

# GREEN VALLEY RANCH EAST FILING 19

## Traffic Impact Study

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FHU Reference No. 121152-01

October 2024

# Table of Contents

Page

<b>I. INTRODUCTION .....</b>	<b>3</b>
I.A Summary.....	3
I.B Scope of Services.....	3
<b>II. TRAVEL DEMAND AND FUTURE GROWTH .....</b>	<b>6</b>
II.A Site Trip Generation.....	6
II.B Trip Distribution .....	6
<b>III. BACKGROUND CONDITIONS.....</b>	<b>8</b>
III.A Background Traffic.....	8
III.B Traffic Operations and Conditions .....	8
<b>IV. FUTURE TOTAL CONDITIONS.....</b>	<b>11</b>
IV.A Total Traffic Volumes.....	11
IV.B Auxiliary Lane Analysis.....	11
IV.C Signal Warrant Analysis .....	13
IV.D Traffic Operations and Conditions .....	15
<b>V. SUMMARY AND RECOMMENDATIONS .....</b>	<b>16</b>

## Appendices

Appendix A.	MUTCD Signal Warrants
Appendix B.	Site Traffic Studies of Nearby Developments
Appendix C.	Analysis Worksheets – Short-Term Background (2028) Conditions
Appendix D.	Analysis Worksheets – Long-Term Background (2050) Conditions
Appendix E.	Analysis Worksheets – Short-Term Total (2028) Conditions
Appendix F.	Analysis Worksheets – Long-Term Total (2050) Conditions
Appendix G.	LOS & Delay Table

List of Figures

	Page
Figure 1. Vicinity Map.....	4
Figure 2. Site Plan.....	5
Figure 3. Site Generated Traffic and Trip Distribution.....	7
Figure 4. Short-Term (2028) and Long-Term (2050) Background Traffic Conditions.....	10
Figure 5. Short-Term (2028) and Long-Term (2050) Total Traffic Conditions.....	12
Figure 6. Internal Traffic Control.....	14

List of Tables

Table 1. ITE Trip Generation Rates and Equations .....	6
Table 2. Site Trip Generation Estimate .....	6
Table 3. Level of Service Criteria .....	9
Table 4. MUTCD Signal Warrants, Total Traffic .....	13
Table 5. 95 <sup>th</sup> Percentile Queue Lengths, Short- and Long-Term Traffic.....	16

# I. INTRODUCTION

## I.A Summary

Green Valley Ranch East Filing 19 consists of 180 single family units, which includes 82 single-family detached and 98 single-family attached (duplex), to be developed within the Green Valley Ranch East master plan. As shown on **Figure 1**, the site is located in the southwest quadrant of the future 48<sup>th</sup> Avenue and Tibet Road intersection in Aurora, Colorado.

**Figure 2** depicts the current site plan concept. As shown, Filing 19 would have vehicular access via two access points: one full access onto Tibet Road via 46<sup>th</sup> Avenue and one right-in right-out (RIRO) access onto 48<sup>th</sup> Avenue. It is anticipated that the full buildout of the site would be completed in 2028.

Three previous reports have addressed the traffic aspects of development in this area of Green Valley Ranch East:

- ▶ *Transportation Analysis, Green Valley Ranch East*, Felsburg Holt & Ullevig, July 2018
- ▶ *Green Valley Ranch East CSP I, Active Adult Residential, Traffic Impact Study*, Felsburg Holt & Ullevig, updated May 28, 2020
- ▶ *Windler Master Traffic Impact Study*, Felsburg Holt & Ullevig, July 2023

The current Filing 19 development proposal is in general conformance with the planning data previously used for the 2018 *Transportation Analysis, Green Valley Ranch East* report (the FDP report). The purpose of this traffic study is to identify the potential impacts specific to Filing 19 to determine the resultant roadway and traffic control improvements required. Both Short-Term (2028) and Long-Term (2050) planning horizons were evaluated.

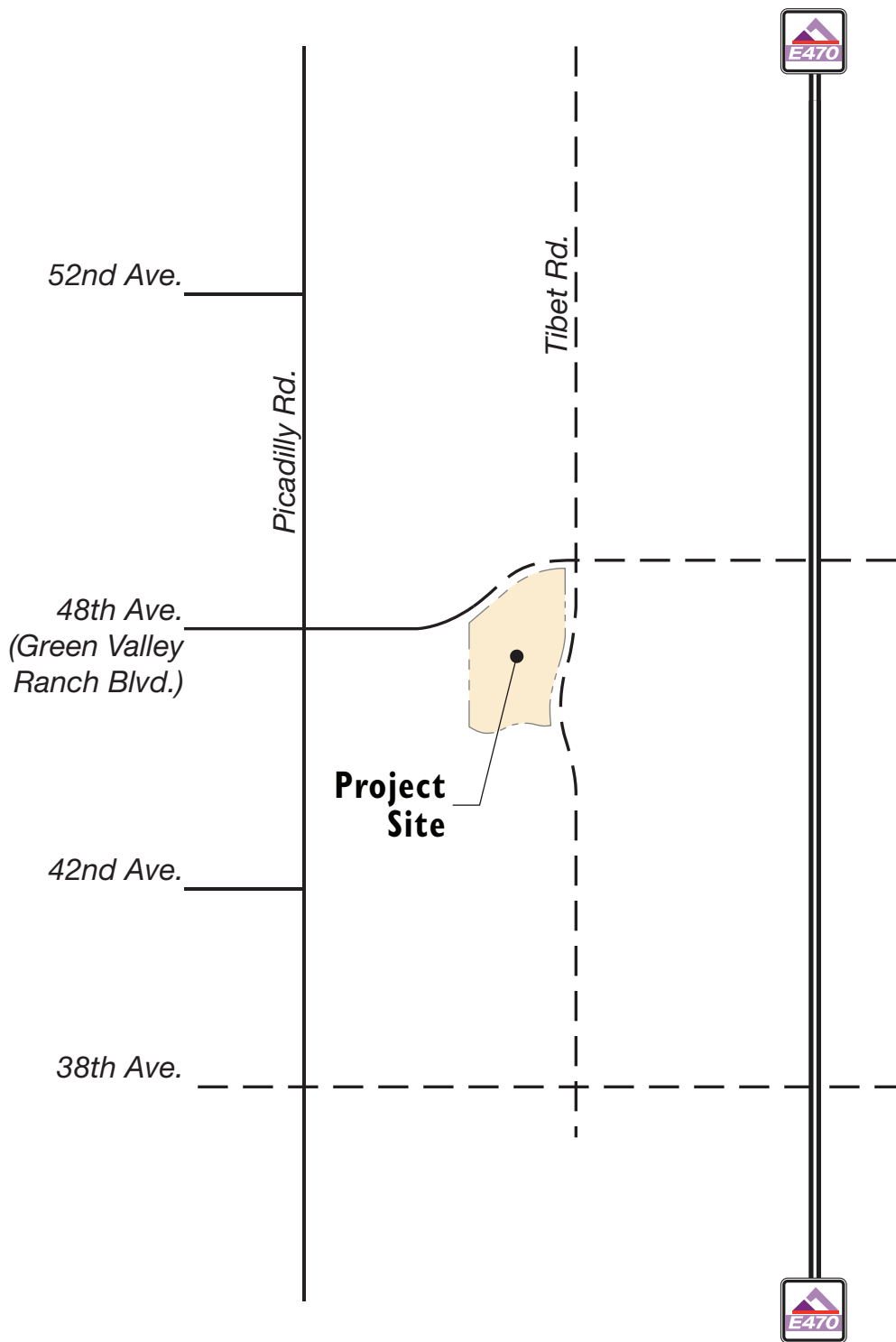
## I.B Scope of Services

The purpose of this Traffic Impact Study (TIS) is to estimate the potential impacts specific to the proposed development and to identify any resultant required roadway and/or intersection improvements and traffic control needs. This TIS also includes an auxiliary turn lane analysis, a queueing analysis, and a Manual on Uniform Traffic Control Devices (MUTCD) control device warrant evaluation for study intersections. The primary focus for traffic operations is at the following intersections:

- ▶ 48<sup>th</sup> Avenue & Tibet Road
- ▶ 48<sup>th</sup> Avenue & Site Drive #1 (RIRO Access)
- ▶ 46<sup>th</sup> Avenue & Tibet Road

The study will evaluate the following time periods:

- ▶ Short-Term Background (2028) AM and PM peak hours
- ▶ Long-Term Background (2050) AM and PM peak hours
- ▶ Short-Term Total (2028) of the development for AM and PM peak hours
- ▶ Long-Term Total (2050) of the development for AM and PM peak hours





## II. TRAVEL DEMAND AND FUTURE GROWTH

### II.A Site Trip Generation

Land use and number of lots were based on the site plan provided by Terracina Design. The proposed development is anticipated to contain single-family housing. Trip generation from the *Institute of Transportation Engineers' (ITE) Trip Generation Manual, Eleventh Edition, 2021*, was used to estimate the traffic generated by the site. NOTE: A mix of average rates and equation rates were used from the *ITE Trip Generation Manual* based on the methodology outlined in *ITE Trip Generation Handbook, 3rd Edition, 2017*, for selecting the proper rates. study. **Table 1** shows the trip generation rates and equations for the single-family detached housing (210) and single-family attached housing (215) based on the independent variables of dwelling units (DUs).

**Table 1. ITE Trip Generation Rates and Equations**

ITE Code	Land Use Description	Size	Unit	Daily Total	Peak Hour	Equations and Rates	Distributions	
							In	Out
210	Single-Family Detached Housing	82	DU	$\ln(T)=0.92*\ln(X)+2.68$	AM	$\ln(T)=0.91*\ln(X)+0.12$	25%	75%
					PM	$\ln(T)=0.94*\ln(X)+0.27$	63%	37%
215	Single-Family Attached Housing	98	DU	$T=7.62*(X)-50.48$	AM	$T = 0.52*(X) - 5.70$	25%	75%
					PM	$T = 0.60*(X) - 3.93$	59%	41%

**Table 2** shows the total trip generation estimates for full buildout of the development. As shown, with the internal trip capture determined, the full buildout of the development is estimated to generate 1,537 daily vehicle-trips to the roadway network, including 107 and 137 vehicle-trips during the AM and PM peak hours. RTD bus routes 42 and 45 serve Green Valley Ranch, both routes terminating along Picadilly Road.

**Table 2. Site Trip Generation Estimate**

ITE Code	Land Use Description	Size	Unit	Daily Total	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
210	Single-Family Detached Housing	82	DU	841	16	47	62	52	30	82
215	Single-Family Attached Housing	98	DU	696	11	34	45	32	23	55
<b>Project Total</b>				<b>1,537</b>	<b>27</b>	<b>81</b>	<b>107</b>	<b>84</b>	<b>53</b>	<b>137</b>

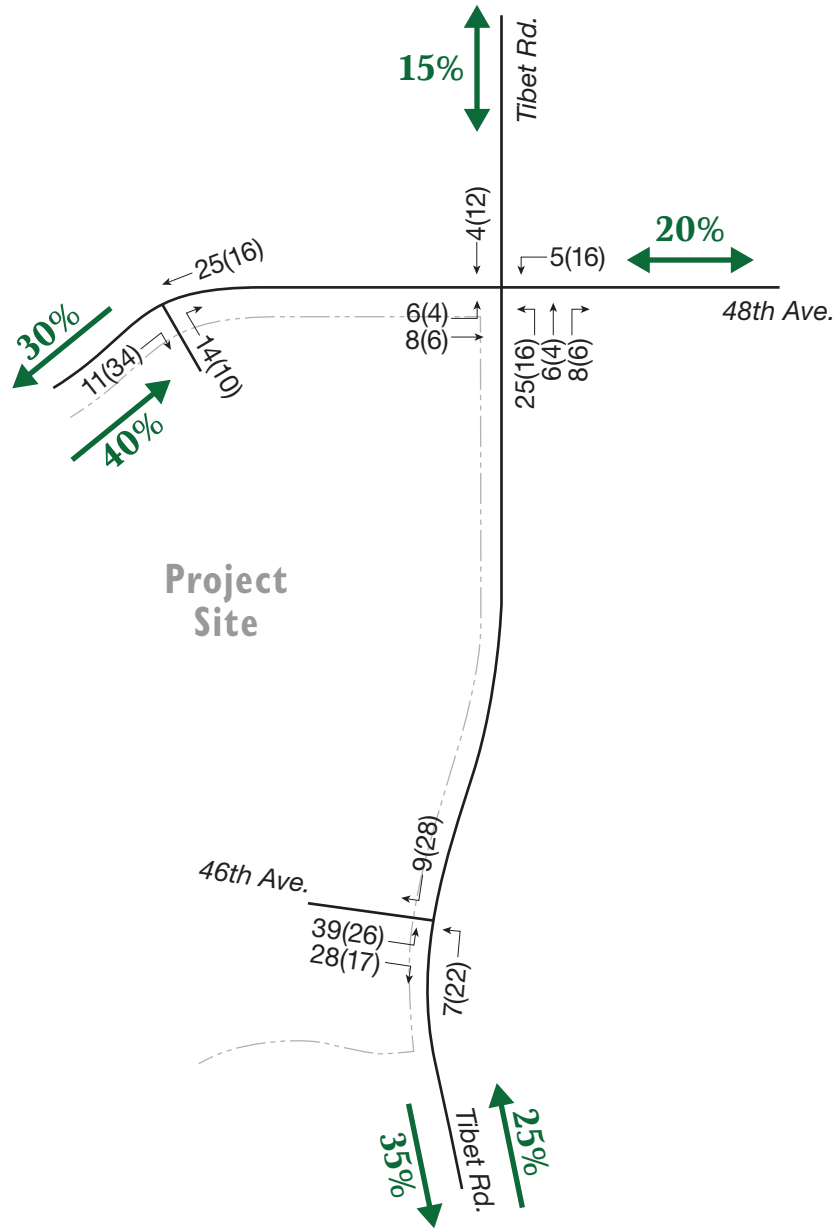
DU=Dwelling Units

### II.B Trip Distribution

The estimated distribution of site generated trips within the roadway network was based on existing traffic patterns, location of the site, and projected growth in the project area. The following distribution percentages were used to assign site generated vehicle-trips to the adjacent roadway network for the AM and PM peak hours:

- ▶ **15 percent** to/from the north via Tibet Road
- ▶ **35/25 percent** to/from the south via Tibet Road
- ▶ **30/40 percent** to/from the west via 48<sup>th</sup> Avenue
- ▶ **20 percent** to/from the east via 48<sup>th</sup> Avenue

The distribution percentages were used to assign site generated vehicle-trips, from **Table 2** to the adjacent roadway network for AM and PM peak hour traffic scenarios. The calculated traffic distribution percentages dictate vehicle movements both to and from the site. **Figure 3** depicts the trip generation for the proposed development.



#### LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

XX% = Site Trip Distribution



### III. BACKGROUND CONDITIONS

This section presents background traffic projections for the 2028 short-term and 2050 long-term planning horizon. The following subsections describe the anticipated roadway network identified by NEATS and the derivation of background traffic projections using the NEATS travel demand model.

In the Short-Term (2028) scenario, it was assumed that the construction of 48<sup>th</sup> Avenue, Tibet Road, and the E-470 interchange on 48<sup>th</sup> Avenue would be completed within the vicinity of the site. It was also assumed that the posted speed limit along 48<sup>th</sup> Avenue would be 45 miles per hour (mph) and 35 mph along Tibet Road. Based on the previously completed studies and analysis of the intersections in the area, it was assumed that the intersection of 48<sup>th</sup> Avenue with Tibet Road would be signalized upon 2028 short-term conditions. Lane assignments at the intersection were based on the analysis conducted in previous studies.

#### III.A Background Traffic

The NEATS travel demand model was used as the primary means of developing background traffic for the GVRE Filing 19 traffic study. Specifically, raw model results were extracted from the 2040 travel demand models, and trips estimated to originate from the Filing 19 property, within the NEATS models, were manually removed from the totals, yielding model-based daily background traffic. Other nearby developments' traffic studies were also considered to further refine volumes provided in NEATS based on planned development in the area. Site trip distribution and traffic assignment figures from these studies can be found in **Appendix B**.

The 2028 short-term background traffic volumes include trips generated by Fulenwider Harvest Mile, Sun Empire, 310 West, and Green Valley Ranch East 5,6, & 17. Additionally, several parcels evaluated in the Windler Master TIS were included in the background volumes, including trips from the following parcels: PA-23, PA-24, PA-25, PA-26, and PA-27. Estimated trips generated by the Green Valley Ranch East 8 & 9 and the remaining parcels evaluated in the Windler Master TIS were added to the 2050 long-term background traffic volumes.

**Figure 4** shows background traffic volume estimates for the 2028 Short-Term and 2050 Long-Term scenarios. As shown, background volumes on Tibet Road would be approximately 6,800 to 17,000 vehicles per day (VPD) under the 2028 Short-Term scenario and 9,800 to 22,050 VPD under the 2050 Long-Term within the study area. 48<sup>th</sup> Avenue would experience approximately 31,500 to 35,700 VPD under the 2028 Short-Term scenario and 36,550 to 45,550 VPD under the 2050 Long-Term within the study area.

#### III.B Traffic Operations and Conditions

Calculations were carried out to assess operations given current traffic demands. These were conducted using techniques documented in the *Highway Capacity Manual (HCM) 6<sup>th</sup> Edition* (Transportation Research Board, 2016) using the existing traffic volumes and intersection geometry. Level of Service (LOS) is a qualitative measure of traffic operational conditions based on roadway capacity and vehicle delay. Levels of service are described by a letter designation ranging from A to F, with LOS A representing free-flow travel, while LOS F represents congested conditions. Trafficware's Synchro traffic analysis software (Version 11.1) was used to perform the LOS calculations.

For signalized intersections, LOS is calculated for the entire intersection, while LOS for unsignalized intersections is calculated for movements that must yield right-of-way to other traffic movements. **Table 3** summarizes LOS criteria for signalized and unsignalized (stop-controlled) intersections.

**Table 3. Level of Service Criteria**

Level of Service	Average Control Delay per Vehicle (sec/veh)	
	Signalized Intersections	Stop/Roundabout Controlled Intersections
A	≤ 10	≤ 10
B	> 10 to 20	> 10 to 15
C	> 20 to 35	> 15 to 25
D	> 35 to 55	> 25 to 35
E	> 55 to 80	> 35 to 50
F	> 80	> 50

Source: HCM 6<sup>th</sup> Edition, Exhibit 19-8 & Exhibit 20-2

### ***Short-Term Background (2028) Traffic Conditions***

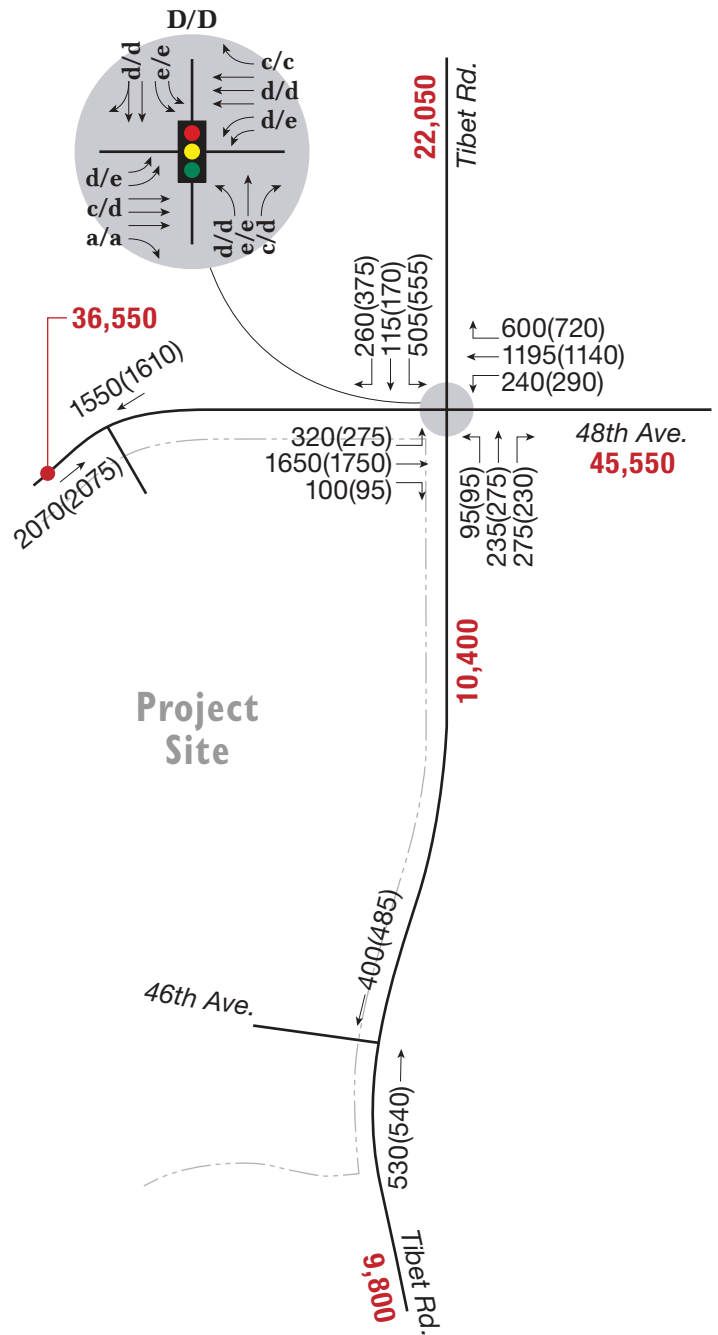
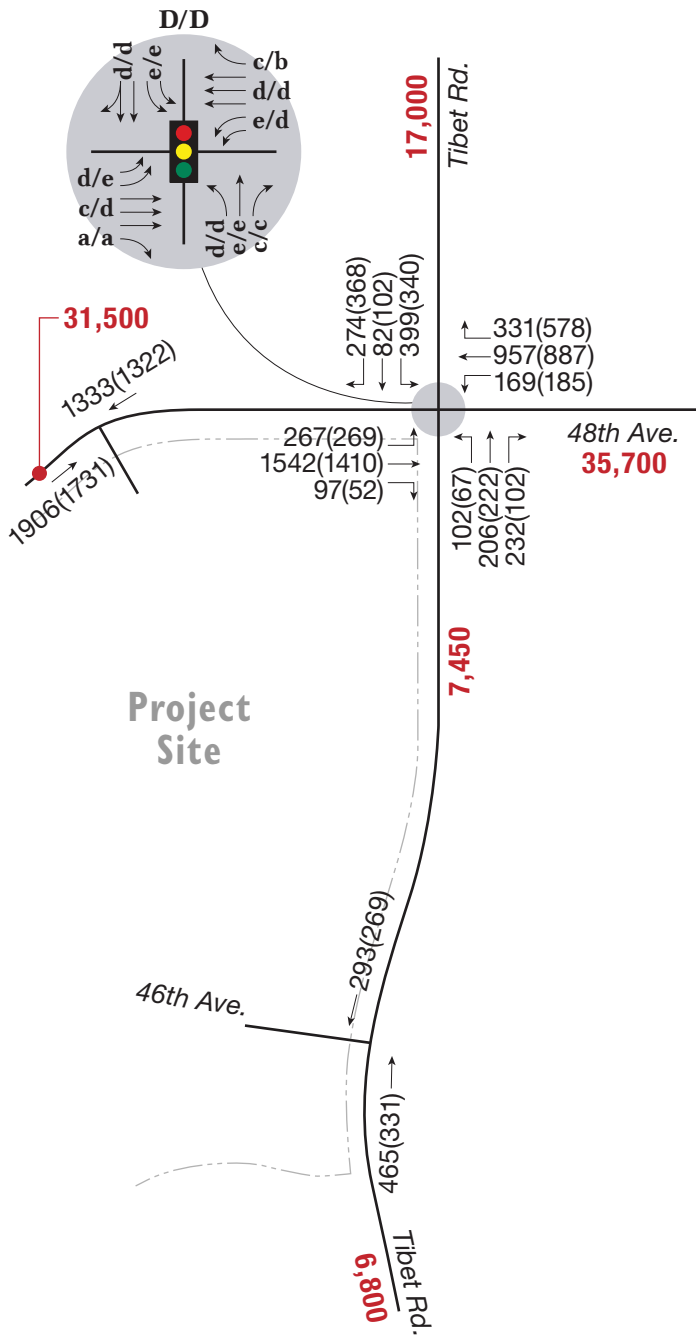
The signalized intersection of 48<sup>th</sup> Avenue with Tibet Road is anticipated to operate at LOS D during the AM and PM peak hours.

**Figure 4** shows the LOS results for Short-Term Background (2028) traffic conditions. Capacity analysis worksheets can be found in **Appendix C**.

### ***Long-Term Background (2050) Traffic Conditions***

The signalized intersection of 48<sup>th</sup> Avenue with Tibet Road is anticipated to operate at LOS D during the AM and the PM peak hours.

**Figure 4** shows the LOS results for Long-Term Background (2050) traffic conditions. Capacity analysis worksheets can be found in **Appendix D**.



#### LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

**XXXX** = Daily Traffic Volumes

**X/X** = AM/PM Peak Hour Intersection Level of Service

**x/x** = AM/PM Peak Hour Critical Movement Level of Service

 = Traffic Signal

## IV. FUTURE TOTAL CONDITIONS

### IV.A Total Traffic Volumes

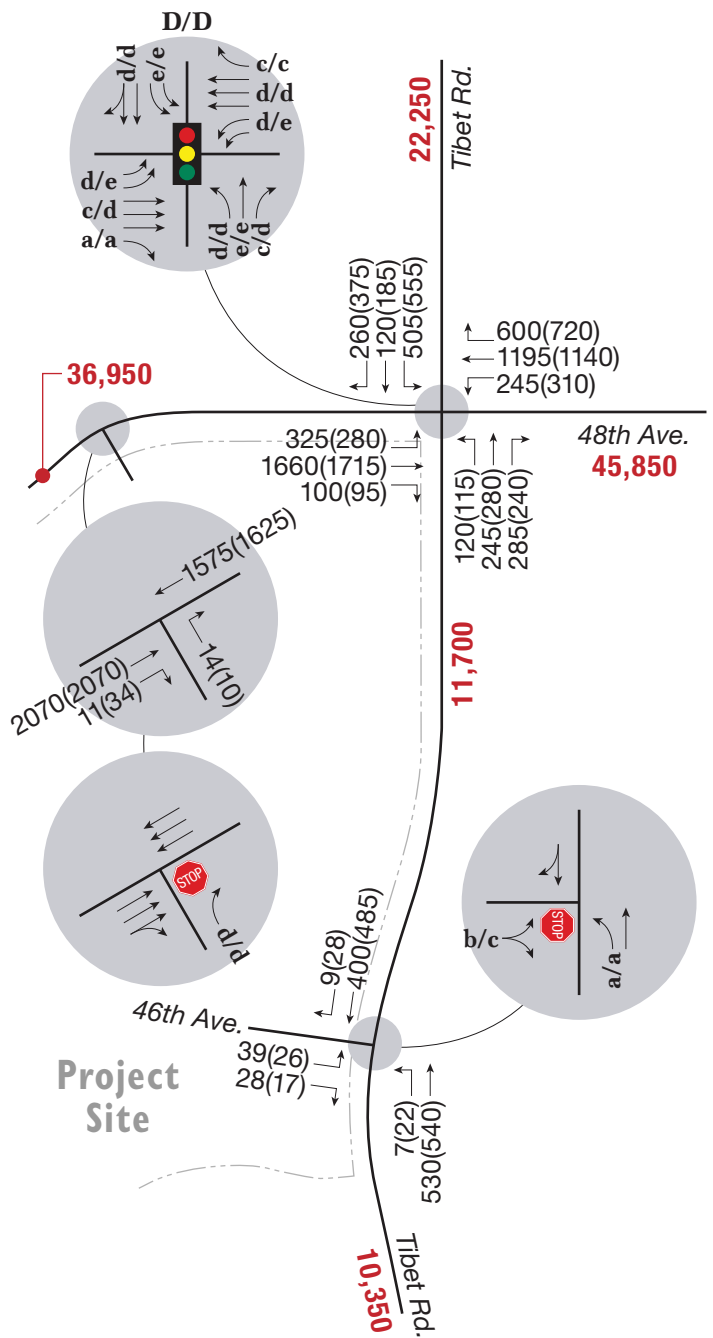
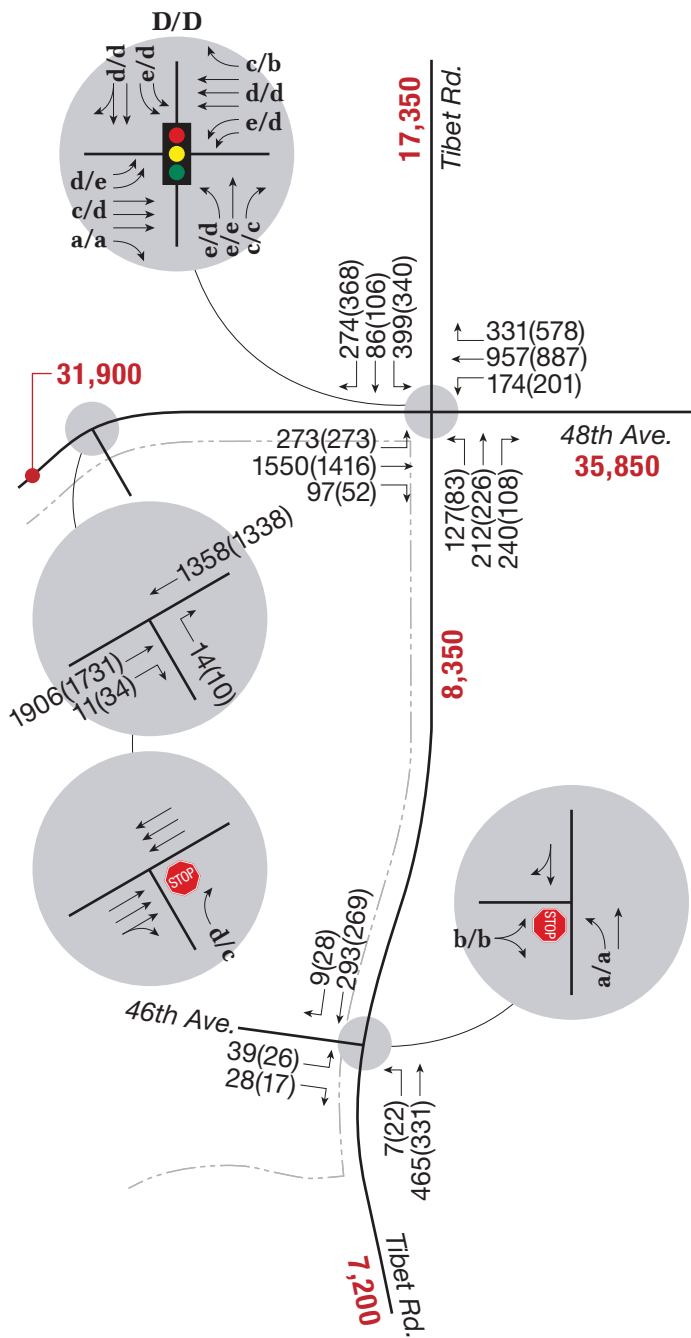
To produce the Short-Term Total (2028) and Long-Term Total (2050) traffic volumes, the site generated traffic volumes shown on **Figure 3** were added to the Short-Term Background (2028) and Long-Term Background (2050) traffic volumes shown on **Figure 4**. Short-Term Total (2028) and Long-Term Total (2050) traffic volumes are shown on **Figure 5**.

As shown, total volumes on Tibet Road would be approximately 7,350 to 17,300 VPD under the 2028 Short-Term scenario and 10,550 to 22,600 VPD under the 2050 Long-Term scenario within the study area. 48<sup>th</sup> Avenue would experience approximately 31,700 to 35,800 VPD under the 2028 Short-Term scenario and 36,850 to 45,650 VPD under the 2050 Long-Term within the study area.

### IV.B Auxiliary Lane Analysis

The Colorado Department of Transportation State Highway Access Code (SHAC) was used to determine storage and taper lengths of auxiliary lanes. It was assumed that 48<sup>th</sup> Avenue and Tibet Road would be classified as a Non-Rural Arterial (NR-C) within the study area. Table 4-6 and Table 4-8 in the SHAC were used to determine the recommended deceleration length/taper and storage lengths, respectively. The following turn-lane additions and improvements are recommended:

- ▶ Provide a northbound left-turn lane at the intersection of 46<sup>th</sup> Avenue with Tibet Road. The left-turn lane should provide at least 50 feet of storage length with a 10:1 taper.
- ▶ Per the SHAC, right-turn lanes are generally not required at intersections along six-lane cross sections and are not required if the right turning volume does not exceed 50 in the peak hours for NR-B facilities at speeds of 40 mph or lower. Therefore, an eastbound right turn lane at the RIRO access at the intersection of 48<sup>th</sup> Avenue with Site Drive #1 is not recommended.
- ▶ Per the SHAC, right-turn lanes are not required if the right turning volume does not exceed 50 in the peak hours for NR-C facilities. Therefore, a southbound right turn lane at the full movement access at the intersection of Tibet Road with 48<sup>th</sup> Avenue is not recommended.
- ▶ To allow dual westbound left-turn lanes at the intersection of 48<sup>th</sup> Avenue with Tibet Road, two southbound through lanes will be provided just south of 48<sup>th</sup> Avenue and taper back roughly 500 feet south of 48<sup>th</sup> Avenue.



### LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

**XXXX** = Daily Traffic Volumes

**X/X** = AM/PM Peak Hour Intersection Level of Service

**x/x** = AM/PM Peak Hour Critical Movement Level of Service

 = Traffic Signal

## IV.C Signal Warrant Analysis

A review was performed to determine if *Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, 2009 Edition*, traffic signal Warrant 1 (Eight-Hour Vehicular Volume) and/or Warrant 2 (Four-Hour Vehicular Volume) are satisfied for stop-controlled study intersection(s) under Short-Term Total (2028) and Long-Term Total (2050). Posted speed and existing and/or proposed lane configurations were assumed at study intersections for the analysis scenario. Right-turn reductions were applied at the intersections based on reduction criteria developed by Felsburg Holt & Ullevig. The following criteria were used and applied at the intersections:

- ▶ 4-Legged Intersections:
  - Shared left/through/right-turn lane: 50 percent
  - Shared left/through/right-turn lane (with acceleration lane): 50 percent
  - Exclusive left-turn & shared through/right-turn lane: 50 percent
  - Exclusive left-turn & shared through/right-turn lane (with acceleration lane): 50 percent
  - Exclusive right-turn lane: 50 percent
  - Exclusive right-turn lane (with acceleration lane): 50 percent
- ▶ 3-Legged Intersections:
  - Shared left/right-turn lane: 50 percent
  - Shared left/right-turn lane (with acceleration lane): 50 percent
  - Exclusive right-turn lane: 50 percent
  - Exclusive right-turn lane (with acceleration lane): 50 percent

**Table 4** summarizes the results of the analysis, and **Appendix A** presents graphical results of the MUTCD warrant analysis.

**Table 4. MUTCD Signal Warrants, Total Traffic**

Intersection	Existing Traffic Control	Short-Term Total (2028) Signal Warrant	Long-Term Total (2050) Signal Warrant
46 <sup>th</sup> Avenue & Tibet Road	–	Not Warranted	Not Warranted
48 <sup>th</sup> Avenue & Site Drive #1	–	Not Warranted	Not Warranted

Based on the results of the signal warrant analysis, traffic signals are **not warranted** at either of the two intersections that provide access into the development. As noted earlier, 48<sup>th</sup> Avenue with Tibet Road is already planned to be signalized based on the previously completed studies in the area and, therefore, signal warrants were not evaluated as part of this study.

Traffic control at the internal intersections within Filing I9 would be unsignalized, with STOP sign-control on the minor approaches. **Figure 6** depicts the proposed internal traffic control. Given the limited continuity of the internal local streets, additional traffic calming measures are not envisioned within Filing I9.



#### LEGEND

 = Stop Sign

## IV.D Traffic Operations and Conditions

### *Short-Term Total (2028) Traffic Conditions*

The future signalized intersection of 48<sup>th</sup> Avenue with Tibet Road is anticipated to operate at LOS D during the AM and PM peak hours. At the stop-controlled intersections, all movements are anticipated to operate at LOS D or better during the peak hours.

**Figure 5** shows the LOS results for Short-Term Total (2028) traffic conditions. Capacity analysis worksheets can be found in **Appendix E**.

### *Long-Term Total (2050) Traffic Conditions*

The future signalized intersection of 48<sup>th</sup> Avenue with Tibet Road is anticipated to operate at LOS D during the AM and PM peak hours. At the stop-controlled intersections, all movements are anticipated to operate at LOS D or better during the peak hours.

**Figure 5** shows the LOS results for Long-Term Total (2050) traffic conditions. Capacity analysis worksheets can be found in **Appendix F**.

### *Estimated 95<sup>th</sup> Percentile Queue Length Analysis*

The 95<sup>th</sup> percentile queue lengths were reviewed at the study intersection for Short-Term (2028) and Long-Term (2050) traffic conditions. **Table 5** summarizes the findings for the signalized intersections within the study area. The 95<sup>th</sup> percentile queue lengths for the AM and PM peak hours and recommended storage lengths are provided in the table.

Recommendations for vehicle storage lengths at each of the external study area intersections are included in **Table 5** for use in identifying construction needs. These dimensions represent the storage space necessary to meet the 95th percentile maximum queue during either the AM or PM peak hour.

Output from the traffic analysis effort was used to recommend these storage lengths, using the following methodology:

- ▶ **Left turn lane storage lengths.** At signalized intersections, the greater of the HCM 6th Edition or Synchro methodology queue calculations were reported. For unsignalized intersections, the HCM 6th Edition calculation was reported.
- ▶ **Through movements.** For signalized intersections, Synchro calculation results were reported. No through movement queues are reported for unsignalized intersections as the through movements are free.
- ▶ **Right turn movements.** The Synchro queue length was used. HCM 6th Edition information was not used because HCM's signalized intersection methodology does not account for right turns on red.

Deceleration lane and taper lengths should be added to these dimensions per City of Aurora standards to identify the total length of each auxiliary lane.



**Table 5. 95<sup>th</sup> Percentile Queue Lengths, Short- and Long-Term Traffic**

Location	Critical Movements	SHAC Required Storage Length	Recommended Storage Length	95 <sup>th</sup> %ile Queue Length (ft) (AM/PM Peak)	
				Short-Term (2028)	Long-Term (2050)
48 <sup>th</sup> Avenue & Tibet Road	NB Left-turn	115-feet	175-feet	150 / 120	160 / 163
	NB Through	–	–	#248 / 279	#345 / #407
	NB Right-turn	280-feet	225-feet	63 / 52	90 / 207
	EB Left-turn**	340-feet	225-feet	153 / 215	198 / 220
	EB Through	–	–	497 / 452	#592 / #640
	EB Right-turn	100-feet	50-feet	10 / 5	11 / 19
	WB Left-turn**	325-feet	250-feet	128 / 148	145 / #233
	WB Through	–	–	313 / 189	409 / 338
	WB Right-turn	720-feet	550-feet	147 / 71	485 / #550
	SB Left-turn**	555-feet	425-feet	290 / 250	398 / 425
	SB Through <sup>+</sup>	–	–	84 / 22	100 / 58
46 <sup>th</sup> Avenue & Tibet Road	NB Left-turn	45-feet	50-feet	0 / 3	3 / 3
	EB Left-turn <sup>+</sup>	40-feet	Continuous	10 / 5	15 / 8
48 <sup>th</sup> Avenue & Site Drive (RIRO)	NB Right-turn	50-feet	Continuous	8 / 5	8 / 5

<sup>+</sup>shared lane

\*\*dual turn lane

# - 95<sup>th</sup> percentile volume exceeds capacity; queues may be longerm - volume for 95<sup>th</sup> percentile queue is metered by upstream signal

Note that the assumed vehicle length is 25ft.

## V. SUMMARY AND RECOMMENDATIONS

Green Valley Ranch East Filing 19 consists of 180 single family units, which includes 82 single-family detached and 98 single-family attached (duplex), to be developed within the Green Valley Ranch East master plan. The site is located in the southwest quadrant of the future 48<sup>th</sup> Avenue and Tibet Road intersection in Aurora, Colorado.

It is anticipated that vehicular access will be provided via two access points: one full access onto Tibet Road via 46<sup>th</sup> Avenue and one right-in right-out (RIRO) access onto 48<sup>th</sup> Avenue. It is anticipated that the full buildout of the site would be completed in 2028.

The full buildout of the development is anticipated to generate approximately 1,537 daily vehicle-trips to the roadway network, including 107 vehicle-trips during the AM and 137 vehicle-trips during the PM peak.

The potential traffic impacts of the development were evaluated under Short-Term Background (2028), Long-Term Background (2050), Short-Term Total (2028), and Long-Term Total (2050) conditions. Based on the results of the analysis, the key findings and recommendations of this study are as follows:

- Provide a two-way stop-controlled (TWSC) condition at the two proposed site access approaches at 46<sup>th</sup> Street and Site Drive #1 (RIRO). These intersections are anticipated to continue to operate acceptably through the Long-Term Future as unsignalized intersections.

- ▶ Provide a northbound left-turn lane at the intersection of 46<sup>th</sup> Avenue with Tibet Road. The left-turn lane should provide at least 50 feet of storage length with a 10:1 taper based on SHAC guidance.
- ▶ To allow dual westbound left-turn lanes at the intersection of 48<sup>th</sup> Avenue with Tibet Road, two southbound through lanes will be provided south of 48<sup>th</sup> Avenue and taper back down to one lane approximately 500 feet south of 48<sup>th</sup> Avenue.
- ▶ Traffic control at the internal intersections within Filing 19 would be unsignalized, with STOP sign-control on the minor approaches. **Figure 6** depicts the proposed internal traffic control.

## Appendix A. MUTCD Signal Warrants

**MUTCD Volume-based Warrant Evaluation**  
**Tibet Road & 46th Avenue**  
**Short-term Total (2028)**



Major Street: Tibet Road  
 Lanes Moving Traffic: 2 or more  
 Approach Speed: 35 MPH

Minor Street: 46th Avenue  
 Lanes Moving Traffic: 1  
 Right Turn Volume Included: 50% EB

Option: Low speed, urban community

**WARRANT 1, Condition A - Minimum Vehicular Volume**

**100% Satisfied** No

	Vehicles per hour 100% (80%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	600 (480)	778	730	683	635	587	540	492	444
Highest Apprch. Minor Street	150 (120)	51	48	45	42	38	35	32	29

**WARRANT 1, Condition B - Interruption of Continuous Traffic**

**100% Satisfied** No

	Vehicles per hour 100% (80%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	900 (720)	778	730	683	635	587	540	492	444
Highest Apprch. Minor Street	75 (60)	51	48	45	42	38	35	32	29

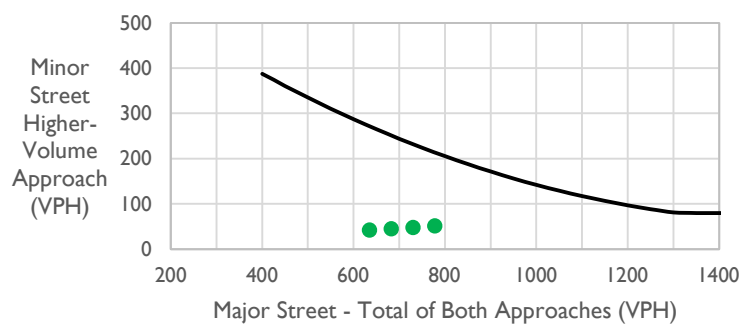
**WARRANT 1, Condition A and Condition B**

**80% Satisfied** No

**WARRANT 2, Four Hour Volume**

**100% Satisfied** No

	Both Apprchs. Major Street	Higher Vol. Apprch. Minor Street
Peak Hour	778	51
2nd Highest	730	48
3rd Highest	683	45
4th Highest	635	42



**MUTCD Volume-based Warrant Evaluation**  
**Tibet Road & 46th Avenue**  
**Long-term Total (2050)**



Major Street: Tibet Road  
 Lanes Moving Traffic: 2 or more  
 Approach Speed: 35 MPH

Minor Street: 46th Avenue  
 Lanes Moving Traffic: 1  
 Right Turn Volume Included: 50% EB

Option: Low speed, urban community

**WARRANT 1, Condition A - Minimum Vehicular Volume**

**100% Satisfied** No

	Vehicles per hour 100% (80%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	600 (480)	1090	1023	956	890	823	756	689	622
Highest Apprch. Minor Street	150 (120)	55	52	48	45	42	38	35	31

**WARRANT 1, Condition B - Interruption of Continuous Traffic**

**100% Satisfied** No

	Vehicles per hour 100% (80%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	900 (720)	1090	1023	956	890	823	756	689	622
Highest Apprch. Minor Street	75 (60)	55	52	48	45	42	38	35	31

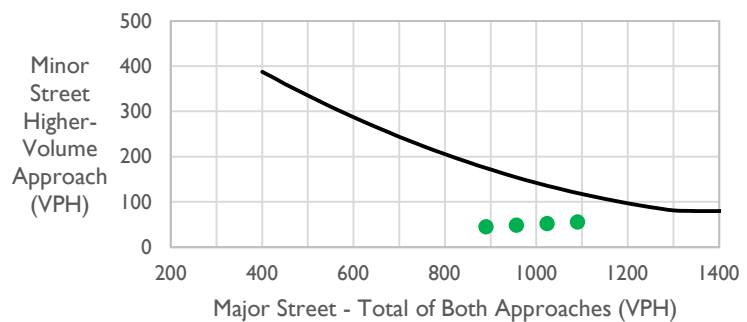
**WARRANT 1, Condition A and Condition B**

**80% Satisfied** No

**WARRANT 2, Four Hour Volume**

**100% Satisfied** No

	Both Apprchs. Major Street	Higher Vol. Apprch. Minor Street
Peak Hour	1090	55
2nd Highest	1023	52
3rd Highest	956	48
4th Highest	890	45



**MUTCD Volume-based Warrant Evaluation**  
**Site Drive #1 & 48th Avenue**  
**Short-term Total (2028)**



Major Street: 48th Avenue  
 Lanes Moving Traffic: 2 or more  
 Approach Speed: 45 MPH

Minor Street: Site Drive #1  
 Lanes Moving Traffic: 1  
 Right Turn Volume Included: 50% NB

Option: High speed major-street

**WARRANT 1, Condition A - Minimum Vehicular Volume**

70% Satisfied

No

	Vehicles per hour 70% (56%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	420 (336)	3275	3074	2874	2673	2472	2271	2071	1870
Highest Apprch. Minor Street	105 (84)	7	7	6	6	5	5	4	4

**WARRANT 1, Condition B - Interruption of Continuous Traffic**

70% Satisfied

No

	Vehicles per hour 70% (56%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	630 (504)	3275	3074	2874	2673	2472	2271	2071	1870
Highest Apprch. Minor Street	53 (42)	7	7	6	6	5	5	4	4

**WARRANT 1, Condition A and Condition B**

56% Satisfied

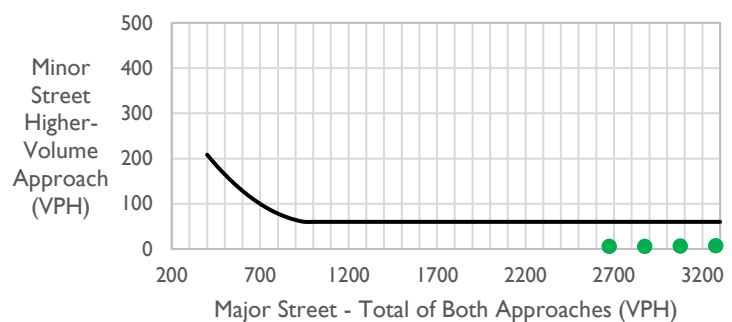
No

**WARRANT 2, Four Hour Volume**

70% Satisfied

No

	Both Apprchs. Major Street	Higher Vol. Apprch. Minor Street
Peak Hour	3275	7
2nd Highest	3074	7
3rd Highest	2874	6
4th Highest	2673	6



**MUTCD Volume-based Warrant Evaluation**  
**Site Drive #1 & 48th Avenue**  
**Long-term Total (2050)**



Major Street: 48th Avenue  
 Lanes Moving Traffic: 2 or more  
 Approach Speed: 45 MPH

Minor Street: Site Drive #1  
 Lanes Moving Traffic: 1  
 Right Turn Volume Included: 50% NB

Option: High speed major-street

**WARRANT 1, Condition A - Minimum Vehicular Volume**

70% Satisfied

No

	Vehicles per hour 70% (56%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	420 (336)	3730	3501	3273	3044	2816	2587	2358	2130
Highest Apprch. Minor Street	105 (84)	8	8	7	7	6	6	5	5

**WARRANT 1, Condition B - Interruption of Continuous Traffic**

70% Satisfied

No

	Vehicles per hour 70% (56%)	Peak Hour	2nd Highest	3rd Highest	4th Highest	5th Highest	6th Highest	7th Highest	8th Highest
Both Apprchs. Major Street	630 (504)	3730	3501	3273	3044	2816	2587	2358	2130
Highest Apprch. Minor Street	53 (42)	8	8	7	7	6	6	5	5

**WARRANT 1, Condition A and Condition B**

56% Satisfied

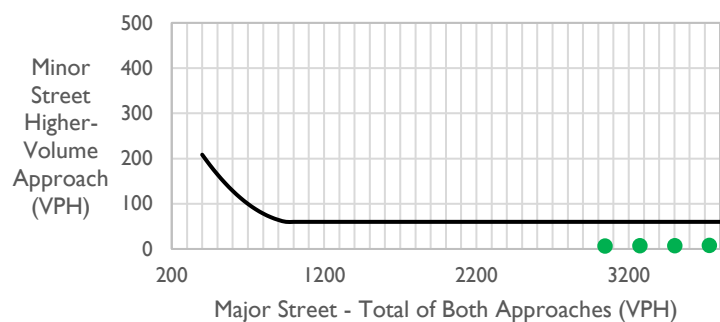
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**WARRANT 2, Four Hour Volume**

70% Satisfied

No

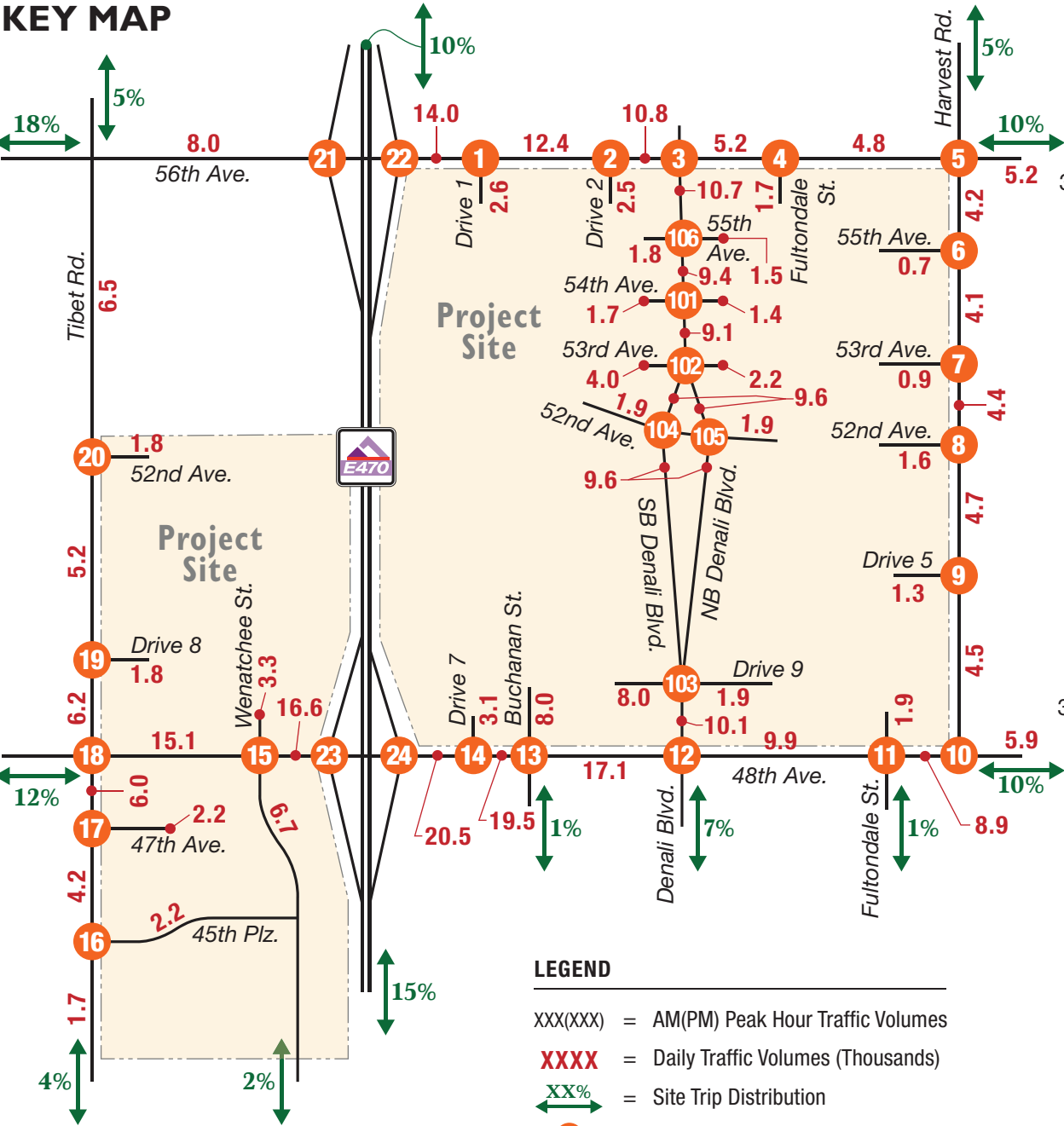
	Both Apprchs. Major Street	Higher Vol. Apprch. Minor Street
Peak Hour	3730	8
2nd Highest	3501	8
3rd Highest	3273	7
4th Highest	3044	7



## Appendix B. Site Traffic Studies of Nearby Developments

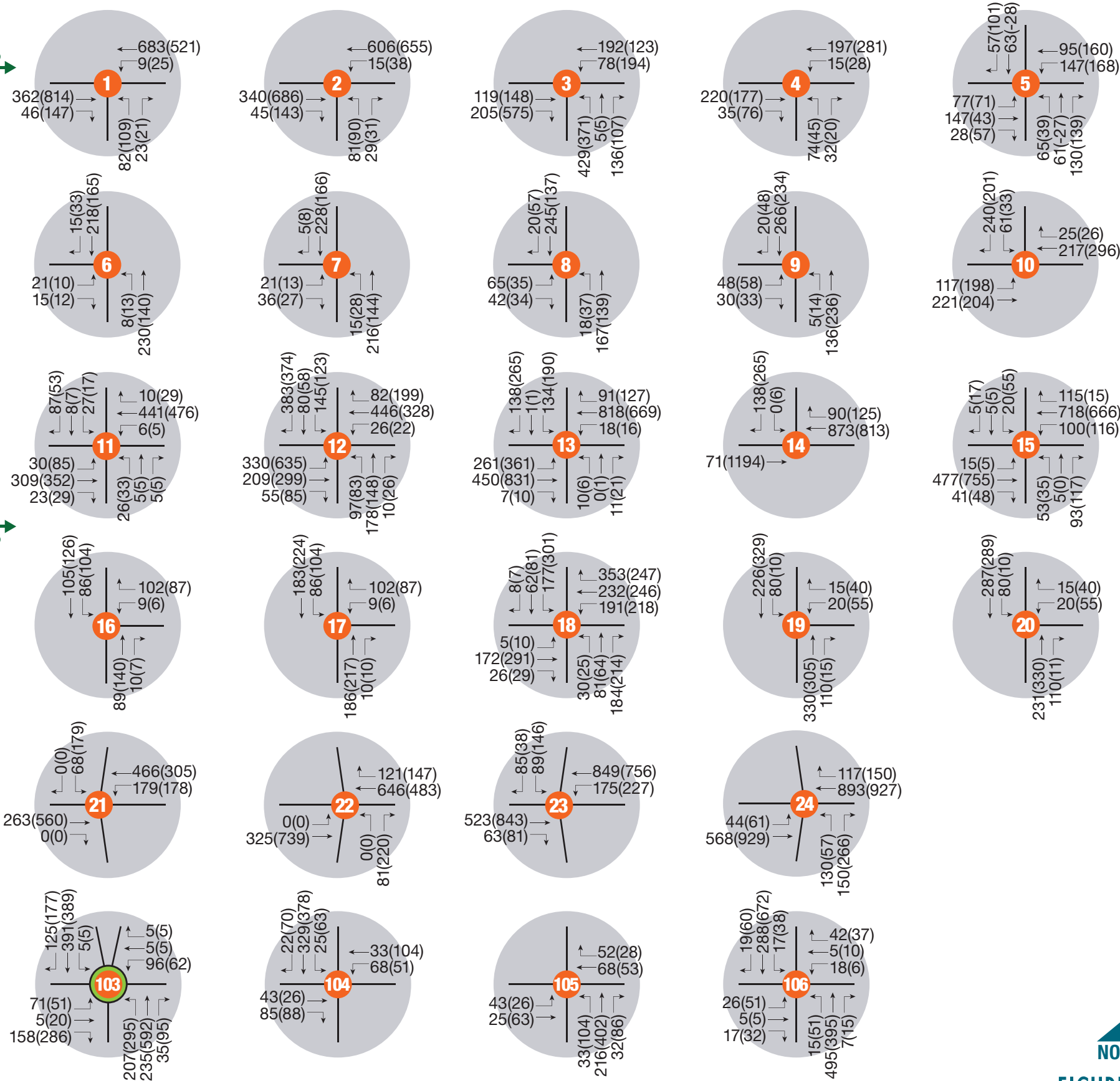


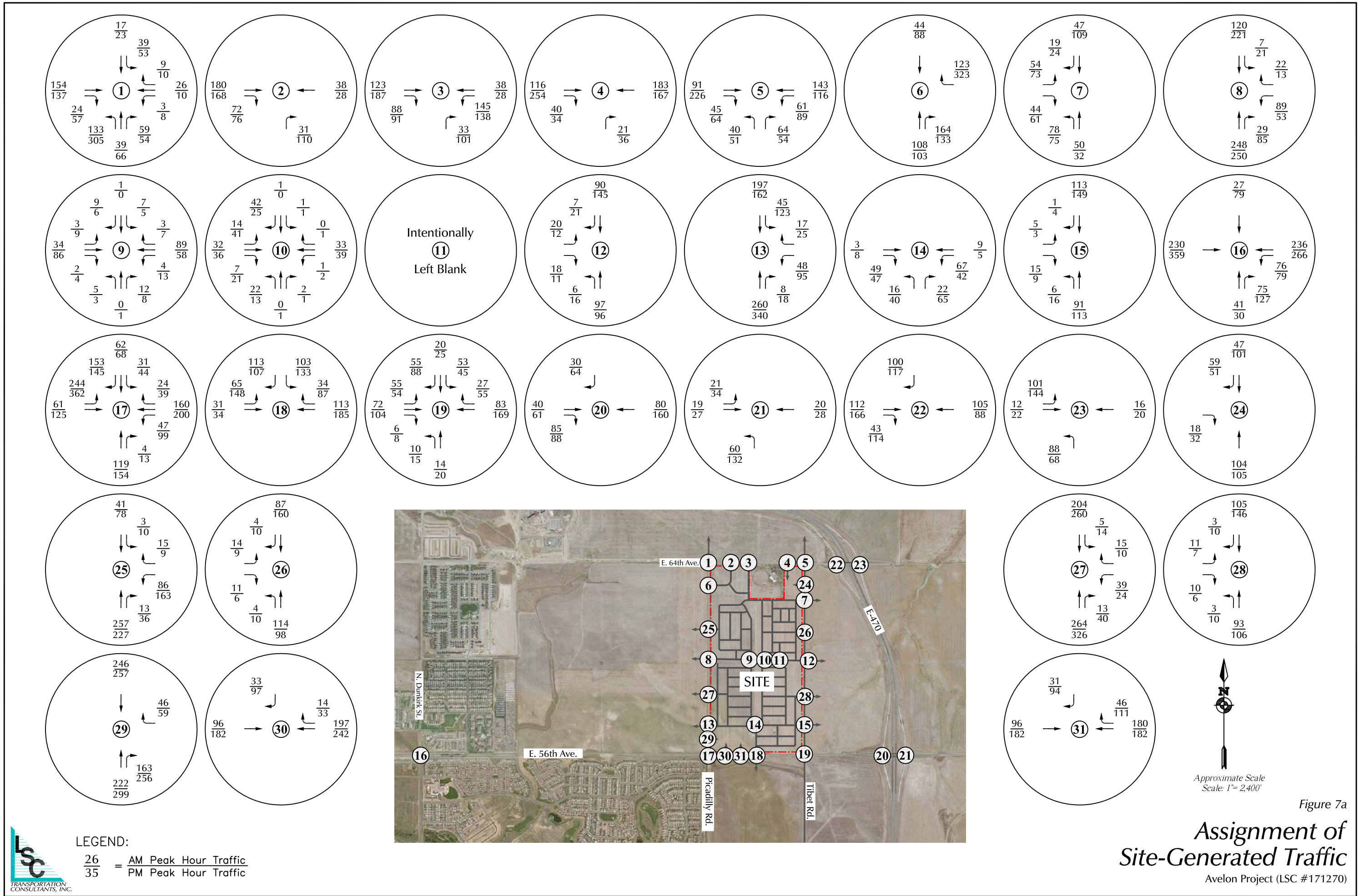
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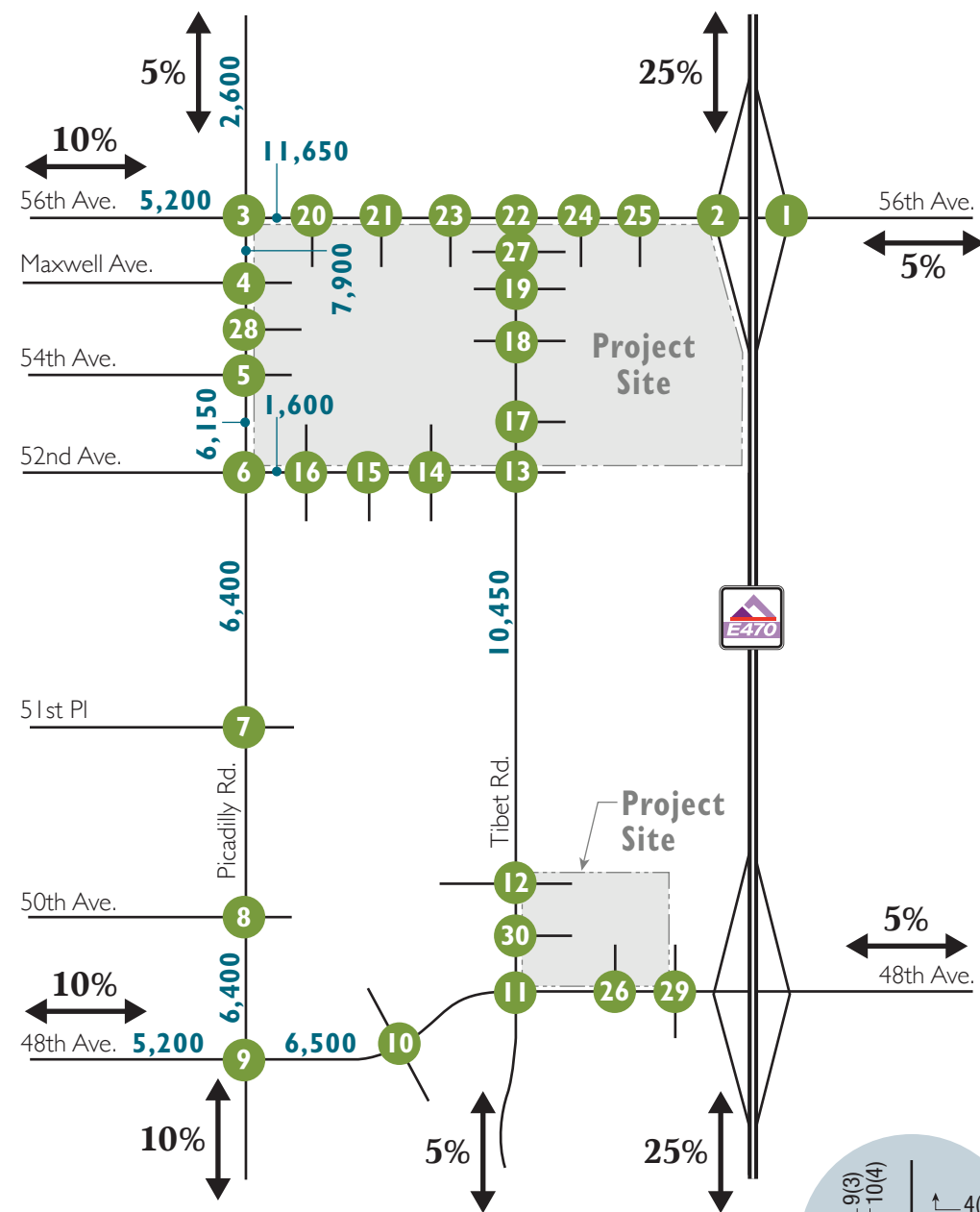


LEGEND

- XXX(XXX) = AM(PM) Peak Hour Traffic Volumes
- XXXX = Daily Traffic Volumes (Thousands)
- XX% = Site Trip Distribution
- X = Study Intersection
- = Roundabout





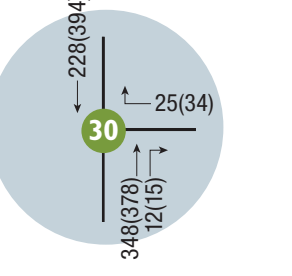
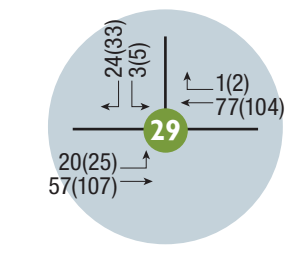
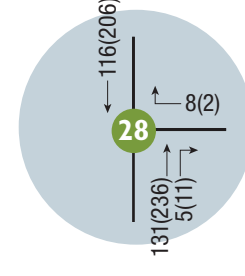
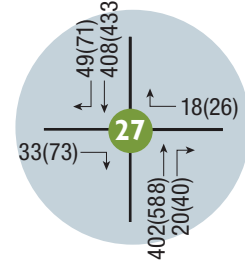
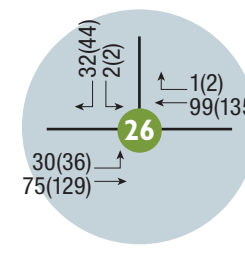
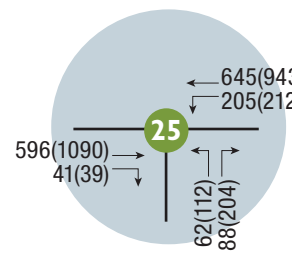
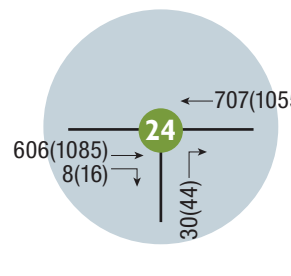
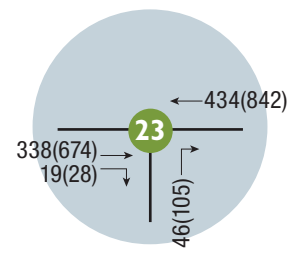
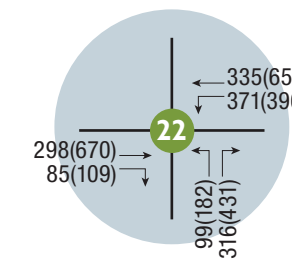
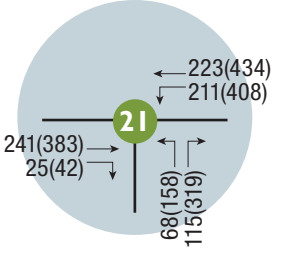
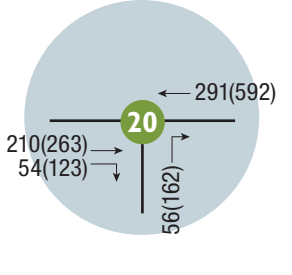
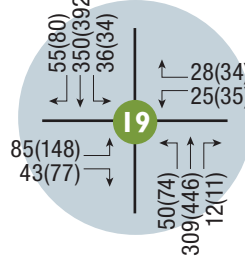
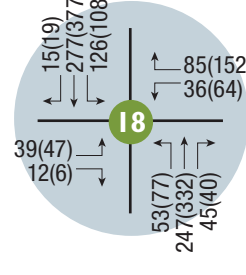
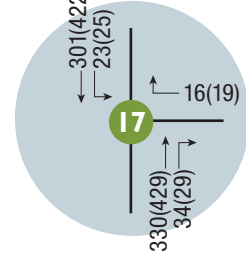
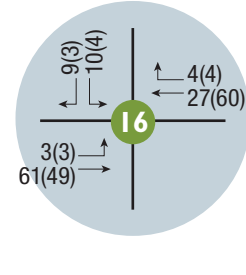
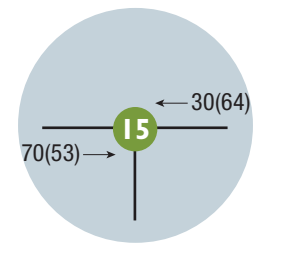
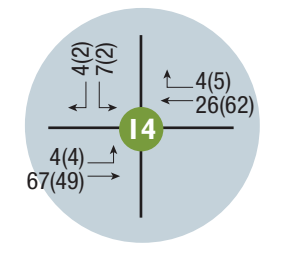
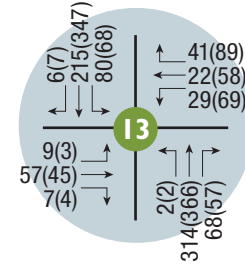
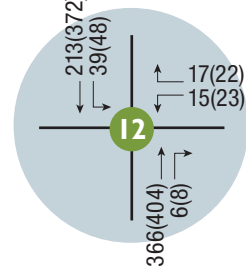
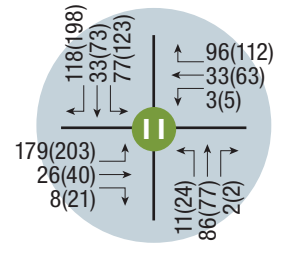
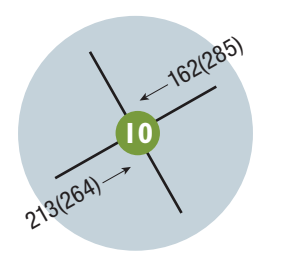
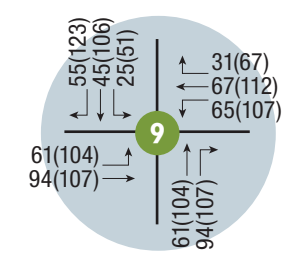
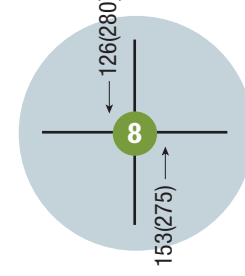
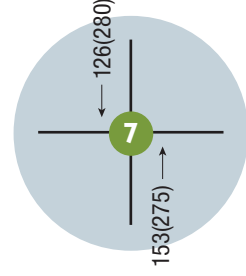
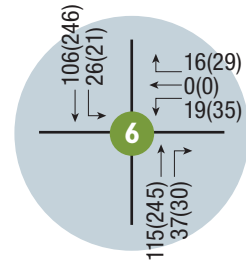
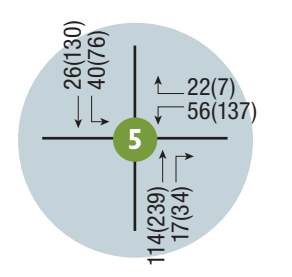
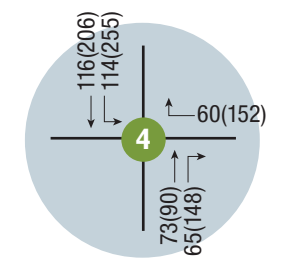
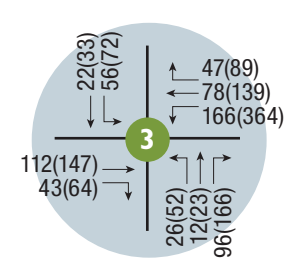
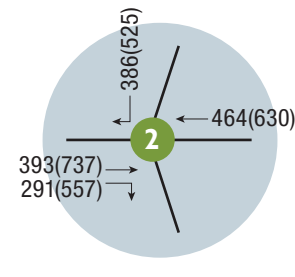
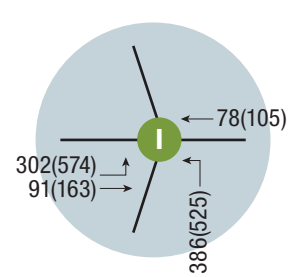


#### LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

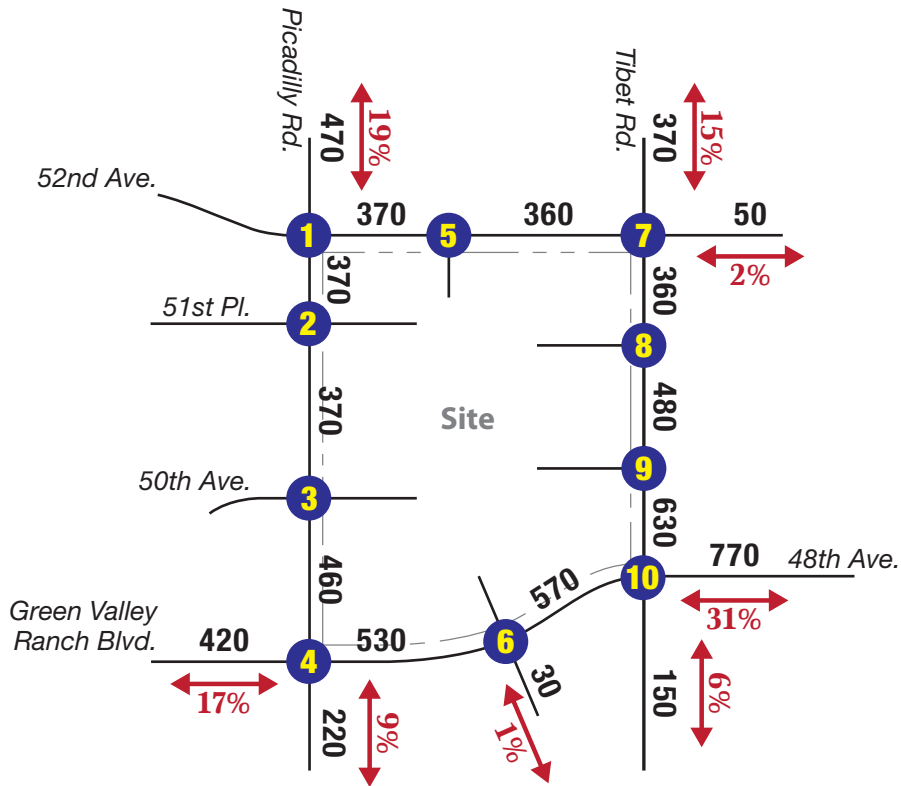
XXXX = Daily Traffic Volumes

XX% = Site Trip Distribution





## KEY MAP

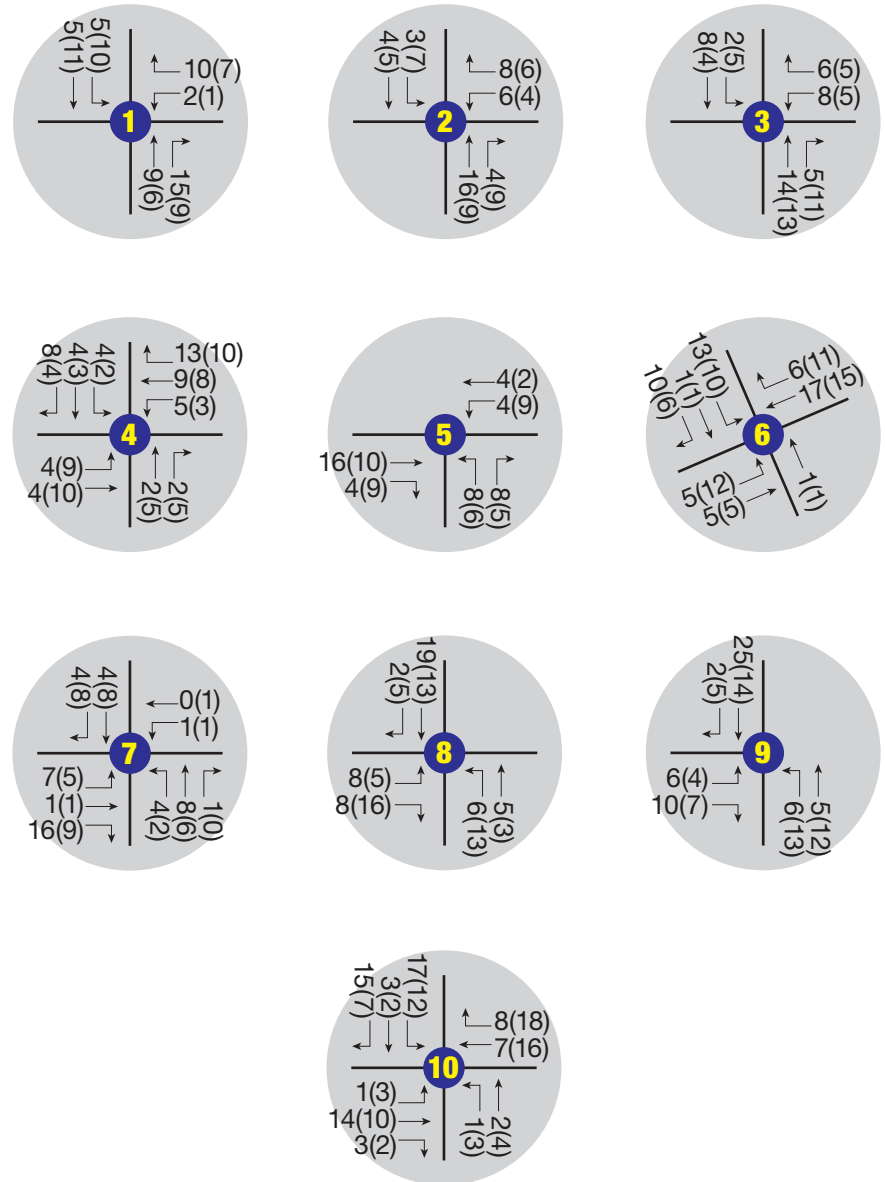


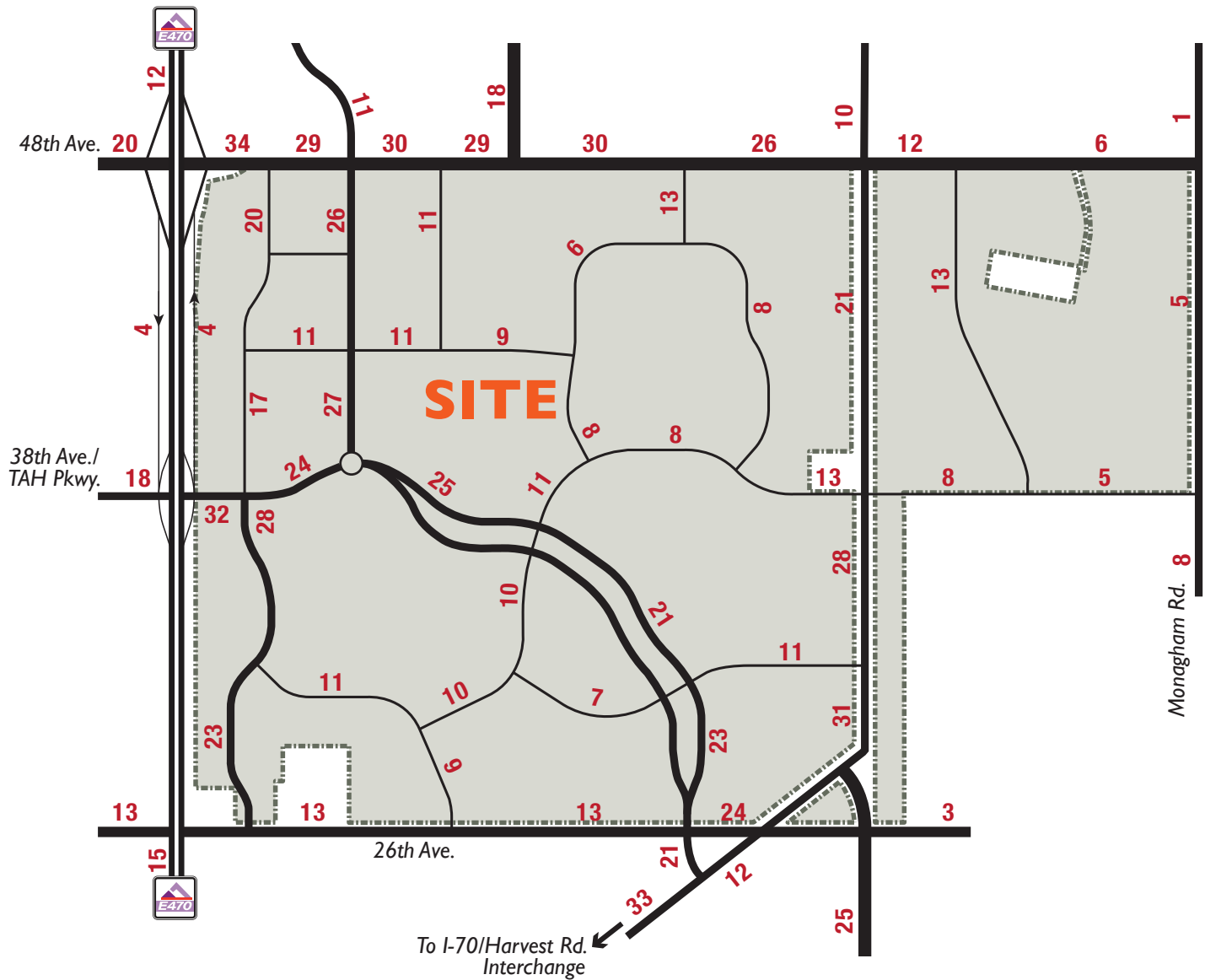
### LEGEND

xxx(xxx) = AM(PM) Peak Hour Traffic Volumes

XXXX = Daily Traffic Volumes

XX% = Site Trip Distribution





#### LEGEND

**XXXX** = Volumes in 1000's

**---** = Aurora Highlands



# Background Trips from Nearby Developments

## Windler

48th and Tibet

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
AM	5	172	26	191	232	353	30	81	184	177	62	8
PM	10	291	29	218	246	247	25	64	214	301	81	7

## Avelon Project

56th and Tibet

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
AM			6	0			10	14	0		20	
PM			8	0			15	20	0		25	

## 310 West

48th and Tibet

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
AM	179	26	8	3	33	96	11	86	2	77	33	118
PM	203	40	21	5	63	112	24	77	2	123	73	198

## Green Valley Ranch East

48th and Tibet

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
AM	1	14	3		7	8	1	2		17	3	15
PM	3	10	2		16	18	3	4		12	2	7

## Sum







48th and Tibet

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
AM	193	212	37	194	272	465	42	177	186	280	107	150
PM	228	341	52	223	325	389	52	157	216	447	167	223

## Appendix C. Analysis Worksheets – Short-Term Background (2028) Conditions

Lanes and Geometrics  
1: 48th Avenue









Short-term Background (2028)  
AM Peak Hour

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	0		0	0
Taper Length (ft)			25		25	
Lane Util. Factor	0.91	1.00	1.00	0.91	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	5085	0	0	5085	0	0
Flt Permitted						
Satd. Flow (perm)	5085	0	0	5085	0	0
Link Speed (mph)	45			45	30	
Link Distance (ft)	849			726	221	
Travel Time (s)	12.9			11.0	5.0	
Intersection Summary						
Area Type:	Other					



































Lanes and Geometrics  
16: Tibet Road

Short-term Background (2028)  
AM Peak Hour

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)	0	0	150			0
Storage Lanes	0	0	0			0
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	0	0	0	1863	1863	0
Flt Permitted						
Satd. Flow (perm)	0	0	0	1863	1863	0
Link Speed (mph)	30			35	35	
Link Distance (ft)	334			1262	967	
Travel Time (s)	7.6			24.6	18.8	
Intersection Summary						
Area Type:	Other					

Lanes and Geometrics  
18: Tibet Road & 48th Avenue

Short-term Background (2028)  
AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  					 	 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)	0%				0%				0%		0%	
Storage Length (ft)	275		300	420		275	275		100	275		150
Storage Lanes	2		1	2		1	1		1	2		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	1.00	1.00	1.00	0.97	0.95	0.95
Ped Bike Factor												
Frt			0.850				0.850		0.850		0.884	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	1770	1863	1583	3433	3129	0
Flt Permitted	0.950			0.950			0.284			0.950		
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	529	1863	1583	3433	3129	0
Right Turn on Red			Yes				Yes		Yes		Yes	
Satd. Flow (RTOR)			105				196		136		298	
Link Speed (mph)	45				45				35		40	
Link Distance (ft)	726				758				595		296	
Travel Time (s)	11.0				11.5				11.6		5.0	












Intersection Summary

Area Type: Other

Queues  
18: Tibet Road & 48th Avenue

Short-term Background (2028)

AM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	290	1676	105	184	1040	360	111	224	252	434	387
v/c Ratio	0.38	0.74	0.10	0.55	0.63	0.40	0.24	0.80	0.51	0.81	0.74
Control Delay	41.6	31.1	1.1	57.5	37.4	9.3	24.2	61.4	10.2	57.3	18.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.6	31.1	1.1	57.5	37.4	9.3	24.2	61.4	10.2	57.3	18.8
Queue Length 50th (ft)	99	405	0	71	261	69	44	124	27	167	38
Queue Length 95th (ft)	141	491	9	106	313	141	66	#227	63	#228	84
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	758	2265	1098	472	1640	901	463	318	553	562	946
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.74	0.10	0.39	0.63	0.40	0.24	0.70	0.46	0.77	0.41

Intersection Summary

























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

# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue







Short-term Background (2028)

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	267	1542	97	169	957	331	102	206	232	399	82	274
Future Volume (veh/h)	267	1542	97	169	957	331	102	206	232	399	82	274
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	290	1676	105	184	1040	360	111	224	252	434	89	298
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	931	2522	907	247	1511	696	199	264	337	496	367	327
Arrive On Green	0.27	0.49	0.49	0.07	0.30	0.30	0.08	0.14	0.14	0.14	0.21	0.21
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	290	1676	105	184	1040	360	111	224	252	434	89	298
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	8.0	29.7	0.9	6.3	21.6	2.5	3.0	14.0	12.1	14.8	5.0	22.0
Cycle Q Clear(g_c), s	8.0	29.7	0.9	6.3	21.6	2.5	3.0	14.0	12.1	14.8	5.0	22.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	931	2522	907	247	1511	696	199	264	337	496	367	327
V/C Ratio(X)	0.31	0.66	0.12	0.74	0.69	0.52	0.56	0.85	0.75	0.88	0.24	0.91
Avail Cap(c_a), veh/h	931	2522	907	475	1511	696	246	320	384	562	407	363
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.77	0.77	0.77	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.9	22.9	4.6	54.6	37.4	24.4	51.6	50.3	22.5	50.3	39.8	46.5
Incr Delay (d2), s/veh	0.2	1.4	0.3	3.4	2.0	2.1	2.4	16.4	6.9	13.2	0.3	24.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	11.4	0.6	2.8	8.9	7.5	3.3	7.7	4.9	7.2	2.2	10.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.1	24.3	4.8	58.1	39.4	26.5	54.0	66.7	29.4	63.6	40.1	71.4
LnGrp LOS	D	C	A	E	D	C	D	E	C	E	D	E
Approach Vol, veh/h	2071		1584				587		821			
Approach Delay, s/veh	24.8		38.6				48.3		63.9			
Approach LOS	C		D				D		E			
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	21.7	21.4	13.1	63.8	13.9	29.3	36.8	40.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	19.5	20.5	16.5	45.5	12.5	27.5	26.5	35.5				
Max Q Clear Time (g_c+I1), s	16.8	16.0	8.3	31.7	5.0	24.0	10.0	23.6				
Green Ext Time (p_c), s	0.5	0.9	0.3	9.2	0.1	0.7	0.8	6.1				
Intersection Summary												
HCM 6th Ctrl Delay			38.2									
HCM 6th LOS			D									









Lanes and Geometrics  
1: 48th Avenue

Short-term Background (2028)  
PM Peak Hour

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)		0	0		0	0
Storage Lanes		0	0		0	0
Taper Length (ft)			25		25	
Lane Util. Factor	0.91	1.00	1.00	0.91	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	5085	0	0	5085	0	0
Flt Permitted						
Satd. Flow (perm)	5085	0	0	5085	0	0
Link Speed (mph)	45			45	30	
Link Distance (ft)	849			726	221	
Travel Time (s)	12.9			11.0	5.0	
Intersection Summary						
Area Type:	Other					

Lanes and Geometrics  
16: Tibet Road

































Short-term Background (2028)  
PM Peak Hour

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12
Grade (%)	0%			0%	0%	
Storage Length (ft)	0	0	150			0
Storage Lanes	0	0	0			0
Taper Length (ft)	25		25			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	0	0	0	1863	1863	0
Flt Permitted						
Satd. Flow (perm)	0	0	0	1863	1863	0
Link Speed (mph)	30			35	35	
Link Distance (ft)	334			1262	967	
Travel Time (s)	7.6			24.6	18.8	
Intersection Summary						
Area Type:	Other					

Lanes and Geometrics  
18: Tibet Road & 48th Avenue

Short-term Background (2028)

PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	  		 	  					 	 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)	0%		0%				0%		0%			
Storage Length (ft)	275		300	420		275	275		100	275		150
Storage Lanes	2		1	2		1	1		1	2		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	1.00	1.00	1.00	0.97	0.95	0.95
Ped Bike Factor												
Frt			0.850				0.850		0.850		0.883	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	5085	1583	3433	5085	1583	1770	1863	1583	3433	3125	0
Flt Permitted	0.950			0.950			0.342			0.950		
Satd. Flow (perm)	3433	5085	1583	3433	5085	1583	637	1863	1583	3433	3125	0
Right Turn on Red			Yes				Yes		Yes		Yes	
Satd. Flow (RTOR)			95				130		95		331	
Link Speed (mph)	45				45				35		40	
Link Distance (ft)	726				758				595		296	
Travel Time (s)	11.0				11.5				11.6		5.0	












Intersection Summary

Area Type: Other

Queues  
18: Tibet Road & 48th Avenue

Short-term Background (2028)

PM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	292	1533	57	201	964	628	73	241	111	370	511
v/c Ratio	0.77	0.73	0.07	0.49	0.45	0.65	0.39	0.80	0.19	0.69	0.48
Control Delay	66.1	33.5	0.7	49.9	22.2	6.5	52.1	71.3	9.1	44.4	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.1	33.5	0.7	49.9	22.2	6.5	52.1	71.3	9.1	44.4	6.0
Queue Length 50th (ft)	114	385	0	83	164	22	56	190	10	137	11
Queue Length 95th (ft)	#172	450	5	122	189	69	104	275	45	179	21
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	391	2086	835	414	2138	992	202	349	571	594	1089
Starvation Cap Reductn	0	0	0	0	0	1	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.73	0.07	0.49	0.45	0.63	0.36	0.69	0.19	0.62	0.47

Intersection Summary

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



























# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue

Short-term Background (2028)

PM Peak Hour












												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	269	1410	52	185	887	578	67	222	102	340	102	368
Future Volume (veh/h)	269	1410	52	185	887	578	67	222	102	340	102	368
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	292	1533	57	201	964	628	73	241	111	370	111	400
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	349	1894	666	556	2200	951	148	279	492	584	477	426
Arrive On Green	0.10	0.37	0.37	0.05	0.14	0.14	0.05	0.15	0.15	0.06	0.09	0.09
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	292	1533	57	201	964	628	73	241	111	370	111	400
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	10.0	32.4	1.4	6.7	20.7	17.4	4.5	15.1	0.0	12.6	7.0	30.1
Cycle Q Clear(g_c), s	10.0	32.4	1.4	6.7	20.7	17.4	4.5	15.1	0.0	12.6	7.0	30.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	349	1894	666	556	2200	951	148	279	492	584	477	426
V/C Ratio(X)	0.84	0.81	0.09	0.36	0.44	0.66	0.49	0.86	0.23	0.63	0.23	0.94
Avail Cap(c_a), veh/h	389	1894	666	556	2200	951	216	351	552	590	481	429
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	0.89	0.89	0.89	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	53.0	33.9	8.3	50.9	38.2	13.4	47.9	49.9	30.7	53.0	43.2	53.7
Incr Delay (d2), s/veh	13.6	3.9	0.3	0.4	0.6	3.2	2.5	16.5	0.2	2.2	0.2	28.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	8.5	19.4	1.0	5.4	14.3	11.9	3.7	13.0	4.2	10.0	5.7	22.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	66.6	37.8	8.5	51.2	38.8	16.6	50.4	66.3	30.9	55.2	43.4	82.3
LnGrp LOS	E	D	A	D	D	B	D	E	C	E	D	F
Approach Vol, veh/h	1882			1793			425			881		
Approach Delay, s/veh	41.4			32.4			54.4			66.0		
Approach LOS	D			C			D			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	24.8	22.4	23.8	49.0	10.4	36.7	16.6	56.2				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	20.5	22.5	14.5	44.5	10.5	32.5	13.5	45.5				
Max Q Clear Time (g_c+I1), s	14.6	17.1	8.7	34.4	6.5	32.1	12.0	22.7				
Green Ext Time (p_c), s	0.7	0.8	0.3	6.7	0.0	0.1	0.2	9.5				
Intersection Summary												
HCM 6th Ctrl Delay	43.6											
HCM 6th LOS	D											

## Appendix D. Analysis Worksheets – Long-Term Background (2050) Conditions

Queues  
18: Tibet Road & 48th Avenue

Long-term Background (2050)

AM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	348	1793	109	261	1299	652	103	255	299	549	408
v/c Ratio	0.46	0.88	0.10	0.65	0.86	0.75	0.21	0.88	0.56	0.91	0.75
Control Delay	42.9	39.7	1.2	58.4	46.7	24.5	23.9	71.6	12.5	65.1	21.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.9	39.7	1.2	58.4	46.7	24.5	23.9	71.6	12.5	65.1	21.1
Queue Length 50th (ft)	121	468	0	100	348	316	41	151	41	219	49
Queue Length 95th (ft)	168	#569	11	142	409	479	64	#323	89	#326	98
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	758	2040	1055	472	1512	875	486	302	561	602	944
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.88	0.10	0.55	0.86	0.75	0.21	0.84	0.53	0.91	0.43

Intersection Summary

























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

# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue

Long-term Background (2050)












AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	320	1650	100	240	1195	600	95	235	275	505	115	260
Future Volume (veh/h)	320	1650	100	240	1195	600	95	235	275	505	115	260
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	348	1793	109	261	1299	652	103	255	299	549	125	283
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	793	2202	879	325	1511	740	279	288	393	590	358	319
Arrive On Green	0.23	0.43	0.43	0.09	0.30	0.30	0.12	0.15	0.15	0.06	0.07	0.07
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	348	1793	109	261	1299	652	103	255	299	549	125	283
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	10.4	36.9	1.2	8.9	28.8	24.2	2.2	16.0	13.1	19.0	8.1	21.3
Cycle Q Clear(g_c), s	10.4	36.9	1.2	8.9	28.8	24.2	2.2	16.0	13.1	19.0	8.1	21.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	793	2202	879	325	1511	740	279	288	393	590	358	319
V/C Ratio(X)	0.44	0.81	0.12	0.80	0.86	0.88	0.37	0.89	0.76	0.93	0.35	0.89
Avail Cap(c_a), veh/h	793	2202	879	475	1511	740	279	304	407	590	407	363
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	0.20	0.20	0.20	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.6	29.9	4.8	53.3	39.9	29.0	46.4	49.8	19.5	55.9	48.5	54.6
Incr Delay (d2), s/veh	0.4	3.4	0.3	1.3	1.4	3.4	0.8	24.7	8.0	21.4	0.6	20.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	14.9	0.6	3.8	11.7	7.4	2.8	9.4	5.3	10.5	3.8	10.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.0	33.3	5.1	54.6	41.3	32.4	47.3	74.4	27.4	77.3	49.1	75.2
LnGrp LOS	D	C	A	D	D	C	D	E	C	E	D	E
Approach Vol, veh/h	2250			2212			657			957		
Approach Delay, s/veh	33.0			40.3			48.8			73.0		
Approach LOS	C			D			D			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	25.0	23.0	15.8	56.3	19.3	28.7	32.0	40.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	20.5	19.5	16.5	45.5	12.5	27.5	26.5	35.5				
Max Q Clear Time (g_c+I1), s	21.0	18.0	10.9	38.9	4.2	23.3	12.4	30.8				
Green Ext Time (p_c), s	0.0	0.4	0.4	5.3	0.1	0.9	1.0	3.7				
Intersection Summary												
HCM 6th Ctrl Delay	43.7											
HCM 6th LOS	D											

Queues  
18: Tibet Road & 48th Avenue

Long-term Background (2050)

PM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	299	1853	103	315	1239	783	103	299	250	603	593
v/c Ratio	0.84	0.97	0.13	0.82	0.64	0.83	0.50	0.92	0.43	0.93	0.54
Control Delay	73.9	52.8	2.3	59.4	24.7	14.3	54.6	85.0	23.8	60.6	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay	73.9	52.8	2.3	59.4	24.7	14.5	54.6	85.0	23.8	60.6	11.1
Queue Length 50th (ft)	119	515	0	134	235	107	79	238	128	240	21
Queue Length 95th (ft)	#192	#634	19	#200	326	545	136	#399	195	#352	55
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	357	1901	786	386	1947	945	212	333	578	647	1098
Starvation Cap Reductn	0	0	0	0	0	7	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.97	0.13	0.82	0.64	0.83	0.49	0.90	0.43	0.93	0.54

Intersection Summary

























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

# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue

Long-term Background (2050)

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	275	1705	95	290	1140	720	95	275	230	555	170	375
Future Volume (veh/h)	275	1705	95	290	1140	720	95	275	230	555	170	375
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	299	1853	103	315	1239	783	103	299	250	603	185	408
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	352	1894	694	402	1967	908	179	328	462	648	526	469
Arrive On Green	0.10	0.37	0.37	0.04	0.13	0.13	0.07	0.18	0.18	0.06	0.10	0.10
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	299	1853	103	315	1239	783	103	299	250	603	185	408
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	10.2	43.0	2.8	10.8	27.6	27.4	6.2	18.8	2.0	20.8	11.7	30.5
Cycle Q Clear(g_c), s	10.2	43.0	2.8	10.8	27.6	27.4	6.2	18.8	2.0	20.8	11.7	30.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	352	1894	694	402	1967	908	179	328	462	648	526	469
V/C Ratio(X)	0.85	0.98	0.15	0.78	0.63	0.86	0.58	0.91	0.54	0.93	0.35	0.87
Avail Cap(c_a), veh/h	360	1894	694	402	1967	908	216	335	468	648	526	469
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	0.68	0.68	0.68	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	53.0	37.3	8.7	56.2	44.3	19.5	46.0	48.6	35.7	55.5	43.4	51.8
Incr Delay (d2), s/veh	16.8	16.2	0.5	6.8	1.1	7.5	2.9	27.8	1.2	20.2	0.4	16.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	8.9	27.0	2.1	8.4	17.6	17.7	5.2	16.7	10.2	17.0	9.4	21.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.8	53.5	9.1	63.0	45.3	27.0	48.9	76.4	37.0	75.7	43.8	67.8
LnGrp LOS	E	D	A	E	D	C	D	E	D	E	D	E
Approach Vol, veh/h	2255			2337			652			1196		
Approach Delay, s/veh	53.6			41.6			56.9			68.1		
Approach LOS	D			D			E			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	27.0	25.5	18.5	49.0	12.5	40.0	16.7	50.7				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	22.5	21.5	13.5	44.5	10.5	33.5	12.5	45.5				
Max Q Clear Time (g_c+I1), s	22.8	20.8	12.8	45.0	8.2	32.5	12.2	29.6				
Green Ext Time (p_c), s	0.0	0.2	0.1	0.0	0.0	0.4	0.0	10.1				
Intersection Summary												
HCM 6th Ctrl Delay	52.3											
HCM 6th LOS	D											





## Appendix E. Analysis Worksheets – Short-Term Total (2028) Conditions

HCM 6th TWSC  
1: Site Drive #1 & 48th Avenue

Short-term Total (2028)  
AM Peak Hour












Intersection						
Int Delay, s/veh	0.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑		↗
Traffic Vol, veh/h	1906	11	0	1358	0	14
Future Vol, veh/h	1906	11	0	1358	0	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2072	12	0	1476	0	15
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	-	1042
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	-	0	194
Stage 1	-	-	0	-	0	-
Stage 2	-	-	0	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	-	194
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0		25.1	
HCM LOS	D					
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT		
Capacity (veh/h)	194	-	-	-		
HCM Lane V/C Ratio	0.078	-	-	-		
HCM Control Delay (s)	25.1	-	-	-		
HCM Lane LOS	D	-	-	-		
HCM 95th %tile Q(veh)	0.3	-	-	-		



Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	39	28	7	465	293	9
Future Vol, veh/h	39	28	7	465	293	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	30	8	505	318	10
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	844	323	328	0	-	0
Stage 1	323	-	-	-	-	-
Stage 2	521	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	*429	*847	*1267	-	-	-
Stage 1	*798	-	-	-	-	-
Stage 2	*653	-	-	-	-	-
Platoon blocked, %	1	1	1	-	-	-
Mov Cap-1 Maneuver	*427	*847	*1267	-	-	-
Mov Cap-2 Maneuver	*517	-	-	-	-	-
Stage 1	*793	-	-	-	-	-
Stage 2	*653	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	11.6	0.1		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	* 1267	-	618	-	-	
HCM Lane V/C Ratio	0.006	-	0.118	-	-	
HCM Control Delay (s)	7.9	-	11.6	-	-	
HCM Lane LOS	A	-	B	-	-	
HCM 95th %tile Q(veh)	0	-	0.4	-	-	
Notes						
~: Volume exceeds capacity		\$: Delay exceeds 300s		+: Computation Not Defined		*: All major volume in platoon

Queues  
18: Tibet Road & 48th Avenue

Short-term Total (2028)  
AM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	297	1685	105	189	1040	360	138	230	261	434	391
v/c Ratio	0.39	0.75	0.10	0.56	0.64	0.40	0.30	0.80	0.52	0.82	0.74
Control Delay	41.7	31.6	1.1	57.5	37.6	9.9	26.6	62.4	10.6	57.8	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	31.6	1.1	57.5	37.6	9.9	26.6	62.4	10.6	57.8	18.7
Queue Length 50th (ft)	102	409	0	73	261	74	56	130	29	168	39
Queue Length 95th (ft)	144	497	10	108	313	147	81	#265	65	#228	84
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	758	2250	1093	472	1631	893	462	318	557	559	948
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.75	0.10	0.40	0.64	0.40	0.30	0.72	0.47	0.78	0.41

























Intersection Summary

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

# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue

Short-term Total (2028)  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	273	1550	97	174	957	331	127	212	240	399	86	274
Future Volume (veh/h)	273	1550	97	174	957	331	127	212	240	399	86	274
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	297	1685	105	189	1040	360	138	230	261	434	93	298
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	921	2499	904	252	1511	696	204	269	344	496	367	327
Arrive On Green	0.27	0.49	0.49	0.07	0.30	0.30	0.08	0.14	0.14	0.14	0.21	0.21
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	297	1685	105	189	1040	360	138	230	261	434	93	298
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	8.3	30.2	0.9	6.4	21.6	2.5	4.9	14.4	12.5	14.8	5.3	22.0
Cycle Q Clear(g_c), s	8.3	30.2	0.9	6.4	21.6	2.5	4.9	14.4	12.5	14.8	5.3	22.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	921	2499	904	252	1511	696	204	269	344	496	367	327
V/C Ratio(X)	0.32	0.67	0.12	0.75	0.69	0.52	0.68	0.85	0.76	0.88	0.25	0.91
Avail Cap(c_a), veh/h	921	2499	904	475	1511	696	246	320	386	562	407	363
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.77	0.77	0.77	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.3	23.3	4.6	54.5	37.4	24.4	51.9	50.1	22.3	50.3	39.9	46.5
Incr Delay (d2), s/veh	0.2	1.5	0.3	3.4	2.0	2.1	5.5	17.3	7.6	13.2	0.4	24.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	6.2	17.2	1.0	5.1	13.2	11.4	7.6	12.6	8.8	11.6	4.1	16.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.5	24.8	4.9	58.0	39.4	26.5	57.4	67.5	29.9	63.6	40.2	71.3
LnGrp LOS	D	C	A	E	D	C	E	E	C	E	D	E
Approach Vol, veh/h	2087		1589				629		825			
Approach Delay, s/veh	25.3		38.7				49.6		63.7			
Approach LOS	C		D				D		E			
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	21.7	21.8	13.3	63.2	14.2	29.3	36.5	40.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	19.5	20.5	16.5	45.5	12.5	27.5	26.5	35.5				
Max Q Clear Time (g_c+I1), s	16.8	16.4	8.4	32.2	6.9	24.0	10.3	23.6				
Green Ext Time (p_c), s	0.5	0.9	0.3	9.0	0.1	0.7	0.9	6.1				
Intersection Summary												
HCM 6th Ctrl Delay			38.6									
HCM 6th LOS			D									

HCM 6th TWSC  
1: Site Drive #1 & 48th Avenue






Short-term Total (2028)  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑↓			↑↑↑		↑
Traffic Vol, veh/h	1731	34	0	1338	0	10
Future Vol, veh/h	1731	34	0	1338	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1882	37	0	1454	0	11

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	-	-	960
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	-	221
Stage 1	-	-	0	-	-
Stage 2	-	-	0	-	-
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	221
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	22.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	221	-	-	-
HCM Lane V/C Ratio	0.049	-	-	-
HCM Control Delay (s)	22.1	-	-	-
HCM Lane LOS	C	-	-	-
HCM 95th %tile Q(veh)	0.2	-	-	-

Intersection						
Int Delay, s/veh	0.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	26	17	22	331	269	28
Future Vol, veh/h	26	17	22	331	269	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	28	18	24	360	292	30












Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	715	307	322	0	-	0
Stage 1	307	-	-	-	-	-
Stage 2	408	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	503	854	1267	-	-	-
Stage 1	809	-	-	-	-	-
Stage 2	731	-	-	-	-	-
Platoon blocked, %	1	1	1	-	-	-
Mov Cap-1 Maneuver	493	854	1267	-	-	-
Mov Cap-2 Maneuver	571	-	-	-	-	-
Stage 1	793	-	-	-	-	-
Stage 2	731	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.9	0.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1267	-	657	-	-
HCM Lane V/C Ratio	0.019	-	0.071	-	-
HCM Control Delay (s)	7.9	-	10.9	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

Queues  
18: Tibet Road & 48th Avenue

Short-term Total (2028)  
PM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	297	1539	57	218	964	628	90	246	117	370	515
v/c Ratio	0.78	0.74	0.07	0.53	0.45	0.65	0.45	0.80	0.20	0.69	0.52
Control Delay	67.1	33.9	0.7	51.0	22.4	6.7	53.5	71.5	9.7	44.3	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.1	33.9	0.7	51.0	22.4	6.7	53.5	71.5	9.7	44.3	7.1
Queue Length 50th (ft)	117	390	0	91	164	171	68	193	12	137	12
Queue Length 95th (ft)	#177	452	5	130	189	71	120	279	52	179	22
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	389	2072	832	414	2125	986	210	349	575	594	1079
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.74	0.07	0.53	0.45	0.64	0.43	0.70	0.20	0.62	0.48

























Intersection Summary

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

# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue

Short-term Total (2028)  
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	273	1416	52	201	887	578	83	226	108	340	106	368
Future Volume (veh/h)	273	1416	52	201	887	578	83	226	108	340	106	368
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	297	1539	57	218	964	628	90	246	117	370	115	400
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	354	1894	683	520	2139	945	167	284	479	612	477	426
Arrive On Green	0.10	0.37	0.37	0.05	0.14	0.14	0.06	0.15	0.15	0.06	0.09	0.09
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	297	1539	57	218	964	628	90	246	117	370	115	400
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	10.1	32.6	1.4	7.3	20.8	16.6	5.6	15.4	0.0	12.5	7.2	30.1
Cycle Q Clear(g_c), s	10.1	32.6	1.4	7.3	20.8	16.6	5.6	15.4	0.0	12.5	7.2	30.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	354	1894	683	520	2139	945	167	284	479	612	477	426
V/C Ratio(X)	0.84	0.81	0.08	0.42	0.45	0.66	0.54	0.87	0.24	0.60	0.24	0.94
Avail Cap(c_a), veh/h	389	1894	683	520	2139	945	216	351	536	612	481	429
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	0.89	0.89	0.89	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.9	34.0	8.0	51.9	39.0	13.1	48.0	49.7	31.6	52.4	43.3	53.7
Incr Delay (d2), s/veh	14.1	3.9	0.2	0.5	0.6	3.3	2.7	17.1	0.3	1.7	0.3	28.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	8.6	19.5	1.0	5.9	14.4	11.5	4.6	13.3	4.5	10.0	6.0	22.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	67.0	37.9	8.3	52.4	39.6	16.3	50.7	66.8	31.8	54.1	43.5	82.3
LnGrp LOS	E	D	A	D	D	B	D	E	C	D	D	F
Approach Vol, veh/h	1893			1810			453			885		
Approach Delay, s/veh	41.6			33.1			54.6			65.4		
Approach LOS	D			C			D			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	25.8	22.7	22.5	49.0	11.7	36.7	16.8	54.8				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	20.5	22.5	14.5	44.5	10.5	32.5	13.5	45.5				
Max Q Clear Time (g_c+l1), s	14.5	17.4	9.3	34.6	7.6	32.1	12.1	22.8				
Green Ext Time (p_c), s	0.7	0.8	0.3	6.6	0.0	0.1	0.1	9.4				
Intersection Summary												
HCM 6th Ctrl Delay	43.9											
HCM 6th LOS	D											

## Appendix F. Analysis Worksheets – Long-Term Total (2050) Conditions



HCM 6th TWSC  
1: Site Drive #1 & 48th Avenue





Long-term Total (2050)  
AM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑		↑
Traffic Vol, veh/h	2070	11	0	1575	0	14
Future Vol, veh/h	2070	11	0	1575	0	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2250	12	0	1712	0	15

Major/Minor	Major1	Major2	Minor1	
Conflicting Flow All	0	0	-	1131
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	0	169
Stage 1	-	0	0	-
Stage 2	-	0	0	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	169
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-












Approach	EB	WB	NB
HCM Control Delay, s	0	0	28.4
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	169	-	-	-
HCM Lane V/C Ratio	0.09	-	-	-
HCM Control Delay (s)	28.4	-	-	-
HCM Lane LOS	D	-	-	-
HCM 95th %tile Q(veh)	0.3	-	-	-

Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	39	28	7	530	400	9
Future Vol, veh/h	39	28	7	530	400	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	42	30	8	576	435	10
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1032	440	445	0	-	0
Stage 1	440	-	-	-	-	-
Stage 2	592	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	258	617	1115	-	-	-
Stage 1	649	-	-	-	-	-
Stage 2	553	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	256	617	1115	-	-	-
Mov Cap-2 Maneuver	387	-	-	-	-	-
Stage 1	644	-	-	-	-	-
Stage 2	553	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	14.3	0.1		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1115	-	458	-	-	
HCM Lane V/C Ratio	0.007	-	0.159	-	-	
HCM Control Delay (s)	8.3	-	14.3	-	-	
HCM Lane LOS	A	-	B	-	-	
HCM 95th %tile Q(veh)	0	-	0.6	-	-	

Queues  
18: Tibet Road & 48th Avenue

Long-term Total (2050)  
AM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	353	1804	109	266	1299	652	130	266	310	549	413
v/c Ratio	0.47	0.89	0.10	0.66	0.86	0.75	0.27	0.90	0.58	0.91	0.75
Control Delay	43.0	40.6	1.2	58.6	47.1	25.2	26.3	76.4	13.2	65.4	21.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.0	40.6	1.2	58.6	47.1	25.2	26.3	76.4	13.2	65.4	21.5
Queue Length 50th (ft)	123	472	0	102	348	321	53	166	46	219	51
Queue Length 95th (ft)	170	#592	11	145	409	485	79	#345	90	#326	100
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	758	2029	1053	472	1504	868	487	302	564	601	945
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.89	0.10	0.56	0.86	0.75	0.27	0.88	0.55	0.91	0.44

























Intersection Summary

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

# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue

Long-term Total (2050)  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	325	1660	100	245	1195	600	120	245	285	505	120	260
Future Volume (veh/h)	325	1660	100	245	1195	600	120	245	285	505	120	260
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	353	1804	109	266	1299	652	130	266	310	549	130	283
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	778	2172	876	330	1511	740	287	296	402	590	358	319
Arrive On Green	0.23	0.43	0.43	0.10	0.30	0.30	0.13	0.16	0.16	0.06	0.07	0.07
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	353	1804	109	266	1299	652	130	266	310	549	130	283
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	10.6	37.7	1.2	9.1	28.8	24.2	3.9	16.7	13.5	19.0	8.4	21.3
Cycle Q Clear(g_c), s	10.6	37.7	1.2	9.1	28.8	24.2	3.9	16.7	13.5	19.0	8.4	21.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	778	2172	876	330	1511	740	287	296	402	590	358	319
V/C Ratio(X)	0.45	0.83	0.12	0.81	0.86	0.88	0.45	0.90	0.77	0.93	0.36	0.89
Avail Cap(c_a), veh/h	778	2172	876	475	1511	740	287	304	409	590	407	363
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	0.20	0.20	0.20	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.1	30.6	4.8	53.2	39.9	29.0	46.5	49.6	19.2	55.9	48.6	54.6
Incr Delay (d2), s/veh	0.4	3.9	0.3	1.4	1.4	3.4	1.1	27.2	8.6	21.4	0.6	20.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	7.9	21.7	1.1	5.3	14.3	9.4	6.4	15.2	9.4	15.9	7.1	16.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.5	34.5	5.1	54.6	41.3	32.4	47.6	76.8	27.9	77.3	49.3	75.1
LnGrp LOS	D	C	A	D	D	C	D	E	C	E	D	E
Approach Vol, veh/h	2266					2217		706		962		
Approach Delay, s/veh	34.0					40.3		49.9		72.9		
Approach LOS	C					D		D		E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	25.0	23.5	16.0	55.6	19.8	28.7	31.5	40.0				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	20.5	19.5	16.5	45.5	12.5	27.5	26.5	35.5				
Max Q Clear Time (g_c+I1), s	21.0	18.7	11.1	39.7	5.9	23.3	12.6	30.8				
Green Ext Time (p_c), s	0.0	0.2	0.4	4.7	0.2	0.9	1.0	3.7				
Intersection Summary												
HCM 6th Ctrl Delay			44.2									
HCM 6th LOS			D									

HCM 6th TWSC  
1: Site Drive #1 & 48th Avenue






Long-term Total (2050)  
PM Peak Hour

Intersection						
Int Delay, s/veh	0.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑			↑↑↑		↑
Traffic Vol, veh/h	2070	34	0	1625	0	10
Future Vol, veh/h	2070	34	0	1625	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2250	37	0	1766	0	11

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	- - - 1144
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	- 0 166
Stage 1	-	- 0	- 0 -
Stage 2	-	- 0	- 0 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	- - - 166
Mov Cap-2 Maneuver	-	-	- - -
Stage 1	-	-	- - -
Stage 2	-	-	- - -

Approach	EB	WB	NB
HCM Control Delay, s	0	0	28.2
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	166	-	-	-
HCM Lane V/C Ratio	0.065	-	-	-
HCM Control Delay (s)	28.2	-	-	-
HCM Lane LOS	D	-	-	-
HCM 95th %tile Q(veh)	0.2	-	-	-

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	26	17	22	540	485	28
Future Vol, veh/h	26	17	22	540	485	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	28	18	24	587	527	30












Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1177	542	557	0	-	0
Stage 1	542	-	-	-	-	-
Stage 2	635	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	211	540	1014	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	528	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	206	540	1014	-	-	-
Mov Cap-2 Maneuver	344	-	-	-	-	-
Stage 1	569	-	-	-	-	-
Stage 2	528	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.1	0.3	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1014	-	402	-	-
HCM Lane V/C Ratio	0.024	-	0.116	-	-
HCM Control Delay (s)	8.6	-	15.1	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	-	-

Queues  
18: Tibet Road & 48th Avenue

Long-term Total (2050)  
PM Peak Hour

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	304	1864	103	337	1239	783	125	304	261	603	609
v/c Ratio	0.81	0.98	0.13	0.87	0.65	0.84	0.60	0.93	0.45	0.93	0.55
Control Delay	69.0	54.7	2.3	64.8	25.6	15.3	58.7	86.3	24.4	60.6	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Delay	69.0	54.7	2.3	64.8	25.6	15.5	58.7	86.3	24.4	60.6	11.5
Queue Length 50th (ft)	120	519	0	144	248	106	95	241	134	240	22
Queue Length 95th (ft)	#184	#640	19	#221	338	#550	158	#405	205	#352	58
Internal Link Dist (ft)		646			678			515			216
Turn Bay Length (ft)	275		300	420		275	275		100	275	
Base Capacity (vph)	386	1895	784	386	1908	933	214	333	579	647	1099
Starvation Cap Reductn	0	0	0	0	0	6	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.98	0.13	0.87	0.65	0.84	0.58	0.91	0.45	0.93	0.55

Intersection Summary

























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

# HCM 6th Signalized Intersection Summary

## 18: Tibet Road & 48th Avenue

Long-term Total (2050)

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	1715	95	310	1140	720	115	280	240	555	185	375
Future Volume (veh/h)	280	1715	95	310	1140	720	115	280	240	555	185	375
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	304	1864	103	337	1239	783	125	304	261	603	201	408
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	360	1894	713	395	1946	901	201	332	462	648	507	452
Arrive On Green	0.10	0.37	0.37	0.04	0.13	0.13	0.08	0.18	0.18	0.06	0.09	0.09
Sat Flow, veh/h	3456	5106	1585	3456	5106	1585	1781	1870	1585	3456	1777	1585
Grp Volume(v), veh/h	304	1864	103	337	1239	783	125	304	261	603	201	408
Grp Sat Flow(s),veh/h/ln	1728	1702	1585	1728	1702	1585	1781	1870	1585	1728	1777	1585
Q Serve(g_s), s	10.4	43.4	2.7	11.6	27.7	27.5	7.6	19.2	3.0	20.8	12.8	30.6
Cycle Q Clear(g_c), s	10.4	43.4	2.7	11.6	27.7	27.5	7.6	19.2	3.0	20.8	12.8	30.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	360	1894	713	395	1946	901	201	332	462	648	507	452
V/C Ratio(X)	0.84	0.98	0.14	0.85	0.64	0.87	0.62	0.92	0.56	0.93	0.40	0.90
Avail Cap(c_a), veh/h	389	1894	713	395	1946	901	216	335	465	648	507	452
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	0.68	0.68	0.68	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	52.8	37.4	8.2	56.7	44.6	19.7	46.3	48.5	36.0	55.5	44.6	52.7
Incr Delay (d2), s/veh	14.8	17.3	0.4	11.7	1.1	7.9	4.9	28.9	1.6	20.2	0.5	20.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	8.8	27.4	2.0	9.3	17.6	17.9	6.5	17.1	10.6	17.0	10.2	22.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	67.6	54.7	8.6	68.4	45.7	27.6	51.1	77.4	37.6	75.7	45.1	73.6
LnGrp LOS	E	D	A	E	D	C	D	E	D	E	D	E
Approach Vol, veh/h	2271			2359			690			1212		
Approach Delay, s/veh	54.3			42.9			57.6			69.9		
Approach LOS	D			D			E			E		
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	27.0	25.8	18.2	49.0	14.0	38.8	17.0	50.2				
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5				
Max Green Setting (Gmax), s	22.5	21.5	13.5	44.5	10.5	33.5	13.5	44.5				
Max Q Clear Time (g_c+I1), s	22.8	21.2	13.6	45.4	9.6	32.6	12.4	29.7				
Green Ext Time (p_c), s	0.0	0.1	0.0	0.0	0.0	0.4	0.1	9.6				
Intersection Summary												
HCM 6th Ctrl Delay	53.5											
HCM 6th LOS	D											



## Appendix G. LOS & Delay Table

Intersection	Movement	AM LOS (Delay) / PM LOS (delay)			
		Short Term Background	Long Term Background	Short Term Total	Long Term Total
48th Avenue & Tibet Road	NB Left-turn	d (54) / d (50.4)	d (47.3) / d (48.9)	e (57.4) / d (50.7)	d (47.6) / d (51.1)
	NB Through	e (66.7) / e (66.3)	e (74.4) / e (76.4)	e (67.5) / e (66.8)	e (76.8) / e (77.4)
	NB Right-turn	c (29.4) / c (30.9)	c (27.4) / d (37)	c (29.2) / c (31.8)	c (27.9) / d (37.6)
	EB Left-turn**	d (35.1) / e (66.6)	d (40) / e (69.8)	d (35.5) / e (67)	d (40.5) / e (67.6)
	EB Through	c (24.3) / d (37.8)	c (33.3) / d (53.5)	c (24.8) / d (37.9)	c (34.5) / d (54.7)
	EB Right-turn	a (4.8) / a (8.5)	a (5.1) / a (9.1)	a (4.9) / a (8.3)	a (5.1) / a (8.6)
	WVB Left-turn**	e (58.1) / d (51.2)	d (54.6) / e (63)	e (58) / d (52.4)	d (54.6) / e (68.4)
	WVB Through	d (39.4) / d (38.8)	d (41.3) / d (45.3)	d (39.4) / d (39.6)	d (41.3) / d (45.7)
	WVB Right-turn	c (26.5) / b (16.6)	c (32.4) / c (27)	c (26.5) / b (16.3)	c (32.4) / c (27.6)
	SB Left-turn**	e (63.6) / e (55.2)	e (77.3) / e (75.7)	e (63.6) / d (54.1)	e (77.8) / e (75.7)
	SB Through	d (40.1) / d (43.4)	d (49.1) / d (43.8)	d (40.2) / d (43.5)	d (49.3) / d (45.1)
46th Avenue & Tibet Road	EB Left/Right	N/A	N/A	b (11.6) / b (10.9)	b (14.3) / c (15.1)
	NB Left	N/A	N/A	a (7.9) / a (7.9)	a (8.3) / a (8.6)
48th Avenue & Site Drive (RIRO)	NB Left	N/A	N/A	d (25.1) / c (22.1)	d (28.4) / d (28.2)