The TIS does not discuss pedestrian or bicycle connectivity, as required in the ECM. It is reasonable to assume that residents will want to access the retail at the southeast corner of the Marksheffel / Constitution intersection and the planned regional trail that crosses Akers Dr about 2000' north of the site. Please add bicycle / pedestrian discussions as appropriate.

SMR Response

Discussion of pedestrian and bicycle connectivity added to the revised Traffic Impact Study.

TRAFFIC IMPACT STUDY

For

Watermark Akers Drive
Colorado Springs, Colorado

September 2020

Engineering Review

11/10/2020 12:51:40 PM
dsdkuehster
stevekuehster@elpasoco.com
(719) 520-6813
EPC Planning & Community Development Department

Address all comments, Note red comments throughout and blue comments on page 2 only.

Comment acknowledged.

Prepared for:

Watermark Residential
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Prepared by:

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09/08/2020
PROFESSIONAL ENGINEER

20-041209

Table of Contents **Page**

1. Provide a Mitigation table that addresses the impacts and names the responsible party to construct the improvements. (Hunter Jumper/Akers, Constitution/Akers intersection improvements or signal improvements) as well as the other improvements needed (Sidewalk Adjacent to Constitution and Akers) etc. list all improvements.
2.. Evaluate the RIRO on Akers for this development and call out if a Deviation of the ECM criteria is needed for this access due to intersection spacing. Also discuss Akers street improvements if needed.
3. Call out: This site is subject to the El Paso County Road Impact Fee program (Resolution 19-471), as amended. Indicate the fees and when they will need to be paid.
4. Call out the Right-of-way preservation if needed adjacent to Constitution/Marksheffel/Akers for the 2060 MTCP.

1) Mitigation table added to the revised study.
2) The right-in/right-out access onto Akers Drive is already analyzed in the Traffic Impact Study (referred to as Access B).
A review of access spacing requirements from the County's ECM, measured from Constitution Avenue and Hunter Jumper Drive, indicates minimum spacing requirements are met. Access spacing regarding the proposed right-in/right-out access will be including in the revised Traffic Impact Study.
No improvements to Akers Drive are assumed to be needed.
3) El Paso County Road Impact Fee called out in revised TIS. Developer to work with County on fees during plan approval process.
4) 20 feet of ROW will be dedicated along the north side of Constitution Avenue.

List of Figures Page

List of Tables Page

Appendices

I. Introduction

Project Overview

This traffic impact study addresses the capacity, geometric, and control requirements associated with the development entitled Watermark Akers Drive.

This proposed residential development consists of various multifamily residential buildings. The development is located on the northwest corner of the Constitution Avenue with Marksheffel Road intersection in Colorado Springs, Colorado.

Study Area Boundaries

The study area to be examined in this analysis encompasses the Akers Drive intersections with Constitution Avenue, Hunter Jumper Drive, and Electronic Drive, as well as the Marksheffel Road intersections with Constitution Avenue and Electronic Drive, and intersections with proposed site accesses.

Figure 1 illustrates location of the site and study intersections.

Site Description

Land for the development is currently vacant and surrounded by a mix of open space, residential, light industrial, and commercial land uses.

It is understood land for the development is currently within the jurisdiction of El Paso County.

The proposed development is understood to entail the new construction of 300 multifamily dwelling units accommodated within multiple three-story buildings and supported by various property amenities including a clubhouse and swimming pool.

Proposed access to the development is provided at the following locations: one full-movement access onto Akers Drive serving as an extension of Hunter Jumper Drive east of Akers Drive (referred to as Access A), and one right-in/right-out access onto Akers Drive (referred to as Access B).

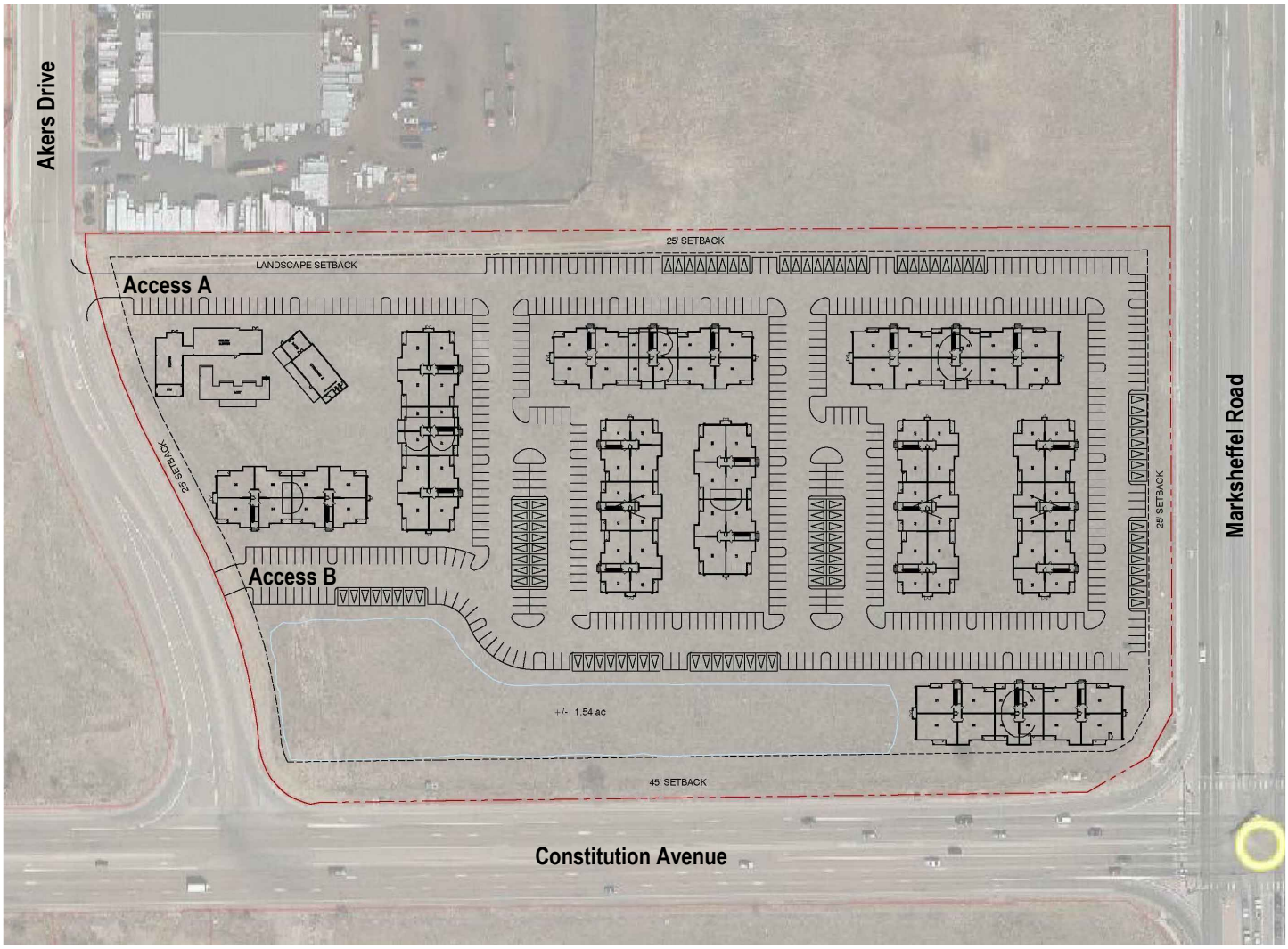
For purposes of this study, it is anticipated that development construction would be completed by end of Year 2022.

A conceptual site plan, as prepared by Watermark Residential, is shown on Figure 2. This plan is provided for illustrative purposes.


North
Not to Scale
Electronic Drive
Akers Drive
Markshéffel Road
Hunter Jumper Drive
Development
Site
Constitution Avenue

North

Not to Scale



Existing and Committed Surface Transportation Network

Within the study area, Constitution Avenue and Marksheffel Road are the primary roadways that will accommodate traffic to and from the proposed development. Secondary roadways include Akers Drive, Electronic Drive, and Hunter Jumper Drive. A brief description of each roadway, conservatively based on the City's major transportation thoroughfare plan[1] and design standards[2], is provided below:

> Marksheffel Road is a north-south principal arterial roadway having four through lanes (two lanes in each direction) with exclusive turn lanes at the intersections within the study area. Marksheffel Road provides a posted speed limit of 50 MPH.
>
> Constitution Avenue is an east-west principal arterial roadway having a varying number of through lanes (two to three lanes in each direction) with exclusive turn lanes at the intersections within the study area. Constitution Avenue provides a posted speed limit of 50 MPH.
>
> Akers Drive is a north-south roadway having two through lanes (one lane in each direction) with a combination of shared and exclusive turn lanes at the intersections within the study area. Akers Drive is unclassified in the City's major transportation thoroughfare plan. However, per Sections 15.0 and 16.0 of the City's design standards the roadway's estimated ROW width, and connection to Constitution Avenue, Akers Drive is assumed to be classified as a collector roadway and provides a posted speed limit of 35 MPH.
>
> Hunter Jumper Drive is an east-west roadway having two through lanes (one lane in each direction) with exclusive turn lanes at the intersection within the study area. Hunter Jumper Drive is unclassified in the City's major transportation thoroughfare plan. However, per Sections 15.0 and 16.0 of the City's design standards and the roadway's estimated ROW width, Hunter Jumper Drive is assumed to be classified as a collector roadway with a posted speed limit of 30 MPH.
>
> Electronic Drive is an east-west roadway having two through lanes (one lane in each direction) with a combination of shared and exclusive turn lanes at the intersections within the study area. Electronic Drive is unclassified in the City's major transportation thoroughfare plan. However, per Sections 15.0 and 16.0 of the City's design standards, the roadway's estimated ROW width, connection to Marksheffel Road, and service to various industrial land uses, Electronic Drive is assumed to be classified as an industrial roadway and provides a posted speed limit of 30 MPH.

The study intersection of Marksheffel Road with Constitution Avenue is 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.

Comparison of existing roadway cross-sections of Marksheffel Road and Constitution Avenue to the City's design standards concludes that both roadways are not built to their ultimate width for accommodation of future regional transportation demands. Both roadways are envisioned to become six-lane roadways (three through lanes in each direction).

---

[1] Major Thoroughfare Plan, City of Colorado Springs, August 2011.
[2] 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 Akers Drive intersections of Constitution Avenue, Hunter Jumper Drive, and Electronic Drive, and at the Marksheffel Road intersections of Constitution Avenue and Electronic Drive. Average daily (24-hour) traffic volumes were collected on Marksheffel Road, Constitution Avenue, and Akers Drive. These counts are shown on Figure 3.

It should be noted that due to the effects of the COVID-19 pandemic, traffic volumes collected may not accurately represent peak hour and 24-hour traffic volumes under normal conditions. Therefore, in order to more accurately represent existing traffic volumes under normal conditions, average daily traffic volumes along Marksheffel Road, provided from the City's GIS web mapping application[3], were referenced and grown at a two percent annual growth rate to Year 2020. Comparing the calculated 24-hour volume to the collected count data concludes that the collected count data represents higher traffic volumes. Therefore, collected count data is considered to adequately represent traffic volumes under normal conditions. These counts are shown on Figure 3.

It should also be noted that a significant number of U-turn vehicles are present at the intersection of Constitution Avenue with Marksheffel Road. It is observed that these U-turns utilize the existing northbound left turn lane. These U-turn movements were individually analyzed within this analysis and are shown separately in Figure 3.

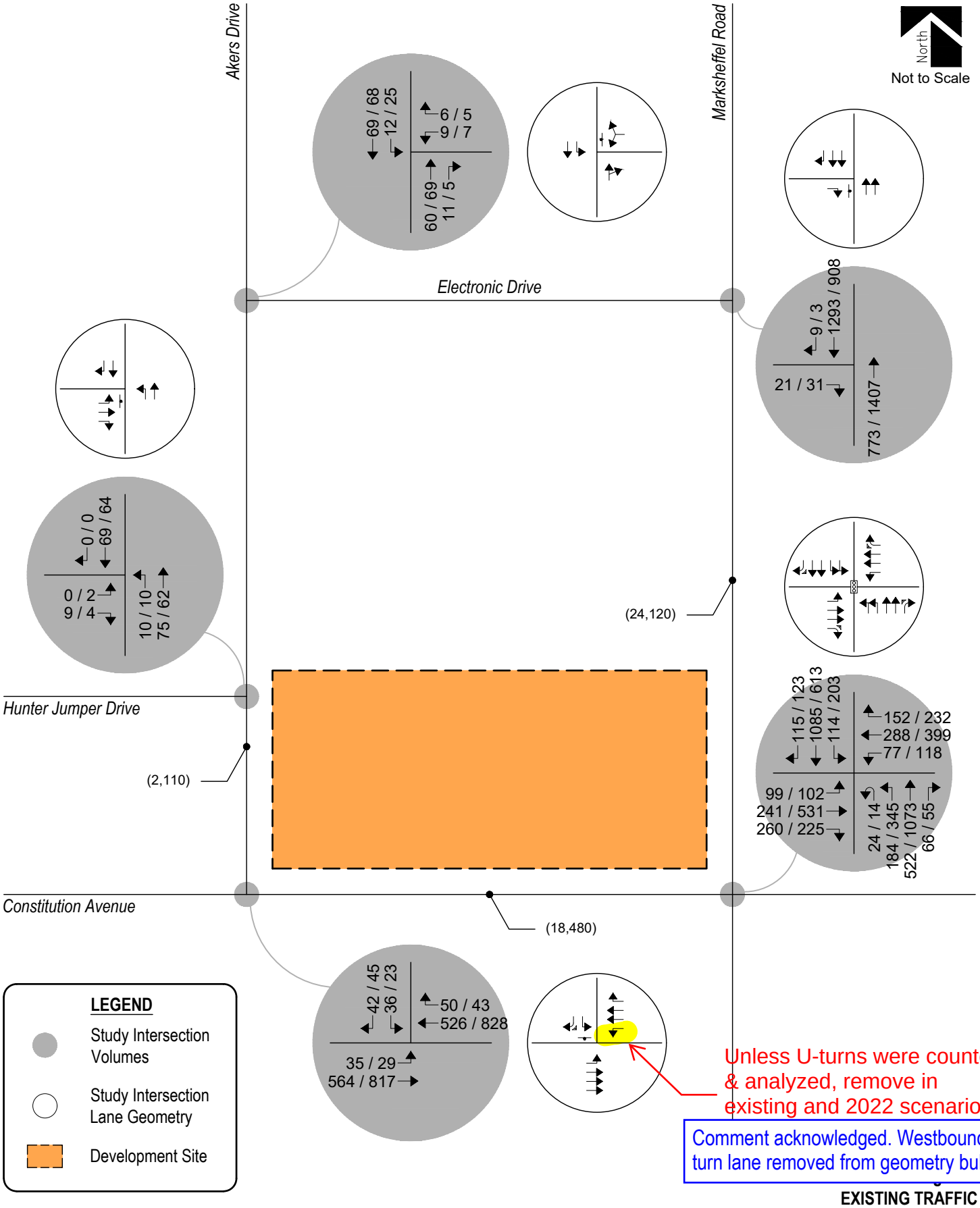
Traffic count data is included for reference in Appendix A.

Existing signal timing parameters for the intersection of Marksheffel Road and Constitution Avenue were obtained from City Staff 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 A.

The site is less than 3 miles from Peterson AFB. Many military bases have unique traffic peaking characteristics. The existing counts presented in Appendix A show that the morning peak may actually begin before 7:00am, which is when the peak hour traffic count data collection was started. Please review 15-minute data from the 24-hour counts and present data to verify that 7:00-8:00 is actually the AM peak.

Hourly ADT counts shown in Appendix A of the Traffic Impact Study indicate 7am is the morning peak traffic hour. A review of trip generation information provided by ITE indicates collected data begins at 7am for this land use (LUC 221). This allows for accuracy in our analysis between collected data and that provided by ITE.

[3] Web Mapping Application, City of Colorado Springs GIS, January 2019.



EXISTING TRAFFIC
Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic

The Signalized and Unsignalized Intersection Analysis techniques, as published in the Highway Capacity Manual (HCM) by the Transportation Research Board and as incorporated into the SYNCHRO computer program, were used to analyze the study intersections for existing 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.

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	LEVEL OF SERVICE	
LANE GROUPS	AM PEAK HOUR	PM PEAK HOUR
Constitution Avenue / Marksheffel Road (Signalized)	C (30.7)	D (41.7)
Constitution Avenue / Akers Drive (Stop-Controlled)		
Eastbound Left	A	A
Southbound Left	B	B
Southbound Right	A	A
Hunter Jumper Drive / Akers Drive (Stop-Controlled)		
Eastbound Left	A	A
Eastbound Right	A	A
Northbound Left	A	A
Electronic Drive / Akers Drive (Stop-Controlled)		
Westbound Left and Right	A	A
Southbound Left	A	A
Electronic Drive / Marksheffel Road (Stop-Controlled)		
Eastbound Right	C	B

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 Constitution Avenue with Marksheffel Road has overall operations at LOS C during morning peak traffic hours and LOS D during afternoon peak traffic hours.

The unsignalized intersection of Constitution Avenue with Akers Drive has turn movement operations at or better than LOS B during both morning and afternoon peak traffic hours.

The stop-controlled intersection of Hunter Jumper Drive with Akers Drive has turn movement operations at LOS A during both morning and afternoon peak traffic hours.

The unsignalized intersection of Electronic Drive with Akers Drive has turn movement operations at LOS A during both morning and afternoon peak traffic hours.

The stop-controlled intersection of Electronic Drive with Marksheffel Road has turn movement operations at LOS C during morning peak traffic hours and LOS B during afternoon peak traffic hours.

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 2022 and 2040, a compounded annual growth rate of approximately two percent was applied to existing traffic volumes. This annual growth rate is consistent with regional growth projections and the level of in-fill development expected within the area.

To account for projected traffic from adjacent developments not yet built, trip generations from The Sands traffic impact study[4] were added to Year 2022 background traffic volumes, while Filings 5-8 and Phases 9-10 from the Hannah Ridge at Feathergrass traffic impact studies[5,6] were added to Year 2040 background traffic volumes. It should be noted that the Hannah Ridge at Feathergrass traffic impact study, dated September 2017, originally assumed various retail land uses for the same development area currently proposed with this project, and included a right-in/right-out access into the site. This access is no longer proposed with this development, therefore ingress and egress traffic volumes originally anticipated to utilize the right-in/right-out access, were not added to background traffic volumes.

A signal warrant analysis, using 2040 background traffic volumes and upon the assumed extension of Akers Drive south of Constitution Avenue, was conducted for the Akers Drive intersection with Constitution Avenue in order to review potential for traffic signal control. Analysis results conclude that the intersection was found to be above the minimum vehicle volumes required to meet Warrant 3 – Peak Hour, from the Manual on Uniform Traffic Control Devices (MUTCD), for the installation of a traffic signal. As such, and consistent with assumptions defined within the Hannah Ridge at Feathergrass Filing Nos. 3 and 4 traffic impact study, the intersection was analyzed under traffic signal control by Year 2040. Warrant study worksheets are provided for reference in Appendix D.

Warrant 3 is intended for use at locations where traffic conditions are such that for a minimum of one hour on an average day, the minor-street (Akers Drive) traffic suffers undue delay when entering or crossing the major street (Constitution Avenue). This assumption provides for a conservative analysis. Said intersection should be monitored further by County Staff as area development occurs to determine when signalization installation is appropriate.

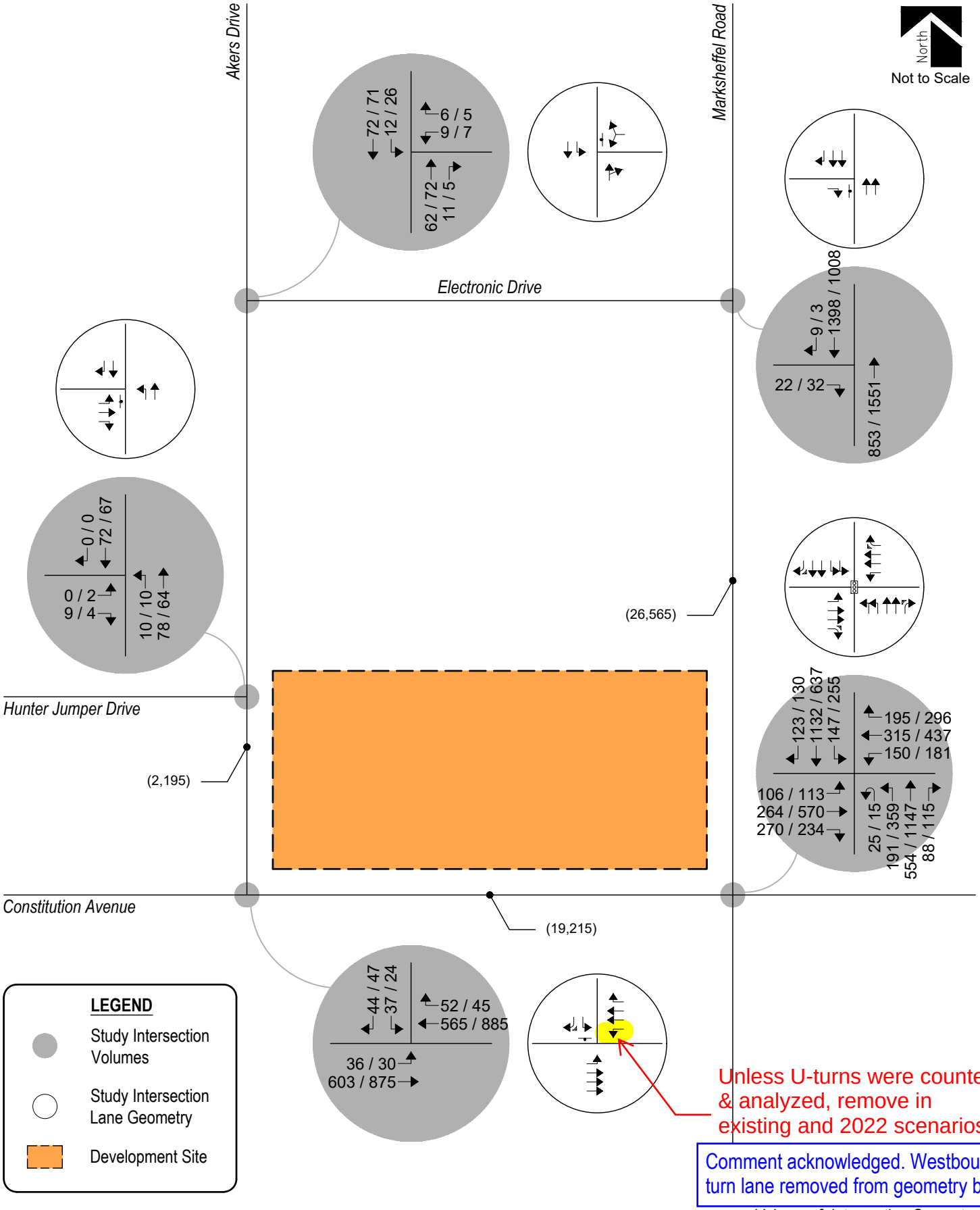
Pursuant to the non-committed area roadway improvements discussed in Section I, Year 2022 background traffic conditions assumes no roadway improvements to accommodate regional transportation demands.

---

[4] The Sands, LSC Transportation Consultants, Inc., May 2016.
[5] Hannah Ridge at Feathergrass Filings 5, 6, and 7, LSC Transportation Consultants, Inc., March 2019.
[6] Hannah Ridge at Feathergrass Filing Nos. 3 and 4, LSC Transportation Consultants, Inc., September 2017.

Year 2040 background traffic conditions assume Marksheffel Road and Constitution Avenue will be built out to their ultimate widths to accommodate regional transportation demands. This is consistent with assumptions defined within The Sands traffic impact study. Additionally, pursuant to the Hannah Ridge at Feathergrass Filing Nos. 3 and 4 traffic impact study, it is assumed Akers Drive is planned to extend south of Constitution Avenue in order to serve future commercial land uses within Phase 10 of the Hannah Ridge at Feathergrass development. Similarly, it is assumed Electronic Drive will extend west of Akers Drive to provide access to the future residential land uses within Phases 5 through 8 of said future development. Year 2040 also assumes existing signal timing parameters for the Marksheffel Road and Constitution Avenue intersection with optimized intersection splits in effort to better long-term intersection performance. This assumption provides for a conservative analysis.

Projected background traffic volumes and intersection geometry for Years 2022 and 2040 are shown on Figure 4 and Figure 5, respectively.



Unless U-turns were counted & analyzed, remove in existing and 2022 scenarios.

Comment acknowledged. Westbound left turn lane removed from geometry bubble.

Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic

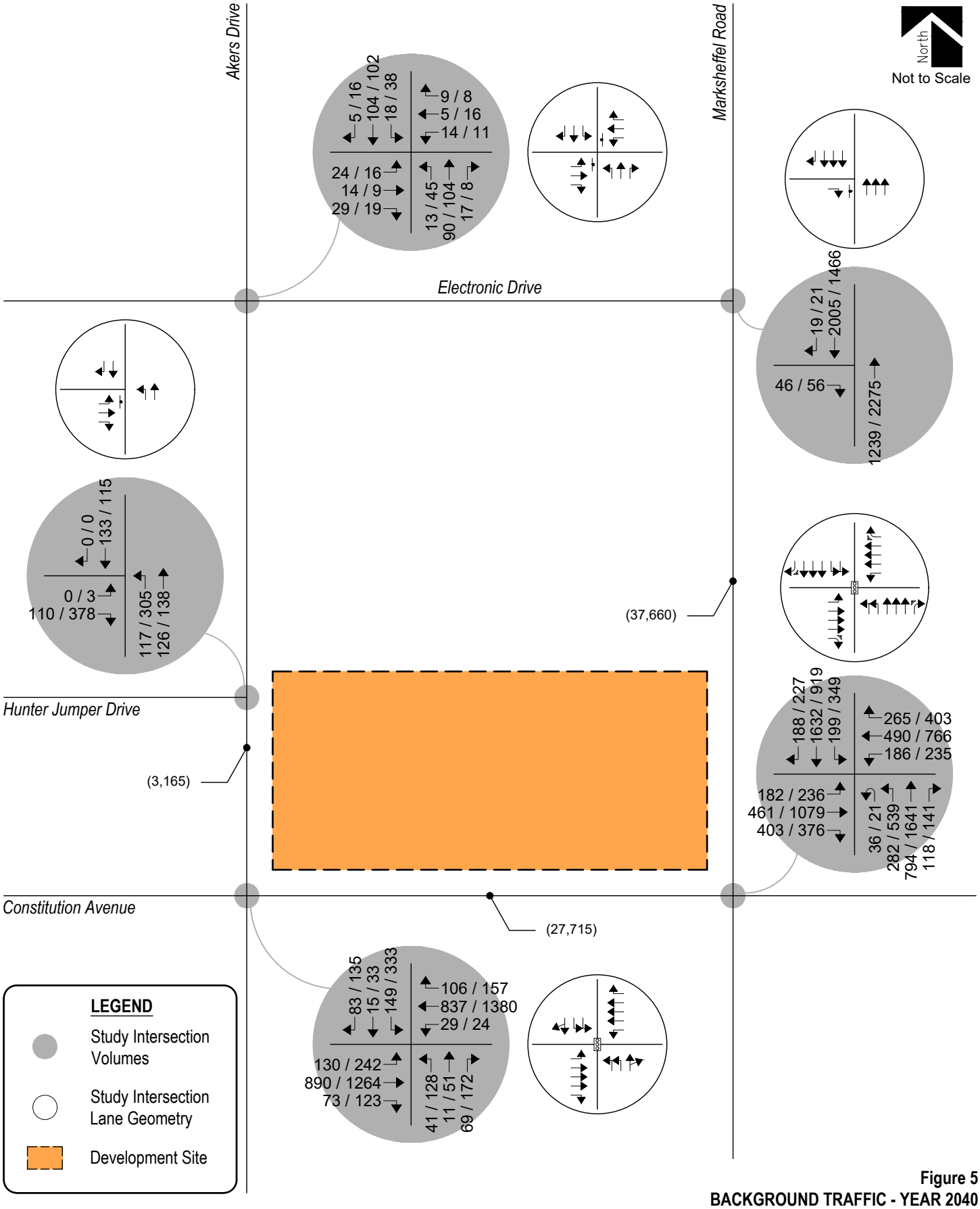


Figure 5
BACKGROUND TRAFFIC - YEAR 2040
Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic

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 2022 are listed in Table 2. Year 2040 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 2022

INTERSECTION	LEVEL OF SERVICE	
LANE GROUPS	AM PEAK HOUR	PM PEAK HOUR
Constitution Avenue / Marksheffel Road (Signalized)	C (33.1)	D (44.9)
Constitution Avenue / Akers Drive (Stop-Controlled)		
Eastbound Left	A	A
Southbound Left	B	B
Southbound Right	A	A
Hunter Jumper Drive / Akers Drive (Stop-Controlled)		
Eastbound Left	A	A
Eastbound Right	A	A
Northbound Left	A	A
Electronic Drive / Akers Drive (Stop-Controlled)		
Westbound Left and Right	A	A
Southbound Left	A	A
Electronic Drive / Marksheffel Road (Stop-Controlled)		
Eastbound Right	C	C

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

Background Traffic Analysis Results – Year 2022

Year 2022 background traffic analysis indicates that the signalized intersection of Constitution Avenue with Marksheffel Road experiences overall operations at LOS C during morning peak traffic hours and LOS D during afternoon peak traffic hours.

The unsignalized intersection of Constitution Avenue with Akers Drive shows turn movement operations at or better than LOS B during both morning and afternoon peak traffic hours.

The stop-controlled intersection of Hunter Jumper Drive with Akers Drive shows turn movement operations at LOS A during both morning and afternoon peak traffic hours.

The unsignalized intersection of Electronic Drive with Akers Drive has turn movement operations at LOS A during both morning and afternoon peak traffic hours.

The stop-controlled intersection of Electronic Drive with Marksheffel Road experiences turn movement operations at LOS C during both morning and afternoon peak traffic hours.

Table 3 – Intersection Capacity Analysis Summary – Background Traffic – Year 2040

INTERSECTION LANE GROUPS	LEVEL OF SERVICE AM PEAK HOUR	 PM PEAK HOUR
Constitution Avenue / Marksheffel Road (Signalized)	D (39.4)	E (56.8)
Constitution Avenue / Akers Drive (Signalized)	B (13.6)	D (54.3)
Hunter Jumper Drive / Akers Drive (Stop-Controlled)		
Eastbound Left	A	C
Eastbound Right	A	B
Northbound Left	A	A
Electronic Drive / Ake		
Eastbound Left		
Eastbound Throug		
Eastbound Right	A	A
Westbound Left	B	B
Westbound Through	B	B
Westbound Right	A	A
Northbound Left	A	A
Southbound Left	A	A
Electronic Drive / Marksheffel Road (Stop-Controlled)		
Eastbound Right	D	C

2040 Background better than existing? Please review.

Morning peak hour level of service operations at Hunter Jumper Drive / Akers Drive intersection is the same as 2040 Background, not better.

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

Background Traffic Analysis Results – Year 2040

By Year 2040 and without the proposed development, the study intersection of Constitution Avenue with Marksheffel Road projects overall operations at LOS D during morning peak traffic hours and LOS E during afternoon peak traffic hours. The LOS E operation anticipated during afternoon peak traffic periods is attributed to eastbound and westbound through volumes, as well as left turning movements in all directions.

The signalized intersection of Constitution Avenue with Akers Drive anticipates overall operations at LOS B during morning peak traffic hours and LOS D during afternoon peak traffic hours.

The stop-controlled intersection of Hunter Jumper Drive with Akers Drive expects turn movement operations at LOS A during morning peak traffic hours and LOS C or better during afternoon peak traffic hours.

The unsignalized intersection of Electronic Drive with Akers Drive shows turn movement operations at or better than LOS B during both morning and afternoon peak traffic hours.

The stop-controlled intersection of Electronic Drive with Marksheffel Road experiences turn movement operations at LOS D during morning peak traffic hours and LOS C during afternoon 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, 10th Edition, were applied to the proposed land use 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 code 221 (Multifamily (Mid-Rise)) was used for estimating trip generation because of its best fit to the proposed land use description.

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

Table 4 – Trip Generation Rates

			TRIP GENERATION RATES						
ITE			24	AM PEAK HOUR			PM PEAK HOUR		
CODE	LAND USE	UNIT	HOUR	ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
221	Multifamily Housing (Mid-Rise)	DU	5.44	0.09	0.27	0.36	0.27	0.17	0.44

Key: DU = Dwelling Units.
Note: All data and calculations above are subject to being rounded to nearest value.

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

Table 5 – Trip Generation Summary

			TOTAL TRIPS GENERATED						
ITE			24	AM PEAK HOUR			PM PEAK HOUR		
CODE	LAND USE	SIZE	HOUR	ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
221	Multifamily Housing (Mid-Rise)	300 DU	1,632	28	80	108	81	51	132
		Total:	*1,632*	*28*	*80*	*108*	*81*	*51*	*132*

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 1,632 daily trips with 108 of those occurring during the morning peak hour and 132 during the afternoon peak hour.

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

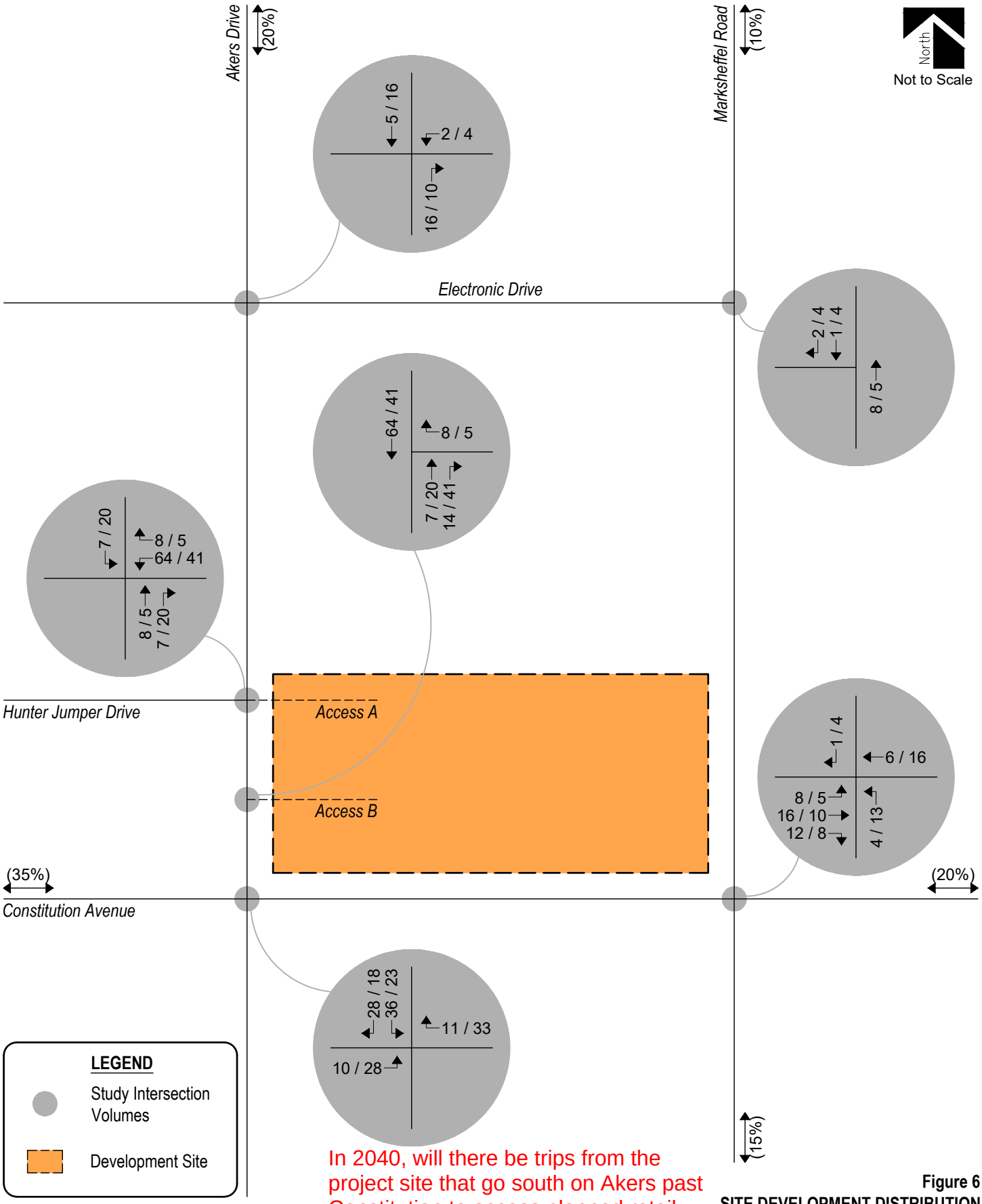
The overall directional distribution of site-generated traffic was determined based on the location of development site within the City and County, proposed and existing area land uses, allowed turning movements, available roadway network, and in reference to the Hannah Ridge at Feathergrass Filing Nos. 3 and 4 traffic impact study.

Overall trip distribution patterns for the development are shown on Figure 6.

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 shown on Figure 6.



In 2040, will there be trips from the project site that go south on Akers past Constitution to access planned retail facilities? This 2040 pattern is shown in the Hannah Ridge at Feathergrass TIS.

Figure 6
SITE DEVELOPMENT DISTRIBUTION
(%) : Overall
SITE-GENERATED
AM / PM Peak Hour

Year 2040 scenarios already include traffic volumes from Hannah Ridge at Feathergrass, as shown in Figure 5 and Figure 8. For purposes of this analysis, we are not anticipating site-generated trips to/from Akers Drive south of Constitution Avenue.

V. Future Traffic Conditions With Proposed Developments

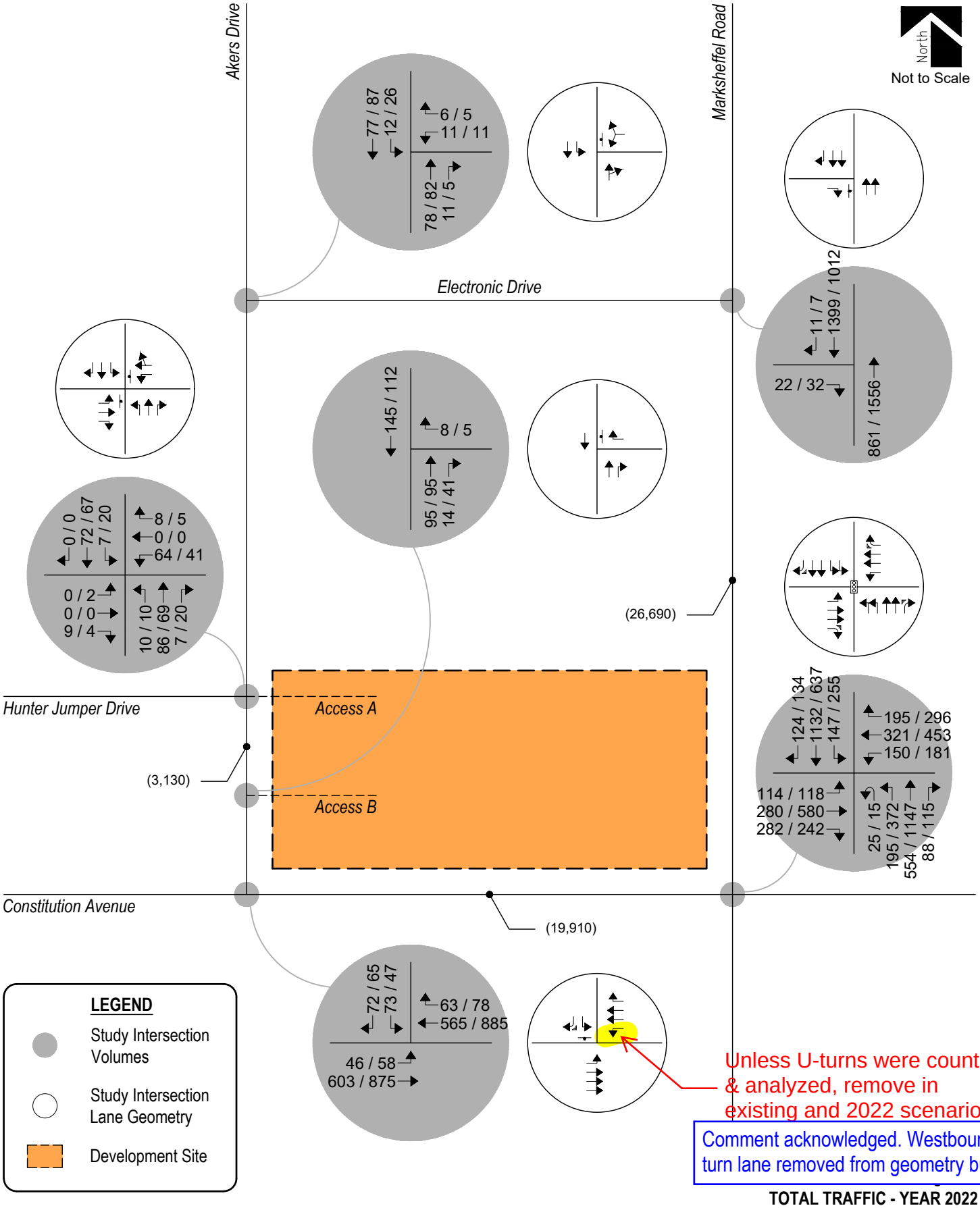
Site-generated traffic was added to background traffic projections for Years 2022 and 2040 to develop total traffic projections. For analysis purposes, it was assumed that development construction would be completed by end of Year 2022.

Pursuant to area roadway improvement discussions provided in Section III, Year 2022 and Year 2040 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.

A signal warrant analysis, using 2022 and 2040 total traffic volumes, was conducted for the Akers Drive with Hunter Jumper Drive intersection to review potential for traffic signal control. Analysis results conclude that the intersection does not have the minimum volume required to meet Warrant 3 – Peak Hour, from the MUTCD, for the installation of a traffic signal. As such, the intersection remained a stop-controlled condition. Warrant study worksheets are provided for reference in Appendix D.

Projected Year 2022 total traffic volumes and intersection geometry are shown in Figure 7.

Figure 8 shows projected total traffic volumes and intersection geometry for Year 2040.



Unless U-turns were counted & analyzed, remove in existing and 2022 scenarios.

Comment acknowledged. Westbound left turn lane removed from geometry bubble.

TOTAL TRAFFIC - YEAR 2022
Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic

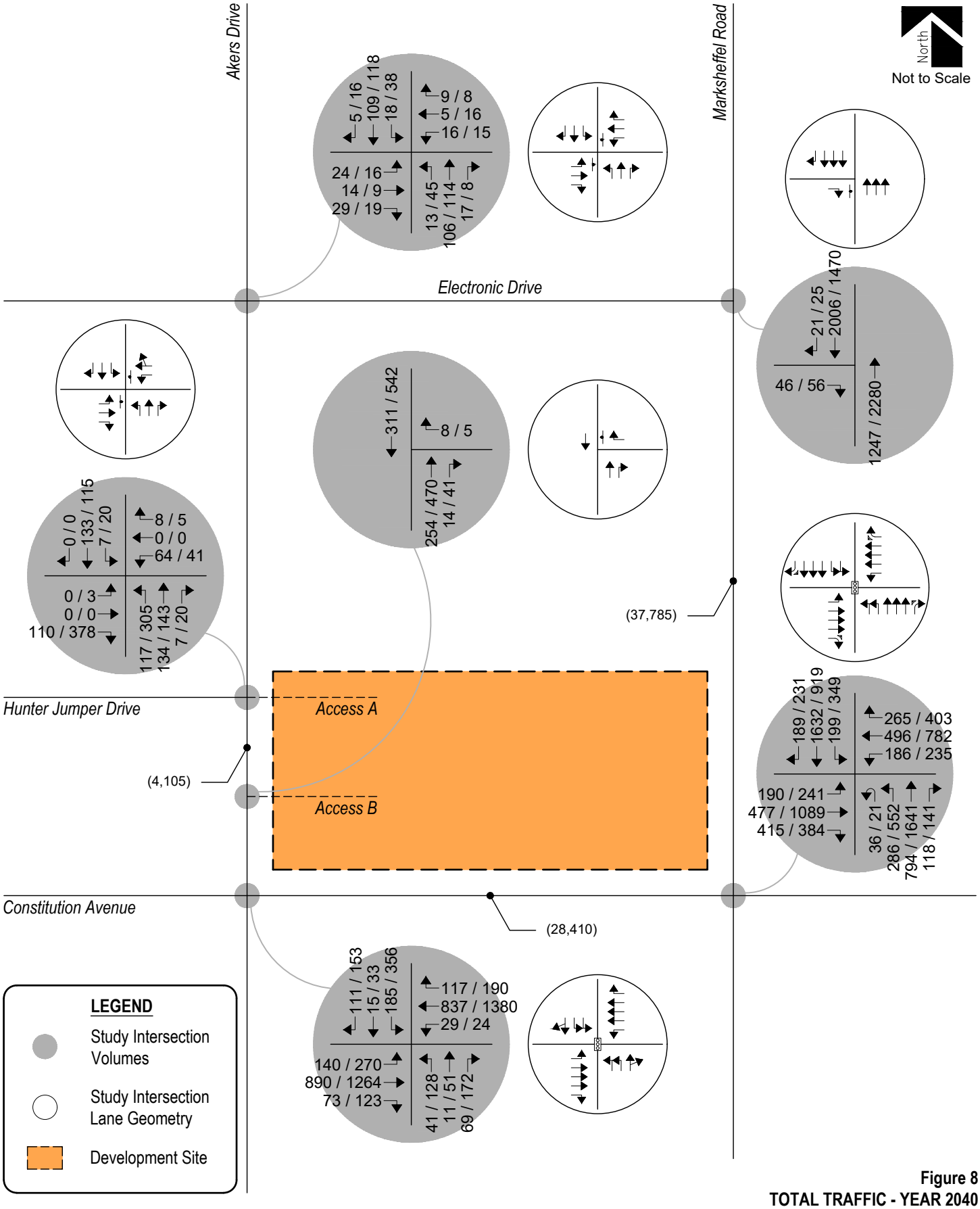


Figure 8
TOTAL TRAFFIC - YEAR 2040
Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic

VI. Project Impacts

The analyses and procedures described in this study were performed in accordance with the Highway Capacity Manual (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.

Peak Hour Intersection Levels of Service

As with background traffic, the operations of the study intersections were analyzed under projected total traffic conditions using the SYNCHRO computer program. Total traffic level of service analysis results for Years 2022 and 2040 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 2022

INTERSECTION	LEVEL OF SERVICE	
LANE GROUPS	AM PEAK HOUR	PM PEAK HOUR
Constitution Avenue / Marksheffel Road (Signalized)	C (33.5)	D (45.2)
Constitution Avenue / Akers Drive (Stop-Controlled)		
Eastbound Left	A	A
Southbound Left	B	B
Southbound Right	A	A
Hunter Jumper Drive / Akers Drive (Stop-Controlled)		
Eastbound Left	A	B
Eastbound Through	A	A
Eastbound Right	A	A
Westbound Left	B	B
Westbound Through and Right	A	A
Northbound Left	A	A
Southbound Left	A	A
Electronic Drive / Akers Drive (Stop-Controlled)		
Westbound Left and Right	A	A
Southbound Left	A	A
Electronic Drive / Marksheffel Road (Stop-Controlled)		
Eastbound Right	C	B
Access B / Akers Drive (Stop-Controlled)		
Westbound Right	A	A

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

2040 Total better than 2040 Background? Please review.

Confirmed that analysis results shown are correct.

Analysis Summary – Total Traffic – Year 2040

INTERSECTION LANE GROUPS	LEVEL OF SERVICE AM PEAK HOUR	 PM PEAK HOUR
Constitution Avenue / Marksheffel Road (Signalized)	D (39.5)	D (53.8)
Constitution Avenue / Akers Drive (Signalized)	B (14.2)	E (65.9)
Hunter Jumper Drive / Akers Drive (Stop-Controlled)		
Eastbound Left	A	D
Eastbound Through	A	A
Eastbound Right	A	B
Westbound Left	C	F
Westbound Throu	A	A
Northbound Left	A	A
Southbound Left	A	A
Electronic Drive / Akers Drive (Stop-Controlled)		
Eastbound Left	B	B
Eastbound Through	B	B
Eastbound Right	A	A
Westbound Left		B
Westbound Through		B
Westbound Right		A
Northbound Left	A	A
Southbound Left	A	A
Electronic Drive / Marksheffel Road (Stop-Controlled)		
Eastbound Right	D	C
Access B / Akers Drive (Stop-Controlled)		
Westbound Right	A	B

2040 Total LOS E requires mitigation when 2040 Background is acceptable.

Mitigation recommendations included.

See comment in Mitigation section.

This LOS F operation occurs on-site, therefore no mitigation recommendation included in revised TIS.

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 2040 and upon development build-out, the signalized intersection of Constitution Avenue with Marksheffel Road shows an overall LOS D operation during both morning and afternoon peak traffic hours. Compared to the background traffic analysis, the traffic generated by the proposed development is not expected to significantly change the operations of the study intersection.

The signalized intersection of Constitution Avenue with Akers Drive anticipates overall operations at LOS B during morning peak traffic hours and LOS E during afternoon peak traffic hours. The LOS E operation anticipated during afternoon peak traffic periods is attributed to the eastbound left turn movement, as well as northbound and southbound left and through volumes.

Acknowledging that warrants are not projected to be met, is there a reasonable mitigation for the LOS F movement on the site access?

The stop-controlled intersect
operations at or better than
afternoon peak traffic hours.
operate at LOS F during the
through traffic volume along

Analysis indicates no reasonable recommendations to mitigate the LOS F for the westbound left turn movement during PM peak traffic hours. Because traffic signal warrant is not met, and since the LOS F operation occurs on-site, it is believed no mitigation necessary as this movement does not negatively impact Akers Drive or adjacent public roadways.

The unsignalized intersection of Electronic Drive with Akers Drive shows turn movement operations at or better than LOS B during both morning and afternoon peak traffic hours.

The stop-controlled intersection of Electronic Drive with Marksheffel Road experiences turn movement operations at LOS D during morning peak traffic hours and LOS C during afternoon peak traffic hours.

The unsignalized intersection of Access B with Akers Drive anticipates turn movement operations at LOS A during morning peak traffic hours and LOS B or better during afternoon peak traffic hours.

These intersection operations are similar to background conditions.

Although site access queuing is not significant, the 2040 EB PM left turn queue at Constitution / Akers exceeds the length of the existing left turn lane, which is back-to-back with the turn lane at Constitution / Hannah Ridge. Since the project site contributes more than 10% of the volume to this movement, please address.

Queue Length Analysis

This issue addressed in the revised TIS.

Queue lengths for propo
conditions. The analysis
zed using Year 2040 total traffic
lengths, which have only a five percent probability of being exceeded during the analysis time period. Queue lengths were modeled and are included with the Synchro worksheets in Appendix C.

No significant queuing at the proposed site accesses was indicated. The greatest on-site queue length anticipated at Access A occurs during the afternoon peak hour. The queue length is approximately three vehicles for the eastbound right and westbound left turn movements.

Auxiliary Lane Analysis

Auxiliary lanes for site development accesses were based on the County's standards[7] and Section III of the City's design standards.

Considering development build-out, an evaluation of auxiliary lane requirements, pursuant to Section 2.3.7 of the County's standards and Section 8.0, Table 2, of the City's design standards reveals that left and right turn deceleration lanes are not required along Akers Drive. However, pursuant to existing striping patterns, it is assumed restriping will occur to allow for a northbound right turn deceleration lane at Access B, and right and left turn decelerations lanes at Access A, in order to provide consistency with the existing lane geometry on the west side of Akers Drive.

[7] El Paso County Engineering Criteria Manual, El Paso County, December 2016.

VII. Conclusion

This traffic impact study addressed the capacity, geometric, and control requirements associated with the development entitled Watermark Akers Drive. This proposed residential development consists of various multifamily residential buildings. The development is located on the northwest corner of the Constitution Avenue with Marksheffel Road intersection in Colorado Springs, Colorado.

The study area examined in this analysis encompassed the Akers Drive intersections with Constitution Avenue, Hunter Jumper Drive, and Electronic Drive, the Marksheffel Road intersections with Constitution Avenue and Electronic Drive, and intersections with proposed site accesses.

Analysis was conducted for critical AM Peak Hour and PM Peak Hour traffic operations for existing traffic conditions, Year 2022 and Year 2040 background traffic conditions, and Year 2022 and Year 2040 total traffic conditions.

Analysis of existing traffic conditions indicates that the signalized intersection of Constitution Avenue with Marksheffel Road has overall operations at LOS C during morning peak traffic hours and LOS D during afternoon peak traffic hours. The unsignalized intersection of Constitution Avenue with Akers Drive has turn movement operations at or better than LOS B during both morning and afternoon peak traffic hours. The stop-controlled intersection of Hunter Jumper Drive with Akers Drive has turn movement operations at LOS A during both morning and afternoon peak traffic hours. The unsignalized intersection of Electronic Drive with Akers Drive has turn movement operations at LOS A during both morning and afternoon peak traffic hours. The stop-controlled intersection of Electronic Drive with Marksheffel Road has turn movement operations at LOS C during morning peak traffic hours and LOS B during afternoon peak traffic hours.

Without the proposed development, Year 2022 background operational analysis shows that the signalized intersection of Constitution Avenue with Marksheffel Road experiences overall operations at LOS C during morning peak traffic hours and LOS D during afternoon peak traffic hours. The unsignalized intersection of Constitution Avenue with Akers Drive shows turn movement operations at or better than LOS B during both morning and afternoon peak traffic hours. The stop-controlled intersection of Hunter Jumper Drive with Akers Drive shows turn movement operations at LOS A during both morning and afternoon peak traffic hours. The unsignalized intersection of Electronic Drive with Akers Drive has turn movement operations at LOS A during both morning and afternoon peak traffic hours. The stop-controlled intersection of Electronic Drive with Marksheffel Road experiences turn movement operations at LOS C during both morning and afternoon peak traffic hours.

Update conclusions based on revisions outlined above, including any mitigations identified and bicycle / pedestrian components.

Comment acknowledged.

By Year 2040 and without the proposed development, the study intersection of Constitution Avenue with Marksheffel Road projects overall operations at LOS D during morning peak traffic hours and LOS E during afternoon peak traffic hours. The LOS E operation anticipated during afternoon peak traffic periods is attributed to eastbound and westbound through volumes, as well as left turning movements in all directions. The signalized intersection of Constitution Avenue with Akers Drive anticipates overall operations at LOS B during morning peak traffic hours and LOS D during afternoon peak traffic hours. The stop-controlled intersection of Hunter Jumper Drive with Akers Drive expects turn movement operations at LOS A during morning peak traffic hours and LOS C or better during afternoon peak traffic hours. The unsignalized intersection of Electronic Drive with Akers Drive shows turn movement operations at or better than LOS B during both morning and afternoon peak traffic hours. The stop-controlled intersection of Electronic Drive with Marksheffel Road experiences turn movement operations at LOS D during morning peak traffic hours and LOS C during afternoon peak traffic hours.

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 are projected to operate at future levels of service comparable to Year 2040 background traffic conditions. Proposed site accesses have long-term operations at LOS D or better during peak traffic periods and upon build-out.

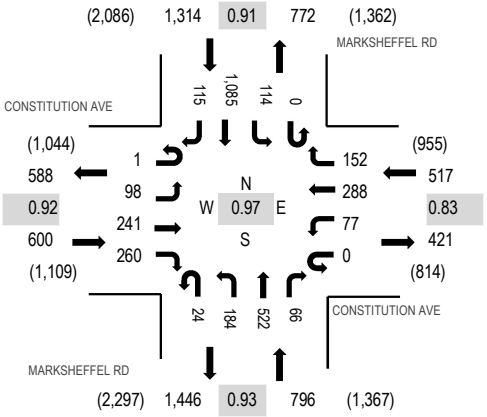
APPENDIX A

Traffic Count Data
Signal Timing Information

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

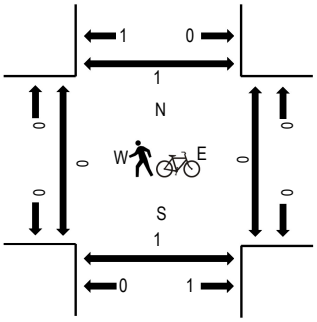
Location: 1 MARKSHEFFEL RD & CONSTITUTION AVE AM
Date: Tuesday, August 11, 2020
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



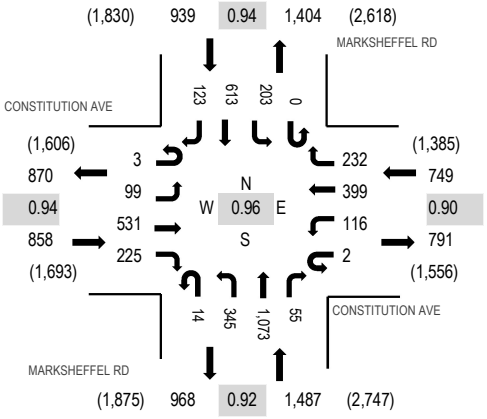
Traffic Counts

Interval Start Time	CONSTITUTION AVE Eastbound				CONSTITUTION AVE 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	23	50	67	0	16	68	38	4	34	141	18	0	36	281	29	805	3,227	0	0	0	0
7:15 AM	1	32	70	60	0	31	49	36	5	48	121	17	0	14	315	31	830	3,038	0	0	0	0
7:30 AM	0	19	64	75	0	21	85	49	7	49	145	12	0	30	240	32	828	2,799	0	0	0	0
7:45 AM	0	24	57	58	0	9	86	29	8	53	115	19	0	34	249	23	764	2,548	0	0	0	1
8:00 AM	0	22	64	44	0	17	46	32	2	40	99	15	0	28	177	30	616	2,290	0	0	1	0
8:15 AM	1	22	72	47	0	22	58	40	4	28	84	13	0	22	160	18	591		0	0	0	1
8:30 AM	0	11	66	34	0	10	64	34	4	48	95	13	0	26	148	24	577		0	0	0	0
8:45 AM	0	24	52	50	0	14	57	44	3	33	83	7	0	15	115	9	506		0	0	0	0
Count Total	2	177	495	435	0	140	513	302	37	333	883	114	0	205	1,685	196	5,517		0	0	1	2
Peak Hour	1	98	241	260	0	77	288	152	24	184	522	66	0	114	1,085	115	3,227		0	0	0	1

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

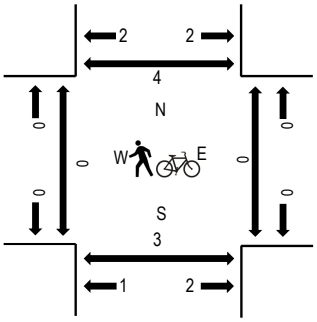
Location: 1 MARKSHEFFEL RD & CONSTITUTION AVE PM
Date: Tuesday, August 11, 2020
Peak Hour: 04:15 PM - 05:15 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



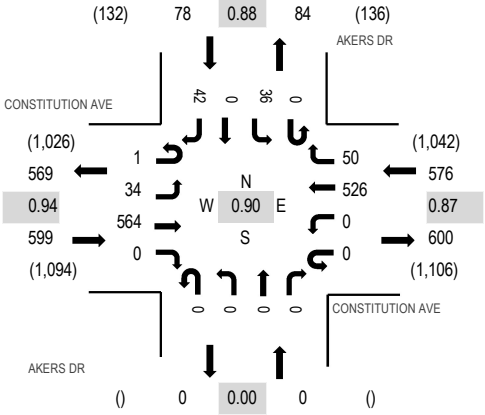
Traffic Counts

Interval Start Time	CONSTITUTION AVE Eastbound				CONSTITUTION AVE Westbound				MARKSHEFFEL RD Northbound				MARKSHEFFEL RD Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	22	130	48	0	27	87	42	1	75	273	8	0	43	153	34	943	3,924	0	0	0	0
4:15 PM	0	28	149	50	0	24	105	54	1	88	252	14	0	54	155	28	1,002	4,033	0	0	0	0
4:30 PM	2	19	129	64	1	29	91	53	3	86	252	13	0	50	153	27	972	3,990	0	0	0	0
4:45 PM	0	23	130	51	1	28	114	66	7	98	253	15	0	55	133	33	1,007	3,930	0	0	0	0
5:00 PM	1	29	123	60	0	35	89	59	3	73	316	13	0	44	172	35	1,052	3,731	0	0	0	0
5:15 PM	0	27	141	63	0	25	96	52	4	71	244	15	0	48	147	26	959		0	0	0	0
5:30 PM	0	23	143	50	0	18	92	46	3	71	226	12	0	48	156	24	912		0	0	0	0
5:45 PM	0	26	116	46	0	29	83	39	4	51	194	8	0	53	133	26	808		0	0	0	0
Count Total	3	197	1,061	432	2	215	757	411	26	613	2,010	98	0	395	1,202	233	7,655		0	0	0	0
Peak Hour	3	99	531	225	2	116	399	232	14	345	1,073	55	0	203	613	123	4,033		0	0	0	0

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

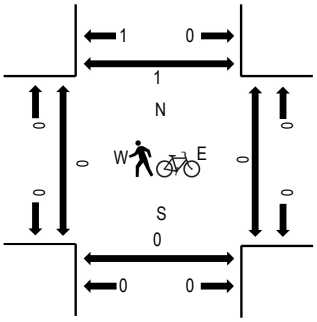
Location: 2 AKERS DR & CONSTITUTION AVE AM
Date: Tuesday, August 11, 2020
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:30 AM - 07:45 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



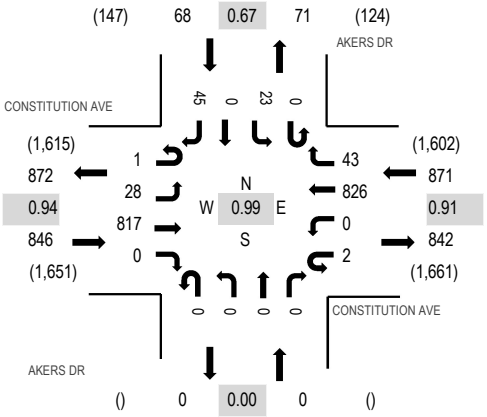
Traffic Counts

Interval Start Time	CONSTITUTION AVE Eastbound				CONSTITUTION AVE Westbound				AKERS DR Northbound				AKERS DR 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	10	135	0	0	0	115	12	0	0	0	0	0	4	0	8	284	1,253	0	0	0	0
7:15 AM	0	12	148	0	0	0	114	16	0	0	0	0	0	12	0	13	315	1,235	0	0	0	0
7:30 AM	0	5	154	0	0	0	153	13	0	0	0	0	0	11	0	13	349	1,172	0	0	0	0
7:45 AM	1	7	127	0	0	0	144	9	0	0	0	0	0	9	0	8	305	1,078	0	0	0	1
8:00 AM	0	9	115	0	0	0	115	5	0	0	0	0	0	13	0	9	266	1,015	0	0	0	0
8:15 AM	0	2	131	0	0	0	102	7	0	0	0	0	0	6	0	4	252		0	0	0	1
8:30 AM	0	3	107	0	0	0	122	13	0	0	0	0	0	5	0	5	255		0	0	0	1
8:45 AM	0	9	119	0	0	0	98	4	0	0	0	0	0	10	0	2	242		0	0	0	0
Count Total	1	57	1,036	0	0	0	963	79	0	0	0	0	0	70	0	62	2,268		0	0	0	3
Peak Hour	1	34	564	0	0	0	526	50	0	0	0	0	0	36	0	42	1,253		0	0	0	1

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

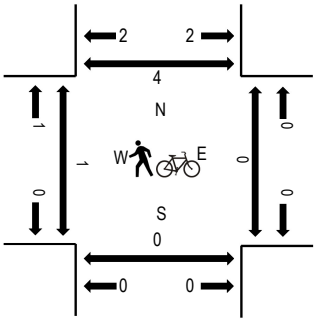
Location: 2 AKERS DR & CONSTITUTION AVE PM
Date: Tuesday, August 11, 2020
Peak Hour: 04:15 PM - 05:15 PM
Peak 15-Minutes: 04:30 PM - 04:45 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



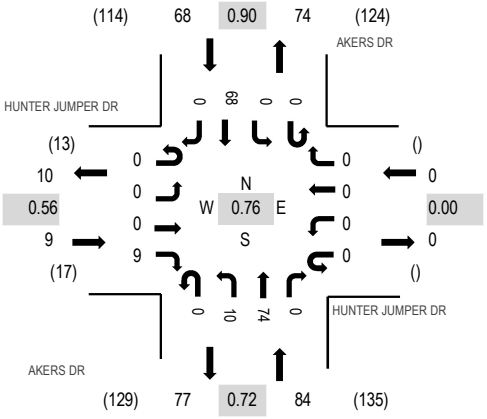
Traffic Counts

Interval Start Time	CONSTITUTION AVE Eastbound				CONSTITUTION AVE Westbound				AKERS DR Northbound				AKERS DR 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	5	190	0	0	0	180	14	0	0	0	0	0	8	0	21	418	1,754	0	0	0	0
4:15 PM	0	7	204	0	0	0	210	10	0	0	0	0	0	4	0	9	444	1,785	0	0	0	0
4:30 PM	1	5	214	0	1	0	192	13	0	0	0	0	0	11	0	16	453	1,757	0	0	0	0
4:45 PM	0	4	186	0	0	0	226	14	0	0	0	0	0	2	0	7	439	1,737	0	0	0	0
5:00 PM	0	12	213	0	1	0	198	6	0	0	0	0	0	6	0	13	449	1,646	0	0	0	0
5:15 PM	0	4	206	0	1	0	178	7	0	0	0	0	0	12	0	8	416		0	0	0	0
5:30 PM	0	4	214	0	0	0	182	12	0	0	0	0	0	7	0	14	433		0	0	0	0
5:45 PM	1	4	177	0	0	0	154	3	0	0	0	0	0	4	0	5	348		0	0	0	1
Count Total	2	45	1,604	0	3	0	1,520	79	0	0	0	0	0	54	0	93	3,400		0	0	0	1
Peak Hour	1	28	817	0	2	0	826	43	0	0	0	0	0	23	0	45	1,785		0	0	0	0

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

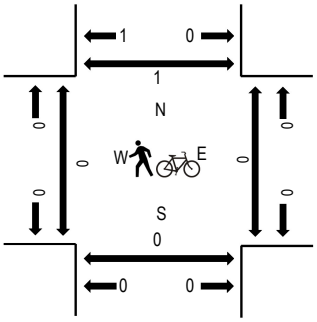
Location: 3 AKERS DR & HUNTER JUMPER DR AM
Date: Tuesday, August 11, 2020
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



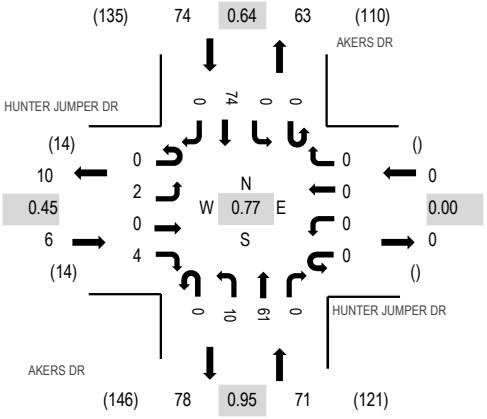
Traffic Counts

Interval Start Time	HUNTER JUMPER DR Eastbound				HUNTER JUMPER DR Westbound				AKERS DR Northbound				AKERS DR 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	0	0	0	0	3	18	0	0	0	12	0	33	161	0	0	0	0
7:15 AM	0	0	0	4	0	0	0	0	0	3	26	0	0	0	20	0	53	160	0	0	0	0
7:30 AM	0	0	0	3	0	0	0	0	0	2	16	0	0	0	21	0	42	129	0	0	0	0
7:45 AM	0	0	0	2	0	0	0	0	0	2	14	0	0	0	15	0	33	114	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	12	0	0	0	20	0	32	105	0	0	0	0
8:15 AM	0	2	0	1	0	0	0	0	0	0	10	0	0	0	9	0	22		0	0	0	0
8:30 AM	0	0	0	2	0	0	0	0	0	2	13	0	0	0	10	0	27		0	0	0	0
8:45 AM	0	1	0	2	0	0	0	0	1	1	12	0	0	0	7	0	24		1	0	0	0
Count Total	0	3	0	14	0	0	0	0	1	13	121	0	0	0	114	0	266		1	0	0	0
Peak Hour	0	0	0	9	0	0	0	0	0	10	74	0	0	0	68	0	161		0	0	0	0

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

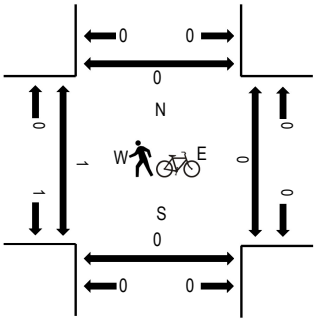
Location: 3 AKERS DR & HUNTER JUMPER DR PM
Date: Tuesday, August 11, 2020
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:00 PM - 04:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



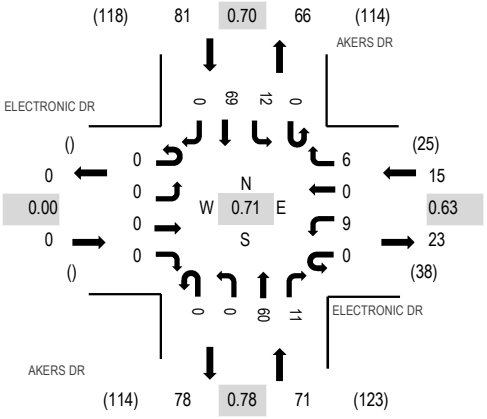
Traffic Counts

Interval Start Time	HUNTER JUMPER DR Eastbound				HUNTER JUMPER DR Westbound				AKERS DR Northbound				AKERS DR Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	1	0	1	0	0	0	0	0	2	16	0	0	0	29	0	49	151	0	0	0	0
4:15 PM	0	0	0	1	0	0	0	0	0	2	15	0	0	0	11	0	29	140	0	0	0	0
4:30 PM	0	0	0	2	0	0	0	0	0	3	16	0	0	0	25	0	46	143	1	0	0	0
4:45 PM	0	1	0	0	0	0	0	0	0	3	14	0	0	0	9	0	27	129	0	0	0	0
5:00 PM	0	1	0	4	0	0	0	0	0	1	18	0	0	0	14	0	38	119	0	0	0	0
5:15 PM	0	0	0	1	0	0	0	0	0	1	10	0	0	0	20	0	32		0	0	0	0
5:30 PM	0	0	0	1	0	0	0	0	1	2	10	0	0	0	18	0	32		0	0	0	0
5:45 PM	0	1	0	0	0	0	0	0	0	0	7	0	0	0	9	0	17		0	0	0	0
Count Total	0	4	0	10	0	0	0	0	1	14	106	0	0	0	135	0	270		1	0	0	0
Peak Hour	0	2	0	4	0	0	0	0	0	10	61	0	0	0	74	0	151		1	0	0	0

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

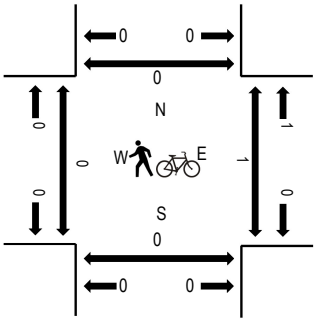
Location: 4 AKERS DR & ELECTRONIC DR AM
Date: Tuesday, August 11, 2020
Peak Hour: 07:15 AM - 08:15 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



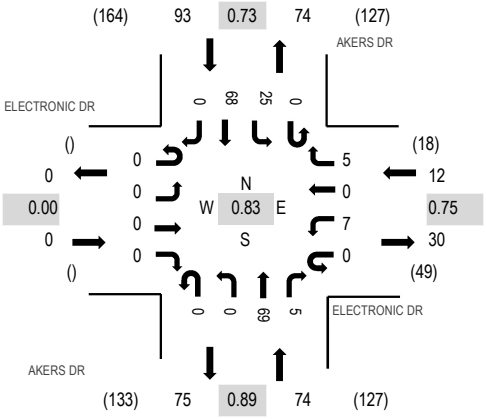
Traffic Counts

Interval Start Time	ELECTRONIC DR Eastbound				ELECTRONIC DR Westbound				AKERS DR Northbound				AKERS DR 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	1	0	0	0	0	14	4	0	5	10	0	34	161	0	0	0	0
7:15 AM	0	0	0	0	0	6	0	0	0	0	18	6	0	10	19	0	59	167	0	0	0	0
7:30 AM	0	0	0	0	0	2	0	1	0	0	17	1	0	2	19	0	42	130	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	14	1	0	0	11	0	26	111	0	0	0	0
8:00 AM	0	0	0	0	0	1	0	5	0	0	11	3	0	0	20	0	40	105	0	0	0	0
8:15 AM	0	0	0	0	0	4	0	0	0	0	8	0	0	3	7	0	22		0	0	0	0
8:30 AM	0	0	0	0	0	1	0	0	0	0	13	1	0	0	8	0	23		0	0	0	0
8:45 AM	0	0	0	0	0	3	0	1	0	0	12	0	0	2	2	0	20		0	0	0	0
Count Total	0	0	0	0	0	18	0	7	0	0	107	16	0	22	96	0	266		0	0	0	0
Peak Hour	0	0	0	0	0	9	0	6	0	0	60	11	0	12	69	0	167		0	0	0	0

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

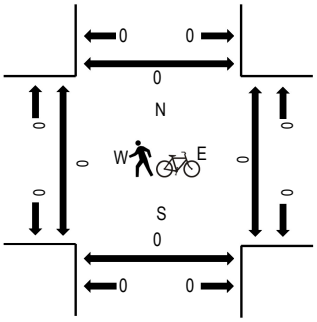
Location: 4 AKERS DR & ELECTRONIC DR PM
Date: Tuesday, August 11, 2020
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:00 PM - 04:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



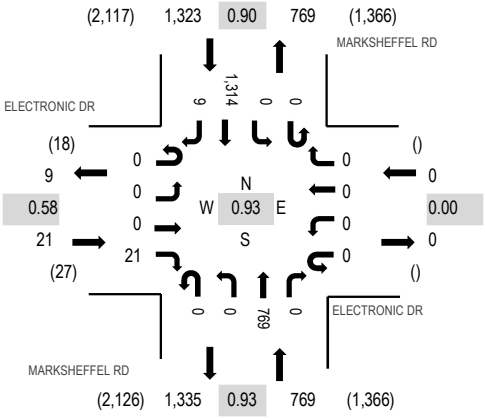
Traffic Counts

Interval Start Time	ELECTRONIC DR Eastbound				ELECTRONIC DR Westbound				AKERS DR Northbound				AKERS DR 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	2	0	2	0	0	16	2	0	9	23	0	54	179	0	0	0	0
4:15 PM	0	0	0	0	0	3	0	0	0	0	19	1	0	6	10	0	39	174	0	0	0	0
4:30 PM	0	0	0	0	0	1	0	3	0	0	16	1	0	7	23	0	51	167	0	0	0	0
4:45 PM	0	0	0	0	0	1	0	0	0	0	18	1	0	3	12	0	35	147	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	3	0	0	19	3	0	8	16	0	49	130	0	0	0	0
5:15 PM	0	0	0	0	0	2	0	0	0	0	12	0	0	3	15	0	32		0	0	0	0
5:30 PM	0	0	0	0	0	1	0	0	0	0	9	0	0	4	17	0	31		0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	10	0	0	1	7	0	18		0	0	0	0
Count Total	0	0	0	0	0	10	0	8	0	0	119	8	0	41	123	0	309		0	0	0	0
Peak Hour	0	0	0	0	0	7	0	5	0	0	69	5	0	25	68	0	179		0	0	0	0

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

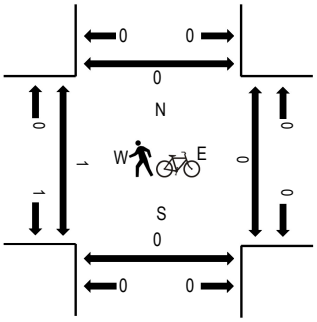
Location: 5 MARKSHEFFEL RD & ELECTRONIC DR AM
Date: Tuesday, August 11, 2020
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:00 AM - 07:15 AM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



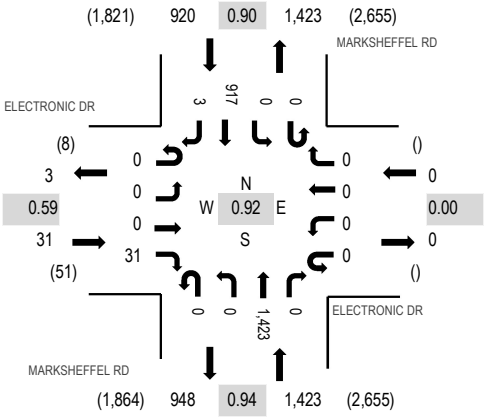
Traffic Counts

Interval Start Time	ELECTRONIC DR Eastbound				ELECTRONIC DR 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	0	9	0	0	0	0	0	0	193	0	0	0	366	1	569	2,113	0	0	0	0
7:15 AM	0	0	0	9	0	0	0	0	0	0	195	0	0	0	331	5	540	1,930	0	0	0	0
7:30 AM	0	0	0	2	0	0	0	0	0	0	207	0	0	0	317	3	529	1,763	0	0	0	0
7:45 AM	0	0	0	1	0	0	0	0	0	0	174	0	0	0	300	0	475	1,558	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	154	0	0	0	231	1	386	1,397	0	0	0	0
8:15 AM	0	0	0	2	0	0	0	0	0	0	153	0	0	0	214	4	373		0	0	0	0
8:30 AM	0	0	0	3	0	0	0	0	0	0	129	0	0	0	191	1	324		2	0	0	0
8:45 AM	0	0	0	1	0	0	0	0	0	0	161	0	0	0	149	3	314		0	0	0	0
Count Total	0	0	0	27	0	0	0	0	0	0	1,366	0	0	0	2,099	18	3,510		2	0	0	0
Peak Hour	0	0	0	21	0	0	0	0	0	0	769	0	0	0	1,314	9	2,113		0	0	0	0

ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

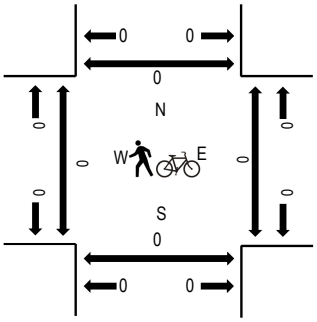
Location: 5 MARKSHEFFEL RD & ELECTRONIC DR PM
Date: Tuesday, August 11, 2020
Peak Hour: 04:30 PM - 05:30 PM
Peak 15-Minutes: 05:00 PM - 05:15 PM

Peak Hour - All Vehicles



Note: Total study counts contained in parentheses.

Peak Hour - Pedestrians/Bicycles on Crosswalk



Traffic Counts

Interval Start Time	ELECTRONIC DR Eastbound				ELECTRONIC DR 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	0	9	0	0	0	0	0	0	348	0	0	0	249	2	608	2,307	0	0	0	0
4:15 PM	0	0	0	6	0	0	0	0	0	0	322	0	0	0	210	2	540	2,343	0	0	0	0
4:30 PM	0	0	0	14	0	0	0	0	0	0	336	0	0	0	237	1	588	2,374	0	0	0	0
4:45 PM	0	0	0	3	0	0	0	0	0	0	354	0	0	0	213	1	571	2,316	0	0	0	0
5:00 PM	0	0	0	10	0	0	0	0	0	0	377	0	0	0	257	0	644	2,220	0	0	0	0
5:15 PM	0	0	0	4	0	0	0	0	0	0	356	0	0	0	210	1	571		0	0	0	0
5:30 PM	0	0	0	4	0	0	0	0	0	0	288	0	0	0	237	1	530		0	0	0	0
5:45 PM	0	0	0	1	0	0	0	0	0	0	274	0	0	0	200	0	475		1	0	0	0
Count Total	0	0	0	51	0	0	0	0	0	0	2,655	0	0	0	1,813	8	4,527		1	0	0	0
Peak Hour	0	0	0	31	0	0	0	0	0	0	1,423	0	0	0	917	3	2,374		0	0	0	0

All Traffic Data Services
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Date Start: 11-Aug-20
CONSTITUTION AVE W.O. MARKSHEFFEL RD
Site Code: 6
Station ID:

Start Time	11-Aug-20 Tue	EB	WB							Total
12:00 AM		29	20							49
01:00		18	14							32
02:00		18	13							31
03:00		28	15							43
04:00		68	42							110
05:00		157	125							282
06:00		478	343							821
07:00		**598**	**577**							**1175**
08:00		516	475							991
09:00		478	514							992
10:00		545	527							1072
11:00		550	562							1112
12:00 PM		691	622							1313
01:00		679	627							1306
02:00		684	550							1234
03:00		767	679							1446
04:00		833	**869**							**1702**
05:00		**861**	742							1603
06:00		581	520							1101
07:00		427	383							810
08:00		345	238							583
09:00		204	146							350
10:00		119	82							201
11:00		65	54							119
Total		9739	8739							18478
Percent		52.7%	47.3%							
AM Peak	-	07:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	598	577	-	-	-	-	-	-	1175
PM Peak	-	17:00	16:00	-	-	-	-	-	-	16:00
Vol.	-	861	869	-	-	-	-	-	-	1702
Grand Total		9739	8739							18478
Percent		52.7%	47.3%							
ADT		ADT 18,478		AADT 18,478						

All Traffic Data Services
www.alltrafficdata.net

Date Start: 11-Aug-20
MARKSHEFFEL RD N.O. CONSTITUTION AVE
Site Code: 7
Station ID:

Start Time	11-Aug-20 Tue	NB	SB							Total
12:00 AM		21	23							44
01:00		20	14							34
02:00		21	21							42
03:00		15	29							44
04:00		55	75							130
05:00		169	316							485
06:00		665	912							1577
07:00		**754**	**1310**							**2064**
08:00		615	809							1424
09:00		611	706							1317
10:00		659	677							1336
11:00		697	658							1355
12:00 PM		753	739							1492
01:00		728	737							1465
02:00		758	731							1489
03:00		1133	859							1992
04:00		**1348**	902							**2250**
05:00		1276	**944**							2220
06:00		648	647							1295
07:00		414	447							861
08:00		286	247							533
09:00		157	156							313
10:00		113	107							220
11:00		89	50							139
Total		12005	12116							24121
Percent		49.8%	50.2%							
AM Peak	-	07:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	754	1310	-	-	-	-	-	-	2064
PM Peak	-	16:00	17:00	-	-	-	-	-	-	16:00
Vol.	-	1348	944	-	-	-	-	-	-	2250
Grand Total		12005	12116							24121
Percent		49.8%	50.2%							
ADT		ADT 24,121		AADT 24,121						

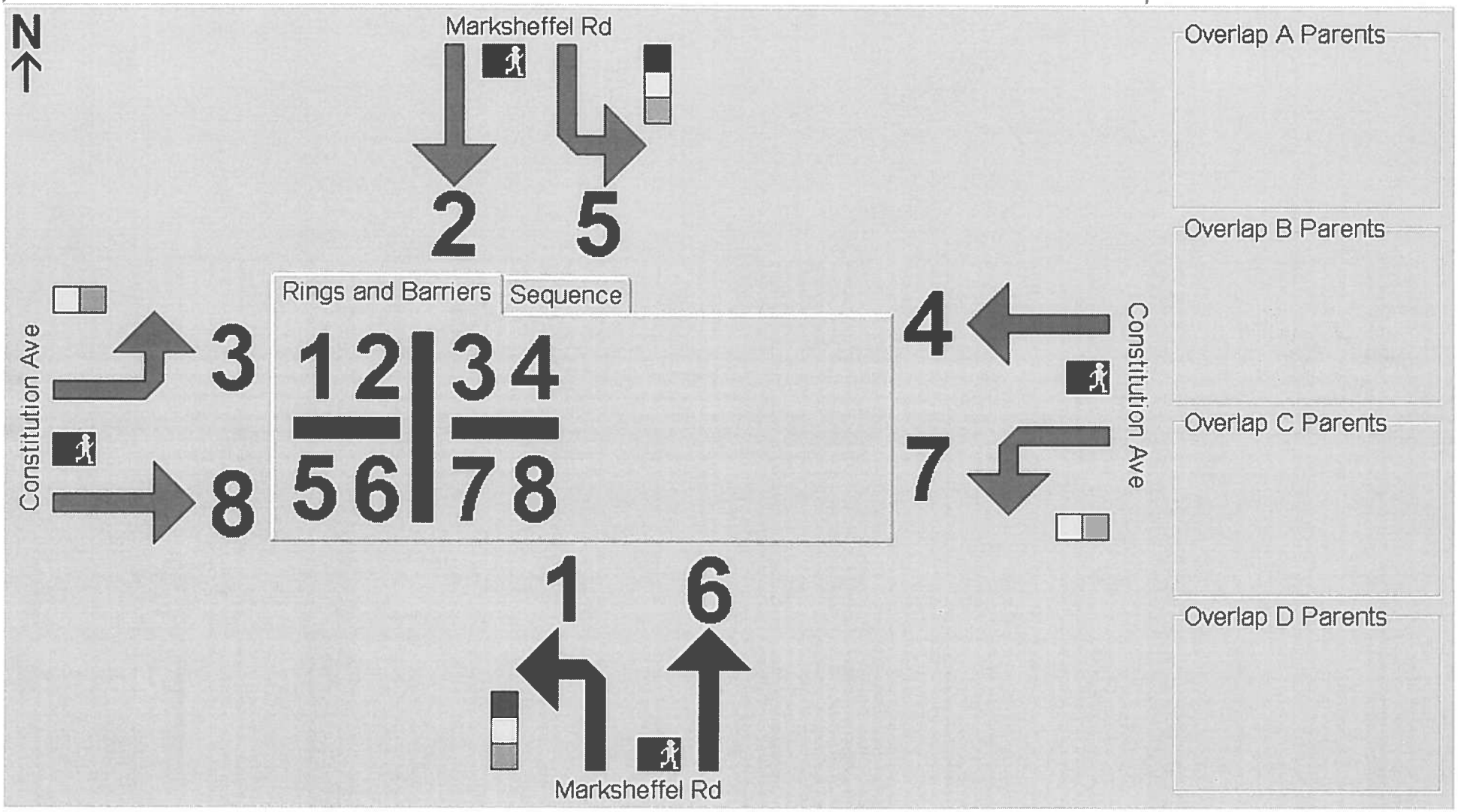
All Traffic Data Services
www.alltrafficdata.net

Date Start: 11-Aug-20
AKERS DR N.O. CONSTITUTION AVE
Site Code: 8
Station ID:

Start Time	11-Aug-20 Tue	NB	SB							Total
12:00 AM		4	2							6
01:00		3	0							3
02:00		1	0							1
03:00		1	2							3
04:00		14	8							22
05:00		46	15							61
06:00		**86**	46							132
07:00		83	**83**							**166**
08:00		56	54							110
09:00		74	69							143
10:00		66	71							137
11:00		82	75							157
12:00 PM		89	**90**							179
01:00		**109**	85							**194**
02:00		80	72							152
03:00		96	87							183
04:00		82	79							161
05:00		46	73							119
06:00		30	30							60
07:00		30	19							49
08:00		22	9							31
09:00		9	12							21
10:00		9	7							16
11:00		3	1							4
Total		1121	989							2110
Percent		53.1%	46.9%							
AM Peak	-	06:00	07:00	-	-	-	-	-	-	07:00
Vol.	-	86	83	-	-	-	-	-	-	166
PM Peak	-	13:00	12:00	-	-	-	-	-	-	13:00
Vol.	-	109	90	-	-	-	-	-	-	194
Grand Total		1121	989							2110
Percent		53.1%	46.9%							
ADT		ADT 2,110		AADT 2,110						

Intersection 624 at Marksheffel Rd and Constitution Ave - Phases and overlaps

8/12/2020 11:05:08 AM



Intersection 624 at Marksheffel Rd and Constitution Ave - Plans schedule

8/12/2020 11:05:14 AM

(•) Plan Changes ( ) Page Changes

Week of 8/10/2020

	Mon 08/10	Tue 08/11	Wed 08/12	Thu 08/13	Fri 08/14
12:00am	Free	Free	Free	Free	Free
Cycle len,offset					
6:30am	Plan1,Ofst1	Plan1,Ofst1	Plan1,Ofst1	Plan1,Ofst1	Plan1,Ofst1
Cycle len,offset	120, 85	120, 85	120, 85	120, 85	120, 85
4:00pm	Plan2,Ofst1	Plan2,Ofst1	Plan2,Ofst1	Plan2,Ofst1	Plan2,Ofst1
Cycle len,offset	140, 74	140, 74	140, 74	140, 74	140, 74
6:00pm	Free	Free	Free	Free	Free
Cycle len,offset					

	Sat 08/15	Sun 08/16
12:00am	Free	Free
Cycle len,offset		
7:30am	Plan1,Ofst1	Plan1,Ofst1
Cycle len,offset	120, 85	120, 85
7:00pm	Free	Free
Cycle len,offset		

Intersection 624 at Marksheffel Rd and Constitution Ave - Coordination plan 1

8/12/2020 11:05:20 AM

Plan	Length	Offset 1	Offset 2
1	120	85	0

Page	Offset 3	Offset 4
1	0	0

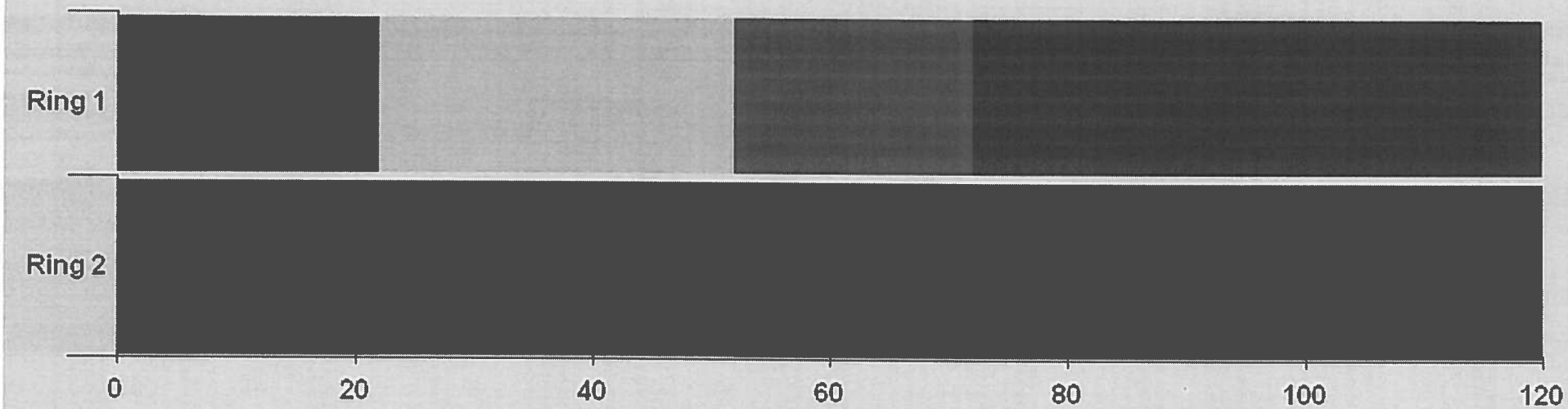
Done modifying

Ring 1 coordinated phase and splits

	20		55
North, left			
Green time = 15		Green time = 48	
Phase 3	15	Phase 4	30
		West, through	
Green time = 10		Green time = 23	

Ring 2 coordinated phase and splits

Phase 5	20	Phase 6	55
South, left		North, through	
Green time = 15		Green time = 48	
Phase 7	15	Phase 8	30
West, left		East, through	
Green time = 10		Green time = 23	



Intersection 624 at Marksheffel Rd and Constitution Ave - Coordination plan 2

8/12/2020 11:05:25 AM

Plan	Length	Offset 1	Offset 2
2	140	74	0

Page	Offset 3	Offset 4
1	0	0

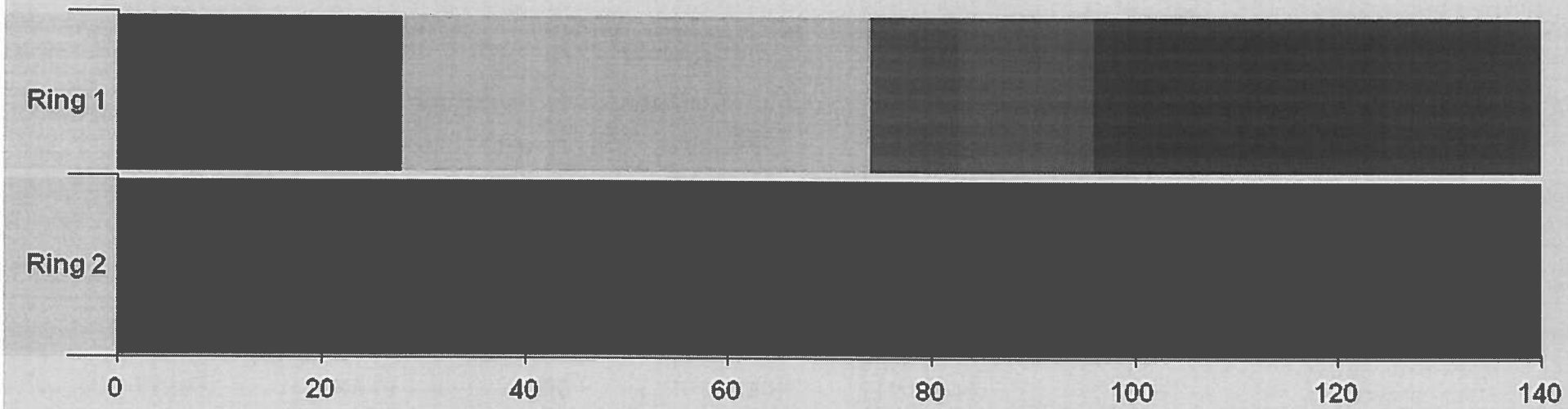
Done modifying

Ring 1 coordinated phase and splits

	22	Phase 2	51
North, left		South, through	
Green time = 17		Green time = 44	
Phase 3	21	Phase 4	46
East, left		West, through	
Green time = 16		Green time = 39	

Ring 2 coordinated phase and splits

Phase 5	22	Phase 6	51
South, left		North, through	
Green time = 17		Green time = 44	
Phase 7	21	Phase 8	46
West, left		East, through	
Green time = 16		Green time = 39	



Intersection 624 at Marksheffel Rd and Constitution Ave - Timing table

Page 1	Phases											
	1	2	3	4	5	6	7	8	9	10	11	12
Min Green	4	4	4	4	4	4	4	4	0	0	0	0
Passage Time I	2.0	2.0	2.0	2.0	2.0	2.0	2.0	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	20	30	12	25	20	30	12	25	0	0	0	0
Max Green II	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Clearance	3.0	5.0	3.0	5.0	3.0	5.0	3.0	5.0	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
Walk Time	0	7	0	7	0	7	0	7	0	0	0	0
Pedestrian Clearance	0	25	0	34	0	25	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
Marksheffel Rd	X	X			X	X						
Constitution Ave			X	X			X	X				
Compass Direction	N	S	E	W	S	N	W	E				
Through, Turn or XPed	Left,prt	Thru	Left,p/p	Thru	Left,prt	Thru	Left,p/p	Thru				

8/12/2020 11:05 AM

APPENDIX B

Level of Service Definitions

The following information can be found in the Highway Capacity Manual, Transportation Research Board, 2010: Chapter 18 – Signalized Intersections and Chapter 19 – Two-Way Stop Controlled Intersections.

Automobile 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 10s/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.

Level of Service (LOS) for Unsignalized TWSC Intersections

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

APPENDIX C

Capacity Worksheets

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	99	241	260	77	288	152	24	184	522	66	114	1085
Future Volume (vph)	99	241	260	77	288	152	24	184	522	66	114	1085
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	0	3433	3539	1583	3433	3539
Flt Permitted	0.408			0.590				0.950			0.950	
Satd. Flow (perm)	760	3539	1583	1099	3539	1583	0	3433	3539	1583	3433	3539
Satd. Flow (RTOR)			275			165				127		
Lane Group Flow (vph)	108	262	283	84	313	165	0	226	567	72	124	1179
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	15.0	30.0	30.0	15.0	30.0	30.0	20.0	20.0	55.0	55.0	20.0	55.0
Total Split (%)	12.5%	25.0%	25.0%	12.5%	25.0%	25.0%	16.7%	16.7%	45.8%	45.8%	16.7%	45.8%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	28.5	18.6	18.6	26.8	15.9	15.9		13.2	61.0	61.0	9.7	57.6
Actuated g/C Ratio	0.24	0.16	0.16	0.22	0.13	0.13		0.11	0.51	0.51	0.08	0.48
v/c Ratio	0.42	0.48	0.59	0.28	0.67	0.47		0.60	0.32	0.08	0.45	0.69
Control Delay	38.3	49.8	11.5	35.2	56.6	11.3		57.5	18.8	0.4	57.4	28.3
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	38.3	49.8	11.5	35.2	56.6	11.3		57.5	18.8	0.4	57.4	28.3
LOS	D	D	B	D	E	B		E	B	A	E	C
Approach Delay		31.3			40.1				27.3			28.7
Approach LOS		C			D				C			C
Queue Length 50th (ft)	65	101	5	50	123	0		87	132	0	47	368
Queue Length 95th (ft)	109	140	86	88	165	61		125	193	3	78	510
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	265	684	527	311	678	436		439	1800	867	429	1697
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	0.41	0.38	0.54	0.27	0.46	0.38		0.51	0.32	0.08	0.29	0.69

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 85 (71%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

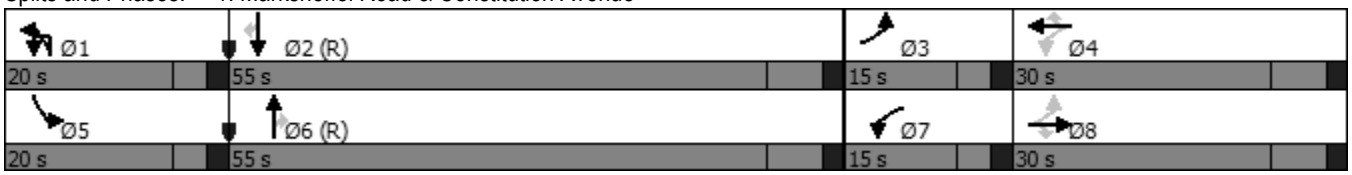
Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	115
Future Volume (vph)	115
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	127
Lane Group Flow (vph)	125
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	55.0
Total Split (%)	45.8%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	57.6
Actuated g/C Ratio	0.48
v/c Ratio	0.15
Control Delay	4.0
Queue Delay	0.0
Total Delay	4.0
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	0
Queue Length 95th (ft)	36
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	825
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.15

Intersection Summary

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 30.7	Intersection LOS: C
Intersection Capacity Utilization 76.3%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Marksheffel Road & Constitution Avenue



Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	35	564	526	50	36	42
Future Vol, veh/h	35	564	526	50	36	42
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	275	-	-	-	355	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	38	613	572	54	39	46

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	626	0	-	0	893	-
Stage 1	-	-	-	-	572	-
Stage 2	-	-	-	-	321	-
Critical Hdwy	4.14	-	-	-	6.29	-
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	2.22	-	-	-	3.67	-
Pot Cap-1 Maneuver	*1306	-	-	-	*767	0
Stage 1	-	-	-	-	*790	0
Stage 2	-	-	-	-	*671	0
Platoon blocked, %	1	-	-	-	1	
Mov Cap-1 Maneuver	*1306	-	-	-	*744	-
Mov Cap-2 Maneuver	-	-	-	-	*744	-
Stage 1	-	-	-	-	*767	-
Stage 2	-	-	-	-	*671	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	10.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	* 1306	-	-	-	744	-
HCM Lane V/C Ratio	0.029	-	-	-	0.053	-
HCM Control Delay (s)	7.8	-	-	-	10.1	0
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	-

Notes

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

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	9	10	75	69	0
Future Vol, veh/h	0	9	10	75	69	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	100	0	130	-	-	120
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	10	11	82	75	0

Counted peak hour factors at Akers / Hunter Jumper and Akers / Electronic are significantly lower than this value. Please adjust per ECM.

Peak Hour Factor at the Akers Drive intersections with Hunter Jumper Drive and Electronic Drive updated in the analysis of the revised Traffic Impact Study.

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	179	75	75	0	-	0
Stage 1	75	-	-	-	-	-
Stage 2	104	-	-	-	-	-
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	811	986	1524	-	-	-
Stage 1	948	-	-	-	-	-
Stage 2	920	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	805	986	1524	-	-	-
Mov Cap-2 Maneuver	792	-	-	-	-	-
Stage 1	941	-	-	-	-	-
Stage 2	920	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0.9	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1524	-	-	986	-	-
HCM Lane V/C Ratio	0.007	-	-	0.01	-	-
HCM Control Delay (s)	7.4	-	0	8.7	-	-
HCM Lane LOS	A	-	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	6	60	11	12	69
Future Vol, veh/h	9	6	60	11	12	69
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	-	-	-	150	-
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	10	7	65	12	13	75

Counted peak hour factors at Akers / Hunter Jumper and Akers / Electronic are significantly lower than this value. Please adjust per ECM.

Peak Hour Factor at the Akers Drive intersections with Hunter Jumper Drive and Electronic Drive updated in the analysis of the revised Traffic Impact Study.

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	172	71	0	0	77	0
Stage 1	71	-	-	-	-	-
Stage 2	101	-	-	-	-	-
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	818	991	-	-	1522	-
Stage 1	952	-	-	-	-	-
Stage 2	923	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	811	991	-	-	1522	-
Mov Cap-2 Maneuver	795	-	-	-	-	-
Stage 1	952	-	-	-	-	-
Stage 2	915	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	1.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	863	1522	-
HCM Lane V/C Ratio	-	-	0.019	0.009	-
HCM Control Delay (s)	-	-	9.3	7.4	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Traffic Vol, veh/h	0	21	0	773	1293	9
Future Vol, veh/h	0	21	0	773	1293	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	23	0	840	1405	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	703	-	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	380	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	380	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.1	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	380	-
HCM Lane V/C Ratio	-	0.06	-
HCM Control Delay (s)	-	15.1	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	0.2	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	102	531	225	118	399	232	14	345	1073	55	203	613
Future Volume (vph)	102	531	225	118	399	232	14	345	1073	55	203	613
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	0	3433	3539	1583	3433	3539
Flt Permitted	0.368			0.193				0.950			0.950	
Satd. Flow (perm)	685	3539	1583	360	3539	1583	0	3433	3539	1583	3433	3539
Satd. Flow (RTOR)			245			252				109		
Lane Group Flow (vph)	111	577	245	128	434	252	0	390	1166	60	221	666
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	21.0	46.0	46.0	21.0	46.0	46.0	22.0	22.0	51.0	51.0	22.0	51.0
Total Split (%)	15.0%	32.9%	32.9%	15.0%	32.9%	32.9%	15.7%	15.7%	36.4%	36.4%	15.7%	36.4%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	42.6	29.0	29.0	45.1	30.2	30.2		21.2	59.9	59.9	14.3	53.0
Actuated g/C Ratio	0.30	0.21	0.21	0.32	0.22	0.22		0.15	0.43	0.43	0.10	0.38
v/c Ratio	0.37	0.79	0.47	0.52	0.57	0.47		0.75	0.77	0.08	0.63	0.50
Control Delay	33.8	60.6	8.0	38.3	51.5	7.7		66.6	39.9	0.3	68.3	36.5
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	33.8	60.6	8.0	38.3	51.5	7.7		66.6	39.9	0.3	68.3	36.5
LOS	C	E	A	D	D	A		E	D	A	E	D
Approach Delay		43.6			35.9				44.9			39.4
Approach LOS		D			D				D			D
Queue Length 50th (ft)	70	264	0	81	187	0		175	473	0	101	248
Queue Length 95th (ft)	104	312	68	118	229	68		#239	#717	2	141	336
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	351	985	617	283	985	622		519	1513	739	421	1338
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	0.32	0.59	0.40	0.45	0.44	0.41		0.75	0.77	0.08	0.52	0.50

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 74 (53%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated

Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	123
Future Volume (vph)	123
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	134
Lane Group Flow (vph)	134
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	51.0
Total Split (%)	36.4%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	53.0
Actuated g/C Ratio	0.38
v/c Ratio	0.20
Control Delay	6.0
Queue Delay	0.0
Total Delay	6.0
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	0
Queue Length 95th (ft)	49
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	681
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.20

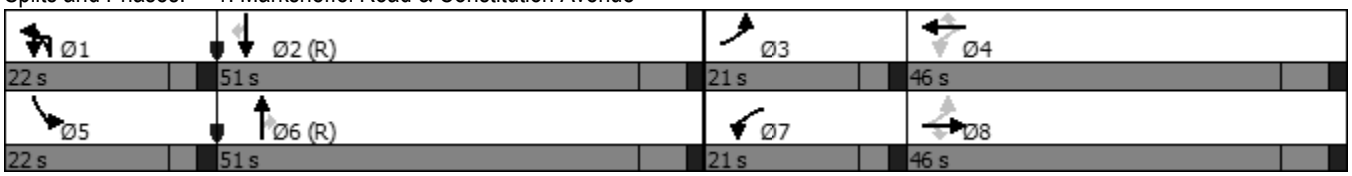
Intersection Summary

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 41.7	Intersection LOS: D
Intersection Capacity Utilization 76.7%	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: 1: Marksheffel Road & Constitution Avenue



Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	29	817	828	43	23	45
Future Vol, veh/h	29	817	828	43	23	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	275	-	-	-	355	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	32	888	900	47	25	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	947	0	-	0	1319	-
Stage 1	-	-	-	-	900	-
Stage 2	-	-	-	-	419	-
Critical Hdwy	4.14	-	-	-	6.29	-
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	2.22	-	-	-	3.67	-
Pot Cap-1 Maneuver	*1120	-	-	-	*678	0
Stage 1	-	-	-	-	*678	0
Stage 2	-	-	-	-	*597	0
Platoon blocked, %	1	-	-	-	1	
Mov Cap-1 Maneuver	*1120	-	-	-	*658	-
Mov Cap-2 Maneuver	-	-	-	-	*658	-
Stage 1	-	-	-	-	*658	-
Stage 2	-	-	-	-	*597	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	10.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	* 1120	-	-	-	658	-
HCM Lane V/C Ratio	0.028	-	-	-	0.038	-
HCM Control Delay (s)	8.3	-	-	-	10.7	0
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1	-

Notes

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

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	4	10	62	64	0
Future Vol, veh/h	2	4	10	62	64	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	100	0	130	-	-	120
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	2	4	11	67	70	0

Counted peak hour factors at Akers / Hunter Jumper and Akers / Electronic are significantly lower than this value. Please adjust per ECM.

Peak Hour Factor at the Akers Drive intersections with Hunter Jumper Drive and Electronic Drive updated in the analysis of the revised Traffic Impact Study.

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	159	70	70	0	-	0
Stage 1	70	-	-	-	-	-
Stage 2	89	-	-	-	-	-
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	832	993	1531	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	934	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	826	993	1531	-	-	-
Mov Cap-2 Maneuver	806	-	-	-	-	-
Stage 1	946	-	-	-	-	-
Stage 2	934	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.9	1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1531	-	806	993	-	-
HCM Lane V/C Ratio	0.007	-	0.003	0.004	-	-
HCM Control Delay (s)	7.4	-	9.5	8.6	-	-
HCM Lane LOS	A	-	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	7	5	69	5	25	68
Future Vol, veh/h	7	5	69	5	25	68
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	-	-	-	150	-
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	8	5	75	5	27	74

Counted peak hour factors at Akers / Hunter Jumper and Akers / Electronic are significantly lower than this value. Please adjust per ECM.

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	206	78	0	0	80	0
Stage 1	78	-	-	-	-	-
Stage 2	128	-	-	-	-	-
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	782	983	-	-	1518	-
Stage 1	945	-	-	-	-	-
Stage 2	898	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	768	983	-	-	1518	-
Mov Cap-2 Maneuver	764	-	-	-	-	-
Stage 1	945	-	-	-	-	-
Stage 2	882	-	-	-	-	-

Peak Hour Factor at the Akers Drive intersections with Hunter Jumper Drive and Electronic Drive updated in the analysis of the revised Traffic Impact Study.

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	842	1518	-
HCM Lane V/C Ratio	-	-	0.015	0.018	-
HCM Control Delay (s)	-	-	9.3	7.4	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0.1	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Traffic Vol, veh/h	0	31	0	1047	908	3
Future Vol, veh/h	0	31	0	1047	908	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	34	0	1138	987	3

Volume figure says 1407

Updated.

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	494	-	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	521	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	521	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	521	-
HCM Lane V/C Ratio	-	0.065	-
HCM Control Delay (s)	-	12.4	-
HCM Lane LOS	-	B	-
HCM 95th %tile Q(veh)	-	0.2	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	106	264	270	150	315	195	25	191	554	88	147	1132
Future Volume (vph)	106	264	270	150	315	195	25	191	554	88	147	1132
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	0	3433	3539	1583	3433	3539
Flt Permitted	0.414			0.480				0.950			0.950	
Satd. Flow (perm)	771	3539	1583	894	3539	1583	0	3433	3539	1583	3433	3539
Satd. Flow (RTOR)			230			212				127		
Lane Group Flow (vph)	115	287	293	163	342	212	0	235	602	96	160	1230
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	15.0	30.0	30.0	15.0	30.0	30.0	20.0	20.0	55.0	55.0	20.0	55.0
Total Split (%)	12.5%	25.0%	25.0%	12.5%	25.0%	25.0%	16.7%	16.7%	45.8%	45.8%	16.7%	45.8%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	28.2	16.7	16.7	28.9	17.0	17.0		13.3	58.6	58.6	10.9	56.2
Actuated g/C Ratio	0.24	0.14	0.14	0.24	0.14	0.14		0.11	0.49	0.49	0.09	0.47
v/c Ratio	0.44	0.58	0.70	0.57	0.68	0.52		0.62	0.35	0.11	0.51	0.74
Control Delay	38.0	52.8	21.3	42.3	55.8	10.7		58.0	20.7	1.9	57.6	30.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	38.0	52.8	21.3	42.3	55.8	10.7		58.0	20.7	1.9	57.6	30.7
LOS	D	D	C	D	E	B		E	C	A	E	C
Approach Delay		37.1			39.4				28.2			31.2
Approach LOS		D			D				C			C
Queue Length 50th (ft)	68	111	44	100	134	0		90	147	0	61	401
Queue Length 95th (ft)	112	150	135	152	176	66		130	218	18	95	553
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	267	678	489	289	678	474		435	1726	837	429	1656
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	0.43	0.42	0.60	0.56	0.50	0.45		0.54	0.35	0.11	0.37	0.74

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 85 (71%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

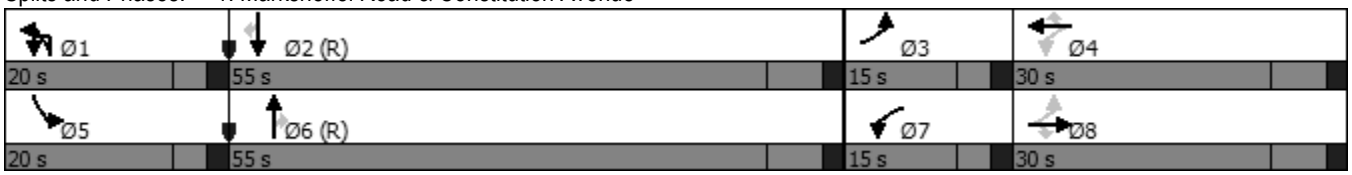
Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	123
Future Volume (vph)	123
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	127
Lane Group Flow (vph)	134
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	55.0
Total Split (%)	45.8%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	56.2
Actuated g/C Ratio	0.47
v/c Ratio	0.17
Control Delay	4.8
Queue Delay	0.0
Total Delay	4.8
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	3
Queue Length 95th (ft)	42
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	808
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.17

Intersection Summary

Maximum v/c Ratio: 0.74

Intersection Signal Delay: 33.1	Intersection LOS: C
Intersection Capacity Utilization 82.5%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Marksheffel Road & Constitution Avenue



Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	36	603	565	52	37	44
Future Vol, veh/h	36	603	565	52	37	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	275	-	-	-	355	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	39	655	614	57	40	48

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	671	0	-	0	954	-
Stage 1	-	-	-	-	614	-
Stage 2	-	-	-	-	340	-
Critical Hdwy	4.14	-	-	-	6.29	-
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	2.22	-	-	-	3.67	-
Pot Cap-1 Maneuver	*1306	-	-	-	*698	0
Stage 1	-	-	-	-	*790	0
Stage 2	-	-	-	-	*656	0
Platoon blocked, %	1	-	-	-	1	
Mov Cap-1 Maneuver	*1306	-	-	-	*677	-
Mov Cap-2 Maneuver	-	-	-	-	*677	-
Stage 1	-	-	-	-	*766	-
Stage 2	-	-	-	-	*656	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	10.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	* 1306	-	-	-	677	-
HCM Lane V/C Ratio	0.03	-	-	-	0.059	-
HCM Control Delay (s)	7.8	-	-	-	10.7	0
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	-

Notes

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

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	9	10	78	72	0
Future Vol, veh/h	0	9	10	78	72	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	100	0	130	-	-	120
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	10	11	85	78	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	185	78	78	0	-	0
Stage 1	78	-	-	-	-	-
Stage 2	107	-	-	-	-	-
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	804	983	1520	-	-	-
Stage 1	945	-	-	-	-	-
Stage 2	917	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	798	983	1520	-	-	-
Mov Cap-2 Maneuver	787	-	-	-	-	-
Stage 1	938	-	-	-	-	-
Stage 2	917	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1520	-	-	983	-	-
HCM Lane V/C Ratio	0.007	-	-	0.01	-	-
HCM Control Delay (s)	7.4	-	0	8.7	-	-
HCM Lane LOS	A	-	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	6	62	11	12	72
Future Vol, veh/h	9	6	62	11	12	72
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	-	-	-	150	-
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	10	7	67	12	13	78

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	177	73	0	0	79	0
Stage 1	73	-	-	-	-	-
Stage 2	104	-	-	-	-	-
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	813	989	-	-	1519	-
Stage 1	950	-	-	-	-	-
Stage 2	920	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	806	989	-	-	1519	-
Mov Cap-2 Maneuver	791	-	-	-	-	-
Stage 1	950	-	-	-	-	-
Stage 2	912	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	1.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	860	1519	-
HCM Lane V/C Ratio	-	-	0.019	0.009	-
HCM Control Delay (s)	-	-	9.3	7.4	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Traffic Vol, veh/h	0	22	0	853	1398	9
Future Vol, veh/h	0	22	0	853	1398	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	24	0	927	1520	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	760	-	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	349	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	349	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.1	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	349	-
HCM Lane V/C Ratio	-	0.069	-
HCM Control Delay (s)	-	16.1	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	0.2	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	113	570	234	181	437	296	15	359	1147	115	255	637
Future Volume (vph)	113	570	234	181	437	296	15	359	1147	115	255	637
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	0	3433	3539	1583	3433	3539
Flt Permitted	0.370			0.165				0.950			0.950	
Satd. Flow (perm)	689	3539	1583	307	3539	1583	0	3433	3539	1583	3433	3539
Satd. Flow (RTOR)			250			322				109		
Lane Group Flow (vph)	123	620	254	197	475	322	0	406	1247	125	277	692
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	21.0	46.0	46.0	21.0	46.0	46.0	22.0	22.0	51.0	51.0	22.0	51.0
Total Split (%)	15.0%	32.9%	32.9%	15.0%	32.9%	32.9%	15.7%	15.7%	36.4%	36.4%	15.7%	36.4%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	44.6	30.6	30.6	50.8	33.7	33.7		21.6	54.2	54.2	16.1	48.7
Actuated g/C Ratio	0.32	0.22	0.22	0.36	0.24	0.24		0.15	0.39	0.39	0.12	0.35
v/c Ratio	0.39	0.80	0.47	0.73	0.56	0.52		0.77	0.91	0.18	0.70	0.56
Control Delay	32.0	60.0	8.1	46.4	48.9	7.2		67.1	52.0	8.6	69.5	40.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	32.0	60.0	8.1	46.4	48.9	7.2		67.1	52.0	8.6	69.5	40.2
LOS	C	E	A	D	D	A		E	D	A	E	D
Approach Delay		43.3			34.9				52.4			43.2
Approach LOS		D			C				D			D
Queue Length 50th (ft)	74	283	3	124	199	0		181	571	9	126	278
Queue Length 95th (ft)	111	333	71	175	248	75		#281	#827	58	173	351
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	362	985	621	279	985	673		529	1369	679	430	1230
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	0.34	0.63	0.41	0.71	0.48	0.48		0.77	0.91	0.18	0.64	0.56

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 74 (53%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	130
Future Volume (vph)	130
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	141
Lane Group Flow (vph)	141
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	51.0
Total Split (%)	36.4%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	48.7
Actuated g/C Ratio	0.35
v/c Ratio	0.22
Control Delay	6.1
Queue Delay	0.0
Total Delay	6.1
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	0
Queue Length 95th (ft)	49
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	642
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.22

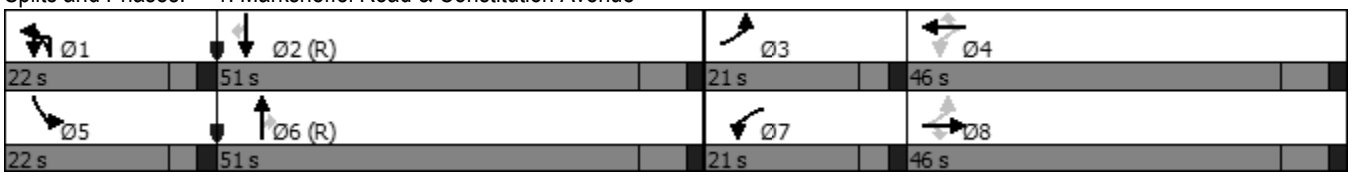
Intersection Summary

Maximum v/c Ratio: 0.91

Intersection Signal Delay: 44.9	Intersection LOS: D
Intersection Capacity Utilization 84.8%	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: 1: Marksheffel Road & Constitution Avenue



Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	30	875	885	45	24	47
Future Vol, veh/h	30	875	885	45	24	47
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	275	-	-	-	355	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	33	951	962	49	26	51

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1011	0	-	0	1408	-
Stage 1	-	-	-	-	962	-
Stage 2	-	-	-	-	446	-
Critical Hdwy	4.14	-	-	-	6.29	-
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	2.22	-	-	-	3.67	-
Pot Cap-1 Maneuver	*1087	-	-	-	*658	0
Stage 1	-	-	-	-	*658	0
Stage 2	-	-	-	-	*578	0
Platoon blocked, %	1	-	-	-	1	
Mov Cap-1 Maneuver	*1087	-	-	-	*638	-
Mov Cap-2 Maneuver	-	-	-	-	*638	-
Stage 1	-	-	-	-	*638	-
Stage 2	-	-	-	-	*578	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	10.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	* 1087	-	-	-	638	-
HCM Lane V/C Ratio	0.03	-	-	-	0.041	-
HCM Control Delay (s)	8.4	-	-	-	10.9	0
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1	-

Notes

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

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	4	10	64	67	0
Future Vol, veh/h	2	4	10	64	67	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	100	0	130	-	-	120
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	2	4	11	70	73	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	165	73	73	0	-	0
Stage 1	73	-	-	-	-	-
Stage 2	92	-	-	-	-	-
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	826	989	1527	-	-	-
Stage 1	950	-	-	-	-	-
Stage 2	932	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	820	989	1527	-	-	-
Mov Cap-2 Maneuver	802	-	-	-	-	-
Stage 1	943	-	-	-	-	-
Stage 2	932	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9	1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1527	-	802	989	-	-
HCM Lane V/C Ratio	0.007	-	0.003	0.004	-	-
HCM Control Delay (s)	7.4	-	9.5	8.7	-	-
HCM Lane LOS	A	-	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0	-	-

Intersection	
Int Delay, s/veh	1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	7	5	72	5	26	71
Future Vol, veh/h	7	5	72	5	26	71
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	-	-	-	150	-
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	8	5	78	5	28	77

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	214	81	0	0	83	0
Stage 1	81	-	-	-	-	-
Stage 2	133	-	-	-	-	-
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	774	979	-	-	1514	-
Stage 1	942	-	-	-	-	-
Stage 2	893	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	760	979	-	-	1514	-
Mov Cap-2 Maneuver	759	-	-	-	-	-
Stage 1	942	-	-	-	-	-
Stage 2	877	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.4	0	2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	837	1514	-
HCM Lane V/C Ratio	-	-	0.016	0.019	-
HCM Control Delay (s)	-	-	9.4	7.4	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0.1	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Traffic Vol, veh/h	0	32	0	1551	1398	3
Future Vol, veh/h	0	32	0	1551	1398	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	35	0	1686	1520	3

Volume figure says 1008

Updated.

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	760	-	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	349	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	349	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.5	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	349	-
HCM Lane V/C Ratio	-	0.1	-
HCM Control Delay (s)	-	16.5	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	0.3	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	182	461	403	186	490	265	36	282	794	118	199	1632
Future Volume (vph)	182	461	403	186	490	265	36	282	794	118	199	1632
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	0	3433	5085	1583	3433	5085
Flt Permitted	0.271			0.458				0.950			0.950	
Satd. Flow (perm)	505	5085	1583	853	5085	1583	0	3433	5085	1583	3433	5085
Satd. Flow (RTOR)			147			270				173		
Lane Group Flow (vph)	198	501	438	202	533	288	0	346	863	128	216	1774
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	19.0	34.0	34.0	13.0	28.0	28.0	18.0	18.0	56.0	56.0	17.0	55.0
Total Split (%)	15.8%	28.3%	28.3%	10.8%	23.3%	23.3%	15.0%	15.0%	46.7%	46.7%	14.2%	45.8%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	40.5	26.0	26.0	30.9	20.9	20.9		13.3	50.7	50.7	11.3	48.7
Actuated g/C Ratio	0.34	0.22	0.22	0.26	0.17	0.17		0.11	0.42	0.42	0.09	0.41
v/c Ratio	0.64	0.46	0.96	0.72	0.60	0.58		0.91	0.40	0.17	0.67	0.86
Control Delay	35.4	38.5	60.0	48.7	48.9	11.7		81.1	25.2	1.6	62.9	38.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	35.4	38.5	60.0	48.7	48.9	11.7		81.1	25.2	1.6	62.9	38.0
LOS	D	D	E	D	D	B		F	C	A	E	D
Approach Delay		46.2			38.4				37.4			37.5
Approach LOS		D			D				D			D
Queue Length 50th (ft)	120	127	242	114	140	12		139	172	0	84	457
Queue Length 95th (ft)	188	165	#442	#193	181	95		#230	209	16	125	525
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	320	1144	470	280	897	501		381	2147	768	343	2063
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	0.62	0.44	0.93	0.72	0.59	0.57		0.91	0.40	0.17	0.63	0.86

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 85 (71%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	188
Future Volume (vph)	188
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	173
Lane Group Flow (vph)	204
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	55.0
Total Split (%)	45.8%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	48.7
Actuated g/C Ratio	0.41
v/c Ratio	0.27
Control Delay	6.2
Queue Delay	0.0
Total Delay	6.2
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	14
Queue Length 95th (ft)	63
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	745
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.27

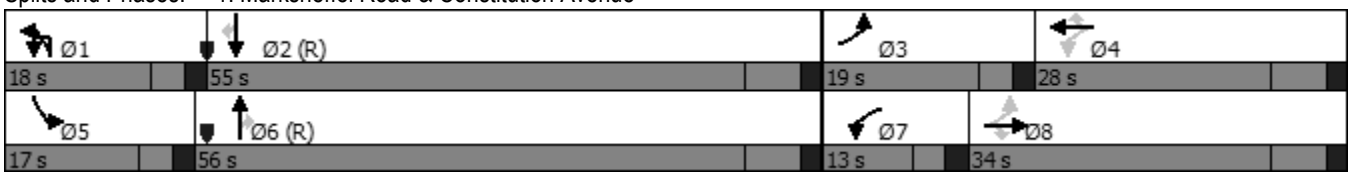
Intersection Summary

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 39.4	Intersection LOS: D
Intersection Capacity Utilization 95.9%	ICU Level of Service F
Analysis Period (min) 15	

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Marksheffel Road & Constitution Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	890	73	29	837	106	41	11	69	149	15	83
Future Volume (vph)	130	890	73	29	837	106	41	11	69	149	15	83
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	3433	1622	0	3433	1626	0
Flt Permitted	0.293			0.274			0.950			0.950		
Satd. Flow (perm)	546	5085	1583	510	5085	1583	3433	1622	0	3433	1626	0
Satd. Flow (RTOR)			82			115		75			90	
Lane Group Flow (vph)	141	967	79	32	910	115	45	87	0	162	106	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4		4	8		8						
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0		24.0	24.0	
Total Split (s)	72.0	72.0	72.0	72.0	72.0	72.0	24.0	24.0		24.0	24.0	
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	20.0%	20.0%		20.0%	20.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		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	
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)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	83.3	83.3	83.3	83.3	83.3	83.3	7.7	7.7		11.0	11.0	
Actuated g/C Ratio	0.69	0.69	0.69	0.69	0.69	0.69	0.06	0.06		0.09	0.09	
v/c Ratio	0.37	0.27	0.07	0.09	0.26	0.10	0.20	0.50		0.52	0.46	
Control Delay	12.0	7.5	1.7	11.7	10.7	5.0	54.4	25.4		57.5	20.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	12.0	7.5	1.7	11.7	10.7	5.0	54.4	25.4		57.5	20.6	
LOS	B	A	A	B	B	A	D	C		E	C	
Approach Delay		7.7			10.1			35.3			42.9	
Approach LOS		A			B			D			D	
Queue Length 50th (ft)	40	91	0	10	112	12	17	9		62	12	
Queue Length 95th (ft)	98	136	17	m23	m171	m32	36	59		95	65	
Internal Link Dist (ft)		734			1022			327			581	
Turn Bay Length (ft)	275		235	235		275	120			355		
Base Capacity (vph)	379	3530	1124	354	3530	1134	514	307		514	320	
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	0.37	0.27	0.07	0.09	0.26	0.10	0.09	0.28		0.32	0.33	

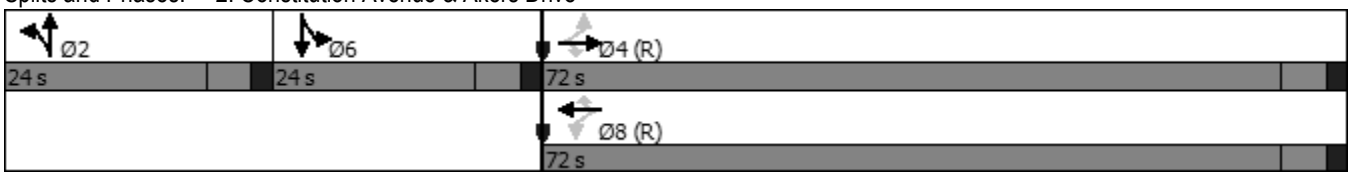
Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.52

Intersection Signal Delay: 13.6	Intersection LOS: B
Intersection Capacity Utilization 49.3%	ICU Level of Service A
Analysis Period (min) 15	

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

Splits and Phases: 2: Constitution Avenue & Akers Drive



Intersection	
Int Delay, s/veh	4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	110	117	126	133	0
Future Vol, veh/h	0	110	117	126	133	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	100	0	130	-	-	120
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	120	127	137	145	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	536	145	145	0	-	0
Stage 1	145	-	-	-	-	-
Stage 2	391	-	-	-	-	-
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	520	902	1437	-	-	-
Stage 1	882	-	-	-	-	-
Stage 2	695	-	-	-	-	-
Platoon blocked, %	1			-	-	-
Mov Cap-1 Maneuver	474	902	1437	-	-	-
Mov Cap-2 Maneuver	553	-	-	-	-	-
Stage 1	804	-	-	-	-	-
Stage 2	695	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.6	3.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1437	-	-	902	-	-
HCM Lane V/C Ratio	0.088	-	-	0.133	-	-
HCM Control Delay (s)	7.7	-	0	9.6	-	-
HCM Lane LOS	A	-	A	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0.5	-	-

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	24	14	29	14	5	9	13	90	17	18	104	5
Future Vol, veh/h	24	14	29	14	5	9	13	90	17	18	104	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	115	-	115	115	-	115	120	-	120	150	-	120
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	26	15	32	15	5	10	14	98	18	20	113	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	296	297	113	305	284	98	118	0	0	116	0	0
Stage 1	153	153	-	126	126	-	-	-	-	-	-	-
Stage 2	143	144	-	179	158	-	-	-	-	-	-	-
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	688	634	940	679	646	1003	1470	-	-	1488	-	-
Stage 1	849	771	-	914	808	-	-	-	-	-	-	-
Stage 2	894	794	-	823	767	-	-	-	-	-	-	-
Platoon blocked, %	1	1		1	1	1		-	-	1	-	-
Mov Cap-1 Maneuver	666	620	940	633	631	1003	1470	-	-	1488	-	-
Mov Cap-2 Maneuver	666	620	-	633	631	-	-	-	-	-	-	-
Stage 1	841	761	-	904	800	-	-	-	-	-	-	-
Stage 2	871	786	-	769	757	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10	10.1	0.8	1.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBL	SBT	SBR
Capacity (veh/h)	1470	-	-	666	620	940	633	631	1003	1488	-	-
HCM Lane V/C Ratio	0.01	-	-	0.039	0.025	0.034	0.024	0.009	0.01	0.013	-	-
HCM Control Delay (s)	7.5	-	-	10.6	11	9	10.8	10.8	8.6	7.5	-	-
HCM Lane LOS	A	-	-	B	B	A	B	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	0.1	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑↑	↑↑↑	↱
Traffic Vol, veh/h	0	46	0	1239	2005	19
Future Vol, veh/h	0	46	0	1239	2005	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	50	0	1347	2179	21

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	1090	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.14	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.92	-	-	-	-
Pot Cap-1 Maneuver	0	181	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	181	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	32.3	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	181	-
HCM Lane V/C Ratio	-	0.276	-
HCM Control Delay (s)	-	32.3	-
HCM Lane LOS	-	D	-
HCM 95th %tile Q(veh)	-	1.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	236	1079	376	235	766	403	21	539	1641	141	349	919
Future Volume (vph)	236	1079	376	235	766	403	21	539	1641	141	349	919
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	0	3433	5085	1583	3433	5085
Flt Permitted	0.158			0.128				0.950			0.950	
Satd. Flow (perm)	294	5085	1583	238	5085	1583	0	3433	5085	1583	3433	5085
Satd. Flow (RTOR)			288			251				134		
Lane Group Flow (vph)	257	1173	409	255	833	438	0	609	1784	153	379	999
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	22.0	40.0	40.0	20.0	38.0	38.0	33.0	33.0	59.0	59.0	21.0	47.0
Total Split (%)	15.7%	28.6%	28.6%	14.3%	27.1%	27.1%	23.6%	23.6%	42.1%	42.1%	15.0%	33.6%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	51.8	33.0	33.0	48.2	31.2	31.2		27.3	52.0	52.0	16.0	40.7
Actuated g/C Ratio	0.37	0.24	0.24	0.34	0.22	0.22		0.20	0.37	0.37	0.11	0.29
v/c Ratio	0.90	0.98	0.69	1.04	0.74	0.80		0.91	0.94	0.23	0.97	0.68
Control Delay	66.1	74.3	20.8	105.3	55.1	33.6		73.9	54.0	7.3	99.0	46.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	66.1	74.3	20.8	105.3	55.1	33.6		73.9	54.0	7.3	99.0	46.7
LOS	E	E	C	F	E	C		E	D	A	F	D
Approach Delay		61.3			57.3				55.9			52.8
Approach LOS		E			E				E			D
Queue Length 50th (ft)	165	391	98	~195	260	171		280	573	11	179	297
Queue Length 95th (ft)	#323	#494	225	#376	312	#324		#380	#676	58	#283	350
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	288	1198	593	245	1132	547		686	1888	672	392	1478
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	0.89	0.98	0.69	1.04	0.74	0.80		0.89	0.94	0.23	0.97	0.68

Intersection Summary

Cycle Length: 140
Actuated Cycle Length: 140
Offset: 74 (53%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated

Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	227
Future Volume (vph)	227
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	247
Lane Group Flow (vph)	247
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	47.0
Total Split (%)	33.6%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	40.7
Actuated g/C Ratio	0.29
v/c Ratio	0.39
Control Delay	6.2
Queue Delay	0.0
Total Delay	6.2
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	0
Queue Length 95th (ft)	65
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	635
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.39

Intersection Summary

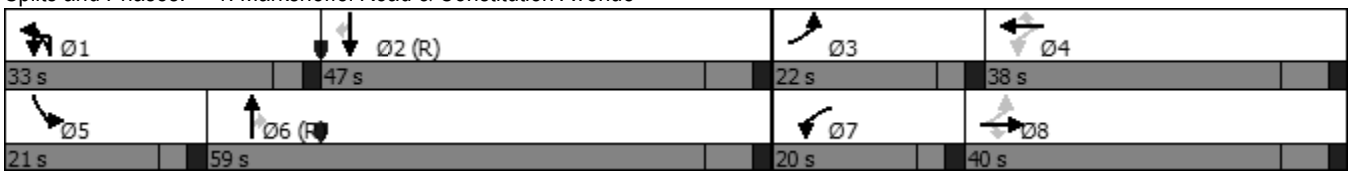
Maximum v/c Ratio: 1.04

Intersection Signal Delay: 56.8	Intersection LOS: E
Intersection Capacity Utilization 95.5%	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: Marksheffel Road & Constitution Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	242	1264	123	24	1380	157	128	51	172	333	33	135
Future Volume (vph)	242	1264	123	24	1380	157	128	51	172	333	33	135
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	3433	1647	0	3433	1639	0
Flt Permitted	0.122			0.147			0.950			0.950		
Satd. Flow (perm)	227	5085	1583	274	5085	1583	3433	1647	0	3433	1639	0
Satd. Flow (RTOR)			134			171		39			91	
Lane Group Flow (vph)	263	1374	134	26	1500	171	139	242	0	362	183	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4		4	8		8						
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0		24.0	24.0	
Total Split (s)	72.0	72.0	72.0	72.0	72.0	72.0	24.0	24.0		24.0	24.0	
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	20.0%	20.0%		20.0%	20.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		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	
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)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	68.2	68.2	68.2	68.2	68.2	68.2	17.2	17.2		16.6	16.6	
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.57	0.57	0.14	0.14		0.14	0.14	
v/c Ratio	2.05	0.48	0.14	0.17	0.52	0.18	0.28	0.90		0.76	0.60	
Control Delay	518.8	16.4	2.5	16.8	17.0	2.3	47.2	76.3		60.9	32.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	518.8	16.4	2.5	16.8	17.0	2.3	47.2	76.3		60.9	32.7	
LOS	F	B	A	B	B	A	D	E		E	C	
Approach Delay		89.9			15.5			65.7			51.5	
Approach LOS		F			B			E			D	
Queue Length 50th (ft)	~229	229	0	10	258	0	50	157		139	65	
Queue Length 95th (ft)	#401	269	28	28	302	31	81	#303		191	143	
Internal Link Dist (ft)		734			1022			309			581	
Turn Bay Length (ft)	275		235	235		275	120			355		
Base Capacity (vph)	128	2889	957	155	2889	973	514	280		514	323	
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	2.05	0.48	0.14	0.17	0.52	0.18	0.27	0.86		0.70	0.57	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 48 (40%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

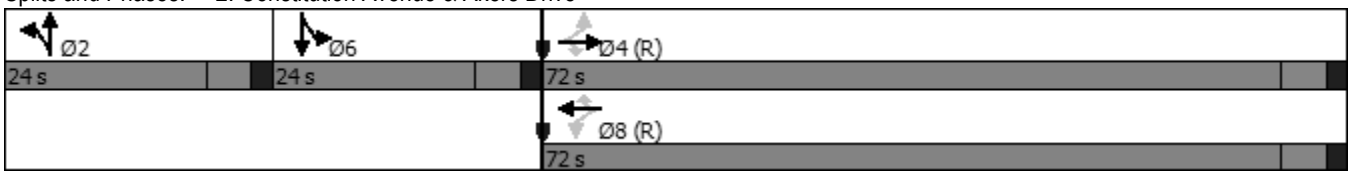
Maximum v/c Ratio: 2.05

Intersection Signal Delay: 54.3	Intersection LOS: D
Intersection Capacity Utilization 82.8%	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: 2: Constitution Avenue & Akers Drive



Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	378	305	138	115	0
Future Vol, veh/h	3	378	305	138	115	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	100	0	130	-	-	120
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	3	411	332	150	125	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	939	125	125	0	-	0
Stage 1	125	-	-	-	-	-
Stage 2	814	-	-	-	-	-
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	287	926	1462	-	-	-
Stage 1	901	-	-	-	-	-
Stage 2	425	-	-	-	-	-
Platoon blocked, %	1			-	-	-
Mov Cap-1 Maneuver	222	926	1462	-	-	-
Mov Cap-2 Maneuver	332	-	-	-	-	-
Stage 1	696	-	-	-	-	-
Stage 2	425	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12	5.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1462	-	332	926	-	-
HCM Lane V/C Ratio	0.227	-	0.01	0.444	-	-
HCM Control Delay (s)	8.2	-	16	12	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0.9	-	0	2.3	-	-

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	9	19	11	16	8	45	104	8	38	102	16
Future Vol, veh/h	16	9	19	11	16	8	45	104	8	38	102	16
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	115	-	115	115	-	115	120	-	120	150	-	120
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	17	10	21	12	17	9	49	113	9	41	111	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	422	413	111	428	421	113	128	0	0	122	0	0
Stage 1	193	193	-	211	211	-	-	-	-	-	-	-
Stage 2	229	220	-	217	210	-	-	-	-	-	-	-
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	562	542	942	558	537	983	1458	-	-	1481	-	-
Stage 1	809	741	-	819	740	-	-	-	-	-	-	-
Stage 2	800	734	-	785	728	-	-	-	-	-	-	-
Platoon blocked, %	1	1		1	1	1		-	-	1	-	-
Mov Cap-1 Maneuver	518	509	942	512	504	983	1458	-	-	1481	-	-
Mov Cap-2 Maneuver	518	509	-	512	504	-	-	-	-	-	-	-
Stage 1	781	720	-	791	715	-	-	-	-	-	-	-
Stage 2	748	709	-	736	708	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.8	11.5	2.2	1.8
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBL	SBT	SBR
Capacity (veh/h)	1458	-	-	518	509	942	512	504	983	1481	-	-
HCM Lane V/C Ratio	0.034	-	-	0.034	0.019	0.022	0.023	0.035	0.009	0.028	-	-
HCM Control Delay (s)	7.6	-	-	12.2	12.2	8.9	12.2	12.4	8.7	7.5	-	-
HCM Lane LOS	A	-	-	B	B	A	B	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	0.1	0.1	0.1	0.1	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑↑	↑↑↑	↱
Traffic Vol, veh/h	0	56	0	2275	1466	21
Future Vol, veh/h	0	56	0	2275	1466	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	61	0	2473	1593	23

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	797	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.14	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.92	-	-	-	-
Pot Cap-1 Maneuver	0	283	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	283	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	21.2	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	283	-
HCM Lane V/C Ratio	-	0.215	-
HCM Control Delay (s)	-	21.2	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	0.8	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	114	280	282	150	321	195	25	195	554	88	147	1132
Future Volume (vph)	114	280	282	150	321	195	25	195	554	88	147	1132
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	0	3433	3539	1583	3433	3539
Flt Permitted	0.405			0.459				0.950			0.950	
Satd. Flow (perm)	754	3539	1583	855	3539	1583	0	3433	3539	1583	3433	3539
Satd. Flow (RTOR)			228			212				127		
Lane Group Flow (vph)	124	304	307	163	349	212	0	239	602	96	160	1230
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	15.0	30.0	30.0	15.0	30.0	30.0	20.0	20.0	55.0	55.0	20.0	55.0
Total Split (%)	12.5%	25.0%	25.0%	12.5%	25.0%	25.0%	16.7%	16.7%	45.8%	45.8%	16.7%	45.8%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	28.7	17.2	17.2	29.3	17.5	17.5		13.1	58.1	58.1	10.9	55.8
Actuated g/C Ratio	0.24	0.14	0.14	0.24	0.15	0.15		0.11	0.48	0.48	0.09	0.46
v/c Ratio	0.48	0.60	0.73	0.57	0.68	0.52		0.64	0.35	0.12	0.51	0.75
Control Delay	38.5	52.8	23.9	42.1	55.1	10.4		58.9	21.1	2.0	57.6	31.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	38.5	52.8	23.9	42.1	55.1	10.4		58.9	21.1	2.0	57.6	31.0
LOS	D	D	C	D	E	B		E	C	A	E	C
Approach Delay		38.3			39.1				28.8			31.5
Approach LOS		D			D				C			C
Queue Length 50th (ft)	74	117	56	100	137	0		92	148	0	61	404
Queue Length 95th (ft)	117	156	152	150	177	65		133	222	18	95	553
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	267	678	487	286	678	474		429	1712	831	429	1646
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	0.46	0.45	0.63	0.57	0.51	0.45		0.56	0.35	0.12	0.37	0.75

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 85 (71%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

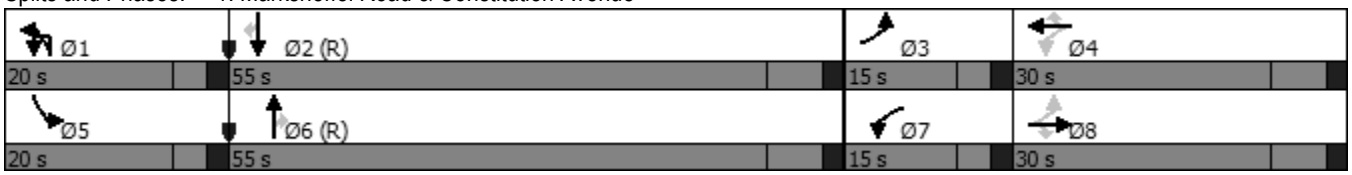
Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	124
Future Volume (vph)	124
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	127
Lane Group Flow (vph)	135
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	55.0
Total Split (%)	45.8%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	55.8
Actuated g/C Ratio	0.46
v/c Ratio	0.17
Control Delay	4.9
Queue Delay	0.0
Total Delay	4.9
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	3
Queue Length 95th (ft)	43
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	804
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.17

Intersection Summary

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 33.5	Intersection LOS: C
Intersection Capacity Utilization 83.3%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Marksheffel Road & Constitution Avenue



Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	46	603	565	63	73	72
Future Vol, veh/h	46	603	565	63	73	72
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	275	-	-	-	355	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	50	655	614	68	79	78

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	682	0	-	0	976	-
Stage 1	-	-	-	-	614	-
Stage 2	-	-	-	-	362	-
Critical Hdwy	4.14	-	-	-	6.29	-
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	2.22	-	-	-	3.67	-
Pot Cap-1 Maneuver	*1306	-	-	-	*675	0
Stage 1	-	-	-	-	*790	0
Stage 2	-	-	-	-	*639	0
Platoon blocked, %	1	-	-	-	1	
Mov Cap-1 Maneuver	*1306	-	-	-	*649	-
Mov Cap-2 Maneuver	-	-	-	-	*649	-
Stage 1	-	-	-	-	*760	-
Stage 2	-	-	-	-	*639	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	11.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	* 1306	-	-	-	649	-
HCM Lane V/C Ratio	0.038	-	-	-	0.122	-
HCM Control Delay (s)	7.9	-	-	-	11.3	0
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.4	-

Notes

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

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	9	64	0	8	10	86	7	7	72	0
Future Vol, veh/h	0	0	9	64	0	8	10	86	7	7	72	0
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	115	-	115	115	-	-	130	-	120	120	-	-
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	0	0	10	70	0	9	11	93	8	8	78	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	218	217	78	214	209	93	78	0	0	101	0	0
Stage 1	94	94	-	115	115	-	-	-	-	-	-	-
Stage 2	124	123	-	99	94	-	-	-	-	-	-	-
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	738	681	983	743	688	964	1520	-	-	1491	-	-
Stage 1	913	817	-	890	800	-	-	-	-	-	-	-
Stage 2	880	794	-	907	817	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	724	673	983	729	680	964	1520	-	-	1491	-	-
Mov Cap-2 Maneuver	724	673	-	729	680	-	-	-	-	-	-	-
Stage 1	907	813	-	884	794	-	-	-	-	-	-	-
Stage 2	866	788	-	893	813	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	8.7	10.3	0.7	0.7
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1520	-	-	-	-	983	729	964	1491	-	-
HCM Lane V/C Ratio	0.007	-	-	-	-	0.01	0.095	0.009	0.005	-	-
HCM Control Delay (s)	7.4	-	-	0	0	8.7	10.5	8.8	7.4	-	-
HCM Lane LOS	A	-	-	A	A	A	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-	0	0.3	0	0	-	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	6	78	11	12	77
Future Vol, veh/h	11	6	78	11	12	77
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	-	-	-	150	-
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	12	7	85	12	13	84

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	201	91	0	0	97	0
Stage 1	91	-	-	-	-	-
Stage 2	110	-	-	-	-	-
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	788	967	-	-	1496	-
Stage 1	933	-	-	-	-	-
Stage 2	915	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	781	967	-	-	1496	-
Mov Cap-2 Maneuver	776	-	-	-	-	-
Stage 1	933	-	-	-	-	-
Stage 2	907	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.4	0	1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	834	1496	-
HCM Lane V/C Ratio	-	-	0.022	0.009	-
HCM Control Delay (s)	-	-	9.4	7.4	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Traffic Vol, veh/h	0	22	0	861	1398	11
Future Vol, veh/h	0	22	0	861	1398	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	24	0	936	1520	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	760	-	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	349	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	349	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.1	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	349	-
HCM Lane V/C Ratio	-	0.069	-
HCM Control Delay (s)	-	16.1	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	0.2	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑	↱		↑
Traffic Vol, veh/h	0	8	95	14	0	145
Future Vol, veh/h	0	8	95	14	0	145
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	-	120	-	-
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	9	103	15	0	158

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	103	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	952	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	952	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	952	-
HCM Lane V/C Ratio	-	-	0.009	-
HCM Control Delay (s)	-	-	8.8	-
HCM Lane LOS	-	-	A	-
HCM 95th %tile Q(veh)	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	118	580	242	181	453	296	15	372	1147	115	255	637
Future Volume (vph)	118	580	242	181	453	296	15	372	1147	115	255	637
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	0	3433	3539	1583	3433	3539
Flt Permitted	0.351			0.166				0.950			0.950	
Satd. Flow (perm)	654	3539	1583	309	3539	1583	0	3433	3539	1583	3433	3539
Satd. Flow (RTOR)			254			322				109		
Lane Group Flow (vph)	128	630	263	197	492	322	0	420	1247	125	277	692
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	21.0	46.0	46.0	21.0	46.0	46.0	22.0	22.0	51.0	51.0	22.0	51.0
Total Split (%)	15.0%	32.9%	32.9%	15.0%	32.9%	32.9%	15.7%	15.7%	36.4%	36.4%	15.7%	36.4%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	45.4	31.1	31.1	51.2	34.0	34.0		22.3	53.7	53.7	16.0	47.4
Actuated g/C Ratio	0.32	0.22	0.22	0.37	0.24	0.24		0.16	0.38	0.38	0.11	0.34
v/c Ratio	0.41	0.80	0.48	0.73	0.57	0.51		0.77	0.92	0.19	0.71	0.58
Control Delay	32.1	59.4	8.4	45.8	49.0	7.1		66.6	53.2	8.6	69.8	41.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	32.1	59.4	8.4	45.8	49.0	7.1		66.6	53.2	8.6	69.8	41.2
LOS	C	E	A	D	D	A		E	D	A	E	D
Approach Delay		42.9			35.1				53.2			43.7
Approach LOS		D			D				D			D
Queue Length 50th (ft)	77	288	6	123	207	0		187	574	9	126	282
Queue Length 95th (ft)	115	337	76	174	257	75		#301	#827	58	174	351
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	357	985	624	280	985	673		546	1357	674	428	1199
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	0.36	0.64	0.42	0.70	0.50	0.48		0.77	0.92	0.19	0.65	0.58

Intersection Summary

Cycle Length: 140
Actuated Cycle Length: 140
Offset: 74 (53%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	134
Future Volume (vph)	134
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	146
Lane Group Flow (vph)	146
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	51.0
Total Split (%)	36.4%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	47.4
Actuated g/C Ratio	0.34
v/c Ratio	0.23
Control Delay	6.1
Queue Delay	0.0
Total Delay	6.1
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	0
Queue Length 95th (ft)	50
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	632
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.23

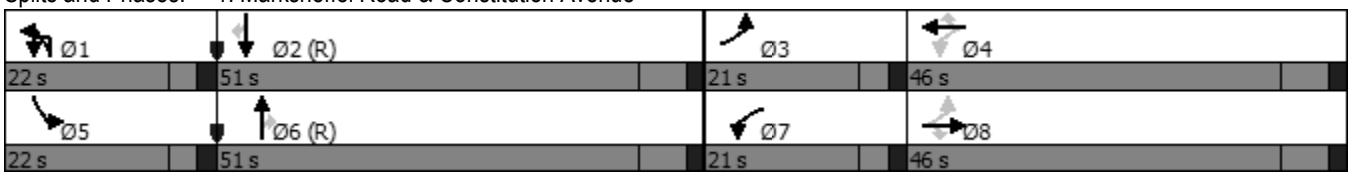
Intersection Summary

Maximum v/c Ratio: 0.92

Intersection Signal Delay: 45.2	Intersection LOS: D
Intersection Capacity Utilization 85.0%	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: 1: Marksheffel Road & Constitution Avenue



Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	58	875	885	78	47	65
Future Vol, veh/h	58	875	885	78	47	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Free
Storage Length	275	-	-	-	355	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	63	951	962	85	51	71

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1047	0	-	0	1468	-
Stage 1	-	-	-	-	962	-
Stage 2	-	-	-	-	506	-
Critical Hdwy	4.14	-	-	-	6.29	-
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	6.04	-
Follow-up Hdwy	2.22	-	-	-	3.67	-
Pot Cap-1 Maneuver	*1087	-	-	-	*658	0
Stage 1	-	-	-	-	*658	0
Stage 2	-	-	-	-	*537	0
Platoon blocked, %	1	-	-	-	1	
Mov Cap-1 Maneuver	*1087	-	-	-	*620	-
Mov Cap-2 Maneuver	-	-	-	-	*620	-
Stage 1	-	-	-	-	*620	-
Stage 2	-	-	-	-	*537	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	11.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	* 1087	-	-	-	620	-
HCM Lane V/C Ratio	0.058	-	-	-	0.082	-
HCM Control Delay (s)	8.5	-	-	-	11.3	0
HCM Lane LOS	A	-	-	-	B	A
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3	-

Notes

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

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	0	4	41	0	5	10	69	20	20	67	0
Future Vol, veh/h	2	0	4	41	0	5	10	69	20	20	67	0
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	115	-	115	115	-	-	130	-	120	120	-	-
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	2	0	4	45	0	5	11	75	22	22	73	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	228	236	73	216	214	75	73	0	0	97	0	0
Stage 1	117	117	-	97	97	-	-	-	-	-	-	-
Stage 2	111	119	-	119	117	-	-	-	-	-	-	-
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	727	665	989	740	684	986	1527	-	-	1496	-	-
Stage 1	888	799	-	910	815	-	-	-	-	-	-	-
Stage 2	894	797	-	885	799	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	711	650	989	724	669	986	1527	-	-	1496	-	-
Mov Cap-2 Maneuver	711	650	-	724	669	-	-	-	-	-	-	-
Stage 1	882	787	-	904	809	-	-	-	-	-	-	-
Stage 2	883	791	-	868	787	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.2	10.1	0.7	1.7
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1527	-	-	711	-	989	724	986	1496	-	-
HCM Lane V/C Ratio	0.007	-	-	0.003	-	0.004	0.062	0.006	0.015	-	-
HCM Control Delay (s)	7.4	-	-	10.1	0	8.7	10.3	8.7	7.4	-	-
HCM Lane LOS	A	-	-	B	A	A	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	-	0	0.2	0	0	-	-

Intersection	
Int Delay, s/veh	1.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	5	82	5	26	87
Future Vol, veh/h	11	5	82	5	26	87
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	-	-	-	150	-
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	12	5	89	5	28	95

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	243	92	0	0	94	0
Stage 1	92	-	-	-	-	-
Stage 2	151	-	-	-	-	-
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	745	965	-	-	1500	-
Stage 1	932	-	-	-	-	-
Stage 2	877	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	731	965	-	-	1500	-
Mov Cap-2 Maneuver	739	-	-	-	-	-
Stage 1	932	-	-	-	-	-
Stage 2	860	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.6	0	1.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	797	1500	-
HCM Lane V/C Ratio	-	-	0.022	0.019	-
HCM Control Delay (s)	-	-	9.6	7.4	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Traffic Vol, veh/h	0	32	0	1556	1012	7
Future Vol, veh/h	0	32	0	1556	1012	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	35	0	1691	1100	8

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	550	-	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	479	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	479	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	479	-
HCM Lane V/C Ratio	-	0.073	-
HCM Control Delay (s)	-	13.1	-
HCM Lane LOS	-	B	-
HCM 95th %tile Q(veh)	-	0.2	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑	↱		↑
Traffic Vol, veh/h	0	5	95	41	0	112
Future Vol, veh/h	0	5	95	41	0	112
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	-	120	-	-
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	5	103	45	0	122

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	103	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	952	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	952	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	952	-
HCM Lane V/C Ratio	-	-	0.006	-
HCM Control Delay (s)	-	-	8.8	-
HCM Lane LOS	-	-	A	-
HCM 95th %tile Q(veh)	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	190	477	415	186	496	265	36	286	794	118	199	1632
Future Volume (vph)	190	477	415	186	496	265	36	286	794	118	199	1632
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	0	3433	5085	1583	3433	5085
Flt Permitted	0.278			0.450				0.950			0.950	
Satd. Flow (perm)	518	5085	1583	838	5085	1583	0	3433	5085	1583	3433	5085
Satd. Flow (RTOR)			142			264				128		
Lane Group Flow (vph)	207	518	451	202	539	288	0	350	863	128	216	1774
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	16.0	35.0	35.0	11.0	30.0	30.0	18.0	18.0	57.0	57.0	17.0	56.0
Total Split (%)	13.3%	29.2%	29.2%	9.2%	25.0%	25.0%	15.0%	15.0%	47.5%	47.5%	14.2%	46.7%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	40.2	27.2	27.2	30.2	22.2	22.2		13.4	51.5	51.5	11.3	49.4
Actuated g/C Ratio	0.34	0.23	0.23	0.25	0.18	0.18		0.11	0.43	0.43	0.09	0.41
v/c Ratio	0.72	0.45	0.96	0.79	0.57	0.57		0.91	0.40	0.17	0.67	0.85
Control Delay	41.9	37.6	61.6	57.4	47.1	11.7		82.0	24.5	4.2	62.9	36.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	41.9	37.6	61.6	57.4	47.1	11.7		82.0	24.5	4.2	62.9	36.8
LOS	D	D	E	E	D	B		F	C	A	E	D
Approach Delay		47.5			39.2				37.6			36.5
Approach LOS		D			D				D			D
Queue Length 50th (ft)	129	132	258	116	139	15		140	169	0	84	450
Queue Length 95th (ft)	#211	171	#396	#212	179	97		#233	206	37	125	517
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	288	1186	478	257	974	516		383	2181	752	343	2094
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	0.72	0.44	0.94	0.79	0.55	0.56		0.91	0.40	0.17	0.63	0.85

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 85 (71%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	189
Future Volume (vph)	189
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	176
Lane Group Flow (vph)	205
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	56.0
Total Split (%)	46.7%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	49.4
Actuated g/C Ratio	0.41
v/c Ratio	0.27
Control Delay	5.9
Queue Delay	0.0
Total Delay	5.9
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	13
Queue Length 95th (ft)	61
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	755
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.27

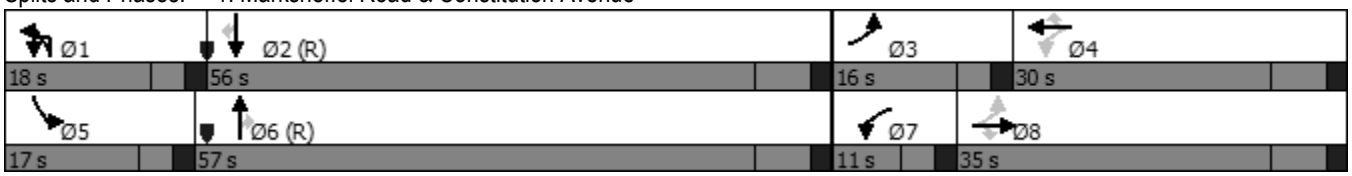
Intersection Summary

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 39.5	Intersection LOS: D
Intersection Capacity Utilization 96.7%	ICU Level of Service F
Analysis Period (min) 15	

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Marksheffel Road & Constitution Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	890	73	29	837	117	41	11	69	185	15	111
Future Volume (vph)	140	890	73	29	837	117	41	11	69	185	15	111
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	3433	1622	0	3433	1617	0
Flt Permitted	0.292			0.272			0.950			0.950		
Satd. Flow (perm)	544	5085	1583	507	5085	1583	3433	1622	0	3433	1617	0
Satd. Flow (RTOR)			82			127		75			121	
Lane Group Flow (vph)	152	967	79	32	910	127	45	87	0	201	137	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4		4	8		8						
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0		24.0	24.0	
Total Split (s)	72.0	72.0	72.0	72.0	72.0	72.0	24.0	24.0		24.0	24.0	
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	20.0%	20.0%		20.0%	20.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		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	
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)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	82.0	82.0	82.0	82.0	82.0	82.0	7.7	7.7		12.3	12.3	
Actuated g/C Ratio	0.68	0.68	0.68	0.68	0.68	0.68	0.06	0.06		0.10	0.10	
v/c Ratio	0.41	0.28	0.07	0.09	0.26	0.11	0.20	0.50		0.57	0.50	
Control Delay	13.6	8.1	1.8	10.7	10.1	4.3	54.4	25.4		57.6	18.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	13.6	8.1	1.8	10.7	10.1	4.3	54.4	25.4		57.6	18.0	
LOS	B	A	A	B	B	A	D	C		E	B	
Approach Delay		8.4			9.4			35.3			41.5	
Approach LOS		A			A			D			D	
Queue Length 50th (ft)	46	95	0	10	112	13	17	9		77	11	
Queue Length 95th (ft)	114	142	17	m21	m153	m26	36	59		113	71	
Internal Link Dist (ft)		734			1022			276			237	
Turn Bay Length (ft)	275		235	235		275	120			355		
Base Capacity (vph)	371	3474	1107	346	3474	1121	514	307		514	345	
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	0.41	0.28	0.07	0.09	0.26	0.11	0.09	0.28		0.39	0.40	

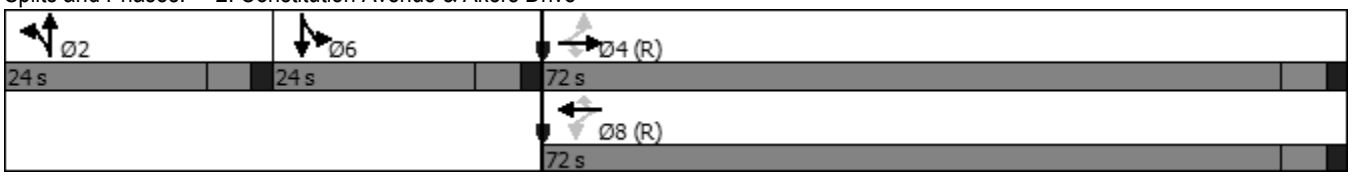
Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.57

Intersection Signal Delay: 14.2	Intersection LOS: B
Intersection Capacity Utilization 55.7%	ICU Level of Service B
Analysis Period (min) 15	

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

Splits and Phases: 2: Constitution Avenue & Akers Drive



Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	110	64	0	8	117	134	7	7	133	0
Future Vol, veh/h	0	0	110	64	0	8	117	134	7	7	133	0
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	115	-	115	115	-	-	130	-	120	120	-	-
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	0	0	120	70	0	9	127	146	8	8	145	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	570	569	145	621	561	146	145	0	0	154	0	0
Stage 1	161	161	-	400	400	-	-	-	-	-	-	-
Stage 2	409	408	-	221	161	-	-	-	-	-	-	-
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	450	441	902	413	446	960	1437	-	-	1446	-	-
Stage 1	841	765	-	648	609	-	-	-	-	-	-	-
Stage 2	640	604	-	781	765	-	-	-	-	-	-	-
Platoon blocked, %	1	1		1	1	1		-	-	1	-	-
Mov Cap-1 Maneuver	414	400	902	332	404	960	1437	-	-	1446	-	-
Mov Cap-2 Maneuver	414	400	-	332	404	-	-	-	-	-	-	-
Stage 1	767	760	-	591	556	-	-	-	-	-	-	-
Stage 2	578	551	-	674	760	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.6	17.6	3.5	0.4
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1437	-	-	-	-	902	332	960	1446	-	-
HCM Lane V/C Ratio	0.088	-	-	-	-	0.133	0.21	0.009	0.005	-	-
HCM Control Delay (s)	7.7	-	-	0	0	9.6	18.7	8.8	7.5	-	-
HCM Lane LOS	A	-	-	A	A	A	C	A	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	-	-	0.5	0.8	0	0	-	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	24	14	29	16	5	9	13	106	17	18	109	5
Future Vol, veh/h	24	14	29	16	5	9	13	106	17	18	109	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	115	-	115	115	-	115	120	-	120	150	-	120
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	26	15	32	17	5	10	14	115	18	20	118	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	318	319	118	327	306	115	123	0	0	133	0	0
Stage 1	158	158	-	143	143	-	-	-	-	-	-	-
Stage 2	160	161	-	184	163	-	-	-	-	-	-	-
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	680	626	934	670	637	*1001	1464	-	-	1474	-	-
Stage 1	844	767	-	911	803	-	-	-	-	-	-	-
Stage 2	891	788	-	818	763	-	-	-	-	-	-	-
Platoon blocked, %	1	1		1	1	1		-	-	1	-	-
Mov Cap-1 Maneuver	657	611	934	624	622	*1001	1464	-	-	1474	-	-
Mov Cap-2 Maneuver	657	611	-	624	622	-	-	-	-	-	-	-
Stage 1	836	756	-	902	795	-	-	-	-	-	-	-
Stage 2	868	780	-	764	752	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10	10.2	0.7	1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBL	SBT	SBR
Capacity (veh/h)	1464	-	-	657	611	934	624	622	1001	1474	-	-
HCM Lane V/C Ratio	0.01	-	-	0.04	0.025	0.034	0.028	0.009	0.01	0.013	-	-
HCM Control Delay (s)	7.5	-	-	10.7	11	9	10.9	10.8	8.6	7.5	-	-
HCM Lane LOS	A	-	-	B	B	A	B	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	0.1	0	0	0	-	-

Notes

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

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑↑	↑↑↑	↱
Traffic Vol, veh/h	0	46	0	1247	2006	21
Future Vol, veh/h	0	46	0	1247	2006	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	50	0	1355	2180	23

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	1090	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.14	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.92	-	-	-	-
Pot Cap-1 Maneuver	0	181	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	181	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	32.3	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	181	-
HCM Lane V/C Ratio	-	0.276	-
HCM Control Delay (s)	-	32.3	-
HCM Lane LOS	-	D	-
HCM 95th %tile Q(veh)	-	1.1	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑	↱		↑
Traffic Vol, veh/h	0	8	254	14	0	311
Future Vol, veh/h	0	8	254	14	0	311
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	-	120	-	-
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	9	276	15	0	338

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	276	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	874	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		1	-	-		-
Mov Cap-1 Maneuver	-	874	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	874	-
HCM Lane V/C Ratio	-	-	0.01	-
HCM Control Delay (s)	-	-	9.2	-
HCM Lane LOS	-	-	A	-
HCM 95th %tile Q(veh)	-	-	0	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	241	1089	384	235	782	403	21	552	1641	141	349	919
Future Volume (vph)	241	1089	384	235	782	403	21	552	1641	141	349	919
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	0	3433	5085	1583	3433	5085
Flt Permitted	0.148			0.160				0.950			0.950	
Satd. Flow (perm)	276	5085	1583	298	5085	1583	0	3433	5085	1583	3433	5085
Satd. Flow (RTOR)			314			240				153		
Lane Group Flow (vph)	262	1184	417	255	850	438	0	623	1784	153	379	999
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	Prot	NA	Perm	Prot	NA
Protected Phases	3	8		7	4		1	1	6		5	2
Permitted Phases	8		8	4		4				6		
Detector Phase	3	8	8	7	4	4	1	1	6	6	5	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	11.0	11.0	9.0	11.0	11.0	9.0	9.0	11.0	11.0	9.0	11.0
Total Split (s)	18.0	34.0	34.0	16.0	32.0	32.0	30.0	30.0	52.0	52.0	18.0	40.0
Total Split (%)	15.0%	28.3%	28.3%	13.3%	26.7%	26.7%	25.0%	25.0%	43.3%	43.3%	15.0%	33.3%
Yellow Time (s)	3.0	5.0	5.0	3.0	5.0	5.0	3.0	3.0	5.0	5.0	3.0	5.0
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
Total Lost Time (s)	5.0	7.0	7.0	5.0	7.0	7.0		5.0	7.0	7.0	5.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)	42.0	27.0	27.0	38.0	25.0	25.0		24.3	45.0	45.0	13.0	33.7
Actuated g/C Ratio	0.35	0.22	0.22	0.32	0.21	0.21		0.20	0.38	0.38	0.11	0.28
v/c Ratio	1.02	1.03	0.70	1.11	0.80	0.84		0.90	0.94	0.22	1.02	0.70
Control Delay	93.1	68.6	9.8	123.5	51.9	36.3		63.3	46.6	4.7	105.0	41.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	93.1	68.6	9.8	123.5	51.9	36.3		63.3	46.6	4.7	105.0	41.9
LOS	F	E	A	F	D	D		E	D	A	F	D
Approach Delay		58.8			59.3				48.2			51.5
Approach LOS		E			E				D			D
Queue Length 50th (ft)	~151	~364	29	~170	231	155		242	482	0	~160	256
Queue Length 95th (ft)	m#309	#462	m98	#342	282	#333		#336	#587	43	#260	308
Internal Link Dist (ft)		1022			405				707			1957
Turn Bay Length (ft)	435		200	225		235		425		325	670	
Base Capacity (vph)	258	1144	599	229	1059	519		715	1906	689	371	1428
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	1.02	1.03	0.70	1.11	0.80	0.84		0.87	0.94	0.22	1.02	0.70

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 85 (71%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated

Lane Group	SBR
Lane Configurations	
Traffic Volume (vph)	231
Future Volume (vph)	231
Satd. Flow (prot)	1583
Flt Permitted	
Satd. Flow (perm)	1583
Satd. Flow (RTOR)	224
Lane Group Flow (vph)	251
Turn Type	Perm
Protected Phases	
Permitted Phases	2
Detector Phase	2
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	11.0
Total Split (s)	40.0
Total Split (%)	33.3%
Yellow Time (s)	5.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	7.0
Lead/Lag	Lag
Lead-Lag Optimize?	Yes
Recall Mode	C-Max
Act Effct Green (s)	33.7
Actuated g/C Ratio	0.28
v/c Ratio	0.41
Control Delay	8.6
Queue Delay	0.0
Total Delay	8.6
LOS	A
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	16
Queue Length 95th (ft)	83
Internal Link Dist (ft)	
Turn Bay Length (ft)	265
Base Capacity (vph)	605
Starvation Cap Reductn	0
Spillback Cap Reductn	0
Storage Cap Reductn	0
Reduced v/c Ratio	0.41

Intersection Summary

Maximum v/c Ratio: 1.11

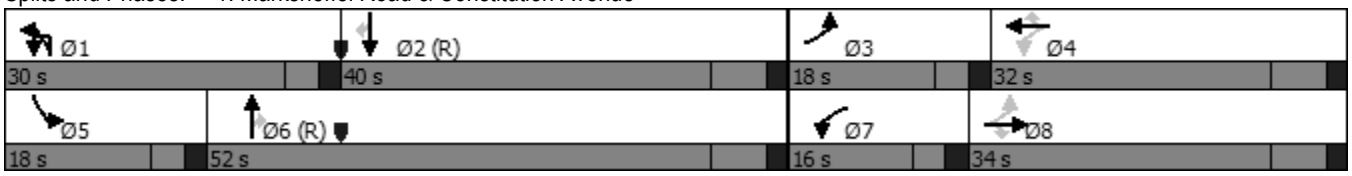
Intersection Signal Delay: 53.8	Intersection LOS: D
Intersection Capacity Utilization 95.7%	ICU Level of Service F
Analysis Period (min) 15	

~ 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: 1: Marksheffel Road & Constitution Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	270	1264	123	24	1380	190	128	51	172	356	33	153
Future Volume (vph)	270	1264	123	24	1380	190	128	51	172	356	33	153
Satd. Flow (prot)	1770	5085	1583	1770	5085	1583	3433	1647	0	3433	1634	0
Flt Permitted	0.121			0.146			0.950			0.950		
Satd. Flow (perm)	225	5085	1583	272	5085	1583	3433	1647	0	3433	1634	0
Satd. Flow (RTOR)			134			207		37			91	
Lane Group Flow (vph)	293	1374	134	26	1500	207	139	242	0	387	202	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Split	NA		Split	NA	
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4		4	8		8						
Detector Phase	4	4	4	8	8	8	2	2		6	6	
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	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0		24.0	24.0	
Total Split (s)	72.0	72.0	72.0	72.0	72.0	72.0	24.0	24.0		24.0	24.0	
Total Split (%)	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	20.0%	20.0%		20.0%	20.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		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	
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)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	67.7	67.7	67.7	67.7	67.7	67.7	17.3	17.3		17.0	17.0	
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.56	0.56	0.14	0.14		0.14	0.14	
v/c Ratio	2.33	0.48	0.14	0.17	0.52	0.21	0.28	0.90		0.80	0.65	
Control Delay	636.7	16.6	2.5	18.9	18.9	5.9	47.2	77.5		62.8	36.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	636.7	16.6	2.5	18.9	18.9	5.9	47.2	77.5		62.8	36.9	
LOS	F	B	A	B	B	A	D	E		E	D	
Approach Delay		116.4			17.4			66.4			53.9	
Approach LOS		F			B			E			D	
Queue Length 50th (ft)	~280	229	0	9	201	27	50	158		150	80	
Queue Length 95th (ft)	#459	269	28	m13	234	m40	81	#306		205	163	
Internal Link Dist (ft)		734			1022			276			237	
Turn Bay Length (ft)	275		235	235		275	120			355		
Base Capacity (vph)	126	2869	951	153	2869	983	514	278		514	322	
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	2.33	0.48	0.14	0.17	0.52	0.21	0.27	0.87		0.75	0.63	

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 2.33

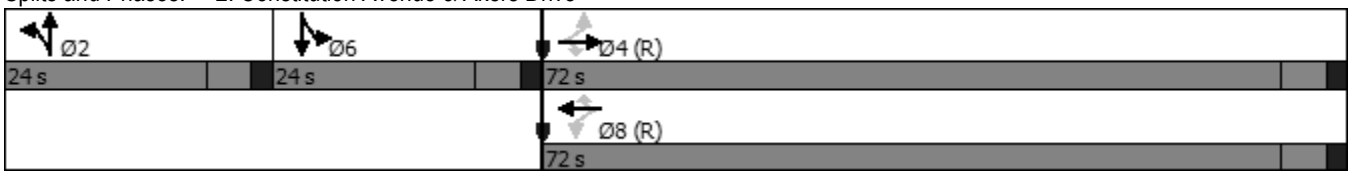
Intersection Signal Delay: 65.9	Intersection LOS: E
Intersection Capacity Utilization 85.1%	ICU Level of Service E
Analysis Period (min) 15	

~ 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: 2: Constitution Avenue & Akers Drive



Intersection	
Int Delay, s/veh	11.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	0	378	41	0	5	305	143	20	20	115	0
Future Vol, veh/h	3	0	378	41	0	5	305	143	20	20	115	0
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	115	-	115	115	-	-	130	-	120	120	-	-
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	3	0	411	45	0	5	332	155	22	22	125	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1002	1010	125	1194	988	155	125	0	0	177	0	0
Stage 1	169	169	-	819	819	-	-	-	-	-	-	-
Stage 2	833	841	-	375	169	-	-	-	-	-	-	-
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	217	232	926	156	240	970	1462	-	-	1425	-	-
Stage 1	833	759	-	366	380	-	-	-	-	-	-	-
Stage 2	359	370	-	646	759	-	-	-	-	-	-	-
Platoon blocked, %	1	1		1	1	1		-	-	1	-	-
Mov Cap-1 Maneuver	176	177	926	71	183	970	1462	-	-	1425	-	-
Mov Cap-2 Maneuver	176	177	-	71	183	-	-	-	-	-	-	-
Stage 1	644	748	-	283	293	-	-	-	-	-	-	-
Stage 2	276	286	-	354	748	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.1	106.1	5.3	1.1
HCM LOS	B	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1462	-	-	176	-	926	71	970	1425	-	-
HCM Lane V/C Ratio	0.227	-	-	0.019	-	0.444	0.628	0.006	0.015	-	-
HCM Control Delay (s)	8.2	-	-	25.8	0	12	118	8.7	7.6	-	-
HCM Lane LOS	A	-	-	D	A	B	F	A	A	-	-
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-	2.3	2.8	0	0	-	-

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	9	19	15	16	8	45	114	8	38	118	16
Future Vol, veh/h	16	9	19	15	16	8	45	114	8	38	118	16
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	115	-	115	115	-	115	120	-	120	150	-	120
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	17	10	21	16	17	9	49	124	9	41	128	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	450	441	128	456	449	124	145	0	0	133	0	0
Stage 1	210	210	-	222	222	-	-	-	-	-	-	-
Stage 2	240	231	-	234	227	-	-	-	-	-	-	-
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	547	528	922	543	522	989	1437	-	-	1474	-	-
Stage 1	792	728	-	821	738	-	-	-	-	-	-	-
Stage 2	801	731	-	769	716	-	-	-	-	-	-	-
Platoon blocked, %	1	1		1	1	1		-	-	1	-	-
Mov Cap-1 Maneuver	504	496	922	498	491	989	1437	-	-	1474	-	-
Mov Cap-2 Maneuver	504	496	-	498	491	-	-	-	-	-	-	-
Stage 1	765	708	-	793	713	-	-	-	-	-	-	-
Stage 2	748	706	-	721	696	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.9	11.8	2	1.7
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	EBLn3	WBLn1	WBLn2	WBLn3	SBL	SBT	SBR
Capacity (veh/h)	1437	-	-	504	496	922	498	491	989	1474	-	-
HCM Lane V/C Ratio	0.034	-	-	0.035	0.02	0.022	0.033	0.035	0.009	0.028	-	-
HCM Control Delay (s)	7.6	-	-	12.4	12.4	9	12.5	12.6	8.7	7.5	-	-
HCM Lane LOS	A	-	-	B	B	A	B	B	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	0.1	0.1	0.1	0.1	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑↑	↑↑↑	↱
Traffic Vol, veh/h	0	56	0	2280	1470	25
Future Vol, veh/h	0	56	0	2280	1470	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	0	-	-	-	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	0	61	0	2478	1598	27

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	799	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.14	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.92	-	-	-	-
Pot Cap-1 Maneuver	0	282	0	-	-	0
Stage 1	0	-	0	-	-	0
Stage 2	0	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	-	282	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	21.2	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	282	-
HCM Lane V/C Ratio	-	0.216	-
HCM Control Delay (s)	-	21.2	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	0.8	-

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑	↱		↑
Traffic Vol, veh/h	0	5	470	41	0	542
Future Vol, veh/h	0	5	470	41	0	542
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	-	120	-	-
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	5	511	45	0	589

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	511	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.22	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.318	-	-	-	-
Pot Cap-1 Maneuver	0	*693	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		1	-	-		-
Mov Cap-1 Maneuver	-	*693	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	693	-
HCM Lane V/C Ratio	-	-	0.008	-
HCM Control Delay (s)	-	-	10.2	-
HCM Lane LOS	-	-	B	-
HCM 95th %tile Q(veh)	-	-	0	-

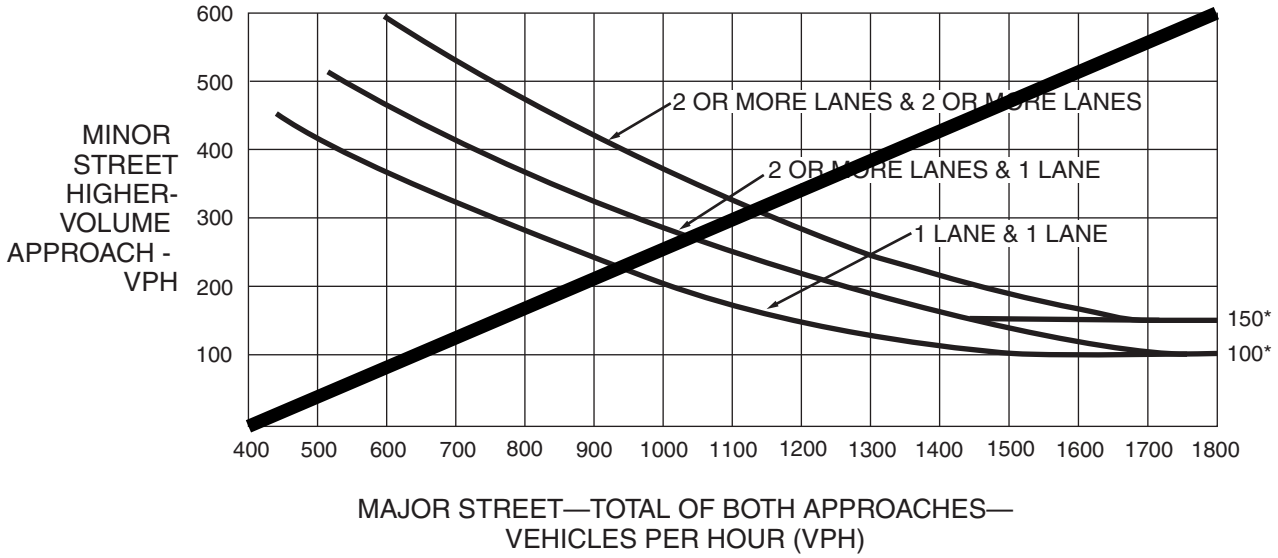
Notes

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

APPENDIX D

Warrant Analysis Forms

Figure 4C-3. Warrant 3, Peak Hour

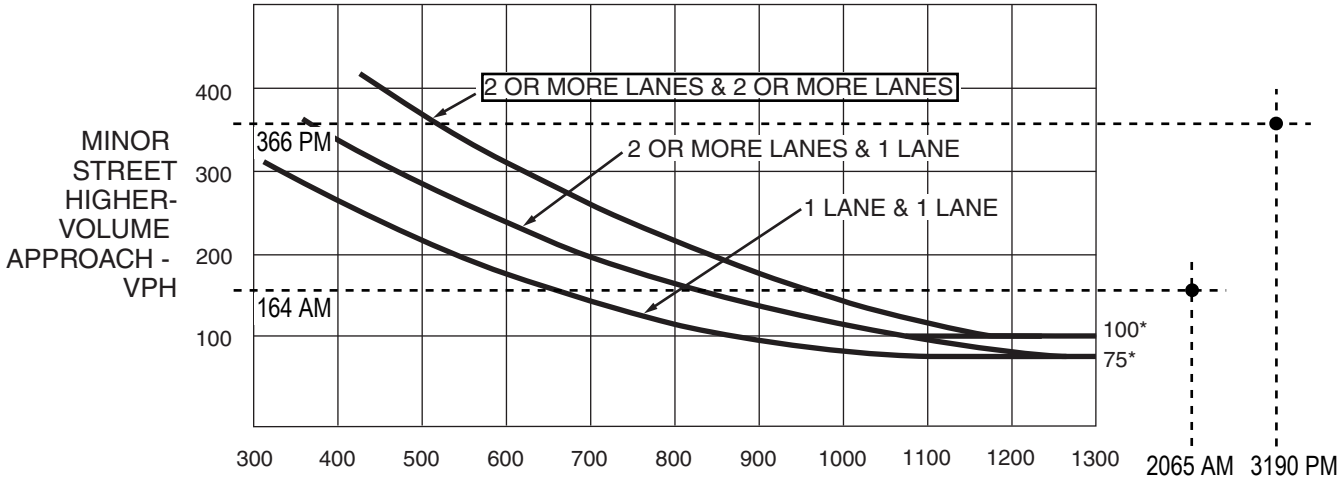


*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)

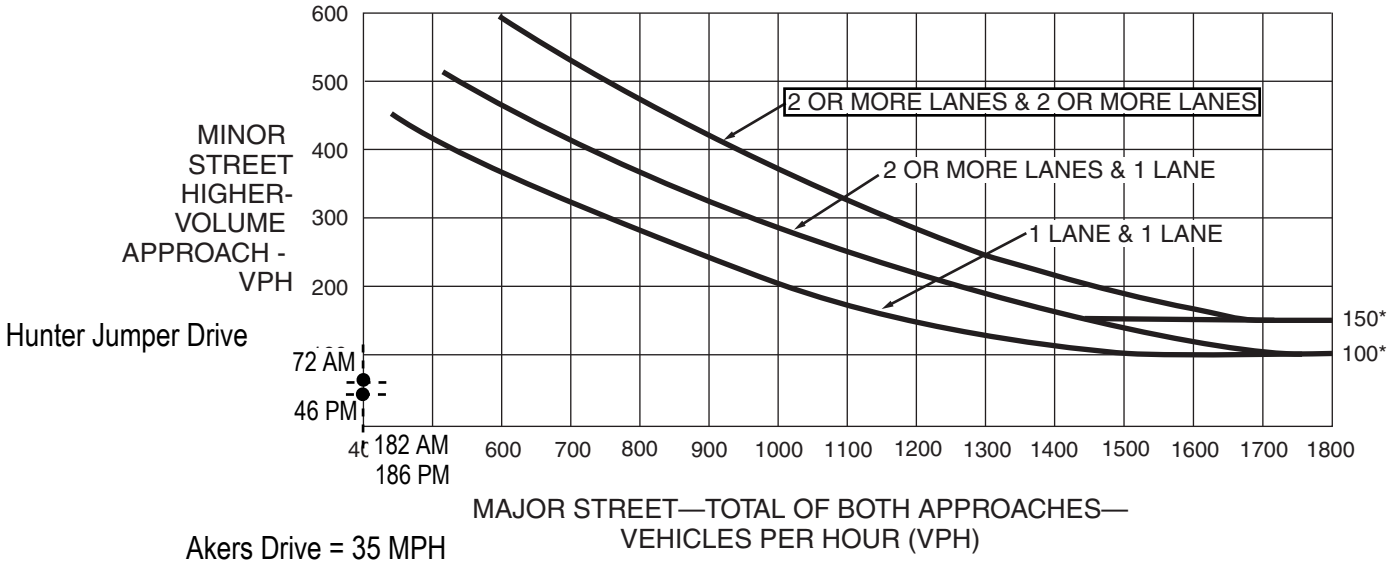
Akers Drive



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Constitution Avenue = 50 MPH

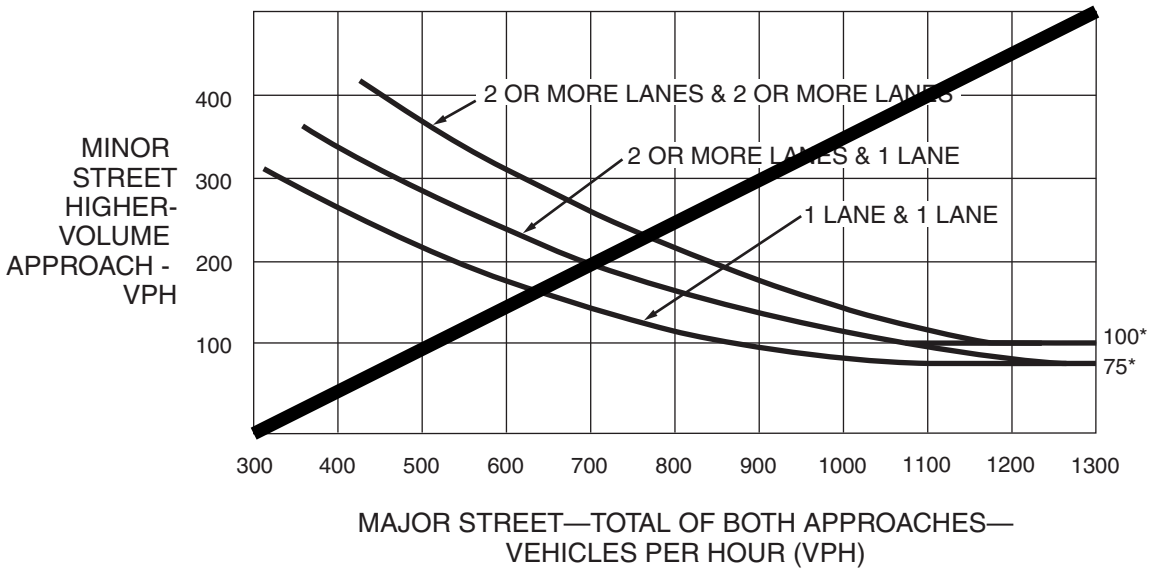
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

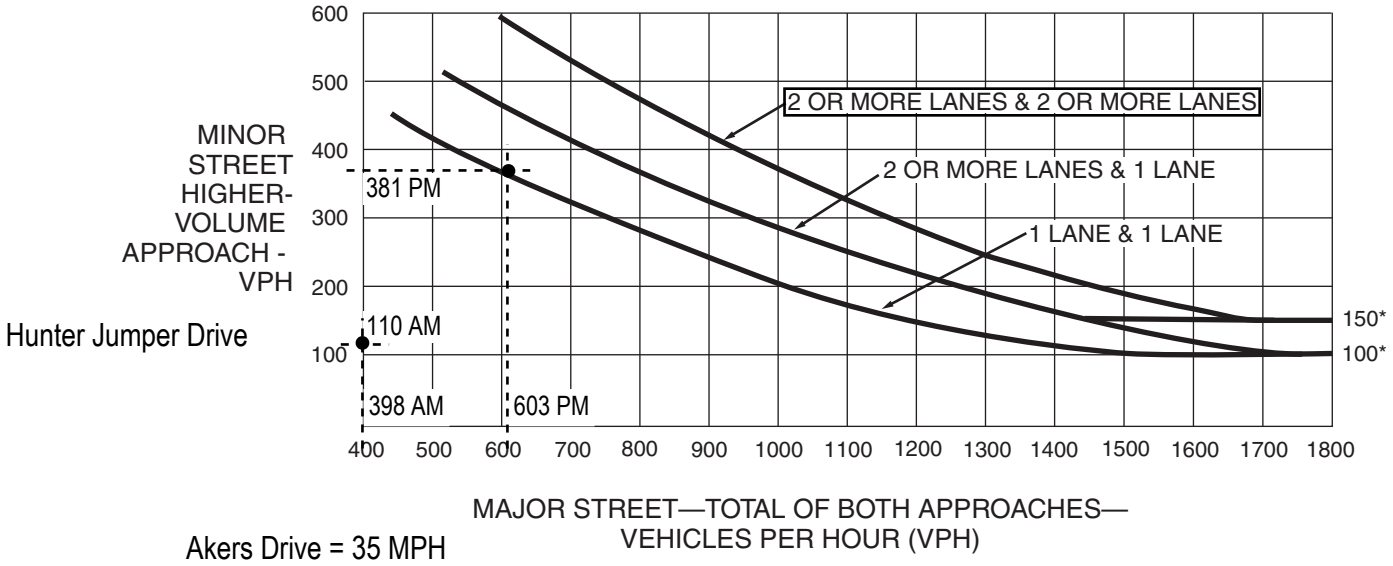
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Project: WATERMARK AKERS DRIVE
Total Traffic - Year 2040
Hunter Jumper Drive & Akers Drive

Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

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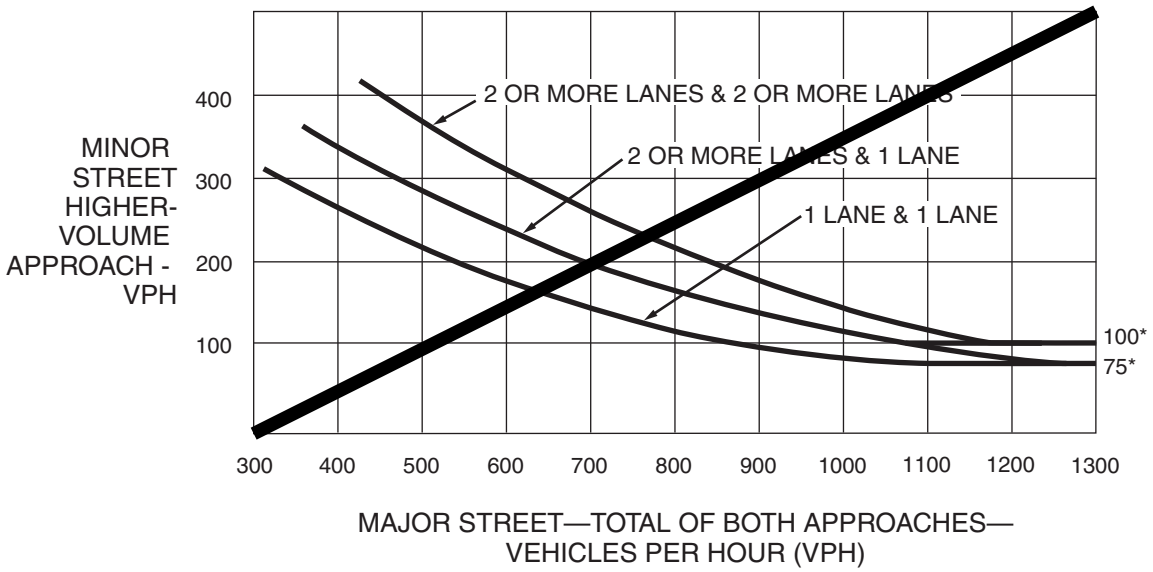


*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Kimley»Horn

October 5, 2020

Watermark Residential
111 Monument Circle
Suite 1600
Indianapolis, IN 46204

Subject: ***Watermark Akers Drive Noise Analysis***
El Paso County, CO

Executive Summary

The purpose of this technical memorandum is to summarize the evaluated noise levels surrounding the proposed Watermark Akers Drive development in El Paso County, CO. The proposed development is approximately 4 miles north of the Colorado Springs Airport and approximately 8 miles west of Downtown Colorado Springs. The site is located north of Constitution Avenue and west of Marksheffel Road. The site is surrounded by undeveloped land to the south and west, residential land uses located northwest, east, and southwest, industrial land uses north of the site and commercial uses southeast of the site. The location of the proposed development is shown in **Figure 1**.

Analysis Findings

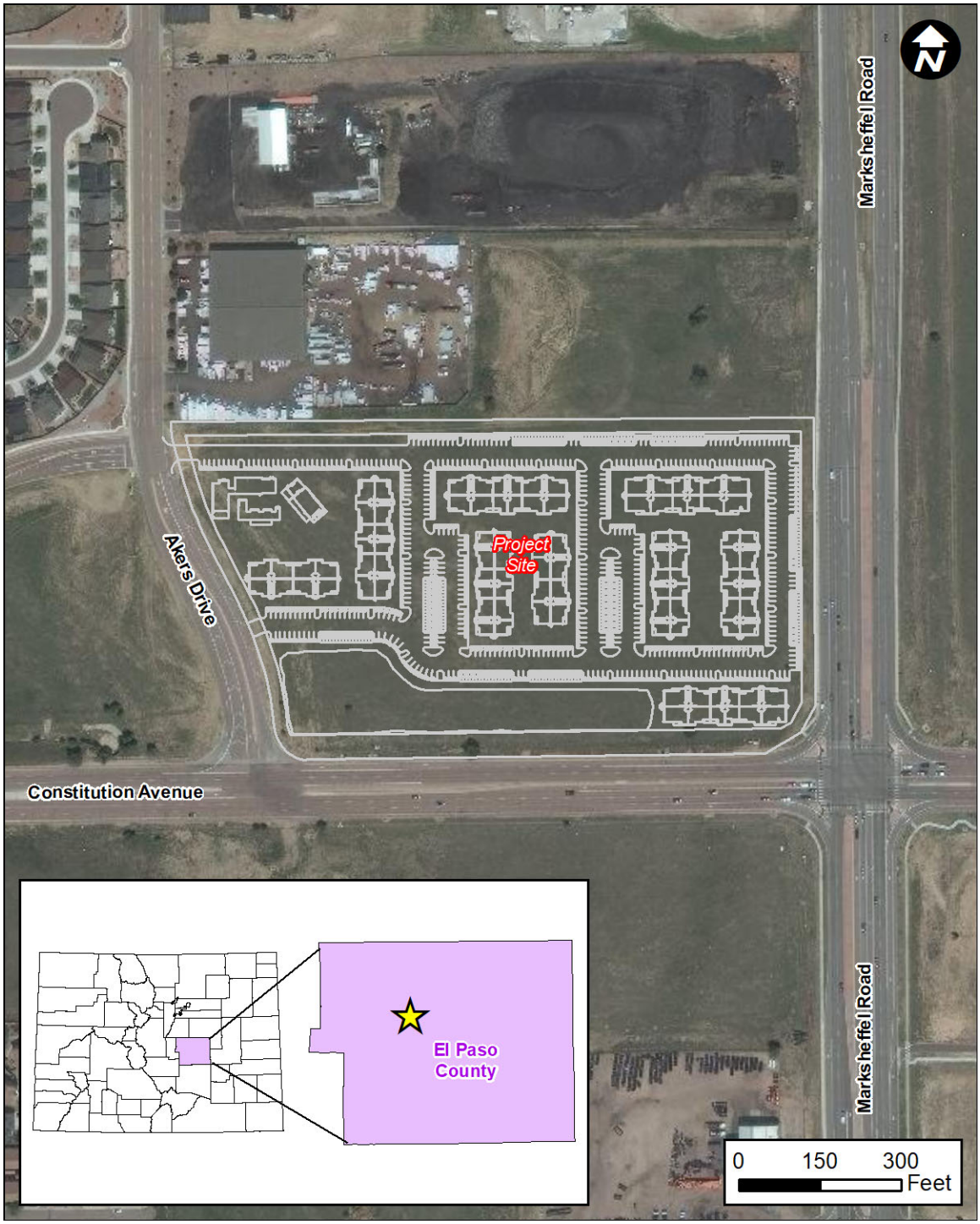
- *The proposed development is located in the northwest quadrant of the intersection of Constitution Avenue and Marksheffel Road. Traffic noise levels from the surrounding roadway network are expected to be the dominant noise source for the proposed development. Noise mitigation through site layout has been used to reduce predicted noise levels. No noise walls are recommended.*

Project Description

This noise assessment was conducted to study and analyze the existing noise environment and determine the anticipated noise levels at the proposed Watermark Akers Drive residential development. This memorandum describes the proposed development, provides general information on noise, outlines the methodologies and procedures for the analysis, and evaluates existing and anticipated future noise levels from the surrounding roadway network.

The proposed development will consist of approximately 300 multifamily dwelling units accommodated within nine three-story buildings and supported by various property amenities including a clubhouse and swimming pool.

Figure 1: Site Location and Vicinity



Characteristics of Noise

Noise is generally defined as unwanted sound. It is emitted from many natural and man-made sources. Sound pressure levels are usually measured and expressed in decibels (dB). The decibel scale is logarithmic and expresses the ratio of the sound pressure unit being measured to a standard reference level. Most sounds occurring in the environment do not consist of a single frequency, but rather a broad band of differing frequencies. The intensities of each frequency add together to generate sound. Because the human ear does not respond to all frequencies equally, the method commonly used to quantify environmental noise consists of evaluating all of the frequencies of a sound according to a weighting system. It has been found that the A-weighted decibel [dB(A)] filter on a sound level meter, which includes circuits to differentially measure selected audible frequencies, best approximates the frequency response of the human ear.

The degree of disturbance from exposure to unwanted sound – noise – depends upon three factors:

1. The amount, nature, and duration of the intruding noise
2. The relationship between the intruding noise and the existing sound environment; and
3. The situation in which the disturbing noise is heard

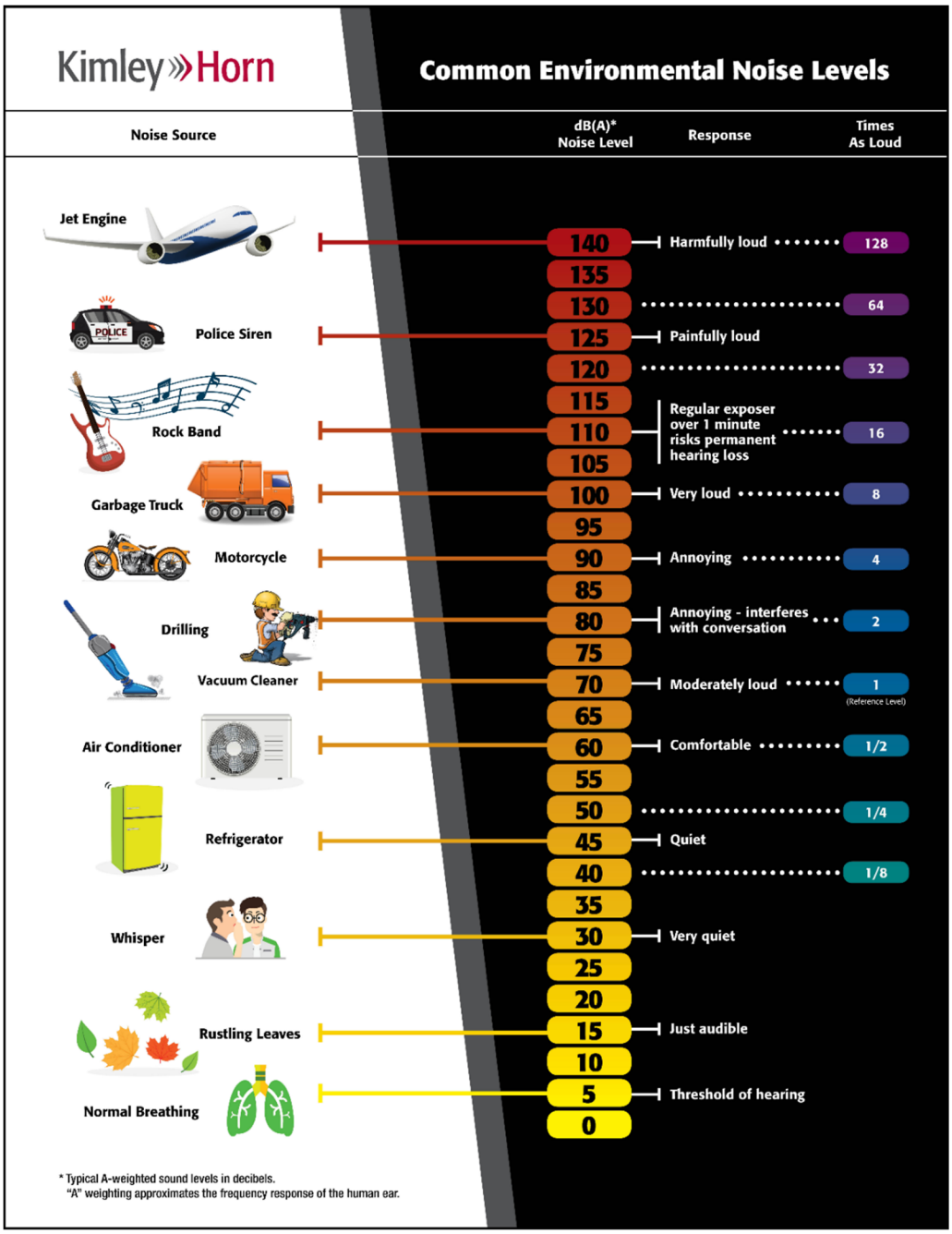
In considering the first of these factors, it is important to note that individuals have varying sensitivity to noise. Loud noises bother some people more than other people, and some individuals become increasingly upset if an unwanted noise persists. The time patterns and durations of noise(s) also affect perception as to whether or not it is offensive. For example, noises that occur during nighttime (sleeping) hours are typically considered to be more offensive than the same noises in the daytime.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). A car horn blowing at night when background noise levels are low would generally be more objectionable than one blowing in the afternoon when background noise levels are typically higher. The response to noise stimulus is analogous to the response to turning on an interior light. During the daytime an illuminated bulb simply adds to the ambient light, but when eyes are conditioned to the dark of night, a suddenly illuminated bulb can be temporarily blinding.

The third factor – situational noise – is related to the interference of noise with activities of individuals. In a 60 dB(A) environment such as is commonly found in a large business office, normal conversation would be possible, while sleep might be difficult. Loud noises may easily interrupt activities that require a quiet setting for greater mental concentration or rest; however, the same loud noises may not interrupt activities requiring less mental focus or tranquility.

As shown in **Figure 2**, most individuals are exposed to fairly high noise levels from many sources on a regular basis. To perceive sounds of greatly varying pressure levels, human hearing has a non-linear sensitivity to sound pressure exposure. Doubling the sound pressure results in a three decibel change in the noise level; however, variations of three decibels [3 dB(A)] or less are commonly considered “barely perceptible” to normal human hearing. A five decibel [5 dB(A)] change is more readily noticeable. A ten-fold increase in the sound pressure level correlates to a 10 decibel [10 dB(A)] noise level increase; however, it is judged by most people as only sounding “twice as loud”.

Figure 2: Common Noise Levels



Over time, individuals tend to accept the noises that intrude into their lives on a regular basis. However, exposure to prolonged and/or extremely loud noise(s) can prevent use of exterior and interior spaces and has been theorized to pose health risks.

Existing Conditions

The site is located northwest of the intersection of Constitution Avenue and Marksheffel Road. The site is surrounded by undeveloped land to the south and west, residential land uses located northwest, east, and southwest, industrial land uses north of the site and commercial uses southeast of the site.

The predominant sources of noise in the vicinity of the proposed development are the traffic noise along Constitution Avenue, Marksheffel Road, and Akers Drive as well as operational activity at nearby commercial/industrial facilities. Other sources of noise also include ambient environmental noise, which includes wind, birds chirping, insects, household appliances, lawn mowers, etc. The proposed development is approximately 4 miles north of the Colorado Springs Airport; therefore, overhead airplane noise is likely to occur on a frequent basis.

To assess existing noise conditions at the site, noise measurements were on September 17, 2020. Larson Davis LxT Type I Precision Integrating Sound Level Meters were set up at one long-term noise monitoring location and one short-term noise monitoring location. Long-term noise measurement hourly Leq values obtained in the field ranged between 53 dB(A) and 57 dB(A). The noise field data of each monitoring site is shown in **Table 1**.

Table 1. Noise Measurement Data

Setup	Measurement Time	L_{eq} Noise Level [dB(A]	Maximum 1-min L_{eq} Noise Level [dB(A]
LT-1	7:52 AM – 11:17 AM (9:33 AM – 9:48 AM)	57.3 (53.1)	81.1 (63.8)
ST-1	9:33 AM – 9:48 AM	55.3	69.0

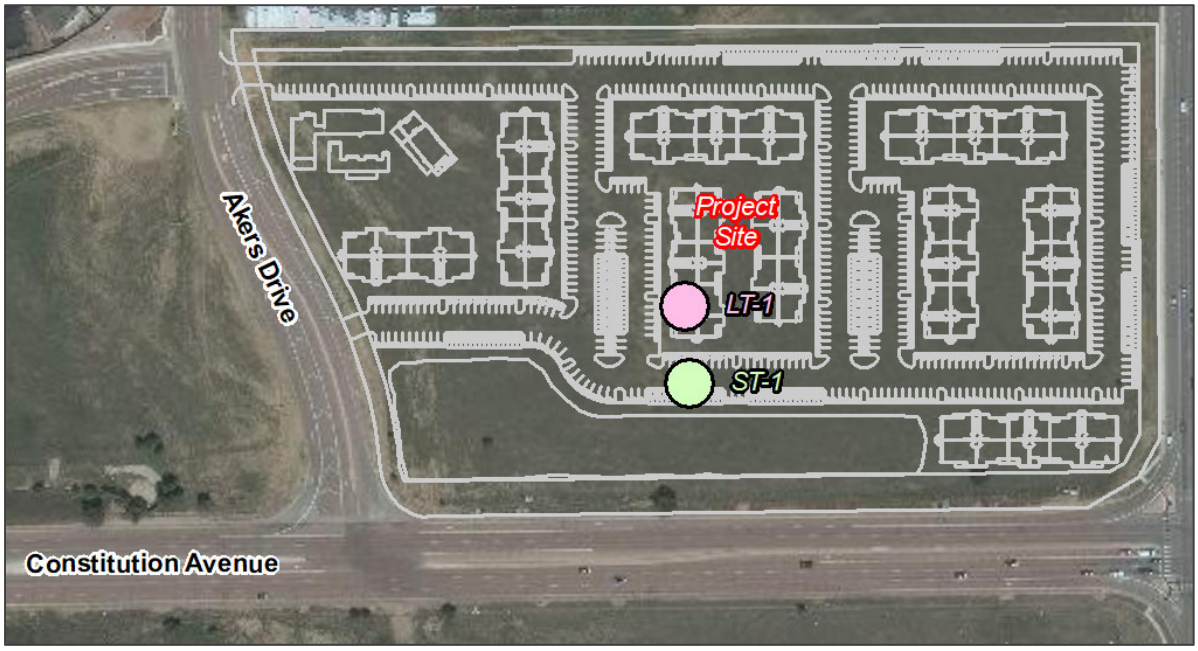
The measurements were taken using the A-weighted scale and are reported in decibels [dB(A)]. Data collected by the noise meters included time, average noise level (Leq), maximum noise level (Lmax), and instantaneous peak noise level (Lpk) for each interval. Hourly average noise levels (Leq(h)) were derived from the Leq values. The existing noise measurements were collected under meteorologically acceptable conditions and were conducted based on the acceptable collection of existing noise level readings. Pictures of each field monitoring setup are shown in **Table 2** and the locations of the monitoring sites are shown in **Figure 3**.

The Federal Highway Administration (FHWA) has developed the Noise Abatement Criteria (NAC) for determining traffic noise impacts for a variety of land uses in accordance with *Title 23 Code of Federal Regulations (CFR), Part 772 (23 CFR 772): Procedures for Abatement of Highway Traffic Noise and Construction Noise* (July 13, 2010). This assessment utilized the guidelines contained in *23 CFR 772* and the current Colorado Department of Transportation (CDOT) *Noise Analysis and Abatement Guidelines* (January 15, 2015) in order to be consistent with standard methodologies.

Table 2. Noise Measurement Setup Pictures

LT-1: Facing West	ST-1: Facing South
	

Figure 3: Measurement Site Locations



The NAC, listed in **Table 3** for various activities, represent the upper limit of acceptable traffic noise conditions and also a balancing of that which may be desirable with that which may be achievable. The NAC applies to areas having frequent human use but does not apply to the entire tract of land on which the activity is based, only to that portion where the activity takes place. The NAC is given in terms of the hourly, A-weighted, equivalent sound level in decibels [dB(A)]. The A-weighted sound

level is a single number measure of sound intensity with weighted frequency characteristics that correspond to human subjective response to noise. However, since most environmental noise fluctuates from moment to moment, it is common practice to condense all of this information into a single number called the equivalent sound level (L_{eq}). The L_{eq} is the value of a steady sound level that would represent the same sound energy as the actual time-varying sound evaluated over the same time period. L_{eq} is typically evaluated over a one-hour time period and is denoted as $L_{eq(h)}$. The noise impact assessment was made using the criteria in **Table 3**.

Table 3. Noise Abatement Criteria

Activity Category	Activity Criteria[1] $L_{eq(h)}$[2] dB(A)	Evaluation Location	Activity Description
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	Exterior	Residential
C[3]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section4(f) sites, schools, television studios, trails, and trail crossings
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[3]	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
F	-	-	Agriculture, airports, bus yards, emergency services, industrial, logging maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	-	-	Undeveloped lands that are not permitted

1. *The $L_{eq(h)}$ Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.*
2. *The equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with $L_{eq(h)}$ being the hourly value of L_{eq}.*
3. *Includes undeveloped lands permitted for this activity category.*

It is important to note that these criteria do not apply to the proposed Watermark Akers Drive development but are offered as a frame of reference for how traffic noise is considered for federally-funded projects considering noise impacts to an area. Also, the information in the CDOT *Noise Analysis and Abatement Guidelines* was used for reference purposes only, being that the proposed development is not required to meet federal and state traffic noise guidelines.

Traffic noise impacts are defined as noise levels that 1) "approach" or exceed the FHWA Noise Abatement Criteria (NAC), as shown in **Table 3**, or 2) those that represent a "substantial increase" over existing noise levels. An impact that represents a "substantial increase" is defined as an increase in noise levels of 10 dB(A) or more over the existing noise level (measured or predicted) as a direct result of a proposed roadway project.

Noise Analysis

Noise levels from the surrounding roadway network were evaluated using the Federal Highway Administration (FHWA) Traffic Noise Model version 2.5 (TNM 2.5). This program computes predicted noise levels at noise-sensitive areas through a series of adjustments to reference sound levels. TNM 2.5 also accounts for topography, groundcover type, and intervening structures.

Traffic noise emission is composed of several variables, including the number, types, and travel speeds of the vehicles, as well as the geometry of the roadway(s) on which the vehicles travel. Traffic noise consists of three primary parts: tire noise, engine noise, and exhaust noise. Of these sources, tire noise is typically the most offensive at unimpeded travel speeds. Traffic noise is not constant; it varies in time depending upon the number, speed, type, and frequency of vehicles that pass by a given receptor. According to the Noise Abatement Criteria impact thresholds shown in **Table 3**, existing traffic noise impacts occur at residential land uses when a noise level of 67 dB(A) is approached [within 1 dB(A)] or exceeded.

The "worst" traffic noise condition is evaluated as the lesser of the design hourly volume (DHV) or the roadway vehicle capacity Level of Service "C" (LOS C) operating at the design speed. The FHWA TNM was used to evaluate highway traffic-related noise conditions at the proposed development. Existing year traffic volumes obtained from the *Watermark Akers Drive – Traffic Impact Study (September 2020)* were used to assess the existing traffic noise conditions. The calculated existing noise levels throughout the property without the proposed development are shown in **Figure 4**.

Build year 2040 design hourly volumes obtained from the *Traffic Impact Study* completed for the proposed development were used to assess the anticipated future traffic noise impacts. Future traffic noise levels are predicted to impact the property to approximately 100 feet from the edge of Constitution Avenue and approximately 150 feet from the edge of Marksheffel Road, which encompasses the first row of units in the proposed development. The anticipated future noise levels throughout the property are shown in **Figure 5**.

Noise Mitigation Measures

The El Paso County Land Development Code specifies design considerations for noise in Chapter 8, Section 8.4, part 2. The code states the County's desire that "divisions of land shall be designed to minimize impacts of noise pollution to residents." In subpart 8.4.2.b.i. several forms of noise mitigation are listed for consideration where noise levels are predicted to exceed 67 dB(A):

- Increased building setbacks;
- Modified site orientation for buildings and outdoor areas;
- Landscape buffers or tracts;
- Noise easement;
- Soil berming; or
- Noise barrier

Although the requirements of this section of the code are applicable to residential subdivisions (including single-family and duplex residential subdivisions which contain lots that will be individually owned), similar noise mitigation principles can be applied to the proposed multi-family development.

The proposed Watermark Akers Drive development has been designed to minimize the number of units that would be exposed to noise levels greater than the 67 dB(A) threshold. As shown in **Figures 4** and **5**, the proposed buildings on-site provide noise mitigation for noise receptors in the middle of the site. Additionally, the site was designed to locate the common recreation space (e.g. swimming pool and clubhouse) as far as possible from Constitution Avenue and Marksheffel Road to provide an area of reduced noise levels for all residents.

Although a noise barrier could be constructed along the property boundary with Constitution Avenue and Marksheffel Road that would benefit first-floor units (e.g. 9A, 9B, 9C, and 8C), impacts are still predicted to occur for second and third story units in these areas. Additionally, building a noise wall would likely provide an adverse visual effect on the first-floor units. For these reasons, a noise wall is not recommended for construction. Additionally, a noise wall is not recommended near noise receptor 1A due to the potential to limit sight distance for vehicles accessing Akers Drive.

Conclusions

This assessment analyzed the potential noise levels at the proposed Watermark Akers Drive residential development associated with the surrounding roadway network. It was determined that traffic related noise from the adjacent roadways is anticipated to be the main source of noise throughout the site. The predicted future noise levels generated from Constitution Avenue and Marksheffel Road are expected to be reduced by the proposed site layout. Although future noise levels are anticipated to impact nearby residences, additional noise abatement measures are not recommended.

Figure 4: Existing Noise Levels

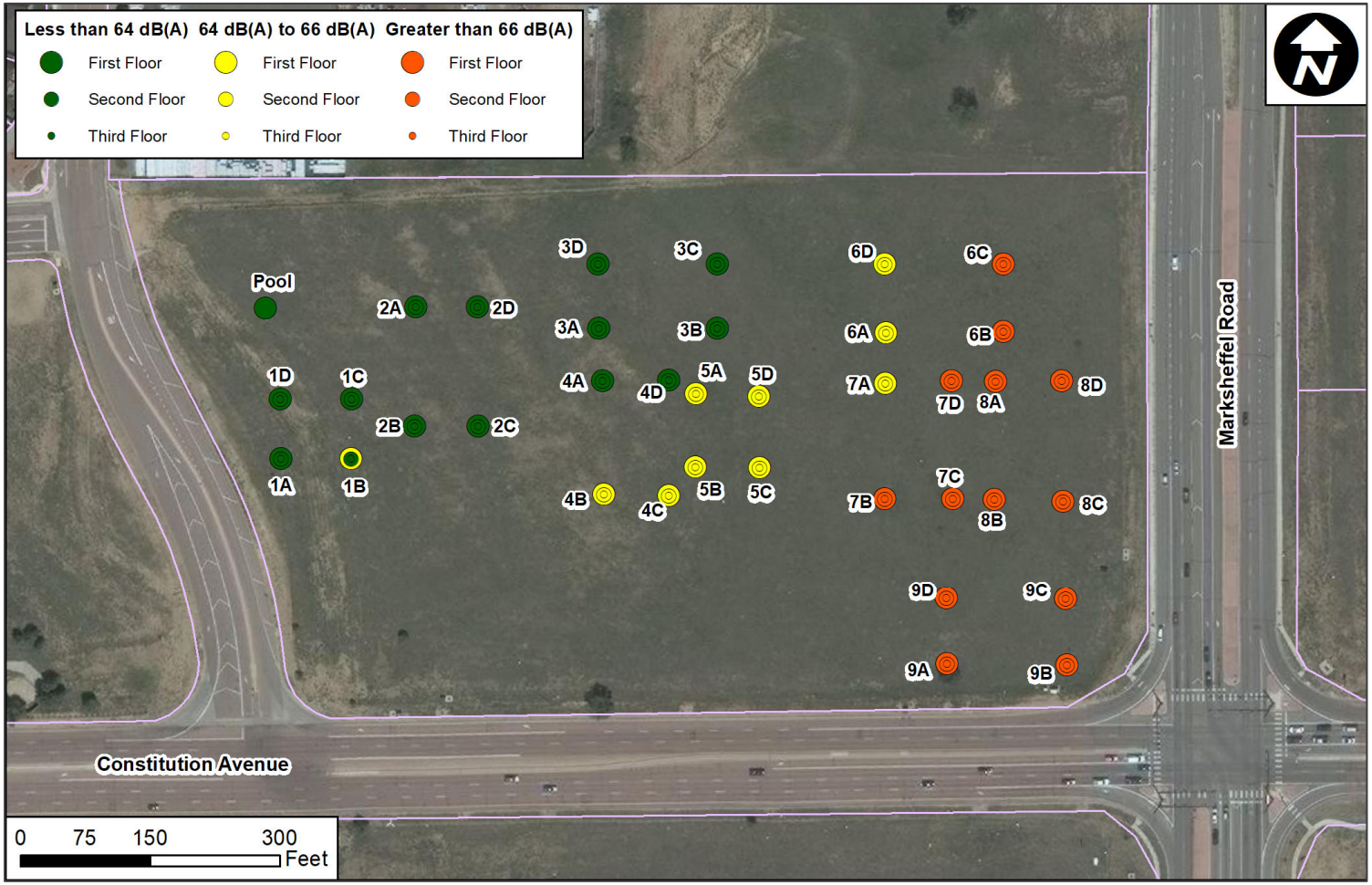


Figure 5: Build Noise Levels