
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, %	0	1	0	0	3	2	0	0	0	3	0	1
Mvmt Flow	59	1170	0	0	1059	197	0	0	0	106	0	85
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1257	0	0	1173	0	0	1821	2548	588	1862	2450	629
Stage 1	-	-	-	-	-	-	1291	1291	-	1159	1159	-
Stage 2	-	-	-	-	-	-	530	1257	-	703	1291	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.56	6.5	6.92
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.56	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.56	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.53	4	3.31
Pot Cap-1 Maneuver	560	-	-	603	-	-	49	27	457	~ 44	31	427
Stage 1	-	-	-	-	-	-	176	236	-	207	272	-
Stage 2	-	-	-	-	-	-	506	245	-	392	236	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	560	-	-	601	-	-	36	24	456	~ 40	28	427
Mov Cap-2 Maneuver	-	-	-	-	-	-	36	24	-	~ 40	28	-
Stage 1	-	-	-	-	-	-	157	211	-	185	272	-
Stage 2	-	-	-	-	-	-	405	245	-	351	211	-
Approach	EB		WB			NB			SB			
HCM Control Delay, s	0.6		0			0			\$ 970.6			
HCM LOS						A			F			
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	-	560	-	-	601	-	-	67				
HCM Lane V/C Ratio	-	0.104	-	-	-	-	-	2.858				
HCM Control Delay (s)	0	12.2	-	-	0	-	-	\$ 970.6				
HCM Lane LOS	A	B	-	-	A	-	-	F				
HCM 95th %tile Q(veh)	-	0.3	-	-	0	-	-	19.3				
Notes												
~: Volume exceeds capacity		\$: Delay exceeds 300s			+: Computation Not Defined				*: All major volume in platoon			

HCM Signalized Intersection Capacity Analysis

31: Covington Way SE & 165th PI SE

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	20	5	15	290	0	165	5	380	110	105	10	325
Future Volume (vph)	20	5	15	290	0	165	5	380	110	105	10	325
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0		5.0	4.0	5.0			4.0	5.0
Lane Util. Factor	1.00	1.00		1.00		1.00	1.00	0.95			1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00		1.00	1.00	0.99			1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00		1.00	1.00	1.00			1.00	1.00
Frt	1.00	0.89		1.00		0.85	1.00	0.97			1.00	1.00
Flt Protected	0.95	1.00		0.95		1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1388	1510		1787		1599	1357	3390			1805	1881
Flt Permitted	0.76	1.00		0.74		1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1107	1510		1399		1599	1357	3390			1805	1881
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	5	16	309	0	176	5	404	117	112	11	346
RTOR Reduction (vph)	0	12	0	0	0	127	0	25	0	0	0	0
Lane Group Flow (vph)	21	9	0	309	0	49	5	496	0	0	123	346
Confl. Peds. (#/hr)									3		3	
Heavy Vehicles (%)	30%	0%	15%	1%	0%	1%	33%	3%	0%	0%	0%	1%
Turn Type	Perm	NA		Perm		Perm	Prot	NA		Prot	Prot	NA
Protected Phases		4			8		5	2		1	1	6
Permitted Phases	4			8		8						
Actuated Green, G (s)	25.3	25.3		25.3		25.3	1.4	39.3			11.4	49.3
Effective Green, g (s)	25.3	25.3		25.3		25.3	1.4	39.3			11.4	49.3
Actuated g/C Ratio	0.28	0.28		0.28		0.28	0.02	0.44			0.13	0.55
Clearance Time (s)	5.0	5.0		5.0		5.0	4.0	5.0			4.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0		3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	311	424		393		449	21	1480			228	1030
v/s Ratio Prot		0.01					0.00	0.15			c0.07	c0.18
v/s Ratio Perm	0.02			c0.22		0.03						
v/c Ratio	0.07	0.02		0.79		0.11	0.24	0.33			0.54	0.34
Uniform Delay, d1	23.7	23.4		29.9		24.0	43.8	16.7			36.8	11.3
Progression Factor	1.00	1.00		1.00		1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2	0.1	0.0		10.0		0.1	5.8	0.6			2.4	0.9
Delay (s)	23.8	23.4		39.8		24.1	49.6	17.3			39.3	12.2
Level of Service	C	C		D		C	D	B			D	B
Approach Delay (s)		23.6			34.1			17.6				16.8
Approach LOS		C			C			B				B
Intersection Summary												
HCM 2000 Control Delay			22.1									
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			90.0									
Intersection Capacity Utilization			65.8%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Covington Way SE & 165th PI SE

01/11/2023

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	190
Future Volume (vph)	190
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.0
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1077
Flt Permitted	1.00
Satd. Flow (perm)	1077
Peak-hour factor, PHF	0.94
Adj. Flow (vph)	202
RTOR Reduction (vph)	91
Lane Group Flow (vph)	111
Confl. Peds. (#/hr)	
Heavy Vehicles (%)	50%
Turn Type	Perm
Protected Phases	
Permitted Phases	6
Actuated Green, G (s)	49.3
Effective Green, g (s)	49.3
Actuated g/C Ratio	0.55
Clearance Time (s)	5.0
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	589
v/s Ratio Prot	
v/s Ratio Perm	0.10
v/c Ratio	0.19
Uniform Delay, d1	10.3
Progression Factor	1.00
Incremental Delay, d2	0.7
Delay (s)	11.0
Level of Service	B
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM 6th Signalized Intersection Summary

32: Covington Way SE & SE Wax Rd

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	365	0	95	0	380	215	60	585	0
Future Volume (veh/h)	0	0	0	365	0	95	0	380	215	60	585	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1885	1900	1870	1900	1870	1900	1870	1885	1900
Adj Flow Rate, veh/h	0	0	0	388	0	101	0	404	229	64	622	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	0	0	0	1	0	2	0	2	0	2	1	0
Cap, veh/h	0	989	0	679	0	158	0	689	592	234	695	0
Arrive On Green	0.00	0.00	0.00	0.52	0.00	0.52	0.00	0.37	0.37	0.37	0.37	0.00
Sat Flow, veh/h	0	1900	0	1168	0	304	0	1870	1606	794	1885	0
Grp Volume(v), veh/h	0	0	0	489	0	0	0	404	229	64	622	0
Grp Sat Flow(s),veh/h/ln	0	1900	0	1472	0	0	0	1870	1606	794	1885	0
Q Serve(g_s), s	0.0	0.0	0.0	21.5	0.0	0.0	0.0	15.7	9.5	6.4	28.0	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	21.5	0.0	0.0	0.0	15.7	9.5	22.0	28.0	0.0
Prop In Lane	0.00		0.00	0.79		0.21	0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	0	989	0	838	0	0	0	689	592	234	695	0
V/C Ratio(X)	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.59	0.39	0.27	0.90	0.00
Avail Cap(c_a), veh/h	0	989	0	838	0	0	0	831	714	295	838	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	15.5	0.0	0.0	0.0	22.9	20.9	31.8	26.8	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.8	0.4	0.6	10.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	7.2	0.0	0.0	0.0	6.7	3.5	1.2	13.9	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	0.0	18.5	0.0	0.0	0.0	23.7	21.3	32.4	37.5	0.0
LnGrp LOS	A	A	A	B	A	A	A	C	C	C	D	A
Approach Vol, veh/h	0			489			633			686		
Approach Delay, s/veh	0.0			18.5			22.8			37.1		
Approach LOS				B			C			D		
Timer - Assigned Phs	2			4			6			8		
Phs Duration (G+Y+Rc), s	51.8			38.2			51.8			38.2		
Change Period (Y+Rc), s	5.0			5.0			5.0			5.0		
Max Green Setting (Gmax), s	40.0			40.0			40.0			40.0		
Max Q Clear Time (g_c+I1), s	0.0			17.7			23.5			30.0		
Green Ext Time (p_c), s	0.0			3.2			2.8			3.2		
Intersection Summary												
HCM 6th Ctrl Delay				27.1								
HCM 6th LOS				C								

Intersection

Int Delay, s/veh 1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	170	30	30	190	15	15
Future Vol, veh/h	170	30	30	190	15	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	185	33	33	207	16	16

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	218
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1352
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1352
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	10.8
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	652	-	-	1352	-
HCM Lane V/C Ratio	0.05	-	-	0.024	-
HCM Control Delay (s)	10.8	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

HCM 6th Signalized Intersection Summary

34: 216th Ave SE & SE 288th St

01/12/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	0	110	0	85	0	325	115	120	375	0
Future Volume (veh/h)	5	0	0	110	0	85	0	325	115	120	375	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1856	1856	1856	1900	1900	1900	1885	1885	1885
Adj Flow Rate, veh/h	5	0	0	115	0	0	0	339	0	125	391	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	0	0	3	3	3	0	0	0	1	1	1
Cap, veh/h	596	0	0	564	0		0	820		744	814	0
Arrive On Green	0.10	0.00	0.00	0.10	0.00	0.00	0.00	0.43	0.00	0.43	0.43	0.00
Sat Flow, veh/h	1729	0	0	1415	0	1572	0	1900	0	1050	1885	0
Grp Volume(v), veh/h	5	0	0	115	0	0	0	339	0	125	391	0
Grp Sat Flow(s),veh/h/ln	1729	0	0	1415	0	1572	0	1900	0	1050	1885	0
Q Serve(g_s), s	0.0	0.0	0.0	1.3	0.0	0.0	0.0	2.1	0.0	1.6	2.5	0.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	1.4	0.0	0.0	0.0	2.1	0.0	3.7	2.5	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	596	0	0	564	0		0	820		744	814	0
V/C Ratio(X)	0.01	0.00	0.00	0.20	0.00		0.00	0.41		0.17	0.48	0.00
Avail Cap(c_a), veh/h	1794	0	0	1734	0		0	1774		1270	1760	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	6.9	0.0	0.0	7.5	0.0	0.0	0.0	3.4	0.0	4.7	3.5	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.1	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	6.9	0.0	0.0	7.7	0.0	0.0	0.0	3.7	0.0	4.8	3.9	0.0
LnGrp LOS	A	A	A	A	A		A	A		A	A	A
Approach Vol, veh/h	5			115		A		339		A		516
Approach Delay, s/veh	6.9			7.7				3.7				4.1
Approach LOS	A			A				A				A
Timer - Assigned Phs	2			4		6		8				
Phs Duration (G+Y+Rc), s	11.4			5.7		11.4		5.7				
Change Period (Y+Rc), s	4.0			4.0		4.0		4.0				
Max Green Setting (Gmax), s	16.0			16.0		16.0		16.0				
Max Q Clear Time (g_c+I1), s	4.1			2.0		5.7		3.4				
Green Ext Time (p_c), s	1.0			0.0		1.7		0.3				
Intersection Summary												
HCM 6th Ctrl Delay	4.4											
HCM 6th LOS	A											

HCM Signalized Intersection Capacity Analysis

35: SE 296th St/216th Ave SE & SE Covington-Sawyer Rd/292nd St

01/11/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	15	190	10	15	20	155	205	10	20	255	215
Future Volume (vph)	215	15	190	10	15	20	155	205	10	20	255	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	5.0		4.0		5.0	4.0			4.0	5.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00			1.00	1.00
Frt		1.00	0.85		0.94		1.00	0.99			1.00	0.85
Flt Protected		0.96	1.00		0.99		0.95	1.00			1.00	1.00
Satd. Flow (prot)		1798	1568		1726		1752	1851			1859	1615
Flt Permitted		0.70	1.00		0.92		0.45	1.00			0.97	1.00
Satd. Flow (perm)		1325	1568		1607		825	1851			1812	1615
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	236	16	209	11	16	22	170	225	11	22	280	236
RTOR Reduction (vph)	0	0	157	0	16	0	0	2	0	0	0	126
Lane Group Flow (vph)	0	252	52	0	33	0	170	234	0	0	302	110
Heavy Vehicles (%)	1%	0%	3%	0%	0%	5%	3%	2%	0%	0%	2%	0%
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases		8			4		5	2			6	
Permitted Phases	8		8	4			2			6		6
Actuated Green, G (s)		19.8	19.8		19.8		50.2	50.2			37.2	37.2
Effective Green, g (s)		20.8	19.8		20.8		50.2	51.2			38.2	37.2
Actuated g/C Ratio		0.26	0.25		0.26		0.63	0.64			0.48	0.47
Clearance Time (s)		5.0	5.0		5.0		5.0	5.0			5.0	5.0
Vehicle Extension (s)		2.0	2.0		2.0		2.0	2.0			2.0	2.0
Lane Grp Cap (vph)		344	388		417		610	1184			865	750
v/s Ratio Prot							c0.03	0.13				
v/s Ratio Perm		c0.19	0.03		0.02		0.15				c0.17	0.07
v/c Ratio		0.73	0.13		0.08		0.28	0.20			0.35	0.15
Uniform Delay, d1		27.1	23.4		22.4		6.8	5.9			13.1	12.3
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		6.8	0.1		0.0		0.1	0.4			1.1	0.4
Delay (s)		33.8	23.5		22.4		6.9	6.3			14.2	12.7
Level of Service		C	C		C		A	A			B	B
Approach Delay (s)		29.1			22.4			6.6			13.5	
Approach LOS		C			C			A			B	
Intersection Summary												
HCM 2000 Control Delay			16.8				HCM 2000 Level of Service				B	
HCM 2000 Volume to Capacity ratio			0.46									
Actuated Cycle Length (s)			80.0				Sum of lost time (s)			13.0		
Intersection Capacity Utilization			55.3%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM 6th Signalized Intersection Summary

36: 219th Ave SE & SE 296th St

01/11/2023

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (veh/h)	265	140	10	250	170	20
Future Volume (veh/h)	265	140	10	250	170	20
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1885	1870	1900	1885	1870	1900
Adj Flow Rate, veh/h	331	175	12	312	212	25
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Percent Heavy Veh, %	1	2	0	1	2	0
Cap, veh/h	1230	1034	641	1365	288	260
Arrive On Green	0.65	0.65	0.01	0.72	0.16	0.16
Sat Flow, veh/h	1885	1585	1810	1885	1781	1610
Grp Volume(v), veh/h	331	175	12	312	212	25
Grp Sat Flow(s),veh/h/ln	1885	1585	1810	1885	1781	1610
Q Serve(g_s), s	5.2	3.0	0.1	3.8	7.9	0.9
Cycle Q Clear(g_c), s	5.2	3.0	0.1	3.8	7.9	0.9
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1230	1034	641	1365	288	260
V/C Ratio(X)	0.27	0.17	0.02	0.23	0.74	0.10
Avail Cap(c_a), veh/h	1230	1034	770	1365	662	598
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.94	0.94	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	5.1	4.8	3.9	3.2	27.9	25.0
Incr Delay (d2), s/veh	0.5	0.3	0.0	0.4	1.4	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.8	0.0	1.0	3.4	0.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	5.6	5.1	4.0	3.6	29.3	25.1
LnGrp LOS	A	A	A	A	C	C
Approach Vol, veh/h	506			324	237	
Approach Delay, s/veh	5.4			3.6	28.9	
Approach LOS	A			A	C	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	5.0	49.7		15.3		54.7
Change Period (Y+Rc), s	4.0	5.0		5.0		5.0
Max Green Setting (Gmax), s	6.0	25.0		25.0		35.0
Max Q Clear Time (g_c+I1), s	2.1	7.2		9.9		5.8
Green Ext Time (p_c), s	0.0	1.1		0.5		0.6
Intersection Summary						
HCM 6th Ctrl Delay			10.1			
HCM 6th LOS			B			

HCM 6th TWSC
37: 218th Ave SE & SE Auburn-Black Diamond Rd

01/11/2023

Intersection

Int Delay, s/veh 2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	425	230	35	265	80	40
Future Vol, veh/h	425	230	35	265	80	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	443	240	36	276	83	42

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	683
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	910
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	910
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	21.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	341	-	-	910	-
HCM Lane V/C Ratio	0.367	-	-	0.04	-
HCM Control Delay (s)	21.5	-	-	9.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.6	-	-	0.1	-

MOVEMENT SUMMARY

 **Site: 101 [38.Ten Trails Pkwy (Site Folder: 2022)]**

Ten Trails Pkwy and SE Auburn Black Diamond Rd

Site Category: (None)

Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Ten Trails Pkwy														
0	L2	50	4.1	55	4.1	0.159	13.2	LOS B	0.9	24.2	0.67	0.73	0.67	34.6
325	T1	40	4.1	44	4.1	0.159	7.3	LOS A	0.9	24.2	0.67	0.73	0.67	34.6
115	R2	25	4.1	27	4.1	0.159	7.3	LOS A	0.9	24.2	0.67	0.73	0.67	33.6
Approach		115	4.1	126	4.1	0.159	9.9	LOS A	0.9	24.2	0.67	0.73	0.67	34.4
East: SE Auburn Black Diamond Rd														
110	L2	30	1.2	36	1.2	0.362	10.9	LOS B	2.5	62.3	0.45	0.51	0.45	36.5
0	T1	265	1.2	319	1.2	0.362	4.9	LOS A	2.5	62.3	0.45	0.51	0.45	36.4
85	R2	55	1.2	66	1.2	0.362	5.0	LOS A	2.5	62.3	0.45	0.51	0.45	35.3
Approach		350	1.2	422	1.2	0.362	5.4	LOS A	2.5	62.3	0.45	0.51	0.45	36.2
North: Ten Trails Pkwy														
120	L2	60	0.7	81	0.7	0.219	12.1	LOS B	1.3	32.8	0.59	0.69	0.59	35.4
375	T1	35	0.7	47	0.7	0.219	6.2	LOS A	1.3	32.8	0.59	0.69	0.59	35.3
0	R2	60	0.7	81	0.7	0.219	6.2	LOS A	1.3	32.8	0.59	0.69	0.59	34.2
Approach		155	0.7	209	0.7	0.219	8.5	LOS A	1.3	32.8	0.59	0.69	0.59	34.9
West: SE Auburn Black Diamond Rd														
5	L2	55	2.7	61	2.7	0.467	11.1	LOS B	3.6	92.0	0.51	0.54	0.51	36.1
0	T1	375	2.7	417	2.7	0.467	5.1	LOS A	3.6	92.0	0.51	0.54	0.51	36.1
0	R2	50	2.7	56	2.7	0.467	5.2	LOS A	3.6	92.0	0.51	0.54	0.51	35.0
Approach		480	2.7	533	2.7	0.467	5.8	LOS A	3.6	92.0	0.51	0.54	0.51	36.0
All Vehicles		1100	2.1	1291	2.0	0.467	6.5	LOS A	3.6	92.0	0.52	0.57	0.52	35.7

Site Level of Service (LOS) Method: Delay (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 per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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.

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MOVEMENT SUMMARY

 **Site: 101 [39.Lake Sawyer Rd (Site Folder: 2022)]**

Lake Sawyer Rd and SE Auburn Black Diamond Rd

Site Category: (None)

Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: Lake Sawyer Rd														
0	L2	150	6.1	195	6.1	0.645	15.2	LOS B	6.8	178.3	0.84	0.88	0.99	33.9
325	T1	75	6.1	97	6.1	0.645	9.2	LOS A	6.8	178.3	0.84	0.88	0.99	33.9
115	R2	215	6.1	279	6.1	0.645	9.2	LOS A	6.8	178.3	0.84	0.88	0.99	32.9
Approach		440	6.1	571	6.1	0.645	11.3	LOS B	6.8	178.3	0.84	0.88	0.99	33.4
East: SE Auburn-Black Diamond Rd														
110	L2	330	1.5	413	1.5	0.741	17.2	LOS B	9.8	247.4	0.93	0.98	1.20	32.4
0	T1	115	1.5	144	1.5	0.741	11.3	LOS B	9.8	247.4	0.93	0.98	1.20	32.3
85	R2	100	1.5	125	1.5	0.741	11.3	LOS B	9.8	247.4	0.93	0.98	1.20	31.5
Approach		545	1.5	681	1.5	0.741	14.9	LOS B	9.8	247.4	0.93	0.98	1.20	32.2
North: Lake Sawyer Rd														
120	L2	70	0.9	101	0.9	0.549	18.6	LOS B	5.1	127.8	0.95	1.04	1.16	32.6
375	T1	110	0.9	159	0.9	0.549	12.6	LOS B	5.1	127.8	0.95	1.04	1.16	32.5
0	R2	60	0.9	87	0.9	0.549	12.7	LOS B	5.1	127.8	0.95	1.04	1.16	31.6
Approach		240	0.9	348	0.9	0.549	14.4	LOS B	5.1	127.8	0.95	1.04	1.16	32.3
West: SE Auburn-Black Diamond Rd														
5	L2	95	0.8	104	0.8	0.660	19.7	LOS B	7.3	182.9	0.96	1.09	1.30	32.2
0	T1	160	0.8	176	0.8	0.660	13.8	LOS B	7.3	182.9	0.96	1.09	1.30	32.1
0	R2	180	0.8	198	0.8	0.660	13.8	LOS B	7.3	182.9	0.96	1.09	1.30	31.3
Approach		435	0.8	478	0.8	0.660	15.1	LOS B	7.3	182.9	0.96	1.09	1.30	31.8
All Vehicles		1660	2.4	2079	2.5	0.741	13.9	LOS B	9.8	247.4	0.91	0.99	1.16	32.4

Site Level of Service (LOS) Method: Delay (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 per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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.

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MOVEMENT SUMMARY

Site: 40 [40.Roberts Dr Morgan St (Site Folder: Existing Volumes)]

Roberts Dr and Morgan St
Site Category: Existing Conditions-Build
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total HV] veh/h %		DEMAND FLOWS [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. Dist] veh ft		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Morgan St														
3	L2	210	2.0	228	2.0	0.187	10.8	LOS B	0.9	22.9	0.38	0.66	0.38	34.0
Approach		210	2.0	228	2.0	0.187	10.8	LOS B	0.9	22.9	0.38	0.66	0.38	34.0
East: Roberts Dr														
1	L2	5	2.0	5	2.0	0.293	10.8	LOS B	1.7	42.8	0.43	0.48	0.43	36.6
6	T1	325	2.0	353	2.0	0.293	4.9	LOS A	1.7	42.8	0.43	0.48	0.43	36.6
Approach		330	2.0	359	2.0	0.293	4.9	LOS A	1.7	42.8	0.43	0.48	0.43	36.6
West: Roberts Dr														
2	T1	240	2.0	261	2.0	0.343	3.8	LOS A	2.2	56.2	0.06	0.40	0.06	38.0
12	R2	215	2.0	234	2.0	0.343	3.9	LOS A	2.2	56.2	0.06	0.40	0.06	36.8
Approach		455	2.0	495	2.0	0.343	3.9	LOS A	2.2	56.2	0.06	0.40	0.06	37.4
All Vehicles		995	2.0	1082	2.0	0.343	5.7	LOS A	2.2	56.2	0.25	0.49	0.25	36.3

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.

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HCM 6th TWSC
41: Railroad Ave/Morgan St & Baker St

01/11/2023

Intersection

Int Delay, s/veh 2.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	55	165	10	80	120
Future Vol, veh/h	10	55	165	10	80	120
Conflicting Peds, #/hr	0	1	0	10	10	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	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	1	2
Mvmt Flow	11	60	179	11	87	130

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	499	196	0
Stage 1	195	-	-
Stage 2	304	-	-
Critical Hdwy	6.4	6.2	-
Critical Hdwy Stg 1	5.4	-	-
Critical Hdwy Stg 2	5.4	-	-
Follow-up Hdwy	3.5	3.3	-
Pot Cap-1 Maneuver	535	850	-
Stage 1	843	-	-
Stage 2	753	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	494	842	-
Mov Cap-2 Maneuver	494	-	-
Stage 1	836	-	-
Stage 2	701	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.2	0	3.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	760	1367
HCM Lane V/C Ratio	-	-	0.093	0.064
HCM Control Delay (s)	-	-	10.2	7.8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.3	0.2

Intersection

Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	15	105	10	10	25	30	115	10	20	255	10
Future Vol, veh/h	10	15	105	10	10	25	30	115	10	20	255	10
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	0	0	0	13	33	0	0	2	0	0	1	0
Mvmt Flow	11	16	114	11	11	27	33	125	11	22	277	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.7	8.6	9.1	10.5
HCM LOS	A	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	19%	8%	22%	7%
Vol Thru, %	74%	12%	22%	89%
Vol Right, %	6%	81%	56%	4%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	155	130	45	285
LT Vol	30	10	10	20
Through Vol	115	15	10	255
RT Vol	10	105	25	10
Lane Flow Rate	168	141	49	310
Geometry Grp	1	1	1	1
Degree of Util (X)	0.22	0.18	0.07	0.391
Departure Headway (Hd)	4.703	4.594	5.119	4.54
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	760	777	696	790
Service Time	2.754	2.646	3.182	2.584
HCM Lane V/C Ratio	0.221	0.181	0.07	0.392
HCM Control Delay	9.1	8.7	8.6	10.5
HCM Lane LOS	A	A	A	B
HCM 95th-tile Q	0.8	0.7	0.2	1.9

Intersection						
Int Delay, s/veh	2.5					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	530	230	5	380	90	0
Future Vol, veh/h	530	230	5	380	90	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	None
Storage Length	-	-	90	-	0	110
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	1	1	3	3	1	1
Mvmt Flow	589	256	6	422	100	0
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	589	0	1151	717
Stage 1	-	-	-	-	717	-
Stage 2	-	-	-	-	434	-
Critical Hdwy	-	-	4.13	-	6.41	6.21
Critical Hdwy Stg 1	-	-	-	-	5.41	-
Critical Hdwy Stg 2	-	-	-	-	5.41	-
Follow-up Hdwy	-	-	2.227	-	3.509	3.309
Pot Cap-1 Maneuver	-	-	981	-	220	431
Stage 1	-	-	-	-	485	-
Stage 2	-	-	-	-	655	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	981	-	219	431
Mov Cap-2 Maneuver	-	-	-	-	219	-
Stage 1	-	-	-	-	485	-
Stage 2	-	-	-	-	651	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0.1		34.5	
HCM LOS	D					
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	219		-	-	-	981
HCM Lane V/C Ratio	0.457		-	-	-	0.006
HCM Control Delay (s)	34.5		0	-	-	8.7
HCM Lane LOS	D		A	-	-	A
HCM 95th %tile Q(veh)	2.2		-	-	-	0

MOVEMENT SUMMARY

Site: 101 [201.Pipeline Rd (Site Folder: Existing Volumes)]

SR 169 and Pipeline Rd
Site Category: Existing Conditions-Build
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] ft				
South: SR 169														
3u	U	210	2.0	228	2.0	0.309	12.7	LOS B	2.3	59.4	0.37	0.62	0.37	34.3
3	L2	225	2.0	245	2.0	0.309	10.2	LOS B	2.3	59.4	0.37	0.62	0.37	33.6
8	T1	430	2.0	467	2.0	0.354	4.4	LOS A	2.7	68.4	0.40	0.44	0.40	36.7
Approach		865	2.0	940	2.0	0.354	7.9	LOS A	2.7	68.4	0.39	0.53	0.39	35.2
North: SR 169														
4	T1	775	2.0	842	2.0	0.673	8.3	LOS A	7.7	195.0	0.82	0.82	0.97	35.2
14	R2	25	2.0	27	2.0	0.032	6.4	LOS A	0.2	4.0	0.55	0.59	0.55	35.3
Approach		800	2.0	870	2.0	0.673	8.2	LOS A	7.7	195.0	0.81	0.81	0.95	35.2
West: Pipeline Rd														
5	L2	110	2.0	120	2.0	0.472	21.5	LOS C	4.1	105.4	1.00	1.06	1.18	30.7
12	R2	105	2.0	114	2.0	0.472	15.7	LOS B	4.1	105.4	1.00	1.06	1.18	29.8
Approach		215	2.0	234	2.0	0.472	18.7	LOS B	4.1	105.4	1.00	1.06	1.18	30.3
All Vehicles		1880	2.0	2043	2.0	0.673	9.3	LOS A	7.7	195.0	0.64	0.71	0.72	34.6

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.

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