

TRAFFIC IMPACT STUDY

For

Schmidt Property Preliminary Plan El Paso County, Colorado

June 2026

Prepared for:

Turkey Canon Quarry Inc
20 Boulder Crescent Street, 2nd Floor
Colorado Springs, Colorado 80903

Prepared by:



SM ROCHA, LLC

TRAFFIC & TRANSPORTATION ENGINEERING CONSULTANTS

8700 Turnpike Drive, Suite 240
Westminster, Colorado 80031
(303) 458-9798

6 South Tejon Street, Suite 618
Colorado Springs, Colorado 80903
(719) 203-6639

Project Manager:
Brandon Wilson, PE

Project Engineer:
Leo Ornelas, EIT

Engineer in Responsible Charge:
Fred Lantz, PE



25-052422

Traffic Engineer's Statement

The attached traffic report and supporting information were prepared under my responsible charge and they comport with the standard of care. So far as is consistent with the standard of care, said report was prepared in general conformance with the criteria established by the County for traffic reports.



Fred Lantz, P.E. #23410

06/11/2026

Date

Developer's Statement

I, the Developer, have read and will comply with all commitments made on my behalf within this report.

Turkey Canon Quarry Inc
20 Boulder Crescent Street, 2nd Floor
Colorado Springs, Colorado 80903

Date

Table of Contents

I. Introduction	1
Project Overview	1
Study Area Boundaries	1
Site Description	1
Existing and Committed Surface Transportation Network	4
II. Existing Traffic Conditions	6
Peak Hour Intersection Levels of Service – Existing Traffic	9
Existing Traffic Analysis Results	9
III. Future Traffic Conditions Without Proposed Development.....	11
Peak Hour Intersection Levels of Service – Background Traffic	16
Background Traffic Analysis Results – Year 2028	17
Background Traffic Analysis Results – Year 2045	18
IV. Proposed Project Traffic	20
Trip Generation	20
Adjustments to Trip Generation Rates	21
Trip Distribution	21
Trip Assignment	22
V. Future Traffic Conditions With Proposed Development.....	27
Total Traffic Auxiliary Lane Analysis	27
Peak Hour Intersection Levels of Service – Total Traffic	32
Total Traffic Analysis Results Upon Development Build-Out	34
VI. Project Impacts	36
Queue Length Analysis.....	36
Development Impacts	38
Recommended Improvements	39
VII. Conclusion	40

List of Figures

Figure 1 – Location.....	2
Figure 2 – Schematic Layout.....	3
Figure 3 – Existing Traffic.....	7
Figure 4 – Existing Traffic Volumes & Intersection Geometry	8
Figure 5 – Background Traffic – Year 2028.....	12
Figure 6 – Background Traffic Volumes & Intersection Geometry – Year 2028.....	13
Figure 7 – Background Traffic – Year 2045.....	14
Figure 8 – Background Traffic Volumes & Intersection Geometry – Year 2045.....	15
Figure 9 – Trip Distribution – Year 2028.....	23
Figure 10 – Site Generated Assignment – Year 2028	24
Figure 11 – Trip Distribution – Year 2045.....	25
Figure 12 – Site Generated Assignment – Year 2045	26
Figure 13 – Total Traffic – Year 2028	28
Figure 14 – Total Traffic Volumes & Intersection Geometry – Year 2028.....	29
Figure 15 – Total Traffic – Year 2045.....	30
Figure 16 – Total Traffic Volumes & Intersection Geometry – Year 2045.....	31

List of Tables

Table 1 – Intersection Capacity Analysis Summary – Existing Traffic	9
Table 2 – Intersection Capacity Analysis Summary – Background Traffic – Year 2028	16
Table 3 – Intersection Capacity Analysis Summary – Background Traffic – Year 2045	18
Table 4 – Trip Generation Rates	20
Table 5 – Trip Generation Summary	21
Table 6 – Intersection Capacity Analysis Summary – Total Traffic – Year 2028	33
Table 7 – Intersection Capacity Analysis Summary – Total Traffic – Year 2045	34
Table 8 – Turn Lane Queues and Storage Requirements – Year 2045.....	37
Table 9 – Recommended Improvements Summary	39

Appendices

APPENDIX A	TRAFFIC COUNT DATA
	SIGNAL TIMING INFORMATION
APPENDIX B	LEVEL OF SERVICE DEFINITIONS
APPENDIX C	CAPACITY WORKSHEETS
APPENDIX D	ADJACENT DEVELOPMENT TRIP GENERATION INFORMATION
APPENDIX E	ROADWAY CLASSIFICATION EXHIBIT

I. Introduction

Project Overview

This traffic impact study is provided as a planning document and addresses the capacity, geometric, and control requirements associated with the development entitled Schmidt Property Preliminary Plan.

This proposed residential development is located near the southeast corner of Black Forest Road and Research Parkway in El Paso County, Colorado.

Study Area Boundaries

The study area to be examined in this analysis encompasses the Black Forest Road intersections with Research Parkway, Vollmer Road, and E Woodmen Road, the Vollmer Road intersection with Marksheffel Road, and includes proposed site accesses.

Figure 1 illustrates location of the site and study intersections.

Site Description

Land for the development is currently vacant and is surrounded by a mix of commercial, institutional and residential land uses.

The proposed development is understood to entail the new construction of 222 single-family detached homes and 50 townhomes.

Proposed access to the development is provided at the following locations: one right-in/right-out access onto Black Forest Road (referred to as Access A), one full-movement access onto Brush Top Road (future connection from Vanderwood Road north to the future Marksheffel Road extension, referred to as Access B), and one full-movement access drive to the south via Salt Brush Road. Access drives internal to the overall development were excluded from this analysis as internal intersections are expected to have operations equal to, or better than, those analyzed along the adjacent public roadway network.

For purposes of this study, it is anticipated that development construction would be completed by end of Year 2028.

General site and access locations are shown on Figure 1.

A schematic layout, as prepared by N.E.S. Inc., is shown in Figure 2. This plan is provided for illustrative purposes only.



Not to Scale

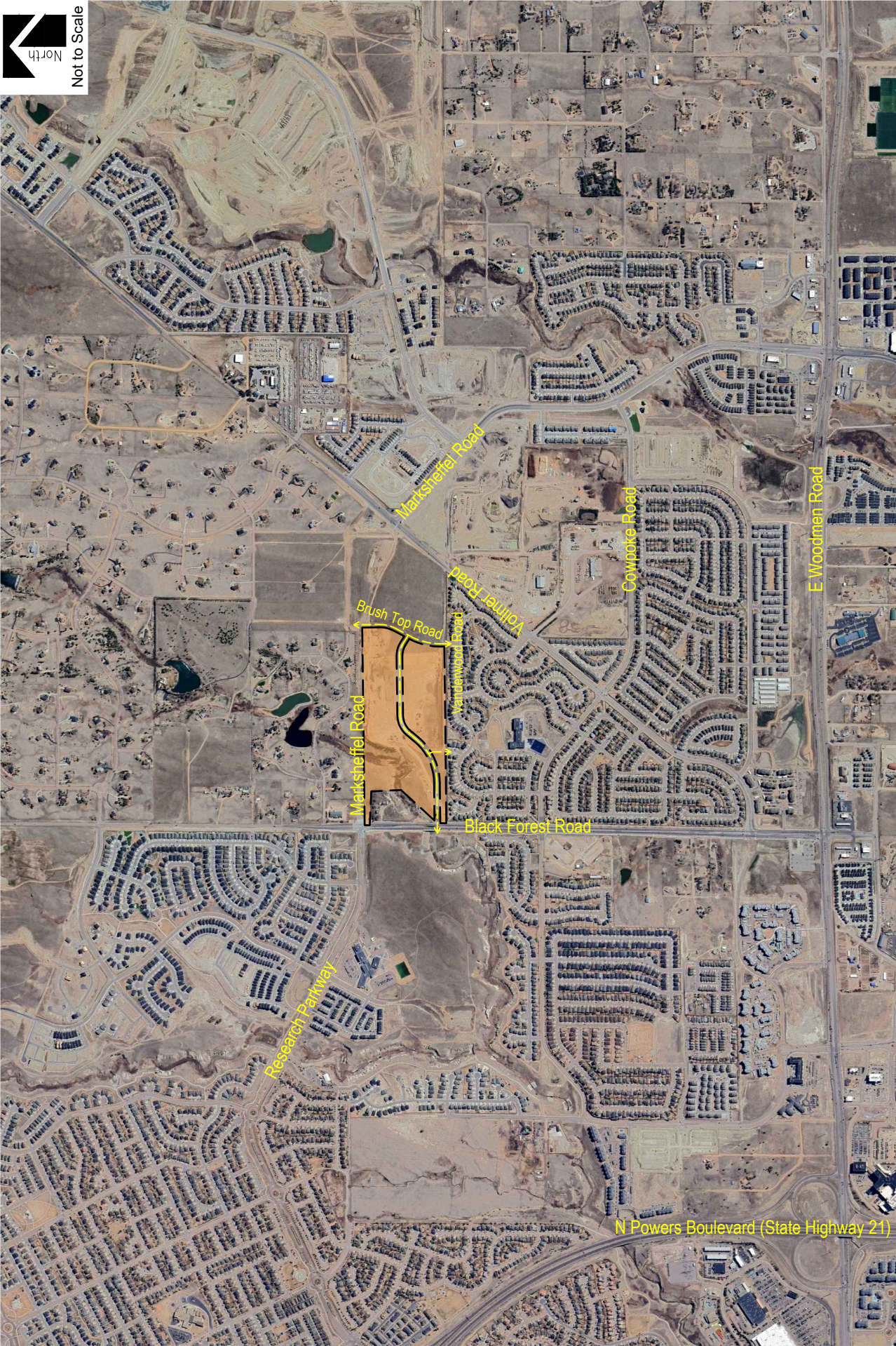


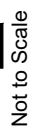
Figure 1
SITE LOCATION

June 2026
Page 2

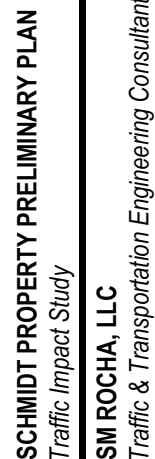
SCHMIDT PROPERTY PRELIMINARY PLAN
Traffic Impact Study

SM ROCHA, LLC
Traffic & Transportation Engineering Consultants





Not to Scale



SCSCHMIDT PROPERTY PRELIMINARY PLAN

Traffic Impact Study

SM ROCHA, LLC

Traffic & Transportation Engineering Consultants

Figure 2
SCHEMATIC LAYOUT

June 2026

Page 3

Existing and Committed Surface Transportation Network

Within the study area, Black Forest Road and the future Marksheffel Road extension are the primary roadways that will accommodate traffic to and from the proposed development. The secondary roadways include Vollmer Road, Research Parkway, E Woodmen Road, and Brush Top Road. A brief description of each roadway, based on El Paso County's Major Transportation Corridors Plan (MTCP)¹, El Paso County's Engineering Criteria Manual (ECM)², and the City of Colorado Springs's Major Thoroughfare Plan (MTP)³, is provided below:

Black Forest Road is a north-south principal arterial roadway providing four through lanes (two lanes in each direction) with exclusive turn lanes at the intersections within the study area. Black Forest Road provides posted speed limits between 30 and 35 MPH.

Research Parkway is an east-west principal arterial roadway having four through lanes (two lanes in each direction) with exclusive turn lanes at the intersection within the study area. Research Parkway provides a posted speed limit of 35 MPH and currently ends at Black Forest Road.

Marksheffel Road is a northwest-southeast principal arterial roadway having four through lanes (two lanes in each direction) with exclusive turn lanes at the intersection within the study area. Marksheffel Road currently does not provide a posted speed limit within the study area. However, per Section 2.3.2 of the County's ECM, Marksheffel Road is assumed to provide a speed limit of 45 MPH. Marksheffel Road currently ends at Vollmer Road.

Vollmer Road is generally a north-south roadway. North of Marksheffel Road, El Paso County identifies Vollmer Road as a major collector roadway while south of Marksheffel Road, Colorado Springs identifies Vollmer Road as a principal arterial roadway. Vollmer Road provides four through lanes (two lanes in each direction) with exclusive turn lanes at the intersections within the study area. Vollmer Road provides a posted speed limit of 35 MPH and currently ends at Black Forest Road.

E Woodmen Road is an east-west expressway roadway having six through lanes (three lanes in each direction) with exclusive turn lanes at the intersection within the study area. E Woodmen Road provides a posted speed limit of 45 MPH.

Brush Top Road is a future north-south collector roadway providing a three-lane cross-section (one through lane in each direction with a center two-way left-turn lane) and is expected to provide a combination of shared and exclusive turn lanes at the intersections within the study area. Per Section 2.3.2, Table 2-7 of the County's ECM, Brush Top Road is expected to provide a posted speed limit of 35 MPH.

¹ El Paso County Major Transportation Corridors Plan, Felsburg Holt & Ullevig, July 18, 2024.

² El Paso County Engineering Criteria Manual, El Paso County, January 9, 2025.

³ City of Colorado Springs Major Thoroughfare Plan, City of Colorado Springs, Department of Public Works, May 16, 2025.

The Black Forest Road intersections with Research Parkway, Vollmer Road and E Woodmen Road are signalized. All other study intersections operate under a stop-controlled condition. A stop-controlled intersection is defined as a roadway intersection where vehicle rights-of-way are controlled by one or more “STOP” signs.

Pursuant to El Paso County’s MTCP, the Colorado Springs ConnectCOS transportation plan⁴, the City of Colorado Springs’ Black Forest Road Corridor Widening webpage, and Pikes Peak Rural Transportation Authority’s (PPRTA) capital improvements projects lists, several improvements to the existing roadway network within the study area are planned for. The following committed improvements for the study area roadways include:

- Marksheffel Road extension north and west to connect with Black Forest Road and align with Research Parkway. Pursuant to ConnectCOS and PPRTA’s capital improvements projects lists, this extension of Marksheffel Road includes a bridge spanning over Cottonwood Creek.

In review of Section 16.0 of the City of Colorado Springs’ Traffic Criteria Manual⁵, it is understood that Black Forest Road, Marksheffel Road, and Vollmer Road all have the potential to be widened to six through lanes (three lanes in each direction). However, for purposes of this analysis and to remain consistent with other traffic studies done in the area, it is assumed each roadway provides a maximum width of four through lanes.

⁴ Connect COS Transportation Plan, City of Colorado Springs, March 2023.

⁵ Engineering Criteria Manual, Section III: Traffic Criteria Manual, City of Colorado Springs City Engineering, July 2010.

II. Existing Traffic Conditions

Morning (AM) and afternoon (PM) peak hour traffic counts were collected at the Black Forest Road intersections with E Woodmen Road, Vollmer Road, and Research Parkway as well as the intersection of Vollmer Road and Marksheffel Road. Average daily traffic (ADT) volumes were collected over a 24-hour period on Black Forest Road, Research Parkway, and Vollmer Road. Counts were collected on Wednesday, September 24, 2025, with AM peak hour counts being collected during the period of 7:00 a.m. to 9:00 a.m. and PM peak hour counts being collected during the period of 4:00 p.m. to 6:00 p.m.

These collected counts were then grown to Year 2026 at a conservative annual growth rate of two percent. The two percent compounded annual growth rate was determined using historical traffic data for the surrounding area provided by the County's MTCP, which anticipates a 10-year growth rate between one and two percent.

Study area intersections and existing ADT's can be seen on Figure 3. Existing volumes and intersection geometry are shown in Figure 4. Traffic count data is included for reference in Appendix A.

Existing signal timing parameters for the Black Forest Road intersections with E Woodmen Road, Vollmer Road, and Research Parkway were obtained from the City of Colorado Springs and used throughout this study to the best extent possible in order to remain consistent with existing signal coordination plans. City signal timing information received is included for reference in Appendix B.

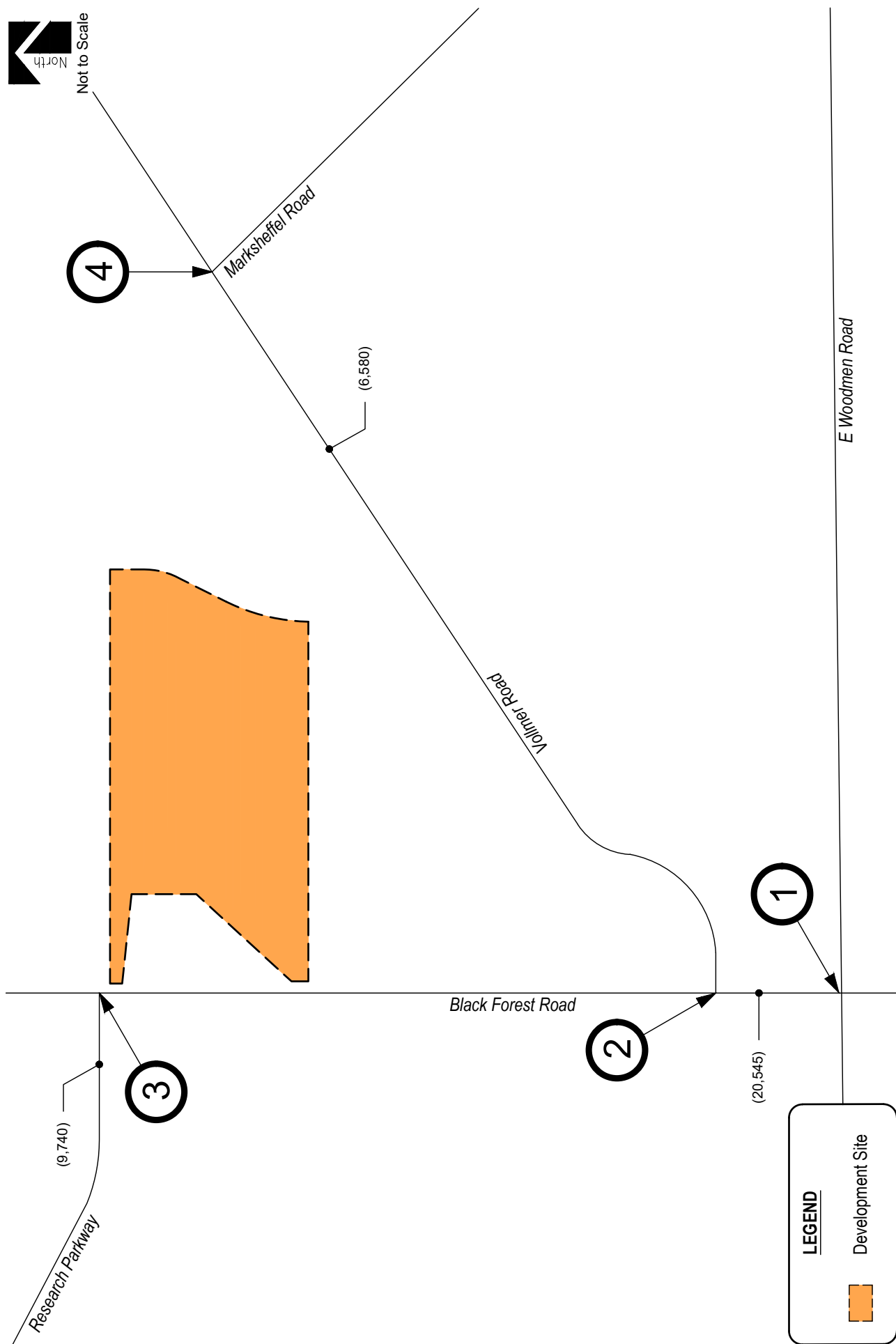
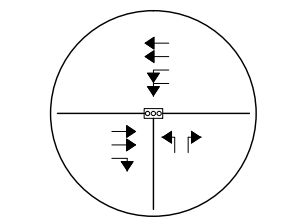
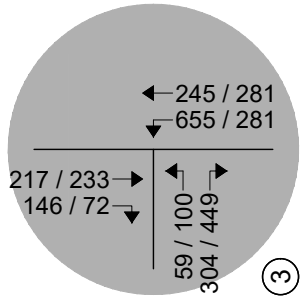
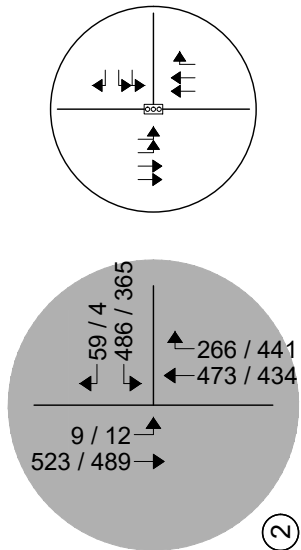
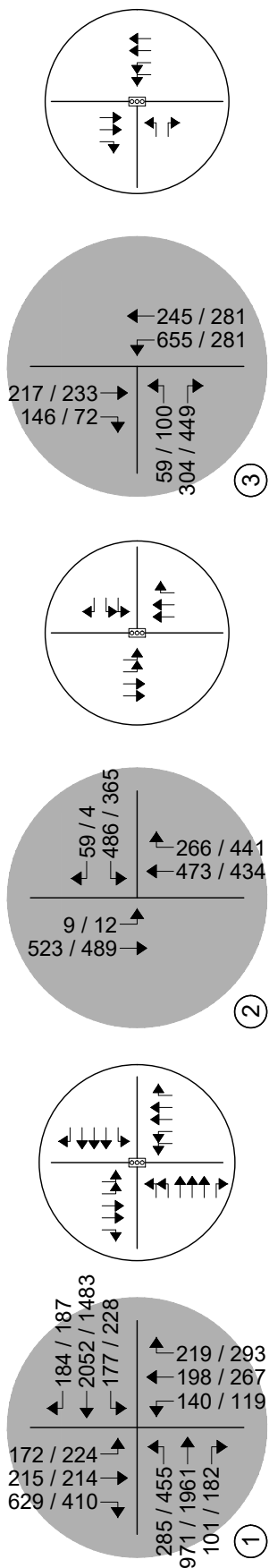


Figure 3
EXISTING TRAFFIC
 (ADT) : Average Daily Traffic



LEGEND

- Study Intersection Volumes
- Study Intersection Lane Geometry

Figure 4
EXISTING TRAFFIC
 Volumes & Intersection Geometry
 AM / PM Peak Hour
 June 2026
 Page 8

Peak Hour Intersection Levels of Service – Existing Traffic

The Signalized and Unsignalized Intersection Analysis techniques, as published in the Highway Capacity Manual (HCM), 7th Edition, by the Transportation Research Board and as incorporated into the SYNCHRO computer program, were used to analyze the study intersections for existing and future traffic conditions. These nationally accepted techniques allow for the determination of intersection level of service (LOS) based on the congestion and delay of each traffic movement

Pursuant to Section B.4.1.A of the County's ECM, the design objective of each scenario of this study shall be level of service "D". Level of service is a method of measurement used by transportation professionals to quantify a driver's perception of travel conditions that include travel time, number of stops, and total amount of stopped delay experienced on a roadway network. The HCM categorizes level of service into a range from "A" which indicates little, if any, vehicle delay, to "F" which indicates a level of operation considered unacceptable to most drivers. These levels of service grades with brief descriptions of the operating condition, for unsignalized and signalized intersections, are included for reference in Appendix B and have been used throughout this study.

The level of service analyses results for existing conditions are summarized in Table 1.

Intersection capacity worksheets developed for this study are provided in Appendix C.

Table 1 – Intersection Capacity Analysis Summary – Existing Traffic

INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
Black Forest Road / E Woodmen Road (Signalized)	E (79.0)	D (48.2)
Black Forest Road / Vollmer Road (Signalized)	B (16.8)	B (14.6)
Black Forest Road / Research Parkway (Signalized)	A (8.7)	B (11.4)
Vollmer Road / Marksheffel Road (Stop-Controlled)		
Westbound Left	C	B
Westbound Right	A	A
Southbound Left	A	A

Key: Signalized Intersection: Level of Service (Control Delay in sec/veh)
Stop-Controlled Intersection: Level of Service

Existing Traffic Analysis Results

Under existing conditions, operational analysis shows that the signalized intersection of Black Forest Road and E Woodmen Road has overall operations at LOS E during the morning peak traffic hour and LOS D during the afternoon peak traffic hour. The LOS E operation anticipated during the morning peak traffic periods is attributed to the high westbound through volumes and southbound right turning volumes. To mitigate the anticipated LOS E, it is recommended to increase the cycle length or provide an overlap phase for the southbound right turning movement.

The signalized intersection of Black Forest Road and Vollmer Road has overall operations at LOS B during the morning and afternoon peak traffic hours.

The signalized intersection of Black Forest Road and Vollmer Road has overall operations at LOS A during the morning peak traffic hour and LOS B during the afternoon peak traffic hour.

The stop-controlled intersection of Vollmer Road and Marksheffel Road has turning movement operations at LOS C or better during the morning peak traffic hour and LOS B or better during the afternoon peak traffic hour.

III. Future Traffic Conditions Without Proposed Development

Background traffic is the traffic projected to be on area roadways without consideration of the proposed development. Background traffic includes traffic generated by development of vacant parcels in the area.

To account for projected increases in background traffic for Years 2028 and 2045, a compounded annual growth rate was determined using historical traffic data for the surrounding area provided by the County's MTCP, which anticipates a 10-year growth rate between one and two percent. Therefore, in order to provide for a conservative analysis, a growth rate of two percent was applied to existing traffic volumes.

Pursuant to the committed area roadway improvements discussed in Section I, and to remain consistent with assumptions made in previous traffic reports within the area, Year 2028 analysis assumes that Marksheffel Road is extended west past Vollmer Road to intersect with the future Brush Top Road. In effort to accurately reflect Year 2028 background traffic volumes, estimated traffic generation from the future adjacent Stonebridge and Rhetoric developments were added. Therefore, trip generation estimates compiled by the Institute of Transportation Engineers (ITE) in their report entitled Trip Generation Manual, 11th Edition, were applied to the adjacent land uses and applied to background traffic volumes. The ITE land use codes 220 (Multifamily Housing (Low-Rise)) and 820 (Shopping Center (>150k)) were used for estimating trip generation because of their conservative rates and best fit to the proposed land use descriptions. Consistent with the latest Stonebridge site plan, the proposed accesses along Brush Top Road serving said development are to be restricted to three-quarter movements. Trip generation estimates are provided for reference in Appendix D.

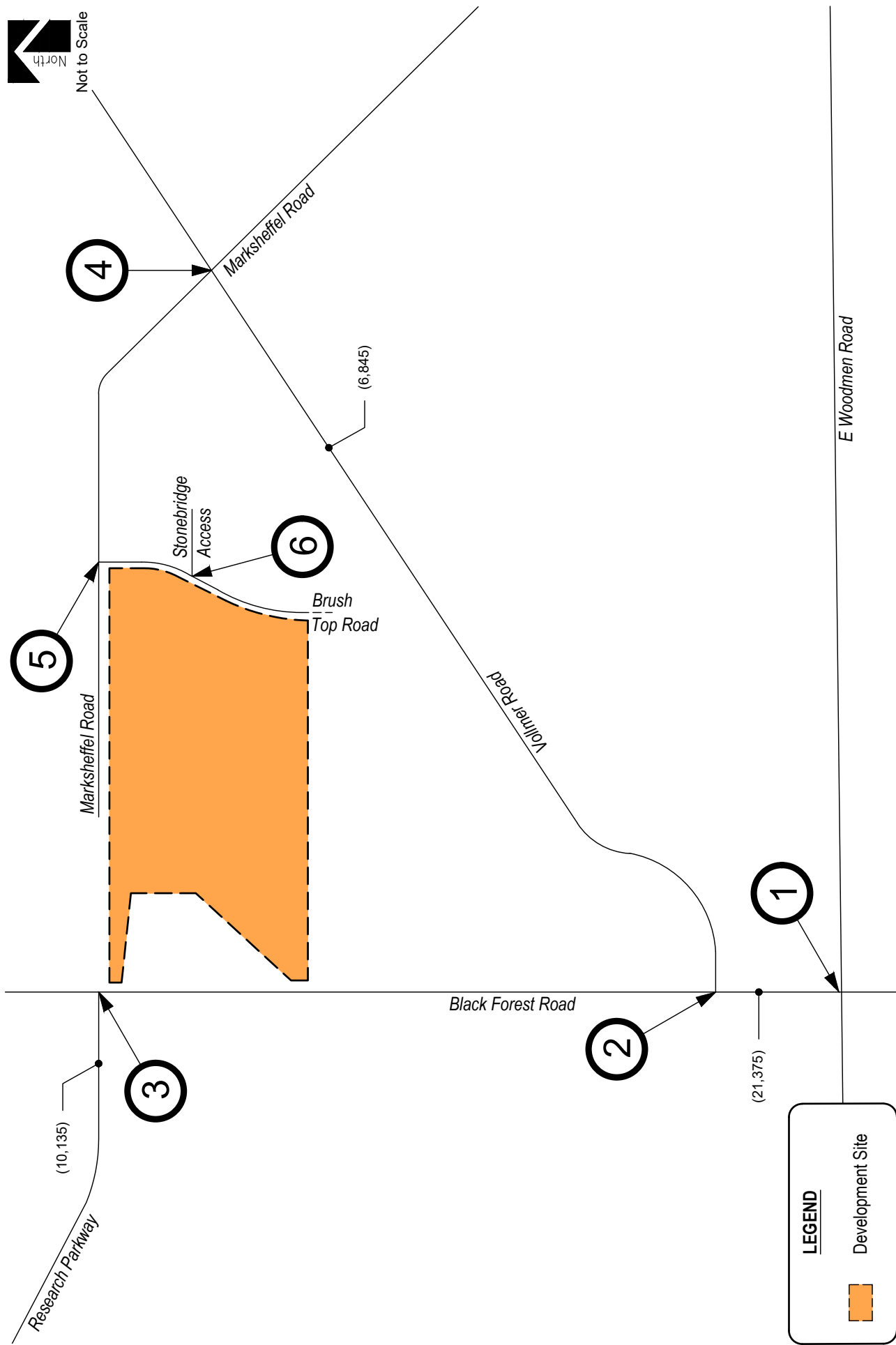
Year 2045 background traffic analysis assumes that Marksheffel Road is extended further west to intersect with Black Forest Road and align with Research Parkway, Vollmer Road is extended west past Black Forest Road to create a four-leg intersection, and that the Vollmer Road and Marksheffel Road intersection becomes signalized. Year 2045 intersection geometries for the Black Forest Road corridor reflect that shown within the City's Black Forest Road Corridor Widening website. In effort to accurately and conservatively reflect Year 2045 background traffic volumes for the study area intersections, Year 2045 total traffic volume shown within the Black Forest Road Widening Corridor Plan⁶ were used as a basis for modeling Year 2045 background traffic volumes.

Year 2045 background traffic conditions assumes existing signal timing parameters for the study area intersections, where applicable, with optimized splits in effort to better long-term intersection performances.

The study area and projected short-term background ADT volumes are shown on Figure 5. Projected background intersection traffic volumes and intersection geometry for Year 2028 are shown in Figure 6.

The study area intersections and projected long-term background ADT volumes are shown in Figure 7. Projected background intersection traffic volumes and intersection geometry for Year 2045 are shown in Figure 8.

⁶ Black Forest Road Widening Corridor Plan, AECOM, February 2020.





Not to Scale

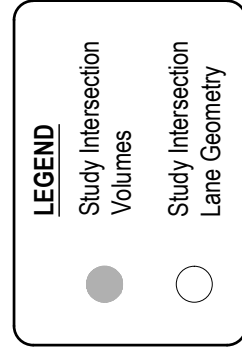
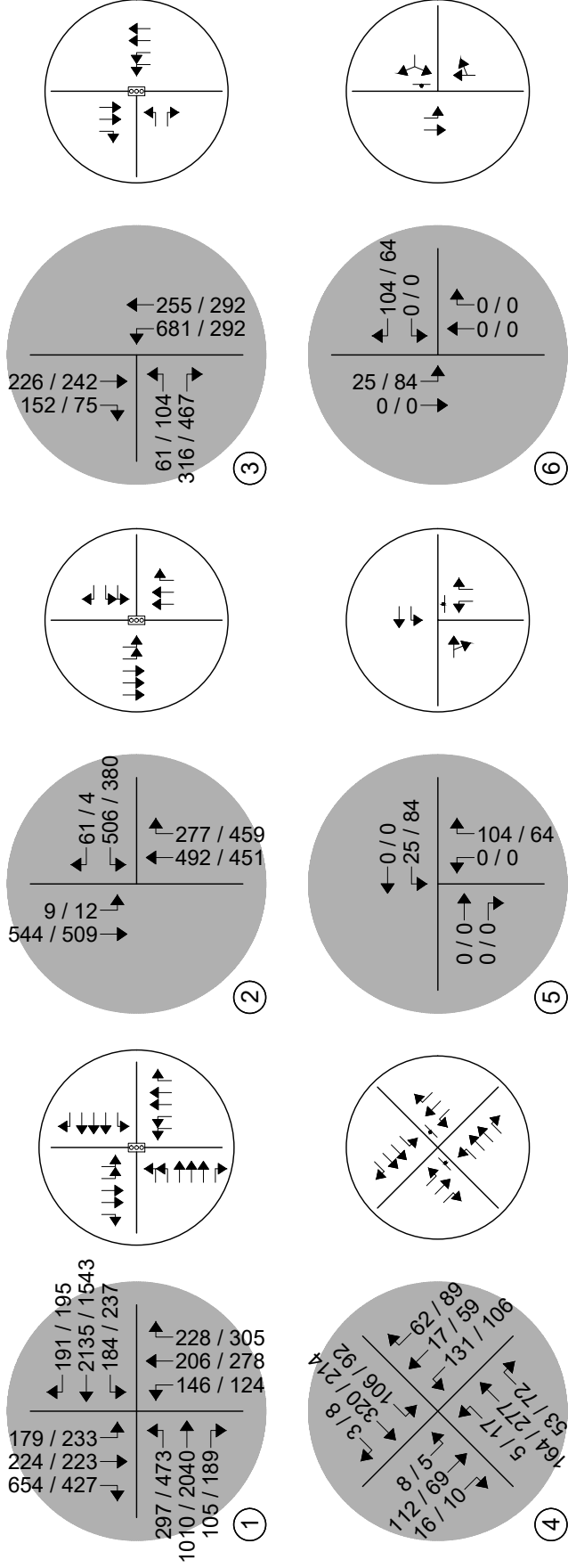


Figure 6
BACKGROUND TRAFFIC - YEAR 2028
Volumes & Intersection Geometry
AM / PM Peak Hour
June 2026
Page 13

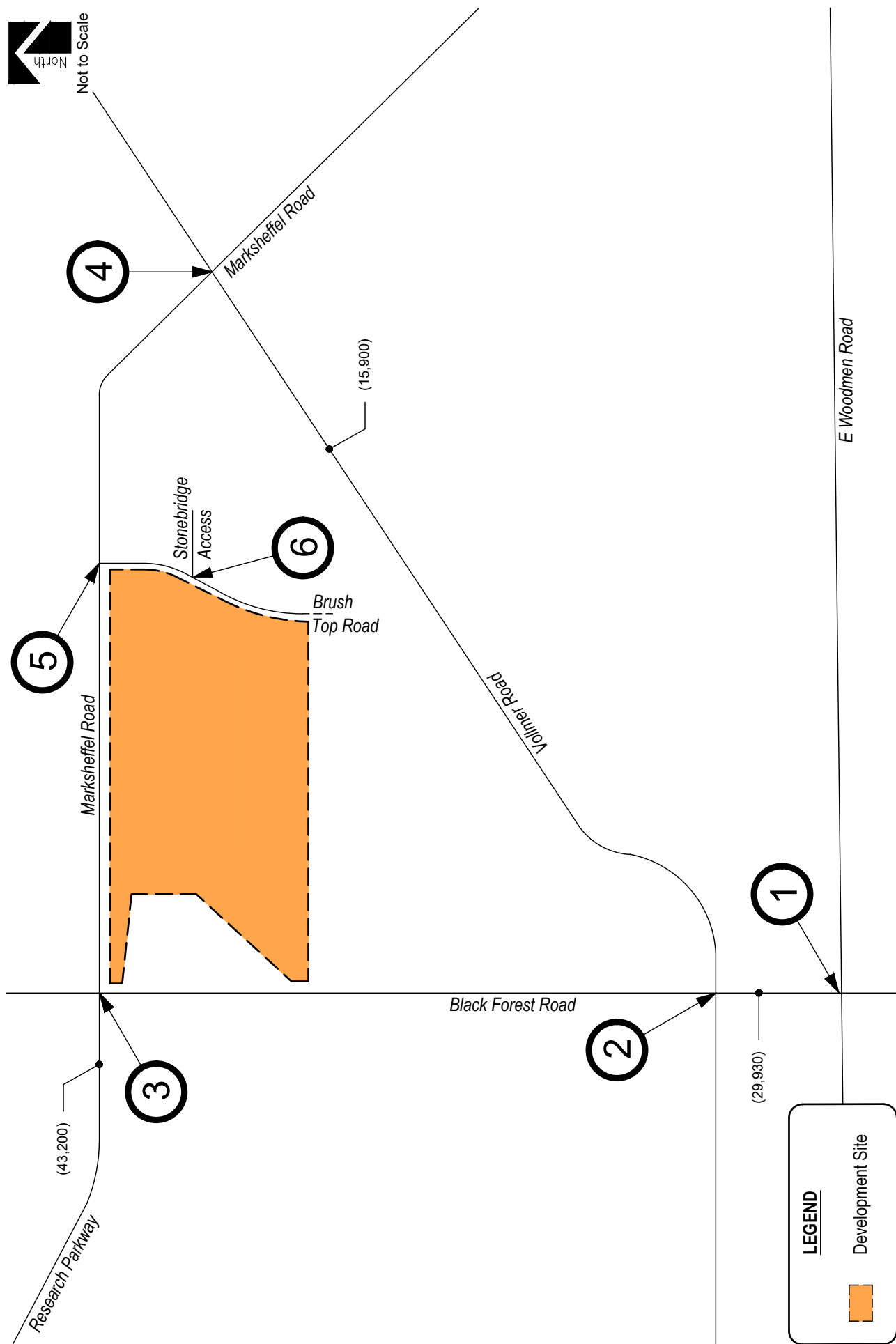


Figure 7
BACKGROUND TRAFFIC - YEAR 2045
 (ADT) : Average Daily Traffic

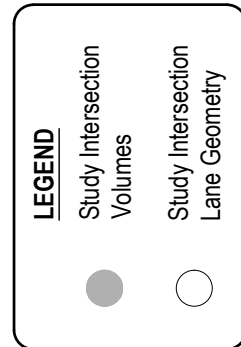
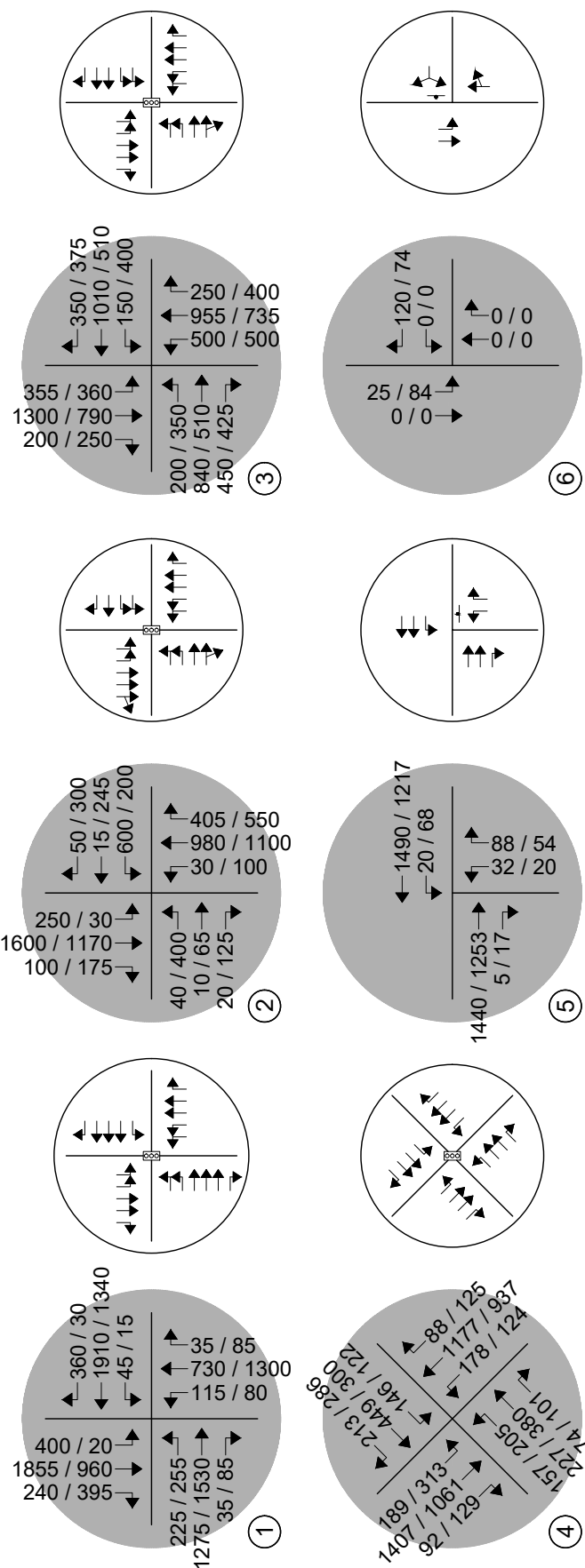


Figure 8
BACKGROUND TRAFFIC - YEAR 2045
Volumes & Intersection Geometry
AM / PM Peak Hour
June 2026
Page 15

Peak Hour Intersection Levels of Service – Background Traffic

As with existing traffic conditions, the operations of study intersections were analyzed under background conditions, without the proposed development, using the SYNCHRO computer program.

Background traffic level of service analysis results for Year 2028 are listed in Table 2. Year 2045 operational results are summarized in Table 3.

Definitions of levels of service are given in Appendix B. Intersection capacity worksheets are provided in Appendix C.

Table 2 – Intersection Capacity Analysis Summary – Background Traffic – Year 2028

INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
Black Forest Road / E Woodmen Road (Signalized)	F (90.1)	D (56.4)
Black Forest Road / Vollmer Road (Signalized)	B (15.9)	B (14.5)
Black Forest Road / Research Parkway (Signalized)	A (7.3)	B (12.7)
Vollmer Road / Marksheffel Road (Stop-Controlled)		
Eastbound Left	C	C
Eastbound Through	D	C
Eastbound Right	A	A
Westbound Left	F	E
Westbound Through	C	C
Westbound Right	A	A
Northbound Left	A	A
Southbound Left	A	A
Brush Top Road / Marsksheffel Road (Stop-Controlled)		
Westbound Left	A	A
Northbound Left	A	A
Northbound Right	A	A
Brush Top Road / Stonebridge Access (Stop-Controlled)		
Westbound Left and Right	A	A
Southbound Left	A	A

Key: Signalized Intersection: Level of Service (Control Delay in sec/veh)
 Stop-Controlled Intersection: Level of Service

Background Traffic Analysis Results – Year 2028

Year 2028 background traffic analysis indicates that the signalized intersection of Black Forest Road and E Woodmen Road is expected to provide overall operations at LOS F during the morning peak traffic hour and LOS D during the afternoon peak traffic hour. The LOS F operation anticipated during the morning peak traffic periods is attributed to the high westbound through volumes, southbound right turning volumes and the westbound through volumes. To mitigate the anticipated LOS F, it is recommended to increase the cycle length or provide an overlap phase for the southbound right turning lane.

The signalized intersection of Black Forest Road and Vollmer Road has overall operations at LOS B during the morning and afternoon peak traffic hours.

The signalized intersection of Black Forest Road and Vollmer Road has overall operations at LOS A during the morning peak traffic hour and LOS B during the afternoon peak traffic hour.

The stop-controlled intersection of Vollmer Road and Marksheffel Road has turning movement operations at LOS D or better during the morning peak traffic hour and LOS C or better during the afternoon peak traffic hour. Exceptions include the westbound left turning movement which operates at LOS F, during the morning peak traffic hour, and LOS E, during the afternoon peak traffic hour, as well as the westbound right turning movement, which operates at LOS F during the afternoon peak traffic hour. To mitigate the projected LOS F and LOS E operations, it is recommended that this intersection becomes signalized. This is consistent with assumptions defined within the Schmidt Property Traffic Impact Study⁷ (now known as Stonebridge).

The unsignalized intersections of Brush Top Road and Marksheffel Road is expected to provide turning movement operations at LOS A during the morning and afternoon peak traffic hours.

The unsignalized intersection of Brush Top Road and Stonebridge Access is expected to provide turning movement operations at LOS A during the morning and afternoon peak traffic hours.

⁷ Schmidt Property: Traffic Impact Study, SM ROCHA LLC, February 2023.

Table 3 – Intersection Capacity Analysis Summary – Background Traffic – Year 2045

INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
Black Forest Road / E Woodmen Road (Signalized)	F (130.9)	D (41.7)
Black Forest Road / Vollmer Road (Signalized)	C (25.2)	C (31.8)
Black Forest Road / Research Parkway (Signalized)	F (108.7)	D (53.0)
Vollmer Road / Marksheffel Road (Signalized)	D (35.6)	C (33.5)
Brush Top Road / Marsksheffel Road (Stop-Controlled)		
Westbound Left	B	B
Northbound Left	F	F
Northbound Right	C	C
Brush Top Road / Stonebridge Access (Stop-Controlled)		
Westbound Left and Right	A	A
Southbound Left	A	A

Key: Signalized Intersection: Level of Service (Control Delay in sec/veh)
 Stop-Controlled Intersection: Level of Service

Background Traffic Analysis Results – Year 2045

By Year 2045 and without the proposed development, the study intersection of Black Forest Road and E Woodmen Road is expected to maintain LOS F operations during the AM peak traffic hour and LOS D operations during the PM peak traffic hour. The LOS F operation continues to be attributed to the through traffic volumes along each approach. Potential mitigation includes the widening of Black Forest Road to its build-out cross-section accommodating six through lanes. This widening improvement is expected to allow for overall LOS E intersection operations during the morning peak traffic hour.

The signalized intersection of Black Forest Road and Vollmer Road is anticipated to provide overall operations at LOS C during the morning peak traffic hour and LOS D during the afternoon peak traffic hour.

The signalized intersection of Black Forest Road and Research Parkway is projected to provide overall operations at LOS F during the morning peak traffic hour and LOS D during the afternoon peak traffic hour. The LOS F operation is attributed to the high through volumes in each direction. Potential mitigations include the widening of Black Forest Road, Research Parkway, and Marksheffel Road to their ultimate widths accommodating six-lane cross-sections, which results in overall operations at LOS D during the morning peak traffic hour.

The signalized intersection of Vollmer Road and Marksheffel Road provides overall operations at LOS D during the morning peak traffic hour and LOS C during the afternoon peak traffic hour.

The stop-controlled intersection of Brush Top Road and Marksheffel Road is anticipated to provide turning movement operations at LOS C or better during the morning and afternoon peak traffic hours. Exceptions include the northbound left turning movement which provides operations at LOS F during the morning and afternoon peak traffic hours. The LOS F operations are attributed to the through traffic volumes along Marksheffel Road and the stop-controlled nature of the intersection. This poor operation occurs for the minor leg approach and is not expected to negatively impact the operations of Marksheffel Road. While signalization is a potential mitigating solution, it is recommended that as actual land uses and densities become defined within the overall area, intersection operational analyses will need to be updated to help assess if transportation improvements are needed to mitigate potential traffic impacts.

The stop-controlled intersection of Brush Top Road and Stonebridge Access is expected to maintain turning movement operations at LOS A during the morning and afternoon peak traffic hours.

It is to be noted that it is not uncommon for unsignalized movements to or from an arterial roadway, in urban areas, to operate with noticeable delays during peak traffic hours. It is, however, likely that turn movements will operate better than the results obtained with this HCM Two-Way Stop-Control (TWSC) level of service analysis would indicate, as the HCM analysis may not accurately account for the effect of vehicle platooning and gaps caused by upstream signals. The upstream signal control along Marksheffel Road will tend to create additional gaps in the traffic stream for turning movements at Brush Top Road and will most likely provide mitigation to the LOS F operation projected during both peak traffic hours.

IV. Proposed Project Traffic

Trip Generation

Standard traffic generation characteristics compiled by the Institute of Transportation Engineers (ITE) in their report entitled Trip Generation Manual, 12th Edition, were applied to the proposed land uses in order to estimate average daily traffic (ADT), AM Peak Hour, and PM Peak Hour vehicle trips. A vehicle trip is defined as a one-way vehicle movement from a point of origin to a point of destination.

The ITE land use codes 210 (Single-Family Detached Housing) and 215 (Single-Family Attached Housing) used for estimating trip generation because of their conservative rates and best fit to the proposed land use descriptions.

Trip generation rates used in this study are presented in Table 4.

Table 4 – Trip Generation Rates

ITE CODE LAND USE UNIT			TRIP GENERATION RATES						
			24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
210	Single-Family Detached Housing	DU	9.09	0.19	0.51	0.70	0.58	0.35	0.93
215	Single-Family Attached Housing	DU	6.57	0.12	0.35	0.47	0.29	0.22	0.51

Key: DU = Dwelling Units.

Note: All data and calculations above are subject to being rounded to nearest value.

Table 5 illustrates projected ADT, AM Peak Hour, and PM Peak Hour traffic volumes likely generated by the proposed development upon build-out.

Table 5 – Trip Generation Summary

ITE CODELAND USESIZE				TOTAL TRIPS GENERATED						
				24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
					ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
<u>Site Development - Previously Assumed *</u>										
210	Single-Family Detached Housing	117	DU	1,106	21	62	82	69	41	110
220	Multifamily Housing (Low-Rise)	318	DU	2,142	31	97	127	102	60	162
Previously Assumed Total:				3,248	51	158	209	172	101	272
<u>Site Development - Proposed</u>										
210	Single-Family Detached Housing	222	DU	2,018	42	113	155	128	78	206
215	Single-Family Attached Housing	50	DU	329	6	18	24	15	11	26
Proposed Total:				2,346	48	131	179	143	89	232
Difference Total:				-902	-3	-27	-30	-29	-12	-41

Key: DU = Dwelling Units.

* = Schmidt Rezone: Traffic Impact Study, SM ROCHA, LLC, October 2024

Note: All data and calculations above are subject to being rounded to nearest value.

Upon build-out, Table 5 illustrates that the proposed development has the potential to generate approximately 2,346 daily vehicle trips with 179 of those occurring during the morning peak hour and 232 during the afternoon peak hour. Table 5 further shows how proposed development traffic volumes do not exceed that approved within the Schmidt Property Rezone Traffic Impact Study⁸.

Adjustments to Trip Generation Rates

A development of this type is not likely to attract trips from within area land uses nor pass-by or diverted link trips from the adjacent roadway system, therefore no trip reduction was taken in this analysis.

Trip Distribution

The overall directional distribution of site-generated traffic was determined based on the location of development site within the County, proposed and existing area land uses, allowed turning movements, available roadway network, in reference to historical traffic count data provided by the Colorado Department of Transportation's (CDOT) Traffic Count Database System (TCDS)⁹, and in reference to distribution partners assumed within the Schmidt Rezone traffic study.

Year 2028 and Year 2045 overall trip distribution patterns for the development are shown on Figure 9 and Figure 11, respectively.

⁸ Schmidt Property Rezone: Traffic Impact Study, SM ROCHA LLC, October 2024.

⁹ Transportation Data Management System, MS2, 2025.

Trip Assignment

Traffic assignment is how generated and distributed vehicle trips are expected to be loaded onto the available roadway network.

Applying trip distribution patterns to site-generated traffic provides the overall site-generated trip assignments for Year 2028 and Year 2045 as shown in Figure 10 and Figure 12, respectively.

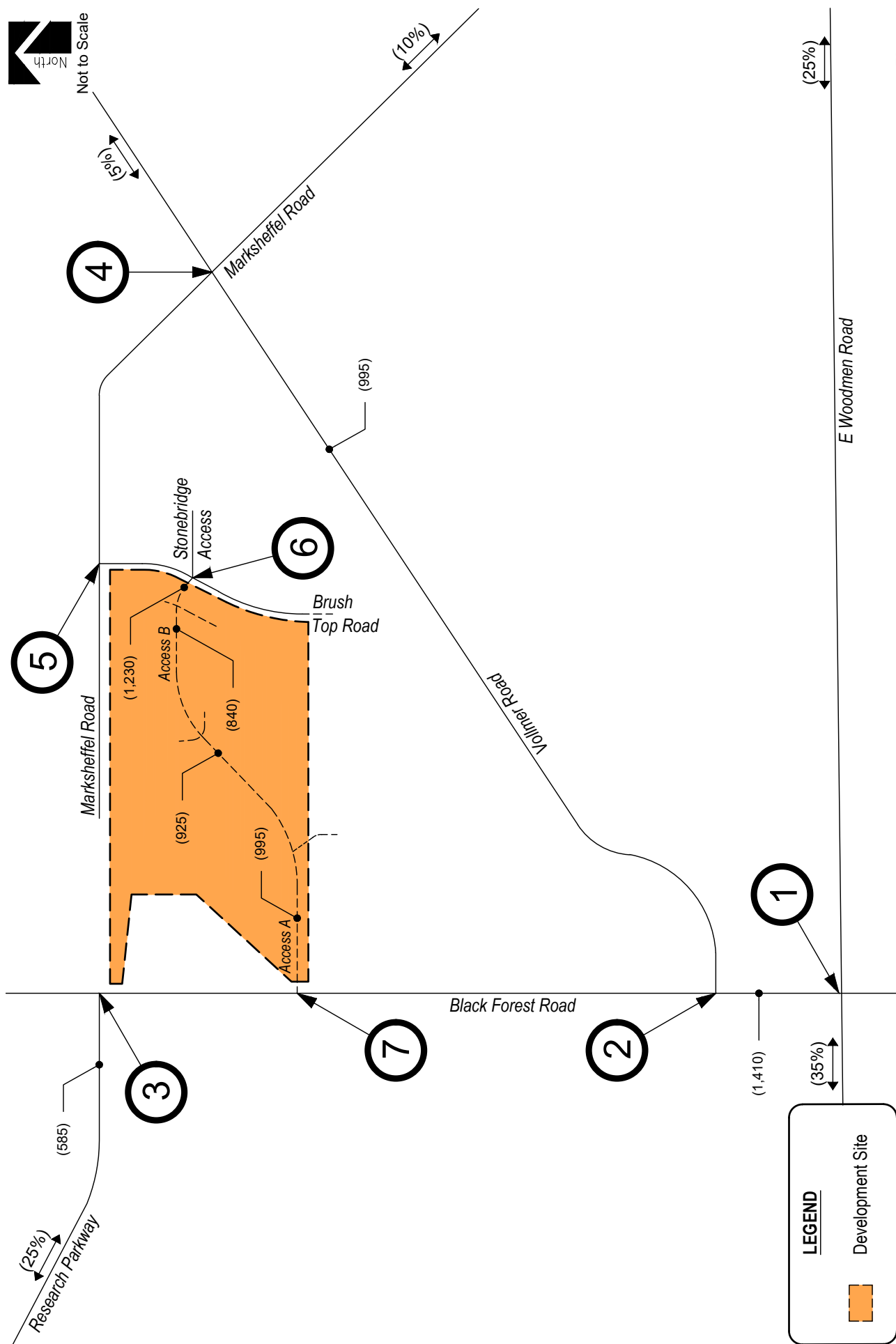
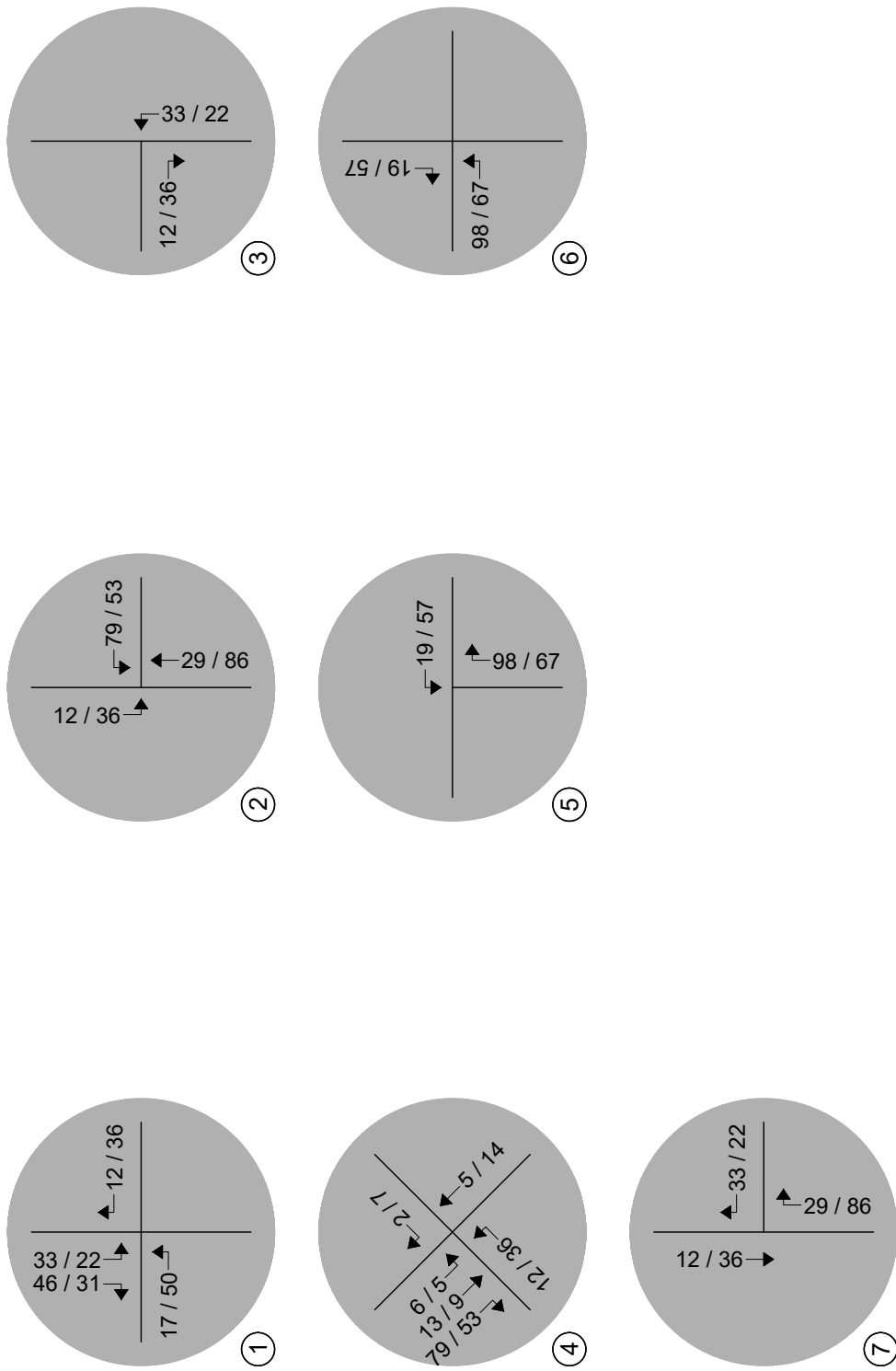


Figure 9
SITE DEVELOPMENT DISTRIBUTION - YEAR 2028
 (%) : Overall
 (ADT) : Average Daily Traffic



LEGEND

Study Intersection

Volumes

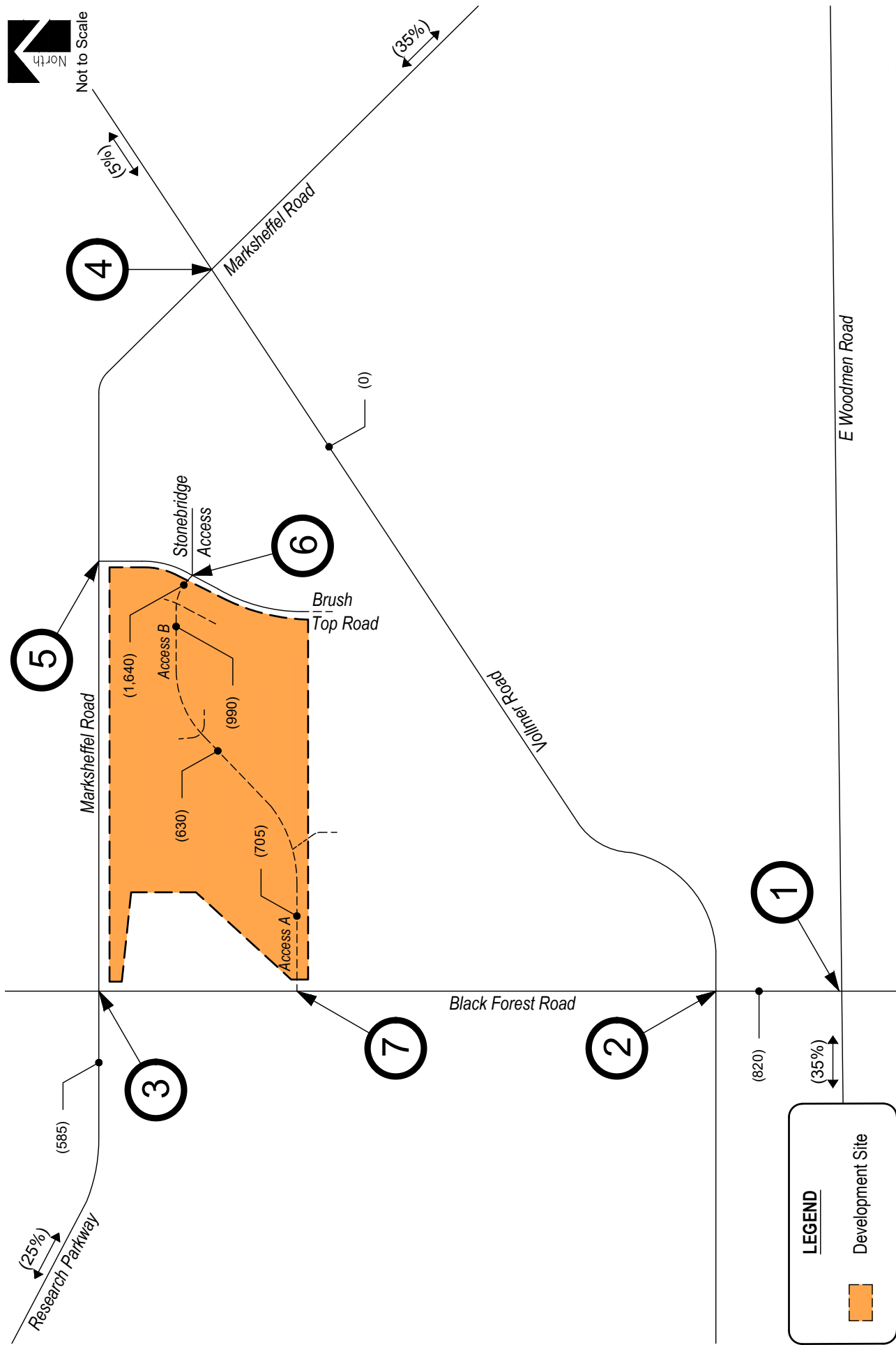
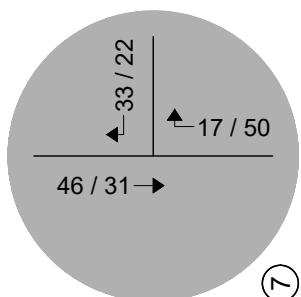
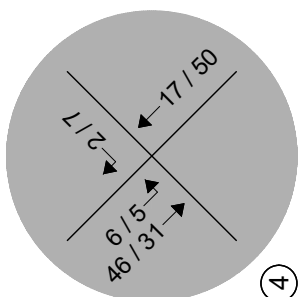
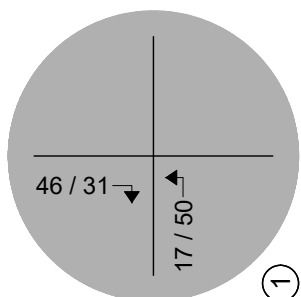
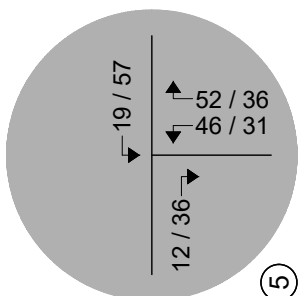
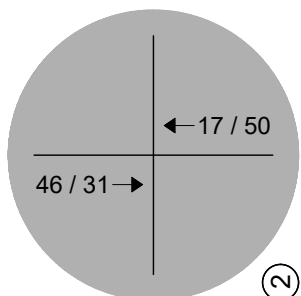
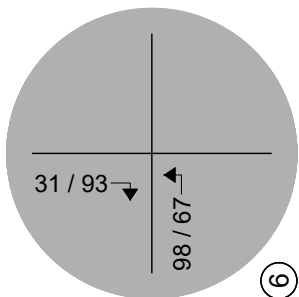
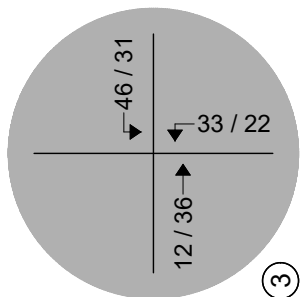


Figure 11
 SITE DEVELOPMENT DISTRIBUTION - YEAR 2045
 (%) : Overall
 (ADT) : Average Daily Traffic



LEGEND

Study Intersection
Volumes

V. Future Traffic Conditions With Proposed Development

Total traffic is the traffic projected to be on area roadways with consideration of the proposed development. Total traffic includes background traffic projections for Years 2028 and 2045 with consideration of site-generated traffic. For analysis purposes, it was assumed that development construction would be completed by end of Year 2028.

Pursuant to area roadway improvement discussions provided in Section III, Year 2028 and Year 2045 total traffic conditions assume no additional roadway improvements to accommodate regional transportation demands. Roadway improvements associated with site development are expected to be limited to site access and frontage as required by the governing agency.

Total Traffic Auxiliary Lane Analysis

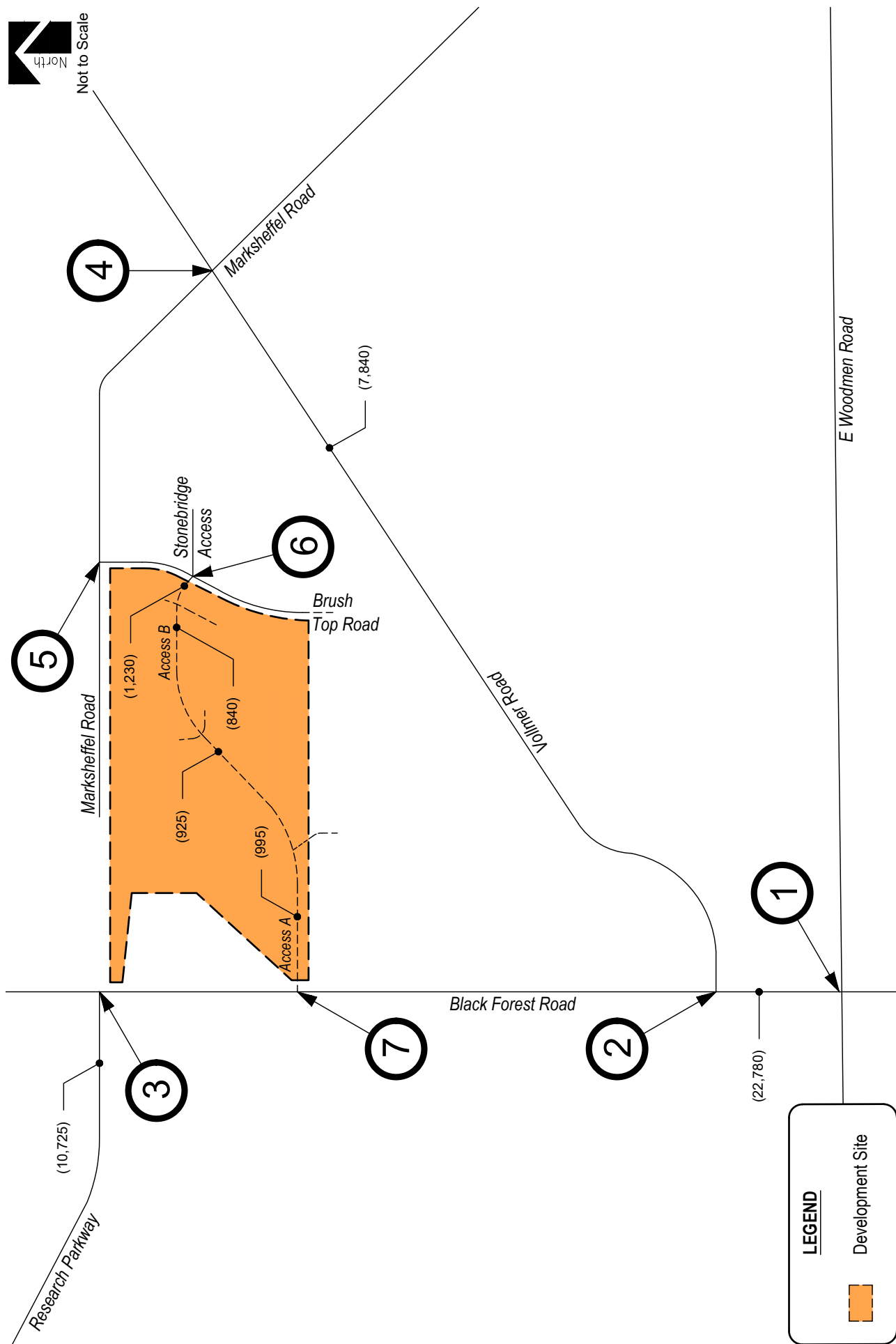
Auxiliary lanes along Black Forest Road at Access A are to be based on the City's Traffic Criteria Manual while auxiliary lanes along Brush Top Road at Access B are to be based on the County's ECM.

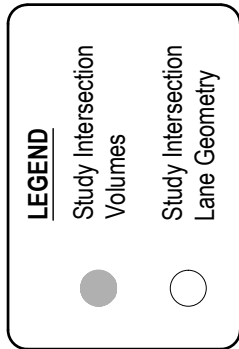
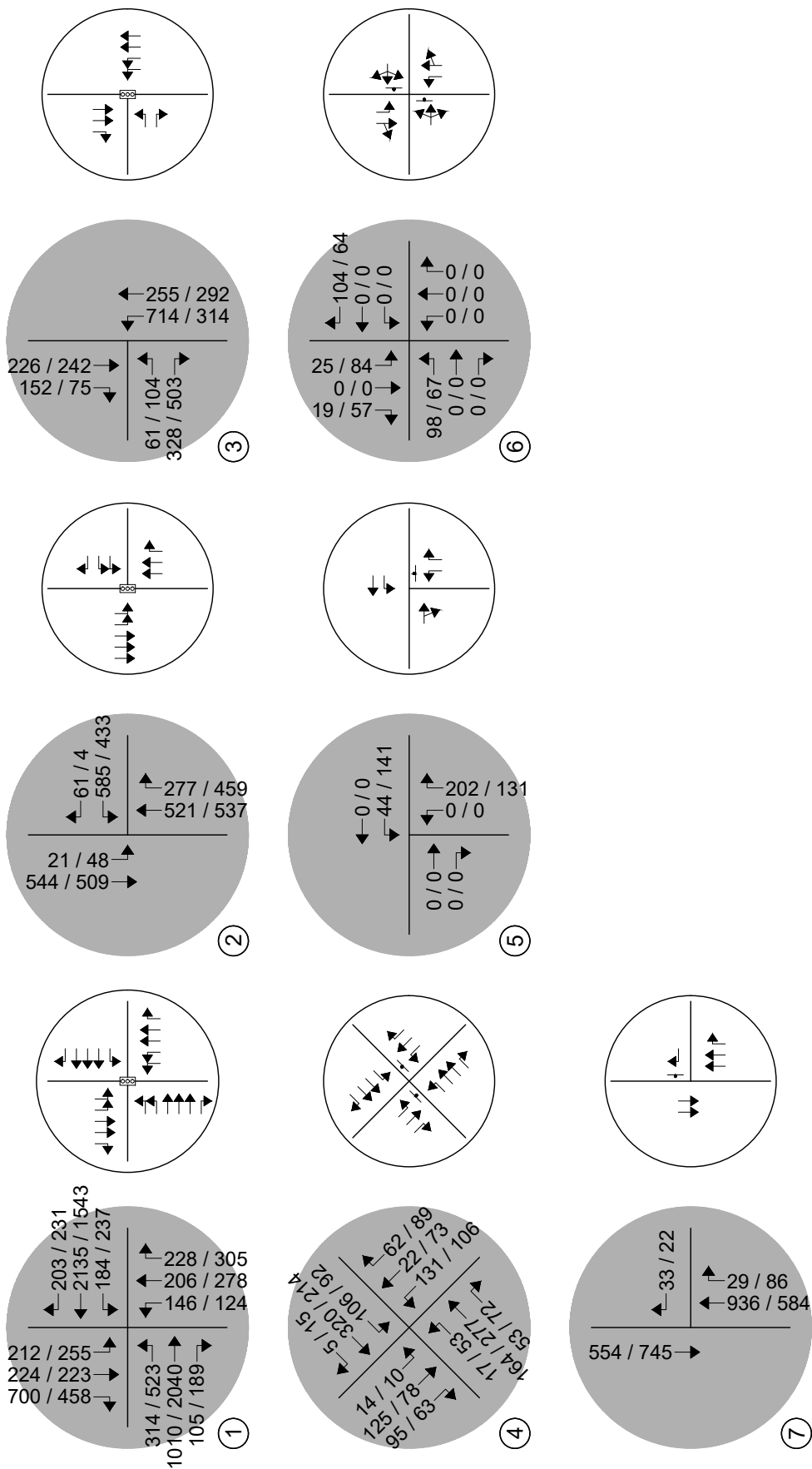
Considering development build-out, an evaluation of auxiliary lane requirements, pursuant to Section 8.0 of the City's Traffic Criteria Manual, reveals that a northbound right turn deceleration lane along Black Forest Road at Access A may be required since the development's projected peak hour right turn ingress volume exceeds the City's threshold of 25 vehicles per hour (vph).

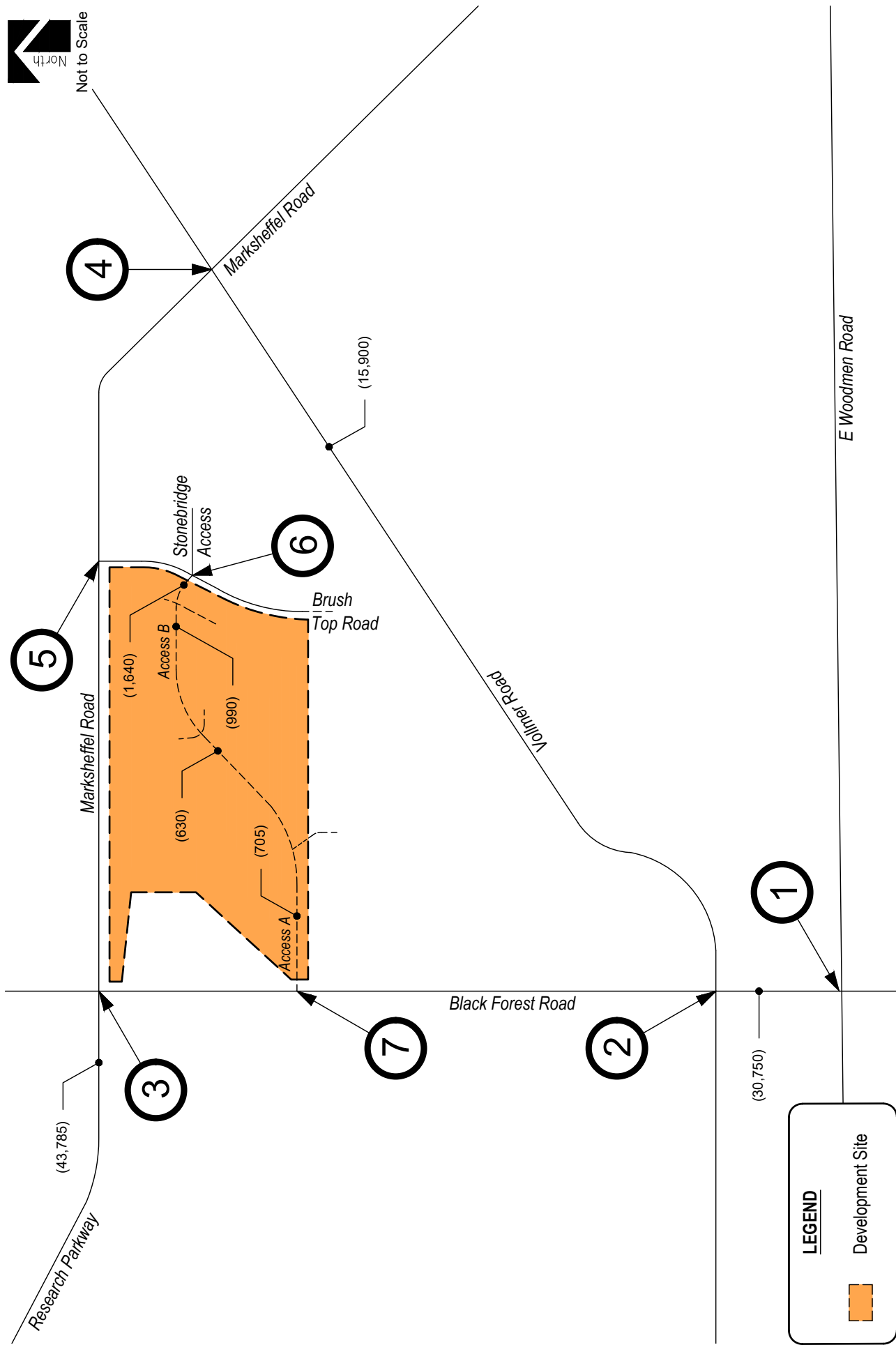
Considering development build-out, an evaluation of auxiliary lane requirements, pursuant to Section 2.3.7.D of the County's ECM, reveals that a southbound right turn deceleration lane along Brush Top Road at Access B may be required since the development's projected peak hour right turn ingress volume exceeds the County's threshold of 50 vph. However, considering the low volumes projected along Brush Top Road, this improvement was not considered. This provides for a conservative analysis.

Projected Year 2028 total study intersection as well as intersection traffic volumes and intersection geometry are shown in Figure 13 and Figure 14, respectively.

Projected Year 2045 total study intersection as well as intersection traffic volumes and intersection geometry are shown in Figure 15 and Figure 16, respectively.

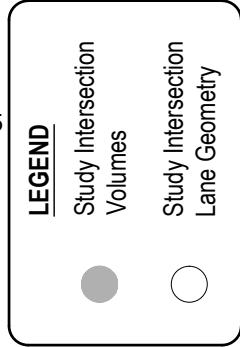
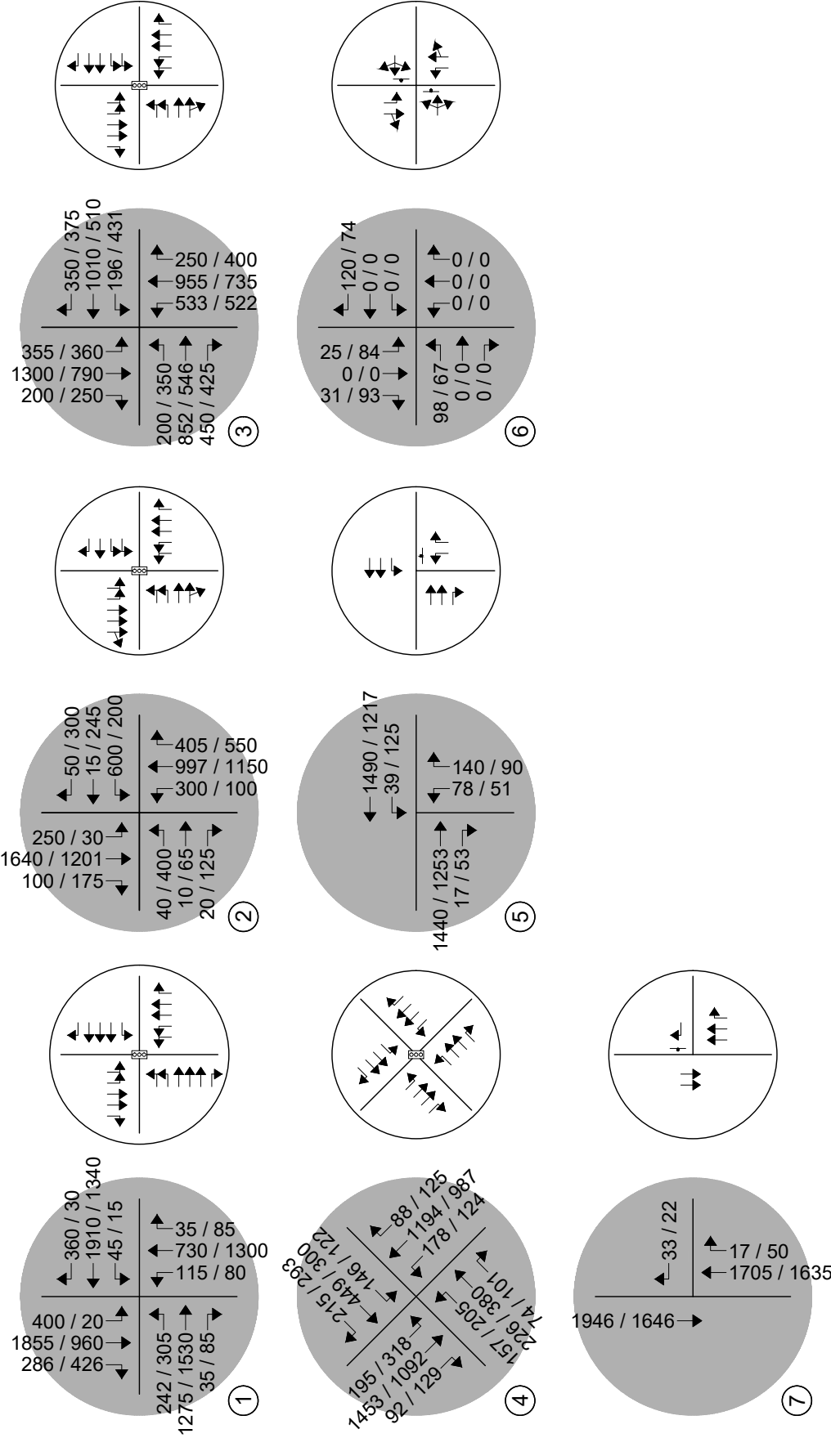








Not to Scale



Peak Hour Intersection Levels of Service – Total Traffic

As with background traffic, the operations of the study intersections were analyzed under projected total traffic conditions using the SYNCHRO computer program. The analyses and procedures were performed in accordance with the latest HCM and are based upon the worst-case conditions that occur during a typical weekday upon build-out of site development and analyzed land uses. Therefore, study intersections are likely to operate with traffic conditions better than those described within this study, which represent the peak hours of weekday operations only.

Total traffic level of service analysis results for Years 2028 and 2045 are summarized in Table 6 and Table 7, respectively.

Definitions of levels of service are given in Appendix B. Intersection capacity worksheets are provided in Appendix C.

Table 6 – Intersection Capacity Analysis Summary – Total Traffic – Year 2028

INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
Black Forest Road / E Woodmen Road (Signalized)	F (96.8)	D (58.7)
Black Forest Road / Vollmer Road (Signalized)	B (17.4)	B (16.3)
Black Forest Road / Research Parkway (Signalized)	A (7.4)	B (14.2)
Vollmer Road / Marksheffel Road (Stop-Controlled)		
Eastbound Left	C	D
Eastbound Through	D	D
Eastbound Right	A	A
Westbound Left	F	F
Westbound Through	C	D
Westbound Right	A	A
Northbound Left	A	A
Southbound Left	A	A
Brush Top Road / Marsksheffel Road (Stop-Controlled)		
Westbound Left	A	A
Northbound Left	A	A
Northbound Right	A	A
Brush Top Road / Stonebridge Access / Access B (Stop-Controlled)		
Eastbound Left, Through, and Right	A	A
Westbound Left Through, and Right	A	A
Northbound Left	A	A
Southbound Left	A	A
Black Forest Road / Access A (Stop-Controlled)		
Westbound Right	B	B

Key: Signalized Intersection: Level of Service (Control Delay in sec/veh)
 Stop-Controlled Intersection: Level of Service

Table 7 – Intersection Capacity Analysis Summary – Total Traffic – Year 2045

INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
Black Forest Road / E Woodmen Road (Signalized)	F (131.6)	D (44.9)
Black Forest Road / Vollmer Road (Signalized)	C (25.0)	D (31.5)
Black Forest Road / Research Parkway (Signalized)	F (115.7)	E (58.3)
Vollmer Road / Marksheffel Road (Signalized)	D (37.5)	C (34.8)
Brush Top Road / Marksheffel Road (Stop-Controlled)		
Westbound Left	B	C
Northbound Left	F	F
Northbound Right	C	C
Brush Top Road / Stonebridge Access / Access B (Stop-Controlled)		
Eastbound Left, Through, and Right	A	A
Westbound Left, Through, and Right	A	A
Northbound Left	A	A
Southbound Left	A	A
Black Forest Road / Access A (Stop-Controlled)		
Westbound Right	C	C

Key: Signalized Intersection: Level of Service (Control Delay in sec/veh)
 Stop-Controlled Intersection: Level of Service

Total Traffic Analysis Results Upon Development Build-Out

Table 7 illustrates how, by Year 2045 and upon development build-out, the signalized intersection of Black Forest Road and E Woodmen Road continues to show an overall LOS F operation during the morning peak traffic hour and LOS D operation during the afternoon peak traffic hour. The LOS F operation continues to be attributed to the through traffic volumes along each approach. Compared to the background traffic analysis, the proposed development is not expected to change or increase vehicular delay for this study intersection.

The signalized intersection of Black Forest Road and Vollmer Road continues to project overall operations at LOS C during the morning peak traffic hour and LOS D during the afternoon peak traffic hour.

The Black Forest Road intersection with Research Parkway has overall operations at LOS F during the morning peak traffic hour and LOS E during the afternoon peak traffic hour. The LOS F and E operations are attributed to the high through volumes in each direction. As described in Section III, potential mitigations include the widening of Black Forest Road, Research Parkway, and Marksheffel Road to their ultimate widths accommodating six-lane cross-sections, which results in overall operations at LOS D or better during the morning and afternoon peak traffic hours.

The signalized intersection of Vollmer Road and Marksheffel Road is expected to provide overall operations at LOS D during the morning peak traffic hour and LOS C during the afternoon peak traffic hour.

The stop-controlled intersection of Brush Top Road and Marksheffel Road has turning movement operations at LOS C or better during the morning and afternoon peak traffic hours. Exceptions continue to include the northbound left turning movement which projects LOS F operations during both peak traffic periods. The LOS F operations are attributed to the through traffic volumes along Marksheffel Road and the stop-controlled nature of the intersection. As expressed in background traffic conditions, these poor operations occur along the minor leg approach and are therefore not expected to negatively impact the operations of Marksheffel Road. While signalization is a potential mitigating solution, it is recommended that as actual land uses and densities become defined within the overall area, intersection operational analyses will need to be updated to help assess if transportation improvements are needed to mitigate potential traffic impacts.

The stop-controlled intersection of Brush Top Road and Access B is expected to provide turning movement operations at LOS A during the morning and afternoon peak traffic hour.

The stop-controlled intersection of Black Forest Road and Access A is expected to provide turning movement operations at LOS C during the morning and afternoon peak traffic hours.

It is to be noted that it is not uncommon for unsignalized movements to or from an arterial roadway, in urban areas, to operate with noticeable delays during peak traffic hours. It is, however, likely that turn movements will operate better than the results obtained with this HCM Two-Way Stop-Control (TWSC) level of service analysis would indicate, as the HCM analysis may not accurately account for the effect of vehicle platooning and gaps caused by upstream signals. The upstream signal controls along Marksheffel Road will tend to create additional gaps in the traffic stream for turning movements at Brush Top Road and will most likely provide mitigation to the LOS F operation projected during both peak traffic hours.

These intersection operations are similar to background conditions.

VI. Project Impacts

It is emphasized that the analyses and procedures described in this study were performed in accordance with the latest HCM and are based upon the worst-case conditions that occur during a typical weekday upon build-out of site development and analyzed land uses. Therefore, study intersections are likely to operate with traffic conditions better than those described within this study, which represent the peak hours of weekday operations only.

Queue Length Analysis

Queue lengths for the study intersections were analyzed using Year 2045 background and total traffic conditions. The analysis yields estimate of 95th percentile queue lengths, which have only a five percent probability of being exceeded during the analysis time period. An average vehicle length of 25 feet was assumed. Queue lengths were modeled and are included with the Synchro worksheets in Appendix C.

Table 8 summarizes the 95th percentile queue results in comparison to the projected storage requirements for turn movements within study area for Year 2045.

Table 8 – Turn Lane Queues and Storage Requirements – Year 2045

Intersection	Turn Movement	Existing Turn Lane Length (feet)	Background 2045		Total 2045		Recommended Turn Lane Length (feet)	
			AM Peak Hour (feet)	PM Peak Hour (feet)	AM Peak Hour (feet)	PM Peak Hour (feet)		
Signalized Intersections								
Black Forest Road / E Woodmen Road	EB	L	500' x2	200'	193'	216'	241'	500' x2
		T	-	393'	534'	393'	534'	-
		R	710'	0'	17'	0'	17'	710'
	WB	L	200'	108'	36'	108'	36'	200'
		T	-	798'	483'	798'	483'	-
		R	245'	169'	0'	169'	0'	245'
	NB	L	195' x2	111'	73'	111'	73'	195' x2
		T	-	357'	720'	357'	720'	-
		R	180'	0'	13'	0'	13'	180'
	SB	L	235' x2	227'	11'	228'	11'	235' x2
		T	-	1193'	488'	1194'	488'	-
		R	410'	116'	336'	162'	390'	410'
Black Forest Road / Vollmer Road	EB	L	-	35'	227'	35'	227'	-
		T,R	-	21'	54'	21'	54'	-
	WB	L	210' x2	293'	113'	293'	113'	210' x2
		T	-	27'	304'	27'	304'	-
		R	-	0'	263'	0'	263'	265'
	NB	L	-	14'	42'	14'	41'	-
		T	-	455'	521'	457'	529'	-
		R	585'	211'	316'	208'	312'	585'
	SB	L	260' x2	87'	12'	85'	12'	260' x2
		T,R	-	148'	280'	136'	264'	-
Black Forest Road / Research Parkway	EB	L	200'	168'	206'	168'	206'	210'
		T,R	-	809'	497'	821'	538'	-
	WB	L	-	130'	265'	176'	294'	295'
		T	-	600'	249'	600'	249'	-
		R	-	163'	188'	163'	188'	190'
	NB	L	315' x2	368'	311'	398'	328'	315' x2
		T	-	488'	309'	430'	308'	-
		R	-	35'	73'	36'	71'	185'
	SB	L	-	241'	232'	241'	232'	245'
		T	-	790'	446'	790'	446'	-
R		285'	104'	64'	104'	64'	285'	
Vollmer Road / Marksheffel Road	EB	L	-	183'	276'	193'	333'	325'
		T	-	592'	443'	624'	461'	-
		R	-	6'	20'	6'	20'	155'
	WB	L	-	184'	76'	184'	80'	185'
		T	-	419'	455'	430'	488'	-
		R	205'	4'	0'	4'	0'	205'
	NB	L	-	162'	228'	162'	228'	230'
		T	-	108'	216'	108'	216'	-
		R	250'	0'	7'	0'	7'	250'
	SB	L	240'	128'	136'	128'	136'	240'
		T	-	243'	183'	243'	183'	-
		R	-	100'	88'	103'	90'	120'

Note: Turn Lane Length does not include taper length.
x2 = Dual Turn Lanes.

Table 8 (Cont.) – Turn Lane Queues and Storage Requirements – Year 2045

Intersection	Turn Movement		Existing Turn Lane Length (feet)	Background 2045		Total 2045		Recommended Turn Lane Length (feet)
				AM Peak Hour (feet)	PM Peak Hour (feet)	AM Peak Hour (feet)	PM Peak Hour (feet)	
Stop-Controlled Intersections								
Brush Top Road / Marksheffel Road	EB	T	-	0'	0'	0'	0'	-
		R	-	0'	0'	0'	0'	-
	WB	L	-	5'	13'	8'	30'	155'
		T	-	0'	0'	0'	0'	-
	NB	L	-	105'	55'	268'	175'	270'
		R	-	28'	13'	58'	30'	-
Brush Top Road / Stonebridge Access / Access B	EB	L,T,R	-	-	-	0'	0'	-
		L,T,R	-	5'	0'	0'	0'	-
	NB	L	-	-	-	0'	0'	TWLT
		T,R	-	0'	0'	0'	0'	-
	SB	L	-	0'	0'	0'	0'	TWLT
		T,R	-	0'	0'	0'	0'	-
Black Forest Road / Access A	WB	R	-	-	-	13'	8'	-
		T	-	-	-	0'	0'	-
	NB	R	-	-	-	0'	0'	200'
		T	-	-	-	0'	0'	-

Note: Turn Lane Length does not include taper length.
TWLT = Two-Way Left-Turn Lane

As Table 8 shows, all turn lane lengths at the study intersections are recommended to accommodate projected 95th percentile queues or minimum turn lane lengths as defined within the City's Traffic Criteria Manual or the County's ECM, whichever is greatest.

It is to be noted that significant vehicle queuing exists during background traffic conditions without the proposed development. As previously mentioned, expanding Black Forest Road, Research Parkway, and Marksheffel Road to their ultimate widths accommodating six through lanes is a possible mitigation to poor operations and projected vehicle queueing.

Development Impacts

Analysis of future traffic conditions indicates that the addition of site-generated traffic is expected to create minimal negative impact to traffic operations for the existing and surrounding roadway system upon roadway and intersection control improvements assumed within this analysis. With all conservative assumptions defined in this analysis, the study intersections are projected to operate at future levels of service comparable to Year 2045 background traffic conditions.

Recommended Improvements

In review of the expected ADT's along the proposed east-west roadway serving the development, as illustrated in Figure 15, it is recommended that the proposed east-west roadway (from Brush Top Road to Salt Brush Road) provide an urban local roadway classification with a 60-foot right-of-way (ROW). West of Salt Brush Road, and considering the proposed east-west roadway's intersection with Black Forest Road, it is recommended that the proposed east-west roadway provide a residential collector roadway classification with a 60-foot ROW. A roadway classification exhibit for said roadway is provided for reference in Appendix E.

Table 9 illustrates the recommended roadway and intersection control improvements associated with the proposed Schmidt Property Preliminary Plan and adjacent area.

Table 9 – Recommended Improvements Summary

IMPROVEMENT	TYPE	TIMING	RESPONSIBILITY
Signalization of the Vollmer Road / Marksheffel Road intersection	Traffic Signal	When Warranted	Developments and other trip generators within the overall area
Extend Marksheffel Road to Black Forest Road	Roadway Segment	Proposed as a PPRTA-3 (2025-2034) Project, Shown in County's MTCP to occur by 2040	Master Planned
Construct bridge crossing along Marksheffel Road over Cottonwood Creek	Roadway Segment	Proposed as a PPRTA-3 (2025-2034) Project	Master Planned
Construct west leg of the Vollmer Road and Black Forest Road intersection	Roadway Segment	When Warranted	Lodge II at Black Forest development
Restripe northbound right turn lane along Black Forest Road at Access A	Auxiliary Lane	Upon Development Buildout	Applicant / Developer (upon appropriate development phase)

Recommended improvements, as shown in Table 9 above, which may be reimbursable under the County's MTCP includes roadway widening improvements along Black Forest Road, Marksheffel Road, and Vollmer Road.

VII. Conclusion

This traffic impact study addressed the capacity, geometric, and control requirements associated with the development entitled Schmidt Property Preliminary Plan. This proposed residential development is located near the southeast corner of Black Forest Road and Research Parkway in El Paso County, Colorado.

The study area examined in this analysis encompassed the Black Forest Road intersections with Research Parkway, Vollmer Road, and E Woodmen Road, the Vollmer Road intersection with Marksheffel Road, and includes proposed site accesses.

Analysis was conducted for critical AM Peak Hour and PM Peak Hour traffic operations for existing traffic conditions, Year 2028 and Year 2045 background traffic conditions, and Year 2028 and Year 2045 total traffic conditions.

Analysis of existing traffic conditions indicates that all signalized intersections operate under LOS B or better during the morning peak traffic hour and LOS D or better during the afternoon peak traffic hour. Exceptions include the Black Forest Road intersection with E Woodmen Road which provides overall operations at LOS E during the morning peak traffic hour. All stop-controlled intersections within the study area operate with turn movements at or better than LOS C during their respective peak traffic periods.

Under Year 2028 background traffic conditions, operational analysis shows that the signalized intersections within the study area are projected to operate at LOS D or better during peak traffic periods. Exceptions include the Black Forest Road and E Woodmen Road intersection, which operates at LOS F during the morning peak traffic hour. The stop-controlled intersections within the study area are expected to provide turning movement operations at LOS D or better during the morning peak traffic hour and LOS C or better during the afternoon peak traffic hour. Exceptions include the intersection of Vollmer Road and Marksheffel Road, where the westbound left turning movement operates at LOS F during the morning peak traffic hour and LOS E during the afternoon peak traffic hour and the westbound right turning movement which operates at LOS F during the afternoon peak traffic hour.

Under Year 2045 background traffic conditions, operational analysis shows that all signalized intersections are projected to operate with LOS D or better operations during peak traffic periods. Exceptions include the Black Forest Roadway intersections with E Woodmen Road and Research Parkway which operate at LOS F during the morning peak traffic hour. All stop-controlled intersections anticipate turn movement operations at or better than LOS C during their respective peak traffic periods. Exceptions include the northbound left turning movement at the Brush Top Road and Marksheffel Road which is expected to provide LOS F operations during both peak traffic periods.

Analysis of future traffic conditions indicates that the addition of site-generated traffic is expected to create no negative impact to traffic operations for the existing and surrounding roadway system upon roadway and intersection control improvements assumed within this analysis. With all conservative assumptions defined in this analysis, the study intersections is projected to operate at future levels of service comparable to Year 2045 background traffic conditions. Proposed site accesses have long-term operations at LOS C or better during peak traffic periods and upon build-out.

APPENDIX A

**Traffic Count Data
Signal Timing Information**



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

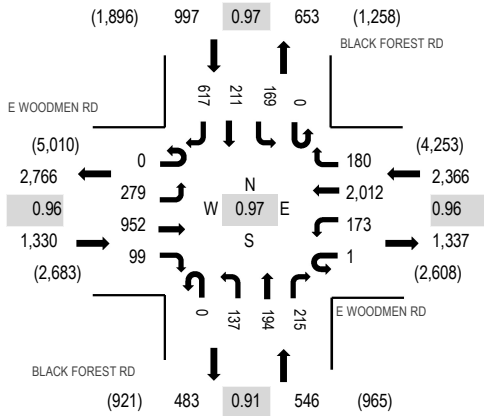
Location: 1 BLACK FOREST RD & E WOODMEN RD AM

Date: Wednesday, September 24, 2025

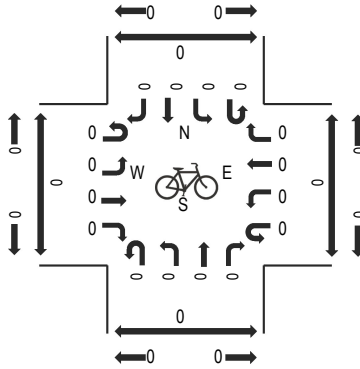
Peak Hour: 07:00 AM - 08:00 AM

Peak 15-Minutes: 07:15 AM - 07:30 AM

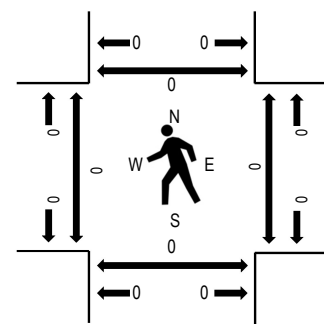
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	E WOODMEN RD Eastbound				E WOODMEN RD Westbound				BLACK FOREST RD Northbound				BLACK FOREST RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	53	202	26	0	45	508	42	0	42	31	47	0	32	71	141	1,240	5,239	0	0	0	0
7:15 AM	0	78	251	17	0	57	511	47	0	34	38	63	0	40	56	162	1,354	5,172	0	0	0	0
7:30 AM	0	71	251	28	1	37	504	45	0	37	50	54	0	49	35	171	1,333	5,027	0	0	0	0
7:45 AM	0	77	248	28	0	34	489	46	0	24	75	51	0	48	49	143	1,312	4,845	0	0	0	0
8:00 AM	1	79	216	16	2	40	420	36	0	32	44	41	0	47	69	130	1,173	4,558	0	0	0	0
8:15 AM	0	74	234	27	2	35	437	42	0	41	46	42	0	49	29	151	1,209		0	1	0	0
8:30 AM	0	68	265	26	2	49	402	34	0	19	37	32	0	40	40	137	1,151		1	0	0	0
8:45 AM	0	90	228	29	1	43	311	31	0	26	24	35	0	35	35	137	1,025		0	0	0	0
Count Total	1	590	1,895	197	8	340	3,582	323	0	255	345	365	0	340	384	1,172	9,797		1	1	0	0
Peak Hour	0	279	952	99	1	173	2,012	180	0	137	194	215	0	169	211	617	5,239		0	0	0	0



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

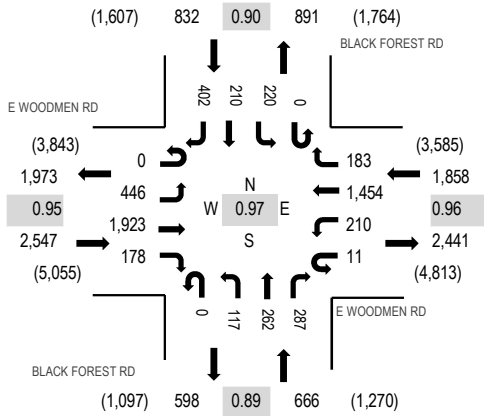
Location: 1 BLACK FOREST RD & E WOODMEN RD PM

Date: Wednesday, September 24, 2025

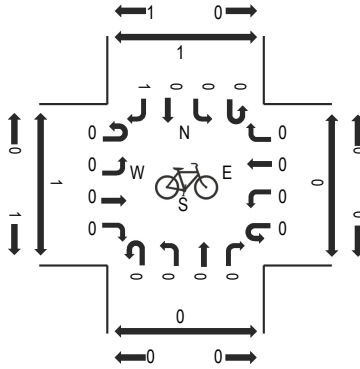
Peak Hour: 04:45 PM - 05:45 PM

Peak 15-Minutes: 05:15 PM - 05:30 PM

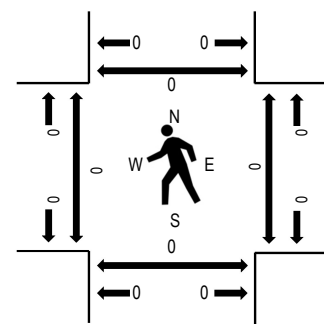
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	E WOODMEN RD Eastbound				E WOODMEN RD Westbound				BLACK FOREST RD Northbound				BLACK FOREST RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	109	535	35	4	40	362	35	0	23	61	51	0	67	33	92	1,447	5,640	0	0	0	0
4:15 PM	0	110	447	35	1	41	312	40	0	19	78	59	0	48	51	118	1,359	5,634	0	0	0	0
4:30 PM	0	125	483	40	3	52	319	42	0	34	51	57	0	40	43	97	1,386	5,792	0	0	0	0
4:45 PM	0	111	475	28	1	50	387	44	0	25	66	67	0	44	52	98	1,448	5,903	0	0	0	0
5:00 PM	0	113	461	73	3	52	363	40	0	29	62	61	0	46	51	87	1,441	5,877	0	0	0	0
5:15 PM	0	97	489	31	4	51	378	46	0	40	75	76	0	71	55	104	1,517		0	0	0	0
5:30 PM	0	125	498	46	3	57	326	53	0	23	59	83	0	59	52	113	1,497		0	0	0	0
5:45 PM	0	106	453	30	3	50	370	53	0	25	63	83	0	38	49	99	1,422		0	0	0	0
Count Total	0	896	3,841	318	22	393	2,817	353	0	218	515	537	0	413	386	808	11,517		0	0	0	0
Peak Hour	0	446	1,923	178	11	210	1,454	183	0	117	262	287	0	220	210	402	5,903		0	0	0	0



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

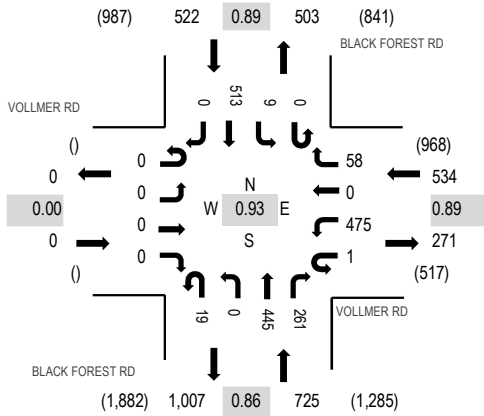
Location: 2 BLACK FOREST RD & VOLLMER RD AM

Date: Wednesday, September 24, 2025

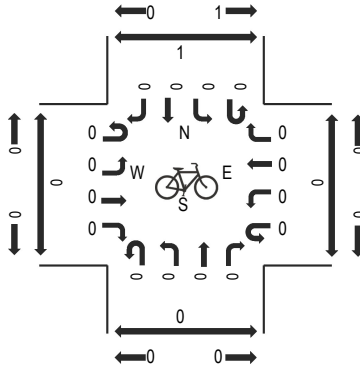
Peak Hour: 07:15 AM - 08:15 AM

Peak 15-Minutes: 07:45 AM - 08:00 AM

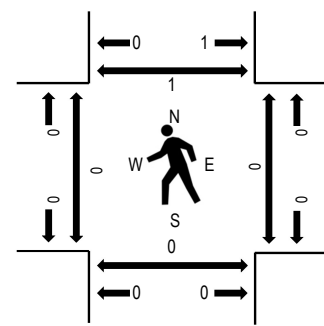
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	VOLLMER RD Eastbound				VOLLMER RD Westbound				BLACK FOREST RD Northbound				BLACK FOREST RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	0	0	0	0	134	0	13	5	0	64	47	0	1	95	0	359	1,713	0	0	0	0
7:15 AM	0	0	0	0	0	154	0	8	6	0	111	58	0	1	97	0	435	1,781	0	0	0	0
7:30 AM	0	0	0	0	1	127	0	17	6	0	112	51	0	2	123	0	439	1,733	0	0	0	0
7:45 AM	0	0	0	0	0	97	0	28	3	0	120	87	0	2	143	0	480	1,657	0	0	0	0
8:00 AM	0	0	0	0	0	97	0	5	4	0	102	65	0	4	150	0	427	1,527	0	0	0	1
8:15 AM	0	0	0	0	0	104	0	5	1	0	90	65	0	1	121	0	387		0	0	0	0
8:30 AM	0	0	0	0	0	96	0	3	1	0	82	60	1	5	115	0	363		1	0	0	0
8:45 AM	0	0	0	0	0	78	0	1	3	0	79	63	0	4	122	0	350		0	0	0	0
Count Total	0	0	0	0	1	887	0	80	29	0	760	496	1	20	966	0	3,240		1	0	0	1
Peak Hour	0	0	0	0	1	475	0	58	19	0	445	261	0	9	513	0	1,781		0	0	0	1



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

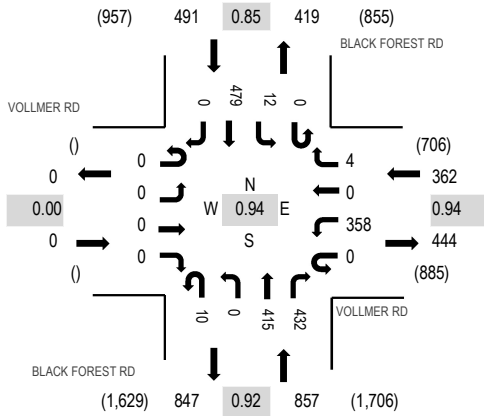
Location: 2 BLACK FOREST RD & VOLLMER RD PM

Date: Wednesday, September 24, 2025

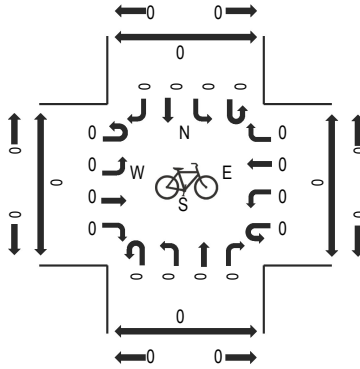
Peak Hour: 04:45 PM - 05:45 PM

Peak 15-Minutes: 05:30 PM - 05:45 PM

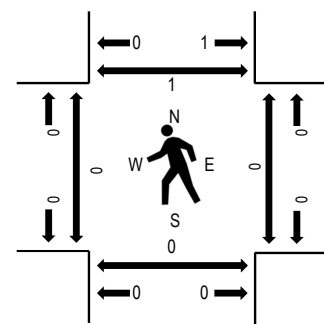
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	VOLLMER RD Eastbound				VOLLMER RD Westbound				BLACK FOREST RD Northbound				BLACK FOREST RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	0	0	0	0	67	0	0	0	0	100	110	0	8	130	0	415	1,659	0	0	0	0
4:15 PM	0	0	0	0	0	98	0	2	4	0	113	100	0	7	117	0	441	1,655	0	0	0	0
4:30 PM	0	0	0	0	0	80	0	4	0	0	105	110	0	5	100	0	404	1,657	0	0	0	0
4:45 PM	0	0	0	0	0	92	0	1	2	0	99	99	0	3	103	0	399	1,710	0	0	0	0
5:00 PM	0	0	0	0	0	83	0	0	1	0	116	102	0	2	107	0	411	1,710	0	0	0	0
5:15 PM	0	0	0	0	0	94	0	2	3	0	95	105	0	5	139	0	443		0	0	0	1
5:30 PM	0	0	0	0	0	89	0	1	4	0	105	126	0	2	130	0	457		0	0	0	0
5:45 PM	0	0	0	0	0	88	0	5	1	0	107	99	0	2	97	0	399		0	0	0	0
Count Total	0	0	0	0	0	691	0	15	15	0	840	851	0	34	923	0	3,369		0	0	0	1
Peak Hour	0	0	0	0	0	358	0	4	10	0	415	432	0	12	479	0	1,710		0	0	0	1



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

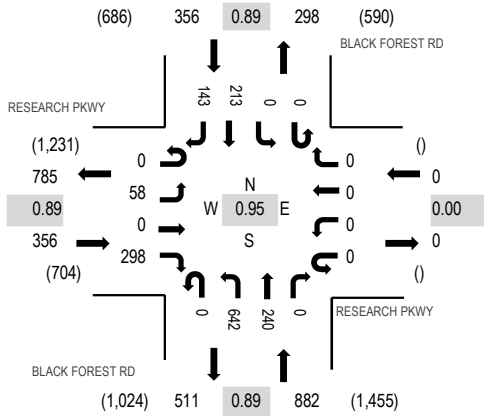
Location: 3 BLACK FOREST RD & RESEARCH PKWY AM

Date: Wednesday, September 24, 2025

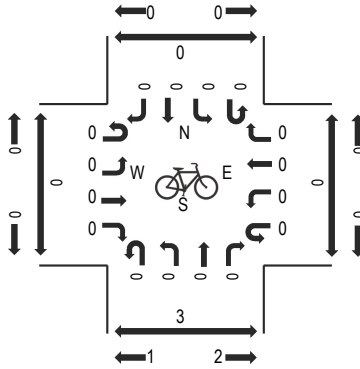
Peak Hour: 07:15 AM - 08:15 AM

Peak 15-Minutes: 07:45 AM - 08:00 AM

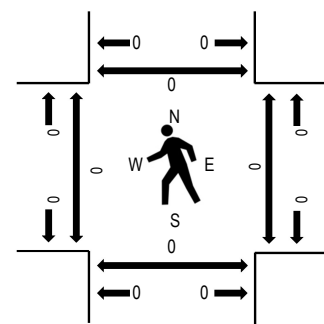
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	RESEARCH PKWY Eastbound				RESEARCH PKWY Westbound				BLACK FOREST RD Northbound				BLACK FOREST RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	4	0	37	0	0	0	0	0	117	34	0	0	0	30	30	252	1,433	0	0	0	0
7:15 AM	0	10	0	53	0	0	0	0	0	161	52	0	0	0	50	48	374	1,594	0	0	0	0
7:30 AM	0	10	0	67	0	0	0	0	0	160	58	0	0	0	54	37	386	1,582	0	0	0	0
7:45 AM	0	17	0	77	0	0	0	0	0	184	65	0	0	0	47	31	421	1,528	0	0	0	0
8:00 AM	0	21	0	101	0	0	0	0	0	137	65	0	0	0	62	27	413	1,412	0	0	0	0
8:15 AM	0	30	0	90	0	0	0	0	0	83	81	0	0	0	56	22	362		0	0	0	0
8:30 AM	0	17	0	83	0	0	0	0	0	86	55	0	0	0	64	27	332		0	0	0	0
8:45 AM	0	17	0	70	0	0	0	0	0	63	54	0	0	0	83	18	305		0	0	0	0
Count Total	0	126	0	578	0	0	0	0	0	991	464	0	0	0	446	240	2,845		0	0	0	0
Peak Hour	0	58	0	298	0	0	0	0	0	642	240	0	0	0	213	143	1,594		0	0	0	0



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

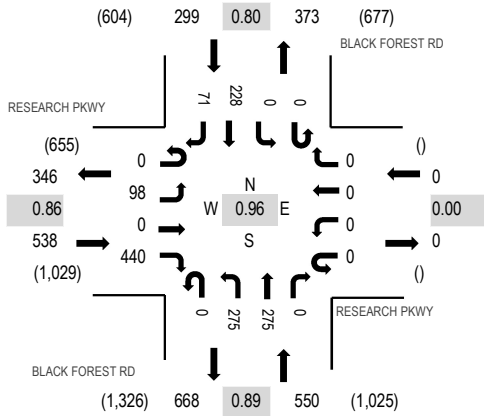
Location: 3 BLACK FOREST RD & RESEARCH PKWY PM

Date: Wednesday, September 24, 2025

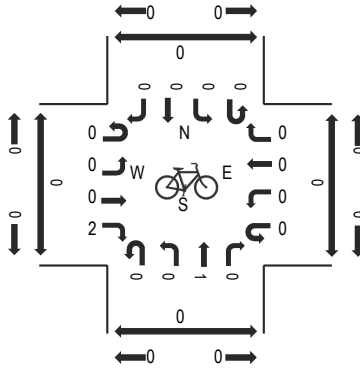
Peak Hour: 05:00 PM - 06:00 PM

Peak 15-Minutes: 05:15 PM - 05:30 PM

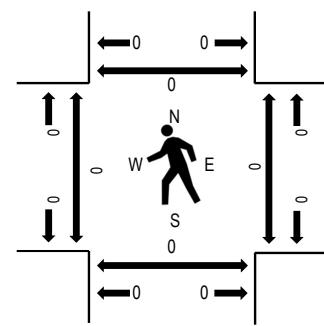
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	RESEARCH PKWY Eastbound				RESEARCH PKWY Westbound				BLACK FOREST RD Northbound				BLACK FOREST RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	22	0	99	0	0	0	0	0	66	39	0	0	0	79	16	321	1,271	0	0	0	0
4:15 PM	0	25	0	99	0	0	0	0	0	71	59	0	0	0	59	9	322	1,278	0	0	0	0
4:30 PM	0	14	0	108	0	0	0	0	0	65	60	0	0	0	59	14	320	1,319	0	0	0	0
4:45 PM	0	26	0	98	0	0	0	0	0	56	59	0	0	0	57	12	308	1,343	0	0	0	0
5:00 PM	0	14	0	106	0	0	0	0	0	73	59	0	0	0	59	17	328	1,387	0	0	0	0
5:15 PM	0	27	0	129	0	0	0	0	0	79	55	0	0	0	58	15	363		0	0	0	0
5:30 PM	0	32	0	107	0	0	0	0	0	59	70	0	0	0	55	21	344		0	0	0	0
5:45 PM	0	25	0	98	0	0	0	0	0	64	91	0	0	0	56	18	352		0	0	0	0
Count Total	0	185	0	844	0	0	0	0	0	533	492	0	0	0	482	122	2,658		0	0	0	0
Peak Hour	0	98	0	440	0	0	0	0	0	275	275	0	0	0	228	71	1,387		0	0	0	0



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

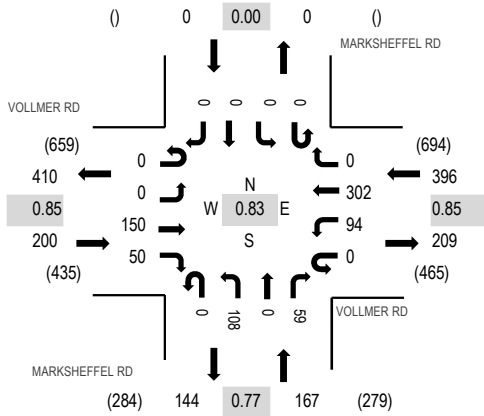
Location: 4 MARKSHEFFEL RD & VOLLMER RD AM

Date: Wednesday, September 24, 2025

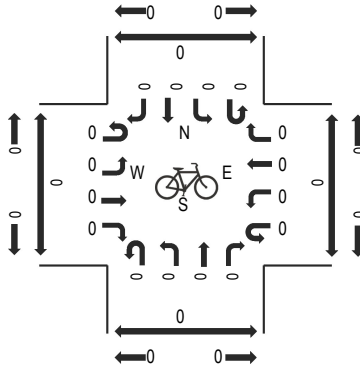
Peak Hour: 07:00 AM - 08:00 AM

Peak 15-Minutes: 07:45 AM - 08:00 AM

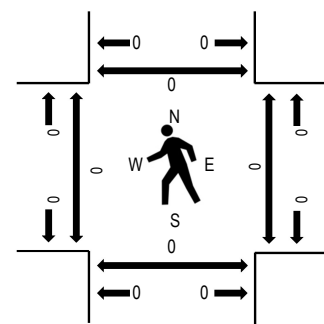
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	VOLLMER RD Eastbound				VOLLMER RD Westbound				MARKSHEFFEL RD Northbound				MARKSHEFFEL RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	0	31	13	0	22	66	0	0	16	0	13	0	0	0	0	161	763	0	0	0	0
7:15 AM	0	0	30	7	0	26	63	0	0	23	0	13	0	0	0	0	162	760	0	0	0	0
7:30 AM	0	0	34	10	0	23	94	0	0	35	0	13	0	0	0	0	209	752	0	0	0	0
7:45 AM	0	0	55	20	0	23	79	0	0	34	0	20	0	0	0	0	231	710	0	0	0	0
8:00 AM	0	0	45	15	0	21	52	0	0	11	0	14	0	0	0	0	158	645	0	0	0	0
8:15 AM	0	0	43	15	0	17	55	0	0	9	0	15	0	0	0	0	154		0	0	0	0
8:30 AM	0	0	46	16	0	21	56	0	0	10	0	18	0	0	0	0	167		0	0	0	0
8:45 AM	0	0	48	7	0	28	48	0	0	8	0	27	0	0	0	0	166		0	0	0	0
Count Total	0	0	332	103	0	181	513	0	0	146	0	133	0	0	0	0	1,408		0	0	0	0
Peak Hour	0	0	150	50	0	94	302	0	0	108	0	59	0	0	0	0	763		0	0	0	0



ALL TRAFFIC DATA SERVICES

(303) 216-2439

www.alltrafficdata.net

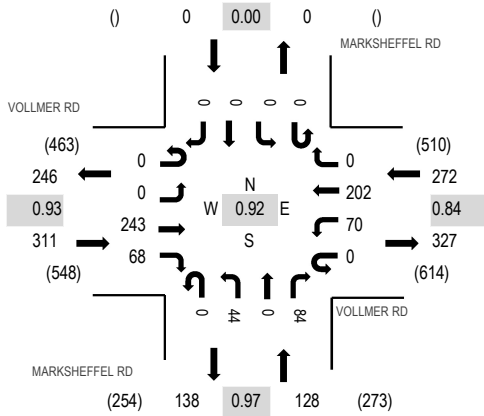
Location: 4 MARKSHEFFEL RD & VOLLMER RD PM

Date: Wednesday, September 24, 2025

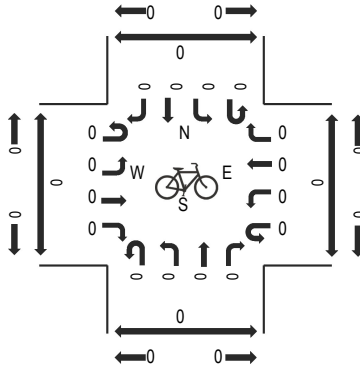
Peak Hour: 04:00 PM - 05:00 PM

Peak 15-Minutes: 04:15 PM - 04:30 PM

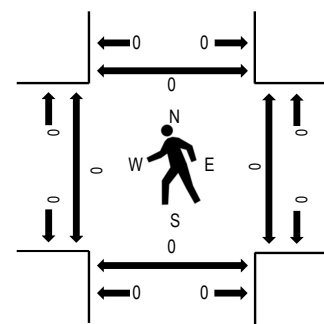
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	VOLLMER RD Eastbound				VOLLMER RD Westbound				MARKSHEFFEL RD Northbound				MARKSHEFFEL RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
4:00 PM	0	0	62	20	0	21	57	0	0	6	0	21	0	0	0	0	187	711	0	0	0	0
4:15 PM	0	0	69	15	0	20	61	0	0	12	0	17	0	0	0	0	194	684	0	0	0	0
4:30 PM	0	0	56	17	0	15	47	0	0	14	0	18	0	0	0	0	167	645	0	0	0	0
4:45 PM	0	0	56	16	0	14	37	0	0	12	0	28	0	0	0	0	163	647	0	0	0	0
5:00 PM	0	0	49	13	0	21	40	0	0	12	0	25	0	0	0	0	160	620	0	2	0	0
5:15 PM	0	0	48	11	0	16	40	0	0	12	0	28	0	0	0	0	155		0	0	0	0
5:30 PM	0	0	55	9	0	19	48	0	0	16	0	22	0	0	0	0	169		0	0	0	0
5:45 PM	0	0	41	11	0	16	38	0	0	11	0	19	0	0	0	0	136		0	0	1	0
Count Total	0	0	436	112	0	142	368	0	0	95	0	178	0	0	0	0	1,331		0	2	1	0
Peak Hour	0	0	243	68	0	70	202	0	0	44	0	84	0	0	0	0	711		0	0	0	0



All Traffic Data Services

5 - BLACK FOREST RD NORTH OF E WOODMEN RD

Time	NB	SB	Total
9/24/2025	10	3	13
9/24/2025 12:15:00 AM	9	7	16
9/24/2025 12:30:00 AM	15	11	26
9/24/2025 12:45:00 AM	11	7	18
9/24/2025 1:00:00 AM	13	5	18
9/24/2025 1:15:00 AM	5	9	14
9/24/2025 1:30:00 AM	4	0	4
9/24/2025 1:45:00 AM	6	7	13
9/24/2025 2:00:00 AM	5	6	11
9/24/2025 2:15:00 AM	5	2	7
9/24/2025 2:30:00 AM	3	2	5
9/24/2025 2:45:00 AM	2	4	6
9/24/2025 3:00:00 AM	2	2	4
9/24/2025 3:15:00 AM	3	3	6
9/24/2025 3:30:00 AM	1	10	11
9/24/2025 3:45:00 AM	4	8	12
9/24/2025 4:00:00 AM	4	9	13
9/24/2025 4:15:00 AM	2	14	16
9/24/2025 4:30:00 AM	8	25	33
9/24/2025 4:45:00 AM	9	30	39
9/24/2025 5:00:00 AM	11	48	59
9/24/2025 5:15:00 AM	17	44	61
9/24/2025 5:30:00 AM	18	57	75
9/24/2025 5:45:00 AM	17	73	90
9/24/2025 6:00:00 AM	39	94	133
9/24/2025 6:15:00 AM	58	112	170
9/24/2025 6:30:00 AM	88	161	249
9/24/2025 6:45:00 AM	111	239	350
9/24/2025 7:00:00 AM	126	244	370
9/24/2025 7:15:00 AM	163	258	421
9/24/2025 7:30:00 AM	166	255	421
9/24/2025 7:45:00 AM	198	240	438
9/24/2025 8:00:00 AM	159	246	405
9/24/2025 8:15:00 AM	162	229	391
9/24/2025 8:30:00 AM	139	217	356
9/24/2025 8:45:00 AM	145	207	352
9/24/2025 9:00:00 AM	126	159	285
9/24/2025 9:15:00 AM	88	167	255
9/24/2025 9:30:00 AM	114	159	273
9/24/2025 9:45:00 AM	116	120	236
9/24/2025 10:00:00 AM	105	142	247
9/24/2025 10:15:00 AM	101	136	237
9/24/2025 10:30:00 AM	91	145	236
9/24/2025 10:45:00 AM	113	149	262
9/24/2025 11:00:00 AM	148	132	280
9/24/2025 11:15:00 AM	130	139	269
9/24/2025 11:30:00 AM	138	152	290
9/24/2025 11:45:00 AM	124	156	280
Total	3,132	4,644	7,776
Percentage	40.3%	59.7%	
Peak Hour	7:15 AM	7:15 AM	7:15 AM
Volume	686	999	1,685
PHF	0.866	0.968	0.962



All Traffic Data Services

5 - BLACK FOREST RD NORTH OF E WOODMEN RD

Time	NB	SB	Total
9/24/2025 12:00:00 PM	169	142	311
9/24/2025 12:15:00 PM	147	133	280
9/24/2025 12:30:00 PM	161	141	302
9/24/2025 12:45:00 PM	135	159	294
9/24/2025 1:00:00 PM	150	127	277
9/24/2025 1:15:00 PM	143	149	292
9/24/2025 1:30:00 PM	138	148	286
9/24/2025 1:45:00 PM	155	140	295
9/24/2025 2:00:00 PM	83	94	177
9/24/2025 2:15:00 PM	125	166	291
9/24/2025 2:30:00 PM	158	143	301
9/24/2025 2:45:00 PM	213	167	380
9/24/2025 3:00:00 PM	212	192	404
9/24/2025 3:15:00 PM	202	188	390
9/24/2025 3:30:00 PM	214	191	405
9/24/2025 3:45:00 PM	205	190	395
9/24/2025 4:00:00 PM	205	192	397
9/24/2025 4:15:00 PM	228	217	445
9/24/2025 4:30:00 PM	218	180	398
9/24/2025 4:45:00 PM	221	194	415
9/24/2025 5:00:00 PM	215	184	399
9/24/2025 5:15:00 PM	218	230	448
9/24/2025 5:30:00 PM	237	224	461
9/24/2025 5:45:00 PM	222	186	408
9/24/2025 6:00:00 PM	223	197	420
9/24/2025 6:15:00 PM	198	157	355
9/24/2025 6:30:00 PM	179	142	321
9/24/2025 6:45:00 PM	160	133	293
9/24/2025 7:00:00 PM	138	97	235
9/24/2025 7:15:00 PM	139	123	262
9/24/2025 7:30:00 PM	176	108	284
9/24/2025 7:45:00 PM	136	79	215
9/24/2025 8:00:00 PM	128	74	202
9/24/2025 8:15:00 PM	129	90	219
9/24/2025 8:30:00 PM	131	65	196
9/24/2025 8:45:00 PM	95	45	140
9/24/2025 9:00:00 PM	88	44	132
9/24/2025 9:15:00 PM	82	45	127
9/24/2025 9:30:00 PM	64	35	99
9/24/2025 9:45:00 PM	57	29	86
9/24/2025 10:00:00 PM	44	26	70
9/24/2025 10:15:00 PM	44	23	67
9/24/2025 10:30:00 PM	30	18	48
9/24/2025 10:45:00 PM	25	11	36
9/24/2025 11:00:00 PM	20	12	32
9/24/2025 11:15:00 PM	24	11	35
9/24/2025 11:30:00 PM	12	7	19
9/24/2025 11:45:00 PM	17	4	21
Total	6,713	5,652	12,365
Percentage	54.3%	45.7%	
Peak Hour	5:15 PM	5:15 PM	5:15 PM
Volume	900	838	1,738
PHF	0.949	0.911	0.943
Grand Total	9,845	10,296	20,141
Percentage	48.9%	51.1%	



All Traffic Data Services

6 - RESEARCH PKWY WEST OF BLACK FOREST RD

Time	EB	WB	Total
9/24/2025	7	2	9
9/24/2025 12:15:00 AM	4	0	4
9/24/2025 12:30:00 AM	5	6	11
9/24/2025 12:45:00 AM	7	1	8
9/24/2025 1:00:00 AM	4	1	5
9/24/2025 1:15:00 AM	4	2	6
9/24/2025 1:30:00 AM	2	0	2
9/24/2025 1:45:00 AM	4	1	5
9/24/2025 2:00:00 AM	1	1	2
9/24/2025 2:15:00 AM	1	1	2
9/24/2025 2:30:00 AM	0	0	0
9/24/2025 2:45:00 AM	0	0	0
9/24/2025 3:00:00 AM	0	2	2
9/24/2025 3:15:00 AM	0	1	1
9/24/2025 3:30:00 AM	2	1	3
9/24/2025 3:45:00 AM	0	3	3
9/24/2025 4:00:00 AM	0	3	3
9/24/2025 4:15:00 AM	1	3	4
9/24/2025 4:30:00 AM	4	4	8
9/24/2025 4:45:00 AM	8	4	12
9/24/2025 5:00:00 AM	2	8	10
9/24/2025 5:15:00 AM	11	10	21
9/24/2025 5:30:00 AM	8	12	20
9/24/2025 5:45:00 AM	7	21	28
9/24/2025 6:00:00 AM	13	25	38
9/24/2025 6:15:00 AM	21	43	64
9/24/2025 6:30:00 AM	29	51	80
9/24/2025 6:45:00 AM	48	97	145
9/24/2025 7:00:00 AM	41	147	188
9/24/2025 7:15:00 AM	63	209	272
9/24/2025 7:30:00 AM	77	197	274
9/24/2025 7:45:00 AM	94	215	309
9/24/2025 8:00:00 AM	122	164	286
9/24/2025 8:15:00 AM	120	105	225
9/24/2025 8:30:00 AM	100	113	213
9/24/2025 8:45:00 AM	87	81	168
9/24/2025 9:00:00 AM	47	81	128
9/24/2025 9:15:00 AM	47	57	104
9/24/2025 9:30:00 AM	49	62	111
9/24/2025 9:45:00 AM	31	56	87
9/24/2025 10:00:00 AM	51	31	82
9/24/2025 10:15:00 AM	41	43	84
9/24/2025 10:30:00 AM	57	45	102
9/24/2025 10:45:00 AM	43	50	93
9/24/2025 11:00:00 AM	58	50	108
9/24/2025 11:15:00 AM	47	58	105
9/24/2025 11:30:00 AM	48	74	122
9/24/2025 11:45:00 AM	72	55	127
Total	1,488	2,196	3,684
Percentage	40.4%	59.6%	
Peak Hour	7:45 AM	7:15 AM	7:15 AM
Volume	436	785	1,141
PHF	0.893	0.913	0.923



All Traffic Data Services

6 - RESEARCH PKWY WEST OF BLACK FOREST RD

Time	EB	WB	Total
9/24/2025 12:00:00 PM	57	67	124
9/24/2025 12:15:00 PM	62	65	127
9/24/2025 12:30:00 PM	61	55	116
9/24/2025 12:45:00 PM	68	61	129
9/24/2025 1:00:00 PM	59	54	113
9/24/2025 1:15:00 PM	64	50	114
9/24/2025 1:30:00 PM	35	52	87
9/24/2025 1:45:00 PM	65	45	110
9/24/2025 2:00:00 PM	62	71	133
9/24/2025 2:15:00 PM	66	89	155
9/24/2025 2:30:00 PM	114	85	199
9/24/2025 2:45:00 PM	75	103	178
9/24/2025 3:00:00 PM	87	114	201
9/24/2025 3:15:00 PM	153	92	245
9/24/2025 3:30:00 PM	204	99	303
9/24/2025 3:45:00 PM	149	103	252
9/24/2025 4:00:00 PM	121	82	203
9/24/2025 4:15:00 PM	124	80	204
9/24/2025 4:30:00 PM	122	79	201
9/24/2025 4:45:00 PM	124	68	192
9/24/2025 5:00:00 PM	120	90	210
9/24/2025 5:15:00 PM	156	94	250
9/24/2025 5:30:00 PM	139	80	219
9/24/2025 5:45:00 PM	123	82	205
9/24/2025 6:00:00 PM	121	84	205
9/24/2025 6:15:00 PM	109	72	181
9/24/2025 6:30:00 PM	63	57	120
9/24/2025 6:45:00 PM	69	48	117
9/24/2025 7:00:00 PM	77	45	122
9/24/2025 7:15:00 PM	71	57	128
9/24/2025 7:30:00 PM	49	45	94
9/24/2025 7:45:00 PM	51	36	87
9/24/2025 8:00:00 PM	50	44	94
9/24/2025 8:15:00 PM	36	37	73
9/24/2025 8:30:00 PM	46	19	65
9/24/2025 8:45:00 PM	38	20	58
9/24/2025 9:00:00 PM	55	15	70
9/24/2025 9:15:00 PM	23	20	43
9/24/2025 9:30:00 PM	18	12	30
9/24/2025 9:45:00 PM	12	6	18
9/24/2025 10:00:00 PM	11	6	17
9/24/2025 10:15:00 PM	14	5	19
9/24/2025 10:30:00 PM	11	8	19
9/24/2025 10:45:00 PM	8	3	11
9/24/2025 11:00:00 PM	9	4	13
9/24/2025 11:15:00 PM	0	3	3
9/24/2025 11:30:00 PM	4	4	8
9/24/2025 11:45:00 PM	2	0	2
Total	3,357	2,510	5,867
Percentage	57.2%	42.8%	
Peak Hour	3:15 PM	2:45 PM	3:15 PM
Volume	627	408	1,003
PHF	0.768	0.895	0.828
Grand Total	4,845	4,706	9,551
Percentage	50.7%	49.3%	



All Traffic Data Services

7 - VOLLMER RD WEST OF MARKSHEFFEL RD

Time	EB	WB	Total
9/24/2025	4	1	5
9/24/2025 12:15:00 AM	1	2	3
9/24/2025 12:30:00 AM	2	2	4
9/24/2025 12:45:00 AM	6	1	7
9/24/2025 1:00:00 AM	3	0	3
9/24/2025 1:15:00 AM	1	1	2
9/24/2025 1:30:00 AM	2	0	2
9/24/2025 1:45:00 AM	0	1	1
9/24/2025 2:00:00 AM	1	0	1
9/24/2025 2:15:00 AM	0	0	0
9/24/2025 2:30:00 AM	0	0	0
9/24/2025 2:45:00 AM	0	1	1
9/24/2025 3:00:00 AM	0	3	3
9/24/2025 3:15:00 AM	0	1	1
9/24/2025 3:30:00 AM	0	1	1
9/24/2025 3:45:00 AM	1	1	2
9/24/2025 4:00:00 AM	1	1	2
9/24/2025 4:15:00 AM	0	5	5
9/24/2025 4:30:00 AM	1	7	8
9/24/2025 4:45:00 AM	2	6	8
9/24/2025 5:00:00 AM	2	7	9
9/24/2025 5:15:00 AM	4	11	15
9/24/2025 5:30:00 AM	4	18	22
9/24/2025 5:45:00 AM	6	26	32
9/24/2025 6:00:00 AM	9	31	40
9/24/2025 6:15:00 AM	9	32	41
9/24/2025 6:30:00 AM	26	42	68
9/24/2025 6:45:00 AM	40	64	104
9/24/2025 7:00:00 AM	44	82	126
9/24/2025 7:15:00 AM	37	86	123
9/24/2025 7:30:00 AM	44	129	173
9/24/2025 7:45:00 AM	75	113	188
9/24/2025 8:00:00 AM	60	63	123
9/24/2025 8:15:00 AM	58	64	122
9/24/2025 8:30:00 AM	62	66	128
9/24/2025 8:45:00 AM	55	56	111
9/24/2025 9:00:00 AM	51	53	104
9/24/2025 9:15:00 AM	36	75	111
9/24/2025 9:30:00 AM	38	51	89
9/24/2025 9:45:00 AM	43	43	86
9/24/2025 10:00:00 AM	39	49	88
9/24/2025 10:15:00 AM	41	42	83
9/24/2025 10:30:00 AM	40	68	108
9/24/2025 10:45:00 AM	46	57	103
9/24/2025 11:00:00 AM	43	53	96
9/24/2025 11:15:00 AM	46	64	110
9/24/2025 11:30:00 AM	55	56	111
9/24/2025 11:45:00 AM	54	35	89
Total	1,092	1,570	2,662
Percentage	41.0%	59.0%	
Peak Hour	7:45 AM	7:00 AM	7:00 AM
Volume	255	410	610
PHF	0.850	0.795	0.811



All Traffic Data Services

7 - VOLLMER RD WEST OF MARKSHEFFEL RD

Time	EB	WB	Total
9/24/2025 12:00:00 PM	68	45	113
9/24/2025 12:15:00 PM	43	46	89
9/24/2025 12:30:00 PM	55	46	101
9/24/2025 12:45:00 PM	55	42	97
9/24/2025 1:00:00 PM	47	38	85
9/24/2025 1:15:00 PM	50	42	92
9/24/2025 1:30:00 PM	36	50	86
9/24/2025 1:45:00 PM	36	53	89
9/24/2025 2:00:00 PM	51	51	102
9/24/2025 2:15:00 PM	45	50	95
9/24/2025 2:30:00 PM	43	74	117
9/24/2025 2:45:00 PM	51	84	135
9/24/2025 3:00:00 PM	71	56	127
9/24/2025 3:15:00 PM	86	48	134
9/24/2025 3:30:00 PM	94	61	155
9/24/2025 3:45:00 PM	62	59	121
9/24/2025 4:00:00 PM	82	63	145
9/24/2025 4:15:00 PM	84	73	157
9/24/2025 4:30:00 PM	73	61	134
9/24/2025 4:45:00 PM	72	49	121
9/24/2025 5:00:00 PM	62	52	114
9/24/2025 5:15:00 PM	59	52	111
9/24/2025 5:30:00 PM	64	64	128
9/24/2025 5:45:00 PM	52	49	101
9/24/2025 6:00:00 PM	52	55	107
9/24/2025 6:15:00 PM	54	38	92
9/24/2025 6:30:00 PM	59	41	100
9/24/2025 6:45:00 PM	48	38	86
9/24/2025 7:00:00 PM	38	34	72
9/24/2025 7:15:00 PM	44	19	63
9/24/2025 7:30:00 PM	39	18	57
9/24/2025 7:45:00 PM	42	19	61
9/24/2025 8:00:00 PM	44	28	72
9/24/2025 8:15:00 PM	28	24	52
9/24/2025 8:30:00 PM	30	12	42
9/24/2025 8:45:00 PM	33	9	42
9/24/2025 9:00:00 PM	35	11	46
9/24/2025 9:15:00 PM	21	6	27
9/24/2025 9:30:00 PM	21	7	28
9/24/2025 9:45:00 PM	16	3	19
9/24/2025 10:00:00 PM	11	6	17
9/24/2025 10:15:00 PM	13	4	17
9/24/2025 10:30:00 PM	6	4	10
9/24/2025 10:45:00 PM	8	2	10
9/24/2025 11:00:00 PM	5	3	8
9/24/2025 11:15:00 PM	6	1	7
9/24/2025 11:30:00 PM	0	3	3
9/24/2025 11:45:00 PM	0	1	1
Total	2,094	1,694	3,788
Percentage	55.3%	44.7%	
Peak Hour	3:15 PM	2:15 PM	3:30 PM
Volume	324	264	578
PHF	0.862	0.786	0.920
Grand Total	3,186	3,264	6,450
Percentage	49.4%	50.6%	

Intersection 660 at Black Forrest Rd and Research Pkwy - Timing table, page 1

Page 1	Phases											
	1	2	3	4	5	6	7	8	9	10	11	12
Min Green	4	4	0	4	4	4	0	4	0	0	0	0
Passage Time I	2.0	3.0	0.0	1.0	1.0	3.0	0.0	1.0	0.0	0.0	0.0	0.0
Passage Time II	2.0	3.0	0.0	1.0	1.0	3.0	0.0	1.0	0.0	0.0	0.0	0.0
Max Green I	10	35	0	20	10	35	0	20	0	0	0	0
Max Green II	10	0	0	0	0	0	0	0	0	0	0	0
Yellow Clearance	3.0	4.5	0.0	3.5	4.5	4.5	0.0	3.5	0.0	0.0	0.0	0.0
Red Clearance	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0
Added Initial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Added Initial	0	0	0	0	0	0	0	0	0	0	0	0
Time Before Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Cars Before Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0
Min Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Green Time	0	0	0	0	0	0	0	0	0	0	0	0
Red Revert Time	5.0	5.0	0.0	5.0	5.0	5.0	0.0	5.0	0.0	0.0	0.0	0.0
Advance Walk Time	0	0	0	0	0	0	0	0	0	0	0	0
Walk Time	0	7	0	7	0	7	0	7	0	0	0	0
Pedestrian Clearance	0	36	0	35	0	36	0	35	0	0	0	0
Handicap Walk	0	0	0	0	0	0	0	0	0	0	0	0
Handicap Ped Clearance	0	0	0	0	0	0	0	0	0	0	0	0
Black Forrest Rd		X			X	X						
Research Pkwy				X				X				
Compass Direction		N		E	N	S		W				
Through, Turn or XPed		Thru		Thru	Left.prt	Thru		Thru				

Intersection 660 at Black Forrest Rd and Research Pkwy - Sequence table, page 1

Page 1	Ring 1 Phases				Ring 2 Phases				Ring 3 Phases			
	1	2	3	4	5	6	7	8	9	10	11	12
State 1					Vehicle							
Barrier 1												
State 2			V & P			V & P						
Barrier 2	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
State 3				V & P				V & P				
Barrier 3	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
State 4												
Barrier 4												
State 5												
Barrier 5												
State 6												
Barrier 6												
State 7												
Barrier 7												
State 8												
Barrier 8												
State 9												
Barrier 9												
State 10												
Barrier 10												
State 11												
Barrier 11												
State 12												
Barrier 12												

Intersection 660 at Black Forrest Rd and Research Pkwy - Phases control table, page 1

Page 1	Vehicle Phases		Ped Phases
	111 123456789012		111 123456789012
Min Recalls		Ped Recalls	
Max Recalls	2 6	Handicap Ped Recalls	
Recall If Maxed		Soft Ped Recalls	
Dual Entry	4 8	Don't Recall (FDW Offset)	2 4 6 8
Do Not Skip		Allow Walk Reduction	
Simultaneous Gap Out		Hold In Walk	
Restricted Phases		Allow Ped Re-service	
Sequential Initial Timing		Rest In Walk	No
Max Timer Starts For Call			
Reduction Starts For Call			
Red To Avoid Left Turn Trap			
Rest In Red	No		

Intersection 660 at Black Forrest Rd and Research Pkwy - Spec signaling cntrl tbl, pg 1

Page 1									
Signaling Control 1					Signaling Control 2				
Function	Flashing permissive left turn	Timer 1	2.0		Function	None		Timer 1	0.0
Operand	0	Timer 2	0.0		Operand	0		Timer 2	0.0
Trigger	Always enabled	Timer 3	0.0		Trigger	Always enabled		Timer 3	0.0
	111	Output 1	25			111		Output 1	1
	123456789012	Output 2	34			123456789012		Output 2	35
Phases 1	5	Output 3	41		Phases 1			Output 3	40
Phases 2	2 6	Output 4	26		Phases 2			Output 4	2
Overlaps 1					Overlaps 1				
Overlaps 2					Overlaps 2				
Signaling Control 3					Signaling Control 4				
Function	None	Timer 1	0.0		Function	None		Timer 1	0.0
Operand	0	Timer 2	0.0		Operand	0		Timer 2	0.0
Trigger	Always enabled	Timer 3	0.0		Trigger	Always enabled		Timer 3	0.0
	111	Output 1	1			111		Output 1	1
	123456789012	Output 2	1			123456789012		Output 2	1
Phases 1		Output 3	1		Phases 1			Output 3	1
Phases 2		Output 4	1		Phases 2			Output 4	1
Overlaps 1					Overlaps 1				
Overlaps 2					Overlaps 2				

Intersection 608 at Black Forrest Rd and Vollmer Rd - Timing table, page 1

Page 1	Phases											
	1	2	3	4	5	6	7	8	9	10	11	12
Min Green	4	10	4	4	4	10	4	4	0	0	0	0
Passage Time I	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	0.0	0.0	0.0	0.0
Passage Time II	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Green I	10	30	10	30	10	30	10	30	0	0	0	0
Max Green II	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Clearance	3.0	5.5	3.0	5.5	3.0	5.5	3.0	5.5	0.0	0.0	0.0	0.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0
Added Initial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Added Initial	0	0	0	0	0	0	0	0	0	0	0	0
Time Before Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Cars Before Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0
Min Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Green Time	0	0	0	0	0	0	0	0	0	0	0	0
Red Revert Time	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	0.0	0.0	0.0
Advance Walk Time	0	0	0	0	0	0	0	0	0	0	0	0
Walk Time	0	7	0	7	0	7	0	7	0	0	0	0
Pedestrian Clearance	0	30	0	34	0	30	0	34	0	0	0	0
Handicap Walk	0	0	0	0	0	0	0	0	0	0	0	0
Handicap Ped Clearance	0	0	0	0	0	0	0	0	0	0	0	0
Black Forrest Rd	X	X			X	X						
Vollmer Rd			X	X			X	X				
Compass Direction	S	N	W	E	N	S	E	W				
Through, Turn or XPed	Left,prt	Thru	Left,prt	Thru	Left,prt	Thru	Left,prt	Thru				

Intersection 608 at Black Forrest Rd and Vollmer Rd - Sequence table, page 1

Page 1	Ring 1 Phases				Ring 2 Phases				Ring 3 Phases			
	1	2	3	4	5	6	7	8	9	10	11	12
State 1	Vehicle				Vehicle							
Barrier 1												
State 2			V & P			V & P						
Barrier 2	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
State 3			Vehicle				Vehicle					
Barrier 3												
State 4				V & P				V & P				
Barrier 4	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
State 5												
Barrier 5												
State 6												
Barrier 6												
State 7												
Barrier 7												
State 8												
Barrier 8												
State 9												
Barrier 9												
State 10												
Barrier 10												
State 11												
Barrier 11												
State 12												
Barrier 12												

Intersection 608 at Black Forrest Rd and Vollmer Rd - Phases control table, page 1

Page 1	Vehicle Phases		Ped Phases
	111 123456789012		111 123456789012
Min Recalls		Ped Recalls	
Max Recalls	2 6	Handicap Ped Recalls	
Recall If Maxed		Soft Ped Recalls	
Dual Entry	3 8	Don't Recall (FDW Offset)	2 4 6 8
Do Not Skip		Allow Walk Reduction	
Simultaneous Gap Out		Hold In Walk	
Restricted Phases		Allow Ped Re-service	2 6
Sequential Initial Timing		Rest In Walk	No
Max Timer Starts For Call			
Reduction Starts For Call			
Red To Avoid Left Turn Trap			
Rest In Red	No		

Intersection 608 at Black Forrest Rd and Vollmer Rd - Schedule table, events 1-25

Event Num	Enabled	Event Type	Event Parameters						Start			Duration			Stop		Repetition		Priority
			Param 1	Param 2	Mon	Day	Hour	Min	Sec	Minutes	Mon	Day	Repeat	Intervals					
1	Yes	Run Plan	Plan 2	Ofst #1	1	1	05	00	00	300	12	31	Weekly	MTWTF	Low				
2	Yes	Run Plan	Plan 3	Ofst #1	1	1	10	00	00	240	12	31	Weekly	MTWTF	Low				
3	Yes	Run Plan	Plan 4	Ofst #1	1	1	14	00	00	480	12	31	Weekly	MTWTF	Very Low				
4	Yes	Run Plan	Plan 5	Ofst #1	1	1	10	00	00	600	12	31	Weekly	S	Low				
5	Yes	Run Plan	Plan 6	Ofst #1	1	1	06	00	00	240	12	31	Weekly	S	Medium				
6	Yes	Run Plan	Plan 6	Ofst #1	1	1	18	00	00	240	12	31	Weekly	S	Medium				
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			

Intersection 531 at Woodmen Rd and Black Forrest Rd - Timing table, page 1

Page 1	Phases											
	1	2	3	4	5	6	7	8	9	10	11	12
Min Green	4	15	4	10	4	15	4	10	0	0	0	0
Passage Time I	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.0	0.0	0.0	0.0
Passage Time II	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Green I	15	40	15	40	20	40	15	40	0	0	0	0
Max Green II	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Clearance	3.0	4.5	3.0	4.0	3.0	4.5	3.0	4.0	0.0	0.0	0.0	0.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0
Added Initial	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Added Initial	0	0	0	0	0	0	0	0	0	0	0	0
Time Before Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Cars Before Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0
Min Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Green Time	0	0	0	0	0	0	0	0	0	0	0	0
Red Revert Time	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Advance Walk Time	0	0	0	0	0	0	0	0	0	0	0	0
Walk Time	0	7	0	7	0	7	0	7	0	0	0	0
Pedestrian Clearance	0	25	0	25	0	25	0	25	0	0	0	0
Handicap Walk	0	0	0	0	0	0	0	0	0	0	0	0
Handicap Ped Clearance	0	0	0	0	0	0	0	0	0	0	0	0
Woodmen Rd	X	X			X	X						
Black Forrest Rd			X	X			X	X				
Compass Direction	W	E	S	N	E	W	N	S				
Through, Turn or XPed	Left,prt	Thru	Left,p/b	Thru	Left,prt	Thru	Left,prt	Thru				

Intersection 531 at Woodmen Rd and Black Forrest Rd - Sequence table, page 1

Page 1	Ring 1 Phases				Ring 2 Phases				Ring 3 Phases			
	1	2	3	4	5	6	7	8	9	10	11	12
State 1	Vehicle				Vehicle							
Barrier 1												
State 2			V & P			V & P						
Barrier 2	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
State 3			Vehicle				Vehicle					
Barrier 3												
State 4				V & P				V & P				
Barrier 4	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
State 5												
Barrier 5												
State 6												
Barrier 6												
State 7												
Barrier 7												
State 8												
Barrier 8												
State 9												
Barrier 9												
State 10												
Barrier 10												
State 11												
Barrier 11												
State 12												
Barrier 12												

Intersection 531 at Woodmen Rd and Black Forrest Rd - Phases control table, page 1

Page 1	Vehicle Phases		Ped Phases
	111 123456789012		111 123456789012
Min Recalls		Ped Recalls	
Max Recalls	2 6	Handicap Ped Recalls	
Recall If Maxed		Soft Ped Recalls	
Dual Entry	4 8	Don't Recall (FDW Offset)	2 4 6 8
Do Not Skip		Allow Walk Reduction	
Simultaneous Gap Out		Hold In Walk	
Restricted Phases		Allow Ped Re-service	2 6
Sequential Initial Timing		Rest In Walk	No
Max Timer Starts For Call			
Reduction Starts For Call			
Red To Avoid Left Turn Trap			
Rest In Red	No		

Intersection 531 at Woodmen Rd and Black Forrest Rd - Schedule table, events 1-25

Event Num	Enabled	Event Type	Event Parameters						Start			Duration			Stop		Repetition		Priority
			Param 1	Param 2	Mon	Day	Hour	Min	Sec	Minutes	Mon	Day	Repeat	Intervals					
1	Yes	Run Plan	Plan 2	Ofst #1	1	1	05	00	00	300	12	31	Weekly	MTWTF	Low				
2	Yes	Run Plan	Plan 3	Ofst #1	1	1	10	00	00	240	12	31	Weekly	MTWTF	Low				
3	Yes	Run Plan	Plan 4	Ofst #1	1	1	14	00	00	480	12	31	Weekly	MTWTF	Very Low				
4	Yes	Run Plan	Plan 5	Ofst #1	1	1	10	00	00	600	12	31	Weekly	S	Low				
5	Yes	Run Plan	Plan 6	Ofst #1	1	1	06	00	00	240	12	31	Weekly	S	Medium				
6	Yes	Run Plan	Plan 6	Ofst #1	1	1	18	00	00	240	12	31	Weekly	S	Medium				
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			

APPENDIX B

Level of Service Definitions

The following information is referenced from the Highway Capacity Manual: A Guide for Multimodal Mobility Analysis, 7th Edition, Transportation Research Board, 2022: Chapter 19 – Signalized Intersections.

Motorized Vehicle Level of Service (LOS) for Signalized Intersections

Levels of service are defined to represent reasonable ranges in control delay.

LOS A Describes operations with a control delay of 10 s/veh or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If it is due to favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

LOS B Describes operations with control delay between 10 and 20 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

LOS C Describes operations with control delay between 20 and 35 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual *cycle failures* (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

LOS D Describes operations with control delay between 35 and 55 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

LOS E Describes operations with control delay between 55 and 80 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

LOS F Describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio ^a	
	$v/c \leq 1.0$	$v/c > 1.0$
≤ 10	A	F
$> 10 - 20$	B	F
$> 20 - 35$	C	F
$> 35 - 55$	D	F
$> 55 - 80$	E	F
> 80	F	F

Note: ^a For approach-based and intersectionwide assessments, LOS is defined solely by control delay.

The following information is referenced from the Highway Capacity Manual: A Guide for Multimodal Mobility Analysis, 7th Edition, Transportation Research Board, 2022: Chapter 20 – Two-Way Stop-Controlled Intersections, Chapter 21 – All-Way Stop-Controlled Intersections, and Chapter 22 - Roundabouts.

Motorized Vehicle Level of Service (LOS) for Unsignalized & Roundabout Intersections

LOS is a quantitative stratification of performance measure(s) representing quality of service. Quality of service describes how well a transportation facility or service operates from a traveler's perspective. LOS is measured on an A – F scale, with LOS A representing the best operating conditions from a traveler's perspective.

Control Delay (s/veh)	<u>LOS by Volume-to-Capacity Ratio^a</u>	
	$v/c \leq 1.0$	$v/c > 1.0$
0 – 10	A	F
> 10 – 15	B	F
> 15 – 25	C	F
> 25 – 35	D	F
> 35 – 50	E	F
> 50	F	F

Note: The LOS criteria apply to each lane on a given approach and to each approach on the minor street. LOS is not calculated for major-street approaches or for the intersection as a whole.

^a For approaches and intersectionwide assessment, LOS is defined solely by control delay.

APPENDIX C

Capacity Worksheets

Timings
1: Black Forest Road & Woodmen Road

Existing Traffic Volumes
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	 	
Traffic Volume (vph)	285	971	101	177	2052	184	140	198	219	172	215	629
Future Volume (vph)	285	971	101	177	2052	184	140	198	219	172	215	629
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.617		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	2230	3539	1583
Satd. Flow (RTOR)			129			137			238			268
Lane Group Flow (vph)	310	1055	110	192	2230	200	152	215	238	187	234	684
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4	8		8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	20.0	47.0	47.0	20.0	47.0	47.0	15.0	28.0	28.0	15.0	28.0	28.0
Total Split (%)	18.2%	42.7%	42.7%	18.2%	42.7%	42.7%	13.6%	25.5%	25.5%	13.6%	25.5%	25.5%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	13.9	41.1	41.1	14.4	41.6	41.6	9.3	22.9	22.9	32.8	22.7	22.7
Actuated g/C Ratio	0.13	0.37	0.37	0.13	0.38	0.38	0.08	0.21	0.21	0.30	0.21	0.21
v/c Ratio	0.71	0.55	0.16	0.83	1.16	0.29	0.53	0.29	0.46	0.24	0.32	1.27
Control Delay (s/veh)	55.8	28.7	3.4	75.3	111.0	9.6	54.9	38.3	8.0	32.6	46.2	162.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	55.8	28.7	3.4	75.3	111.0	9.6	54.9	38.3	8.0	32.6	46.2	162.7
LOS	E	C	A	E	F	A	D	D	A	C	D	F
Approach Delay (s/veh)		32.5			100.7			30.6			116.0	
Approach LOS		C			F			C			F	
Queue Length 50th (ft)	110	218	0	135	~709	29	54	69	0	47	71	~425
Queue Length 95th (ft)	158	264	27	#253	#806	83	88	106	67	80	112	#678
Internal Link Dist (ft)		682			389			338			903	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	468	1901	672	241	1922	683	312	736	518	793	730	539
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.55	0.16	0.80	1.16	0.29	0.49	0.29	0.46	0.24	0.32	1.27

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 98 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Timings 1: Black Forest Road & Woodmen Road

Existing Traffic Volumes
AM Peak Hour

Maximum v/c Ratio: 1.27

Intersection Signal Delay (s/veh): 79.0

Intersection LOS: E

Intersection Capacity Utilization 97.2%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Black Forest Road & Woodmen Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
20 s	47 s	15 s	28 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
20 s	47 s	15 s	28 s

Timings
2: Black Forest Road & Vollmer Road

Existing Traffic Volumes
AM Peak Hour

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	486	59	473	266	9	523
Future Volume (vph)	486	59	473	266	9	523
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Satd. Flow (RTOR)		64		289		
Lane Group Flow (vph)	528	64	514	289	10	568
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	3		2		1	6
Permitted Phases		3		2		
Detector Phase	3	3	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	10.0	10.0	5.0	5.0
Minimum Split (s)	9.0	9.0	17.5	17.5	10.0	12.5
Total Split (s)	35.0	35.0	65.0	65.0	10.0	75.0
Total Split (%)	31.8%	31.8%	59.1%	59.1%	9.1%	68.2%
Yellow Time (s)	3.0	3.0	5.5	5.5	3.0	5.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	7.5	7.5	5.0	7.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	22.4	22.4	72.8	72.8	5.9	75.1
Actuated g/C Ratio	0.20	0.20	0.66	0.66	0.05	0.68
v/c Ratio	0.75	0.17	0.22	0.25	0.05	0.24
Control Delay (s/veh)	48.1	9.3	3.9	1.5	49.9	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	48.1	9.3	3.9	1.5	49.9	7.4
LOS	D	A	A	A	D	A
Approach Delay (s/veh)	43.9		3.0			8.1
Approach LOS	D		A			A
Queue Length 50th (ft)	185	0	17	0	3	72
Queue Length 95th (ft)	229	34	102	53	12	114
Internal Link Dist (ft)	1543		903			4209
Turn Bay Length (ft)	210			585	260	
Base Capacity (vph)	936	478	2340	1144	182	2414
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.13	0.22	0.25	0.05	0.24
Intersection Summary						
Cycle Length: 110						
Actuated Cycle Length: 110						
Offset: 90 (82%), Referenced to phase 2:NBT and 6:SBT, Start of Green						
Natural Cycle: 40						
Control Type: Actuated-Coordinated						

Timings
2: Black Forest Road & Vollmer Road

Existing Traffic Volumes
AM Peak Hour

Maximum v/c Ratio: 0.75

Intersection Signal Delay (s/veh): 16.8

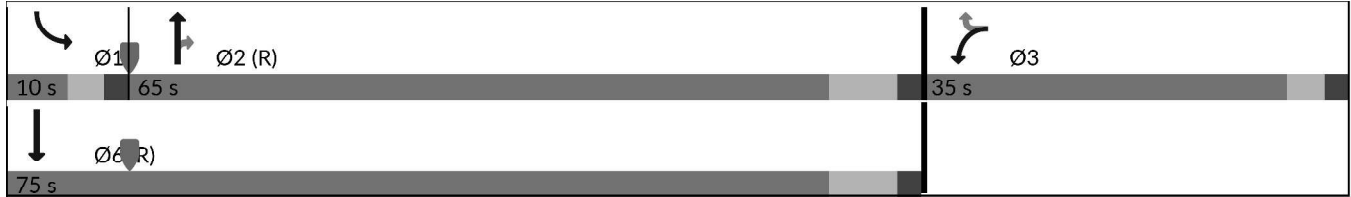
Intersection LOS: B

Intersection Capacity Utilization 38.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2: Black Forest Road & Vollmer Road



Timings 3: Black Forest Road & Research Parkway

Existing Traffic Volumes
AM Peak Hour

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	59	304	655	245	217	146
Future Volume (vph)	59	304	655	245	217	146
Satd. Flow (prot)	1770	1583	3433	3539	3539	1583
Flt Permitted	0.950		0.561			
Satd. Flow (perm)	1770	1583	2027	3539	3539	1583
Satd. Flow (RTOR)		395				159
Lane Group Flow (vph)	77	395	712	266	236	159
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.5	9.5	9.5	9.5	9.5	9.5
Total Split (s)	45.0	45.0	36.0	65.0	29.0	29.0
Total Split (%)	40.9%	40.9%	32.7%	59.1%	26.4%	26.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effect Green (s)	11.3	11.3	87.7	87.7	69.7	69.7
Actuated g/C Ratio	0.10	0.10	0.80	0.80	0.63	0.63
v/c Ratio	0.42	0.76	0.40	0.09	0.11	0.15
Control Delay (s/veh)	51.7	14.8	4.0	3.0	9.5	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	51.7	14.8	4.0	3.0	9.5	2.4
LOS	D	B	A	A	A	A
Approach Delay (s/veh)	20.8			3.7	6.7	
Approach LOS	C			A	A	
Queue Length 50th (ft)	53	0	50	16	30	0
Queue Length 95th (ft)	79	33	105	38	69	33
Internal Link Dist (ft)	835			873	359	
Turn Bay Length (ft)	200		315			285
Base Capacity (vph)	635	821	2005	2820	2242	1061
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.48	0.36	0.09	0.11	0.15
Intersection Summary						
Cycle Length: 110						
Actuated Cycle Length: 110						
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green						
Natural Cycle: 45						
Control Type: Actuated-Coordinated						

Timings
3: Black Forest Road & Research Parkway

Existing Traffic Volumes
AM Peak Hour

Maximum v/c Ratio: 0.76

Intersection Signal Delay (s/veh): 8.7

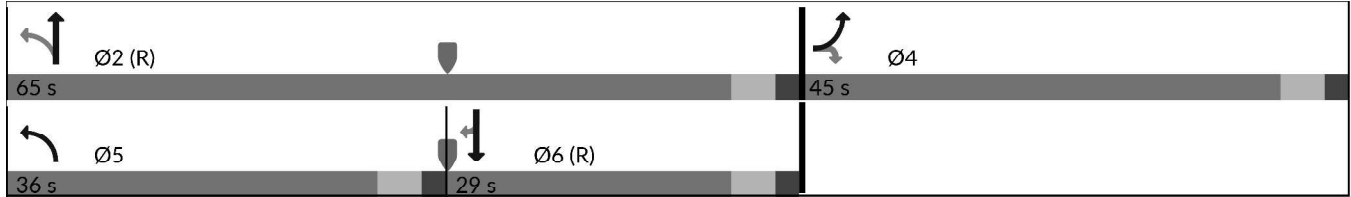
Intersection LOS: A

Intersection Capacity Utilization 41.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Black Forest Road & Research Parkway



HCM 7th TWSC
4: Vollmer Road & Marksheffel Road

Existing Traffic Volumes
AM Peak Hour

Intersection						
Int Delay, s/veh	4					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations	↰	↰	↰↰	↰	↰	↰↰
Traffic Vol, veh/h	110	60	153	51	96	308
Future Vol, veh/h	110	60	153	51	96	308
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	205	-	250	240	-
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	120	65	166	55	104	335
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	542	83	0	0	222	0
Stage 1	166	-	-	-	-	-
Stage 2	376	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	470	960	-	-	1344	-
Stage 1	846	-	-	-	-	-
Stage 2	664	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	434	960	-	-	1344	-
Mov Cap-2 Maneuver	434	-	-	-	-	-
Stage 1	846	-	-	-	-	-
Stage 2	613	-	-	-	-	-
Approach	NW	NE	SW			
HCM Ctrl Dly, s/v	13.82	0	1.88			
HCM LOS	B					
Minor Lane/Major Mvmt	NET	NER	NWL	n1NWL	n2SWL	SWT
Capacity (veh/h)	-	-	434	960	1344	-
HCM Lane V/C Ratio	-	-	0.276	0.068	0.078	-
HCM Ctrl Dly (s/v)	-	-	16.4	9	7.9	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	1.1	0.2	0.3	-

Timings
1: Black Forest Road & Woodmen Road

Existing Traffic Volumes
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	  	
Traffic Volume (vph)	455	1961	182	228	1483	187	119	267	293	224	214	410
Future Volume (vph)	455	1961	182	228	1483	187	119	267	293	224	214	410
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.424		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	1532	3539	1583
Satd. Flow (RTOR)			198			170			266			298
Lane Group Flow (vph)	495	2132	198	248	1612	203	129	290	318	243	233	446
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	pm+pt	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4	8		8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	27.0	55.0	55.0	20.0	48.0	48.0	17.0	28.0	28.0	17.0	28.0	28.0
Total Split (%)	22.5%	45.8%	45.8%	16.7%	40.0%	40.0%	14.2%	23.3%	23.3%	14.2%	23.3%	23.3%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	20.8	48.5	48.5	20.2	47.8	47.8	9.7	17.6	17.6	31.3	19.1	19.1
Actuated g/C Ratio	0.17	0.40	0.40	0.17	0.40	0.40	0.08	0.15	0.15	0.26	0.16	0.16
v/c Ratio	0.83	1.04	0.26	0.84	0.80	0.28	0.46	0.56	0.69	0.42	0.41	0.89
Control Delay (s/veh)	60.7	65.7	4.0	73.4	36.7	7.4	57.8	51.1	17.8	36.1	49.1	39.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	60.7	65.7	4.0	73.4	36.7	7.4	57.8	51.1	17.8	36.1	49.1	39.1
LOS	E	E	A	E	D	A	E	D	B	D	D	D
Approach Delay (s/veh)		60.5			38.2			37.9			40.9	
Approach LOS		E			D			D			D	
Queue Length 50th (ft)	192	~662	0	196	428	17	50	111	36	56	66	4
Queue Length 95th (ft)	256	#758	47	#394	#520	72	81	153	132	87	102	#268
Internal Link Dist (ft)		702			409			338			903	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	632	2055	757	297	2027	733	343	648	507	599	654	535
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	1.04	0.26	0.84	0.80	0.28	0.38	0.45	0.63	0.41	0.36	0.83

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 78 (65%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Timings 1: Black Forest Road & Woodmen Road

Existing Traffic Volumes
PM Peak Hour

Maximum v/c Ratio: 1.04

Intersection Signal Delay (s/veh): 48.2

Intersection LOS: D

Intersection Capacity Utilization 84.0%

ICU Level of Service E

Analysis Period (min) 15

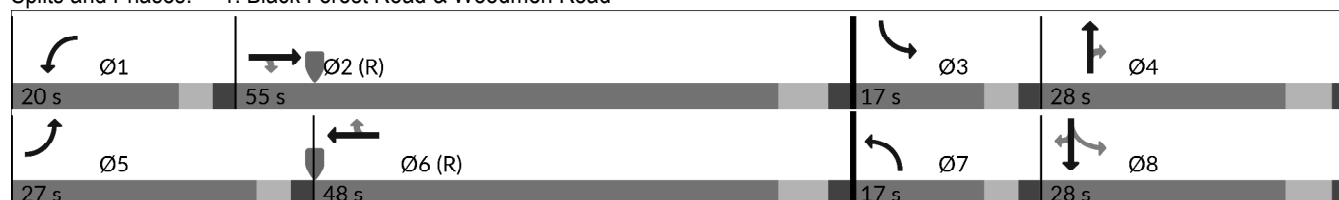
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Black Forest Road & Woodmen Road



Timings
2: Black Forest Road

Existing Traffic Volumes
PM Peak Hour

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	 		 		 	 
Traffic Volume (vph)	365	4	434	441	12	489
Future Volume (vph)	365	4	434	441	12	489
Satd. Flow (prot)	3433	1583	3539	1583	3433	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	3539
Satd. Flow (RTOR)		4		479		
Lane Group Flow (vph)	397	4	472	479	13	532
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	3		2		1	6
Permitted Phases		3		2		
Detector Phase	3	3	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	10.0	10.0	4.0	10.0
Minimum Split (s)	9.0	9.0	17.5	17.5	9.0	17.5
Total Split (s)	36.0	36.0	72.0	72.0	12.0	84.0
Total Split (%)	30.0%	30.0%	60.0%	60.0%	10.0%	70.0%
Yellow Time (s)	3.0	3.0	5.5	5.5	3.0	5.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	7.5	7.5	5.0	7.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	19.2	19.2	83.7	83.7	6.0	88.3
Actuated g/C Ratio	0.16	0.16	0.70	0.70	0.05	0.74
v/c Ratio	0.72	0.02	0.19	0.38	0.08	0.20
Control Delay (s/veh)	55.6	24.8	1.9	2.0	55.1	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	55.6	24.8	1.9	2.0	55.1	5.4
LOS	E	C	A	A	E	A
Approach Delay (s/veh)	55.3		1.9			6.6
Approach LOS	E		A			A
Queue Length 50th (ft)	154	0	8	14	5	60
Queue Length 95th (ft)	200	10	41	41	15	92
Internal Link Dist (ft)	1543		903			4209
Turn Bay Length (ft)	210			585	260	
Base Capacity (vph)	886	411	2469	1249	200	2604
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.01	0.19	0.38	0.07	0.20
Intersection Summary						
Cycle Length: 120						
Actuated Cycle Length: 120						
Offset: 60 (50%), Referenced to phase 2:NBT and 6:SBT, Start of Green						
Natural Cycle: 45						
Control Type: Actuated-Coordinated						

Timings
2: Black Forest Road

Existing Traffic Volumes
PM Peak Hour

Maximum v/c Ratio: 0.72

Intersection Signal Delay (s/veh): 14.6

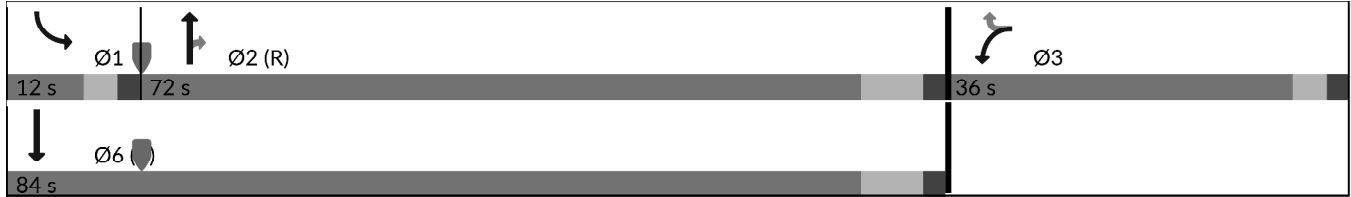
Intersection LOS: B

Intersection Capacity Utilization 41.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2: Black Forest Road



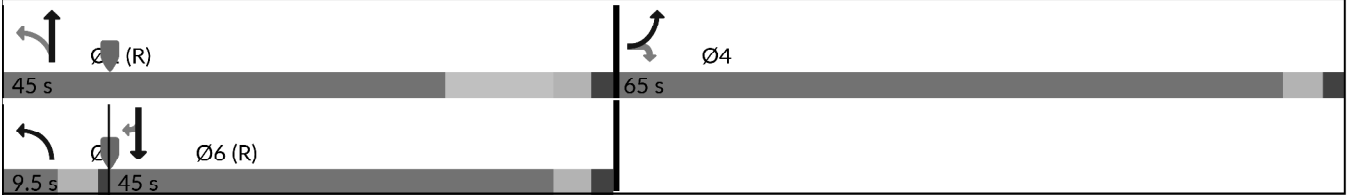
Timings
3: Black Forest Road & Research Parkway

Existing Traffic Volumes
PM Peak Hour

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	100	449	281	281	233	72
Future Volume (vph)	100	449	281	281	233	72
Satd. Flow (prot)	1770	1583	3433	3539	3539	1583
Flt Permitted	0.950		0.564			
Satd. Flow (perm)	1770	1583	2038	3539	3539	1583
Satd. Flow (RTOR)		483				78
Lane Group Flow (vph)	109	488	305	305	253	78
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	9.5	9.5	9.5	9.5	9.5	9.5
Total Split (s)	65.0	65.0	9.5	45.0	45.0	45.0
Total Split (%)	54.4%	54.4%	7.9%	37.7%	37.7%	37.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.5	5.5	5.5	5.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effect Green (s)	14.3	14.3	95.2	94.2	81.7	81.7
Actuated g/C Ratio	0.12	0.12	0.80	0.79	0.68	0.68
v/c Ratio	0.52	0.79	0.18	0.11	0.10	0.07
Control Delay (s/veh)	56.5	14.6	3.5	3.6	7.6	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	56.5	14.6	3.5	3.6	7.6	2.3
LOS	E	B	A	A	A	A
Approach Delay (s/veh)	22.2			3.5	6.3	
Approach LOS	C			A	A	
Queue Length 50th (ft)	83	4	20	22	30	0
Queue Length 95th (ft)	128	106	48	51	65	21
Internal Link Dist (ft)	835			873	359	
Turn Bay Length (ft)	200		315			285
Base Capacity (vph)	881	1030	1717	2789	2420	1107
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.47	0.18	0.11	0.10	0.07
Intersection Summary						
Cycle Length: 119.5						
Actuated Cycle Length: 119.5						
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green						
Natural Cycle: 40						
Control Type: Actuated-Coordinated						

Maximum v/c Ratio: 0.79	
Intersection Signal Delay (s/veh): 11.4	Intersection LOS: B
Intersection Capacity Utilization 43.4%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Black Forest Road & Research Parkway



HCM 7th TWSC
4: Marksheffel Road

Existing Traffic Volumes
PM Peak Hour

Intersection						
Int Delay, s/veh	2.8					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	45	86	248	69	71	206
Future Vol, veh/h	45	86	248	69	71	206
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	205	-	250	240	-
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	49	93	270	75	77	224
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	536	135	0	0	345	0
Stage 1	270	-	-	-	-	-
Stage 2	266	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	475	889	-	-	1211	-
Stage 1	751	-	-	-	-	-
Stage 2	754	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	444	889	-	-	1211	-
Mov Cap-2 Maneuver	444	-	-	-	-	-
Stage 1	751	-	-	-	-	-
Stage 2	706	-	-	-	-	-
Approach	NW	NE	SW			
HCM Ctrl Dly, s/v	11.1	0	2.1			
HCM LOS	B					
Minor Lane/Major Mvmt	NET	NER	NWL	N2	SWL	SWT
Capacity (veh/h)	-	-	444	889	1211	-
HCM Lane V/C Ratio	-	-	0.11	0.105	0.064	-
HCM Ctrl Dly (s/v)	-	-	14.1	9.5	8.2	-
HCM Lane LOS	-	-	B	A	A	-
HCM 95th %tile Q(veh)	-	-	0.4	0.4	0.2	-

Timings
1: Black Forest Road & Woodmen Road

Background Traffic Volumes
AM Peak Hour - Year 2028

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	297	1010	105	184	2135	191	146	206	228	179	224	654
Future Volume (vph)	297	1010	105	184	2135	191	146	206	228	179	224	654
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			129			137			248			266
Lane Group Flow (vph)	323	1098	114	200	2321	208	159	224	248	195	243	711
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	20.0	47.0	47.0	20.0	47.0	47.0	15.0	28.0	28.0	15.0	28.0	28.0
Total Split (%)	18.2%	42.7%	42.7%	18.2%	42.7%	42.7%	13.6%	25.5%	25.5%	13.6%	25.5%	25.5%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	14.0	41.0	41.0	14.5	41.5	41.5	9.3	22.3	22.3	9.7	22.7	22.7
Actuated g/C Ratio	0.13	0.37	0.37	0.13	0.38	0.38	0.08	0.20	0.20	0.09	0.21	0.21
v/c Ratio	0.74	0.58	0.17	0.86	1.21	0.30	0.55	0.31	0.48	0.65	0.33	1.32
Control Delay (s/veh)	56.9	29.2	3.7	78.7	132.2	10.2	55.5	38.9	8.1	73.3	33.3	178.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	56.9	29.2	3.7	78.7	132.2	10.2	55.5	38.9	8.1	73.3	33.3	178.9
LOS	E	C	A	E	F	B	E	D	A	E	C	F
Approach Delay (s/veh)		33.2			119.0			31.0			130.2	
Approach LOS		C			F			C			F	
Queue Length 50th (ft)	115	230	0	142	~758	33	57	72	0	75	53	~527
Queue Length 95th (ft)	164	277	30	#268	#855	89	92	110	67	111	86	#742
Internal Link Dist (ft)		692			359			298			322	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	468	1894	670	241	1916	682	312	717	519	312	728	537
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.58	0.17	0.83	1.21	0.30	0.51	0.31	0.48	0.63	0.33	1.32

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 98 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 130

Control Type: Actuated-Coordinated

Timings

1: Black Forest Road & Woodmen Road

Background Traffic Volumes
AM Peak Hour - Year 2028

Maximum v/c Ratio: 1.32

Intersection Signal Delay (s/veh): 90.1

Intersection LOS: F

Intersection Capacity Utilization 100.5%

ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Black Forest Road & Woodmen Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
20 s	47 s	15 s	28 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
20 s	47 s	15 s	28 s

Timings
2: Black Forest Road & Vollmer Road

Background Traffic Volumes
AM Peak Hour - Year 2028

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	506	61	492	277	9	544
Future Volume (vph)	506	61	492	277	9	544
Satd. Flow (prot)	3433	1583	3539	1583	3433	5085
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	5085
Satd. Flow (RTOR)		66		301		
Lane Group Flow (vph)	550	66	535	301	10	591
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	3		2		1	6
Permitted Phases		3		2		
Detector Phase	3	3	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	10.0	10.0	5.0	5.0
Minimum Split (s)	9.0	9.0	17.5	17.5	10.0	12.5
Total Split (s)	44.0	44.0	54.0	54.0	12.0	66.0
Total Split (%)	40.0%	40.0%	49.1%	49.1%	10.9%	60.0%
Yellow Time (s)	3.0	3.0	5.5	5.5	3.0	5.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	7.5	7.5	5.0	7.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	23.5	23.5	71.7	71.7	5.9	74.0
Actuated g/C Ratio	0.21	0.21	0.65	0.65	0.05	0.67
v/c Ratio	0.75	0.17	0.23	0.26	0.05	0.17
Control Delay (s/veh)	47.0	8.9	3.3	0.9	46.0	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	47.0	8.9	3.3	0.9	46.0	6.1
LOS	D	A	A	A	D	A
Approach Delay (s/veh)	42.9		2.5			6.8
Approach LOS	D		A			A
Queue Length 50th (ft)	192	0	20	0	3	58
Queue Length 95th (ft)	235	34	103	32	m8	52
Internal Link Dist (ft)	1543		500			320
Turn Bay Length (ft)	210			585	260	
Base Capacity (vph)	1217	603	2306	1136	218	3420
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.11	0.23	0.26	0.05	0.17
Intersection Summary						
Cycle Length: 110						
Actuated Cycle Length: 110						
Offset: 90 (82%), Referenced to phase 2:NBT and 6:SBT, Start of Green						
Natural Cycle: 45						
Control Type: Actuated-Coordinated						

Timings
2: Black Forest Road & Vollmer Road

Background Traffic Volumes
AM Peak Hour - Year 2028

Maximum v/c Ratio: 0.75

Intersection Signal Delay (s/veh): 15.9

Intersection LOS: B

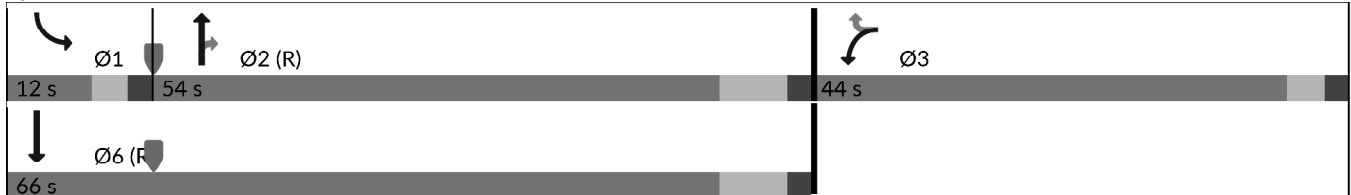
Intersection Capacity Utilization 38.5%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road



Timings 3: Black Forest Road & Research Parkway

Background Traffic Volumes
AM Peak Hour - Year 2028

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	61	316	681	255	226	152
Future Volume (vph)	61	316	681	255	226	152
Satd. Flow (prot)	1770	1583	3433	3539	3539	1583
Flt Permitted	0.950		0.556			
Satd. Flow (perm)	1770	1583	2009	3539	3539	1583
Satd. Flow (RTOR)		343				165
Lane Group Flow (vph)	66	343	740	277	246	165
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.5	9.5	9.5	9.5	9.5	9.5
Total Split (s)	45.0	45.0	36.0	65.0	29.0	29.0
Total Split (%)	40.9%	40.9%	32.7%	59.1%	26.4%	26.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effect Green (s)	10.4	10.4	88.6	88.6	70.5	70.5
Actuated g/C Ratio	0.09	0.09	0.81	0.81	0.64	0.64
v/c Ratio	0.40	0.75	0.42	0.10	0.11	0.15
Control Delay (s/veh)	52.3	15.5	2.4	1.5	9.0	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	52.3	15.5	2.4	1.5	9.0	2.2
LOS	D	B	A	A	A	A
Approach Delay (s/veh)	21.5			2.1	6.3	
Approach LOS	C			A	A	
Queue Length 50th (ft)	46	0	20	7	31	0
Queue Length 95th (ft)	84	85	48	20	67	32
Internal Link Dist (ft)	835			4773	359	
Turn Bay Length (ft)	200		315			285
Base Capacity (vph)	635	788	2013	2851	2267	1073
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.44	0.37	0.10	0.11	0.15
Intersection Summary						
Cycle Length: 110						
Actuated Cycle Length: 110						
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green						
Natural Cycle: 45						
Control Type: Actuated-Coordinated						

Timings
3: Black Forest Road & Research Parkway

Background Traffic Volumes
AM Peak Hour - Year 2028

Maximum v/c Ratio: 0.75

Intersection Signal Delay (s/veh): 7.3

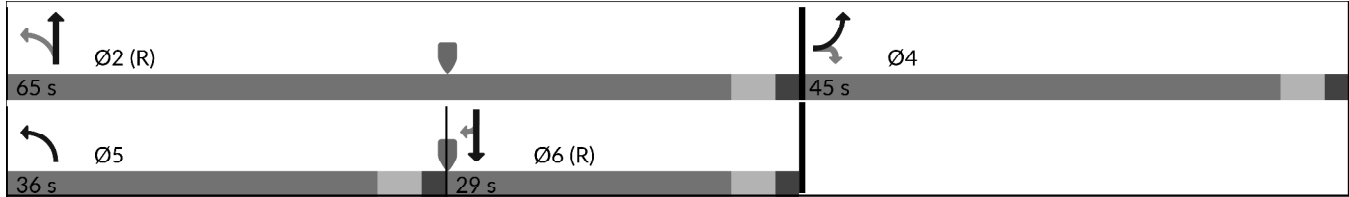
Intersection LOS: A

Intersection Capacity Utilization 42.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Black Forest Road & Research Parkway



HCM 7th TWSC
4: Vollmer Road & Marksheffel Road

Background Traffic Volumes
AM Peak Hour - Year 2028

Intersection												
Int Delay, s/veh	14.5											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	8	112	16	131	17	62	5	164	53	106	320	3
Future Vol, veh/h	8	112	16	131	17	62	5	164	53	106	320	3
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	-	-	None
Storage Length	200	-	200	200	-	205	200	-	250	240	-	200
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	9	122	17	142	18	67	5	178	58	115	348	3

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	688	825	174	654	771	89	351	0	0	236	0	0
Stage 1	578	578	-	189	189	-	-	-	-	-	-	-
Stage 2	109	247	-	465	582	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	333	306	839	352	329	951	1204	-	-	1328	-	-
Stage 1	468	499	-	794	743	-	-	-	-	-	-	-
Stage 2	884	701	-	547	498	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	265	278	839	183	299	951	1204	-	-	1328	-	-
Mov Cap-2 Maneuver	265	278	-	183	299	-	-	-	-	-	-	-
Stage 1	428	456	-	791	739	-	-	-	-	-	-	-
Stage 2	797	698	-	358	454	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Ctrl Dly, s/v	24.96	48.52	0.18	1.97
HCM LOS	C	E		

Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR	
Capacity (veh/h)	1204	-	-	183	299	951	265	278	839	1328	-	-
HCM Lane V/C Ratio	0.005	-	-	0.776	0.062	0.071	0.033	0.437	0.021	0.087	-	-
HCM Ctrl Dly (s/v)	8	-	-	71.2	17.8	9.1	19	27.6	9.4	8	-	-
HCM Lane LOS	A	-	-	F	C	A	C	D	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	5.2	0.2	0.2	0.1	2.1	0.1	0.3	-	-

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Background Traffic Volumes
AM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	8.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	0	25	0	0	104
Future Vol, veh/h	0	0	25	0	0	104
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	50	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	0	0	27	0	0	113
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1	0	55	1
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	54	-
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	-	-	1622	-	952	1083
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	968	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1622	-	936	1083
Mov Cap-2 Maneuver	-	-	-	-	936	-
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	952	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		7.26		8.71	
HCM LOS	A					
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	1083	-	-	1622	-
HCM Lane V/C Ratio	-	0.104	-	-	0.017	-
HCM Ctrl Dly (s/v)	0	8.7	-	-	7.3	-
HCM Lane LOS	A	A	-	-	A	-
HCM 95th %tile Q(veh)	-	0.3	-	-	0.1	-

HCM 7th TWSC
6: Brush Top Road & Stonebridge Access

Background Traffic Volumes
AM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	4.8					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	104	0	104	25	0
Future Vol, veh/h	0	104	0	104	25	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	-	-	-	50	-
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	113	0	113	27	0
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	111	57	0	0	113	0
Stage 1	57	-	-	-	-	-
Stage 2	54	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	886	1010	-	-	1476	-
Stage 1	966	-	-	-	-	-
Stage 2	968	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	870	1010	-	-	1476	-
Mov Cap-2 Maneuver	834	-	-	-	-	-
Stage 1	966	-	-	-	-	-
Stage 2	950	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	9.01	0		7.48		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	1010	1476	-	
HCM Lane V/C Ratio	-	-	0.112	0.018	-	
HCM Ctrl Dly (s/v)	-	-	9	7.5	-	
HCM Lane LOS	-	-	A	A	-	
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-	

Timings
1: Black Forest Road & Woodmen Road

Background Traffic Volumes
PM Peak Hour - Year 2028

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	 	
Traffic Volume (vph)	473	2040	189	237	1543	195	124	278	305	233	223	427
Future Volume (vph)	473	2040	189	237	1543	195	124	278	305	233	223	427
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			205			171			238			295
Lane Group Flow (vph)	514	2217	205	258	1677	212	135	302	332	253	242	464
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	27.0	55.0	55.0	20.0	48.0	48.0	17.0	28.0	28.0	17.0	28.0	28.0
Total Split (%)	22.5%	45.8%	45.8%	16.7%	40.0%	40.0%	14.2%	23.3%	23.3%	14.2%	23.3%	23.3%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	21.0	48.5	48.5	18.9	46.4	46.4	9.9	18.4	18.4	11.7	20.2	20.2
Actuated g/C Ratio	0.18	0.40	0.40	0.16	0.39	0.39	0.08	0.15	0.15	0.10	0.17	0.17
v/c Ratio	0.86	1.08	0.27	0.93	0.85	0.30	0.48	0.56	0.75	0.76	0.41	0.91
Control Delay (s/veh)	62.5	79.7	4.0	89.3	40.0	8.1	57.9	50.4	25.0	80.8	46.7	41.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	62.5	79.7	4.0	89.3	40.0	8.1	57.9	50.4	25.0	80.8	46.7	41.5
LOS	E	E	A	F	D	A	E	D	C	F	D	D
Approach Delay (s/veh)		71.4			42.8			40.8			53.2	
Approach LOS		E			D			D			D	
Queue Length 50th (ft)	202	~713	0	~241	469	22	53	113	65	105	62	4
Queue Length 95th (ft)	#279	#809	47	#413	#576	79	85	160	174	#158	106	#305
Internal Link Dist (ft)		641			398			348			432	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	629	2055	761	278	1964	716	343	648	484	343	664	537
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.82	1.08	0.27	0.93	0.85	0.30	0.39	0.47	0.69	0.74	0.36	0.86

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 78 (65%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Timings 1: Black Forest Road & Woodmen Road

Background Traffic Volumes
PM Peak Hour - Year 2028

Maximum v/c Ratio: 1.08

Intersection Signal Delay (s/veh): 56.4

Intersection LOS: E

Intersection Capacity Utilization 86.3%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Black Forest Road & Woodmen Road

 Ø1 20 s	 Ø2 (R) 55 s	 Ø3 17 s	 Ø4 28 s
 Ø5 27 s	 Ø6 (R) 48 s	 Ø7 17 s	 Ø8 28 s

Timings
2: Black Forest Road & Vollmer Road

Background Traffic Volumes
PM Peak Hour - Year 2028

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	380	4	451	459	12	509
Future Volume (vph)	380	4	451	459	12	509
Satd. Flow (prot)	3433	1583	3539	1583	3433	5085
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	5085
Satd. Flow (RTOR)		4		499		
Lane Group Flow (vph)	413	4	490	499	13	553
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	3		2		1	6
Permitted Phases		3		2		
Detector Phase	3	3	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	10.0	10.0	4.0	10.0
Minimum Split (s)	9.0	9.0	25.5	25.5	9.5	25.5
Total Split (s)	36.0	36.0	72.0	72.0	12.0	84.0
Total Split (%)	30.0%	30.0%	60.0%	60.0%	10.0%	70.0%
Yellow Time (s)	3.0	3.0	5.5	5.5	3.0	5.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	7.5	7.5	5.0	7.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	19.7	19.7	83.2	83.2	6.0	87.8
Actuated g/C Ratio	0.16	0.16	0.69	0.69	0.05	0.73
v/c Ratio	0.73	0.02	0.20	0.40	0.08	0.15
Control Delay (s/veh)	55.4	24.3	2.0	2.1	55.1	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	55.4	24.3	2.0	2.1	55.1	5.2
LOS	E	C	A	A	E	A
Approach Delay (s/veh)	55.1		2.1			6.4
Approach LOS	E		A			A
Queue Length 50th (ft)	161	0	9	15	5	42
Queue Length 95th (ft)	206	10	m48	m55	15	64
Internal Link Dist (ft)	1543		391			260
Turn Bay Length (ft)	210			585	260	
Base Capacity (vph)	886	411	2453	1250	200	3719
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.01	0.20	0.40	0.07	0.15
Intersection Summary						
Cycle Length: 120						
Actuated Cycle Length: 120						
Offset: 60 (50%), Referenced to phase 2:NBT and 6:SBT, Start of Green						
Natural Cycle: 50						
Control Type: Actuated-Coordinated						

Timings
2: Black Forest Road & Vollmer Road

Background Traffic Volumes
PM Peak Hour - Year 2028

Maximum v/c Ratio: 0.73

Intersection Signal Delay (s/veh): 14.5

Intersection LOS: B

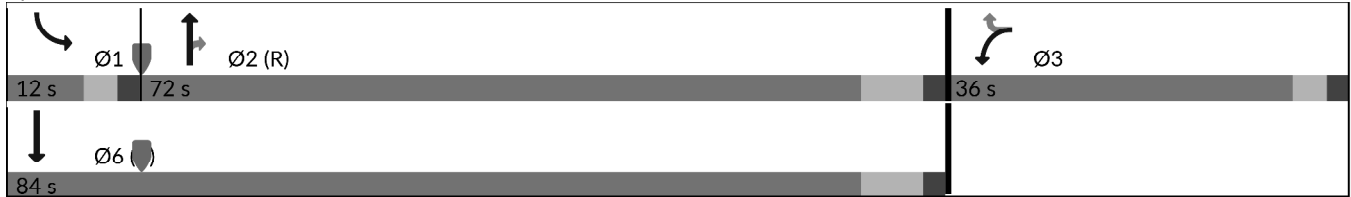
Intersection Capacity Utilization 42.2%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road



Timings
3: Black Forest Road & Research Parkway

Background Traffic Volumes
PM Peak Hour - Year 2028

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	104	467	292	292	242	75
Future Volume (vph)	104	467	292	292	242	75
Satd. Flow (prot)	1770	1583	3433	3539	3539	1583
Flt Permitted	0.950		0.558			
Satd. Flow (perm)	1770	1583	2016	3539	3539	1583
Satd. Flow (RTOR)		469				82
Lane Group Flow (vph)	113	508	317	317	263	82
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	9.5	9.5	9.5	9.5	9.5	9.5
Total Split (s)	65.0	65.0	9.5	45.0	45.0	45.0
Total Split (%)	54.4%	54.4%	7.9%	37.7%	37.7%	37.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.5	5.5	5.5	5.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effect Green (s)	15.7	15.7	93.8	92.8	80.1	80.1
Actuated g/C Ratio	0.13	0.13	0.78	0.78	0.67	0.67
v/c Ratio	0.49	0.83	0.19	0.12	0.11	0.08
Control Delay (s/veh)	53.3	18.1	4.1	4.1	8.5	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	53.3	18.1	4.1	4.1	8.5	2.7
LOS	D	B	A	A	A	A
Approach Delay (s/veh)	24.5			4.1	7.1	
Approach LOS	C			A	A	
Queue Length 50th (ft)	86	28	21	23	32	0
Queue Length 95th (ft)	126	141	58	61	74	24
Internal Link Dist (ft)	835			4833	359	
Turn Bay Length (ft)	200		315			285
Base Capacity (vph)	881	1023	1681	2749	2371	1087
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.50	0.19	0.12	0.11	0.08
Intersection Summary						
Cycle Length: 119.5						
Actuated Cycle Length: 119.5						
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green						
Natural Cycle: 40						
Control Type: Actuated-Coordinated						

Timings
3: Black Forest Road & Research Parkway

Background Traffic Volumes
PM Peak Hour - Year 2028

Maximum v/c Ratio: 0.83

Intersection Signal Delay (s/veh): 12.7

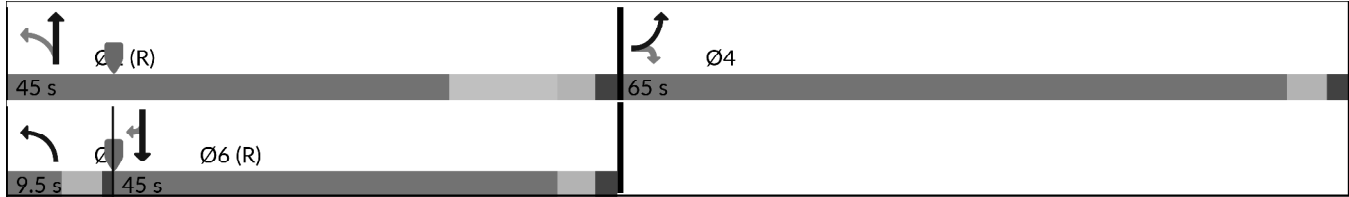
Intersection LOS: B

Intersection Capacity Utilization 44.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Black Forest Road & Research Parkway



HCM 7th TWSC
4: Vollmer Road & Marksheffel Road

Background Traffic Volumes
PM Peak Hour - Year 2028

Intersection												
Int Delay, s/veh	8.7											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	5	69	10	106	59	89	17	277	72	92	214	8
Future Vol, veh/h	5	69	10	106	59	89	17	277	72	92	214	8
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	-	-	None
Storage Length	200	-	200	200	-	205	200	-	250	240	-	200
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	5	75	11	115	64	97	18	301	78	100	233	9

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	652	849	116	692	779	151	241	0	0	379	0	0
Stage 1	433	433	-	338	338	-	-	-	-	-	-	-
Stage 2	220	416	-	354	441	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	353	296	914	330	326	869	1322	-	-	1176	-	-
Stage 1	572	580	-	650	639	-	-	-	-	-	-	-
Stage 2	763	590	-	636	575	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	226	267	914	218	294	869	1322	-	-	1176	-	-
Mov Cap-2 Maneuver	226	267	-	218	294	-	-	-	-	-	-	-
Stage 1	523	531	-	641	630	-	-	-	-	-	-	-
Stage 2	600	582	-	494	526	-	-	-	-	-	-	-

Approach	SE		NW		NE		SW	
HCM Ctrl Dly, s/v	21.74		24.32		0.36		2.45	
HCM LOS	C		C					

Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR	
Capacity (veh/h)	1322	-	-	218	294	869	226	267	914	1176	-	-
HCM Lane V/C Ratio	0.014	-	-	0.529	0.218	0.111	0.024	0.28	0.012	0.085	-	-
HCM Ctrl Dly (s/v)	7.8	-	-	38.7	20.7	9.7	21.3	23.6	9	8.3	-	-
HCM Lane LOS	A	-	-	E	C	A	C	C	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	2.8	0.8	0.4	0.1	1.1	0	0.3	-	-

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Background Traffic Volumes
PM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	7.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	0	84	0	0	64
Future Vol, veh/h	0	0	84	0	0	64
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	50	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	0	0	91	0	0	70
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1	0	184	1
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	183	-
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	-	-	1622	-	806	1083
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	849	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1622	-	760	1083
Mov Cap-2 Maneuver	-	-	-	-	760	-
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	801	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		7.35		8.55	
HCM LOS	A					
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	1083	-	-	1622	-
HCM Lane V/C Ratio	-	0.064	-	-	0.056	-
HCM Ctrl Dly (s/v)	0	8.6	-	-	7.4	-
HCM Lane LOS	A	A	-	-	A	-
HCM 95th %tile Q(veh)	-	0.2	-	-	0.2	-

HCM 7th TWSC
6: Brush Top Road & Stonebridge Access

Background Traffic Volumes
PM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	0					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	64	0	0	84	0
Future Vol, veh/h	0	64	0	0	84	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	-	-	-	50	-
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	70	0	0	91	0

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	183	0	0	0	0	0
Stage 1	0	-	-	-	-	-
Stage 2	183	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	807	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	849	-	-	-	-	-
Platoon blocked, %		-	-	-	-	-
Mov Cap-1 Maneuver	807	-	-	-	-	-
Mov Cap-2 Maneuver	777	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	849	-	-	-	-	-

Approach	WB	NB	SB
HCM Ctrl Dly, s/v		0	
HCM LOS	-		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-
HCM Ctrl Dly (s/v)	-	-	-	-
HCM Lane LOS	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-

Timings
1: Black Forest Road & Woodmen Road

Background Traffic Volumes
AM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	225	1275	35	45	1910	360	115	730	35	400	1855	240
Future Volume (vph)	225	1275	35	45	1910	360	115	730	35	400	1855	240
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			179			265			183			134
Lane Group Flow (vph)	245	1386	38	49	2076	391	125	793	38	435	2016	261
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	11.0	43.0	43.0	9.0	41.0	41.0	9.0	36.0	36.0	22.0	49.0	49.0
Total Split (%)	10.0%	39.1%	39.1%	8.2%	37.3%	37.3%	8.2%	32.7%	32.7%	20.0%	44.5%	44.5%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	6.0	38.3	38.3	4.0	34.5	34.5	4.0	30.5	30.5	16.5	43.0	43.0
Actuated g/C Ratio	0.05	0.35	0.35	0.04	0.31	0.31	0.04	0.28	0.28	0.15	0.39	0.39
v/c Ratio	1.31	0.78	0.06	0.77	1.30	0.58	1.01	0.81	0.07	0.84	1.46	0.37
Control Delay (s/veh)	213.8	36.4	0.2	112.9	173.7	13.7	136.7	44.9	0.2	51.2	236.2	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	213.8	36.4	0.2	112.9	173.7	13.7	136.7	44.9	0.2	51.2	236.2	9.1
LOS	F	D	A	F	F	B	F	D	A	D	F	A
Approach Delay (s/veh)		61.6			147.7			55.1			184.7	
Approach LOS		E			F			E			F	
Queue Length 50th (ft)	~117	332	0	36	~700	67	~47	281	0	139	~1042	66
Queue Length 95th (ft)	#200	393	0	#108	#798	169	#111	357	0	m#227	#1193	m116
Internal Link Dist (ft)		692			359			298			322	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	187	1770	667	64	1594	678	124	980	570	530	1383	700
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.31	0.78	0.06	0.77	1.30	0.58	1.01	0.81	0.07	0.82	1.46	0.37

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 98 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Timings

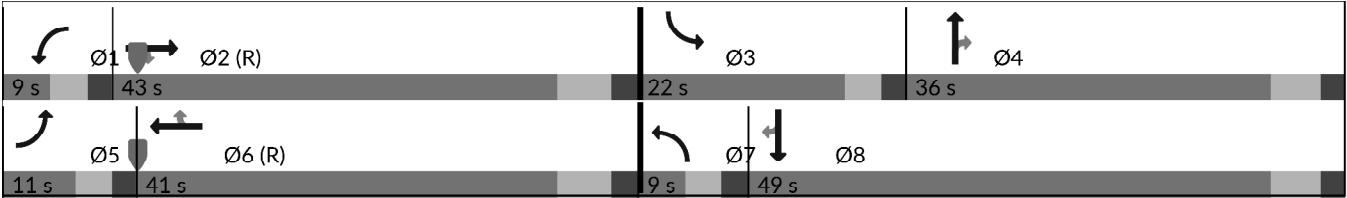
1: Black Forest Road & Woodmen Road

Background Traffic Volumes

AM Peak Hour - Year 2045

Maximum v/c Ratio: 1.46	
Intersection Signal Delay (s/veh): 130.9	Intersection LOS: F
Intersection Capacity Utilization 116.7%	ICU Level of Service H
Analysis Period (min) 15	
~ Volume exceeds capacity, queue is theoretically infinite.	
Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 1: Black Forest Road & Woodmen Road



Timings
2: Black Forest Road & Vollmer Road

Background Traffic Volumes
AM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 			 	 		 	  	
Traffic Volume (vph)	40	10	20	600	15	50	30	980	405	250	1600	100
Future Volume (vph)	40	10	20	600	15	50	30	980	405	250	1600	100
Satd. Flow (prot)	3433	3185	0	3433	1863	1583	3433	3539	1583	3433	5040	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3185	0	3433	1863	1583	3433	3539	1583	3433	5040	0
Satd. Flow (RTOR)		22				183			440		12	
Lane Group Flow (vph)	43	33	0	652	16	54	33	1065	440	272	1848	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Detector Phase	7	4		3	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		4.0	5.0	5.0	5.0	10.0	10.0	5.0	5.0	
Minimum Split (s)	9.5	10.5		9.0	23.5	23.5	9.5	17.5	17.5	10.0	12.5	
Total Split (s)	9.5	10.5		32.0	33.0	33.0	9.5	50.5	50.5	17.0	58.0	
Total Split (%)	8.6%	9.5%		29.1%	30.0%	30.0%	8.6%	45.9%	45.9%	15.5%	52.7%	
Yellow Time (s)	3.5	3.5		3.0	3.5	3.5	3.5	5.5	5.5	3.0	5.5	
All-Red Time (s)	1.0	2.0		2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	5.5		5.0	5.5	5.5	4.5	7.5	7.5	5.0	7.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	
Act Effect Green (s)	5.0	5.4		24.7	24.9	24.9	5.4	49.5	49.5	11.8	60.6	
Actuated g/C Ratio	0.05	0.05		0.22	0.23	0.23	0.05	0.45	0.45	0.11	0.55	
v/c Ratio	0.28	0.19		0.85	0.04	0.11	0.20	0.67	0.46	0.74	0.66	
Control Delay (s/veh)	55.4	29.1		51.9	31.9	0.4	47.1	27.2	10.8	65.8	11.6	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay (s/veh)	55.4	29.1		51.9	31.9	0.4	47.1	27.2	10.8	65.8	11.6	
LOS	E	C		D	C	A	D	C	B	E	B	
Approach Delay (s/veh)		44.0			47.6			22.9			18.5	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	15	4		228	9	0	10	413	150	103	265	
Queue Length 95th (ft)	35	21		293	27	0	m14	m455	m211	m87	m148	
Internal Link Dist (ft)		991			1543			500			320	
Turn Bay Length (ft)	200			210			200		585	260		
Base Capacity (vph)	156	176		842	465	533	167	1593	954	380	2781	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.28	0.19		0.77	0.03	0.10	0.20	0.67	0.46	0.72	0.66	

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Timings
2: Black Forest Road & Vollmer Road

Background Traffic Volumes
AM Peak Hour - Year 2045

Maximum v/c Ratio: 0.85

Intersection Signal Delay (s/veh): 25.2

Intersection LOS: C

Intersection Capacity Utilization 75.7%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road



Timings
3: Black Forest Road & Marksheffel Road

Background Traffic Volumes
AM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	840	450	150	1010	350	500	955	250	355	1300	200
Future Volume (vph)	200	840	450	150	1010	350	500	955	250	355	1300	200
Satd. Flow (prot)	3433	3355	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3355	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)		91				268			134			134
Lane Group Flow (vph)	217	1402	0	163	1098	380	543	1038	272	386	1413	217
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		5.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	4.0
Minimum Split (s)	9.5	9.5		10.5	10.5	10.5	9.5	9.5	9.5	10.5	9.5	9.5
Total Split (s)	12.0	38.0		11.0	37.0	37.0	19.0	42.6	42.6	18.4	42.0	42.0
Total Split (%)	10.9%	34.5%		10.0%	33.6%	33.6%	17.3%	38.7%	38.7%	16.7%	38.2%	38.2%
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	6.5	32.5		5.5	31.5	31.5	13.5	37.1	37.1	12.9	36.5	36.5
Actuated g/C Ratio	0.06	0.30		0.05	0.29	0.29	0.12	0.34	0.34	0.12	0.33	0.33
v/c Ratio	1.07	1.33		0.95	1.08	0.59	1.29	0.87	0.44	0.96	1.20	0.35
Control Delay (s/veh)	133.8	185.8		110.5	91.8	14.1	190.6	30.9	5.6	84.9	133.7	12.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	133.8	185.8		110.5	91.8	14.1	190.6	30.9	5.6	84.9	133.7	12.6
LOS	F	F		F	F	B	F	C	A	F	F	B
Approach Delay (s/veh)		178.8			75.6			74.0			111.3	
Approach LOS		F			E			E			F	
Queue Length 50th (ft)	~89	~667		61	~465	62	~254	380	6	144	~650	42
Queue Length 95th (ft)	#168	#809		#130	#600	163	#368	#488	35	#241	#790	104
Internal Link Dist (ft)		835			1924			4773			359	
Turn Bay Length (ft)	200			200		200	315		200	200		285
Base Capacity (vph)	202	1055		171	1013	644	421	1193	622	402	1174	614
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.07	1.33		0.95	1.08	0.59	1.29	0.87	0.44	0.96	1.20	0.35

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Timings 3: Black Forest Road & Marksheffel Road

Background Traffic Volumes
AM Peak Hour - Year 2045

Maximum v/c Ratio: 1.33

Intersection Signal Delay (s/veh): 108.7

Intersection LOS: F

Intersection Capacity Utilization 110.4%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Black Forest Road & Marksheffel Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
18.4 s	42.6 s	11 s	38 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
19 s	42 s	12 s	37 s

Timings
4: Vollmer Road & Marksheffel Road

Background Traffic Volumes
AM Peak Hour - Year 2045

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	189	1407	92	178	1177	88	157	227	74	146	449	213
Future Volume (vph)	189	1407	92	178	1177	88	157	227	74	146	449	213
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.096			0.100			0.310			0.550		
Satd. Flow (perm)	179	3539	1583	186	3539	1583	577	3539	1583	1025	3539	1583
Satd. Flow (RTOR)			164			164			164			179
Lane Group Flow (vph)	205	1529	100	193	1279	96	171	247	80	159	488	232
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Total Split (s)	14.2	47.0	47.0	12.6	45.4	45.4	11.4	18.4	18.4	12.0	19.0	19.0
Total Split (%)	15.8%	52.2%	52.2%	14.0%	50.4%	50.4%	12.7%	20.4%	20.4%	13.3%	21.1%	21.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	Max	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	50.2	41.5	41.5	47.0	39.9	39.9	18.8	12.9	12.9	20.0	13.5	13.5
Actuated g/C Ratio	0.56	0.46	0.46	0.52	0.44	0.44	0.21	0.14	0.14	0.22	0.15	0.15
v/c Ratio	0.81	0.94	0.12	0.87	0.82	0.12	0.86	0.49	0.22	0.57	0.92	0.60
Control Delay (s/veh)	43.2	35.6	0.8	54.5	27.1	0.6	67.7	39.2	1.4	35.8	62.7	17.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	43.2	35.6	0.8	54.5	27.1	0.6	67.7	39.2	1.4	35.8	62.7	17.0
LOS	D	D	A	D	C	A	E	D	A	D	E	B
Approach Delay (s/veh)		34.6			28.8			42.9			45.8	
Approach LOS		C			C			D			D	
Queue Length 50th (ft)	64	425	0	59	328	0	79	70	0	73	148	27
Queue Length 95th (ft)	#183	#592	6	#184	419	4	#162	108	0	128	#243	100
Internal Link Dist (ft)		770			950			4352			1886	
Turn Bay Length (ft)	200		200	200		205	200		250	240		200
Base Capacity (vph)	253	1631	818	222	1569	793	198	507	367	281	530	389
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.94	0.12	0.87	0.82	0.12	0.86	0.49	0.22	0.57	0.92	0.60

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NWTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Timings 4: Vollmer Road & Marksheffel Road

Background Traffic Volumes
AM Peak Hour - Year 2045

Maximum v/c Ratio: 0.94

Intersection Signal Delay (s/veh): 35.6

Intersection LOS: D

Intersection Capacity Utilization 88.2%

ICU Level of Service E

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 4: Vollmer Road & Marksheffel Road

 Ø1 14.2 s	 Ø2 (R) 45.4 s	 Ø3 12 s	 Ø4 18.4 s
 Ø5 12.6 s	 Ø6 47 s	 Ø7 11.4 s	 Ø8 19 s

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Background Traffic Volumes
AM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	6.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Traffic Vol, veh/h	1440	5	20	1490	32	88
Future Vol, veh/h	1440	5	20	1490	32	88
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	200	-	50	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	1565	5	22	1620	35	96

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1571
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	416
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	416
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.19	156.42
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	26	337	-	-	416	-
HCM Lane V/C Ratio	1.361	0.284	-	-	0.052	-
HCM Ctrl Dly (s/v)	\$ 531.9	19.9	-	-	14.1	-
HCM Lane LOS	F	C	-	-	B	-
HCM 95th %tile Q(veh)	4.2	1.1	-	-	0.2	-

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

HCM 7th TWSC
6: Brush Top Road & Stonebridge Access

Background Traffic Volumes
AM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	5.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	72	48	0	25	0
Future Vol, veh/h	0	72	48	0	25	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	-	-	-	50	-
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	78	52	0	27	0
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	107	52	0	0	52	0
Stage 1	52	-	-	-	-	-
Stage 2	54	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	891	1015	-	-	1554	-
Stage 1	970	-	-	-	-	-
Stage 2	968	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	875	1015	-	-	1554	-
Mov Cap-2 Maneuver	838	-	-	-	-	-
Stage 1	970	-	-	-	-	-
Stage 2	951	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	8.84	0		7.36		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	1015	1554	-	
HCM Lane V/C Ratio	-	-	0.077	0.017	-	
HCM Ctrl Dly (s/v)	-	-	8.8	7.4	-	
HCM Lane LOS	-	-	A	A	-	
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-	

Timings
1: Black Forest Road & Woodmen Road

Background Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	 	
Traffic Volume (vph)	255	1530	85	15	1340	30	80	1300	85	20	960	395
Future Volume (vph)	255	1530	85	15	1340	30	80	1300	85	20	960	395
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			129			129			134			134
Lane Group Flow (vph)	277	1663	92	16	1457	33	87	1413	92	22	1043	429
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	14.0	44.0	44.0	9.0	39.0	39.0	9.0	48.0	48.0	9.0	48.0	48.0
Total Split (%)	12.7%	40.0%	40.0%	8.2%	35.5%	35.5%	8.2%	43.6%	43.6%	8.2%	43.6%	43.6%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	9.0	42.9	42.9	4.0	32.5	32.5	4.0	47.4	47.4	4.0	42.0	42.0
Actuated g/C Ratio	0.08	0.39	0.39	0.04	0.30	0.30	0.04	0.43	0.43	0.04	0.38	0.38
v/c Ratio	0.99	0.84	0.13	0.25	0.97	0.06	0.70	0.93	0.12	0.18	0.77	0.62
Control Delay (s/veh)	102.4	36.0	2.1	61.1	55.8	0.2	81.3	42.1	1.6	48.0	27.8	20.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	102.4	36.0	2.1	61.1	55.8	0.2	81.3	42.1	1.6	48.0	27.8	20.0
LOS	F	D	A	E	E	A	F	D	A	D	C	C
Approach Delay (s/veh)		43.5			54.6			41.9			25.9	
Approach LOS		D			D			D			C	
Queue Length 50th (ft)	104	367	0	11	377	0	32	463	0	6	354	241
Queue Length 95th (ft)	#193	#534	17	36	#483	0	#73	#720	13	m11	488	336
Internal Link Dist (ft)		641			398			348			432	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	280	1983	695	64	1502	558	124	1524	758	124	1351	687
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.99	0.84	0.13	0.25	0.97	0.06	0.70	0.93	0.12	0.18	0.77	0.62

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Timings

1: Black Forest Road & Woodmen Road

Background Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 0.99

Intersection Signal Delay (s/veh): 41.7

Intersection LOS: D

Intersection Capacity Utilization 83.7%

ICU Level of Service E

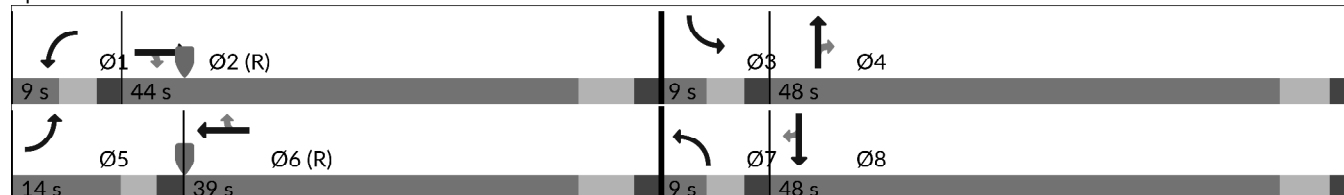
Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Black Forest Road & Woodmen Road



Timings
2: Black Forest Road & Vollmer Road

Background Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	400	65	125	200	245	300	100	1100	550	30	1170	175
Future Volume (vph)	400	65	125	200	245	300	100	1100	550	30	1170	175
Satd. Flow (prot)	3433	3189	0	3433	1863	1583	3433	3539	1583	3433	4989	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3189	0	3433	1863	1583	3433	3539	1583	3433	4989	0
Satd. Flow (RTOR)		136				149			570		29	
Lane Group Flow (vph)	435	207	0	217	266	326	109	1196	598	33	1462	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Detector Phase	7	4		3	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		4.0	5.0	5.0	5.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	10.5	23.5		23.5	23.5	23.5	10.5	25.5	25.5	9.5	25.5	
Total Split (s)	23.0	25.5		23.5	26.0	26.0	11.1	51.5	51.5	9.5	49.9	
Total Split (%)	20.9%	23.2%		21.4%	23.6%	23.6%	10.1%	46.8%	46.8%	8.6%	45.4%	
Yellow Time (s)	3.5	3.5		3.0	3.5	3.5	3.5	5.5	5.5	3.0	5.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5		5.0	5.5	5.5	5.5	7.5	7.5	5.0	7.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	
Act Effect Green (s)	16.9	24.1		12.2	18.9	18.9	6.2	50.0	50.0	5.0	44.0	
Actuated g/C Ratio	0.15	0.22		0.11	0.17	0.17	0.06	0.45	0.45	0.05	0.40	
v/c Ratio	0.83	0.26		0.57	0.83	0.83	0.56	0.74	0.58	0.21	0.73	
Control Delay (s/veh)	59.1	13.9		52.0	65.9	41.4	44.6	33.8	15.8	71.7	17.8	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay (s/veh)	59.1	13.9		52.0	65.9	41.4	44.6	33.8	15.8	71.7	17.8	
LOS	E	B		D	E	D	D	C	B	E	B	
Approach Delay (s/veh)		44.5			52.3			28.7			19.0	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	156	21		77	183	124	40	482	212	12	290	
Queue Length 95th (ft)	#227	54		113	#304	#263	m42	m521	m316	m12	m280	
Internal Link Dist (ft)		954			1543			391			260	
Turn Bay Length (ft)	200			210			200		585	260		
Base Capacity (vph)	546	803		577	347	416	193	1608	1030	155	2012	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.80	0.26		0.38	0.77	0.78	0.56	0.74	0.58	0.21	0.73	

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 95

Control Type: Actuated-Coordinated

Timings

2: Black Forest Road & Vollmer Road

Background Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 0.83

Intersection Signal Delay (s/veh): 31.8

Intersection LOS: C

Intersection Capacity Utilization 77.6%

ICU Level of Service D

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road

	Ø1		Ø2 (R)		Ø3		Ø4
9.5 s		51.5 s		23.5 s		25.5 s	
	Ø5		Ø6 (R)		Ø7		Ø8
11.1 s		49.9 s		23 s		26 s	

Timings
3: Black Forest Road & Marksheffel Road

Background Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	350	510	425	400	510	375	500	735	400	360	790	250
Future Volume (vph)	350	510	425	400	510	375	500	735	400	360	790	250
Satd. Flow (prot)	3433	3299	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3299	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)		184				288			316			272
Lane Group Flow (vph)	380	1016	0	435	554	408	543	799	435	391	859	272
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0
Minimum Split (s)	9.5	9.5		10.5	10.5	10.5	10.5	9.5	9.5	10.5	9.5	9.5
Total Split (s)	20.8	33.2		19.8	32.2	32.2	23.2	37.6	37.6	19.4	33.8	33.8
Total Split (%)	18.9%	30.2%		18.0%	29.3%	29.3%	21.1%	34.2%	34.2%	17.6%	30.7%	30.7%
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	14.9	27.7		14.3	27.1	27.1	17.7	32.1	32.1	13.9	28.3	28.3
Actuated g/C Ratio	0.14	0.25		0.13	0.25	0.25	0.16	0.29	0.29	0.13	0.26	0.26
v/c Ratio	0.82	1.05		0.98	0.64	0.67	0.98	0.77	0.64	0.90	0.94	0.45
Control Delay (s/veh)	61.5	76.1		85.2	41.0	17.3	80.5	32.4	9.5	72.7	59.6	6.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	61.5	76.1		85.2	41.0	17.3	80.5	32.4	9.5	72.7	59.6	6.5
LOS	E	E		F	D	B	F	C	A	E	E	A
Approach Delay (s/veh)		72.1			47.9			41.5			53.5	
Approach LOS		E			D			D			D	
Queue Length 50th (ft)	137	~363		162	188	72	202	204	36	144	318	0
Queue Length 95th (ft)	#206	#497		#265	249	188	m#311	309	m73	#232	#446	64
Internal Link Dist (ft)		835			1530			4833			359	
Turn Bay Length (ft)	200			200		200	315		200	200		285
Base Capacity (vph)	477	968		446	872	607	552	1032	685	433	910	609
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	1.05		0.98	0.64	0.67	0.98	0.77	0.64	0.90	0.94	0.45

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 110

Control Type: Actuated-Coordinated

Timings 3: Black Forest Road & Marksheffel Road

Background Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 1.05

Intersection Signal Delay (s/veh): 53.0

Intersection LOS: D

Intersection Capacity Utilization 93.6%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Black Forest Road & Marksheffel Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
19.4 s	37.6 s	19.8 s	33.2 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
23.2 s	33.8 s	20.8 s	32.2 s

Timings
4: Vollmer Road & Marksheffel Road

Background Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	313	1061	129	124	937	125	205	380	101	122	300	286
Future Volume (vph)	313	1061	129	124	937	125	205	380	101	122	300	286
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.126			0.152			0.248			0.435		
Satd. Flow (perm)	235	3539	1583	283	3539	1583	462	3539	1583	810	3539	1583
Satd. Flow (RTOR)			173			223			173			311
Lane Group Flow (vph)	340	1153	140	135	1018	136	223	413	110	133	326	311
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Total Split (s)	30.0	62.4	62.4	17.4	49.8	49.8	19.2	27.2	27.2	13.0	21.0	21.0
Total Split (%)	25.0%	52.0%	52.0%	14.5%	41.5%	41.5%	16.0%	22.7%	22.7%	10.8%	17.5%	17.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	Max	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	73.8	56.9	56.9	61.9	48.9	48.9	33.6	20.6	20.6	22.1	14.6	14.6
Actuated g/C Ratio	0.62	0.47	0.47	0.52	0.41	0.41	0.28	0.17	0.17	0.18	0.12	0.12
v/c Ratio	0.82	0.69	0.17	0.44	0.71	0.18	0.81	0.68	0.27	0.64	0.76	0.67
Control Delay (s/veh)	39.9	27.3	1.7	17.8	33.9	0.5	58.6	52.7	2.4	50.3	62.9	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	39.9	27.3	1.7	17.8	33.9	0.5	58.6	52.7	2.4	50.3	62.9	13.0
LOS	D	C	A	B	C	A	E	D	A	D	E	B
Approach Delay (s/veh)		27.7			28.7			47.0			40.6	
Approach LOS		C			C			D			D	
Queue Length 50th (ft)	165	362	0	41	361	0	143	160	0	81	131	0
Queue Length 95th (ft)	276	443	20	76	455	0	#228	216	7	136	183	88
Internal Link Dist (ft)		901			950			4352			1886	
Turn Bay Length (ft)	200		200	200		205	200		250	240		200
Base Capacity (vph)	460	1678	841	306	1441	777	278	639	427	209	457	475
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.69	0.17	0.44	0.71	0.18	0.80	0.65	0.26	0.64	0.71	0.65

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NWTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Timings 4: Vollmer Road & Marksheffel Road

Background Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 0.82

Intersection Signal Delay (s/veh): 33.5

Intersection LOS: C

Intersection Capacity Utilization 81.2%

ICU Level of Service D

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 4: Vollmer Road & Marksheffel Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
30 s	49.8 s	13 s	27.2 s
 Ø5	 Ø6	 Ø7	 Ø8
17.4 s	62.4 s	19.2 s	21 s

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Background Traffic Volumes
PM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	2.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓	↑
Traffic Vol, veh/h	1253	17	68	1217	20	54
Future Vol, veh/h	1253	17	68	1217	20	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	200	-	50	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	1362	18	74	1323	22	59
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1380	0	2171	681
Stage 1	-	-	-	-	1362	-
Stage 2	-	-	-	-	809	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	492	-	40	393
Stage 1	-	-	-	-	203	-
Stage 2	-	-	-	-	398	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	492	-	34	393
Mov Cap-2 Maneuver	-	-	-	-	34	-
Stage 1	-	-	-	-	203	-
Stage 2	-	-	-	-	338	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		0.72		71.92	
HCM LOS	F					
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	34	393	-	-	492	-
HCM Lane V/C Ratio	0.642	0.149	-	-	0.15	-
HCM Ctrl Dly (s/v)	223.5	15.8	-	-	13.6	-
HCM Lane LOS	F	C	-	-	B	-
HCM 95th %tile Q(veh)	2.2	0.5	-	-	0.5	-

HCM 7th TWSC
6: Brush Top Road & Stonebridge Access

Background Traffic Volumes
PM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	0					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	74	0	0	84	0
Future Vol, veh/h	0	74	0	0	84	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	-	-	-	50	-
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	80	0	0	91	0

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	183	0	0	0	0
Stage 1	0	-	-	-	-
Stage 2	183	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218
Pot Cap-1 Maneuver	807	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	849	-	-	-	-
Platoon blocked, %		-	-	-	-
Mov Cap-1 Maneuver	807	-	-	-	-
Mov Cap-2 Maneuver	777	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	849	-	-	-	-

Approach	WB	NB	SB
HCM Ctrl Dly, s/v		0	
HCM LOS	-		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-
HCM Ctrl Dly (s/v)	-	-	-	-
HCM Lane LOS	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-

Timings

1: Black Forest Road & Woodmen Road

Total Traffic Volumes AM Peak Hour - Year 2028

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	 	
Traffic Volume (vph)	314	1010	105	184	2135	203	146	206	228	212	224	700
Future Volume (vph)	314	1010	105	184	2135	203	146	206	228	212	224	700
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			129			145			248			266
Lane Group Flow (vph)	341	1098	114	200	2321	221	159	224	248	230	243	761
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	20.0	47.0	47.0	20.0	47.0	47.0	15.0	28.0	28.0	15.0	28.0	28.0
Total Split (%)	18.2%	42.7%	42.7%	18.2%	42.7%	42.7%	13.6%	25.5%	25.5%	13.6%	25.5%	25.5%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	14.3	41.0	41.0	14.5	41.2	41.2	9.3	22.1	22.1	9.9	22.7	22.7
Actuated g/C Ratio	0.13	0.37	0.37	0.13	0.37	0.37	0.08	0.20	0.20	0.09	0.21	0.21
v/c Ratio	0.77	0.58	0.17	0.86	1.22	0.32	0.55	0.32	0.48	0.75	0.33	1.42
Control Delay (s/veh)	58.2	29.2	3.7	78.7	135.3	10.3	55.5	39.0	8.1	78.3	33.8	218.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	58.2	29.2	3.7	78.7	135.3	10.3	55.5	39.0	8.1	78.3	33.8	218.4
LOS	E	C	A	E	F	B	E	D	A	E	C	F
Approach Delay (s/veh)		33.7			121.1			31.0			155.9	
Approach LOS		C			F			C			F	
Queue Length 50th (ft)	122	230	0	142	~758	36	57	72	0	89	51	~574
Queue Length 95th (ft)	173	277	30	#268	#855	94	92	110	67	#139	90	#803
Internal Link Dist (ft)		692			359			298			322	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	468	1894	670	241	1905	683	312	711	516	312	728	537
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.58	0.17	0.83	1.22	0.32	0.51	0.32	0.48	0.74	0.33	1.42

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 98 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 130

Control Type: Actuated-Coordinated

Timings 1: Black Forest Road & Woodmen Road

Total Traffic Volumes
AM Peak Hour - Year 2028

Maximum v/c Ratio: 1.42

Intersection Signal Delay (s/veh): 96.8

Intersection LOS: F

Intersection Capacity Utilization 103.3%

ICU Level of Service G

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Black Forest Road & Woodmen Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
20 s	47 s	15 s	28 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
20 s	47 s	15 s	28 s

Timings
2: Black Forest Road & Vollmer Road

Total Traffic Volumes
AM Peak Hour - Year 2028

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	585	61	521	277	21	544
Future Volume (vph)	585	61	521	277	21	544
Satd. Flow (prot)	3433	1583	3539	1583	3433	5085
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	5085
Satd. Flow (RTOR)		66		301		
Lane Group Flow (vph)	636	66	566	301	23	591
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	3		2		1	6
Permitted Phases		3		2		
Detector Phase	3	3	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	10.0	10.0	5.0	5.0
Minimum Split (s)	9.0	9.0	17.5	17.5	10.0	12.5
Total Split (s)	44.0	44.0	54.0	54.0	12.0	66.0
Total Split (%)	40.0%	40.0%	49.1%	49.1%	10.9%	60.0%
Yellow Time (s)	3.0	3.0	5.5	5.5	3.0	5.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	7.5	7.5	5.0	7.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	26.5	26.5	66.2	66.2	6.3	71.0
Actuated g/C Ratio	0.24	0.24	0.60	0.60	0.06	0.65
v/c Ratio	0.77	0.15	0.27	0.28	0.12	0.18
Control Delay (s/veh)	45.1	8.0	4.9	1.4	46.3	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	45.1	8.0	4.9	1.4	46.3	7.5
LOS	D	A	A	A	D	A
Approach Delay (s/veh)	41.6		3.7			9.0
Approach LOS	D		A			A
Queue Length 50th (ft)	219	0	23	0	8	64
Queue Length 95th (ft)	262	32	112	m51	m15	84
Internal Link Dist (ft)	1543		500			320
Turn Bay Length (ft)	210			585	260	
Base Capacity (vph)	1217	603	2129	1072	220	3280
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.11	0.27	0.28	0.10	0.18
Intersection Summary						
Cycle Length: 110						
Actuated Cycle Length: 110						
Offset: 90 (82%), Referenced to phase 2:NBT and 6:SBT, Start of Green						
Natural Cycle: 45						
Control Type: Actuated-Coordinated						

Timings
2: Black Forest Road & Vollmer Road

Total Traffic Volumes
AM Peak Hour - Year 2028

Maximum v/c Ratio: 0.77

Intersection Signal Delay (s/veh): 17.4

Intersection LOS: B

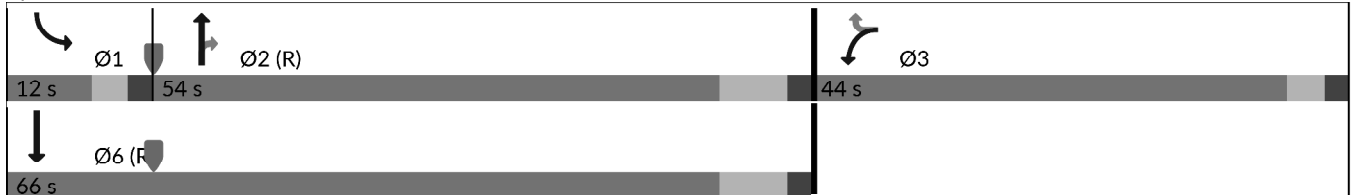
Intersection Capacity Utilization 41.5%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road



Timings
3: Black Forest Road & Research Parkway

Total Traffic Volumes
AM Peak Hour - Year 2028

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	61	328	714	255	226	152
Future Volume (vph)	61	328	714	255	226	152
Satd. Flow (prot)	1770	1583	3433	3539	3539	1583
Flt Permitted	0.950		0.556			
Satd. Flow (perm)	1770	1583	2009	3539	3539	1583
Satd. Flow (RTOR)		357				165
Lane Group Flow (vph)	66	357	776	277	246	165
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.5	9.5	9.5	9.5	9.5	9.5
Total Split (s)	45.0	45.0	36.0	65.0	29.0	29.0
Total Split (%)	40.9%	40.9%	32.7%	59.1%	26.4%	26.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effect Green (s)	10.4	10.4	88.6	88.6	70.0	70.0
Actuated g/C Ratio	0.09	0.09	0.81	0.81	0.64	0.64
v/c Ratio	0.39	0.75	0.43	0.10	0.11	0.15
Control Delay (s/veh)	52.0	15.6	2.6	1.5	9.3	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	52.0	15.6	2.6	1.5	9.3	2.3
LOS	D	B	A	A	A	A
Approach Delay (s/veh)	21.3			2.3	6.4	
Approach LOS	C			A	A	
Queue Length 50th (ft)	46	0	22	7	31	0
Queue Length 95th (ft)	84	88	52	20	69	33
Internal Link Dist (ft)	835			973	359	
Turn Bay Length (ft)	200		315			285
Base Capacity (vph)	635	797	2012	2849	2252	1067
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.45	0.39	0.10	0.11	0.15
Intersection Summary						
Cycle Length: 110						
Actuated Cycle Length: 110						
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green						
Natural Cycle: 45						
Control Type: Actuated-Coordinated						

Timings
3: Black Forest Road & Research Parkway

Total Traffic Volumes
AM Peak Hour - Year 2028

Maximum v/c Ratio: 0.75

Intersection Signal Delay (s/veh): 7.4

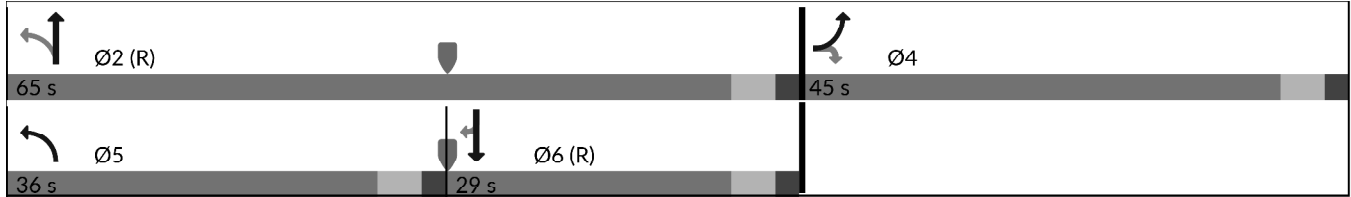
Intersection LOS: A

Intersection Capacity Utilization 43.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Black Forest Road & Research Parkway



HCM 7th TWSC
4: Vollmer Road & Marksheffel Road

Total Traffic Volumes
AM Peak Hour - Year 2028

Intersection												
Int Delay, s/veh	24.8											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↙	↑	↗	↙	↑	↗	↙	↑↑	↗	↙	↑↑	↗
Traffic Vol, veh/h	14	125	95	131	22	62	17	164	53	106	320	5
Future Vol, veh/h	14	125	95	131	22	62	17	164	53	106	320	5
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	-	-	None
Storage Length	200	-	200	200	-	205	200	-	250	240	-	200
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	15	136	103	142	24	67	18	178	58	115	348	5

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	716	851	174	688	799	89	353	0	0	236	0	0
Stage 1	578	578	-	215	215	-	-	-	-	-	-	-
Stage 2	138	273	-	472	584	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	317	296	839	333	317	951	1202	-	-	1328	-	-
Stage 1	468	499	-	767	723	-	-	-	-	-	-	-
Stage 2	851	683	-	541	496	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	245	266	839	~ 135	285	951	1202	-	-	1328	-	-
Mov Cap-2 Maneuver	245	266	-	~ 135	285	-	-	-	-	-	-	-
Stage 1	428	456	-	755	712	-	-	-	-	-	-	-
Stage 2	752	672	-	304	453	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Ctrl Dly, s/v	22.29	99.77	0.58	1.96
HCM LOS	C	F		

Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR	
Capacity (veh/h)	1202	-	-	135	285	951	245	266	839	1328	-	-
HCM Lane V/C Ratio	0.015	-	-	1.052	0.084	0.071	0.062	0.511	0.123	0.087	-	-
HCM Ctrl Dly (s/v)	8	-	-	156.3	18.8	9.1	20.7	31.9	9.9	8	-	-
HCM Lane LOS	A	-	-	F	C	A	C	D	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	7.8	0.3	0.2	0.2	2.7	0.4	0.3	-	-

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

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Total Traffic Volumes
AM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	8.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰		↰	↱	↰	↱
Traffic Vol, veh/h	0	0	44	0	0	202
Future Vol, veh/h	0	0	44	0	0	202
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	50	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	0	0	48	0	0	220
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1	0	97	1
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	96	-
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	-	-	1622	-	903	1083
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	928	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1622	-	876	1083
Mov Cap-2 Maneuver	-	-	-	-	876	-
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	901	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		7.29		9.17	
HCM LOS	A					
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	1083	-	-	1622	-
HCM Lane V/C Ratio	-	0.203	-	-	0.029	-
HCM Ctrl Dly (s/v)	0	9.2	-	-	7.3	-
HCM Lane LOS	A	A	-	-	A	-
HCM 95th %tile Q(veh)	-	0.8	-	-	0.1	-

HCM 7th TWSC
6: Brush Top Road & Access B/Stonebridge Access

Total Traffic Volumes
AM Peak Hour - Year 2028

Intersection												
Int Delay, s/veh		0										
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↱	↰		↱	↰	
Traffic Vol, veh/h	98	0	0	0	0	104	0	0	0	25	0	19
Future Vol, veh/h	98	0	0	0	0	104	0	0	0	25	0	19
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	-	-	None
Storage Length	-	-	-	-	-	-	50	-	-	50	-	-
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	107	0	0	0	0	113	0	0	0	27	0	21
Major/Minor	Minor2		Minor1			Major1			Major2			
Conflicting Flow All	65	65	10	54	75	0	21	0	-	0	0	0
Stage 1	65	65	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	54	75	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
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	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	929	826	1071	944	815	-	1595	-	0	-	-	-
Stage 1	946	841	-	-	-	-	-	-	0	-	-	-
Stage 2	-	-	-	958	833	-	-	-	0	-	-	-
Platoon blocked, %								-			-	-
Mov Cap-1 Maneuver	-	826	1071	944	815	-	1595	-	-	-	-	-
Mov Cap-2 Maneuver	-	826	-	944	815	-	-	-	-	-	-	-
Stage 1	946	841	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	958	833	-	-	-	-	-	-	-
Approach	EB		WB			NB			SB			
HCM Ctrl Dly, s/v		0										
HCM LOS		-		-								
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1595	-	-	-	-	-	-					
HCM Lane V/C Ratio	-	-	-	-	-	-	-					
HCM Ctrl Dly (s/v)	0	-	-	-	-	-	-					
HCM Lane LOS	A	-	-	-	-	-	-					
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-					

HCM 7th TWSC
7: Black Forest Road & Access A

Total Traffic Volumes
AM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↗↗	↗		↗↗
Traffic Vol, veh/h	0	28	964	23	0	552
Future Vol, veh/h	0	28	964	23	0	552
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	-	200	-	-
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	30	1048	25	0	600
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	-	524	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	498	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	498	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Approach	WB	NB	SB			
HCM Ctrl Dly, s/v	12.7	0	0			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBT			
Capacity (veh/h)	-	-	498			
HCM Lane V/C Ratio	-	-	0.061			
HCM Ctrl Dly (s/v)	-	-	12.7			
HCM Lane LOS	-	-	B			
HCM 95th %tile Q(veh)	-	-	0.2			

Timings

1: Black Forest Road & Woodmen Road

Total Traffic Volumes PM Peak Hour - Year 2028

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	 	
Traffic Volume (vph)	523	2040	189	237	1543	231	124	278	305	255	223	458
Future Volume (vph)	523	2040	189	237	1543	231	124	278	305	255	223	458
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			205			202			237			295
Lane Group Flow (vph)	568	2217	205	258	1677	251	135	302	332	277	242	498
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	27.0	55.0	55.0	20.0	48.0	48.0	17.0	28.0	28.0	17.0	28.0	28.0
Total Split (%)	22.5%	45.8%	45.8%	16.7%	40.0%	40.0%	14.2%	23.3%	23.3%	14.2%	23.3%	23.3%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	22.0	48.5	48.5	17.5	44.0	44.0	9.9	19.6	19.6	11.9	21.6	21.6
Actuated g/C Ratio	0.18	0.40	0.40	0.15	0.37	0.37	0.08	0.16	0.16	0.10	0.18	0.18
v/c Ratio	0.90	1.08	0.27	1.00	0.90	0.35	0.48	0.52	0.73	0.81	0.38	0.95
Control Delay (s/veh)	67.0	79.7	4.0	108.4	44.2	8.3	57.9	48.8	23.8	85.5	45.1	47.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	67.0	79.7	4.0	108.4	44.2	8.3	57.9	48.8	23.8	85.5	45.1	47.8
LOS	E	E	A	F	D	A	E	D	C	F	D	D
Approach Delay (s/veh)		72.1			47.7			39.6			57.4	
Approach LOS		E			D			D			E	
Queue Length 50th (ft)	227	~713	0	~241	469	26	53	113	66	115	64	78
Queue Length 95th (ft)	#329	#809	47	#413	#576	90	85	160	175	#182	108	#367
Internal Link Dist (ft)		641			398			348			432	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	637	2055	761	258	1866	708	343	648	483	343	674	540
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	1.08	0.27	1.00	0.90	0.35	0.39	0.47	0.69	0.81	0.36	0.92

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 78 (65%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Timings 1: Black Forest Road & Woodmen Road

Total Traffic Volumes
PM Peak Hour - Year 2028

Maximum v/c Ratio: 1.08

Intersection Signal Delay (s/veh): 58.7

Intersection LOS: E

Intersection Capacity Utilization 86.9%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Black Forest Road & Woodmen Road

 Ø1 20 s	 Ø2 (R) 55 s	 Ø3 17 s	 Ø4 28 s
 Ø5 27 s	 Ø6 (R) 48 s	 Ø7 17 s	 Ø8 28 s

Timings
2: Black Forest Road & Vollmer Road

Total Traffic Volumes
PM Peak Hour - Year 2028

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	433	4	537	459	48	509
Future Volume (vph)	433	4	537	459	48	509
Satd. Flow (prot)	3433	1583	3539	1583	3433	5085
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3433	1583	3539	1583	3433	5085
Satd. Flow (RTOR)		4		499		
Lane Group Flow (vph)	471	4	584	499	52	553
Turn Type	Prot	Perm	NA	Perm	Prot	NA
Protected Phases	3		2		1	6
Permitted Phases		3		2		
Detector Phase	3	3	2	2	1	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	10.0	10.0	4.0	10.0
Minimum Split (s)	9.0	9.0	25.5	25.5	9.5	25.5
Total Split (s)	36.0	36.0	72.0	72.0	12.0	84.0
Total Split (%)	30.0%	30.0%	60.0%	60.0%	10.0%	70.0%
Yellow Time (s)	3.0	3.0	5.5	5.5	3.0	5.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	7.5	7.5	5.0	7.5
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None	None	C-Max	C-Max	None	C-Max
Act Effect Green (s)	21.7	21.7	75.7	75.7	7.2	85.8
Actuated g/C Ratio	0.18	0.18	0.63	0.63	0.06	0.72
v/c Ratio	0.76	0.01	0.26	0.42	0.25	0.15
Control Delay (s/veh)	54.7	23.3	3.6	2.4	56.3	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	54.7	23.3	3.6	2.4	56.3	5.9
LOS	D	C	A	A	E	A
Approach Delay (s/veh)	54.4		3.0			10.2
Approach LOS	D		A			B
Queue Length 50th (ft)	183	0	33	4	20	45
Queue Length 95th (ft)	230	10	m99	m91	41	68
Internal Link Dist (ft)	1543		391			260
Turn Bay Length (ft)	210			585	260	
Base Capacity (vph)	886	411	2231	1182	218	3634
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.01	0.26	0.42	0.24	0.15
Intersection Summary						
Cycle Length: 120						
Actuated Cycle Length: 120						
Offset: 60 (50%), Referenced to phase 2:NBT and 6:SBT, Start of Green						
Natural Cycle: 50						
Control Type: Actuated-Coordinated						

Timings
2: Black Forest Road & Vollmer Road

Total Traffic Volumes
PM Peak Hour - Year 2028

Maximum v/c Ratio: 0.76

Intersection Signal Delay (s/veh): 16.3

Intersection LOS: B

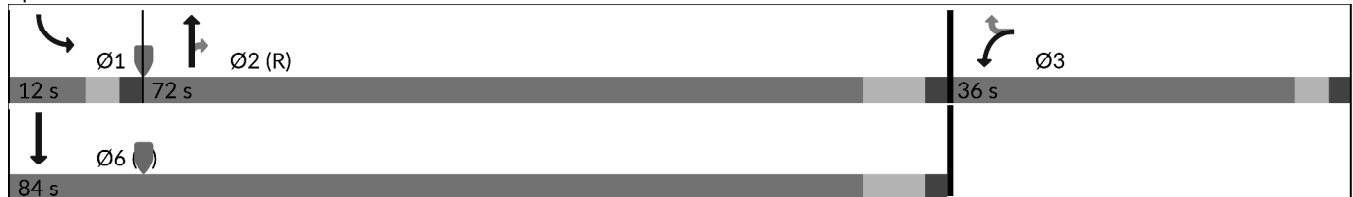
Intersection Capacity Utilization 43.3%

ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road



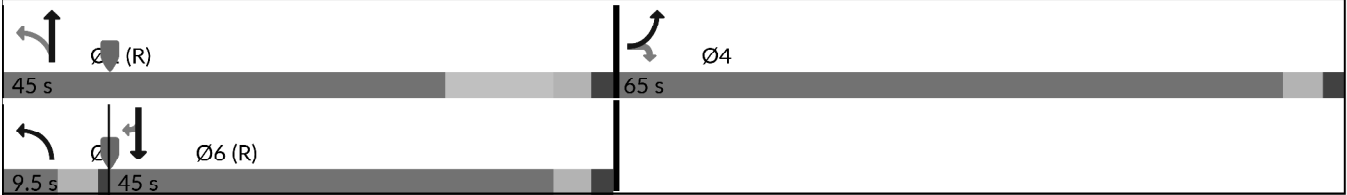
Timings
3: Black Forest Road & Research Parkway

Total Traffic Volumes
PM Peak Hour - Year 2028

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	104	503	314	292	242	75
Future Volume (vph)	104	503	314	292	242	75
Satd. Flow (prot)	1770	1583	3433	3539	3539	1583
Flt Permitted	0.950		0.557			
Satd. Flow (perm)	1770	1583	2013	3539	3539	1583
Satd. Flow (RTOR)		469				82
Lane Group Flow (vph)	113	547	341	317	263	82
Turn Type	Prot	Perm	pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases		4	2			6
Detector Phase	4	4	5	2	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	9.5	9.5	9.5	9.5	9.5	9.5
Total Split (s)	65.0	65.0	9.5	45.0	45.0	45.0
Total Split (%)	54.4%	54.4%	7.9%	37.7%	37.7%	37.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	4.5	5.5	5.5	5.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effect Green (s)	18.0	18.0	91.5	90.5	77.2	77.2
Actuated g/C Ratio	0.15	0.15	0.77	0.76	0.65	0.65
v/c Ratio	0.42	0.86	0.21	0.12	0.12	0.08
Control Delay (s/veh)	48.2	21.7	5.1	5.1	10.3	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	48.2	21.7	5.1	5.1	10.3	3.3
LOS	D	C	A	A	B	A
Approach Delay (s/veh)	26.2			5.1	8.6	
Approach LOS	C			A	A	
Queue Length 50th (ft)	84	57	25	25	34	0
Queue Length 95th (ft)	118	176	72	70	84	27
Internal Link Dist (ft)	835			963	359	
Turn Bay Length (ft)	200		315			285
Base Capacity (vph)	881	1023	1646	2680	2285	1051
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.53	0.21	0.12	0.12	0.08
Intersection Summary						
Cycle Length: 119.5						
Actuated Cycle Length: 119.5						
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green						
Natural Cycle: 40						
Control Type: Actuated-Coordinated						

Maximum v/c Ratio: 0.86	
Intersection Signal Delay (s/veh): 14.2	Intersection LOS: B
Intersection Capacity Utilization 47.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Black Forest Road & Research Parkway



HCM 7th TWSC
4: Vollmer Road & Marksheffel Road

Total Traffic Volumes
PM Peak Hour - Year 2028

Intersection												
Int Delay, s/veh	13.2											
Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	10	78	63	106	73	89	53	277	72	92	214	15
Future Vol, veh/h	10	78	63	106	73	89	53	277	72	92	214	15
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	-	-	None
Storage Length	200	-	200	200	-	205	200	-	250	240	-	200
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	11	85	68	115	79	97	58	301	78	100	233	16

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	738	927	116	775	865	151	249	0	0	379	0	0
Stage 1	433	433	-	416	416	-	-	-	-	-	-	-
Stage 2	305	495	-	359	449	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	4.14	-	-	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Cap-1 Maneuver	306	267	914	288	290	869	1314	-	-	1176	-	-
Stage 1	572	580	-	584	590	-	-	-	-	-	-	-
Stage 2	679	544	-	632	571	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	170	233	914	155	254	869	1314	-	-	1176	-	-
Mov Cap-2 Maneuver	170	233	-	155	254	-	-	-	-	-	-	-
Stage 1	523	531	-	559	564	-	-	-	-	-	-	-
Stage 2	496	521	-	449	522	-	-	-	-	-	-	-

Approach	SE	NW	NE	SW
HCM Ctrl Dly, s/v	20.65	40.01	1.04	2.39
HCM LOS	C	E		

Minor Lane/Major Mvmt	NEL	NET	NERNWLn1	NWLn2	NWLn3	SELn1	SELn2	SELn3	SWL	SWT	SWR	
Capacity (veh/h)	1314	-	-	155	254	869	170	233	914	1176	-	-
HCM Lane V/C Ratio	0.044	-	-	0.742	0.313	0.111	0.064	0.363	0.075	0.085	-	-
HCM Ctrl Dly (s/v)	7.9	-	-	75.5	25.5	9.7	27.6	29	9.3	8.3	-	-
HCM Lane LOS	A	-	-	F	D	A	D	D	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	4.5	1.3	0.4	0.2	1.6	0.2	0.3	-	-

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Total Traffic Volumes
PM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	8.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱		↲	↱	↲	↱
Traffic Vol, veh/h	0	0	141	0	0	131
Future Vol, veh/h	0	0	141	0	0	131
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	50	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	0	0	153	0	0	142
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1	0	308	1
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	307	-
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	-	-	1622	-	685	1083
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	746	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1622	-	620	1083
Mov Cap-2 Maneuver	-	-	-	-	620	-
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	676	-
Approach	EB		WB		NB	
HCM Ctrl Dly, s/v	0		7.45		8.82	
HCM LOS	A					
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	1083	-	-	1622	-
HCM Lane V/C Ratio	-	0.131	-	-	0.095	-
HCM Ctrl Dly (s/v)	0	8.8	-	-	7.5	-
HCM Lane LOS	A	A	-	-	A	-
HCM 95th %tile Q(veh)	-	0.5	-	-	0.3	-

HCM 7th TWSC
6: Brush Top Road & Access B/Stonebridge Access

Total Traffic Volumes
PM Peak Hour - Year 2028

Intersection												
Int Delay, s/veh		0										
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↵	↵		↵	↵	
Traffic Vol, veh/h	67	0	0	0	0	64	0	0	0	84	0	57
Future Vol, veh/h	67	0	0	0	0	64	0	0	0	84	0	57
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	-	-	None
Storage Length	-	-	-	-	-	-	50	-	-	50	-	-
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	73	0	0	0	0	70	0	0	0	91	0	62
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	214	214	31	183	245	0	62	0	0	0	0	0
Stage 1	214	214	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	183	245	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
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	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	743	684	1043	779	657	-	1541	-	-	-	-	-
Stage 1	789	726	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	819	704	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	684	1043	779	657	-	1541	-	-	-	-	-
Mov Cap-2 Maneuver	-	684	-	779	657	-	-	-	-	-	-	-
Stage 1	789	726	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	819	704	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Ctrl Dly, s/v		0										
HCM LOS		-		-								
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1541	-	-	-	-	-	-	-				
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-				
HCM Ctrl Dly (s/v)	0	-	-	-	-	-	-	-				
HCM Lane LOS	A	-	-	-	-	-	-	-				
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-	-				

HCM 7th TWSC
7: Black Forest Road & Access A

Total Traffic Volumes
PM Peak Hour - Year 2028

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↗↗	↗		↗↗
Traffic Vol, veh/h	0	22	584	86	0	745
Future Vol, veh/h	0	22	584	86	0	745
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	-	200	-	-
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	24	635	93	0	810

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	-	317	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	678	-
Stage 1	0	-	-
Stage 2	0	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	678	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	WB	NB	SB
HCM Ctrl Dly, s/v	10.5	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBT
Capacity (veh/h)	-	-	678
HCM Lane V/C Ratio	-	-	0.035
HCM Ctrl Dly (s/v)	-	-	10.5
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.1

Timings

1: Black Forest Road & Woodmen Road

Total Traffic Volumes AM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	 	
Traffic Volume (vph)	242	1275	35	45	1910	360	115	730	35	400	1855	286
Future Volume (vph)	242	1275	35	45	1910	360	115	730	35	400	1855	286
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			179			265			183			134
Lane Group Flow (vph)	263	1386	38	49	2076	391	125	793	38	435	2016	311
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	11.0	43.0	43.0	9.0	41.0	41.0	9.0	36.0	36.0	22.0	49.0	49.0
Total Split (%)	10.0%	39.1%	39.1%	8.2%	37.3%	37.3%	8.2%	32.7%	32.7%	20.0%	44.5%	44.5%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	6.0	38.3	38.3	4.0	34.5	34.5	4.0	30.5	30.5	16.5	43.0	43.0
Actuated g/C Ratio	0.05	0.35	0.35	0.04	0.31	0.31	0.04	0.28	0.28	0.15	0.39	0.39
v/c Ratio	1.41	0.78	0.06	0.77	1.30	0.58	1.01	0.81	0.07	0.84	1.46	0.44
Control Delay (s/veh)	250.4	36.4	0.2	112.9	173.7	13.7	136.7	44.9	0.2	51.9	236.0	11.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	250.4	36.4	0.2	112.9	173.7	13.7	136.7	44.9	0.2	51.9	236.0	11.2
LOS	F	D	A	F	F	B	F	D	A	D	F	B
Approach Delay (s/veh)		69.0			147.7			55.1			181.7	
Approach LOS		E			F			E			F	
Queue Length 50th (ft)	~130	332	0	36	~700	67	~47	281	0	140	~1042	90
Queue Length 95th (ft)	#216	393	0	#108	#798	169	#111	357	0	m#228	#1194	m162
Internal Link Dist (ft)		692			359			298			322	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	187	1770	667	64	1594	678	124	980	570	530	1383	700
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.41	0.78	0.06	0.77	1.30	0.58	1.01	0.81	0.07	0.82	1.46	0.44

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 98 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Timings

1: Black Forest Road & Woodmen Road

Total Traffic Volumes
AM Peak Hour - Year 2045

Maximum v/c Ratio: 1.46

Intersection Signal Delay (s/veh): 131.6

Intersection LOS: F

Intersection Capacity Utilization 117.2%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

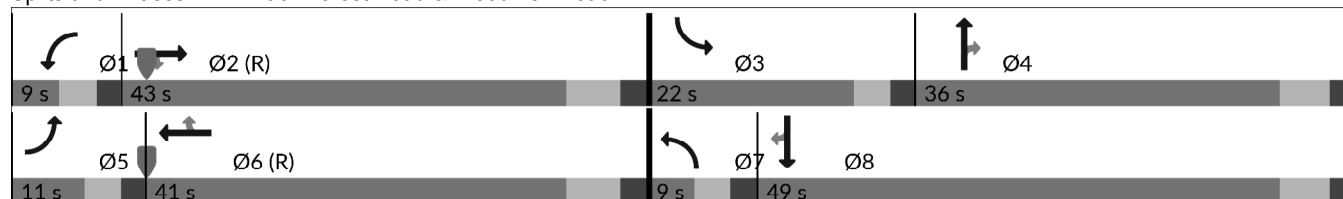
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Black Forest Road & Woodmen Road



Timings
2: Black Forest Road & Vollmer Road

Total Traffic Volumes
AM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	10	20	600	15	50	30	997	405	250	1640	100
Future Volume (vph)	40	10	20	600	15	50	30	997	405	250	1640	100
Satd. Flow (prot)	3433	3185	0	3433	1863	1583	3433	3539	1583	3433	5040	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3185	0	3433	1863	1583	3433	3539	1583	3433	5040	0
Satd. Flow (RTOR)		22				183			440		11	
Lane Group Flow (vph)	43	33	0	652	16	54	33	1084	440	272	1892	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Detector Phase	7	4		3	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		4.0	5.0	5.0	5.0	10.0	10.0	5.0	5.0	
Minimum Split (s)	9.5	10.5		9.0	23.5	23.5	9.5	17.5	17.5	10.0	12.5	
Total Split (s)	9.5	10.5		32.0	33.0	33.0	9.5	50.5	50.5	17.0	58.0	
Total Split (%)	8.6%	9.5%		29.1%	30.0%	30.0%	8.6%	45.9%	45.9%	15.5%	52.7%	
Yellow Time (s)	3.5	3.5		3.0	3.5	3.5	3.5	5.5	5.5	3.0	5.5	
All-Red Time (s)	1.0	2.0		2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	5.5		5.0	5.5	5.5	4.5	7.5	7.5	5.0	7.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	
Act Effect Green (s)	5.0	5.4		24.7	24.9	24.9	5.4	49.5	49.5	11.8	60.6	
Actuated g/C Ratio	0.05	0.05		0.22	0.23	0.23	0.05	0.45	0.45	0.11	0.55	
v/c Ratio	0.28	0.19		0.85	0.04	0.11	0.20	0.68	0.46	0.74	0.68	
Control Delay (s/veh)	55.4	29.1		51.9	31.9	0.4	47.5	27.2	10.6	65.7	11.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay (s/veh)	55.4	29.1		51.9	31.9	0.4	47.5	27.2	10.6	65.7	11.3	
LOS	E	C		D	C	A	D	C	B	E	B	
Approach Delay (s/veh)		44.0			47.6			23.0			18.2	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	15	4		228	9	0	10	421	151	103	268	
Queue Length 95th (ft)	35	21		293	27	0	m14	m457	m208	m85	m136	
Internal Link Dist (ft)		991			1543			500			320	
Turn Bay Length (ft)	200			210			200		585	260		
Base Capacity (vph)	156	176		842	465	533	167	1593	954	380	2780	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.28	0.19		0.77	0.03	0.10	0.20	0.68	0.46	0.72	0.68	

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Timings

2: Black Forest Road & Vollmer Road

Total Traffic Volumes
AM Peak Hour - Year 2045

Maximum v/c Ratio: 0.85

Intersection Signal Delay (s/veh): 25.0

Intersection LOS: C

Intersection Capacity Utilization 76.4%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road



Timings

3: Black Forest Road & Marksheffel Road

Total Traffic Volumes
AM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	852	450	196	1010	350	533	955	250	355	1300	200
Future Volume (vph)	200	852	450	196	1010	350	533	955	250	355	1300	200
Satd. Flow (prot)	3433	3355	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3355	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)		89				268			134			134
Lane Group Flow (vph)	217	1415	0	213	1098	380	579	1038	272	386	1413	217
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		5.0	5.0	5.0	4.0	4.0	4.0	5.0	4.0	4.0
Minimum Split (s)	9.5	9.5		10.5	10.5	10.5	9.5	9.5	9.5	10.5	9.5	9.5
Total Split (s)	12.0	38.0		11.0	37.0	37.0	19.0	42.6	42.6	18.4	42.0	42.0
Total Split (%)	10.9%	34.5%		10.0%	33.6%	33.6%	17.3%	38.7%	38.7%	16.7%	38.2%	38.2%
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	6.5	32.5		5.5	31.5	31.5	13.5	37.1	37.1	12.9	36.5	36.5
Actuated g/C Ratio	0.06	0.30		0.05	0.29	0.29	0.12	0.34	0.34	0.12	0.33	0.33
v/c Ratio	1.07	1.34		1.25	1.08	0.59	1.38	0.87	0.44	0.96	1.20	0.35
Control Delay (s/veh)	133.8	192.2		193.3	91.8	14.1	224.0	30.9	5.6	84.9	133.7	12.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	133.8	192.2		193.3	91.8	14.1	224.0	30.9	5.6	84.9	133.7	12.6
LOS	F	F		F	F	B	F	C	A	F	F	B
Approach Delay (s/veh)		184.4			87.1			86.4			111.3	
Approach LOS		F			F			F			F	
Queue Length 50th (ft)	~89	~678		~97	~465	62	~281	366	6	144	~650	42
Queue Length 95th (ft)	#168	#821		#176	#600	163	#398	#430	36	#241	#790	104
Internal Link Dist (ft)		835			1924			993			359	
Turn Bay Length (ft)	200			200		200	315		200	200		285
Base Capacity (vph)	202	1053		171	1013	644	421	1193	622	402	1174	614
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.07	1.34		1.25	1.08	0.59	1.38	0.87	0.44	0.96	1.20	0.35

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 150

Control Type: Actuated-Coordinated

Timings 3: Black Forest Road & Marksheffel Road

Total Traffic Volumes
AM Peak Hour - Year 2045

Maximum v/c Ratio: 1.38

Intersection Signal Delay (s/veh): 115.7

Intersection LOS: F

Intersection Capacity Utilization 113.0%

ICU Level of Service H

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Black Forest Road & Marksheffel Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
18.4 s	42.6 s	11 s	38 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
19 s	42 s	12 s	37 s

Timings
4: Vollmer Road & Marksheffel Road

Total Traffic Volumes
AM Peak Hour - Year 2045

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	195	1453	92	178	1194	88	157	227	74	146	449	215
Future Volume (vph)	195	1453	92	178	1194	88	157	227	74	146	449	215
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.096			0.100			0.310			0.550		
Satd. Flow (perm)	179	3539	1583	186	3539	1583	577	3539	1583	1025	3539	1583
Satd. Flow (RTOR)			164			164			164			178
Lane Group Flow (vph)	212	1579	100	193	1298	96	171	247	80	159	488	234
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Total Split (s)	14.2	47.0	47.0	12.6	45.4	45.4	11.4	18.4	18.4	12.0	19.0	19.0
Total Split (%)	15.8%	52.2%	52.2%	14.0%	50.4%	50.4%	12.7%	20.4%	20.4%	13.3%	21.1%	21.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	Max	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	50.2	41.5	41.5	47.0	39.9	39.9	18.8	12.9	12.9	20.0	13.5	13.5
Actuated g/C Ratio	0.56	0.46	0.46	0.52	0.44	0.44	0.21	0.14	0.14	0.22	0.15	0.15
v/c Ratio	0.84	0.97	0.12	0.87	0.83	0.12	0.86	0.49	0.22	0.57	0.92	0.60
Control Delay (s/veh)	46.8	40.6	0.8	54.5	27.7	0.6	67.7	39.2	1.4	35.8	62.7	17.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	46.8	40.6	0.8	54.5	27.7	0.6	67.7	39.2	1.4	35.8	62.7	17.5
LOS	D	D	A	D	C	A	E	D	A	D	E	B
Approach Delay (s/veh)		39.2			29.3			42.9			45.9	
Approach LOS		D			C			D			D	
Queue Length 50th (ft)	68	450	0	59	336	0	79	70	0	73	148	29
Queue Length 95th (ft)	#193	#624	6	#184	430	4	#162	108	0	128	#243	103
Internal Link Dist (ft)		770			950			4352			1886	
Turn Bay Length (ft)	200		200	200		205	200		250	240		200
Base Capacity (vph)	253	1631	818	222	1568	793	198	507	367	281	530	388
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.97	0.12	0.87	0.83	0.12	0.86	0.49	0.22	0.57	0.92	0.60

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NWTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Timings 4: Vollmer Road & Marksheffel Road

Total Traffic Volumes
AM Peak Hour - Year 2045

Maximum v/c Ratio: 0.97

Intersection Signal Delay (s/veh): 37.5

Intersection LOS: D

Intersection Capacity Utilization 89.5%

ICU Level of Service E

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 4: Vollmer Road & Marksheffel Road

 Ø1 14.2 s	 Ø2 (R) 45.4 s	 Ø3 12 s	 Ø4 18.4 s
 Ø5 12.6 s	 Ø6 47 s	 Ø7 11.4 s	 Ø8 19 s

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Total Traffic Volumes
AM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	39.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Traffic Vol, veh/h	1440	17	39	1490	78	140
Future Vol, veh/h	1440	17	39	1490	78	140
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	200	-	50	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	1565	18	42	1620	85	152

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1584
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	411
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	411
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.38	\$ 583.33
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	23	337	-	-	411	-
HCM Lane V/C Ratio	3.744	0.452	-	-	0.103	-
HCM Ctrl Dly (s/v)	\$ 1586.9	24.2	-	-	14.8	-
HCM Lane LOS	F	C	-	-	B	-
HCM 95th %tile Q(veh)	10.7	2.3	-	-	0.3	-

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

HCM 7th TWSC
6: Brush Top Road & Access B/Stonebridge Access

Total Traffic Volumes
AM Peak Hour - Year 2045

Intersection												
Int Delay, s/veh		0										
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↵	↵		↵	↵	
Traffic Vol, veh/h	98	0	0	0	0	120	0	0	0	25	0	31
Future Vol, veh/h	98	0	0	0	0	120	0	0	0	25	0	31
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	-	-	None
Storage Length	-	-	-	-	-	-	50	-	-	50	-	-
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	107	0	0	0	0	130	0	0	0	27	0	34
Major/Minor	Minor2		Minor1			Major1			Major2			
Conflicting Flow All	71	71	17	54	88	0	34	0	0	0	0	0
Stage 1	71	71	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	54	88	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
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	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	920	819	1062	944	802	-	1578	-	-	-	-	-
Stage 1	939	836	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	958	822	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	819	1062	944	802	-	1578	-	-	-	-	-
Mov Cap-2 Maneuver	-	819	-	944	802	-	-	-	-	-	-	-
Stage 1	939	836	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	958	822	-	-	-	-	-	-	-
Approach	EB		WB			NB			SB			
HCM Ctrl Dly, s/v		0										
HCM LOS		-										
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1578	-	-	-	-	-	-	-				
HCM Lane V/C Ratio	-	-	-	-	-	-	-	-				
HCM Ctrl Dly (s/v)	0	-	-	-	-	-	-	-				
HCM Lane LOS	A	-	-	-	-	-	-	-				
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-	-				

HCM 7th TWSC
7: Black Forest Road & Access A

Total Traffic Volumes
AM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↗↗	↗		↗↗
Traffic Vol, veh/h	0	33	1705	17	0	1946
Future Vol, veh/h	0	33	1705	17	0	1946
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	-	200	-	-
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	36	1853	18	0	2115
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	-	927	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	270	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	270	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	20.35	0		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBT		
Capacity (veh/h)	-	- 270		-		
HCM Lane V/C Ratio	-	- 0.133		-		
HCM Ctrl Dly (s/v)	-	- 20.3		-		
HCM Lane LOS	-	- C		-		
HCM 95th %tile Q(veh)	-	- 0.5		-		

Timings

1: Black Forest Road & Woodmen Road

Total Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  			  		 	 		 	  	
Traffic Volume (vph)	305	1530	85	15	1340	30	80	1300	85	20	960	426
Future Volume (vph)	305	1530	85	15	1340	30	80	1300	85	20	960	426
Satd. Flow (prot)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5085	1583	1770	5085	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)			129			129			134			134
Lane Group Flow (vph)	332	1663	92	16	1457	33	87	1413	92	22	1043	463
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases			2			6			4			8
Detector Phase	5	2	2	1	6	6	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	4.0	15.0	15.0	4.0	15.0	15.0	4.0	10.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	21.5	21.5	9.0	21.5	21.5	9.0	16.0	16.0	9.0	16.0	16.0
Total Split (s)	14.0	44.0	44.0	9.0	39.0	39.0	9.0	48.0	48.0	9.0	48.0	48.0
Total Split (%)	12.7%	40.0%	40.0%	8.2%	35.5%	35.5%	8.2%	43.6%	43.6%	8.2%	43.6%	43.6%
Yellow Time (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.5	6.5	5.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	9.0	42.9	42.9	4.0	32.5	32.5	4.0	47.4	47.4	4.0	42.0	42.0
Actuated g/C Ratio	0.08	0.39	0.39	0.04	0.30	0.30	0.04	0.43	0.43	0.04	0.38	0.38
v/c Ratio	1.19	0.84	0.13	0.25	0.97	0.06	0.70	0.93	0.12	0.18	0.77	0.67
Control Delay (s/veh)	157.8	36.0	2.1	61.1	55.8	0.2	81.3	42.1	1.6	48.4	27.5	21.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	157.8	36.0	2.1	61.1	55.8	0.2	81.3	42.1	1.6	48.4	27.5	21.6
LOS	F	D	A	E	E	A	F	D	A	D	C	C
Approach Delay (s/veh)		53.9			54.6			41.9			26.1	
Approach LOS		D			D			D			C	
Queue Length 50th (ft)	~147	367	0	11	377	0	32	463	0	6	355	264
Queue Length 95th (ft)	#241	#534	17	36	#483	0	#73	#720	13	m11	488	390
Internal Link Dist (ft)		641			398			348			432	
Turn Bay Length (ft)	500		710	200		245	195		180	235		410
Base Capacity (vph)	280	1983	695	64	1502	558	124	1524	758	124	1351	687
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.19	0.84	0.13	0.25	0.97	0.06	0.70	0.93	0.12	0.18	0.77	0.67

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Natural Cycle: 120

Control Type: Actuated-Coordinated

Timings

1: Black Forest Road & Woodmen Road

Total Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 1.19

Intersection Signal Delay (s/veh): 44.9

Intersection LOS: D

Intersection Capacity Utilization 85.1%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

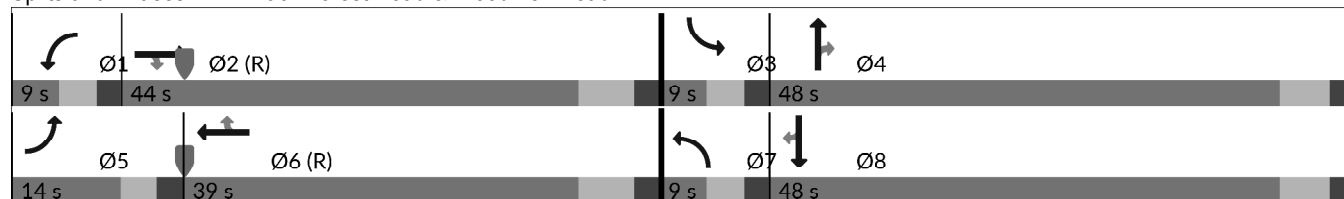
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Black Forest Road & Woodmen Road



Timings
2: Black Forest Road & Vollmer Road

Total Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 			 	 		 	  	
Traffic Volume (vph)	400	65	125	200	245	300	100	1150	550	30	1201	175
Future Volume (vph)	400	65	125	200	245	300	100	1150	550	30	1201	175
Satd. Flow (prot)	3433	3189	0	3433	1863	1583	3433	3539	1583	3433	4989	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3189	0	3433	1863	1583	3433	3539	1583	3433	4989	0
Satd. Flow (RTOR)		136				149			545		28	
Lane Group Flow (vph)	435	207	0	217	266	326	109	1250	598	33	1495	0
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Detector Phase	7	4		3	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		4.0	5.0	5.0	5.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	10.5	23.5		23.5	23.5	23.5	10.5	25.5	25.5	9.5	25.5	
Total Split (s)	23.0	25.5		23.5	26.0	26.0	11.1	51.5	51.5	9.5	49.9	
Total Split (%)	20.9%	23.2%		21.4%	23.6%	23.6%	10.1%	46.8%	46.8%	8.6%	45.4%	
Yellow Time (s)	3.5	3.5		3.0	3.5	3.5	3.5	5.5	5.5	3.0	5.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5		5.0	5.5	5.5	5.5	7.5	7.5	5.0	7.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	
Act Effect Green (s)	16.9	24.1		12.2	18.9	18.9	6.2	50.0	50.0	5.0	44.0	
Actuated g/C Ratio	0.15	0.22		0.11	0.17	0.17	0.06	0.45	0.45	0.05	0.40	
v/c Ratio	0.83	0.26		0.57	0.83	0.83	0.56	0.78	0.59	0.21	0.74	
Control Delay (s/veh)	59.1	13.9		52.0	65.9	41.4	45.4	33.8	15.7	71.6	17.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay (s/veh)	59.1	13.9		52.0	65.9	41.4	45.4	33.8	15.7	71.6	17.3	
LOS	E	B		D	E	D	D	C	B	E	B	
Approach Delay (s/veh)		44.5			52.3			28.9			18.4	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	156	21		77	183	124	40	505	208	12	295	
Queue Length 95th (ft)	#227	54		113	#304	#263	m41	m529	m312	m12	m264	
Internal Link Dist (ft)		954			1543			391			260	
Turn Bay Length (ft)	200			210			200		585	260		
Base Capacity (vph)	546	803		577	347	416	193	1608	1016	155	2012	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.80	0.26		0.38	0.77	0.78	0.56	0.78	0.59	0.21	0.74	
Intersection Summary												
Cycle Length: 110												
Actuated Cycle Length: 110												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green												
Natural Cycle: 95												
Control Type: Actuated-Coordinated												

Timings

2: Black Forest Road & Vollmer Road

Total Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 0.83

Intersection Signal Delay (s/veh): 31.5

Intersection LOS: C

Intersection Capacity Utilization 79.0%

ICU Level of Service D

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Black Forest Road & Vollmer Road

 Ø1	 Ø2 (R)	 Ø3	 Ø4
9.5 s	51.5 s	23.5 s	25.5 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
11.1 s	49.9 s	23 s	26 s

Timings
3: Black Forest Road & Marksheffel Road

Total Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	350	546	425	431	510	375	518	735	400	360	790	250
Future Volume (vph)	350	546	425	431	510	375	518	735	400	360	790	250
Satd. Flow (prot)	3433	3306	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3306	0	3433	3539	1583	3433	3539	1583	3433	3539	1583
Satd. Flow (RTOR)		171				288			311			272
Lane Group Flow (vph)	380	1055	0	468	554	408	563	799	435	391	859	272
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		5.0	5.0	5.0	5.0	4.0	4.0	5.0	4.0	4.0
Minimum Split (s)	9.5	9.5		10.5	10.5	10.5	10.5	9.5	9.5	10.5	9.5	9.5
Total Split (s)	20.8	33.2		19.8	32.2	32.2	23.2	37.6	37.6	19.4	33.8	33.8
Total Split (%)	18.9%	30.2%		18.0%	29.3%	29.3%	21.1%	34.2%	34.2%	17.6%	30.7%	30.7%
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	14.9	27.7		14.3	27.1	27.1	17.7	32.1	32.1	13.9	28.3	28.3
Actuated g/C Ratio	0.14	0.25		0.13	0.25	0.25	0.16	0.29	0.29	0.13	0.26	0.26
v/c Ratio	0.82	1.10		1.05	0.64	0.67	1.02	0.77	0.64	0.90	0.94	0.45
Control Delay (s/veh)	61.5	93.1		102.8	41.0	17.3	88.4	32.4	9.4	72.7	59.6	6.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	61.5	93.1		102.8	41.0	17.3	88.4	32.4	9.4	72.7	59.6	6.5
LOS	E	F		F	D	B	F	C	A	E	E	A
Approach Delay (s/veh)		84.7			54.5			44.4			53.5	
Approach LOS		F			D			D			D	
Queue Length 50th (ft)	137	~402		~188	188	72	~214	205	34	144	318	0
Queue Length 95th (ft)	#206	#538		#294	249	188	#328	308	m71	#232	#446	64
Internal Link Dist (ft)		835			1530			943			359	
Turn Bay Length (ft)	200			200		200	315		200	200		285
Base Capacity (vph)	477	960		446	872	607	552	1032	682	433	910	609
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	1.10		1.05	0.64	0.67	1.02	0.77	0.64	0.90	0.94	0.45

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 120

Control Type: Actuated-Coordinated

Timings 3: Black Forest Road & Marksheffel Road

Total Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 1.10

Intersection Signal Delay (s/veh): 58.3

Intersection LOS: E

Intersection Capacity Utilization 96.0%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Black Forest Road & Marksheffel Road

 Ø1 19.4 s	 Ø2 (R) 37.6 s	 Ø3 19.8 s	 Ø4 33.2 s
 Ø5 23.2 s	 Ø6 (R) 33.8 s	 Ø7 20.8 s	 Ø8 32.2 s

Timings
4: Vollmer Road & Marksheffel Road

Total Traffic Volumes
PM Peak Hour - Year 2045

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	318	1092	129	124	987	125	205	380	101	122	300	293
Future Volume (vph)	318	1092	129	124	987	125	205	380	101	122	300	293
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.101			0.144			0.248			0.435		
Satd. Flow (perm)	188	3539	1583	268	3539	1583	462	3539	1583	810	3539	1583
Satd. Flow (RTOR)			173			223			173			318
Lane Group Flow (vph)	346	1187	140	135	1073	136	223	413	110	133	326	318
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Total Split (s)	30.0	62.4	62.4	17.4	49.8	49.8	19.2	27.2	27.2	13.0	21.0	21.0
Total Split (%)	25.0%	52.0%	52.0%	14.5%	41.5%	41.5%	16.0%	22.7%	22.7%	10.8%	17.5%	17.5%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	Max	Max	C-Max	C-Max	None	None	None	None	None	None
Act Effect Green (s)	74.2	56.9	56.9	60.8	47.8	47.8	33.6	20.6	20.6	22.1	14.6	14.6
Actuated g/C Ratio	0.62	0.47	0.47	0.51	0.40	0.40	0.28	0.17	0.17	0.18	0.12	0.12
v/c Ratio	0.85	0.71	0.17	0.45	0.76	0.18	0.81	0.68	0.27	0.64	0.76	0.68
Control Delay (s/veh)	47.8	27.9	1.7	19.0	36.4	0.5	58.6	52.7	2.4	50.3	62.9	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	47.8	27.9	1.7	19.0	36.4	0.5	58.6	52.7	2.4	50.3	62.9	13.0
LOS	D	C	A	B	D	A	E	D	A	D	E	B
Approach Delay (s/veh)		29.8			31.0			47.0			40.3	
Approach LOS		C			C			D			D	
Queue Length 50th (ft)	190	378	0	41	398	0	143	160	0	81	131	0
Queue Length 95th (ft)	#333	461	20	80	488	0	#228	216	7	136	183	90
Internal Link Dist (ft)		901			950			4352			1886	
Turn Bay Length (ft)	200		200	200		205	200		250	240		200
Base Capacity (vph)	441	1678	841	298	1410	765	278	639	427	209	457	481
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.71	0.17	0.45	0.76	0.18	0.80	0.65	0.26	0.64	0.71	0.66

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NWTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Timings

4: Vollmer Road & Marksheffel Road

Total Traffic Volumes
PM Peak Hour - Year 2045

Maximum v/c Ratio: 0.85

Intersection Signal Delay (s/veh): 34.8

Intersection LOS: C

Intersection Capacity Utilization 82.9%

ICU Level of Service E

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 4: Vollmer Road & Marksheffel Road

 Ø1 30 s	 Ø2 (R) 49.8 s	 Ø3 13 s	 Ø4 27.2 s
 Ø5 17.4 s	 Ø6 62.4 s	 Ø7 19.2 s	 Ø8 21 s

HCM 7th TWSC
5: Brush Top Road & Marksheffel Road

Total Traffic Volumes
PM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	19.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Traffic Vol, veh/h	1253	53	125	1217	51	90
Future Vol, veh/h	1253	53	125	1217	51	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	200	-	50	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	1362	58	136	1323	55	98

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1420
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.14
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.22
Pot Cap-1 Maneuver	-	-	476
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	476
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.45	\$ 363.5
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	23	393	-	-	476	-
HCM Lane V/C Ratio	2.367	0.249	-	-	0.286	-
HCM Ctrl Dly (s/v)	\$ 974.7	17.2	-	-	15.6	-
HCM Lane LOS	F	C	-	-	C	-
HCM 95th %tile Q(veh)	7	1	-	-	1.2	-

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

HCM 7th TWSC
6: Brush Top Road & Access B/Stonebridge Access

Total Traffic Volumes
PM Peak Hour - Year 2045

Intersection												
Int Delay, s/veh	0											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↕	↕		↕	↕	
Traffic Vol, veh/h	67	0	0	0	0	74	0	0	0	84	0	93
Future Vol, veh/h	67	0	0	0	0	74	0	0	0	84	0	93
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	-	-	None
Storage Length	-	-	-	-	-	-	50	-	-	0	-	-
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	73	0	0	0	0	80	0	0	0	91	0	101

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	233	233	51	183	284	0	101	0	0	0	0	0
Stage 1	233	233	-	0	0	-	-	-	-	-	-	-
Stage 2	0	0	-	183	284	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
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	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	722	667	1018	779	625	-	1491	-	-	-	-	-
Stage 1	770	712	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	819	677	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	667	1018	779	625	-	1491	-	-	-	-	-
Mov Cap-2 Maneuver	-	667	-	779	625	-	-	-	-	-	-	-
Stage 1	770	712	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	819	677	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0			
HCM LOS	-	-	-	-

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1491	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-	-
HCM Ctrl Dly (s/v)	0	-	-	-	-	-	-
HCM Lane LOS	A	-	-	-	-	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-	-	-

HCM 7th TWSC
7: Black Forest Road & Access A

Total Traffic Volumes
PM Peak Hour - Year 2045

Intersection						
Int Delay, s/veh	0.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↗↗	↗		↗↗
Traffic Vol, veh/h	0	22	1635	50	0	1646
Future Vol, veh/h	0	22	1635	50	0	1646
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	-	200	-	-
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	24	1777	54	0	1789
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	-	889	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	286	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	286	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	18.71	0		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBT		
Capacity (veh/h)	-	- 286		-		
HCM Lane V/C Ratio	-	- 0.083		-		
HCM Ctrl Dly (s/v)	-	- 18.7		-		
HCM Lane LOS	-	- C		-		
HCM 95th %tile Q(veh)	-	- 0.3		-		

APPENDIX D

Adjacent Development Trip Generation Information

ITE CODE LAND USE UNIT			TRIP GENERATION RATES						
			24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
220	Multifamily Housing (Low-Rise)	DU	6.74	0.10	0.30	0.40	0.32	0.19	0.51

Key: DU = Dwelling Units.

Note: All data and calculations above are subject to being rounded to nearest value.

ITE CODE LAND USE SIZE DU				TOTAL TRIPS GENERATED						
				24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
					ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
220	Multifamily Housing (Low-Rise)	525	DU	3,539	50	160	210	169	99	268
<i>Total:</i>				3,539	50	160	210	169	99	268

Key: DU = Dwelling Units.

Note: All data and calculations above are subject to being rounded to nearest value.

ITE CODE LAND USE UNIT			TRIP GENERATION RATES						
			24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
820	Shopping Center (>150k)	KSF	37.01	0.52	0.32	0.84	1.63	1.77	3.40

Key: KSF = Thousand Square Feet Gross Floor Area.

Note: All data and calculations above are subject to being rounded to nearest value.

ITE CODE LAND USE SIZE UNIT				TOTAL TRIPS GENERATED						
				24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
					ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
820	Shopping Center (>150k)	219.4	KSF	8,120	114	70	184	358	388	746
<i>Total:</i>				8,120	114	70	184	358	388	746

Key: KSF = Thousand Square Feet Gross Floor Area.

Note: All data and calculations above are subject to being rounded to nearest value.

APPENDIX E

Roadway Classification Exhibit

 Residential Collector (Urban) Roadway Classification
(3,000 - 10,000 ADT)

