

REVISED TRAFFIC IMPACT STUDY

For

**Tempur-Sealy
38th and Tower Development
Aurora, Colorado**

August 2019
Revised:
September 2019

Prepared for:

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19-081044

I. Introduction

Project Overview

This traffic impact study addresses the capacity, geometric, and control requirements associated with the development entitled 38th and Tower Development.

This original version of City approved traffic impact study has been revised to address recent City review comments regarding the analysis of traffic impacts associated with Tempur-Sealy and its proposed site plan amendment for minor site items including perimeter fencing.

The following are analysis objectives for this revision to the previously approved traffic impact study¹ for the overall 38th and Tower development dated June 2018:

- Evaluate internal site traffic distribution and impact from Tempur-Sealy and proposed perimeter fencing with reference to previously approved traffic impact study.
- Evaluate traffic generation relationship to number of dock doors to determine any resulting increase in truck volume for Tempur-Sealy.
- Obtain City support and approval of proposed site plan amendment and perimeter fencing.

This study has been further revised to address City review comments regarding level of service operations at site access (Access A) being below City standards with the proposed gating/limiting traffic flow, queue length for heavy trucks at Tempur-Sealy main gate (at Access D), and other review comments received in letter dated September 18, 2019 and during the September 23, 2019 meeting.

The overall and existing mixed-use development is located at the northeast corner of Tower Road and 38th Avenue in Aurora, Colorado. Tempur-Sealy is a warehouse and distribution (general light industrial) tenant within an existing building located immediately east of an existing 7 Eleven.

The applicable areas of revision to this original version of City approved traffic impact study pertain to internal site traffic distribution and access assignment, total traffic analysis, and resulting site access level of service from minor change in site traffic distribution caused by proposed Tempur-Sealy perimeter fencing and limited access to the existing full movement access (Access D) onto 38th Avenue. No change to existing and background traffic analysis is needed.

Study Area Boundaries

The study area to be re-examined in this analysis encompasses the 38th Avenue intersection with Tower Road and existing site accesses.

Figure 1 illustrates location of the site and study intersections.

¹ 38th and Tower Development – Traffic Impact Study, SM ROCHA LLC, June 2018.

Site Description

The overall 38th and Tower development entailed new construction of a 7-Eleven gas station convenience store with 10 fueling positions, a fast food restaurant with drive-through approximately 2,300-square feet in size, a car wash approximately 4,800-square feet in size, and two general light industrial buildings totaling approximately 420,000-square feet in size.

The overall development is surrounded by a mix of commercial, industrial and residential land uses.

Overall site development access is provided at the following locations:

Tower Road

- Full-movement access (Access A) located approximately 850 feet north of 38th Avenue.
- Right-in / right-out access (Access B) located approximately 300 feet north of 38th Avenue.

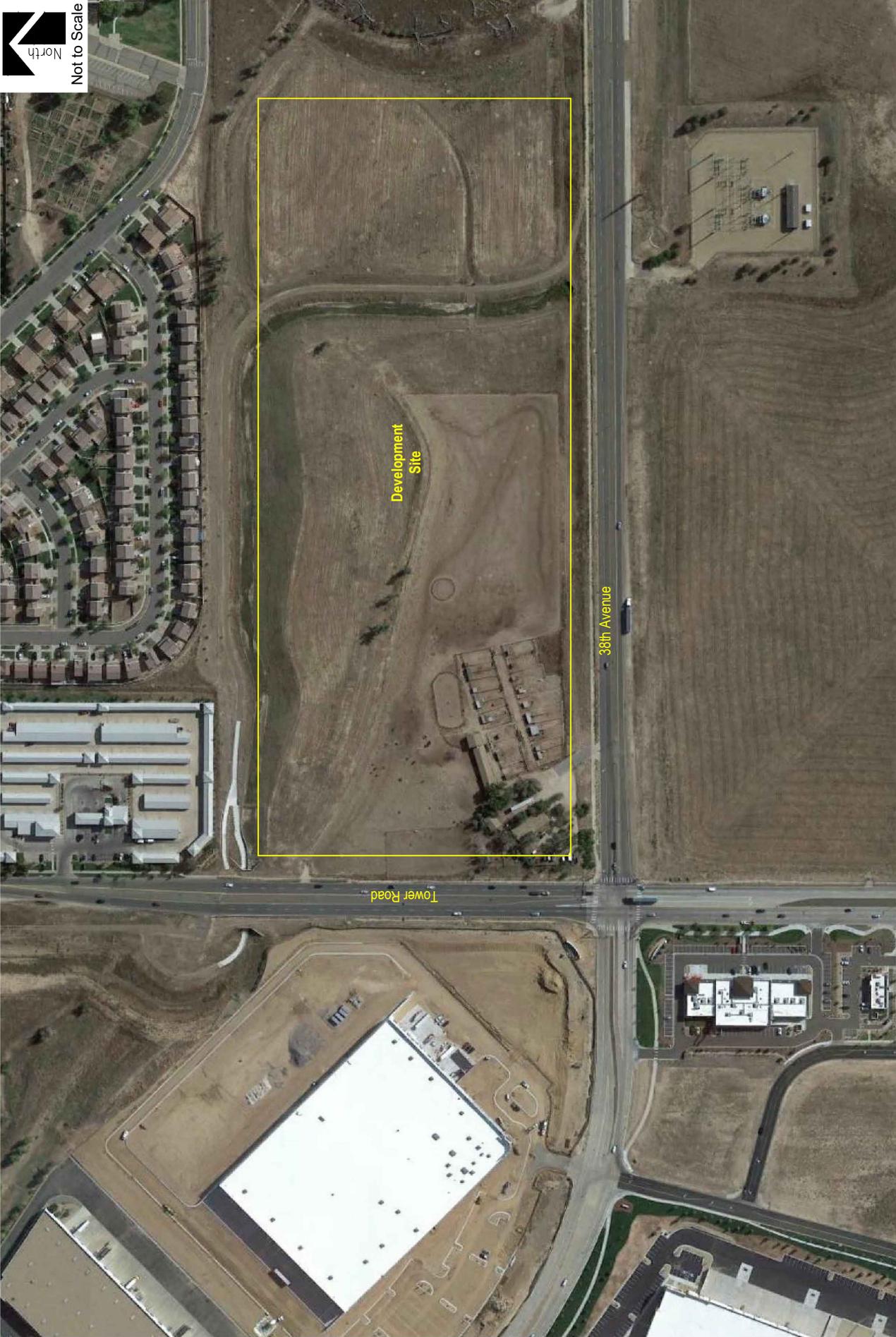
38th Avenue

- Right-in / right-out access (Access C) located approximately 550 feet east of Tower Road.
- Full-movement access (Access D) located approximately 1,425 feet east of Tower Road.
- Right-in / right-out access (Access E) located approximately 1,725 feet east of Tower Road.
- Full-movement access (Access F) located approximately 2,150 feet east of Tower Road.

Specific access from Tower Road and 38th Avenue that serve Tempur-Sealy are Access A, Access C and Access D. Access C is located near the southwest corner of the Tempur-Sealy building and Access D is at the southeast corner.

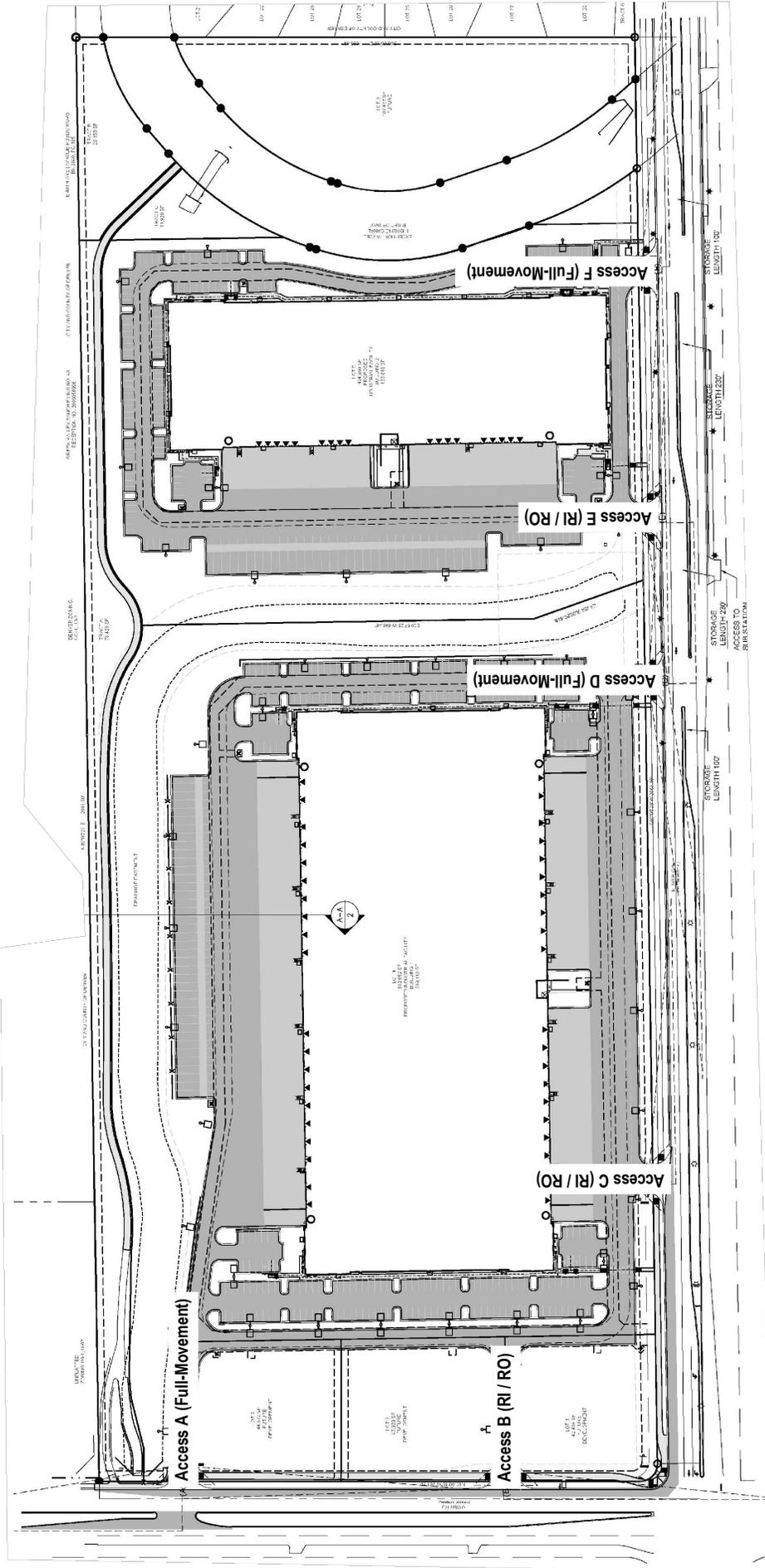
For purposes of this study revision and to remain consistent with the previously approved traffic study, it is anticipated that development construction would not be phased and be completed by end of Year 2019. This is true to date with the general light industrial building area underway with tenant finishes.

A conceptual site plan, as prepared by Ware Malcomb, is shown on Figure 2. This plan is provided for illustrative purposes only.





Not to Scale



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Traffic Impact Study

Figure 2
SITE PLAN

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Existing and Committed Surface Transportation Network

Within the study area, 38th Avenue is the primary roadway that will accommodate traffic to and from the proposed development. Tower Road is a secondary roadway. A brief roadway description is provided below:

38th Avenue is an east-west arterial roadway having a combination of three to four through lanes (one to two lanes in each direction) with a combination of shared and exclusive turn lanes at the intersection within study area. 38th Avenue provides a posted speed limit of 40 MPH.

Tower Road is a north-south arterial roadway having five through lanes (three lanes in the southbound direction, two lanes in the northbound direction) with a combination of shared and exclusive turn lanes at the intersection within study area. 40 MPH is the posted speed limit for Tower Road.

Based on the City of Aurora's 2009 Comprehensive Plan, the eastbound section 38th Avenue, east of Tower Road, is assumed to be widened from one to two through lanes by Year 2037. In Figure 1 (Baseline 2035 Roadway Network) of the Adams County Transportation Plan, Tower Road is envisioned to ultimately become an arterial roadway with six through lanes. However, pursuant to City Staff, northbound Tower Road, south of 38th Avenue, was analyzed with two through lanes by Year 2037 as three through lanes is not feasible due to ROW restrictions.

Existing Traffic Control Devices

The study intersection of 38th Avenue and Tower Road 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.

II. Existing Traffic Conditions

Morning (AM) and afternoon (PM) peak hour traffic counts were collected at the 38th Avenue and Tower Road intersection. Observed U-turn volumes were added to the respective left turn movements for analysis purposes. Average daily (24-hour) traffic volumes were collected on Tower Road, and 38th Avenue. These counts are shown on Figure 3.

Traffic count data is included for reference in Appendix A.

Existing signal timing parameters for 38th Avenue and Tower Road was previously 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 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 technique allows 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 analyzes results for existing conditions are summarized in Table 1.

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

TABLE 1 INTERSECTION CAPACITY ANALYSIS SUMMARY EXISTING TRAFFIC		
INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
38th Avenue / Tower Road (Signalized)	C (30.5)	C (26.8)

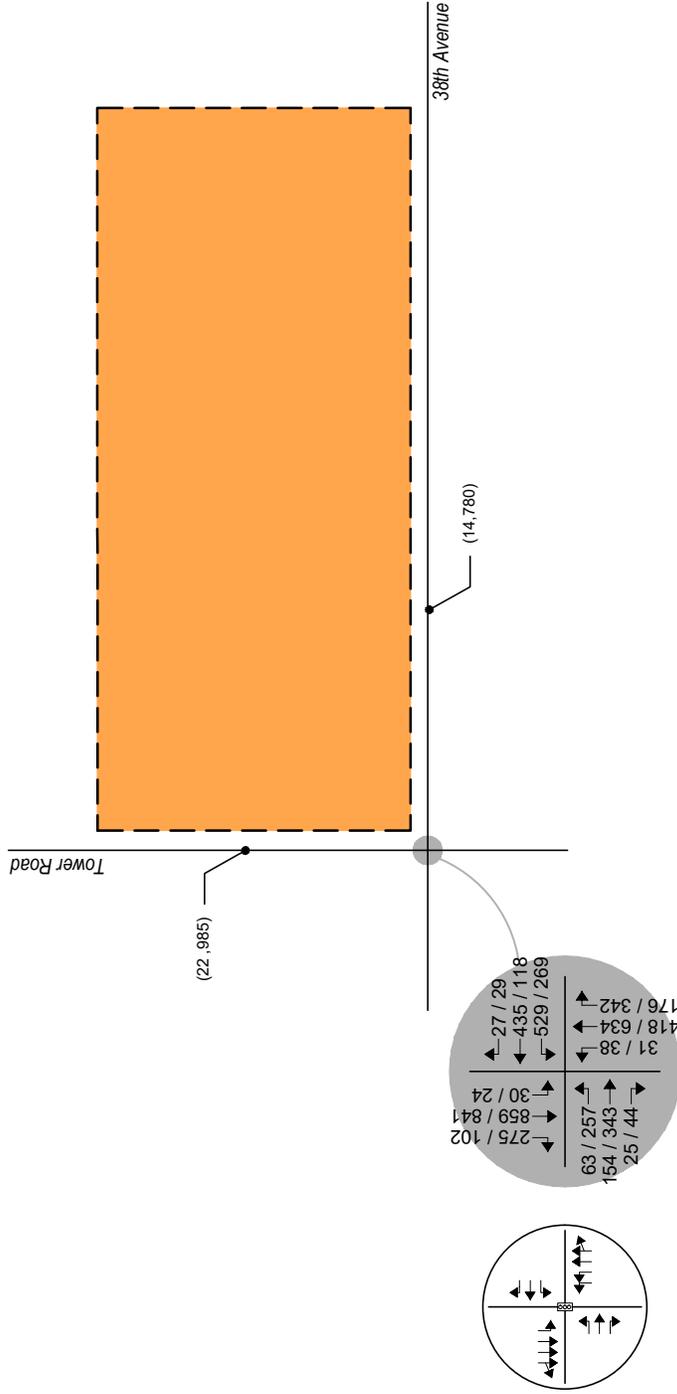
Key: Signalized Intersection: Level of Service (Control Delay in sec/veh)

Existing Traffic Analysis Results

Under existing conditions, operational analysis shows that the signalized intersection of 38th Avenue with Tower Road has overall operations at LOS C during both the morning and afternoon peak traffic hour.



Not to Scale



LEGEND

-  Study Intersection Volumes
-  Study Intersection Lane Geometry
-  Development Site

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Figure 3
EXISTING TRAFFIC
Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic

III. Future Traffic Conditions without the 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.

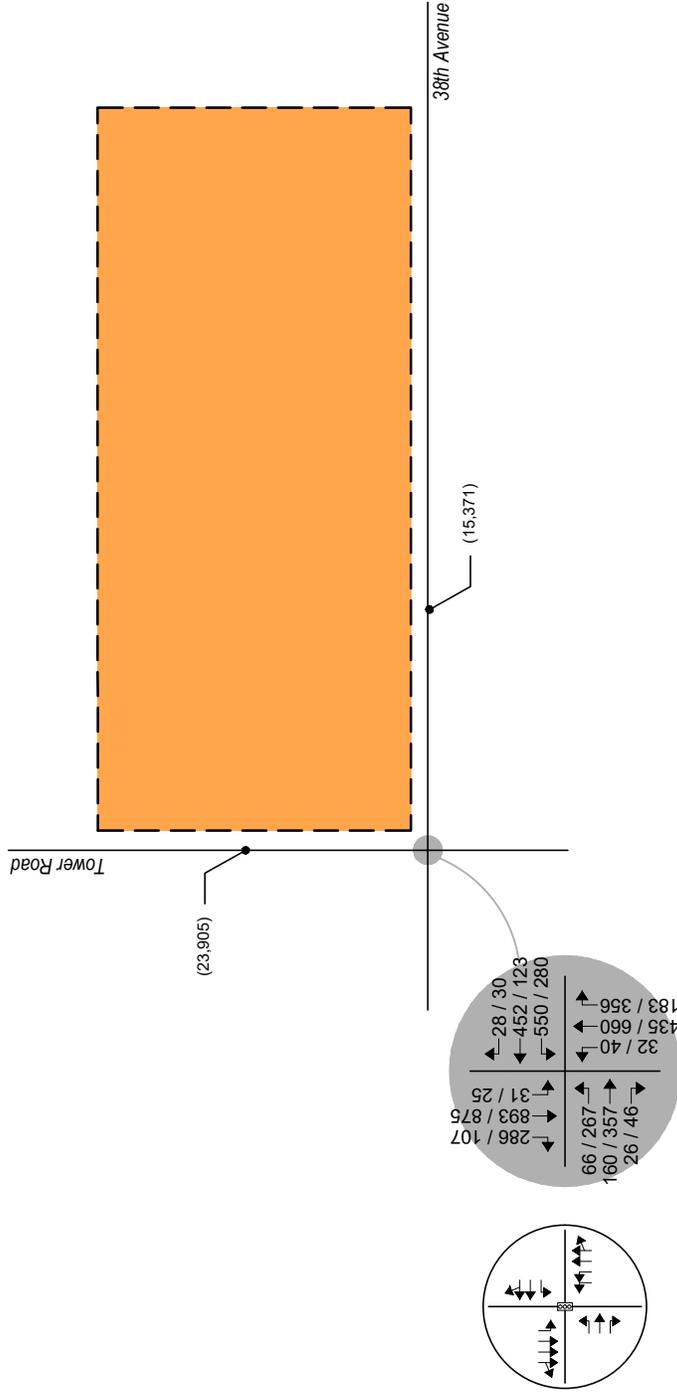
To account for projected increases in background traffic for Years 2019 and 2037, a compounded annual growth rate of approximately two percent was applied to existing traffic volumes. This annual growth rate was previously approved by City Staff and is consistent with regional growth projections and the level of in-fill development expected within the area.

Pursuant to the roadway improvements discussion provided in Section I, Year 2037 background traffic conditions assume roadway improvements to accommodate regional transportation demands. These improvements include the widening of 38th Avenue to four through lanes and Tower Road to six through lanes. Year 2019 and Year 2037 background traffic conditions assume that the lane geometry, for westbound traffic at 38th Avenue and Tower Road, to be composed of a dedicated left turn lane, an exclusive through lane, and a shared through and right turn lane. Year 2037 assumes existing signal timing parameters for 38th Avenue and Tower Road 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 2019 and 2037 are shown on Figure 4 and Figure 5, respectively.



Not to Scale



LEGEND

- Study Intersection Volumes
- Study Intersection Lane Geometry
- ▭ Development Site

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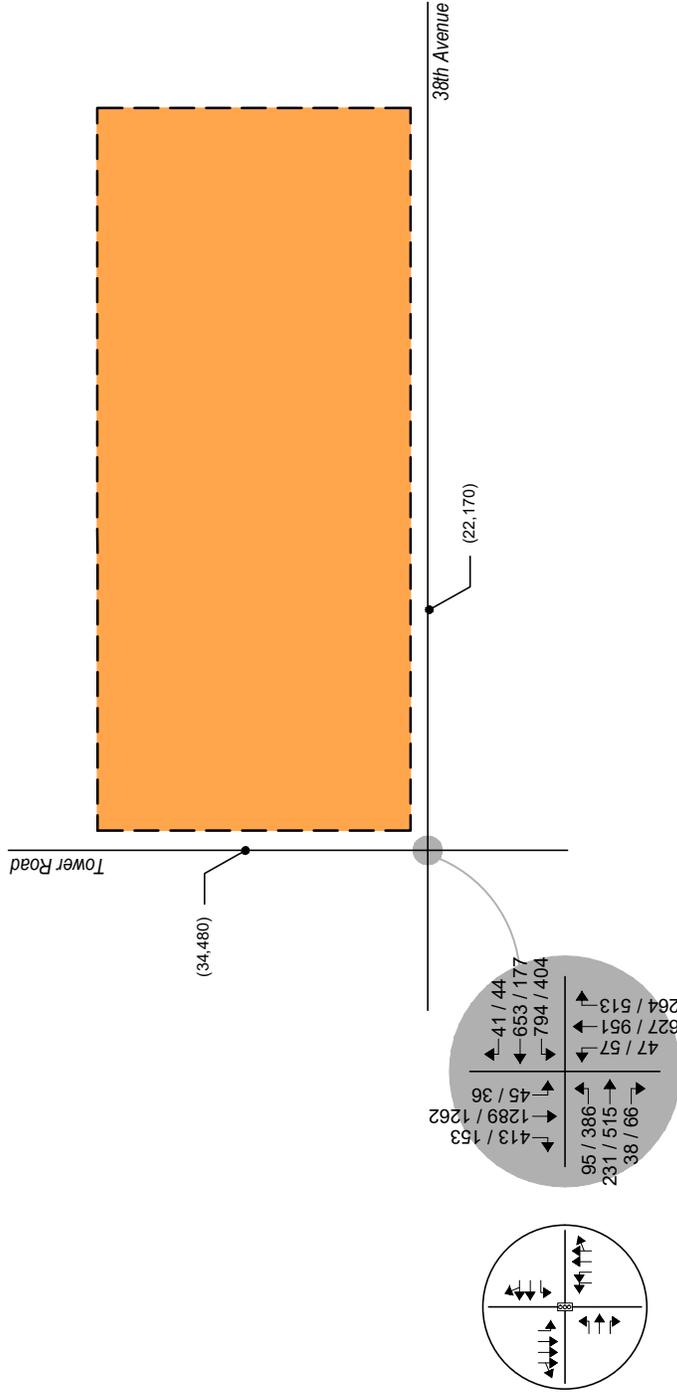


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Figure 4
BACKGROUND TRAFFIC - YEAR 2019
Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic



Not to Scale



LEGEND

-  Study Intersection Volumes
-  Study Intersection Lane Geometry
-  Development Site

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Figure 5
BACKGROUND TRAFFIC - YEAR 2037
Volumes & Intersection Geometry
AM / PM Peak Hour
(ADT) : Average Daily Traffic

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

Background traffic level of service analyzes results for Year 2019 are listed in Table 2. Year 2037 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 2019		
INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
38th Avenue / Tower Road (Signalized)	C (34.2)	C (27.8)

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

Background Traffic Analysis Results – Year 2019

Year 2019 background traffic analysis indicates that the signalized intersection of 38th Avenue with Tower Road has overall operations at LOS C during both the AM and PM peak traffic hour.

TABLE 3 INTERSECTION CAPACITY ANALYSIS SUMMARY BACKGROUND TRAFFIC - YEAR 2037		
INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
38th Avenue / Tower Road (Signalized)	C (21.3)	B (17.8)

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

Background Traffic Analysis Results – Year 2037

By Year 2037 and without the proposed development, the study intersection of 38th Avenue with Tower Road is projected to experience an overall LOS C operation during the AM peak traffic hour and LOS B during the PM peak traffic hour.

IV. Proposed Project Traffic

Trip Generation

Standard traffic generation characteristics compiled by the Institute of Transportation Engineers (ITE) in their report entitled Trip Generation, 9th 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.

This study revision continues use of Trip Generation, 9th Edition, to remain consistent with the previously approved traffic study.

The ITE land use code 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									
ITE CODE	LAND USE	UNIT	TRIP GENERATION RATES						
			24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
110	General Light Industrial	KSF	6.97	0.81	0.11	0.92	0.12	0.85	0.97
945	Gas / Convenience	VFP	162.78	5.08	5.08	10.16	6.76	6.76	13.51
934	Fast Food with Drive-Through	KSF	496.12	23.16	22.26	45.42	16.98	15.67	32.65
948	Automated Car Wash	KSF	141.20	*	*	*	7.06	7.06	14.12

Key: KSF = Thousand Square Feet Gross Floor Area. VFP = Vehicle Fueling Positions.
 * = ITE does not report significant AM peak hour generation due to the nature of the business (ie, operating hours typically open after AM
 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									
ITE CODE	LAND USE	SIZE	TOTAL TRIPS GENERATED						
			24 HOUR	AM PEAK HOUR			PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
110	General Light Industrial	287.9 KSF	2,006	233	32	265	34	246	279
110	General Light Industrial	132.5 KSF	923	107	15	122	15	113	129
934	Fast Food with Drive-Through	2.3 KSF	1,157	54	52	106	40	37	76
945	Gas / Convenience	10.0 VFP	1,628	51	51	102	68	68	135
948	Automated Car Wash	4.8 KSF	678	*	*	*	34	34	68
<i>Total:</i>			<i>6,393</i>	<i>445</i>	<i>149</i>	<i>594</i>	<i>190</i>	<i>497</i>	<i>687</i>

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

Upon build out, Table 5 illustrates that the proposed development with assumed land uses has the potential to generate approximately 6,393 daily trips with 594 of those occurring during the morning peak hour and 687 during the afternoon peak hour.

Traffic Generation Dock Door Relationship

As earlier discussed, Tempur-Sealy is a warehouse and distribution facility. Table 4 above defines the ITE land-use category of General Light Industrial and its independent variable of square feet of building floor area to estimate vehicle trip generation for this type of facility.

ITE trip generation rates for transportation engineering applications are traditionally provided for specific land-use categories. These rates provide a well-defined and accepted set of independent variables for estimating vehicle trip generation. These independent variables were developed because they are of particular interest in traffic impact studies and well explain the variability in trip rates. ITE defines an independent variable as a physical, measurable and predictable characteristic that describes the study site of baseline site (for example, gross floor area) and that has a direct relationship to the variation in the number of trips generated by a land use. The independent variables provided for the General Light Industrial land-use category and similar land-use categories are gross floor area, employees, and acres.

An evaluation was conducted to determine if the number of Tempur-Sealy dock doors could determine traffic generation for a warehouse/distribution facility. No relationship or predictable characteristic between number of dock doors to vehicle trip generation is known to exist. Therefore, the vehicle trip generation rate defined in Table 4 and previously approved for overall site development remains valid.

Adjustments to Trip Generation Rates

While a mixed-use development of this type is likely to attract trips from within area land uses as well as pass-by or diverted link trips from the adjacent roadway system, no trip reduction was taken in this analysis. This assumption provides for a conservative analysis.

As example, published ITE pass-by and diverted link trip data indicates an average trip generation reduction rate between 50 and 85 percent as typical to service stations with convenience store and fast food restaurant with drive-through window. Considering the lowest reduction percentage, primary trip generation from the proposed service station and fast food development equates to half of trip generation volumes presented in Table 5.

A primary trip is defined by ITE as a trip made for the specific purpose of visiting the destination generator.

Trip Distribution

The overall directional distribution of site-generated traffic was determined based on the location of development site within the City, proposed and existing area land uses, allowed turning movements, and available roadway network. In order to produce the most accurate analysis, the distribution for the development was considered individually due to the nature of each land use type. Distributions were first considered for the general light industrial land use, quick service restaurant and gas/convenience (represented in Figure 6 as “retail”).

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

Trip Assignment

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

Applying trip distribution patterns of individual land uses and sum of respective site-generated traffic provides the overall site-generated trip assignments shown on Figure 6.

Revised Internal Site Traffic Distribution and Assignment

The previous traffic study approval assumed that a general percentage (approximately 30%) of traffic generated by the overall retail area (located along Tower Road and on the west side of Tempur-Sealy) would travel east, through the Tempur-Sealy southern drive aisle, to use the full movement access (Access D) and continue eastern travel along 38th Avenue. The total described retail traffic volume is 32 and 41 vehicles occurring during the respective morning and afternoon peak hour.

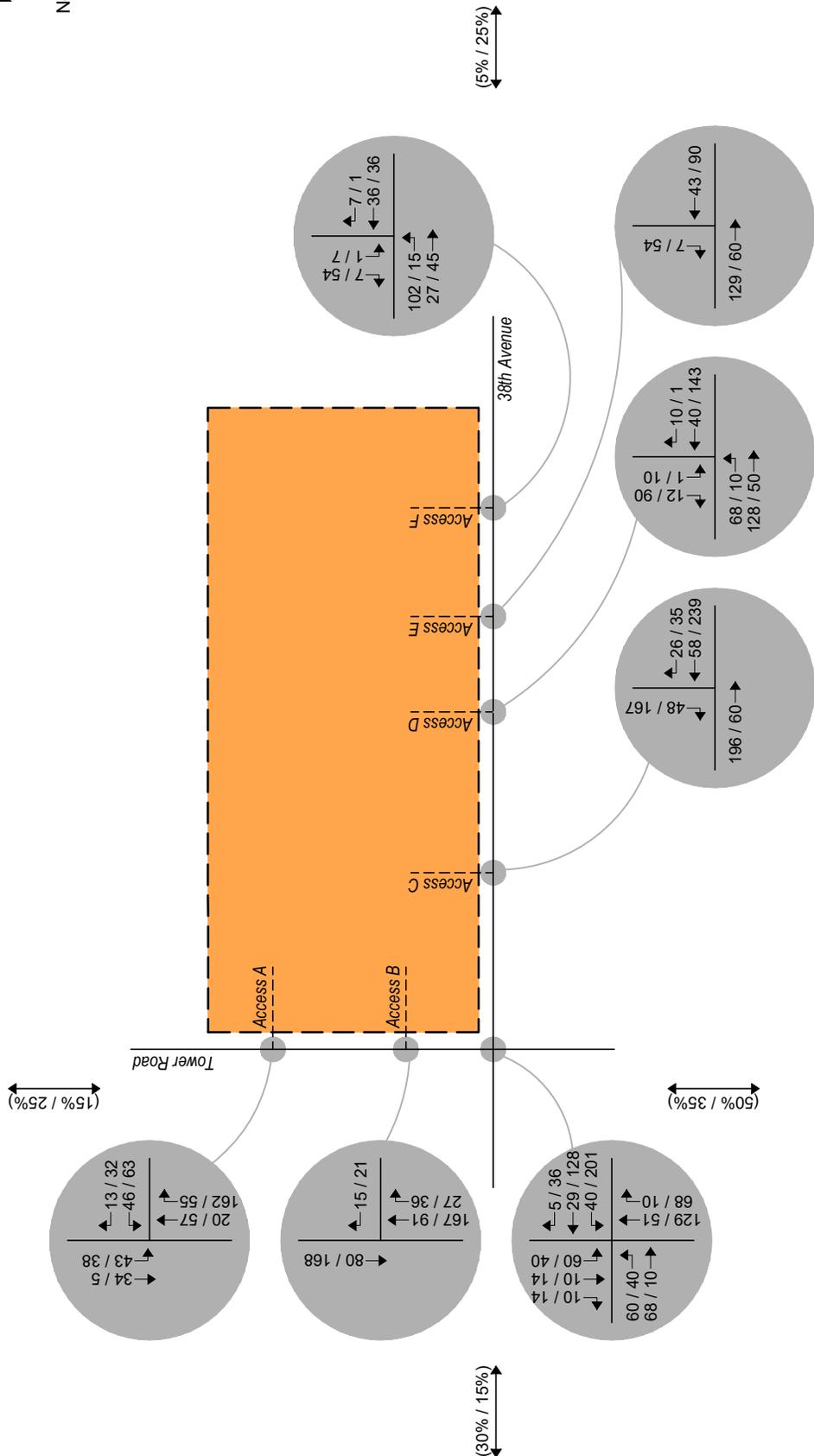
As discussed above, no trip reduction was taken in this analysis to provide for a conservative analysis and to remain consistent with assumptions made within the original June 2018 study.

The site plan amendment for Tempur-Sealy proposes security fencing that would preclude retail traffic travel to Access D. This re-route of retail traffic is minor and not expected to cause a negative impact to retailer, retail patrons or site accesses.

To provide for a conservative analysis, the highest, non-reduced peak hour traffic volume of 41 vehicles at Access D was re-routed among available accesses to continue direct or in-direct travel along 38th Avenue. Specifically, the southbound right turn volume at Access D was assigned to Access C (right-in/right-out) and all previously assumed southbound left turn retail traffic at Access D was re-assigned to the westbound left turn at Access A (full-movement). This re-route of traffic is shown on Figure 6.



Not to Scale



LEGEND

- Study Intersection
- Volumes
- Development Site

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

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V. Future Traffic Forecasts with Proposed Development

Site-generated traffic was added to background traffic projections for Years 2019 and 2037 to develop total traffic projections. For analysis purposes, it was assumed that all development construction would be completed by end of Year 2019.

Pursuant to City Staff review comments for the previous June 2018 study, it is assumed that by Year 2019 Tower Road will become six through lanes north of 38th Avenue. Additionally, pursuant to roadway improvements discussed in Section III, Year 2037 total traffic conditions assume additional roadway improvements to accommodate regional transportation demands beyond that described in background traffic conditions. By Year 2037, 38th Avenue is anticipated to expand to accommodate two through lanes in each direction, allowing for dual westbound left turn lanes, two through lanes, and a dedicated right turn lane at its intersection with Tower Road. At its intersection with 38th Avenue, northbound Tower Road was expanded to accommodate dual left turn lanes, two through lanes, and a dedicated right lane. Southbound Tower Road is anticipated to have one dedicated left turn lane, two through lanes, and a shared through and right turn lane. Year 2037 also assumes existing signal timing parameters for 38th Avenue and Tower Road with optimized intersection splits in effort to better long-term intersection performance. These assumptions provide for a conservative analysis as approved in the previous June 2018 study.

Projected Year 2019 total traffic volumes and intersection geometry are shown in Figure 7.

Figure 8 shows projected total traffic volumes and intersection geometry for Year 2037.



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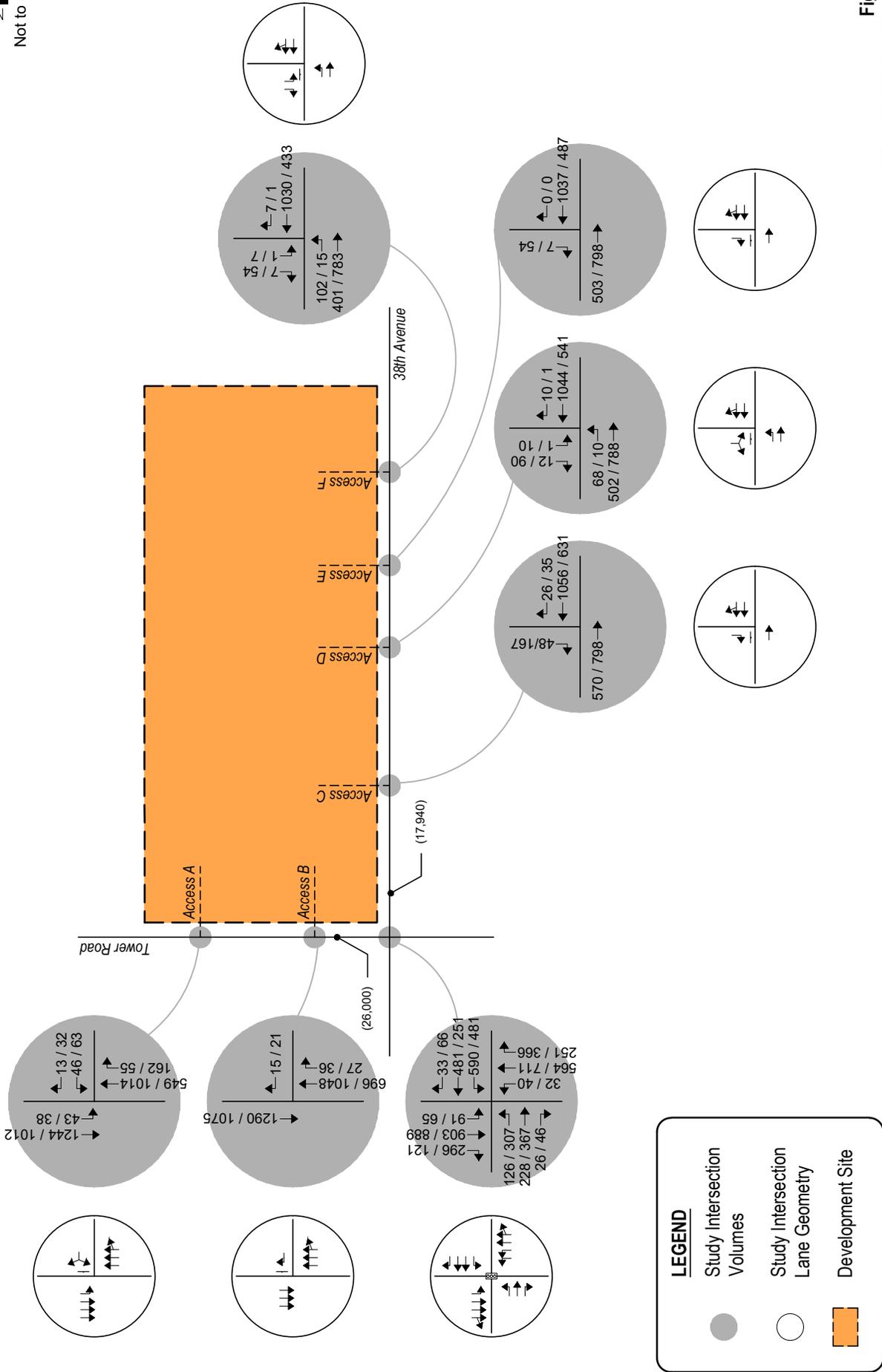


Figure 7
TOTAL TRAFFIC - YEAR 2019
 Volumes & Intersection Geometry
 AM / PM Peak Hour
 (ADT) : Average Daily Traffic

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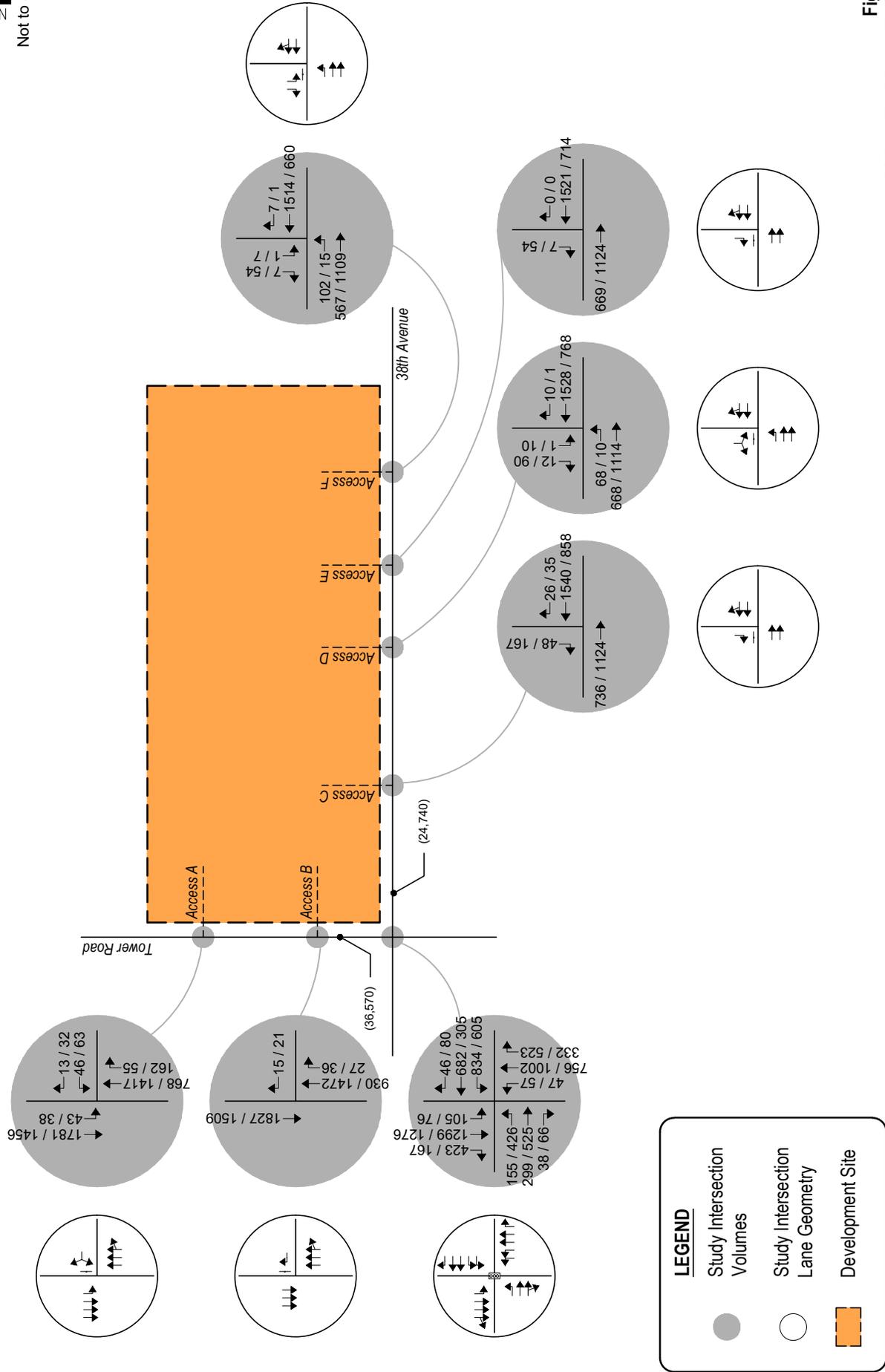


Figure 8
TOTAL TRAFFIC - YEAR 2037
 Volumes & Intersection Geometry
 AM / PM Peak Hour
 (ADT) : Average Daily Traffic

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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 operation only.

Additional consideration for percent heavy truck associated with general light industrial uses and upstream signal control effects for vehicle platooning or gaps in traffic streams at unsignalized turn movements are also included in this study.

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 2019 and 2037 are summarized in Table 6 and Table 7.

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 2019		
INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
38th Avenue / Tower Road (Signalized)	D (49.2)	D (52.1)
Access A / Tower Road (Stop-Controlled)		
Westbound Left and Right	C	C
Southbound Left	A	A
Access B / Tower Road (Stop-Controlled)		
Westbound Right	A	B
Access C / 38th Avenue (Stop-Controlled)		
Southbound Right	B	B
Access D / 38th Avenue (Stop-Controlled)		
Eastbound Left	C	B
Southbound Left and Right	C	B
Access E / 38th Avenue (Stop-Controlled)		
Southbound Right	C	B
Access F / 38th Avenue (Stop-Controlled)		
Eastbound Left	C	A
Southbound Left	E	B
Southbound Right	C	B

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

TABLE 7		
INTERSECTION CAPACITY ANALYSIS SUMMARY		
TOTAL TRAFFIC - YEAR 2037		
INTERSECTION LANE GROUPS	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
38th Avenue / Tower Road (Signalized)	C (31.6)	C (33.4)
Access A / Tower Road (Stop-Controlled)		
Westbound Left and Right	C	D
Southbound Left	A	B
Access B / Tower Road (Stop-Controlled)		
Westbound Right	B	B
Access C / 38th Avenue (Stop-Controlled)		
Southbound Right	C	C
Access D / 38th Avenue (Stop-Controlled)		
Eastbound Left	F	B
Southbound Left and Right	D	C
Access E / 38th Avenue (Stop-Controlled)		
Southbound Right	D	C
Access F / 38th Avenue (Stop-Controlled)		
Eastbound Left	E	B
Southbound Left	F	B
Southbound Right	D	B

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 – Long Term Year 2037

Table 7 illustrates how, by Year 2037, the signalized intersection of 38th Avenue with Tower Road shows an overall LOS C operation during morning and afternoon peak traffic hours. Compared to the background traffic analysis results, the traffic generated by the proposed development upon build-out is not expected to significantly change the operations of the study intersection. Compared to Year 2019, the LOS is expected to improve from a LOS D in the morning and afternoon to a LOS C during both the morning and afternoon, due to the assumed optimization of intersection splits and roadway improvements as discussed in Section V.

The full-movement intersection of Tower Road with Access A operates at LOS C during the morning peak traffic hour and LOS D during the afternoon peak traffic hour and conforms to City operational goal for minor movements at an unsignalized intersection.

The right-in/right-out intersection of Tower Road with Access B is projected to have morning and afternoon peak traffic hour operations at LOS B.

The right-in/right-out intersection of 38th Avenue with Access C is projected to have LOS C operation for both morning and afternoon peak traffic hours.

The full movement, unsignalized intersection of 38th Avenue with Access D is projected to have LOS D or better operations during peak traffic hours. An exception is the eastbound left turn movement which is projected to operate just barely at LOS F during morning peak traffic hour. The LOS F operation is attributed to application of a conservative morning peak hour volume for the eastbound left turn movement, the opposing through traffic volume along 38th Avenue and the unsignalized nature of the intersection. This specific, projected and long-term level of service is below the City operational goal of LOS D but complies with City allowed exception as this is a minor movement with light traffic demand. Intersection analysis results further concludes a minor 95th percentile queue length of approximately 3 vehicles, or 75 feet, for the minor left turn movement during the morning peak hour and LOS F condition to which is accommodated through recent intersection improvements.

The intersection of 38th Avenue with Access E operates at LOS D during morning peak traffic hours and LOS C during after peak traffic hours.

The full movement, unsignalized intersection of 38th Avenue with Access F is projected to have morning and afternoon peak traffic hour operations at LOS D or better. Exceptions include the eastbound left turn and southbound left turn movements which operate at LOS E and LOS F, respectively, during the morning peak traffic hour. The LOS E and LOS F operations have similar attributions to that described for Access D and comply with the City allowed operation exception for the specific condition. Moreover, analysis results for this intersection conclude a minor 95th percentile queue length of approximately 3 vehicles, or 75 feet, for the left turn movement during the morning peak hour and LOS E condition. The left turn queue length is accommodated through intersection improvements. A minor 95th percentile queue length of approximately 1 vehicle, or 25 feet, is projected for the minor (1 vehicle) southbound left turn movement during the morning peak hour and LOS F condition. This 1 vehicle queue is addressed through private on-site improvements and will not impact the public roadway of 38th Avenue.

While it is not uncommon for unsignalized movements to or from an arterial roadway, in urban areas, to operate with noticeable delays during peak traffic hours, upstream signal controls will tend to create vehicle platooning and additional gaps in the traffic stream for turn movements. This effect was considered within the HCM Two Way Stop Control (TWSC) level of service analysis contained in this study and modeled to the best extent possible to project intersection turn movement operations during both peak traffic hours as described in Tables 6 and 7 of this study.

Site Access Queue Length Analysis

Eastbound left turn lane queue lengths at proposed Access A, Access D and Access F intersections along Tower Road and 38th Avenue were analyzed using Year 2037 total traffic conditions. The analysis yields estimate of 95th percentile queue lengths, which have only a five percent probability of being exceeded during the analysis time period. Queue lengths were modeled and are included with the Synchro worksheets in Appendix C.

No significant queue at the proposed site accesses were indicated. The greatest on-site queue length anticipated at Access A is approximately 50 feet, or two vehicles, occurring during the afternoon peak hour. The greatest on-site queue length anticipated at Access D is approximately 25 feet, or one

vehicle, occurring during the afternoon peak hour. The greatest on-site queue length anticipated at Access F is approximately 25 feet, or one vehicle, occurring during the afternoon peak hour. Based upon proposed internal driveway lengths and geometries it is believed these queues are adequately accommodated through proposed on-site improvements.

Furthermore, it is to be noted that the above analysis does not account for potential U-turns where it is believed likely vehicles may not travel north through the site to Access A but may rather exit the site via right-turn movements at Access C and proceed to make U-turns at the signalized intersection of 38th Avenue and Tower Road in order to proceed east on 38th Avenue. This is considered likely given the shorter travel distance such a route offers.

Additionally, as noted in previous sections, it is likely that a significant number for visiting trips may be pass-by trips which would result in fewer vehicles making left turns out of the site. For instance, gas station and fast-food drive-through trips are likely to either come from the north or south and continue north or south, respectively, after visiting the site. Based on the above considerations it is concluded that the re-allocation of left-turn volumes from Access D to Access A are not expected to negatively impact adjacent roadway or intersection operations.

Gated Access Queue Analysis

Vehicle storage associated with the proposed Tempur-Sealy main gate access (north of Access D) was evaluated against established ITE research, traffic engineering publications and recommendations.

Data on main gate usage for the proposed development was provided by Tempur-Sealy and analyzed to determine queue length needs at gate entry. Based on the data provided approximately 100 percent of heavy truck traffic (AASHTO WB-50 or smaller) is assumed to use the main gate for entry into the Tempur-Sealy establishment.

Tempur-Sealy projects 20-30 heavy trucks entering the main gate within a 12-hour period. This equates to 2-3 trucks entering per hour and is expected to occur outside of adjacent street traffic peak hours. However, the entering peak hour trip volume of 68 vehicles was used to provide for a conservative analysis and remain consistent with the highest peak hour volume shown on Figure 8 and the level of service analysis performed in this study.

Vehicle queueing calculations were performed using standard probability equations based on the highest number of vehicles entering the site during peak hour (68 vehicles), assumed gate opening service rate (12 seconds per manufacturer) upon actuation of gate opener remote or vehicle tag, and the percentage of entering vehicles using the entry gate. Based on these calculations a 95th percentile queue length of 1 vehicle was established. This equates to a gate entry reservoir length of 55 feet. The probability calculations worksheet is provided for reference at the end of Appendix C.

The above analyses and recommendations were then applied to the proposed site plan. It is concluded that the proposed site plan meets and exceeds the queue length requirement of 1 vehicle, and adequate vehicle storage is provided on-site.

VII. Conclusion

This revised traffic impact study addresses the capacity, geometric, and control requirements associated with the development entitled 38th and Tower including Tempur-Sealy and proposed site plan amendment.

This study has been further revised to address City review comments regarding level of service operations at site access (Access A) being below City standards with the proposed gating/limiting traffic flow, queue length for heavy trucks at Tempur-Sealy main gate (at Access D), and other review comments received in letter dated September 18, 2019 and during the September 23, 2019 meeting.

The overall and existing mixed-use development is located at the northeast corner of Tower Road and 38th Avenue in Aurora, Colorado. Tempur-Sealy is a warehouse and distribution (general light industrial) tenant within an existing building located immediately east of an existing 7 Eleven.

The overall mixed-use development entailed new construction of a 7-Eleven gas station convenience store with 10 fueling positions, two 3,000 square foot fast food restaurants with drive-through, and two general light industrial buildings.

The study area examined in this revised analysis encompasses the intersection of 38th Avenue with Tower Road and existing site accesses.

Analysis was conducted for critical AM Peak Hour and PM Peak Hour traffic operations for existing traffic condition, Year 2019 and Year 2037 background traffic conditions, and Year 2019 and Year 2037 total traffic conditions.

Analysis of existing traffic conditions indicates that the signalized intersection of 38th Avenue with Tower Road has an overall operation of LOS C or better during morning and afternoon peak traffic hours.

Without the proposed development, Year 2019 background operational analysis shows that the signalized intersection of 38th Avenue with Tower Road has an overall projected operation at LOS C during both the morning and afternoon peak traffic hours.

By Year 2037 and without the proposed development and with anticipated roadway improvements, the 38th Avenue with Tower Road intersection has overall projected operations at LOS C during the AM peak traffic hour and LOS B during the PM peak traffic hour.

Analysis of future traffic conditions indicates that the redistribution of site-generated traffic is expected to create no negative impact to traffic operations for the existing and surrounding roadway system. With all conservative assumptions defined in this analysis, the study intersection is projected to operate at future levels of service comparable to Year 2037 background traffic conditions. Proposed site accesses have long-term operations at LOS D or better during peak traffic periods and upon build-out. There are a few intersections where turn movements are shown to experience LOS E and LOS F operations. These LOS E and LOS F operations are attributed to the through traffic volumes along adjacent roadways and the stop-controlled nature of the intersections but comply with City allowed

exception to level of service operations as these operational results are associated with minor movements with light traffic demand.

Analysis results determine no relationship or predictable characteristic between number of dock doors to vehicle trip generation that can be used for Tempur-Sealy.

Analysis results for Tempur-Sealy and the proposed site plan amendment indicate no cause of negative impact to access or public roadway operations upon re-route of retail traffic caused by proposed perimeter fencing. Proposed site plan amendment with perimeter fencing should be allowed.

APPENDIX A

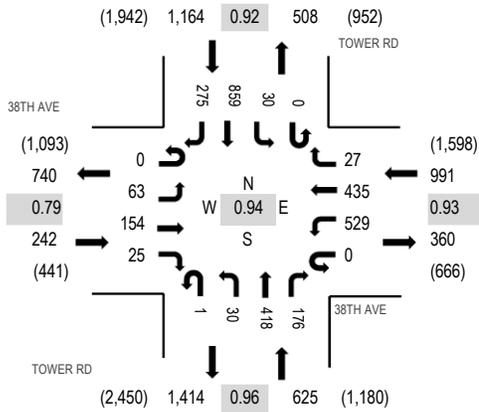
Traffic Count Data Signal Timing Information



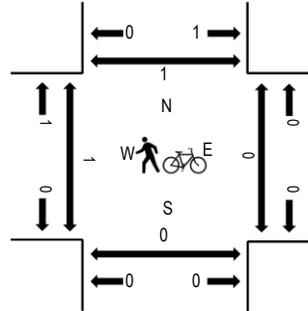
(303) 216-2439
www.alltrafficdata.net

Location: 1 TOWER RD & 38TH AVE AM
Date and Start Time: Tuesday, January 24, 2017
Peak Hour: 07:00 AM - 08:00 AM
Peak 15-Minutes: 07:15 AM - 07:30 AM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

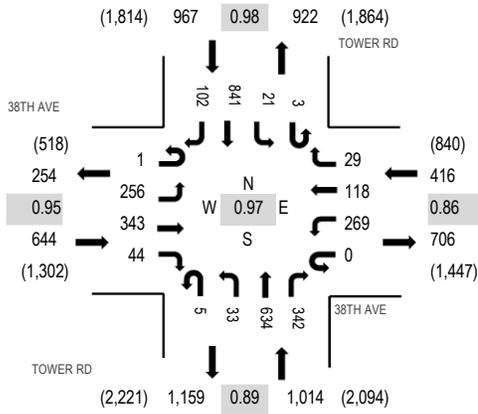
Interval Start Time	38TH AVE Eastbound				38TH AVE Westbound				TOWER RD Northbound				TOWER RD Southbound				Total	Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right			West	East	South	North
7:00 AM	0	14	28	5	0	142	102	6	0	6	91	40	0	5	182	62	683	3,022	0	0	0	0
7:15 AM	0	21	34	5	0	146	110	9	1	10	114	37	0	4	245	69	805	2,952	0	0	0	0
7:30 AM	0	13	35	7	0	120	126	7	0	9	109	47	0	8	228	74	783	2,731	1	0	0	1
7:45 AM	0	15	57	8	0	121	97	5	0	5	104	52	0	13	204	70	751	2,444	0	0	0	0
8:00 AM	0	19	30	5	0	107	81	9	0	6	85	54	0	8	173	36	613	2,139	1	2	1	1
8:15 AM	0	19	37	8	0	91	46	6	0	8	106	38	0	9	183	33	584		1	0	0	0
8:30 AM	0	13	18	6	0	93	43	6	0	9	90	42	0	4	149	23	496		0	0	0	0
8:45 AM	0	16	24	4	0	84	39	2	0	6	73	38	0	4	133	23	446		0	0	0	0
Count Total	0	130	263	48	0	904	644	50	1	59	772	348	0	55	1,497	390	5,161		3	2	1	2
Peak Hour	0	63	154	25	0	529	435	27	1	30	418	176	0	30	859	275	3,022		1	0	0	1



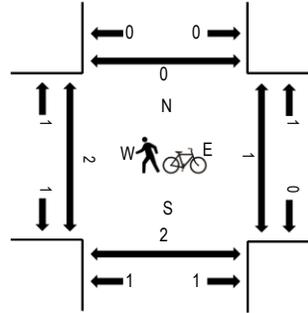
(303) 216-2439
www.alltrafficdata.net

Location: 1 TOWER RD & 38TH AVE PM
Date and Start Time: Tuesday, January 24, 2017
Peak Hour: 04:00 PM - 05:00 PM
Peak 15-Minutes: 04:15 PM - 04:30 PM

Peak Hour - All Vehicles



Peak Hour - Pedestrians/Bicycles on Crosswalk



Note: Total study counts contained in parentheses.

Traffic Counts

Interval Start Time	38TH AVE Eastbound				38TH AVE Westbound				TOWER RD Northbound				TOWER 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	61	72	12	0	78	35	11	2	6	174	73	1	9	214	23	771	3,041	0	1	0	0
4:15 PM	0	64	101	12	0	66	23	6	0	13	164	89	1	2	214	28	783	3,012	0	0	0	0
4:30 PM	0	58	87	13	0	77	32	9	3	9	146	85	1	3	206	22	751	3,039	1	0	1	0
4:45 PM	1	73	83	7	0	48	28	3	0	5	150	95	0	7	207	29	736	2,993	1	0	0	0
5:00 PM	0	72	77	22	0	65	26	10	1	8	154	96	0	6	175	30	742	3,009	0	0	1	0
5:15 PM	0	72	95	7	0	71	36	6	0	8	175	102	1	2	216	19	810		0	2	0	0
5:30 PM	1	64	76	15	0	72	42	9	0	6	135	90	1	5	170	19	705		0	1	2	0
5:45 PM	0	64	76	17	0	56	27	4	0	18	175	112	0	4	175	24	752		0	0	2	0
Count Total	2	528	667	105	0	533	249	58	6	73	1,273	742	5	38	1,577	194	6,050		2	4	6	0
Peak Hour	1	256	343	44	0	269	118	29	5	33	634	342	3	21	841	102	3,041		2	1	1	0

ALL TRAFFIC DATA SERVICES

9660 W. 44TH AVE
 WHEAT RIDGE, CO 80033
 WWW.ALLTRAFFICDATA.NET

2 - 38TH AVE E/O TOWER RD
 Date Start: 24-Jan-17
 Date End: 24-Jan-17
 Site Code: 2
 38TH AVENUE E/O TOWER RD

Start Time	24-Jan-17 Tue	EB	WB	Total
12:00 AM		66	45	111
01:00		67	34	101
02:00		32	47	79
03:00		33	75	108
04:00		71	136	207
05:00		82	410	492
06:00		189	746	935
07:00		375	978	1353
08:00		303	592	895
09:00		212	385	597
10:00		211	346	557
11:00		268	347	615
12:00 PM		332	397	729
01:00		350	360	710
02:00		472	351	823
03:00		584	533	1117
04:00		719	407	1126
05:00		746	438	1184
06:00		598	351	949
07:00		467	247	714
08:00		352	171	523
09:00		244	157	401
10:00		192	91	283
11:00		108	60	168
Total		7073	7704	14777
Percent		47.9%	52.1%	
AM Peak	-	07:00	07:00	-
Vol.	-	375	978	-
PM Peak	-	17:00	15:00	-
Vol.	-	746	533	-
Grand Total		7073	7704	14777
Percent		47.9%	52.1%	
ADT		ADT 14,777	ADT 14,777	AADT 14,777

ALL TRAFFIC DATA SERVICES

9660 W. 44TH AVE
 WHEAT RIDGE, CO 80033
 WWW.ALLTRAFFICDATA.NET

3 - TOWER RD N/O. 38TH AVE
 Date Start: 24-Jan-17
 Date End: 24-Jan-17
 Site Code: 3
 TOWER ROAD N/O 38TH AVENUE

Start Time	24-Jan-17 Tue	NB	SB	Total
12:00 AM		72	82	154
01:00		64	47	111
02:00		50	43	93
03:00		66	84	150
04:00		72	151	223
05:00		169	393	562
06:00		360	745	1105
07:00		520	1178	1698
08:00		468	834	1302
09:00		438	582	1020
10:00		454	614	1068
11:00		517	712	1229
12:00 PM		734	802	1536
01:00		660	747	1407
02:00		772	701	1473
03:00		940	923	1863
04:00		935	967	1902
05:00		939	849	1788
06:00		736	648	1384
07:00		548	428	976
08:00		407	320	727
09:00		311	248	559
10:00		201	190	391
11:00		143	120	263
Total		10576	12408	22984
Percent		46.0%	54.0%	
AM Peak	-	07:00	07:00	-
Vol.	-	520	1178	-
PM Peak	-	15:00	16:00	-
Vol.	-	940	967	-
Grand Total		10576	12408	22984
Percent		46.0%	54.0%	
ADT		ADT 22,984	ADT 22,984	AADT 22,984

SEPAC ECOM All Data

7/5/2017
12:24:21PM

Intersection Name: **38thTowerAMOPPM10.10.2.13**

Intersection Alias: **399**

Access Data

1 :1200 Baud
3 :19200 Baud

Access Code: **9999**

Channel:

Address: **1**

Revision: **3.33e**

IP Address: **10.10.2.13**

Phase Initialization Data

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Initial	0-None	3-Yel	1-Inact	1-Inact	0-None	3-Yel	0-None	1-Inact	0-None							

PHASE DATA

Phase	<u>Vehicle Basic Timings</u>							<u>Misc Timings</u>						<u>Pedestrian Timings</u>					Alt Ped Flash Ext Rest in Walk	
	Min		Passage	Max1	Max2	Yellow	All Red	Green Delay	Yellow Delay	Walk Offset Time	Walk Offset Mode	Bike Green	Bike Psg	Ped Walk	Alt Walk	Ped Clr	Flash Walk	Ext Ped		Rest in Clr
	Green	Passage																		
1	10	4.0	25	30	4.0	1.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
2	10	5.0	50	99	4.0	2.0	0.0	0.0	0	0-Advance	0	0	5	19		No	0	No		
3	3	1.5	30	99	3.0	1.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
4	5	2.0	35	99	4.0	1.0	0.0	0.0	0	0-Advance	0	0	5	24		No	0	No		
5	10	4.0	25	30	4.0	1.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
6	10	5.0	50	99	4.0	2.0	0.0	0.0	0	0-Advance	0	0	5	23		No	0	No		
7	10	4.0	25	30	4.0	1.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
8	5	2.0	35	99	4.0	1.0	0.0	0.0	0	0-Advance	0	0	5	25		No	0	No		
9	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
10	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
11	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
12	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
13	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
14	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
15	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		
16	0	0.0	0	0	3.0	0.0	0.0	0.0	0	0-Advance	0	0	0	0		No	0	No		

Vehicle Density Timings

Ph.	<u>Vehicle Density Timings</u>							<u>General Control</u>				<u>Miscellaneous</u>					<u>Special Sequence</u>		
	Added Initial	Max Initial	Time B4 Redu	Car B4 Redu	Time To Redu	Min Gap	Non-Act Response	Veh Recall	Ped Recall	Recall Delay	Non Lock	Dual Entry	Last Car Pass	Condit Service	No Simu Gap Out	Omit	Minus Yel	Omit Call	
1	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
2	3.0	20	25	0	10	3.0	NonActI	Min	None	0	No	Yes	No	No	No	0	0	0	
3	0.0	0	0	0	0	0.0	None	None	None	0	Yes	No	No	No	No	4	0	0	
4	0.0	0	0	0	0	0.0	NonActII	None	None	0	Yes	Yes	No	No	No	0	0	0	
5	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
6	3.0	20	25	0	10	3.0	NonActI	Min	None	0	No	Yes	No	No	No	0	0	0	
7	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
8	0.0	0	0	0	0	0.0	NonActII	None	None	0	Yes	Yes	No	No	No	0	0	0	
9	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
10	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
11	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
12	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
13	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
14	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	
15	0.0	0	0	0	0	0.0	None	None	None	0	No	No	No	No	No	0	0	0	

Vehical Detector Phase Assignment						Pedestrian Detector						Special Detector Phase Assignment							
	Assign		Switch				Assign		Switch				Assign		Switch				
	Phase	Mode	Phase	Extend	Delay		Phase	Mode	Phase	Extend	Delay		Phase	Mode	Phase	Extend	Delay		
Veh Det:1	2	Veh	0	0.0	0	Ped Det:1	2	Ped	0	0.0	0	Default Data							
Veh Det:5	4	Veh	0	0.0	0	Ped Det:2	4	Ped	0	0.0	0								
Veh Det:6	4	Veh	0	0.0	10	Ped Det:3	6	Ped	0	0.0	0								
Veh Det:9	6	Veh	0	0.0	0	Ped Det:4	8	Ped	0	0.0	0								
Veh Det:13	8	Veh	0	0.0	0														
Veh Det:14	8	Veh	0	0.0	10														
Veh Det:15	3	Veh	8	0.0	0														

Unit Data

General Control

Startup Time:	0 sec		Input	Output
Startup State:	Flash	Ring	Respons	Selection
Red Revert:	40.0 sec	1	Ring 1	Ring 1
Auto Ped Clr:	No	2	Ring 2	Ring 2
Stop T Reset:	No	3	None	None
Alt Sequence:	0	4	None	None
Special Seq:	0-Standard			
I/O Modes:				
ABC Input(Entry) Modes:	0	D Input(Entry) Modes:	2	
ABC Output(O/STS) Modes:	0	D Output(O/STS) Modes:	0	

Remote Flash

Test A = Flash

Phase	Entry	Exit
-------	-------	------

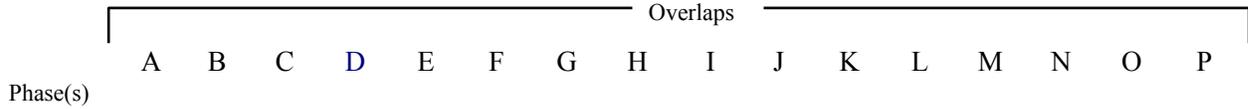
Default Data

- No Flash

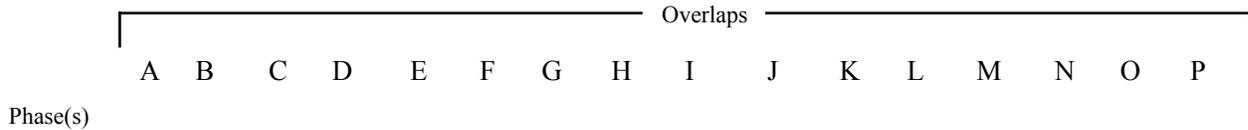
Default Data

- No Flash

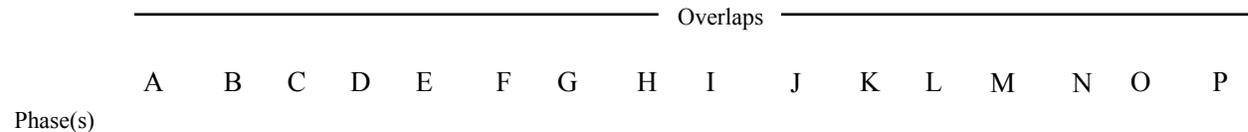
Overlaps



Start Green



Minus PED



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Trail Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trail Yellow	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Trail Red	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TG Preempt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stop Grn/Yel Phase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ring

Phase	Ring	Next Phase	Phase(s)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	1	3	1	2	3	4	1	1	3	3	9	10	11	12	13	14	15	16
3	1	4	5	5	7	7	2	2	4	4								
4	1	1	6	6	8	8	5	6	7	8								
6	2	7																
8	2	5																

Alternate Sequences

	Ph. Pair 1	Ph. Pair 2	Ph. Pair 3	Ph. Pair 4
Alt. Seq. 1	1/2			
Alt. Seq. 2	3/4			
Alt. Seq. 3	1/2	3/4		
Alt. Seq. 4	5/6			
Alt. Seq. 5	1/2	5/6		
Alt. Seq. 6	3/4	5/6		
Alt. Seq. 7	1/2	3/4	5/6	
Alt. Seq. 8	7/8			
Alt. Seq. 9	1/2	7/8		
Alt. Seq. 10	3/4	7/8		
Alt. Seq. 11	1/2	3/4	7/8	
Alt. Seq. 12	5/6	7/8		
Alt. Seq. 13	1/2	5/6	7/8	
Alt. Seq. 14	3/4	5/6	7/8	
Alt. Seq. 15	1/2	3/4	5/6	7/8

Port 1 Data

BIU Addr	Port Status	Basic Det	Message
0	Used	No	No
1	Used	No	No
8	Used	No	No
16	Used	No	No

Signal Driver Output

Channel	Control	Hardware Pins
1	1 - Veh Phase 1	1 - Phase 1 RYG
2	2 - Veh Phase 2	2 - Phase 2 RYG
3	3 - Veh Phase 3	3 - Phase 3 RYG
4	4 - Veh Phase 4	4 - Phase 4 RYG
5	5 - Veh Phase 5	5 - Phase 5 RYG
6	6 - Veh Phase 6	6 - Phase 6 RYG
7	7 - Veh Phase 7	7 - Phase 7 RYG
8	8 - Veh Phase 8	8 - Phase 8 RYG
9	18 - Ped Phase 2	10 - Phase 2 DPW
10	20 - Ped Phase 4	12 - Phase 4 DPW
11	22 - Ped Phase 6	14 - Phase 6 DPW
12	24 - Ped Phase 8	16 - Phase 8 DPW
13	0 - None	17 - Overlap A RYG
14	0 - None	18 - Overlap B RYG
15	0 - None	19 - Overlap C RYG
16	0 - None	20 - Overlap D RYG
17	0 - None	9 - Phase 1 DPW
18	0 - None	11 - Phase 3 DPW
19	0 - None	13 - Phase 5 DPW
20	0 - None	15 - Phase 7 DPW
21	0 - None	21 - Phase 1 ONC
22	0 - None	22 - Phase 2 ONC
23	0 - None	23 - Phase 3 ONC
24	0 - None	24 - Phase 4 ONC

Coordination Data

General Coordination Data

Operation Mode: 1=Auto

Coordination Mode: 0=Permissive

Maximum Mode: 0=Inhibit

Correction Mode: 3=Short Way Plus

Offset Mode: 1=End Grn

Force Mode: 0=Plan

Max Dwell Time: 0

Yield Period: 0

Manual Dial: 1

Manual Split: 1

Manual Offset: 1

Dial/Split **Cycle**

1/1 120

2/1 120

3/1 120

Split Times and Phase Modes

Dial 1 / Split 1

Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode
2	50	1=Coordinate	3	35	0=Actuated	4	24	0=Actuated	6	50	1=Coordinate
8	59	0=Actuated									

Dial 2 / Split 1

Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode
2	63	1=Coordinate	3	22	0=Actuated	4	29	0=Actuated	6	63	1=Coordinate
8	51	0=Actuated									

Dial 3 / Split 1

Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode	Ph.	Splits	Ph. Mode
2	57	1=Coordinate	3	25	0=Actuated	4	38	0=Actuated	6	57	1=Coordinate
8	63	0=Actuated									

Traffic Plan Data

Plan: 1/1/1 Offset Time: 50 Alternat Sequence: 0 Rg 2 Lag Time: 0 Rg 3 Lag Time: 0 Rg 4 Lag Time: 0
Mode: 0=Normal Special Function: 0 Correction Mode: 0=No

Plan: 2/1/1 Offset Time: 39 Alternat Sequence: 0 Rg 2 Lag Time: 0 Rg 3 Lag Time: 0 Rg 4 Lag Time: 0
Mode: 0=Normal Special Function: 0 Correction Mode: 0=No

Plan: 3/1/1 Offset Time: 34 Alternat Sequence: 0 Rg 2 Lag Time: 0 Rg 3 Lag Time: 0 Rg 4 Lag Time: 0
Mode: 0=Normal Special Function: 0 Correction Mode: 0=No

Local TBC Data

Start of Daylight Saving Month: 3 Week: 2 Cycle Zero Reference Hours: 24 Min: 0
 End of Daylight Saving Month: 11 Week: 1

Source	Equate Days						
Day	1	2	3	4	5	6	7
2	3	4	5	6	0	0	0

Traffic Data

Event	Day	Time	D/S/O	flash	PHASE FUNCTION															
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1	0:0	0/0/4		<input type="checkbox"/>															
2	2	0:0	0/0/4		<input type="checkbox"/>															
3	2	6:0	1/1/1		<input type="checkbox"/>															
4	2	9:0	2/1/1		<input type="checkbox"/>															
5	2	14:0	3/1/1		<input type="checkbox"/>															
6	2	19:0	2/1/1		<input type="checkbox"/>															
7	7	0:0	0/0/4		<input type="checkbox"/>															
8	10	0:0	0/0/4		<input type="checkbox"/>															

AUX. Events

Event	Program	Day	Hour	Min.	Aux Outputs			Det. Diag.	Det. Rpt.	Det. Mult100	Dimming	Special Function Outputs								
					1	2	3	D1	D2	D3		1	2	3	4	5	6	7	8	
1	1	1	0	1	<input type="checkbox"/>	X	<input type="checkbox"/>													
2	2	2	0	1	<input type="checkbox"/>	X	<input type="checkbox"/>													
3	7	7	0	1	<input type="checkbox"/>	X	<input type="checkbox"/>													
4	10	10	0	1	<input type="checkbox"/>	X	<input type="checkbox"/>													

Default Data - No Special Day(s) or Week(s) Programmed

<u>Special Functions</u>																
Function	SF1	SF2	SF3	SF4	SF5	SF6	SF7	SF8	SF9	SF10	SF11	SF12	SF13	SF14	SF15	SF16
Special Function 2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Special Function 3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Special Function 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Special Function 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Special Function 6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
Special Function 7	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
Special Function 8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>													
SPC 1-8 as Phs Func 1-8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Phase Function</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>															

<u>Phase Omit</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>															

<u>Ped Omit</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>															

<u>Veh Det Coord ReSvc</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Function Phase Recall</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Phase Min Recall</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>															

<u>Veh Det Ped Recall</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Veh Det Bike Recall</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Vehicle Function</u>															
<u>Veh Det Switch Omit</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Veh Det Switch Now</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Veh Det Switch Also</u>															
<u>Veh Det 15 Switch Also</u>															
PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>Veh Det 16 Switch Also</u>															
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>													

Overlap Function

PF1	PF2	PF3	PF4	PF5	PF6	PF7	PF8	PF9	PF10	PF11	PF12	PF13	PF14	PF15	PF16
<input type="checkbox"/>															

Dimming Data

Default Data - No Dimming Programmed

Lane Definition

Lanes	Name	Green Inbound	Yellow Inbound	Red Inbound	Green Outbound	Yellow Outbound
-------	------	---------------	----------------	-------------	----------------	-----------------

Default Data - Lane Definition

program_day program_hour program_minute LanePhFun

Preemption Data

General Preemption Data

Preempt > Flash Preempt 2 > Preempt 3 Preempt 4 > Preempt 5
 Preempt 1 > Preempt 2 Preempt 3 > Preempt 4 Preempt 5 > Preempt 6

Preempt Timers

Preempt	Non-Locking	Link to Preempt	Delay	Ext end	Duration	Max Call	Lock-Out	Min Green	Min Walk	Debounce	Gate ext end	Select			Track				Dwell			Return		
												Ped Clear	Yel	Red	Grn	Ped	Yel	Red	Green	Ped Clear	Yel	Red		
1	No	0	0	0	0	0	0	0	0	0	0	8	40	20	10	8	40	20	10	8	40	20		
2	No	0	0	0	0	0	0	0	0	0	0	8	40	20	10	8	40	20	10	8	40	20		
3	No	0	0	0	0	0	0	0	0	0	0	8	40	20	10	8	40	20	10	8	40	20		
4	No	0	0	0	0	0	0	0	0	0	0	8	40	20	10	8	40	20	10	8	40	20		
5	No	0	0	0	0	0	0	0	0	0	0	8	40	20	10	8	40	20	10	8	40	20		
6	No	0	0	0	0	0	0	0	0	0	0	8	40	20	10	8	40	20	10	8	40	20		

Preempt 1			Preempt 2			Preempt 3			Preempt 4			Preempt 5			Preempt 6		
Phase	Exit Phase	Exit Calls															
1	No	Yes															
2	Yes	Yes															
3	No	Yes															
4	No	Yes															
5	No	Yes															
6	Yes	Yes															
7	No	Yes															
8	No	Yes															

Priority Timers

Prio rity	Non- Locking	Del ay	Ext end	Free Dial	Free Split	Min Green	No Lock out	Lock out A	Lock out B	Max Green	Pre- Green	Recall	Excl-co Phase Svc.	Transit Overlap	Signal Type	Blankout
--------------	-----------------	-----------	------------	--------------	---------------	--------------	-------------------	------------------	------------------	--------------	---------------	--------	--------------------------	-----------------	-------------	----------

Priority Detector Channels

Priority

Detector

Priority Fixed Phases

Priority

Legend: 0 1
 CO-PHASE FALSE TRUE
 QJ-PHASE

Priority

Priority Bank :

Level

Partial Priority

Alt Seq
 Alt Seq Enabled
 Min Walk

Full Priority

Freq. Override
 Ped skip
 Force full Priority
 Frequency
 Freq. Level

Recovery

Method
 Return
 PedWait
 PedOverride

Codes: 0 X
 FALSE TRUE

<p>Priority :</p> <hr/> <p>Priority Bank : Queue Phase Detector Time</p> <p>Default data</p>	<p>Priority :</p> <hr/> <p>Priority Bank : Queue Phase Detector Time</p> <p>Default data</p>	<p>Priority :</p> <hr/> <p>Priority Bank : Queue Phase Detector Time</p> <p>Default data</p>
<p>Priority :</p> <hr/> <p>Priority Bank : Queue Phase Detector Time</p> <p>Default data</p>	<p>Priority :</p> <hr/> <p>Priority Bank : Queue Phase Detector Time</p> <p>Default data</p>	<p>Priority :</p> <hr/> <p>Priority Bank : Queue Phase Detector Time</p> <p>Default data</p>

Priority : Bank Detector PE 1A 2A 3A 4A 5A 6A B <p style="text-align: center;">Default Data</p>	Priority : Bank Detector PE 1A 2A 3A 4A 5A 6A B <p style="text-align: center;">Default Data</p>
Priority : Bank Detector PE 1A 2A 3A 4A 5A 6A B <p style="text-align: center;">Default Data</p>	Priority : Bank Detector PE 1A 2A 3A 4A 5A 6A B <p style="text-align: center;">Default Data</p>
Priority : Bank Detector PE 1A 2A 3A 4A 5A 6A B <p style="text-align: center;">Default Data</p>	Priority : Bank Detector PE 1A 2A 3A 4A 5A 6A B <p style="text-align: center;">Default Data</p>

Preempt 1

Vehical Phases			Pedestrian Phases			Overlaps						
Ph.	Track	Dwell	Cycle	Ph.	Track	Dwell	Cycle	Ovlp.	Track	Dwell	Cycle	Trail Grn

Default Data

Default Data

Default Data

Preempt 2

Vehical Phases			Pedestrian Phases			Overlaps						
Ph.	Track	Dwell	Cycle	Ph.	Track	Dwell	Cycle	Ovlp.	Track	Dwell	Cycle	Trail Grn

Default Data

Default Data

Default Data

Preempt 3

Vehical Phases			Pedestrian Phases			Overlaps						
Ph.	Track	Dwell	Cycle	Ph.	Track	Dwell	Cycle	Ovlp.	Track	Dwell	Cycle	Trail Grn

Default Data

Default Data

Default Data

Preempt 4

Vehical Phases			Pedestrian Phases			Overlaps						
Ph.	Track	Dwell	Cycle	Ph.	Track	Dwell	Cycle	Ovlp.	Track	Dwell	Cycle	Trail Grn

Default Data

Default Data

Default Data

Preempt 5

Vehical Phases			Pedestrian Phases			Overlaps						
Ph.	Track	Dwell	Cycle	Ph.	Track	Dwell	Cycle	Ovlp.	Track	Dwell	Cycle	Trail Grn

Default Data

Default Data

Default Data

Preempt 6

Vehical Phases			Pedestrian Phases			Overlaps						
Ph.	Track	Dwell	Cycle	Ph.	Track	Dwell	Cycle	Ovlp.	Track	Dwell	Cycle	Trail Grn

Default Data

Default Data

Default Data

System/Detectors Data

Local Critical Alarms

Local Free: No Cycle Failure: No Coord Failure: No Conflict Flash: Yes Remote Flash: Yes Revert to Backup: 15 1st Phone:
Local Flash: Yes Cycle Fault: Yes Coord Fault: Yes Preemption: Yes Voltage Monitor: Yes 2nd Phone:
Special Status 1: No Special Status 2: No Special Status 3: No Special Status 4: No Special Status 5: No Special Status 6: No

Traffic Responsive

System	Detector	Veh/	Average	Occupancy	Min	Queue 1	System	Weight	Queue 2	System	Weight	
Detector	Channel	Name	Hr	Time(mins)	Correction/10	Volume %	Detectors	Detectors	Factor	Detectors	Detectors	Factor

Default Data

Sample Interval:

Default Data

Queue: 1 Input Selection: 0=Average
Detector Failed Level : 0
Queue: 2 Input Selection: 0=Average
Detector Failed Level : 0

Queue:

Level Enter Leave Dial / Split / Offset
/ /

Default Data

Default Data

Vehicle Detector

Diagnostic Value 0

Detector	Max Presence	No Activity	Erratic Count
1	45	0	0
2	45	0	0
3	45	0	0
4	45	0	0
5	45	0	0
6	45	0	0
7	45	0	0
8	45	0	0
9	45	0	0
10	45	0	0
11	45	0	0
12	45	0	0
13	45	0	0
14	45	0	0
15	45	0	0
16	45	0	0
17	45	0	0
18	45	0	0
19	45	0	0
20	45	0	0
21	45	0	0
22	45	0	0
23	45	0	0
24	45	0	0
25	45	0	0
26	45	0	0
27	45	0	0
28	45	0	0
29	45	0	0
30	45	0	0
31	45	0	0
32	45	0	0
33	45	0	0
34	45	0	0
35	45	0	0
36	45	0	0
37	45	0	0
38	45	0	0
39	45	0	0
40	45	0	0
41	45	0	0
42	45	0	0
43	45	0	0
44	45	0	0
45	45	0	0
46	45	0	0
47	45	0	0
48	45	0	0
49	45	0	0
50	45	0	0
51	45	0	0
52	45	0	0
53	45	0	0
54	45	0	0

Vehicle Detector

Diagnostic Value 1

Detector	Max Presence	No Activity	Erratic Count
Default Data - No Diag 1 Values			

Special Detector

Diagnostic Value 0

Detector	Max Presence	No Activity	Erratic Count
1	45	0	0
2	45	0	0
3	45	0	0
4	45	0	0
5	45	0	0
6	45	0	0
7	45	0	0
8	45	0	0

Default Data - No Diag 0 Valu

55	45	0	0
56	45	0	0
57	45	0	0
58	45	0	0
59	45	0	0
60	45	0	0
61	45	0	0
62	45	0	0
63	45	0	0
64	45	0	0

Pedestrian Detector

Diagnostic Value 0

Detector	Max Presence	No Activity	Erratic Count
1	45	0	0
2	45	0	0
3	45	0	0
4	45	0	0
5	45	0	0
6	45	0	0
7	45	0	0
8	45	0	0

Default Data - No Diag 0 Values

Speed Trap Data

Speed Trap:

Measurement:

Detector 1 Detector_2 Distance :

Default Data

Volume Detector Data

Report Interval 0

Volume Controller
 Detector Detector
 Number Channel

Default Data

Pedestrian Detector

Diagnostic Value 1

Detector	Max Presence	No Activity	Erratic Count
----------	--------------	-------------	---------------

Default Data - No Diag 1 Values

Special Detector

Diagnostic Value 1

Detector	Max Presence	No Activity	Erratic Count
----------	--------------	-------------	---------------

Default Data - No Diag 1 Values

Speed Trap Speed Trap
 Low Treshold High Treshold

Dial/Split/Offset
 //

Default Data

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



Queue Length Probability Analysis Worksheet

Provide input (red) values in the indicated fields.

Input

Output (blue) values are shown as indicated.

Output

Values in black are constants and do not change.

Constant

AM Peak Hour Trips Entering: **68** vehicles
Assumed % Gate Use Trips: **100** %
Assumed Service Rate: **12** seconds

Traffic Intensity

$$\rho = \frac{\lambda}{\mu}$$

λ = mean arrival rate per min
 μ = mean service rate per min

λ = **1.13** veh/min
 μ = **5** veh/min
 ρ = **0.226** veh/min

Average Vehicle Queue

$$E(n) = \frac{\rho}{1 - \rho}$$

ρ = **0.226** veh/min
 $E(n)$ = **0.3** veh
Queue = **16** ft

Average Drive-Thru Wait Time

$$E(v) = \frac{1}{\mu(1 - \rho)}$$

ρ = **0.226** veh/min
 μ = **5** veh/min
 $E(v)$ = **0.26** min

Average Order Board-Window Wait Time

$$E(w) = \frac{\rho}{\mu(1 - \rho)}$$

ρ = **0.226** veh/min
 μ = **5** veh/min
 $E(w)$ = **0.06** min

Queue Probability Equation

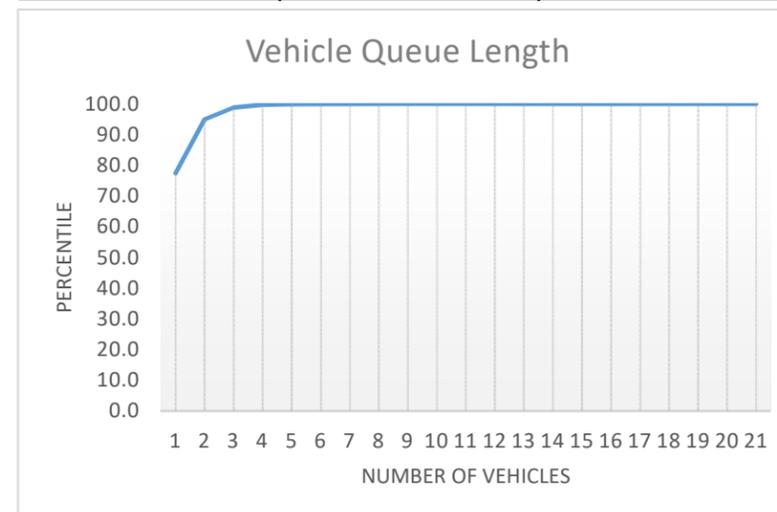
$$P(n) = \rho^n(1 - \rho)$$

Percentile

$$\sum_0^n P(n) \geq \%$$

50th Percentile
85th Percentile
95th Percentile

Number of Vehicles in Queue (n)	Probability of Occurance P(n) (%)	Percentile
0	77.40	77.4
1	17.49	94.9
2	3.95	98.9
3	0.89	99.7
4	0.20	99.9
5	0.05	100.0
6	0.01	100.0
7	0.00	100.0
8	0.00	100.0
9	0.00	100.0
10	0.00	100.0
11	0.00	100.0
12	0.00	100.0
13	0.00	100.0
14	0.00	100.0
15	0.00	100.0
16	0.00	100.0
17	0.00	100.0
18	0.00	100.0
19	0.00	100.0
20	0.00	100.0



Notes:

- The **greatest** volume of entering peak hour trips should be used (AM is shown as it is typically the highest).
- Percent gate use trips are determined based on land use, and confirmed (when possible) with client/developer/owner.
- Service rate is defined as the rate at which vehicles pass a given point in the queue; or, the average time a vehicle spends in a given queue position before progressing through the gate to the next position. This varies with gate application but is typically more more than 12 seconds. However, it may be adjusted for establishments which take longer or shorter to complete the opening request. See the **average wait time** outputs for average time spent in the queue as a whole.
- Traffic intensity must be less than 1. An intensity greater than 1 indicates an over-saturated queue (vehicles arrive faster than they can be served). When a queue is at capacity (intensity = 1) the next vehicle will typically choose to park or go elsewhere to avoid a long delay.

Standard Vehicle Length (AASHTO WB50)
55 Feet

Recommended Queue Design Length

Length	50th Queue	85th Queue	95th Queue
Vehicles	0	1	1
Feet	0	55	55

Timings
1: Tower Road & 38th Avenue

Existing Traffic Volumes
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	63	154	25	529	435	27	31	418	176	30	859	275
Future Volume (vph)	63	154	25	529	435	27	31	418	176	30	859	275
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3383	0	1770	4902	0
Flt Permitted	0.497			0.411			0.158			0.344		
Satd. Flow (perm)	926	1863	1583	766	1863	1583	571	3383	0	641	4902	0
Satd. Flow (RTOR)			68			68		71			89	
Lane Group Flow (vph)	67	164	27	563	463	29	33	632	0	32	1207	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2				6
Permitted Phases	4		4	8		8	2			6		
Detector Phase	7	4	4	3	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	3.0	5.0	5.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	9.5	24.0	24.0	35.0	59.0	59.0	50.0	50.0		50.0	50.0	
Total Split (s)	35.0	24.0	24.0	35.0	24.0	24.0	61.0	61.0		61.0	61.0	
Total Split (%)	29.2%	20.0%	20.0%	29.2%	20.0%	20.0%	50.8%	50.8%		50.8%	50.8%	
Yellow Time (s)	3.5	4.0	4.0	3.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0	5.0	4.0	5.0	5.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	None	None	None	None	None	C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	28.1	19.4	19.4	55.0	43.4	43.4	55.0	55.0		55.0	55.0	
Actuated g/C Ratio	0.23	0.16	0.16	0.46	0.36	0.36	0.46	0.46		0.46	0.46	
v/c Ratio	0.25	0.54	0.09	0.93	0.69	0.05	0.13	0.40		0.11	0.53	
Control Delay	24.0	54.1	0.6	50.1	40.1	0.1	20.4	19.8		19.9	22.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	24.0	54.1	0.6	50.1	40.1	0.1	20.4	19.8		19.9	22.3	
LOS	C	D	A	D	D	A	C	B		B	C	
Approach Delay		40.7			44.4			19.8			22.2	
Approach LOS		D			D			B			C	
Queue Length 50th (ft)	29	119	0	338	311	0	7	146		14	220	
Queue Length 95th (ft)	57	192	0	#507	450	1	19	194		35	264	
Internal Link Dist (ft)		1605			4252			1259			1549	
Turn Bay Length (ft)	200			200			245			75		
Base Capacity (vph)	603	301	312	610	674	616	261	1589		293	2294	
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	0.11	0.54	0.09	0.92	0.69	0.05	0.13	0.40		0.11	0.53	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 55 (46%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 120
 Control Type: Actuated-Coordinated

Timings
1: Tower Road & 38th Avenue

Existing Traffic Volumes
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	343	44	269	118	29	38	634	342	24	841	102
Future Volume (vph)	257	343	44	269	118	29	38	634	342	24	841	102
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	3433	3352	0	1770	5004	0
Flt Permitted	0.656			0.263			0.231			0.175		
Satd. Flow (perm)	1222	1863	1583	490	1863	1583	835	3352	0	326	5004	0
Satd. Flow (RTOR)			68			68		110			23	
Lane Group Flow (vph)	265	354	45	277	122	30	39	1007	0	25	972	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2				6
Permitted Phases	4		4	8		8	2			6		
Detector Phase	7	4	4	3	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)	9.5	23.0	23.0	9.5	23.0	23.0	24.0	24.0		24.0	24.0	
Total Split (s)	35.0	24.0	24.0	35.0	24.0	24.0	61.0	61.0		61.0	61.0	
Total Split (%)	29.2%	20.0%	20.0%	29.2%	20.0%	20.0%	50.8%	50.8%		50.8%	50.8%	
Yellow Time (s)	3.5	4.0	4.0	3.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0	5.0	4.0	5.0	5.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	None	None	None	None	None	C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	49.7	32.0	32.0	51.3	32.3	32.3	55.0	55.0		55.0	55.0	
Actuated g/C Ratio	0.41	0.27	0.27	0.43	0.27	0.27	0.46	0.46		0.46	0.46	
v/c Ratio	0.45	0.71	0.10	0.69	0.24	0.06	0.10	0.63		0.17	0.42	
Control Delay	24.1	50.2	4.5	30.8	37.5	0.2	19.5	23.9		22.8	21.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	24.1	50.2	4.5	30.8	37.5	0.2	19.5	23.9		22.8	21.9	
LOS	C	D	A	C	D	A	B	C		C	C	
Approach Delay		36.6			30.6			23.7			22.0	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	129	247	0	135	74	0	8	273		11	176	
Queue Length 95th (ft)	194	#452	17	201	137	2	20	344		32	213	
Internal Link Dist (ft)		1605			4252			1259			1549	
Turn Bay Length (ft)	200			200			245			75		
Base Capacity (vph)	694	497	472	555	501	475	382	1595		149	2305	
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	0.38	0.71	0.10	0.50	0.24	0.06	0.10	0.63		0.17	0.42	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 55 (46%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated

Timings
1: Tower Road & 38th Avenue

Background Traffic Volumes - Year 2019
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	160	26	550	452	28	32	435	183	31	893	286
Future Volume (vph)	66	160	26	550	452	28	32	435	183	31	893	286
Satd. Flow (prot)	1770	1863	1583	1770	3507	0	3433	3383	0	1770	4902	0
Flt Permitted	0.464			0.339			0.154			0.340		
Satd. Flow (perm)	864	1863	1583	631	3507	0	557	3383	0	633	4902	0
Satd. Flow (RTOR)			68		4			72			89	
Lane Group Flow (vph)	70	170	28	585	511	0	34	658	0	33	1254	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2				6
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	4	3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	9.5	23.0	23.0	9.5	23.0		24.0	24.0		24.0	24.0	
Total Split (s)	35.0	24.0	24.0	35.0	24.0		61.0	61.0		61.0	61.0	
Total Split (%)	29.2%	20.0%	20.0%	29.2%	20.0%		50.8%	50.8%		50.8%	50.8%	
Yellow Time (s)	3.5	4.0	4.0	3.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0	5.0	4.0	5.0		6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes							
Recall Mode	None	None	None	None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	24.3	15.6	15.6	51.6	39.9		58.4	58.4		58.4	58.4	
Actuated g/C Ratio	0.20	0.13	0.13	0.43	0.33		0.49	0.49		0.49	0.49	
v/c Ratio	0.30	0.71	0.11	1.04	0.44		0.13	0.39		0.11	0.52	
Control Delay	26.1	65.4	0.8	77.0	32.8		19.8	18.4		19.3	20.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	26.1	65.4	0.8	77.0	32.8		19.8	18.4		19.3	20.7	
LOS	C	E	A	E	C		B	B		B	C	
Approach Delay		48.4			56.4			18.5			20.7	
Approach LOS		D			E			B			C	
Queue Length 50th (ft)	32	127	0	~392	164		7	147		14	221	
Queue Length 95th (ft)	58	198	0	#594	215		19	203		36	278	
Internal Link Dist (ft)		1605			4252			1259			1549	
Turn Bay Length (ft)	200			200			245			75		
Base Capacity (vph)	565	294	307	565	1168		271	1683		308	2432	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.12	0.58	0.09	1.04	0.44		0.13	0.39		0.11	0.52	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 55 (46%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 65
 Control Type: Actuated-Coordinated

Timings
 1: Tower Road & 38th Avenue

Maximum v/c Ratio: 1.04
 Intersection Signal Delay: 34.2 Intersection LOS: C
 Intersection Capacity Utilization 77.2% ICU Level of Service D
 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: Tower Road & 38th Avenue

 Ø2 (R)	 Ø3	 Ø4
61 s	35 s	24 s
 Ø5 (R)	 Ø7	 Ø8
61 s	35 s	24 s

Timings
1: Tower Road & 38th Avenue

Background Traffic Volumes -Year 2019
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	267	357	46	280	123	30	40	660	356	25	875	107
Future Volume (vph)	267	357	46	280	123	30	40	660	356	25	875	107
Satd. Flow (prot)	1770	1863	1583	1770	3437	0	3433	3352	0	1770	5004	0
Flt Permitted	0.652			0.230			0.217			0.161		
Satd. Flow (perm)	1215	1863	1583	428	3437	0	784	3352	0	300	5004	0
Satd. Flow (RTOR)			68		21			110			23	
Lane Group Flow (vph)	275	368	47	289	158	0	41	1047	0	26	1012	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	4	3	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	
Minimum Split (s)	9.5	23.0	23.0	9.5	23.0		24.0	24.0		24.0	24.0	
Total Split (s)	35.0	24.0	24.0	35.0	24.0		61.0	61.0		61.0	61.0	
Total Split (%)	29.2%	20.0%	20.0%	29.2%	20.0%		50.8%	50.8%		50.8%	50.8%	
Yellow Time (s)	3.5	4.0	4.0	3.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0	5.0	4.0	5.0		6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes							
Recall Mode	None	None	None	None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	49.5	31.3	31.3	51.5	31.8		55.0	55.0		55.0	55.0	
Actuated g/C Ratio	0.41	0.26	0.26	0.43	0.26		0.46	0.46		0.46	0.46	
v/c Ratio	0.47	0.76	0.10	0.74	0.17		0.11	0.66		0.19	0.44	
Control Delay	24.4	53.2	5.0	33.6	31.2		19.8	24.6		23.8	22.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	24.4	53.2	5.0	33.6	31.2		19.8	24.6		23.8	22.2	
LOS	C	D	A	C	C		B	C		C	C	
Approach Delay		38.5			32.7			24.4			22.3	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	135	261	0	141	42		9	290		12	185	
Queue Length 95th (ft)	202	#490	19	211	77		21	365		34	224	
Internal Link Dist (ft)		1605			4252			1259			1549	
Turn Bay Length (ft)	200			200			245			75		
Base Capacity (vph)	692	486	463	542	925		359	1595		137	2305	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.40	0.76	0.10	0.53	0.17		0.11	0.66		0.19	0.44	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 55 (46%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated

Timings
 1: Tower Road & 38th Avenue

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 27.8

Intersection LOS: C

Intersection Capacity Utilization 76.4%

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: Tower Road & 38th Avenue

 Ø2 (R)	 Ø3	 Ø4
61 s	35 s	24 s
 Ø5 (R)	 Ø7	 Ø8
61 s	35 s	24 s

Timings
1: Tower Road & 38th Avenue

Background Traffic Volumes - Year 2037
AM Peak Hour

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	231	38	794	653	41	57	627	264	45	1289	413
Future Volume (vph)	95	231	38	794	653	41	57	627	264	45	1289	413
Satd. Flow (prot)	3433	3465	0	3433	3539	1583	3433	4862	0	1770	4902	0
Flt Permitted	0.337			0.455			0.136			0.249		
Satd. Flow (perm)	1218	3465	0	1644	3539	1583	491	4862	0	464	4902	0
Satd. Flow (RTOR)		10					117	177			134	
Lane Group Flow (vph)	102	289	0	854	702	44	61	958	0	48	1830	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2				6
Permitted Phases	4			8		8	2			6		
Detector Phase	7	4		3	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	
Minimum Split (s)	9.5	23.0		9.5	23.0	23.0	24.0	24.0		24.0	24.0	
Total Split (s)	9.5	23.0		14.2	27.7	27.7	32.8	32.8		32.8	32.8	
Total Split (%)	13.6%	32.9%		20.3%	39.6%	39.6%	46.9%	46.9%		46.9%	46.9%	
Yellow Time (s)	3.5	4.0		3.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0		4.0	5.0	5.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Recall Mode	None	None		None	None	None	C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	20.0	14.5		29.7	21.1	21.1	30.3	30.3		30.3	30.3	
Actuated g/C Ratio	0.29	0.21		0.42	0.30	0.30	0.43	0.43		0.43	0.43	
v/c Ratio	0.20	0.40		0.89	0.66	0.08	0.29	0.43		0.24	0.83	
Control Delay	12.7	24.0		29.1	24.7	0.3	19.4	12.4		18.4	21.8	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	12.7	24.0		29.1	24.7	0.3	19.4	12.4		18.4	21.8	
LOS	B	C		C	C	A	B	B		B	C	
Approach Delay		21.0			26.4			12.8			21.7	
Approach LOS		C			C			B			C	
Queue Length 50th (ft)	12	53		134	139	0	8	83		13	238	
Queue Length 95th (ft)	23	82		#185	185	0	25	123		40	#363	
Internal Link Dist (ft)		1605			4252			1259			1549	
Turn Bay Length (ft)	200			200		150	245			75		
Base Capacity (vph)	505	898		957	1147	592	212	2207		201	2200	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.20	0.32		0.89	0.61	0.07	0.29	0.43		0.24	0.83	

Intersection Summary

Cycle Length: 70
 Actuated Cycle Length: 70
 Offset: 26.8 (38%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 70
 Control Type: Actuated-Coordinated

Timings
 1: Tower Road & 38th Avenue

Background Traffic Volumes - Year 2037
 AM Peak Hour

Maximum v/c Ratio: 0.89
 Intersection Signal Delay: 21.3 Intersection LOS: C
 Intersection Capacity Utilization 80.1% 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: Tower Road & 38th Avenue

 Ø2 (R)	 Ø3	 Ø4
32.8 s	14.2 s	23 s
 Ø5 (R)	 Ø7	 Ø8
32.8 s	9.5 s	27.7 s

Timings
1: Tower Road & 38th Avenue

Background Traffic Volumes -Year 2037
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	386	515	66	404	177	44	57	951	513	30	1262	153
Future Volume (vph)	386	515	66	404	177	44	57	951	513	30	1262	153
Satd. Flow (prot)	3433	3479	0	3433	3539	1583	3433	4816	0	1770	5004	0
Flt Permitted	0.633			0.288			0.167			0.167		
Satd. Flow (perm)	2287	3479	0	1041	3539	1583	603	4816	0	311	5004	0
Satd. Flow (RTOR)		15				136		252			39	
Lane Group Flow (vph)	411	618	0	430	188	47	61	1558	0	32	1506	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2				6
Permitted Phases	4			8		8	2			6		
Detector Phase	7	4		3	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	
Minimum Split (s)	9.5	23.0		9.5	23.0	23.0	24.0	24.0		24.0	24.0	
Total Split (s)	9.6	23.0		9.6	23.0	23.0	27.4	27.4		27.4	27.4	
Total Split (%)	16.0%	38.3%		16.0%	38.3%	38.3%	45.7%	45.7%		45.7%	45.7%	
Yellow Time (s)	3.5	4.0		3.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0		4.0	5.0	5.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Recall Mode	None	None		None	None	None	C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	21.1	15.5		22.1	15.5	15.5	23.9	23.9		23.9	23.9	
Actuated g/C Ratio	0.35	0.26		0.37	0.26	0.26	0.40	0.40		0.40	0.40	
v/c Ratio	0.46	0.68		0.71	0.21	0.09	0.25	0.75		0.26	0.75	
Control Delay	13.0	23.3		18.2	17.2	0.4	17.1	16.4		20.5	18.8	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	13.0	23.3		18.2	17.2	0.4	17.1	16.4		20.5	18.8	
LOS	B	C		B	B	A	B	B		C	B	
Approach Delay		19.2			16.7			16.5			18.8	
Approach LOS		B			B			B			B	
Queue Length 50th (ft)	46	100		47	27	0	7	146		8	164	
Queue Length 95th (ft)	68	143		69	47	0	22	209		31	227	
Internal Link Dist (ft)		1605			4252			1259			1549	
Turn Bay Length (ft)	200			200		150	245			75		
Base Capacity (vph)	901	1054		606	1061	570	240	2069		123	2016	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.46	0.59		0.71	0.18	0.08	0.25	0.75		0.26	0.75	

Intersection Summary

Cycle Length: 60
 Actuated Cycle Length: 60
 Offset: 21.4 (36%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated

Timings
 1: Tower Road & 38th Avenue

Background Traffic Volumes -Year 2037

PM Peak Hour

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 17.8

Intersection LOS: B

Intersection Capacity Utilization 70.2%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Tower Road & 38th Avenue

 Ø2 (R)	 Ø3	 Ø4
27.4 s	9.6 s	23 s
 Ø5 (R)	 Ø7	 Ø8
27.4 s	9.6 s	23 s

Timings
1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2019
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	126	228	26	590	481	33	32	564	251	91	903	296
Future Volume (vph)	126	228	26	590	481	33	32	564	251	91	903	296
Satd. Flow (prot)	1444	1520	1583	1736	3505	1442	3433	2917	0	1203	4892	0
Flt Permitted	0.463			0.218			0.141			0.231		
Satd. Flow (perm)	704	1520	1583	398	3505	1442	510	2917	0	293	4892	0
Satd. Flow (RTOR)			105			68		78			93	
Lane Group Flow (vph)	134	243	28	628	512	35	34	867	0	97	1283	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4		4	8		8	2			6		
Detector Phase	7	4	4	3	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)	9.5	24.0	24.0	35.0	24.0	24.0	61.0	61.0		61.0	61.0	
Total Split (s)	18.8	24.0	24.0	35.0	40.2	40.2	61.0	61.0		61.0	61.0	
Total Split (%)	15.7%	20.0%	20.0%	29.2%	33.5%	33.5%	50.8%	50.8%		50.8%	50.8%	
Yellow Time (s)	3.5	4.0	4.0	3.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0	5.0	4.0	5.0	5.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	None	None	None	None	None	C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	31.3	19.0	19.0	55.0	37.7	37.7	55.0	55.0		55.0	55.0	
Actuated g/C Ratio	0.26	0.16	0.16	0.46	0.31	0.31	0.46	0.46		0.46	0.46	
v/c Ratio	0.53	1.01	0.08	1.19	0.46	0.07	0.15	0.63		0.72	0.56	
Control Delay	30.3	111.8	0.5	132.6	35.2	1.8	21.1	24.7		59.1	22.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	30.3	111.8	0.5	132.6	35.2	1.8	21.1	24.7		59.1	22.9	
LOS	C	F	A	F	D	A	C	C		E	C	
Approach Delay		77.1			86.3			24.6			25.4	
Approach LOS		E			F			C			C	
Queue Length 50th (ft)	61	~193	0	~523	168	0	7	240		60	240	
Queue Length 95th (ft)	104	#362	0	#754	227	6	19	309		#161	285	
Internal Link Dist (ft)		1605			472			1259			223	
Turn Bay Length (ft)	200			200			245			75		
Base Capacity (vph)	286	240	339	528	1102	500	233	1379		134	2292	
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	0.47	1.01	0.08	1.19	0.46	0.07	0.15	0.63		0.72	0.56	
Intersection Summary												
Cycle Length: 120												
Actuated Cycle Length: 120												
Offset: 55 (46%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow												
Natural Cycle: 130												
Control Type: Actuated-Coordinated												

Timings
 1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2019
 AM Peak Hour

Maximum v/c Ratio: 1.19

Intersection Signal Delay: 49.2

Intersection LOS: D

Intersection Capacity Utilization 90.8%

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: 1: Tower Road & 38th Avenue

 Ø2 (R)	 Ø3	 Ø4
61 s	35 s	24 s
 Ø5 (R)	 Ø7	 Ø8
61 s	18.8 s	40.2 s

HCM 2010 TWSC
2: Tower Road & Access A

Total Traffic Volumes - Year 2019
AM Peak Hour

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑↑		Y	↑↑↑
Traffic Vol, veh/h	46	13	549	162	43	1244
Future Vol, veh/h	46	13	549	162	43	1244
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	-	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	49	14	584	172	46	1323

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1291	378	0	0	756
Stage 1	670	-	-	-	-
Stage 2	621	-	-	-	-
Critical Hdwy	5.74	7.14	-	-	5.34
Critical Hdwy Stg 1	6.64	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.82	3.92	-	-	3.12
Pot Cap-1 Maneuver	327	*804	-	-	793
Stage 1	693	-	-	-	-
Stage 2	454	-	-	-	-
Platoon blocked, %	1	1	-	-	1
Mov Cap-1 Maneuver	308	*804	-	-	793
Mov Cap-2 Maneuver	308	-	-	-	-
Stage 1	693	-	-	-	-
Stage 2	428	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.3	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	356	793
HCM Lane V/C Ratio	-	-	0.176	0.058
HCM Control Delay (s)	-	-	17.3	9.8
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	0.6	0.2

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

HCM 2010 TWSC
 3: Tower Road & Access B

Total Traffic Volumes - Year 2019
 AM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗ ↑↑↑	↑↑↑			↑↑↑
Traffic Vol, veh/h	0	15	696	27	0	1290
Future Vol, veh/h	0	15	696	27	0	1290
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	16	740	29	0	1372

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	-	385	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	*761	-	-	0
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %		1	-	-	-
Mov Cap-1 Maneuver	-	*761	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.8	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBT
Capacity (veh/h)	-	-	761
HCM Lane V/C Ratio	-	-	0.021
HCM Control Delay (s)	-	-	9.8
HCM Lane LOS	-	-	A
HCM 95th %tile Q(veh)	-	-	0.1

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

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑			↑
Traffic Vol, veh/h	0	570	1056	26	0	48
Future Vol, veh/h	0	570	1056	26	0	48
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	25	2	2	2	2
Mvmt Flow	0	606	1123	28	0	51

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	-	0	- 0 - 576
Stage 1	-	-	- - -
Stage 2	-	-	- - -
Critical Hdwy	-	-	- - 6.93
Critical Hdwy Stg 1	-	-	- - -
Critical Hdwy Stg 2	-	-	- - -
Follow-up Hdwy	-	-	- - 3.319
Pot Cap-1 Maneuver	0	-	- 0 461
Stage 1	0	-	- 0 -
Stage 2	0	-	- 0 -
Platoon blocked, %	-	-	- - -
Mov Cap-1 Maneuver	-	-	- - 461
Mov Cap-2 Maneuver	-	-	- - -
Stage 1	-	-	- - -
Stage 2	-	-	- - -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	13.8
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	461
HCM Lane V/C Ratio	-	-	-	0.111
HCM Control Delay (s)	-	-	-	13.8
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.4

Intersection						
Int Delay, s/veh	0.9					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↕		↘	
Traffic Vol, veh/h	68	502	1044	10	1	12
Future Vol, veh/h	68	502	1044	10	1	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	95	15	2	2	2	60
Mvmt Flow	72	534	1111	11	1	13

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1122	0	-	0	1795 561
Stage 1	-	-	-	-	1117 -
Stage 2	-	-	-	-	678 -
Critical Hdwy	5.525	-	-	-	6.63 7.8
Critical Hdwy Stg 1	-	-	-	-	5.83 -
Critical Hdwy Stg 2	-	-	-	-	5.43 -
Follow-up Hdwy	3.1025	-	-	-	3.519 3.87
Pot Cap-1 Maneuver	324	-	-	-	*146 367
Stage 1	-	-	-	-	*275 -
Stage 2	-	-	-	-	*632 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	324	-	-	-	*113 367
Mov Cap-2 Maneuver	-	-	-	-	*113 -
Stage 1	-	-	-	-	*214 -
Stage 2	-	-	-	-	*632 -

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	17
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	324	-	-	-	313
HCM Lane V/C Ratio	0.223	-	-	-	0.044
HCM Control Delay (s)	19.3	-	-	-	17
HCM Lane LOS	C	-	-	-	C
HCM 95th %tile Q(veh)	0.8	-	-	-	0.1

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

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑			↑
Traffic Vol, veh/h	0	503	1037	0	0	7
Future Vol, veh/h	0	503	1037	0	0	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	15	2	2	2	90
Mvmt Flow	0	535	1103	0	0	7

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	-	0	- 0 - 552
Stage 1	-	-	- - -
Stage 2	-	-	- - -
Critical Hdwy	-	-	- - 8.25
Critical Hdwy Stg 1	-	-	- - -
Critical Hdwy Stg 2	-	-	- - -
Follow-up Hdwy	-	-	- - 4.155
Pot Cap-1 Maneuver	0	-	- 0 331
Stage 1	0	-	- 0 -
Stage 2	0	-	- 0 -
Platoon blocked, %	-	-	- - -
Mov Cap-1 Maneuver	-	-	- - 331
Mov Cap-2 Maneuver	-	-	- - -
Stage 1	-	-	- - -
Stage 2	-	-	- - -

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

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	331
HCM Lane V/C Ratio	-	-	-	0.022
HCM Control Delay (s)	-	-	-	16.1
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	0.1

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↑↑		↙	↗
Traffic Vol, veh/h	102	401	1030	7	1	7
Future Vol, veh/h	102	401	1030	7	1	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	230	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	60	2	2	2	2	90
Mvmt Flow	109	427	1096	7	1	7

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1103	0	-	0	1745 552
Stage 1	-	-	-	-	1100 -
Stage 2	-	-	-	-	645 -
Critical Hdwy	5	-	-	-	6.63 8.25
Critical Hdwy Stg 1	-	-	-	-	5.83 -
Critical Hdwy Stg 2	-	-	-	-	5.43 -
Follow-up Hdwy	2.77	-	-	-	3.519 4.155
Pot Cap-1 Maneuver	417	-	-	-	*128 331
Stage 1	-	-	-	-	*281 -
Stage 2	-	-	-	-	*728 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	417	-	-	-	*95 331
Mov Cap-2 Maneuver	-	-	-	-	*95 -
Stage 1	-	-	-	-	*208 -
Stage 2	-	-	-	-	*728 -

Approach	EB	WB	SB
HCM Control Delay, s	3.4	0	19.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	417	-	-	-	95	331
HCM Lane V/C Ratio	0.26	-	-	-	0.011	0.022
HCM Control Delay (s)	16.6	-	-	-	43.3	16.1
HCM Lane LOS	C	-	-	-	E	C
HCM 95th %tile Q(veh)	1	-	-	-	0	0.1

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

Timings
1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2019
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	307	367	46	481	251	66	40	711	366	65	889	121
Future Volume (vph)	307	367	46	481	251	66	40	711	366	65	889	121
Satd. Flow (prot)	1770	1863	1583	1337	2674	1077	3433	3293	0	1570	4994	0
Flt Permitted	0.592			0.138			0.161			0.100		
Satd. Flow (perm)	1103	1863	1583	194	2674	1077	582	3293	0	165	4994	0
Satd. Flow (RTOR)			105			68		82			22	
Lane Group Flow (vph)	316	378	47	496	259	68	41	1110	0	67	1041	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2				6
Permitted Phases	4		4	8		8	2			6		
Detector Phase	7	4	4	3	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)	9.5	23.0	23.0	9.5	23.0	23.0	24.0	24.0		24.0	24.0	
Total Split (s)	24.0	30.0	30.0	44.0	50.0	50.0	46.0	46.0		46.0	46.0	
Total Split (%)	20.0%	25.0%	25.0%	36.7%	41.7%	41.7%	38.3%	38.3%		38.3%	38.3%	
Yellow Time (s)	3.5	4.0	4.0	3.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	5.0	5.0	4.0	5.0	5.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	None	None	None	None	None	C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)	41.6	25.0	25.0	70.0	48.4	48.4	40.0	40.0		40.0	40.0	
Actuated g/C Ratio	0.35	0.21	0.21	0.58	0.40	0.40	0.33	0.33		0.33	0.33	
v/c Ratio	0.67	0.97	0.11	1.00	0.24	0.14	0.21	0.96		1.22	0.62	
Control Delay	25.0	87.3	0.6	73.8	25.1	6.5	32.4	55.8		229.6	34.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	25.0	87.3	0.6	73.8	25.1	6.5	32.4	55.8		229.6	34.8	
LOS	C	F	A	E	C	A	C	E		F	C	
Approach Delay		55.2			52.9			55.0			46.6	
Approach LOS		E			D			D			D	
Queue Length 50th (ft)	119	293	0	~344	68	0	11	416		~64	242	
Queue Length 95th (ft)	175	#490	0	#576	106	30	27	#565		#160	291	
Internal Link Dist (ft)		1605			472			1259			223	
Turn Bay Length (ft)	200			200			245			75		
Base Capacity (vph)	522	388	412	494	1078	475	194	1152		55	1679	
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	0.61	0.97	0.11	1.00	0.24	0.14	0.21	0.96		1.22	0.62	
Intersection Summary												
Cycle Length: 120												
Actuated Cycle Length: 120												
Offset: 55 (46%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												

Timings

1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2019

PM Peak Hour

Maximum v/c Ratio: 1.22

Intersection Signal Delay: 52.1

Intersection LOS: D

Intersection Capacity Utilization 99.0%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Tower Road & 38th Avenue

 Ø2 (R) 46 s	 Ø3 44 s	 Ø4 30 s
 Ø5 (R) 46 s	 Ø7 24 s	 Ø8 50 s

HCM 2010 TWSC
2: Tower Road & Access A

Total Traffic Volumes - Year 2019
PM Peak Hour

Intersection						
Int Delay, s/veh	0.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑↑		Y	↑↑↑
Traffic Vol, veh/h	63	32	1014	55	38	1012
Future Vol, veh/h	63	32	1014	55	38	1012
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	-	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	65	33	1045	57	39	1043

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1569	551	0	0	1102
Stage 1	1074	-	-	-	-
Stage 2	495	-	-	-	-
Critical Hdwy	5.74	7.14	-	-	5.34
Critical Hdwy Stg 1	6.64	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.82	3.92	-	-	3.12
Pot Cap-1 Maneuver	*355	*696	-	-	854
Stage 1	*715	-	-	-	-
Stage 2	*528	-	-	-	-
Platoon blocked, %	1	1	-	-	1
Mov Cap-1 Maneuver	*339	*696	-	-	854
Mov Cap-2 Maneuver	*339	-	-	-	-
Stage 1	*715	-	-	-	-
Stage 2	*504	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.5	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	410	854
HCM Lane V/C Ratio	-	-	0.239	0.046
HCM Control Delay (s)	-	-	16.5	9.4
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	0.9	0.1

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

HCM 2010 TWSC
3: Tower Road & Access B

Total Traffic Volumes - Year 2019
PM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗ ↑↑↑	↑↑↑			↑↑↑
Traffic Vol, veh/h	0	21	1048	36	0	1075
Future Vol, veh/h	0	21	1048	36	0	1075
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	22	1080	37	0	1108

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	-	559	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	*675	-	-	0
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %		1	-	-	-
Mov Cap-1 Maneuver	-	*675	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.5	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBT
Capacity (veh/h)	-	-	675
HCM Lane V/C Ratio	-	-	0.032
HCM Control Delay (s)	-	-	10.5
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.1

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

Intersection						
Int Delay, s/veh	1.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑			↑
Traffic Vol, veh/h	0	798	631	35	0	167
Future Vol, veh/h	0	798	631	35	0	167
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	30	2	2	2
Mvmt Flow	0	823	651	36	0	172

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	-	0	- 0 - 344
Stage 1	-	-	- - -
Stage 2	-	-	- - -
Critical Hdwy	-	-	- - 6.93
Critical Hdwy Stg 1	-	-	- - -
Critical Hdwy Stg 2	-	-	- - -
Follow-up Hdwy	-	-	- - 3.319
Pot Cap-1 Maneuver	0	-	- 0 653
Stage 1	0	-	- 0 -
Stage 2	0	-	- 0 -
Platoon blocked, %	-	-	- - -
Mov Cap-1 Maneuver	-	-	- - 653
Mov Cap-2 Maneuver	-	-	- - -
Stage 1	-	-	- - -
Stage 2	-	-	- - -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.5
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	653
HCM Lane V/C Ratio	-	-	-	0.264
HCM Control Delay (s)	-	-	-	12.5
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	1.1

Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↕		↘	
Traffic Vol, veh/h	10	788	541	1	10	90
Future Vol, veh/h	10	788	541	1	10	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	90	2	20	2	2	90
Mvmt Flow	10	812	558	1	10	93

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	559	0	-	0	1391 280
Stage 1	-	-	-	-	559 -
Stage 2	-	-	-	-	832 -
Critical Hdwy	5.45	-	-	-	6.63 8.25
Critical Hdwy Stg 1	-	-	-	-	5.83 -
Critical Hdwy Stg 2	-	-	-	-	5.43 -
Follow-up Hdwy	3.055	-	-	-	3.519 4.155
Pot Cap-1 Maneuver	635	-	-	-	*415 534
Stage 1	-	-	-	-	*537 -
Stage 2	-	-	-	-	*415 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	635	-	-	-	*409 534
Mov Cap-2 Maneuver	-	-	-	-	*409 -
Stage 1	-	-	-	-	*528 -
Stage 2	-	-	-	-	*415 -

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	13.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	635	-	-	-	518
HCM Lane V/C Ratio	0.016	-	-	-	0.199
HCM Control Delay (s)	10.8	-	-	-	13.7
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.7

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

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑↑			↑
Traffic Vol, veh/h	0	798	487	0	0	54
Future Vol, veh/h	0	798	487	0	0	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	2	2	10	2	2	95
Mvmt Flow	0	823	502	0	0	56

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	-	0	- 0 - 251
Stage 1	-	-	- - -
Stage 2	-	-	- - -
Critical Hdwy	-	-	- - 8.325
Critical Hdwy Stg 1	-	-	- - -
Critical Hdwy Stg 2	-	-	- - -
Follow-up Hdwy	-	-	- - 4.2025
Pot Cap-1 Maneuver	0	-	- 0 553
Stage 1	0	-	- 0 -
Stage 2	0	-	- 0 -
Platoon blocked, %	-	-	- - -
Mov Cap-1 Maneuver	-	-	- - 553
Mov Cap-2 Maneuver	-	-	- - -
Stage 1	-	-	- - -
Stage 2	-	-	- - -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.2
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	553
HCM Lane V/C Ratio	-	-	-	0.101
HCM Control Delay (s)	-	-	-	12.2
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.3

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑	↕		↙	↗
Traffic Vol, veh/h	15	783	433	1	7	54
Future Vol, veh/h	15	783	433	1	7	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	230	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	60	2	2	2	2	95
Mvmt Flow	15	807	446	1	7	56

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	447	0	-	0	1284 224
Stage 1	-	-	-	-	447 -
Stage 2	-	-	-	-	837 -
Critical Hdwy	5	-	-	-	6.63 8.325
Critical Hdwy Stg 1	-	-	-	-	5.83 -
Critical Hdwy Stg 2	-	-	-	-	5.43 -
Follow-up Hdwy	2.77	-	-	-	3.519 4.2025
Pot Cap-1 Maneuver	826	-	-	-	*415 580
Stage 1	-	-	-	-	*612 -
Stage 2	-	-	-	-	*415 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	826	-	-	-	*408 580
Mov Cap-2 Maneuver	-	-	-	-	*408 -
Stage 1	-	-	-	-	*601 -
Stage 2	-	-	-	-	*415 -

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	12.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	826	-	-	-	408	580
HCM Lane V/C Ratio	0.019	-	-	-	0.018	0.096
HCM Control Delay (s)	9.4	-	-	-	14	11.9
HCM Lane LOS	A	-	-	-	B	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1	0.3

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

Timings
1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2037
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	155	299	38	834	682	46	47	756	332	105	1299	423
Future Volume (vph)	155	299	38	834	682	46	47	756	332	105	1299	423
Satd. Flow (prot)	1504	3008	0	3400	3539	1482	3433	3139	1346	1245	4897	0
Flt Permitted	0.318			0.250			0.067			0.266		
Satd. Flow (perm)	504	3008	0	895	3539	1482	242	3139	1346	349	4897	0
Satd. Flow (RTOR)		10					55		353		92	
Lane Group Flow (vph)	165	358	0	887	726	49	50	804	353	112	1832	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	7	4		3	8	8	2	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)	9.5	23.0		9.5	23.0	23.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	20.0	24.0		35.0	39.0	39.0	61.0	61.0	61.0	61.0	61.0	
Total Split (%)	16.7%	20.0%		29.2%	32.5%	32.5%	50.8%	50.8%	50.8%	50.8%	50.8%	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	
Act Effct Green (s)	31.0	17.8		51.5	33.8	33.8	59.5	59.5	59.5	59.5	59.5	
Actuated g/C Ratio	0.26	0.15		0.43	0.28	0.28	0.50	0.50	0.50	0.50	0.50	
v/c Ratio	0.69	0.79		0.89	0.73	0.11	0.42	0.52	0.42	0.65	0.74	
Control Delay	39.4	60.9		39.7	43.7	7.7	34.7	22.6	3.5	44.7	25.6	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	39.4	60.9		39.7	43.7	7.7	34.7	22.6	3.5	44.7	25.6	
LOS	D	E		D	D	A	C	C	A	D	C	
Approach Delay		54.1			40.5			17.5			26.7	
Approach LOS		D			D			B			C	
Queue Length 50th (ft)	77	136		258	261	0	12	224	0	65	400	
Queue Length 95th (ft)	126	190		337	336	26	37	287	51	#167	467	
Internal Link Dist (ft)		1605			472			1259			223	
Turn Bay Length (ft)	200			200		150	245			75		
Base Capacity (vph)	269	497		1020	1025	468	119	1556	845	173	2474	
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	0.61	0.72		0.87	0.71	0.10	0.42	0.52	0.42	0.65	0.74	
Intersection Summary												
Cycle Length: 120												
Actuated Cycle Length: 120												
Offset: 57.5 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow												
Natural Cycle: 70												
Control Type: Actuated-Coordinated												

Timings
 1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2037
 AM Peak Hour

Maximum v/c Ratio: 0.89
 Intersection Signal Delay: 31.6 Intersection LOS: C
 Intersection Capacity Utilization 87.0% 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: Tower Road & 38th Avenue

 Ø2 (R)	 Ø3	 Ø4
61 s	35 s	24 s
 Ø5 (R)	 Ø7	 Ø8
61 s	20 s	39 s

HCM 2010 TWSC
2: Tower Road & Access A

Total Traffic Volumes - Year 2037
AM Peak Hour

Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑↑		Y	↑↑↑
Traffic Vol, veh/h	46	13	768	162	43	1781
Future Vol, veh/h	46	13	768	162	43	1781
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	-	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	49	14	817	172	46	1895

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	1753	495	0	0	989
Stage 1	903	-	-	-	-
Stage 2	850	-	-	-	-
Critical Hdwy	5.74	7.14	-	-	5.34
Critical Hdwy Stg 1	6.64	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.82	3.92	-	-	3.12
Pot Cap-1 Maneuver	224	*740	-	-	798
Stage 1	721	-	-	-	-
Stage 2	344	-	-	-	-
Platoon blocked, %	1	1	-	-	1
Mov Cap-1 Maneuver	211	*740	-	-	798
Mov Cap-2 Maneuver	211	-	-	-	-
Stage 1	721	-	-	-	-
Stage 2	324	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	24.2	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	250	798
HCM Lane V/C Ratio	-	-	0.251	0.057
HCM Control Delay (s)	-	-	24.2	9.8
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	1	0.2

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

Intersection						
Int Delay, s/veh	0.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗ ↑↑↑	↑↑↑			↑↑↑
Traffic Vol, veh/h	0	15	930	27	0	1827
Future Vol, veh/h	0	15	930	27	0	1827
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	16	989	29	0	1944

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	-	509	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	*718	-	-	0
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %		1	-	-	-
Mov Cap-1 Maneuver	-	*718	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBT
Capacity (veh/h)	-	-	718
HCM Lane V/C Ratio	-	-	0.022
HCM Control Delay (s)	-	-	10.1
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.1

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

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↑
Traffic Vol, veh/h	0	736	1540	26	0	48
Future Vol, veh/h	0	736	1540	26	0	48
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	20	2	2	2	2
Mvmt Flow	0	783	1638	28	0	51

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	833
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	-	-	-	312
Stage 1	0	-	-	-	-
Stage 2	0	-	-	-	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	312
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	18.8
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	312
HCM Lane V/C Ratio	-	-	-	0.164
HCM Control Delay (s)	-	-	-	18.8
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	0.6

Intersection						
Int Delay, s/veh	1.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑↑	↑↗		↘	
Traffic Vol, veh/h	68	668	1528	10	1	12
Future Vol, veh/h	68	668	1528	10	1	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	95	10	2	2	2	60
Mvmt Flow	72	711	1626	11	1	13

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1637	0	-	0	2132 819
Stage 1	-	-	-	-	1632 -
Stage 2	-	-	-	-	500 -
Critical Hdwy	6	-	-	-	6.84 8.1
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	3.15	-	-	-	3.52 3.9
Pot Cap-1 Maneuver	140	-	-	-	*49 221
Stage 1	-	-	-	-	*145 -
Stage 2	-	-	-	-	*776 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	140	-	-	-	*24 221
Mov Cap-2 Maneuver	-	-	-	-	*24 -
Stage 1	-	-	-	-	*70 -
Stage 2	-	-	-	-	*776 -

Approach	EB	WB	SB
HCM Control Delay, s	5.1	0	34.7
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	140	-	-	-	135
HCM Lane V/C Ratio	0.517	-	-	-	0.102
HCM Control Delay (s)	55.4	-	-	-	34.7
HCM Lane LOS	F	-	-	-	D
HCM 95th %tile Q(veh)	2.5	-	-	-	0.3

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

Intersection						
Int Delay, s/veh	0.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↑
Traffic Vol, veh/h	0	669	1521	0	0	7
Future Vol, veh/h	0	669	1521	0	0	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	10	2	2	2	95
Mvmt Flow	0	712	1618	0	0	7

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

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

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	182
HCM Lane V/C Ratio	-	-	-	0.041
HCM Control Delay (s)	-	-	-	25.6
HCM Lane LOS	-	-	-	D
HCM 95th %tile Q(veh)	-	-	-	0.1

Intersection						
Int Delay, s/veh	2.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑↑	↑↗		↙	↗
Traffic Vol, veh/h	102	567	1514	7	1	7
Future Vol, veh/h	102	567	1514	7	1	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	230	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	65	2	2	2	2	95
Mvmt Flow	109	603	1611	7	1	7

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	1618	0	-	0	2135 809
Stage 1	-	-	-	-	1615 -
Stage 2	-	-	-	-	520 -
Critical Hdwy	5.4	-	-	-	6.84 8.8
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	2.85	-	-	-	3.52 4.25
Pot Cap-1 Maneuver	198	-	-	-	*47 182
Stage 1	-	-	-	-	*148 -
Stage 2	-	-	-	-	*824 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	198	-	-	-	*21 182
Mov Cap-2 Maneuver	-	-	-	-	*21 -
Stage 1	-	-	-	-	*66 -
Stage 2	-	-	-	-	*824 -

Approach	EB	WB	SB
HCM Control Delay, s	6.6	0	45.6
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	198	-	-	-	21	182
HCM Lane V/C Ratio	0.548	-	-	-	0.051	0.041
HCM Control Delay (s)	43.2	-	-	-	185.4	25.6
HCM Lane LOS	E	-	-	-	F	D
HCM 95th %tile Q(veh)	2.9	-	-	-	0.2	0.1

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

Timings
1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2037
PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	426	525	66	605	305	80	57	1002	523	76	1276	167
Future Volume (vph)	426	525	66	605	305	80	57	1002	523	76	1276	167
Satd. Flow (prot)	1770	3479	0	2801	2777	1114	3433	3539	1583	1570	4999	0
Flt Permitted	0.435			0.158			0.083			0.144		
Satd. Flow (perm)	810	3479	0	466	2777	1114	300	3539	1583	238	4999	0
Satd. Flow (RTOR)		10				85			556		24	
Lane Group Flow (vph)	453	629	0	644	324	85	61	1066	556	81	1535	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		
Detector Phase	7	4		3	8	8	2	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)	9.5	23.0		9.5	23.0	23.0	24.0	24.0	24.0	24.0	24.0	
Total Split (s)	38.2	31.0		35.0	27.8	27.8	54.0	54.0	54.0	54.0	54.0	
Total Split (%)	31.8%	25.8%		29.2%	23.2%	23.2%	45.0%	45.0%	45.0%	45.0%	45.0%	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	
Act Effct Green (s)	52.1	25.3		52.1	25.3	25.3	54.4	54.4	54.4	54.4	54.4	
Actuated g/C Ratio	0.43	0.21		0.43	0.21	0.21	0.45	0.45	0.45	0.45	0.45	
v/c Ratio	0.80	0.85		0.89	0.55	0.28	0.45	0.67	0.54	0.75	0.67	
Control Delay	33.6	56.5		46.7	46.4	11.0	38.6	29.2	4.1	72.5	28.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	33.6	56.5		46.7	46.4	11.0	38.6	29.2	4.1	72.5	28.1	
LOS	C	E		D	D	B	D	C	A	E	C	
Approach Delay		46.9			43.8			21.2			30.3	
Approach LOS		D			D			C			C	
Queue Length 50th (ft)	234	238		200	115	0	17	344	0	53	342	
Queue Length 95th (ft)	315	312		272	172	44	44	441	66	#156	416	
Internal Link Dist (ft)		1605			472			1259			223	
Turn Bay Length (ft)	200			200		150	245			75		
Base Capacity (vph)	648	782		804	591	304	135	1603	1021	108	2278	
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	0.70	0.80		0.80	0.55	0.28	0.45	0.67	0.54	0.75	0.67	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 49.5 (41%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 75
 Control Type: Actuated-Coordinated

Timings
 1: Tower Road & 38th Avenue

Total Traffic Volumes - Year 2037
 PM Peak Hour

Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 33.4	Intersection LOS: C
Intersection Capacity Utilization 81.4%	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: Tower Road & 38th Avenue

 Ø2 (R)	 Ø3	 Ø4
54 s	35 s	31 s
 Ø5 (R)	 Ø7	 Ø8
54 s	38.2 s	27.8 s

HCM 2010 TWSC
2: Tower Road & Access A

Total Traffic Volumes - Year 2037
PM Peak Hour

Intersection						
Int Delay, s/veh	1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑↑		Y	↑↑↑
Traffic Vol, veh/h	63	32	1417	55	38	1456
Future Vol, veh/h	63	32	1417	55	38	1456
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	-	-	-	250	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	67	34	1507	59	40	1549

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	2237	783	0	0	1566
Stage 1	1537	-	-	-	-
Stage 2	700	-	-	-	-
Critical Hdwy	5.74	7.14	-	-	5.34
Critical Hdwy Stg 1	6.64	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-
Follow-up Hdwy	3.82	3.92	-	-	3.12
Pot Cap-1 Maneuver	*205	*588	-	-	*740
Stage 1	*604	-	-	-	-
Stage 2	*413	-	-	-	-
Platoon blocked, %	1	1	-	-	1
Mov Cap-1 Maneuver	*194	*588	-	-	*740
Mov Cap-2 Maneuver	*194	-	-	-	-
Stage 1	*604	-	-	-	-
Stage 2	*391	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	28.7	0	0.3
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	251	* 740
HCM Lane V/C Ratio	-	-	0.403	0.055
HCM Control Delay (s)	-	-	28.7	10.1
HCM Lane LOS	-	-	D	B
HCM 95th %tile Q(veh)	-	-	1.8	0.2

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

HCM 2010 TWSC
3: Tower Road & Access B

Total Traffic Volumes - Year 2037
PM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗ ↑↑↑	↑↑↑			↑↑↑
Traffic Vol, veh/h	0	21	1472	36	0	1509
Future Vol, veh/h	0	21	1472	36	0	1509
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	22	1566	38	0	1605

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	-	802	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	*588	-	-	0
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %		1	-	-	-
Mov Cap-1 Maneuver	-	*588	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBT
Capacity (veh/h)	-	-	588
HCM Lane V/C Ratio	-	-	0.038
HCM Control Delay (s)	-	-	11.4
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.1

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

Intersection						
Int Delay, s/veh	1.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↑
Traffic Vol, veh/h	0	1124	858	35	0	167
Future Vol, veh/h	0	1124	858	35	0	167
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	20	2	2	2
Mvmt Flow	0	1196	913	37	0	178

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	475
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	-	-	-	536
Stage 1	0	-	-	-	-
Stage 2	0	-	-	-	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	536
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	15
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	536
HCM Lane V/C Ratio	-	-	-	0.331
HCM Control Delay (s)	-	-	-	15
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	1.4

Intersection						
Int Delay, s/veh	0.9					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑↑	↑↗		↘	
Traffic Vol, veh/h	10	1114	768	1	10	90
Future Vol, veh/h	10	1114	768	1	10	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	100	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	90	2	15	2	2	90
Mvmt Flow	11	1185	817	1	11	96

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	818	0	-	0	1433 409
Stage 1	-	-	-	-	818 -
Stage 2	-	-	-	-	615 -
Critical Hdwy	5.9	-	-	-	6.84 8.7
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	3.1	-	-	-	3.52 4.2
Pot Cap-1 Maneuver	423	-	-	-	*406 401
Stage 1	-	-	-	-	*394 -
Stage 2	-	-	-	-	*584 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	423	-	-	-	*395 401
Mov Cap-2 Maneuver	-	-	-	-	*395 -
Stage 1	-	-	-	-	*384 -
Stage 2	-	-	-	-	*584 -

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	17.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	423	-	-	-	400
HCM Lane V/C Ratio	0.025	-	-	-	0.266
HCM Control Delay (s)	13.7	-	-	-	17.2
HCM Lane LOS	B	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	1.1

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

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↑
Traffic Vol, veh/h	0	1124	714	0	0	54
Future Vol, veh/h	0	1124	714	0	0	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	2	7	2	2	95
Mvmt Flow	0	1196	760	0	0	57

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	380
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	-	-	-	8.8
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	4.25
Pot Cap-1 Maneuver	0	-	-	-	415
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	415
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

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

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	415
HCM Lane V/C Ratio	-	-	-	0.138
HCM Control Delay (s)	-	-	-	15.1
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	0.5

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↙	↑↑	↑↗		↙	↗
Traffic Vol, veh/h	15	1109	660	1	7	54
Future Vol, veh/h	15	1109	660	1	7	54
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	230	-	-	-	0	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	60	2	2	2	2	95
Mvmt Flow	16	1180	702	1	7	57

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	703	0	-	0	1325 352
Stage 1	-	-	-	-	703 -
Stage 2	-	-	-	-	622 -
Critical Hdwy	5.3	-	-	-	6.84 8.8
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	2.8	-	-	-	3.52 4.25
Pot Cap-1 Maneuver	593	-	-	-	*532 438
Stage 1	-	-	-	-	*452 -
Stage 2	-	-	-	-	*584 -
Platoon blocked, %		-	-	-	1
Mov Cap-1 Maneuver	593	-	-	-	*517 438
Mov Cap-2 Maneuver	-	-	-	-	*517 -
Stage 1	-	-	-	-	*440 -
Stage 2	-	-	-	-	*584 -

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	14.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	593	-	-	-	517	438
HCM Lane V/C Ratio	0.027	-	-	-	0.014	0.131
HCM Control Delay (s)	11.2	-	-	-	12.1	14.5
HCM Lane LOS	B	-	-	-	B	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0	0.4

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