

TRAFFIC IMPACT ANALYSIS

ATEC

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I. INTRODUCTION

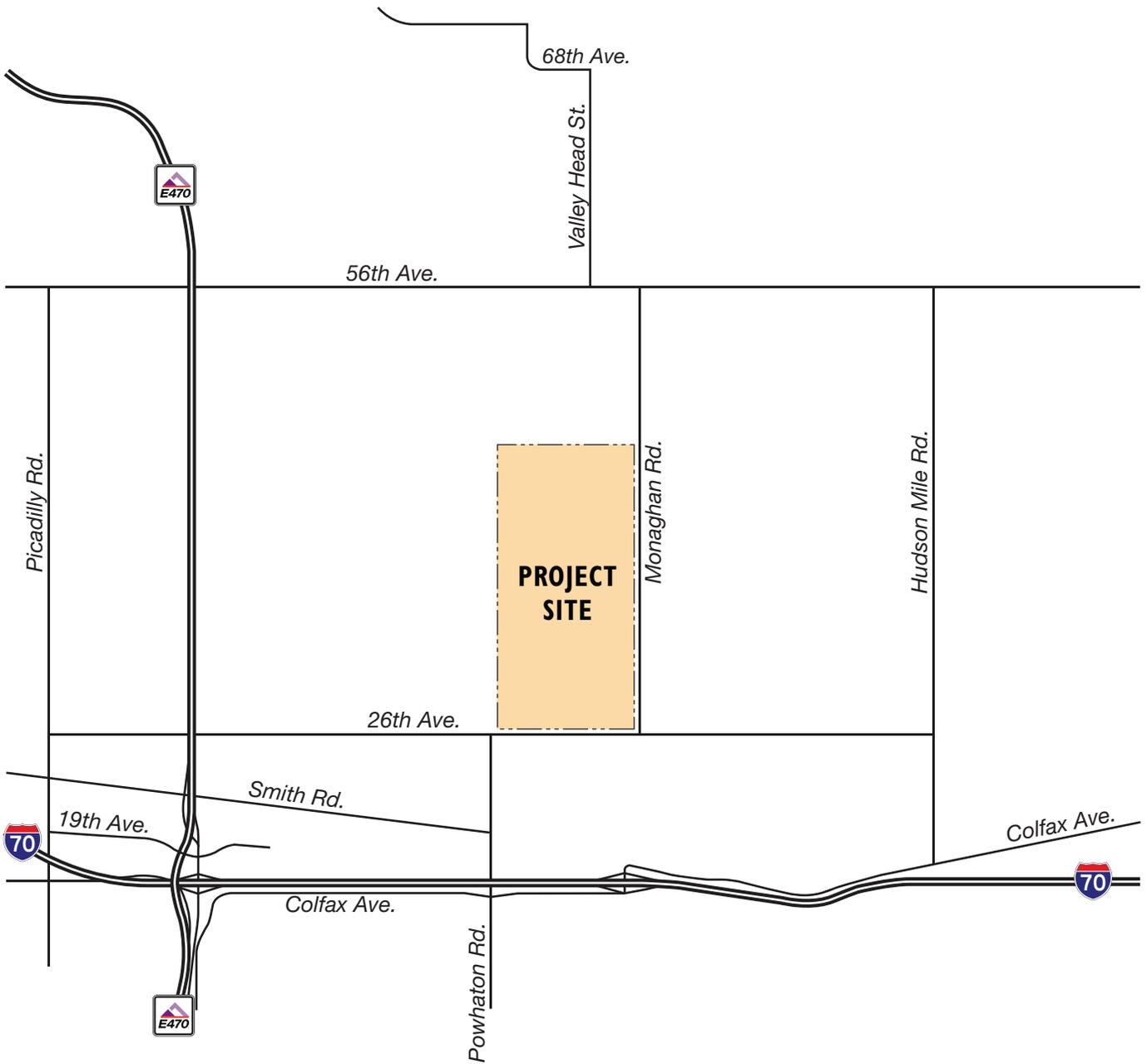
The ATEC development is an approximate 1141.9-acre master plan development proposal located between Peña Boulevard and Interstate 70 (I-70) in Aurora, as shown on **Figure 1**. The uses will consist primarily of commercial, industrial and mixed use, with 14 million square feet of developed space. It should be noted that the northern portion of this parcel was included in the previous traffic analysis for the Aurora Highlands, completed in August 2018. Build-out of this Framework Development Plan (FDP) will take many years to complete, likely well beyond the 2040 horizon of this analysis.

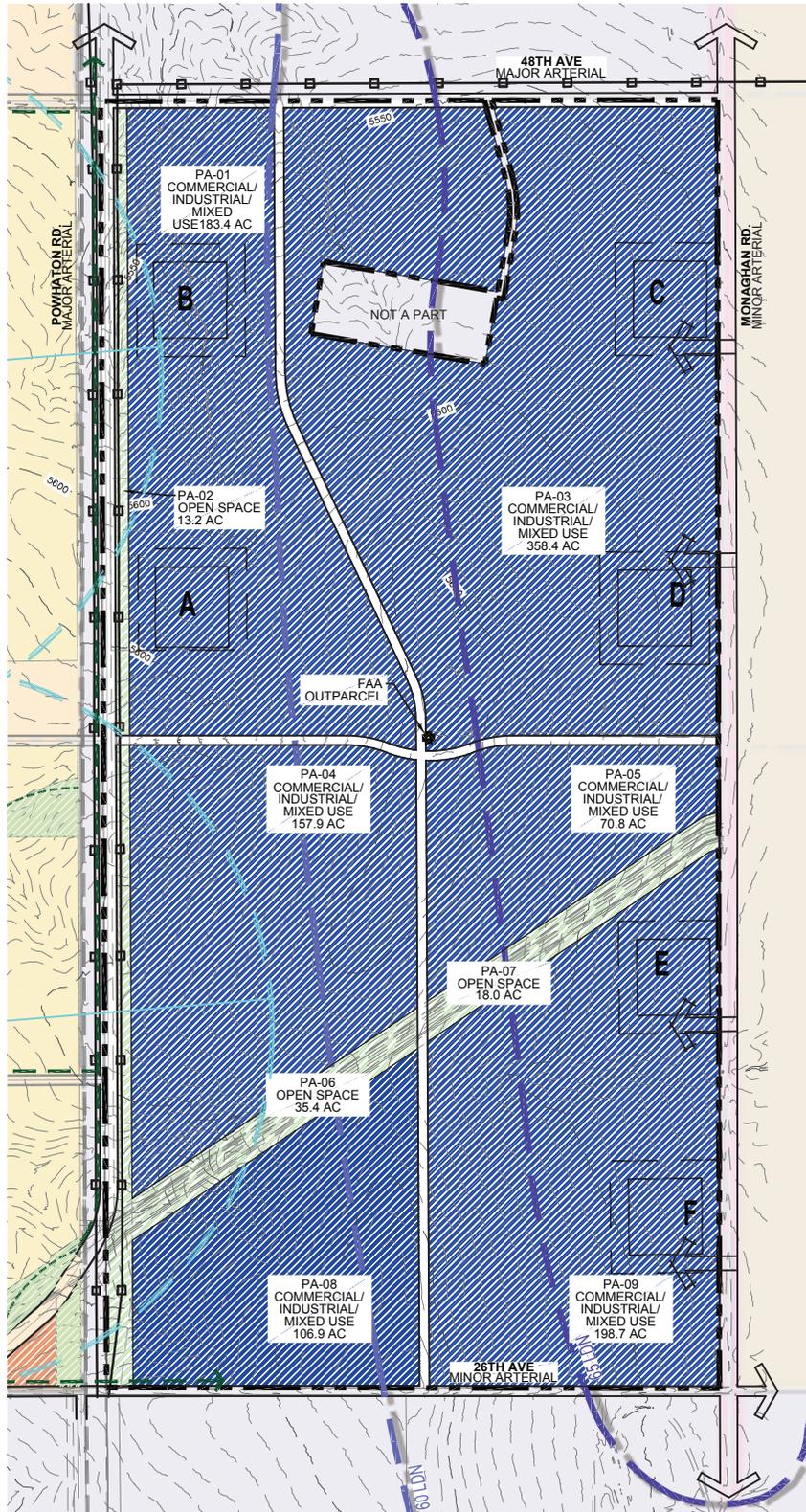
The site is rectangular in shape and bounded on the south by 26th Avenue and 48th Avenue on the north. A future extension of Powhatan Road to the north would serve as the western boundary of the development, and Monaghan Road will serve as the eastern boundary of the site. **Figure 2** illustrates the proposed FDP site plan. A total of seven parcels are identified for development, bisected by an interior roadway network. Exact alignments will be determined at the time of Contextual Site Plan (CSP), but roadway connection intentions are presented for the FDP's planning areas, consistent with the City's Roadways Design and Technical Criteria manual per Section 4.04.1.

Currently, access into the area is very limited. In this undeveloped portion of Adams County, 56th Avenue and 26th Avenue are the primary means of access to the property. 56th Avenue provides a direct connection to E-470 to the west. Powhatan Road provides a connection to E. Colfax Avenue to the south, which provides a direct connection to I-70 approximately 0.9 mile to the east.

The purpose of this study is to assess the traffic impacts on the boundary roadways (arterials and minor arterials) related to the proposed development and support projected traffic volumes. This report includes information on existing traffic conditions, vehicle-trips associated with the planned development, total traffic volume projections, and recommendations on future roadway needs including supporting analysis for roadway classifications. The focus of this analysis is on the long-term timeframe, year 2040, using the recently completed *Aurora Northeast Area Transportation Study (NEATS) Refresh Transportation Plan* as a means of developing background traffic along study area roadways. While other nearby master transportation plans (including the Aurora Highlands FDP) are considered in this study, the foundation of which 2040 traffic forecasts (for background traffic) are developed in this report are primarily based on results of the NEATS effort and modeling with some consideration of these other master plans in progress.

There is currently very little development in the area; however, other master plan developments are currently being planned. A short-term timeframe was not specifically analyzed in this study because of the numerous variables associated with the surrounding development and the timing of that development. The long-term (year 2040) timeframe is the focus of this study realizing that a roadway improvement phasing plan (in conjunction with other development) will be needed to serve this and the adjoining FDPs.





II. EXISTING CONDITIONS

II.A. Land Use

Currently, the site is undeveloped and lies entirely within the Aurora City Limits. The area that immediately surrounds this 1142 acres is also largely undeveloped. Green Valley Ranch is a nearby residential area to the west (west of Picadilly Road), and the Majestic Commerce Center is an industrial/warehouse area located immediately south of Green Valley Ranch. Just east of E-470 near the 38th Avenue land line, the E-470 Authority owns and operates an office building and maintenance facility near Toll Plaza C. Various other small commercial developments exist along I-70 directly south of the master plan, but there is little development near the ATEC master plan site.

II.B. Transportation Network

Roadways

Key roadways that currently serve the site include the following:

- **E-470** is a north-south four-lane tollway that is located 2 miles to the west of the proposed development. A grade-separated interchange is provided at 56th Avenue. An interchange is planned at 48th Avenue where the bridge over E-470 at 48th Avenue is in place (the roadway connecting to it is not yet built, nor are the ramps). The Aurora Highlands study identified an interchange at 38th Avenue in conjunction with one-way frontage roads flanking E-470 and connecting with a future 48th Avenue interchange.
- **26th Avenue** is a minor two-lane roadway facility along the south side of the ATEC development that crosses E-470 (no interchange) and runs for 7 miles, from Picadilly Road to the west and Watkins Road to the east.
- **Powhatan Road** is a two-lane road that extends south from 26th Avenue as a two-lane facility, crossing the Union Pacific Railroad (UPRR) at-grade, spanning I-70, and extending south approximately 5 miles to Jewell Avenue. The northern extension of Powhatan Road north of 26th Avenue will ultimately define the west side of the development.
- **Monaghan Road** is an existing two-lane road that will be the eastern boundary for the proposed development. Monaghan Road runs for 3 miles from 26th Street to 56th Street.

A key future roadway worth noting is Harvest Road. Ultimately, Harvest Road will serve as the primary entrance north into DEN, continuing south of the site winding east to the Powhatan alignments, and connecting to I-70 via an interchange. The planned roadway network through the area contains many of the elements identified in the current NEATS study, but the roadway plan also reflects more detail with respect to internal collector roadways.

Traffic Volumes and Operations

Since the area in the immediate vicinity of the ATEC FDP is undeveloped, there is very little existing traffic on the roadway network. A spot check of the most recent counts on the county roadways surrounding the development indicate that volumes are typically under 1,000 vehicles per day (VPD). On I-70 near the Powhatan Road alignment, approximately 27,000 VPD were observed in 2018.

III. FUTURE ROADWAY NETWORK

In 2018, the City of Aurora completed the *NEATS Refresh* study. This study provides Year 2040 and regional build-out transportation recommendations for the roadways and a multimodal transportation system. The NEATS study area encompassed a regional area extending from approximately between Tower Road east to Schumaker Road, and from Jewell Avenue on the south to 72nd Avenue on the north. Recommendations with respect to the ATEC FDP include:

- **26th Avenue** would be designated as a four-lane minor arterial plus turn lanes. The grade separation over E-470 would be maintained to the west, and 26th Avenue would continue to end at Watkins Road to the east. Signalized and roundabout intersections would be allowed at one-eighth to one-half mile spacing with other public or private access usually restricted to right-in, right-out intersections.
- **38th Avenue** would be a two-lane collector street with turn lanes as required that would provide access through the ATEC development, from Monaghan Road through Powhatan Road and into the adjacent Aurora Highlands development. Signalized, roundabout and stop-controlled intersections would be allowed at one-eighth mile spacing with some restrictions on other public or private access intersections.
- **48th Avenue** would be designated as a four-lane major arterial with turn lanes between Monaghan Road and Powhatan Road. East of Powhatan Road, 48th Avenue would be widened to provide a six-lane major arterial with turn lanes through the interchange with E-470 and to the intersection with Picadilly Road. At-grade signalized intersections would be allowed at one-eighth to one-half mile spacing with other public or private access usually restricted to right-in/right-out intersections.
- **Powhatan Road** would be designated as a six-lane major arterial with turn lanes along the western boundary of the ATEC FDP, from 26th Avenue to 48th Avenue. North of 48th Avenue, the designation would be reduced to a four-lane minor arterial with turn lanes. To the south of 26th Avenue, the designation would remain as a major arterial with turn lanes, but the cross section would be reduced to a four-lane section. A new grade separation over the UPRR would be constructed and the existing grade separation over I-70 would remain. At-grade signalized intersections would be allowed at one-half mile spacing with other public or private access usually restricted to right-in, right-out intersections.
- **Monaghan Road**, immediately adjacent to the ATEC FDP, would be designated as a four-lane minor arterial with turn lanes from 26th Street north to 64th Avenue. To the south, Monaghan Road would be extended as a four-lane major arterial with turn lanes to include a grade separation over the UPRR and tie into the existing interchange with I-70. South of the interstate, Monaghan Road would continue as a four-lane major arterial to Jewell Avenue. Signalized and roundabout intersections would be allowed at one-eighth to one-half mile spacing with other public or private access usually restricted to right-in, right-out intersections.
- **Harvest Road** is proposed to be a six-lane major arterial with turn lanes from its current northern terminus at East 6th Avenue, continuing north through a new interchange with I-70, a grade separation over the UPRR and its transition to the northeast to tie into Powhatan Road near the intersection with 26th Avenue as indicated in the current *NEATS Refresh*. Given the diagonal roadway south of 26th Avenue that will lead to the I-70/Harvest Road interchange, more analysis will be needed to determine an optimal configuration of the 26th Avenue/ Powhatan Road intersection area given the five "legs" planned to intersect there. At-grade signalized intersections would be allowed at one-half mile spacing with other public or private access usually restricted to right-in, right-out intersections.

IV. FUTURE PROJECTED CONDITIONS

This traffic study assesses the traffic conditions and impacts associated with the full build out of the master plan. The intent is to assess the lane configuration of the major roadway network adjacent to the FDP and the collector roads planned to be built within. The build-out scenario assesses year 2040 conditions consistent with the *NEATS Refresh*. The long-term analysis assesses the road system given daily traffic projections and peak hour traffic projections at the perimeter roadways, and incorporates the potential of ATEC being built out to its maximum density (and the remainder of the area is represented from the *NEATS Refresh 2040*). As individual parcels develop, a more refined traffic impact study may be appropriate to assess access specifics and/or to update information presented in this report.

Traffic projections shown in this study are based on the premise that ATEC would be built out to its maximum allowed densities per the FDP proposal. Traffic demands associated with the remainder of the area and region are based on raw travel demand modeling results associated with NEATS. Resulting projections shown here will be greater than those in NEATS since this study considers the maximum buildout potential of ATEC, whereas the *NEATS Refresh* considered a much less intense 2040 development completion level.

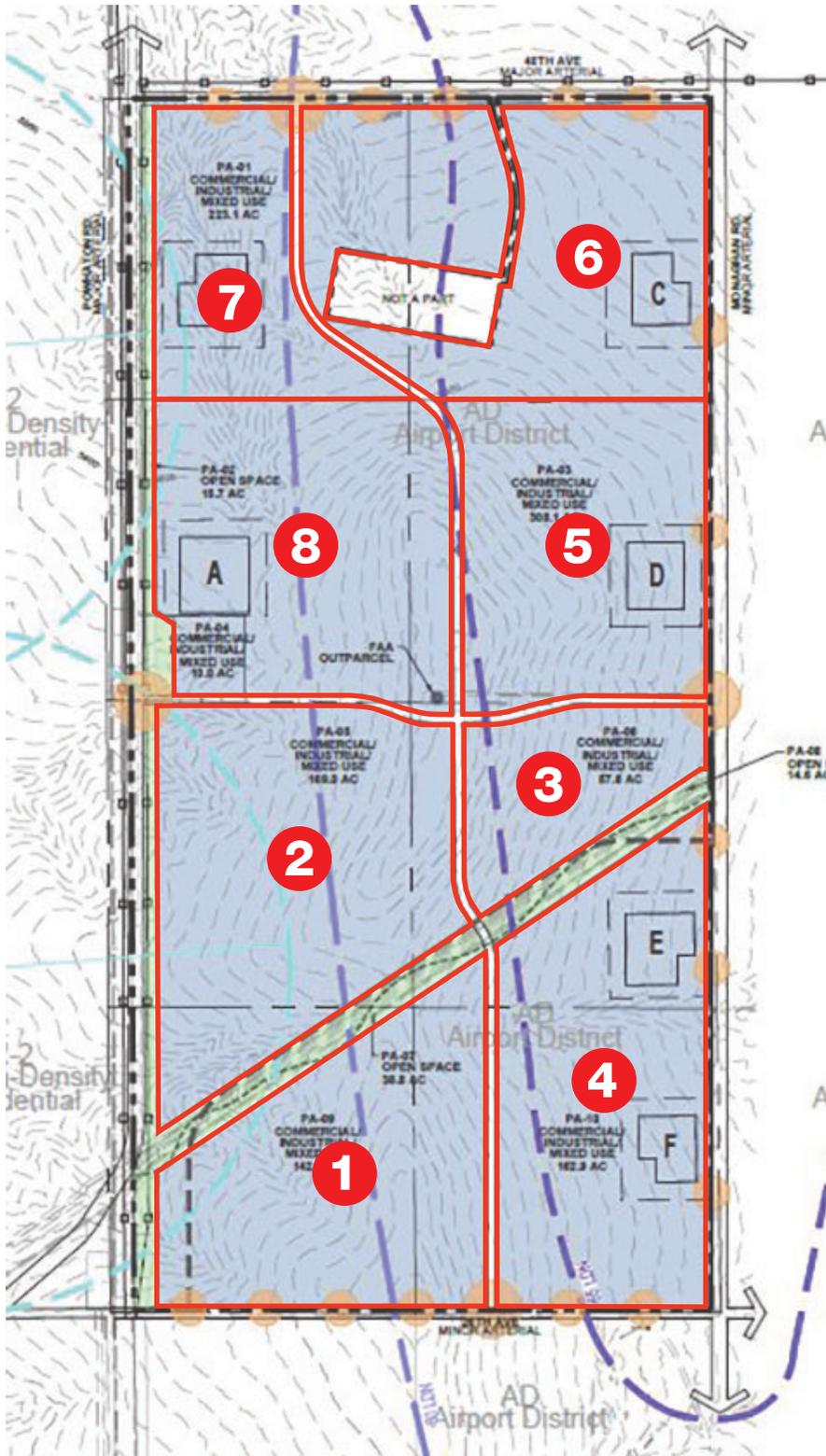
IV.A. Site Trip Generation

The number of vehicle-trips that will be generated by the proposed development was forecast based on trip rates and procedures documented in *Trip Generation* (Institute of Transportation Engineers, Tenth Edition, 2017). The category used in this analysis includes industrial uses, ITE Code 130, Industrial Park. **Table 1** summarizes the trip generation estimates by planning area. In total, the entire ATEC FDP is estimated to generate 47,185 external vehicle trips per day if built out to its absolute maximum. The planning areas shown in **Table 1** correspond to the Transportation Analysis Zones (TAZs) shown on **Figure 3**. Commercial/industrial land use for this FDP is anticipated to yield up to 14 million square feet of development over the 1,141.9-acre site.

It should be noted that the rectangular white parcel shown on **Figure 3** between TAZs 6 and 7 in the northern portion of the development is not included in this trip generation estimate. However, the land use assumptions in the NEATS model would have included an assumption for this land use and the volumes would be incorporated into the future traffic forecasts for the area. If this parcel is eventually incorporated into this FDP, another 21 acres (plus or minus) of industrial development could occur, increasing the FDP total trip estimates by less than 2 percent.

Table I. Trip Generation Summary

Planning Area	Fig. 3 Zone #	Acres	Land Use	Developed SF Area	Daily Trips	AM Peak Hour			PM Peak Hour		
						In	Out	Total	In	Out	Total
PA-01	7	223.1	Commercial/ Industrial	2,975,000	10,025	964	226	1,190	250	940	1,190
PA-02	--	15.7	Open Space	--	--	--	--	--	--	--	--
PA-03	5,6	308.1	Commercial/ Industrial	4,020,000	13,550	1,302	306	1,608	338	1,270	1,608
PA-04	2	169.0	Commercial/ Industrial	2,310,000	7,785	748	176	924	194	730	924
PA-05	3	57.6	Commercial/ Industrial	705,000	2,375	228	54	282	59	223	282
PA-07	--	14.6	Open Space	--	--	--	--	--	--	--	--
PA-08	1	142.1	Commercial/ Industrial	1,750,000	5,900	567	133	700	147	553	700
PA-09	4	162.9	Commercial/ Industrial	2,240,000	7,550	726	170	896	188	708	896
Totals		1,141.9		14,000,000	47,185	4,535	1,065	5,600	1,176	4,424	5,600



LEGEND

X = Traffic Analysis Zones (TAZ)

IV.B. Trip Distribution and Traffic Assignment

The site trip distribution assumptions for the ATEC development have been estimated from the NEATS model TAZ centroid traffic loadings and professional judgment of the directionality of these trips apparent in the 2040 NEATS assignment results. The distribution percentages are based on patterns observed from the NEATS travel demand modeling.

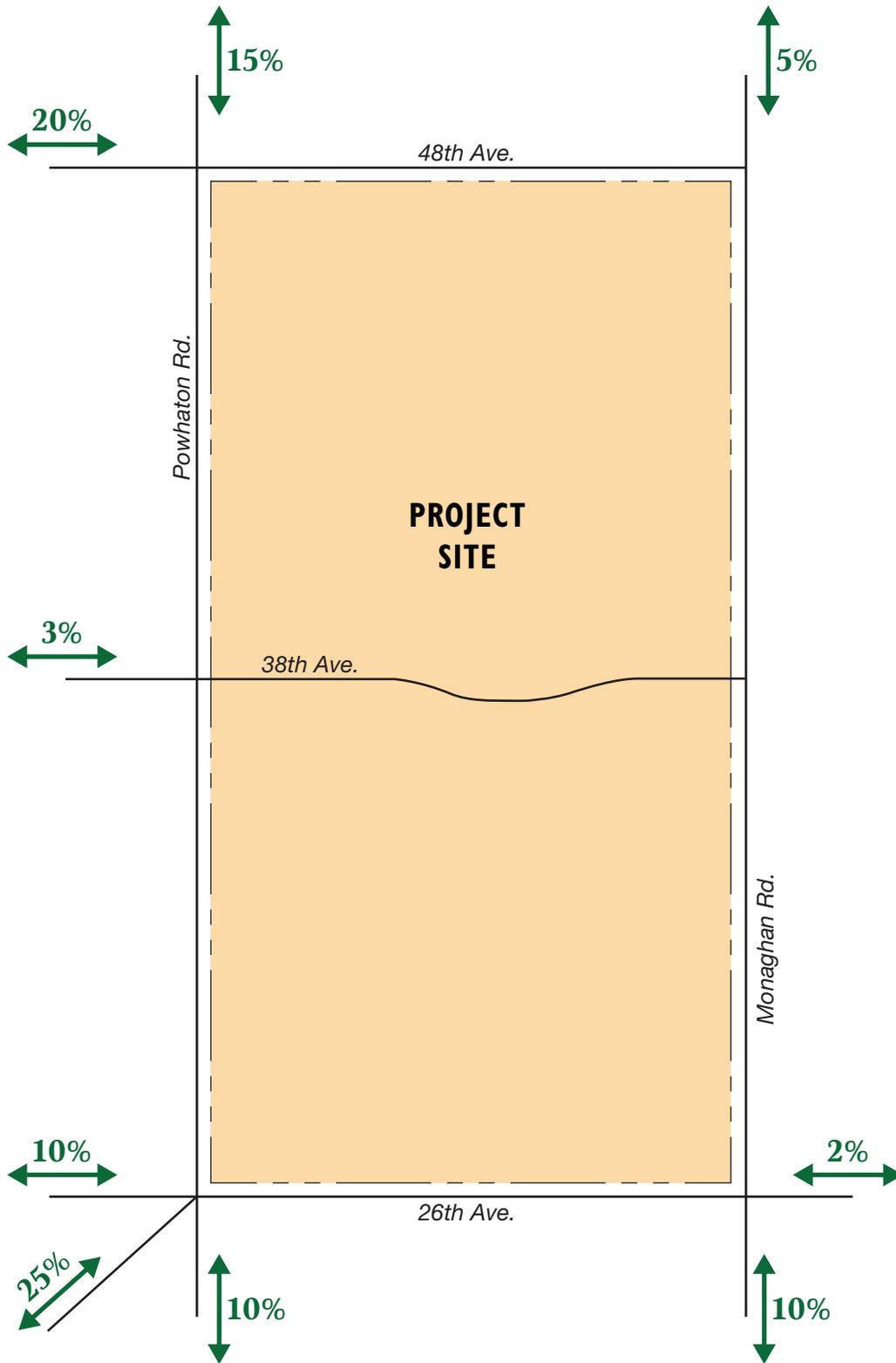
Figure 4 shows the trip distribution percentages used in the study. Resulting projections will be greater than those in NEATS since this study considers the maximum build out potential of ATEC, whereas the *NEATS Refresh* considered a less-intense 2040 development completion level. Very little development was assumed to occur in the ATEC property with respect to the NEATS travel demand model.

The trip distribution for the site will be primarily focused to the south, west, and north. Numerous roads will be served the site traffic in these overall cardinal directions. However, westerly-oriented traffic is anticipated to primarily make use of 48th Avenue, and to a lesser degree 26th Avenue. This is primarily due to the planned residential area to the west (The Aurora Highlands), which will not provide a direct east-west arterial through its center. Rather, ATEC westerly-oriented traffic will primarily use 48th Avenue and 26th Avenue, for traveling to/from the west. This, in combination with the fact that there will not be any access onto Powhatan Road (other than 38th Avenue), contributes to a relatively heavy loading onto these roadways (primarily via the north-south collector roadway).

Twenty percent of the site traffic is anticipated to/from the north towards DEN and other planned development, of which 15 percent of the traffic will make use of Powhatan Road and 5 percent along Monaghan Road. Very little site traffic (2 percent) is anticipated to travel east along 26th Avenue.

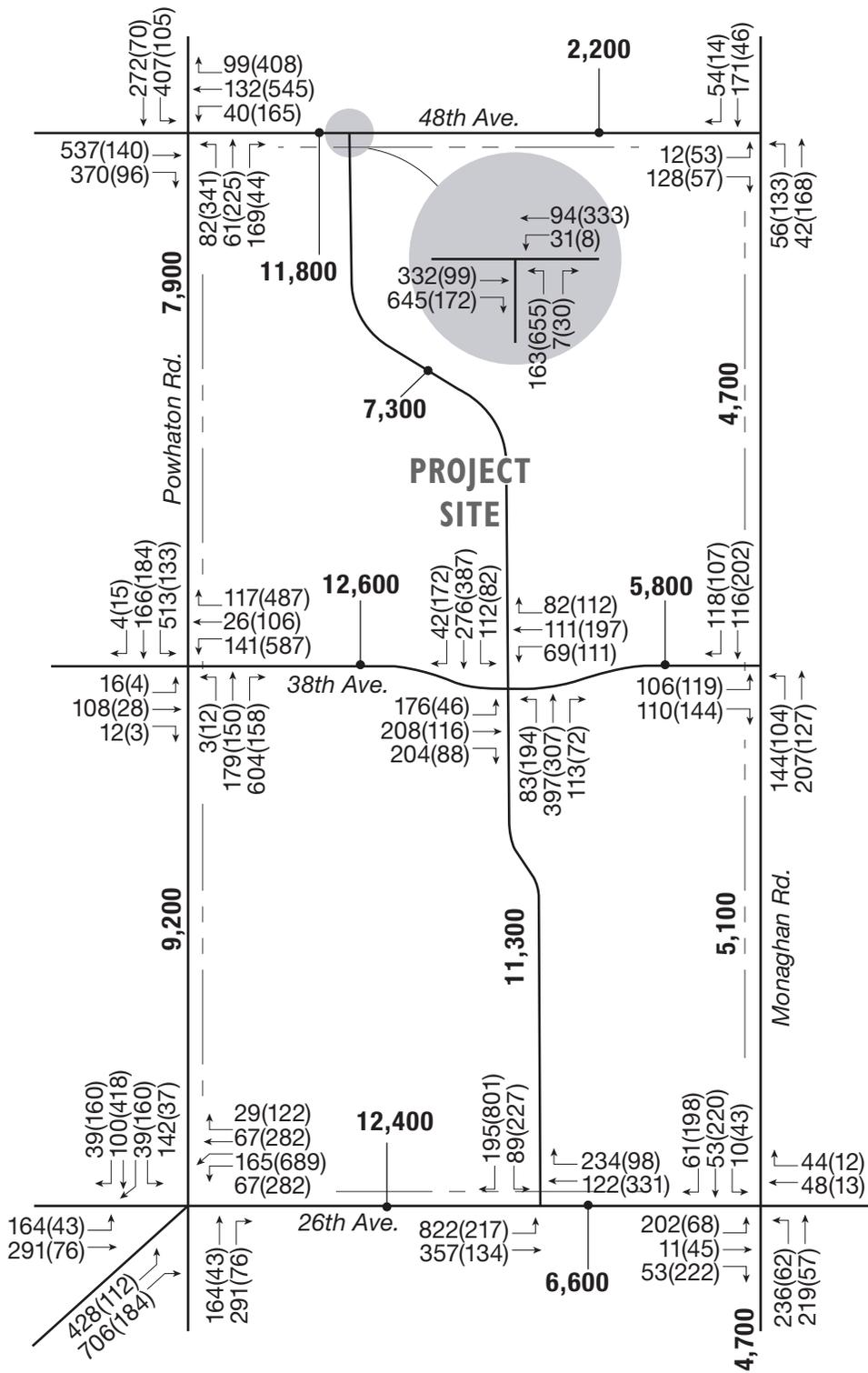
Applying the trip distribution percentages of **Figure 4** to the trip generation estimate of **Table I** yields the site-generated traffic shown on **Figure 5**. These estimates have been developed assuming that the zones (shown on **Figure 3**) will have access to each adjacent roadway, with the exception of Powhatan Road in which no direct access will be allowed. The roadways that will be impacted the most by site traffic include 48th Avenue, 38th Avenue, and 26th Avenue just west of Powhatan Road, each of which are projected to serve approximately 12,000 to 13,000 VPD of ATEC traffic. The internal collector roads are anticipated to serve 5,800 to 12,600 VPD of site traffic.

In the event that the 21-acre out-parcel in northern one-half of the FDP was to be added to this FDP, the traffic projections shown on **Figure 5** would increase only slightly. Resulting projections with the 21-acre out-parcel would differ only minimally, being within a typical acceptable tolerance range characteristic of long-term traffic forecasting. The projections shown in this study are sufficient whether this relatively small parcel is included or not.



LEGEND

XX% = Trip Distribution



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

XXXX = Daily Traffic Volumes

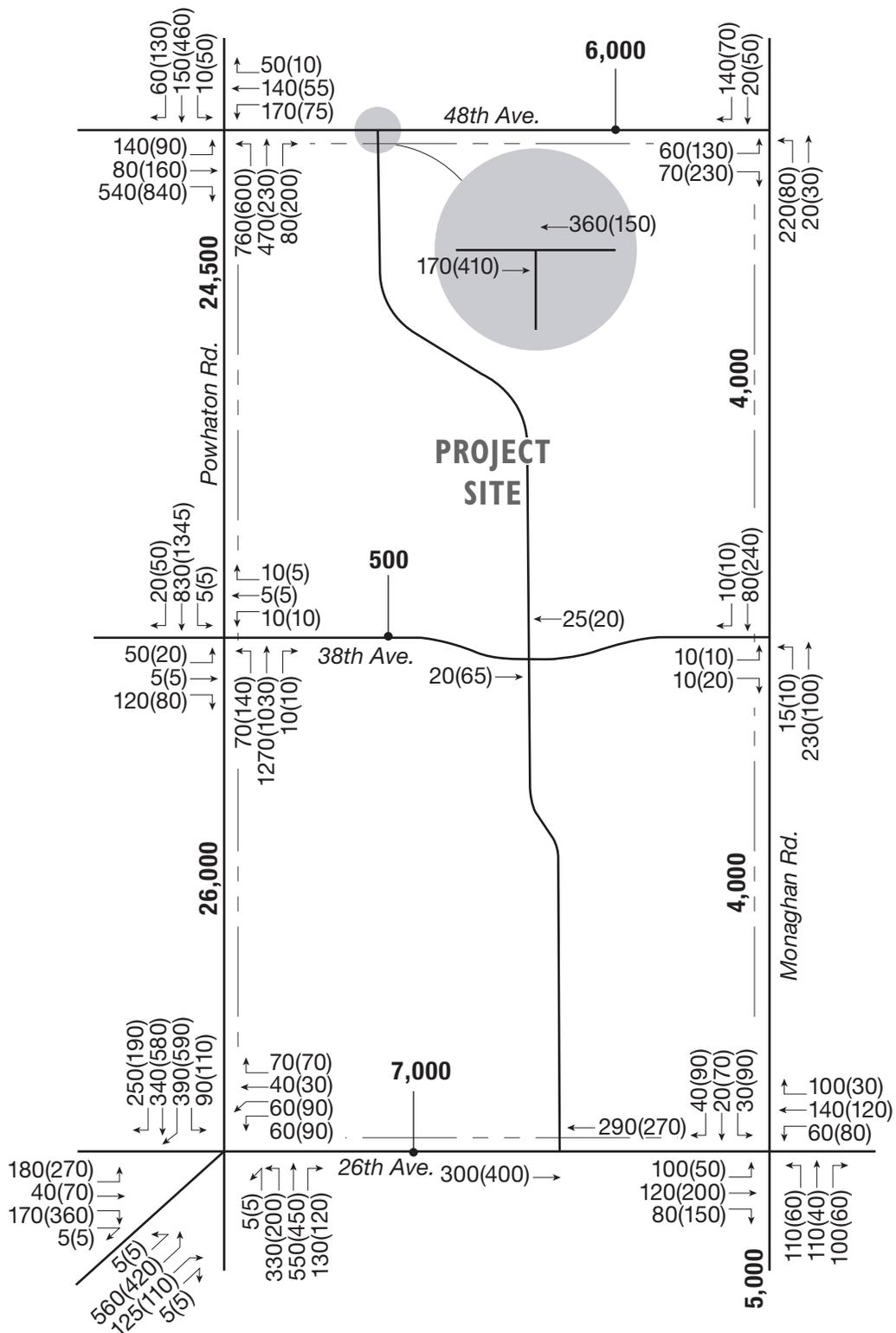
IV.C. Background Traffic Volumes

The NEATS travel demand modeling was used as the primary means of developing background traffic for this ATEC FDP traffic study. Specifically, estimated NEATS trips from the ATEC FDP area (which were minimal) were removed from the NEATS total 2040 traffic demand estimates in developing 2040 background traffic for this study. It should be noted that the background traffic used in this study, being based on NEATS, does not necessarily reflect other FDPs in the area reaching their maximum build out potential, which is highly unlikely scenario.

Resulting daily traffic was then converted to AM and PM peak hour traffic by applying a 9 percent and 10 percent, respectively, peak hour percentage. Directional split of the peak hour traffic was estimated from the AM and PM peak period assignment results per the NEATS travel demand modeling.

The peak hour intersection turning movement projections were then developed by applying techniques developed by the National Cooperative Highway Research Program, and adjustments were then made to produce reasonable AM and PM peak hour directional reflection patterns and to reasonably balance traffic flows between successive intersections.

Background traffic volume estimates are shown on **Figure 6**. Harvest Road/Powhatan Road will be the busiest roadways in the study area serving an estimated background traffic demand of 26,000 VPD north of 26th Avenue. Again, these background traffic projections are based on 2040 modeling results from the *NEATS Refresh* effort.



LEGEND

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

V. YEAR 2040 TOTAL TRAFFIC CONDITIONS

The daily and peak hour traffic volume estimates for the ATEC site shown on **Figure 5** were combined with the Year 2040 background traffic volume projections of **Figure 6** to create the Year 2040 total traffic forecasts along the study area roads and intersections. These estimated forecasts are shown on **Figure 7**.

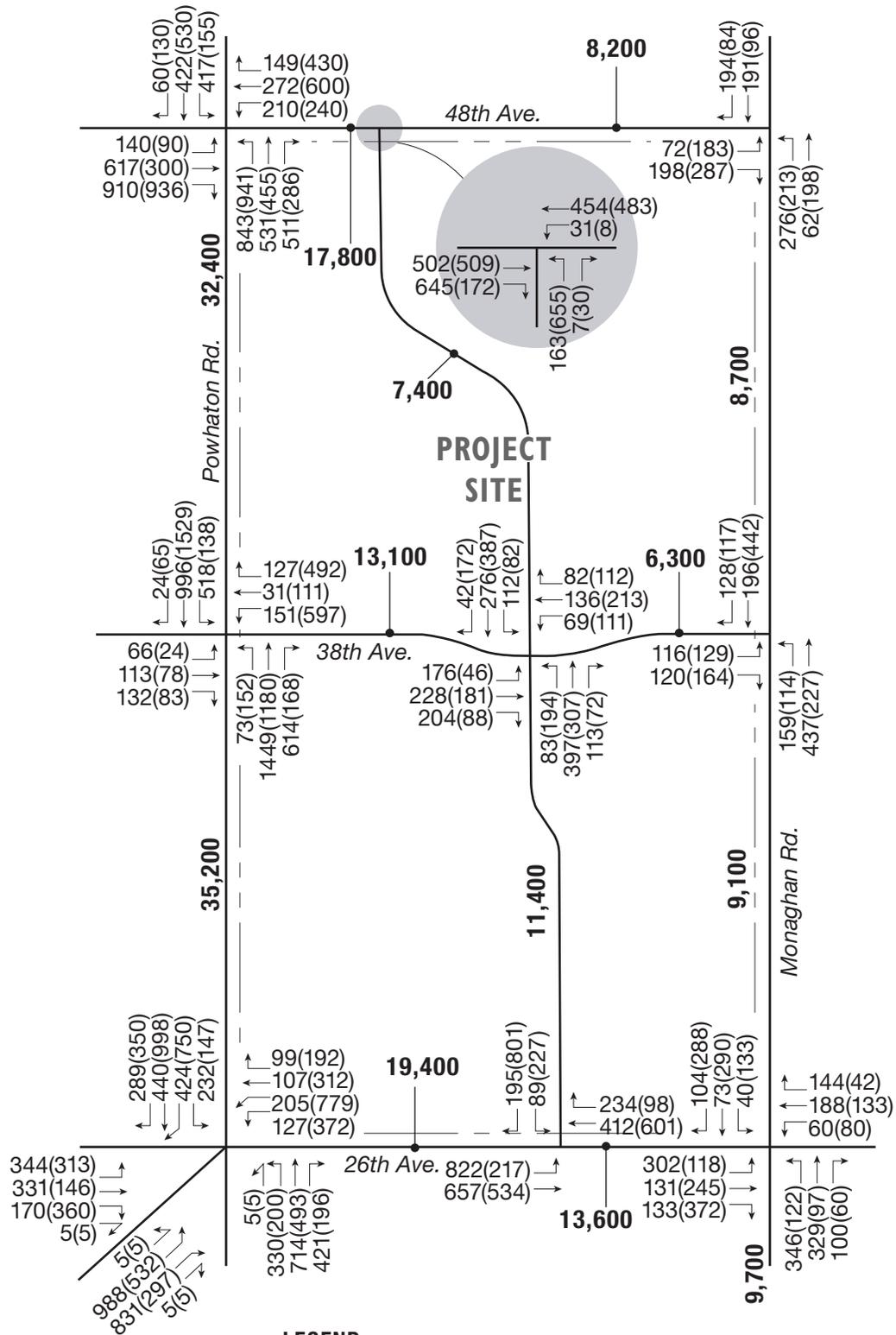
The segment of Harvest Road/Powhatan Road north of 26th Avenue is forecast to carry the most traffic in the immediate study area, with volumes of approximately 35,000 VPD. There is a strong pattern projected involving vehicles traveling the diagonal segment of Harvest Road, south of 26th Avenue. This segment will ultimately provide a new interchange with I-70. Other notable volume forecasts include 48th Avenue at the north end of the site. Between Monaghan Road and Powhatan Road, an anticipated volume of up to 17,800 VPD is projected, increasing significantly west of Powhatan Road.

The future intersection of 26th Avenue with Powhatan Road and the proposed Harvest Road is indicated on **Figure 7** as a five-leg intersection. The projected 2040 turning movements show that there are some very heavy conflicting movements, indicating that a configuration for this intersection must be developed to provide an effective way to accommodate the future traffic. One alternative concept was presented in the NEATS report and an alternative concept is introduced for this intersection later in this chapter.

V.A. Traffic Signalization Warrant Analyses

The *Manual on Uniform Traffic Control Devices* (MUTCD) identifies eight warrants that provide guidance to determine whether installation of a traffic signal is justified. Some of these warrants are based on traffic volume levels, while others are based on the accident history of an intersection or whether the intersection is a designated school crossing. The four-hour warrant has been applied to assess the need. Forecasts for the four highest hours of a typical weekday were developed by applying factors to the AM and PM peak hours. Other than the 5-legged intersection at Powhatan Road/Harvest Road/26th Avenue (which will clearly involve signalization), all other intersections were evaluated as shown in **Appendix A**. The following were found to meet warrants based on the 2040 traffic projections:

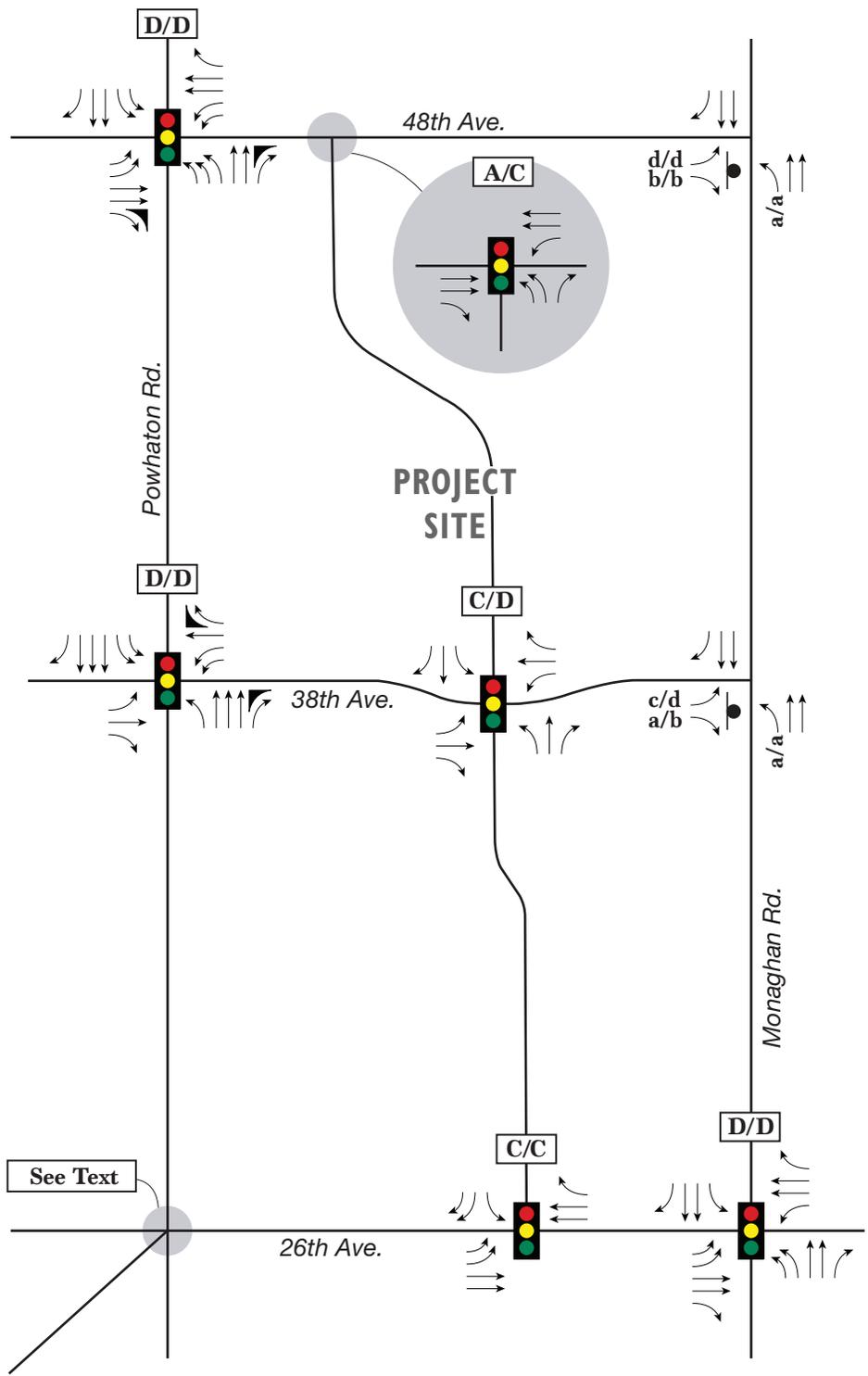
- Powhatan Road/38th Avenue
- Powhatan Road/48th Avenue
- Monaghan Road/26th Avenue
- 26th Avenue/ North-south internal collector road
- 48th Avenue/North-south internal collector road
- 38th Avenue/North-south internal collector road



V.B. Capacity Analyses

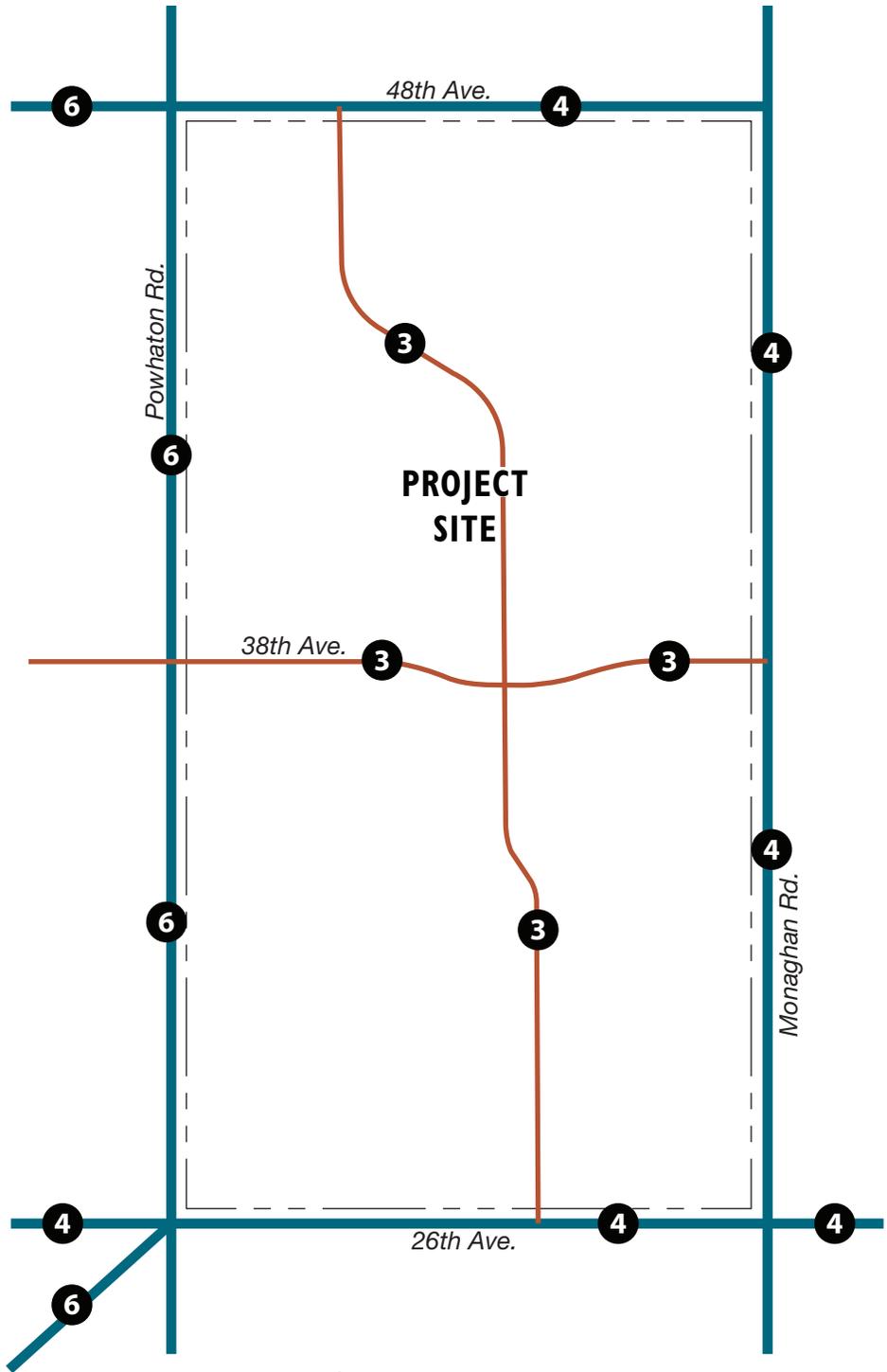
Capacity analyses were conducted for the surrounding roadway network using the traffic volume estimates of **Figure 7**. The level of service analysis results and intersection lane requirements can be found on **Figure 8** (worksheets are shown in **Appendix B**). With respect to the roadways, **Figure 9** shows the roadway needs in map form with following cross-sections descriptions below:

- Harvest Road (diagonally to the southwest) should ultimately be built to a major arterial classification to include six through lanes of traffic. Turn lanes are needed at the major intersections as described below.
- Powhatan Road, from 26th Avenue to 48th Avenue, should ultimately be built to a major arterial classification to include six through lanes of traffic. North of 48th Avenue, the cross section would reduce to a four-lane minor arterial. South of 26th Avenue, the cross section would also reduce to a four-lane section. Turn lanes are needed at the intersections as described below.
- Monaghan Road, from 26th Avenue to 48th Avenue should be built to a four-lane minor arterial cross-section with widened sections for turn lanes at major intersections as described below.
- 26th Avenue should be built to a four-lane minor arterial standard. Left turn lanes will be needed at all cross-streets, and right turn lanes will be needed at the heavier-used cross-streets.
- 38th Avenue should be built to a three-lane collector standard through the site, which includes a center left turn lane and one through lane in each direction. Additional turn lanes will be needed at the Powhatan Road intersection.
- 48th Avenue will be a four-lane arterial adjacent to the ATEC site, widening to a six-lane arterial west of Powhatan Road. Turn lanes will be required at all intersections.
- The north-south collector road should be built to a three-lane collector standard through the site, which includes a center left turn lane and one through lane in each direction. Additional turn lanes will be needed at the 26th Avenue and 48th Avenue intersections.



LEGEND

- X/X = AM/PM Peak Hour Signalized Intersection Level of Service
- x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service
- = Stop Sign
- 🚦 = Traffic Signal



LEGEND

-  = Arterial
-  = Collector
-  = Number of Through Lanes

With respect to the intersections, the following illustrate the turn lane geometry needs:

- **Powhaton/48th.** Lane needs include dual left turn lanes on all four approaches, with the northbound approach needing to provide triple left turn lanes. Each approach should also provide separate right turn lane in which the northbound and eastbound right turn lanes are channelized. This should allow for a LOS D operation during peak hours.
- **48th/North-South Collector Road.** As a tee intersection, this intersection should function no worse than a LOS C. Dual left turn lanes are needed along the northbound approach as it is a separate eastbound right turn lane. In the event that the 21-acre out-parcel within the northern section of the FDP is incorporated into the ATEC FDP plan, this intersection may be located east of the location shown in this report. This potentially revised location will not introduce any new concern relative to traffic operations provided that there will be adequate spacing between all successive intersections ultimately located along 48th Avenue.
- **48th/Monaghan.** With 48th Avenue terminating at Monaghan, this will be a tee-intersection that is not anticipated to warrant signalization. Side-street stop control will suffice relative to operations given single turn lanes for all turning movements, and dual through lanes north-south.
- **Powhaton/38th.** Lane needs include a single left turn lane along all but the westbound approach, which should be built with dual left turn lanes. Separate right turn lanes should also be provided along all four approaches with the northbound approach being channelized.
- **38th/North-South Collector Road.** This internal intersection will warrant signalization. An LOS D results with a separate lane for each movement along all four approaches.
- **38th/Monaghan.** With 48th Avenue terminating at Monaghan, this will be a tee-intersection that is not anticipated to warrant signalization. Side-street stop control will suffice relative to operations given single turn lanes for all turning movements, and dual through lanes north-south.
- **26th/North-South Collector.** Signalization will be warranted based on the 2040 traffic, and this intersection will experience a heavy pattern of traffic between the north and west legs of this intersection. As such, dual left turn lanes will be needed along the eastbound approach (turning into the FDP area) and dual right turn lanes should be provided southbound (turning out of the FDP area). As an alternative, a free-flow southbound right turn lane could instead be built provided that a westbound acceleration lane is added to 26th Avenue to receive free-flowing traffic. A single right turn lane will be needed along the westbound approach as well.
- **26th/Monaghan.** This intersection is projected to function at LOS D provided that dual left turn lanes are provided along the northbound and eastbound approaches and that separate right turn lanes are provided along all four approaches.
- **Powhaton/Harvest/26th.** This is a planned five-legged intersection in which the exact configuration has not been finalized. The next section presents the configuration documented in the NEATS report, and an alternative configuration is also offered. Additional vetting and analysis beyond the scope of this study is needed toward arriving at an ultimate solution.

In addition to the turn lane needs described above, a queuing analysis at the study area intersections was also completed, the results of which are shown in **Table 2**.

Table 2. Year 2040 Intersection Queuing Results*

Location	Critical Movements	95% Queue Length (ft)	SHAC Recommended Auxiliary Lane Length
		2040 Build (AM Peak/PM Peak)	
48 th Avenue & Powhatan Road (Intersection 1)	EB Left-turn	100 / 75	175
	EB Through	400 / 200	Continuous
	EB Right-turn	Free Movement	Continuous
	WB Left-turn	100 / 200	300
	WB Through	225 / 375	Continuous
	WB Right-turn	200 / 600	A
	NB Left-turn	175 / 400	1150
	NB Through	175 / 300	Continuous
	NB Right-turn	Free Movement	Continuous
	SB Left-turn	325 / 125	500
	SB Through	325 / 375	Continuous
SB Right-turn	100 / 200	175	
48 th Avenue & N-S Collector (Intersection 2)	EB Through	0 / 300	Continuous
	EB Right-turn	25 / 225	600
	WB Through	50 / 125	Continuous
	WB Right-turn	25 / 25	775
	NB Left-turn	125 / 400	800
	NB Right-turn	25 / 50	50
48 th Avenue & Monaghan Road (Intersection 3)	EB Left-turn	50 / 50	225
	EB Right-turn	25 / 25	350
	NB Left-turn	50 / 50	350
38 th Avenue & Monaghan Road (Intersection 4)	EB Left-turn	25 / 50	175
	EB Right-turn	50 / 25	200
	NB Left-turn	25 / 25	200
26 th Avenue & Monaghan Road (Intersection 5)	EB Left-turn	250 / 100	375
	EB Through	100 / 200	Continuous
	EB Right-turn	255 / 550	450
	WB Left-turn	125 / 150	100
	WB Through	150 / 100	Continuous
	WB Right-turn	225 / 75	175
	NB Left-turn	250 / 100	425
	NB Through	125 / 50	Continuous
	NB Right-turn	75 / 75	125
	SB Left-turn	25 / 225	175
SB Through	50 / 150	Continuous	
SB Right-turn	100 / 250	350	

Location	Critical Movements	95% Queue Length (ft)	SHAC Recommended Auxiliary Lane Length
		2040 Build (AM Peak/PM Peak)	
26 th Avenue & N-S Collector (Intersection 6)	EB Left-turn	500 / 175	1000
	EB Through	75 / 200	Continuous
	WB Through	25 / 75	Continuous
	WB Right-turn	25 / 25	300
	SB Left-turn	150 / 250	975
	SB Right-turn	300 / 850	275
38 th Avenue & Powhatan Road (Intersection 7)	EB Left-turn	100 / 50	100
	EB Through	175 / 125	Continuous
	EB Right-turn	225 / 150	175
	WB Left-turn	125 / 450	725
	WB Through	50 / 175	Continuous
	WB Right-turn	Free Movement	Continuous
	NB Left-turn	125 / 200	200
	NB Through	525 / 325	Continuous
	NB Right-turn	Free Movement	Continuous
	SB Left-turn	250 / 75	625
	SB Through	250 / 475	Continuous
SB Right-turn	25 / 75	100	
38 th Avenue & N-S Collector (Intersection 8)	EB Left-turn	50 / 75	225
	EB Through	300 / 300	Continuous
	EB Right-turn	275 / 150	250
	WB Left-turn	100 / 150	150
	WB Through	200 / 300	Continuous
	WB Right-turn	125 / 150	150
	NB Left-turn	50 / 200	250
	NB Through	275 / 425	Continuous
	NB Right-turn	75 / 100	150
	SB Left-turn	75 / 75	150
	SB Through	125 / 525	Continuous
SB Right-turn	25 / 200	225	

Notes:

*Where dual lanes are provided the presented value is on a per lane basis.

**The SHAC Recommended Auxiliary Storage Lengths above represent the storage length without the inclusion of taper length.

*** Recommended length based primarily on 95th percentile queue than SHAC

The City of Aurora's *Traffic Impact Study Guidelines* indicate that the CDOT SHAC be used to determine storage and taper lengths. These values often yield overly conservative results and provide storage well in excess of 95th percentile queues (which already incorporate a heavy vehicle percentage), often by a factor of two to three. The SHAC procedures do not account for other conditions in the intersection such as low opposing through movements if a left turn movement is in question. As such, there are instances above where the final recommendation would more appropriately align with the 95th percentile lengths relative to informing design. Lead-in taper lengths of 144 feet (188 feet where

dual left turn lanes are to be provided) should be used, indicative of a 40 MPH speed per CDOT SHAC. The table indicates which movements are more appropriately sized from the 95th percentile result.

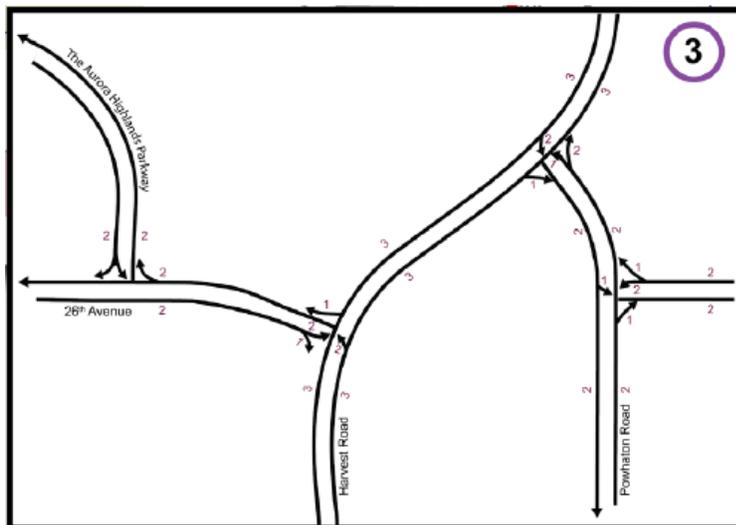
V.C. Harvest Road/Powhatan Road/26th Avenue Intersection Configuration

The intersection of Powhatan Road/Harvest Road/26th Avenue is planned to serve five legs in the future. A signalized intersection serving five approaches can be problematic, so this report section delves into possible solutions. The final agreed solution here will require more vetting and more analysis than presented in this report, but the material offered in this section helps advance the understanding of peak hour traffic patterns that can help a more detailed process.

North-south traffic through the intersection is projected to be heavy. The *NEATS Refresh* anticipates the extension of Harvest Road as a six-lane major arterial. The roadway will extend along the section line north from Jewell Avenue to 6th Avenue. North of 6th Avenue, the alignment will curve to the east to cross I-70 at the approximate half-section line between Harvest Road and Powhatan Road in order to provide sufficient distance along I-70 between the new Harvest Road/Powhatan Road interchange and the E-470/I-70 system-to-system interchange. North of I-70, the alignment will veer east to intersect 26th Avenue at approximately the Powhatan Road section line. The corridor will then assume the Powhatan Road section line alignment to 48th Avenue.

The *NEATS Refresh* provided a concept for the intersection configuration of the new Harvest Road alignment with 26th Avenue and Powhatan Road as shown on **Figure 10**. This concept shows the six-lane Harvest Road alignment transitioning into the six-lane Powhatan Road alignment north of 26th Avenue as the major movement. Powhatan Road from the south provides a tee-intersection into Harvest Road north of an intersection with the east leg of 26th Avenue. The west leg of 26th Avenue provides a tee-intersection with Harvest Road to complete the roadway network connections.

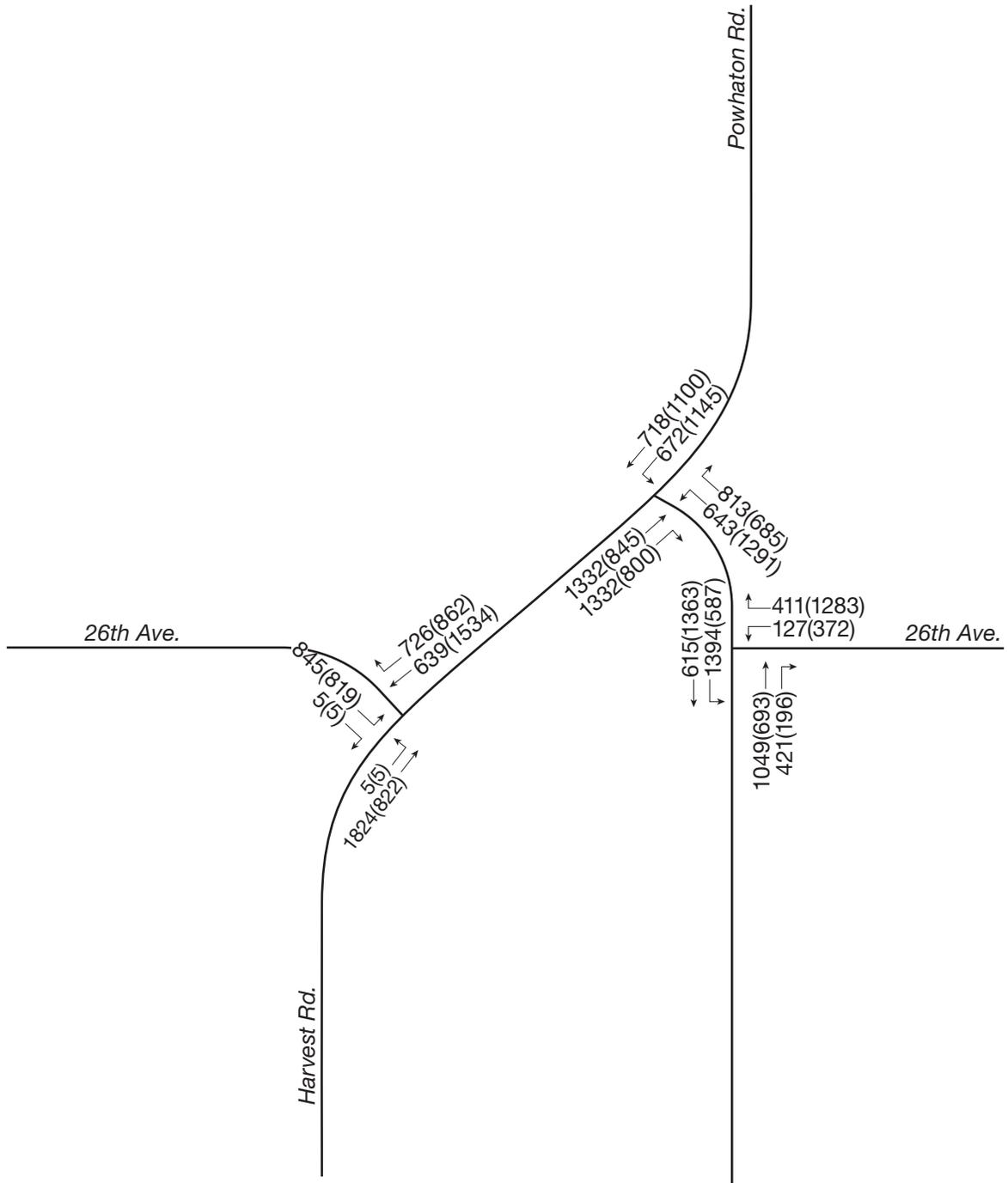
Figure 10. Harvest Road/Powhatan Road/26th Avenue Intersection (NEATS Refresh)



While this configuration provides for the direct connection with the heavy travel corridor of Harvest Road/Powhatan Road, it also severs the direct connection along 26th Avenue, requiring all east/west travel on 26th Avenue to turn onto a short segment of Harvest Road.

The Year 2040 Total Traffic turning movement forecasts were applied to this configuration and are shown in **Figure 11**. This allows for an evaluation of future turning movements to determine if this configuration would be able to function at an acceptable level.

For the most part, since the configuration provides three tee intersections, the turning movement volumes anticipated should operate acceptably under signalized control. However, there are a few movements that are of particular concern.



LEGEND

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

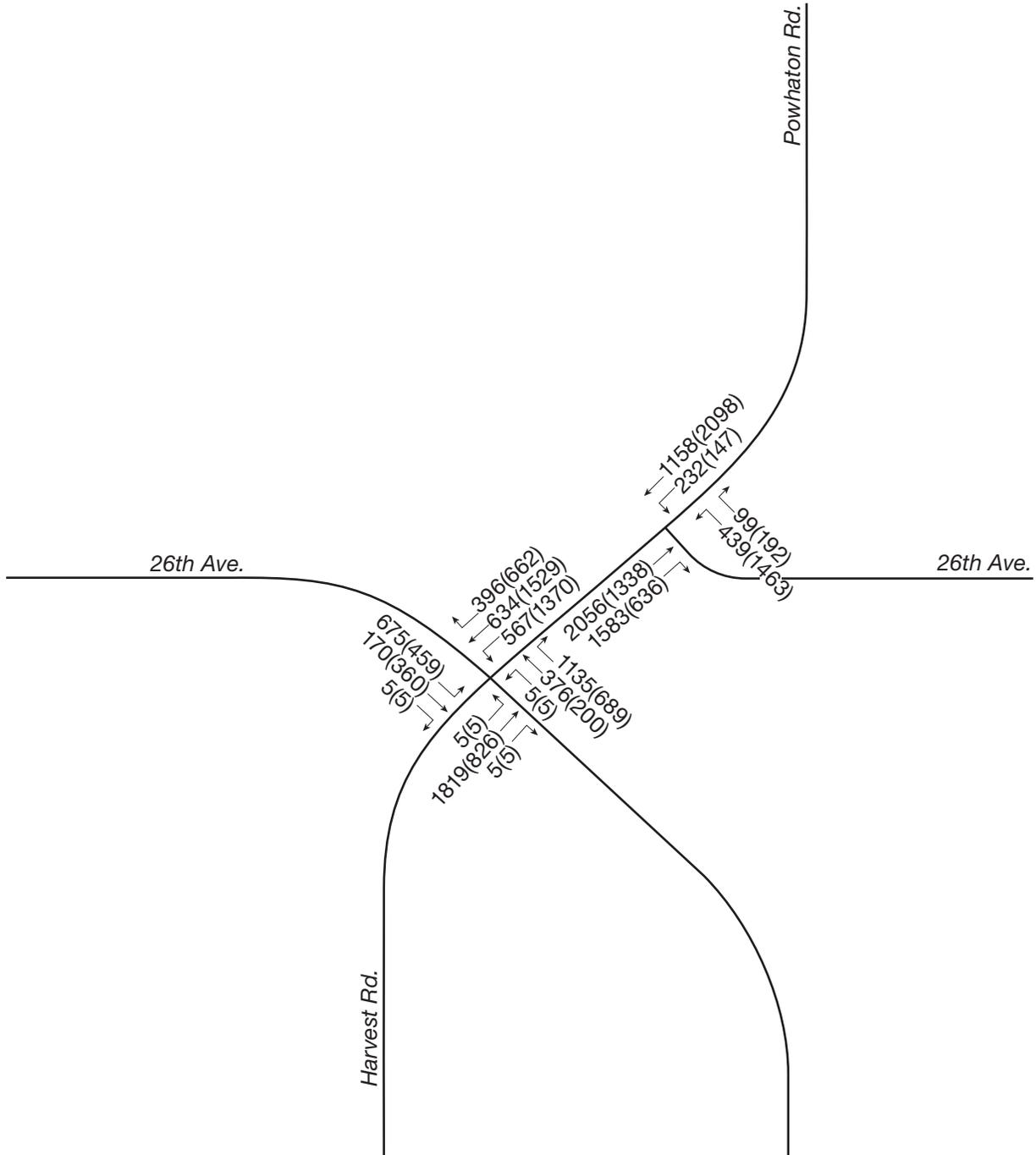
Since 26th Avenue is not a continuous roadway through this area, and the traffic forecasts indicate that there will be approximately 19,400 VPD to the east of Powhatan Road, some very heavy turning movements are anticipated as a result. For example, during the PM peak hour, approximately 1,300 vehicles per hour (VPH) are projected making the westbound to northbound right turn from 26th Avenue to Powhatan Road. More than 300 of these right turns are destined to continue west on 26th Avenue, and approximately 780 VPH will be headed southwest on Harvest Road. This creates a total left turn volume at the Powhatan Road/Harvest Road intersection of nearly 1,300 vehicles in the PM peak hour. Also, during the PM peak hour, more than 1,100 southbound vehicles on Powhatan Road are forecast to turn left and continue along Powhatan Road. These are both very high left turn volumes to accommodate, but processing these through a tee-intersection instead of a traditional four-leg intersection will help provide enough capacity.

An alternative concept was developed to consider a different configuration of the group of intersections created by the new diagonal Harvest Road alignment. This concept is shown on **Figure 12**. With this concept, the Harvest Road/Powhatan Road alignment would still serve as the primary roadway through the area. The alignment of 26th Avenue to the west would curve to the southeast and tie into the southern leg of Powhatan Road, providing a four-way intersection with 26th Avenue/Harvest Road/Powhatan Road. The east leg of 26th Avenue would provide a tee-intersection with Harvest Road north of this four-way intersection.

There is still projected to be a heavy westbound left turn from 26th Avenue to southbound Harvest Road of approximately 1450 VPH during the PM peak hour. The other heavy left turn forecast would be the southbound left turn from Powhatan Road onto the south leg of Powhatan Road, which would be approximately 1,380 vehicles per hour in the PM peak hour.

For both of these concepts, there could be some modifications to the configuration to address these heavy turning movements. For example, it may be possible under either alternative to provide a through movement connection of 26th Avenue that would eliminate the need for those movements to turn onto a short section of Harvest Road. Even if this connection only provided for the westbound through movements on 26th Avenue, it may provide enough relief at the eastern intersection with 26th Avenue/Harvest Road to be worthy of consideration.

A continued development of alternative concepts should be conducted involving a broader range of stakeholders. It is possible that future developments could significantly change the travel patterns currently anticipated for the area. Ultimately, it will be necessary to conduct a more detailed design analysis to determine the appropriate configuration for this Harvest Road corridor between 6th Avenue and 26th Avenue/Powhatan Road, but this study begins to set some groundwork toward an ultimate solution at this location.



LEGEND

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

VI. SUMMARY AND RECOMMENDATIONS

CGF Management is planning to develop an approximate 1142-acre site in Aurora, Colorado, referred to as ATEC. The FDP site is located along the east side of the future Powhaton Road between 26th Avenue and the future 48th Avenue. If built to its maximum allowed density, up to 14 million square feet of industrial building space could occur, estimated to generate up to 47,185 external vehicle-trips per day.

The recently updated *NEATS Refresh* identifies the appropriate roadway classification and laneage of the surrounding street system. The NEATS study was a key resource in preparing this traffic impact study with respect to the major roadways and the traffic demand for the rest of the area outside the ATEC FDP.

The overarching roadway recommendations include:

- **Powhaton Road.** This roadway will ultimately serve as a busy north-south major arterial facility through the region. As such, ultimate traffic demands will be significant requiring a six-lane facility and dual left turn lanes along select approaches at all study area intersections. Additional analyses will be needed at its intersection with 26th Avenue where a five-legged condition is possible.
- **48th Avenue.** This roadway provides east-west continuity as far east as Monaghan Road. West of Powhaton, 48th Avenue is planned to serve as part of the regional north-south major arterial necessitating a six-lane arterial and robust intersection laneage to serve the heavy north to west (and vice-versa) pattern at the Powhaton intersection. East of Powhaton Road, 48th Avenue need only be a four-lane arterial with turn lanes at intersections. This roadway will not continue east beyond Monaghan Road.
- **38th Avenue.** This road will also not extend east of Monaghan Road. Passing through the FDP, this road should be planned as three-lane collector road, with additional turn lanes needed at intersections.
- **Monaghan Road.** Projected traffic along this roadway is the among the lowest of those included in this study. The NEATS plan identifies this roadway to be a four-lane minor arterial that will more than suffice given the 2040 traffic projections shown in this study.
- **26th Avenue.** The NEATS plan identifies this roadway to be a four-lane minor arterial that will suffice given the 2040 traffic projections. Turn lanes are needed at intersection with several requiring dual left turn lanes. Additional analyses will be needed at its intersection with Powhaton where a five-legged condition is possible.
- **North-south Internal Road.** Passing through the FDP, this road should be planned as three-lane collector road, with additional turn lanes needed at intersections.

The Harvest/Powhaton/26th Avenue intersection will serve five intersection “legs”. This configuration does not lend itself to a single intersection. The NEATS report shows one possible configuration that involves a series of tee intersections, and an additional alternative is shown in this study with long-term projected peak hour turning movements. Additional vetting and analysis are needed to reach a final solution at this intersection. This study begins to lay some of the groundwork that could inform that additional vetting.

Relative to the other study area intersections, traffic signals are anticipated to be installed at the major intersections including:

- Powhatan Road/38th Avenue
- Powhatan Road/48th Avenue
- Monaghan Road/26th Avenue
- 26th Avenue/North-south internal collector road
- 48th Avenue/North-south internal collector road
- 38th Avenue/North-south internal collector road

There is a possibility that the 21-acre out-parcel located in the northern section of the FDP could be incorporated into the ATEC FDP. This represents only a 2 percent increase in trip estimates and, when combined with background traffic projections, reflects a minor difference in traffic demand, a difference that would be well within the typical accepted tolerance of traffic volume forecasting and would not require adjustment to recommendations provided herein. Further, the incorporation of this parcel into the FDP could result in adjusting the location of the north-south collector road intersection onto 48th Avenue. This potentially revised location will not introduce any new concerns relative to traffic operations provided that there will be adequate spacing between all successive intersections ultimately located along 48th Avenue.

APPENDIX A. YEAR 2040 SIGNAL WARRANT
ANALYSIS

MUTCD Volume-based Warrant Evaluation
26th & Monaghan
Intersection # 5
2040 Total Traffic



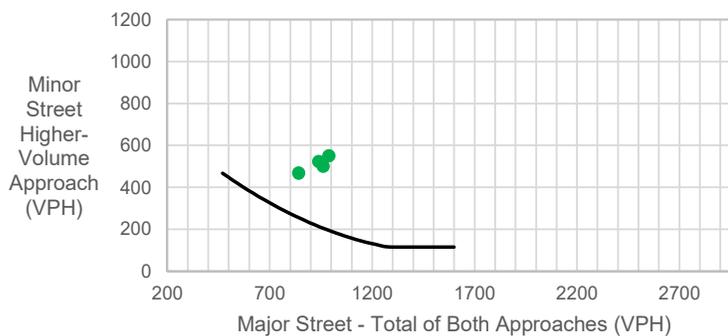
Major Street: 26th Ave
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: Monaghan Rd
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
PM Peak Hour	990	550
95% PM Peak Hour	941	523
85% PM Peak Hour	842	468
AM Peak Hour	962	500

Satisfied **Yes**
 (100% Factor)



MUTCD Volume-based Warrant Evaluation
26th & N-S Collector
Intersection # 6
2040 Total Traffic



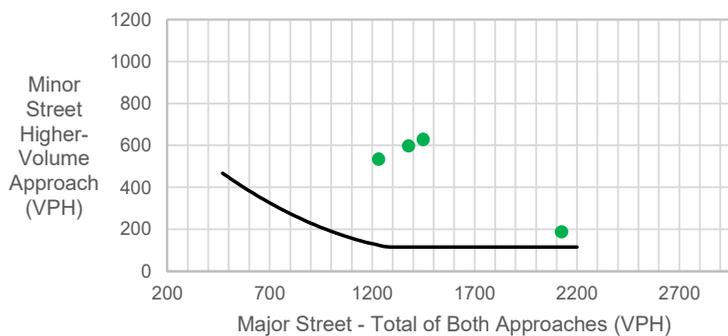
Major Street: 26th Ave
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: N-S Collector
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
PM Peak Hour	1450	628
95% PM Peak Hour	1378	597
85% PM Peak Hour	1233	534
AM Peak Hour	2125	187

Satisfied **Yes**
 (100% Factor)



MUTCD Volume-based Warrant Evaluation
38th & Monaghan
Intersection # 4
2040 Total Traffic



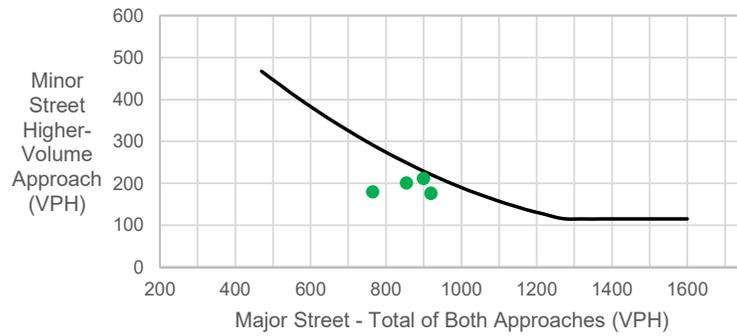
Major Street: Monaghan Rd
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: 38th Ave
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
PM Peak Hour	900	211
95% PM Peak Hour	855	200
85% PM Peak Hour	765	179
AM Peak Hour	920	176

Satisfied No
 (100% Factor)



MUTCD Volume-based Warrant Evaluation
38th & N-S Collector
Intersection # 8
2040 Total Traffic



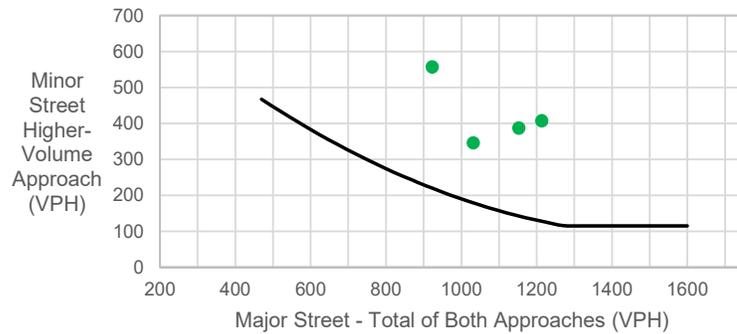
Major Street: 38th Ave
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: N-S Collector
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Apprch. Minor Street
PM Peak Hour	1214	407
95% PM Peak Hour	1153	387
85% PM Peak Hour	1032	346
AM Peak Hour	923	557

Satisfied **Yes**
 (100% Factor)



MUTCD Volume-based Warrant Evaluation
38th & Powhatan
Intersection # 7
2040 Total Traffic



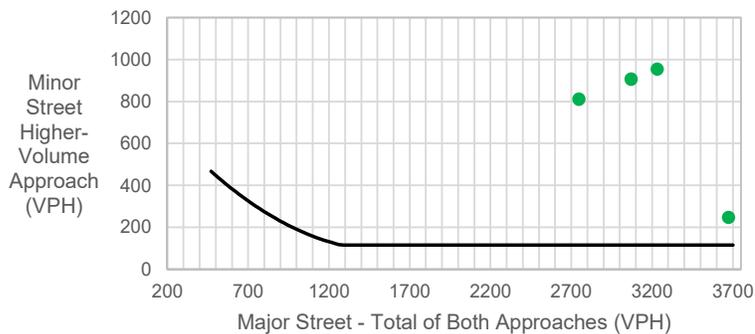
Major Street: Powhatan Rd
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: 38th Ave
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
PM Peak Hour	3232	954
95% PM Peak Hour	3070	906
85% PM Peak Hour	2747	811
AM Peak Hour	3674	246

Satisfied **Yes**
 (100% Factor)



**MUTCD Volume-based Warrant Evaluation
Monaghan Rd & 48th Street**

Intersection # 3

2040 Total Traffic



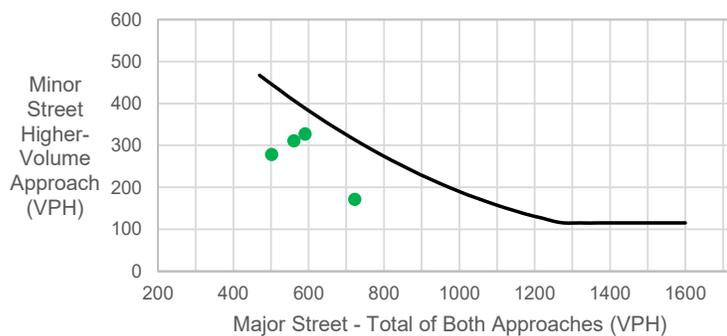
Major Street: Monaghan Rd
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: 48th Ave
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Apprch. Minor Street
PM Peak Hour	591	327
95% PM Peak Hour	561	311
95% PM Peak Hour	502	278
AM Peak Hour	723	171

Satisfied No
 (100% Factor)



MUTCD Volume-based Warrant Evaluation
48th & N-S Collector
Intersection # 2
2040 Total Traffic



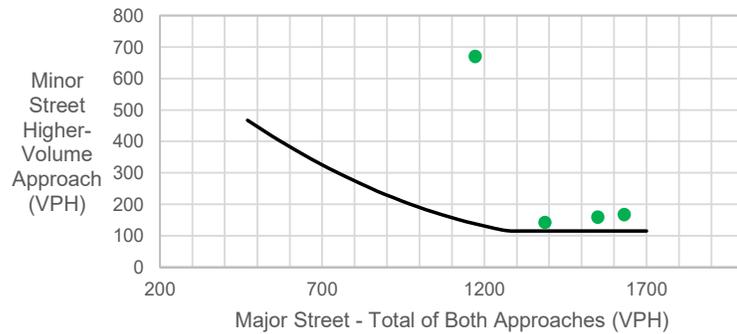
Major Street: 48th Ave
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: N-S Collector
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
PM Peak Hour	1632	167
95% PM Peak Hour	1550	159
85% PM Peak Hour	1387	142
AM Peak Hour	1172	670

Satisfied **Yes**
 (100% Factor)



MUTCD Volume-based Warrant Evaluation

48th & Powhaton

Intersection # 1

2040 Total Traffic



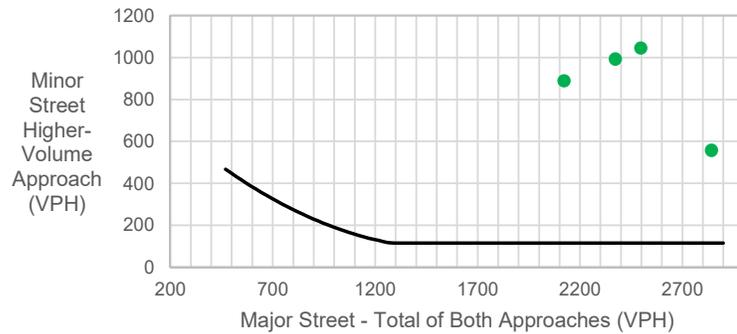
Major Street: 48th Ave
 Approach Speed: 40 MPH
 Lanes Moving Traffic: 2 or more
 Option: Low Speed, Urban

Minor Street: Powhaton Rd
 Right Turn Volume Included: 0% EB, 50% WB
 Lanes Moving Traffic: 2 or more

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
PM Peak Hour	2497	1045
95% PM Peak Hour	2372	993
85% PM Peak Hour	2122	888
AM Peak Hour	2843	557

Satisfied **Yes**
 (100% Factor)



APPENDIX B. YEAR 2040 TOTAL TRAFFIC LEVEL OF SERVICE WORKSHEETS

Timings
1: Powhatan Rd & 48th Ave

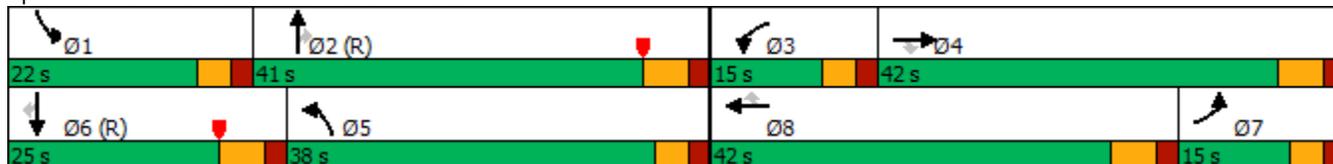
ATEC
11/15/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	617	910	210	272	149	842	531	571	417	422	60
Future Volume (vph)	140	617	910	210	272	149	842	531	571	417	422	60
Turn Type	Prot	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	9.0	22.0	22.0	9.0	26.5	26.5	9.0	22.0	22.0
Total Split (s)	15.0	42.0	42.0	15.0	42.0	42.0	38.0	41.0	41.0	22.0	25.0	25.0
Total Split (%)	12.5%	35.0%	35.0%	12.5%	35.0%	35.0%	31.7%	34.2%	34.2%	18.3%	20.8%	20.8%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	30.1	36.0	36.0	10.0	15.9	15.9	33.6	35.0	35.0	17.0	18.4	18.4
Actuated g/C Ratio	0.25	0.30	0.30	0.08	0.13	0.13	0.28	0.29	0.29	0.14	0.15	0.15
v/c Ratio	0.18	0.63	1.10	0.80	0.63	0.46	0.66	0.56	1.00	0.93	0.85	0.16
Control Delay	37.1	39.5	79.3	65.9	43.9	9.1	21.6	19.8	45.1	78.2	64.5	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.1	39.5	79.3	65.9	43.9	9.1	21.6	19.8	45.1	78.2	64.5	0.9
LOS	D	D	E	E	D	A	C	B	D	E	E	A
Approach Delay		61.0			43.0			28.0			66.6	
Approach LOS		E			D			C			E	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 45 (38%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 120
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.10
 Intersection Signal Delay: 47.3
 Intersection LOS: D
 Intersection Capacity Utilization 88.2%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: Powhatan Rd & 48th Ave



HCM 6th Signalized Intersection Summary
1: Powhatan Rd & 48th Ave

ATEC
11/15/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 		  	 		 	 	
Traffic Volume (veh/h)	140	617	910	210	272	149	842	531	571	417	422	60
Future Volume (veh/h)	140	617	910	210	272	149	842	531	571	417	422	60
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	152	671	0	228	296	162	915	577	0	453	459	65
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	628	807		284	425	190	1762	1299		490	526	235
Arrive On Green	0.18	0.23	0.00	0.03	0.04	0.04	0.59	0.61	0.00	0.14	0.15	0.15
Sat Flow, veh/h	3456	3554	1585	3456	3554	1585	5023	3554	1585	3456	3554	1585
Grp Volume(v), veh/h	152	671	0	228	296	162	915	577	0	453	459	65
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1728	1777	1585	1674	1777	1585	1728	1777	1585
Q Serve(g_s), s	4.5	21.6	0.0	7.9	9.9	9.0	13.0	10.4	0.0	15.5	15.2	4.4
Cycle Q Clear(g_c), s	4.5	21.6	0.0	7.9	9.9	9.0	13.0	10.4	0.0	15.5	15.2	4.4
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	628	807		284	425	190	1762	1299		490	526	235
V/C Ratio(X)	0.24	0.83		0.80	0.70	0.85	0.52	0.44		0.93	0.87	0.28
Avail Cap(c_a), veh/h	628	1066		288	1066	476	1762	1299		490	563	251
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.97	0.97	0.97	0.72	0.72	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	42.0	44.2	0.0	57.4	55.5	30.6	18.8	16.9	0.0	50.9	50.0	45.4
Incr Delay (d2), s/veh	0.2	4.3	0.0	14.4	2.0	10.1	0.2	0.8	0.0	23.6	17.8	2.9
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	3.5	15.1	0.0	7.5	8.4	7.6	7.0	6.4	0.0	13.0	12.7	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.2	48.5	0.0	71.8	57.5	40.7	19.0	17.7	0.0	74.5	67.8	48.3
LnGrp LOS	D	D		E	E	D	B	B		E	E	D
Approach Vol, veh/h		823	A		686			1492	A		977	
Approach Delay, s/veh		47.4			58.3			18.5			69.6	
Approach LOS		D			E			B			E	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	22.0	49.9	14.9	33.3	48.1	23.8	27.8	20.4				
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	6.0	* 6	6.0	* 6				
Max Green Setting (Gmax), s	17.0	35.0	10.0	36.0	33.0	* 19	10.0	* 36				
Max Q Clear Time (g_c+I1), s	17.5	12.4	9.9	23.6	15.0	17.2	6.5	11.9				
Green Ext Time (p_c), s	0.0	4.0	0.0	3.7	3.6	0.6	0.1	2.5				

Intersection Summary

HCM 6th Ctrl Delay	43.9
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
Unsignalized Delay for [NBR, EBR] is excluded from calculations of the approach delay and intersection delay.

Timings
2: N-S Collector & 48th Ave



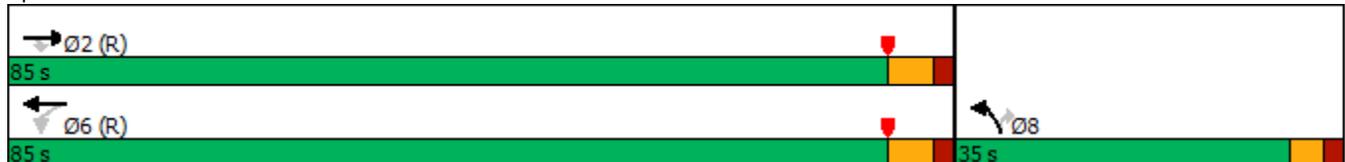
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓	↑
Traffic Volume (vph)	502	645	31	454	163	7
Future Volume (vph)	502	645	31	454	163	7
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		2	6			8
Detector Phase	2	2	6	6	8	8
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	21.5	21.5
Total Split (s)	85.0	85.0	85.0	85.0	35.0	35.0
Total Split (%)	70.8%	70.8%	70.8%	70.8%	29.2%	29.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	5.0	5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	97.5	97.5	97.5	97.5	11.5	11.5
Actuated g/C Ratio	0.81	0.81	0.81	0.81	0.10	0.10
v/c Ratio	0.19	0.49	0.05	0.17	0.54	0.05
Control Delay	2.4	0.9	1.9	2.0	52.7	24.6
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	2.4	1.0	1.9	2.0	52.7	24.6
LOS	A	A	A	A	D	C
Approach Delay	1.6			1.9	51.4	
Approach LOS	A			A	D	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 116 (97%), Referenced to phase 2:EBT and 6:WBTL, Start of Yellow
 Natural Cycle: 50
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.54
 Intersection Signal Delay: 6.4
 Intersection Capacity Utilization 53.3%
 Analysis Period (min) 15

Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 2: N-S Collector & 48th Ave



HCM 6th Signalized Intersection Summary
 2: N-S Collector & 48th Ave

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↵	↑↑	↵↵	↵
Traffic Volume (veh/h)	502	645	31	454	163	7
Future Volume (veh/h)	502	645	31	454	163	7
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	546	701	34	493	177	8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	2974	1327	433	2974	247	113
Arrive On Green	1.00	1.00	0.84	0.84	0.07	0.07
Sat Flow, veh/h	3647	1585	446	3647	3456	1585
Grp Volume(v), veh/h	546	701	34	493	177	8
Grp Sat Flow(s),veh/h/ln	1777	1585	446	1777	1728	1585
Q Serve(g_s), s	0.0	0.0	1.6	3.2	6.0	0.6
Cycle Q Clear(g_c), s	0.0	0.0	1.6	3.2	6.0	0.6
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2974	1327	433	2974	247	113
V/C Ratio(X)	0.18	0.53	0.08	0.17	0.72	0.07
Avail Cap(c_a), veh/h	2974	1327	433	2974	864	396
HCM Platoon Ratio	1.67	1.67	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.43	0.43	1.00	1.00	0.88	0.88
Uniform Delay (d), s/veh	0.0	0.0	1.7	1.9	54.5	52.0
Incr Delay (d2), s/veh	0.1	0.7	0.4	0.1	3.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.0	0.4	0.2	1.4	4.9	0.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	0.1	0.7	2.1	2.0	57.9	52.2
LnGrp LOS	A	A	A	A	E	D
Approach Vol, veh/h	1247			527	185	
Approach Delay, s/veh	0.4			2.0	57.7	
Approach LOS	A			A	E	
Timer - Assigned Phs		2			6	8
Phs Duration (G+Y+Rc), s		106.4			106.4	13.6
Change Period (Y+Rc), s		6.0			6.0	5.0
Max Green Setting (Gmax), s		79.0			79.0	30.0
Max Q Clear Time (g_c+I1), s		2.0			5.2	8.0
Green Ext Time (p_c), s		8.5			4.5	0.6
Intersection Summary						
HCM 6th Ctrl Delay			6.2			
HCM 6th LOS			A			

Intersection						
Int Delay, s/veh	6.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↕	↕	↗
Traffic Vol, veh/h	72	198	276	62	191	194
Future Vol, veh/h	72	198	276	62	191	194
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	0	250	-	-	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	15	15	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	78	215	300	67	208	211

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	842	104	419	0	-	0
Stage 1	208	-	-	-	-	-
Stage 2	634	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	303	931	1137	-	-	-
Stage 1	807	-	-	-	-	-
Stage 2	491	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	223	931	1137	-	-	-
Mov Cap-2 Maneuver	223	-	-	-	-	-
Stage 1	594	-	-	-	-	-
Stage 2	491	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15.2	7.6	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1137	-	223	931	-	-
HCM Lane V/C Ratio	0.264	-	0.351	0.231	-	-
HCM Control Delay (s)	9.3	-	29.6	10	-	-
HCM Lane LOS	A	-	D	B	-	-
HCM 95th %tile Q(veh)	1.1	-	1.5	0.9	-	-

Intersection						
Int Delay, s/veh	3.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↕↕	↕↕	↗
Traffic Vol, veh/h	116	120	159	437	196	128
Future Vol, veh/h	116	120	159	437	196	128
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	0	0	-	-	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	126	130	173	475	213	139

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	797	107	352	0	-	0
Stage 1	213	-	-	-	-	-
Stage 2	584	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	487	926	1203	-	-	-
Stage 1	802	-	-	-	-	-
Stage 2	729	-	-	-	-	-
Platoon blocked, %	1			-	-	-
Mov Cap-1 Maneuver	417	926	1203	-	-	-
Mov Cap-2 Maneuver	417	-	-	-	-	-
Stage 1	687	-	-	-	-	-
Stage 2	729	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.3	2.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1203	-	417	926	-	-
HCM Lane V/C Ratio	0.144	-	0.302	0.141	-	-
HCM Control Delay (s)	8.5	-	17.3	9.5	-	-
HCM Lane LOS	A	-	C	A	-	-
HCM 95th %tile Q(veh)	0.5	-	1.3	0.5	-	-

Timings
5: Monaghan Rd & 26th Ave

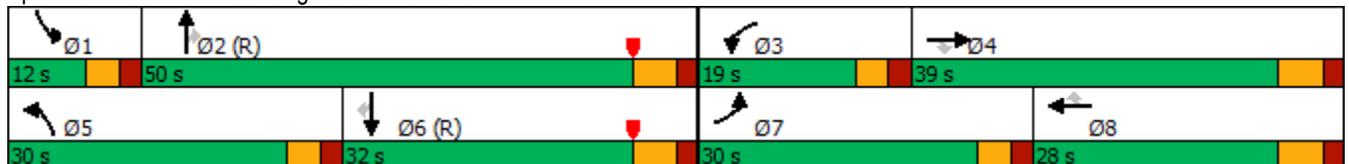
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	302	131	133	60	188	144	346	329	100	10	73	104
Future Volume (vph)	302	131	133	60	188	144	346	329	100	10	73	104
Turn Type	Prot	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0
Total Split (s)	30.0	39.0	39.0	19.0	28.0	28.0	30.0	50.0	50.0	12.0	32.0	32.0
Total Split (%)	25.0%	32.5%	32.5%	15.8%	23.3%	23.3%	25.0%	41.7%	41.7%	10.0%	26.7%	26.7%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag									
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	16.7	21.6	21.6	9.8	12.4	12.4	18.4	71.3	71.3	6.3	50.5	50.5
Actuated g/C Ratio	0.14	0.18	0.18	0.08	0.10	0.10	0.15	0.59	0.59	0.05	0.42	0.42
v/c Ratio	0.69	0.22	0.35	0.45	0.56	0.45	0.72	0.17	0.11	0.12	0.05	0.14
Control Delay	50.5	39.3	5.8	61.8	56.7	6.2	56.1	13.0	0.8	56.4	24.0	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.5	39.3	5.8	61.8	56.7	6.2	56.1	13.0	0.8	56.4	24.0	0.4
LOS	D	D	A	E	E	A	E	B	A	E	C	A
Approach Delay		37.4			38.9			30.6			12.6	
Approach LOS		D			D			C			B	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 58 (48%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.72
 Intersection Signal Delay: 32.6
 Intersection LOS: C
 Intersection Capacity Utilization 44.5%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 5: Monaghan Rd & 26th Ave



HCM 6th Signalized Intersection Summary
5: Monaghan Rd & 26th Ave

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	302	131	133	60	188	144	346	329	100	10	73	104
Future Volume (veh/h)	302	131	133	60	188	144	346	329	100	10	73	104
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	328	142	145	65	204	157	376	358	109	11	79	113
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	409	689	307	84	436	194	453	2009	896	18	1580	705
Arrive On Green	0.04	0.06	0.06	0.05	0.12	0.12	0.13	0.57	0.57	0.01	0.44	0.44
Sat Flow, veh/h	3456	3554	1585	1781	3554	1585	3456	3554	1585	1781	3554	1585
Grp Volume(v), veh/h	328	142	145	65	204	157	376	358	109	11	79	113
Grp Sat Flow(s),veh/h/ln	1728	1777	1585	1781	1777	1585	1728	1777	1585	1781	1777	1585
Q Serve(g_s), s	11.3	4.5	10.6	4.3	6.4	11.6	12.7	5.8	3.9	0.7	1.5	5.1
Cycle Q Clear(g_c), s	11.3	4.5	10.6	4.3	6.4	11.6	12.7	5.8	3.9	0.7	1.5	5.1
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	409	689	307	84	436	194	453	2009	896	18	1580	705
V/C Ratio(X)	0.80	0.21	0.47	0.77	0.47	0.81	0.83	0.18	0.12	0.60	0.05	0.16
Avail Cap(c_a), veh/h	720	977	436	208	652	291	720	2009	896	104	1580	705
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.97	0.97	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.3	47.4	50.2	56.5	49.0	51.3	50.8	12.6	12.2	59.1	18.9	19.9
Incr Delay (d2), s/veh	3.6	0.1	1.1	13.9	0.8	9.7	4.6	0.2	0.3	28.1	0.1	0.5
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	9.2	3.8	8.1	4.1	5.2	8.8	9.7	4.3	2.6	0.9	1.2	3.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	59.9	47.5	51.3	70.5	49.8	61.0	55.4	12.8	12.4	87.2	19.0	20.4
LnGrp LOS	E	D	D	E	D	E	E	B	B	F	B	C
Approach Vol, veh/h		615			426			843			203	
Approach Delay, s/veh		55.0			57.1			31.8			23.5	
Approach LOS		E			E			C			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	6.2	73.9	10.7	29.3	20.7	59.4	19.2	20.7				
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0				
Max Green Setting (Gmax), s	7.0	44.0	14.0	33.0	25.0	26.0	25.0	22.0				
Max Q Clear Time (g_c+I1), s	2.7	7.8	6.3	12.6	14.7	7.1	13.3	13.6				
Green Ext Time (p_c), s	0.0	2.9	0.1	1.3	1.0	0.7	0.9	1.1				
Intersection Summary												
HCM 6th Ctrl Delay			43.0									
HCM 6th LOS			D									

Timings
6: 26th Ave & N-S Collector



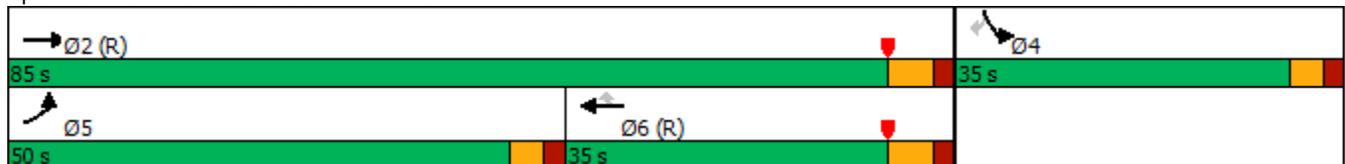
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖↖	↗↗	↖↖	↗	↖	↖↖
Traffic Volume (vph)	822	657	412	234	89	195
Future Volume (vph)	822	657	412	234	89	195
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Detector Phase	5	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	22.0	21.0	21.0
Total Split (s)	50.0	85.0	35.0	35.0	35.0	35.0
Total Split (%)	41.7%	70.8%	29.2%	29.2%	29.2%	29.2%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Recall Mode	None	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	37.4	97.1	54.6	54.6	11.9	11.9
Actuated g/C Ratio	0.31	0.81	0.46	0.46	0.10	0.10
v/c Ratio	0.83	0.25	0.28	0.30	0.55	0.45
Control Delay	45.6	3.2	4.1	0.8	61.9	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.6	3.2	4.1	0.8	61.9	11.5
LOS	D	A	A	A	E	B
Approach Delay		26.8	2.9		27.3	
Approach LOS		C	A		C	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 16 (13%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.83
 Intersection Signal Delay: 20.4
 Intersection Capacity Utilization 53.1%
 Analysis Period (min) 15

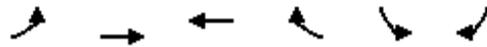
Intersection LOS: C
 ICU Level of Service A

Splits and Phases: 6: 26th Ave & N-S Collector



HCM 6th Signalized Intersection Summary
6: 26th Ave & N-S Collector

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	822	657	412	234	89	195
Future Volume (veh/h)	822	657	412	234	89	195
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	893	714	448	254	97	212
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1002	2875	1697	757	177	277
Arrive On Green	0.29	0.81	0.95	0.95	0.10	0.10
Sat Flow, veh/h	3456	3647	3647	1585	1781	2790
Grp Volume(v), veh/h	893	714	448	254	97	212
Grp Sat Flow(s),veh/h/ln	1728	1777	1777	1585	1781	1395
Q Serve(g_s), s	29.7	5.8	0.9	1.3	6.2	8.9
Cycle Q Clear(g_c), s	29.7	5.8	0.9	1.3	6.2	8.9
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	1002	2875	1697	757	177	277
V/C Ratio(X)	0.89	0.25	0.26	0.34	0.55	0.77
Avail Cap(c_a), veh/h	1296	2875	1697	757	445	697
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.79	0.79	0.95	0.95
Uniform Delay (d), s/veh	40.8	2.7	1.4	1.4	51.5	52.7
Incr Delay (d2), s/veh	6.6	0.2	0.3	0.9	2.5	4.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	19.5	3.0	0.6	0.9	5.2	11.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	47.4	2.9	1.7	2.4	54.0	56.9
LnGrp LOS	D	A	A	A	D	E
Approach Vol, veh/h		1607	702		309	
Approach Delay, s/veh		27.7	2.0		56.0	
Approach LOS		C	A		E	
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		103.1		16.9	39.8	63.3
Change Period (Y+Rc), s		6.0		5.0	5.0	6.0
Max Green Setting (Gmax), s		79.0		30.0	45.0	29.0
Max Q Clear Time (g_c+I1), s		7.8		10.9	31.7	3.3
Green Ext Time (p_c), s		6.0		1.0	3.1	4.1

Intersection Summary

HCM 6th Ctrl Delay	24.1
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

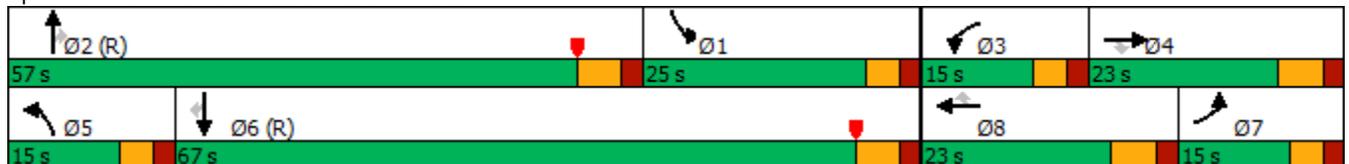
Timings
7: Powhatan Rd & 38th Ave

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	66	113	132	151	31	127	73	1449	614	518	996	24
Future Volume (vph)	66	113	132	151	31	127	73	1449	614	518	996	24
Turn Type	Prot	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0
Total Split (s)	15.0	23.0	23.0	15.0	23.0	23.0	15.0	57.0	57.0	25.0	67.0	67.0
Total Split (%)	12.5%	19.2%	19.2%	12.5%	19.2%	19.2%	12.5%	47.5%	47.5%	20.8%	55.8%	55.8%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	13.9	13.0	13.0	9.6	10.9	10.9	9.6	54.7	54.7	20.7	68.2	68.2
Actuated g/C Ratio	0.12	0.11	0.11	0.08	0.09	0.09	0.08	0.46	0.46	0.17	0.57	0.57
v/c Ratio	0.35	0.61	0.44	0.60	0.20	0.45	0.56	0.68	0.72	0.95	0.38	0.03
Control Delay	52.5	63.7	8.0	60.6	51.9	13.4	68.2	28.0	16.4	46.6	9.0	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.5	63.7	8.0	60.6	51.9	13.4	68.2	28.0	16.4	46.6	9.0	0.0
LOS	D	E	A	E	D	B	E	C	B	D	A	A
Approach Delay		37.8			40.3			26.0			21.5	
Approach LOS		D			D			C			C	

Intersection Summary

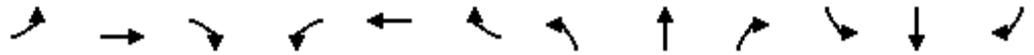
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 56 (47%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.95
 Intersection Signal Delay: 26.3
 Intersection LOS: C
 Intersection Capacity Utilization 72.9%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 7: Powhatan Rd & 38th Ave



HCM 6th Signalized Intersection Summary
7: Powhatan Rd & 38th Ave

ATEC
11/15/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖↗	↑	↗	↖	↑↑↑	↗	↖↗	↑↑↑	↗
Traffic Volume (veh/h)	66	113	132	151	31	127	73	1449	614	518	996	24
Future Volume (veh/h)	66	113	132	151	31	127	73	1449	614	518	996	24
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	72	123	143	164	34	0	79	1575	0	563	1083	26
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	230	203	172	221	66		100	1928		892	3000	931
Arrive On Green	0.13	0.11	0.11	0.06	0.04	0.00	0.06	0.38	0.00	0.17	0.39	0.39
Sat Flow, veh/h	1781	1870	1585	3456	1870	1585	1781	5106	1585	3456	5106	1585
Grp Volume(v), veh/h	72	123	143	164	34	0	79	1575	0	563	1083	26
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1728	1870	1585	1781	1702	1585	1728	1702	1585
Q Serve(g_s), s	4.4	7.5	10.6	5.6	2.1	0.0	5.3	33.3	0.0	18.2	18.0	0.5
Cycle Q Clear(g_c), s	4.4	7.5	10.6	5.6	2.1	0.0	5.3	33.3	0.0	18.2	18.0	0.5
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	230	203	172	221	66		100	1928		892	3000	931
V/C Ratio(X)	0.31	0.60	0.83	0.74	0.52		0.79	0.82		0.63	0.36	0.03
Avail Cap(c_a), veh/h	230	265	225	288	265		148	2170		892	3000	931
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	1.00	1.00	0.94	0.94	0.00	1.00	1.00	0.00	0.11	0.11	0.11
Uniform Delay (d), s/veh	47.4	51.0	52.4	55.2	56.9	0.0	55.9	33.6	0.0	44.3	20.5	3.0
Incr Delay (d2), s/veh	0.8	2.9	17.8	6.8	5.8	0.0	15.2	4.0	0.0	0.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.6	6.7	8.8	4.8	2.0	0.0	5.0	20.4	0.0	9.7	9.2	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	48.2	53.9	70.2	62.0	62.7	0.0	71.1	37.6	0.0	44.5	20.5	3.0
LnGrp LOS	D	D	E	E	E		E	D		D	C	A
Approach Vol, veh/h		338			198	A		1654	A		1672	
Approach Delay, s/veh		59.6			62.1			39.2			28.3	
Approach LOS		E			E			D			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	37.0	51.3	12.7	19.0	11.8	76.5	21.5	10.2				
Change Period (Y+Rc), s	6.0	* 6	5.0	6.0	5.0	6.0	6.0	* 6				
Max Green Setting (Gmax), s	20.0	* 51	10.0	17.0	10.0	61.0	10.0	* 17				
Max Q Clear Time (g_c+I1), s	20.2	35.3	7.6	12.6	7.3	20.0	6.4	4.1				
Green Ext Time (p_c), s	0.0	10.0	0.1	0.4	0.0	10.1	0.0	0.1				

Intersection Summary

HCM 6th Ctrl Delay	37.4
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Timings
8: N-S Collector & 38th Ave

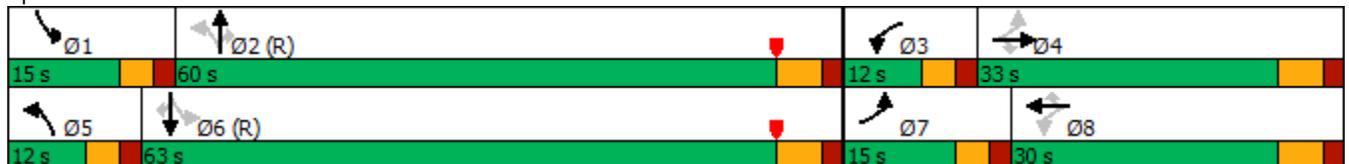
ATEC
11/15/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	176	228	204	69	136	82	83	397	113	112	176	42
Future Volume (vph)	176	228	204	69	136	82	83	397	113	112	176	42
Turn Type	pm+pt	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0
Total Split (s)	15.0	33.0	33.0	12.0	30.0	30.0	12.0	60.0	60.0	15.0	63.0	63.0
Total Split (%)	12.5%	27.5%	27.5%	10.0%	25.0%	25.0%	10.0%	50.0%	50.0%	12.5%	52.5%	52.5%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag									
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	36.9	24.1	24.1	25.5	15.4	15.4	67.1	57.9	57.9	69.1	58.9	58.9
Actuated g/C Ratio	0.31	0.20	0.20	0.21	0.13	0.13	0.56	0.48	0.48	0.58	0.49	0.49
v/c Ratio	0.53	0.66	0.45	0.28	0.62	0.29	0.13	0.48	0.15	0.25	0.21	0.05
Control Delay	34.5	50.3	13.1	27.4	56.4	6.7	4.9	9.9	0.6	10.7	17.1	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.5	50.3	13.1	27.4	56.4	6.7	4.9	9.9	0.6	10.7	17.1	1.0
LOS	C	D	B	C	E	A	A	A	A	B	B	A
Approach Delay		33.2			35.3			7.5			12.9	
Approach LOS		C			D			A			B	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 19 (16%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.66
 Intersection Signal Delay: 21.4
 Intersection LOS: C
 Intersection Capacity Utilization 62.3%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 8: N-S Collector & 38th Ave



HCM 6th Signalized Intersection Summary
8: N-S Collector & 38th Ave

ATEC
11/15/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	176	228	204	69	136	82	83	397	113	112	176	42
Future Volume (veh/h)	176	228	204	69	136	82	83	397	113	112	176	42
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	191	248	222	75	148	89	90	432	123	122	191	46
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	275	313	266	180	248	210	714	1037	879	501	1055	894
Arrive On Green	0.03	0.06	0.06	0.05	0.13	0.13	0.04	0.55	0.55	0.05	0.56	0.56
Sat Flow, veh/h	1781	1870	1585	1781	1870	1585	1781	1870	1585	1781	1870	1585
Grp Volume(v), veh/h	191	248	222	75	148	89	90	432	123	122	191	46
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	1870	1585	1781	1870	1585	1781	1870	1585
Q Serve(g_s), s	10.0	15.7	16.6	4.3	8.9	6.2	2.6	16.1	4.5	3.5	6.0	1.6
Cycle Q Clear(g_c), s	10.0	15.7	16.6	4.3	8.9	6.2	2.6	16.1	4.5	3.5	6.0	1.6
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	275	313	266	180	248	210	714	1037	879	501	1055	894
V/C Ratio(X)	0.70	0.79	0.84	0.42	0.60	0.42	0.13	0.42	0.14	0.24	0.18	0.05
Avail Cap(c_a), veh/h	275	421	357	198	374	317	752	1037	879	568	1055	894
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.49	0.49	0.49	1.00	1.00	1.00	0.63	0.63	0.63	0.88	0.88	0.88
Uniform Delay (d), s/veh	44.1	54.6	55.1	42.6	49.0	47.8	10.7	15.5	12.9	11.5	12.7	11.7
Incr Delay (d2), s/veh	3.7	3.7	6.4	1.5	2.3	1.4	0.0	0.8	0.2	0.2	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	1.5	11.5	10.7	3.6	7.8	4.6	1.8	10.4	3.0	2.5	4.6	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.8	58.3	61.4	44.2	51.3	49.2	10.7	16.3	13.1	11.7	13.0	11.8
LnGrp LOS	D	E	E	D	D	D	B	B	B	B	B	B
Approach Vol, veh/h		661			312			645			359	
Approach Delay, s/veh		56.3			49.0			14.9			12.4	
Approach LOS		E			D			B			B	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	10.5	72.6	10.8	26.1	9.4	73.7	15.0	21.9				
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0				
Max Green Setting (Gmax), s	10.0	54.0	7.0	27.0	7.0	57.0	10.0	24.0				
Max Q Clear Time (g_c+I1), s	5.5	18.1	6.3	18.6	4.6	8.0	12.0	10.9				
Green Ext Time (p_c), s	0.1	3.4	0.0	1.5	0.0	1.3	0.0	0.8				
Intersection Summary												
HCM 6th Ctrl Delay			33.7									
HCM 6th LOS			C									

Timings
1: Powhatan Rd & 48th Ave

ATEC
11/15/2019

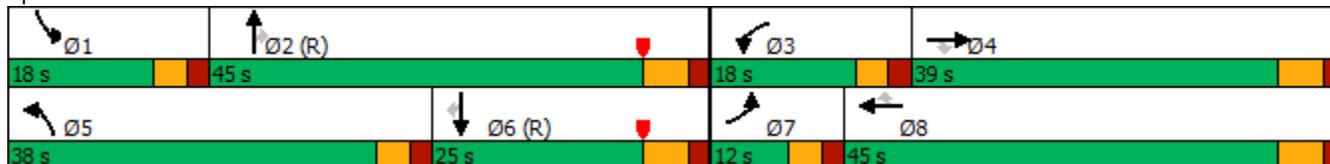


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖
Traffic Volume (vph)	90	300	936	240	600	410	941	455	286	155	530	130
Future Volume (vph)	90	300	936	240	600	410	941	455	286	155	530	130
Turn Type	Prot	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0
Total Split (s)	12.0	39.0	39.0	18.0	45.0	45.0	38.0	45.0	45.0	18.0	25.0	25.0
Total Split (%)	10.0%	32.5%	32.5%	15.0%	37.5%	37.5%	31.7%	37.5%	37.5%	15.0%	20.8%	20.8%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag									
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	6.9	33.4	33.4	12.6	39.1	39.1	31.1	40.8	40.8	11.2	20.9	20.9
Actuated g/C Ratio	0.06	0.28	0.28	0.10	0.33	0.33	0.26	0.34	0.34	0.09	0.17	0.17
v/c Ratio	0.54	0.36	1.25	0.78	0.61	0.61	0.85	0.44	0.44	0.56	1.01	0.33
Control Delay	66.2	36.2	140.0	61.8	28.0	10.3	33.7	20.1	3.9	59.4	89.8	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.2	36.2	140.0	61.8	28.0	10.3	33.7	20.1	3.9	59.4	89.8	3.0
LOS	E	D	F	E	C	B	C	C	A	E	F	A
Approach Delay		111.5			28.7			24.9			70.2	
Approach LOS		F			C			C			E	

Intersection Summary

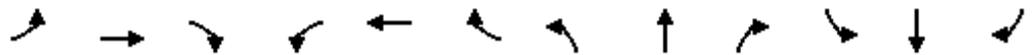
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 109 (91%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 150
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.25
 Intersection Signal Delay: 55.7
 Intersection LOS: E
 Intersection Capacity Utilization 93.6%
 ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 1: Powhatan Rd & 48th Ave



HCM 6th Signalized Intersection Summary
1: Powhatan Rd & 48th Ave

ATEC
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖	↖↗	↕	↖
Traffic Volume (veh/h)	90	300	936	240	600	410	941	455	286	155	530	130
Future Volume (veh/h)	90	300	936	240	600	410	941	455	286	155	530	130
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	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	98	326	0	261	652	446	1023	495	0	168	576	141
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, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	146	893		317	1069	477	1173	1269		224	670	299
Arrive On Green	0.04	0.27	0.00	0.03	0.11	0.11	0.08	0.13	0.00	0.07	0.20	0.20
Sat Flow, veh/h	3237	3328	1485	3237	3328	1485	4705	3328	1485	3237	3328	1485
Grp Volume(v), veh/h	98	326	0	261	652	446	1023	495	0	168	576	141
Grp Sat Flow(s),veh/h/ln	1618	1664	1485	1618	1664	1485	1568	1664	1485	1618	1664	1485
Q Serve(g_s), s	3.6	9.5	0.0	9.6	22.5	35.8	25.8	16.4	0.0	6.1	20.1	10.1
Cycle Q Clear(g_c), s	3.6	9.5	0.0	9.6	22.5	35.8	25.8	16.4	0.0	6.1	20.1	10.1
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	146	893		317	1069	477	1173	1269		224	670	299
V/C Ratio(X)	0.67	0.37		0.82	0.61	0.94	0.87	0.39		0.75	0.86	0.47
Avail Cap(c_a), veh/h	189	915		351	1082	482	1294	1269		351	670	299
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.83	0.83	0.83	0.65	0.65	0.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.4	35.6	0.0	57.0	46.5	52.4	53.2	39.6	0.0	54.8	46.3	42.3
Incr Delay (d2), s/veh	6.0	0.3	0.0	11.5	0.8	22.5	4.3	0.6	0.0	5.0	13.6	5.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.9	7.1	0.0	7.9	14.9	23.5	15.8	11.1	0.0	4.8	14.6	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	62.5	35.9	0.0	68.5	47.3	74.9	57.4	40.2	0.0	59.8	59.9	47.6
LnGrp LOS	E	D		E	D	E	E	D		E	E	D
Approach Vol, veh/h		424	A		1359			1518	A		885	
Approach Delay, s/veh		42.0			60.4			51.8			57.9	
Approach LOS		D			E			D			E	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.3	51.8	16.8	38.2	34.9	30.1	10.4	44.5				
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0				
Max Green Setting (Gmax), s	13.0	39.0	13.0	33.0	33.0	19.0	7.0	39.0				
Max Q Clear Time (g_c+I1), s	8.1	18.4	11.6	11.5	27.8	22.1	5.6	37.8				
Green Ext Time (p_c), s	0.2	3.3	0.1	2.1	2.1	0.0	0.0	0.8				

Intersection Summary

HCM 6th Ctrl Delay	54.9
HCM 6th LOS	D

Notes

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

Timings
2: N-S Collector & 48th Ave



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓↓	↓
Traffic Volume (vph)	509	172	8	483	655	30
Future Volume (vph)	509	172	8	483	655	30
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		2	6			8
Detector Phase	2	2	6	6	8	8
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	21.0	21.0
Total Split (s)	35.0	35.0	35.0	35.0	85.0	85.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	70.8%	70.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	5.0	5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	C-Min	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	72.8	72.8	72.8	72.8	36.2	36.2
Actuated g/C Ratio	0.61	0.61	0.61	0.61	0.30	0.30
v/c Ratio	0.28	0.19	0.02	0.26	0.74	0.07
Control Delay	10.0	2.0	11.6	11.3	29.7	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.0	2.0	11.6	11.3	29.7	1.9
LOS	A	A	B	B	C	A
Approach Delay	8.0			11.3	28.4	
Approach LOS	A			B	C	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 66 (55%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
 Natural Cycle: 45
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.74
 Intersection Signal Delay: 16.4
 Intersection LOS: B
 Intersection Capacity Utilization 41.9%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 2: N-S Collector & 48th Ave



HCM 6th Signalized Intersection Summary
2: N-S Collector & 48th Ave

ATEC
11/15/2019



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓↓	↓
Traffic Volume (veh/h)	509	172	8	483	655	30
Future Volume (veh/h)	509	172	8	483	655	30
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	553	187	9	525	712	33
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	10	10	10	10	10
Cap, veh/h	2181	973	408	2181	819	376
Arrive On Green	0.22	0.22	0.66	0.66	0.25	0.25
Sat Flow, veh/h	3416	1485	673	3416	3237	1485
Grp Volume(v), veh/h	553	187	9	525	712	33
Grp Sat Flow(s),veh/h/ln	1664	1485	673	1664	1618	1485
Q Serve(g_s), s	16.5	12.4	0.8	7.7	25.3	2.0
Cycle Q Clear(g_c), s	16.5	12.4	17.3	7.7	25.3	2.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2181	973	408	2181	819	376
V/C Ratio(X)	0.25	0.19	0.02	0.24	0.87	0.09
Avail Cap(c_a), veh/h	2181	973	408	2181	2158	990
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.90	0.90	1.00	1.00	0.93	0.93
Uniform Delay (d), s/veh	22.7	21.1	14.2	8.5	42.9	34.2
Incr Delay (d2), s/veh	0.3	0.4	0.1	0.3	2.8	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	11.7	8.5	0.2	5.0	15.5	1.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	22.9	21.4	14.3	8.7	45.7	34.3
LnGrp LOS	C	C	B	A	D	C
Approach Vol, veh/h	740			534	745	
Approach Delay, s/veh	22.6			8.8	45.2	
Approach LOS	C			A	D	
Timer - Assigned Phs		2			6	8
Phs Duration (G+Y+Rc), s		84.6			84.6	35.4
Change Period (Y+Rc), s		6.0			6.0	5.0
Max Green Setting (Gmax), s		29.0			29.0	80.0
Max Q Clear Time (g_c+I1), s		18.5			19.3	27.3
Green Ext Time (p_c), s		3.3			2.5	3.1
Intersection Summary						
HCM 6th Ctrl Delay			27.3			
HCM 6th LOS			C			

Intersection						
Int Delay, s/veh	10.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↙	↗	↙	↕↕	↕↕	↗
Traffic Vol, veh/h	183	287	213	198	96	84
Future Vol, veh/h	183	287	213	198	96	84
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	0	250	-	-	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	15	15	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	10	10	10	10	10	10
Mvmt Flow	199	312	232	215	104	91

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	676	52	195	0	-	0
Stage 1	104	-	-	-	-	-
Stage 2	572	-	-	-	-	-
Critical Hdwy	7	7.1	4.3	-	-	-
Critical Hdwy Stg 1	6	-	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-	-	-
Follow-up Hdwy	3.6	3.4	2.3	-	-	-
Pot Cap-1 Maneuver	370	979	1319	-	-	-
Stage 1	885	-	-	-	-	-
Stage 2	506	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	305	979	1319	-	-	-
Mov Cap-2 Maneuver	305	-	-	-	-	-
Stage 1	729	-	-	-	-	-
Stage 2	506	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.6	4.3	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1319	-	305	979	-	-
HCM Lane V/C Ratio	0.176	-	0.652	0.319	-	-
HCM Control Delay (s)	8.3	-	36.5	10.4	-	-
HCM Lane LOS	A	-	E	B	-	-
HCM 95th %tile Q(veh)	0.6	-	4.3	1.4	-	-

Intersection						
Int Delay, s/veh	6.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↕↕	↕↕	↗
Traffic Vol, veh/h	129	164	114	227	442	117
Future Vol, veh/h	129	164	114	227	442	117
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	0	0	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	10	10	10	10	10	10
Mvmt Flow	140	178	124	247	480	127

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	852	240	607	0	-	0
Stage 1	480	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Critical Hdwy	7	7.1	4.3	-	-	-
Critical Hdwy Stg 1	6	-	-	-	-	-
Critical Hdwy Stg 2	6	-	-	-	-	-
Follow-up Hdwy	3.6	3.4	2.3	-	-	-
Pot Cap-1 Maneuver	283	737	915	-	-	-
Stage 1	566	-	-	-	-	-
Stage 2	644	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	245	737	915	-	-	-
Mov Cap-2 Maneuver	245	-	-	-	-	-
Stage 1	489	-	-	-	-	-
Stage 2	644	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	23	3.2	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	915	-	245	737	-	-
HCM Lane V/C Ratio	0.135	-	0.572	0.242	-	-
HCM Control Delay (s)	9.6	-	37.7	11.4	-	-
HCM Lane LOS	A	-	E	B	-	-
HCM 95th %tile Q(veh)	0.5	-	3.2	0.9	-	-

Timings
5: Monaghan Rd & 26th Ave

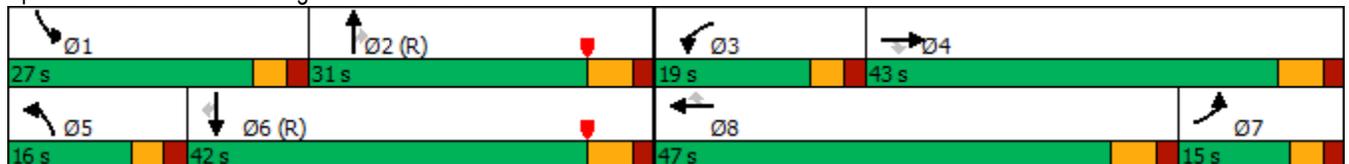
ATEC
11/15/2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	245	372	80	133	42	122	97	60	133	290	288
Future Volume (vph)	118	245	372	80	133	42	122	97	60	133	290	288
Turn Type	Prot	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0	9.0	26.5	26.5
Total Split (s)	15.0	43.0	43.0	19.0	47.0	47.0	16.0	31.0	31.0	27.0	42.0	42.0
Total Split (%)	12.5%	35.8%	35.8%	15.8%	39.2%	39.2%	13.3%	25.8%	25.8%	22.5%	35.0%	35.0%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	18.1	17.2	17.2	11.7	10.7	10.7	10.3	53.4	53.4	15.8	58.8	58.8
Actuated g/C Ratio	0.15	0.14	0.14	0.10	0.09	0.09	0.09	0.44	0.44	0.13	0.49	0.49
v/c Ratio	0.27	0.57	0.73	0.55	0.50	0.16	0.49	0.07	0.08	0.67	0.20	0.36
Control Delay	35.8	42.7	13.0	63.8	57.5	1.2	57.9	23.4	0.2	64.2	19.8	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	42.7	13.0	63.8	57.5	1.2	57.9	23.4	0.2	64.2	19.8	3.9
LOS	D	D	B	E	E	A	E	C	A	E	B	A
Approach Delay		26.6			50.2			33.6			21.7	
Approach LOS		C			D			C			C	

Intersection Summary

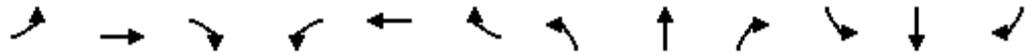
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 28 (23%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.73
 Intersection Signal Delay: 28.9
 Intersection LOS: C
 Intersection Capacity Utilization 49.6%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 5: Monaghan Rd & 26th Ave



HCM 6th Signalized Intersection Summary
5: Monaghan Rd & 26th Ave

ATEC
11/15/2019



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔	↑↑	↗	↖	↑↑	↗	↔↔	↑↑	↗	↖	↑↑	↗
Traffic Volume (veh/h)	118	245	372	80	133	42	122	97	60	133	290	288
Future Volume (veh/h)	118	245	372	80	133	42	122	97	60	133	290	288
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	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	128	266	404	87	145	46	133	105	65	145	315	313
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, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	915	979	437	108	227	101	186	1179	526	172	1332	594
Arrive On Green	0.09	0.10	0.10	0.06	0.07	0.07	0.06	0.35	0.35	0.10	0.40	0.40
Sat Flow, veh/h	3237	3328	1485	1668	3328	1485	3237	3328	1485	1668	3328	1485
Grp Volume(v), veh/h	128	266	404	87	145	46	133	105	65	145	315	313
Grp Sat Flow(s),veh/h/ln	1618	1664	1485	1668	1664	1485	1618	1664	1485	1668	1664	1485
Q Serve(g_s), s	4.4	8.9	32.4	6.2	5.1	2.8	4.8	2.5	3.5	10.2	7.5	7.0
Cycle Q Clear(g_c), s	4.4	8.9	32.4	6.2	5.1	2.8	4.8	2.5	3.5	10.2	7.5	7.0
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	915	979	437	108	227	101	186	1179	526	172	1332	594
V/C Ratio(X)	0.14	0.27	0.93	0.80	0.64	0.45	0.72	0.09	0.12	0.84	0.24	0.53
Avail Cap(c_a), veh/h	915	1026	458	195	1137	507	297	1179	526	306	1332	594
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.93	0.93	0.93	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	41.0	42.3	52.9	55.3	54.5	33.6	55.6	25.8	26.2	52.8	23.9	3.6
Incr Delay (d2), s/veh	0.1	0.1	23.0	12.7	3.0	3.2	5.0	0.1	0.5	10.5	0.4	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	3.2	7.1	22.0	5.4	4.0	2.5	3.8	1.9	2.4	8.4	5.5	10.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.1	42.4	75.8	68.1	57.4	36.8	60.6	26.0	26.6	63.3	24.3	6.9
LnGrp LOS	D	D	E	E	E	D	E	C	C	E	C	A
Approach Vol, veh/h		798			278			303			773	
Approach Delay, s/veh		59.1			57.3			41.3			24.6	
Approach LOS		E			E			D			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	17.4	48.5	12.8	41.3	11.9	54.0	39.9	14.2				
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	6.0	* 6				
Max Green Setting (Gmax), s	22.0	25.0	14.0	37.0	11.0	36.0	10.0	* 41				
Max Q Clear Time (g_c+I1), s	12.2	5.5	8.2	34.4	6.8	9.5	6.4	7.1				
Green Ext Time (p_c), s	0.2	0.7	0.1	0.9	0.1	3.3	0.1	1.1				

Intersection Summary

HCM 6th Ctrl Delay	44.0
HCM 6th LOS	D

Notes

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

Timings
6: 26th Ave & N-S Collector

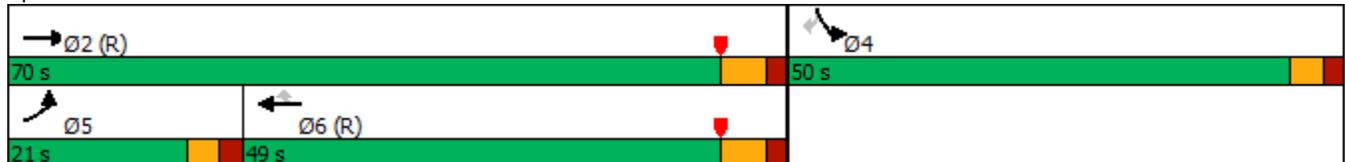


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↗↗	↕↕	↖↖	↗	↖	↗↗
Traffic Volume (vph)	217	534	601	98	227	801
Future Volume (vph)	217	534	601	98	227	801
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Detector Phase	5	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	22.0	21.0	21.0
Total Split (s)	21.0	70.0	49.0	49.0	50.0	50.0
Total Split (%)	17.5%	58.3%	40.8%	40.8%	41.7%	41.7%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Recall Mode	None	C-Min	C-Min	C-Min	None	None
Act Effct Green (s)	14.1	83.2	64.1	64.1	25.8	25.8
Actuated g/C Ratio	0.12	0.69	0.53	0.53	0.22	0.22
v/c Ratio	0.63	0.25	0.37	0.13	0.70	0.82
Control Delay	57.8	8.0	14.3	2.7	48.8	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.8	8.0	14.3	2.7	48.8	17.4
LOS	E	A	B	A	D	B
Approach Delay		22.4	12.7		24.3	
Approach LOS		C	B		C	

Intersection Summary

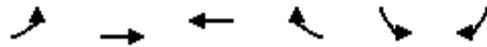
Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 3 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.82
 Intersection Signal Delay: 20.5
 Intersection LOS: C
 Intersection Capacity Utilization 53.8%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 6: 26th Ave & N-S Collector



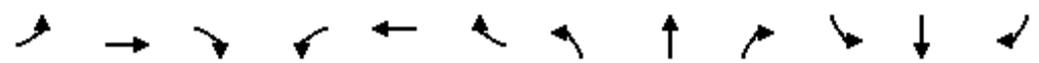
HCM 6th Signalized Intersection Summary
6: 26th Ave & N-S Collector

ATEC
11/15/2019



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖↖	↑↑	↗↗	↖	↘	↘↘
Traffic Volume (veh/h)	217	534	601	98	227	801
Future Volume (veh/h)	217	534	601	98	227	801
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No	No		No	
Adj Sat Flow, veh/h/ln	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	236	580	653	107	247	871
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	10	10	10	10	10	10
Cap, veh/h	295	1839	1397	623	594	930
Arrive On Green	0.09	0.55	0.84	0.84	0.36	0.36
Sat Flow, veh/h	3237	3416	3416	1485	1668	2613
Grp Volume(v), veh/h	236	580	653	107	247	871
Grp Sat Flow(s),veh/h/ln	1618	1664	1664	1485	1668	1306
Q Serve(g_s), s	8.6	11.3	6.2	1.6	13.4	38.7
Cycle Q Clear(g_c), s	8.6	11.3	6.2	1.6	13.4	38.7
Prop In Lane	1.00			1.00	1.00	1.00
Lane Grp Cap(c), veh/h	295	1839	1397	623	594	930
V/C Ratio(X)	0.80	0.32	0.47	0.17	0.42	0.94
Avail Cap(c_a), veh/h	432	1839	1397	623	626	980
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.91	0.91	0.88	0.88
Uniform Delay (d), s/veh	53.5	14.5	6.1	5.7	29.2	37.4
Incr Delay (d2), s/veh	6.6	0.5	1.0	0.5	0.4	14.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	6.8	7.8	3.2	1.1	9.1	33.5
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	60.0	15.0	7.1	6.3	29.6	51.4
LnGrp LOS	E	B	A	A	C	D
Approach Vol, veh/h		816	760		1118	
Approach Delay, s/veh		28.0	7.0		46.6	
Approach LOS		C	A		D	
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		72.3		47.7	15.9	56.4
Change Period (Y+Rc), s		6.0		5.0	5.0	6.0
Max Green Setting (Gmax), s		64.0		45.0	16.0	43.0
Max Q Clear Time (g_c+I1), s		13.3		40.7	10.6	8.2
Green Ext Time (p_c), s		4.6		2.0	0.4	5.6
Intersection Summary						
HCM 6th Ctrl Delay			29.8			
HCM 6th LOS			C			

Timings
7: Powhatan Rd & 38th Ave

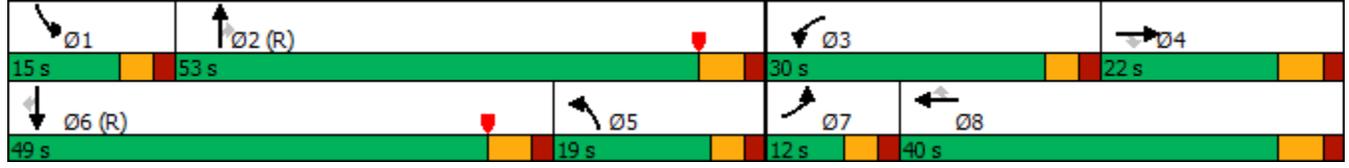


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑	↗	↘↗	↑	↗	↘	↑↑↑	↗	↘↗	↑↑↑	↗
Traffic Volume (vph)	24	78	83	597	111	492	152	1180	168	138	1529	65
Future Volume (vph)	24	78	83	597	111	492	152	1180	168	138	1529	65
Turn Type	Prot	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0	9.0	22.0	22.0
Total Split (s)	12.0	22.0	22.0	30.0	40.0	40.0	19.0	53.0	53.0	15.0	49.0	49.0
Total Split (%)	10.0%	18.3%	18.3%	25.0%	33.3%	33.3%	15.8%	44.2%	44.2%	12.5%	40.8%	40.8%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lag	Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	6.5	12.8	12.8	25.3	35.9	35.9	13.7	50.4	50.4	9.5	46.2	46.2
Actuated g/C Ratio	0.05	0.11	0.11	0.21	0.30	0.30	0.11	0.42	0.42	0.08	0.38	0.38
v/c Ratio	0.29	0.46	0.26	0.97	0.23	0.85	0.88	0.65	0.25	0.60	0.92	0.11
Control Delay	62.9	57.4	1.8	74.4	33.0	33.2	93.4	30.3	4.3	70.5	27.5	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.9	57.4	1.8	74.4	33.0	33.2	93.4	30.3	4.3	70.5	27.5	0.0
LOS	E	E	A	E	C	C	F	C	A	E	C	A
Approach Delay		33.2			53.7			33.8			29.9	
Approach LOS		C			D			C			C	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 46 (38%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 100
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.97
 Intersection Signal Delay: 37.5
 Intersection LOS: D
 Intersection Capacity Utilization 75.8%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 7: Powhatan Rd & 38th Ave



HCM 6th Signalized Intersection Summary
7: Powhatan Rd & 38th Ave

ATEC
11/15/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	78	83	597	111	492	152	1180	168	138	1529	65
Future Volume (veh/h)	24	78	83	597	111	492	152	1180	168	138	1529	65
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	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	26	85	90	649	121	0	165	1283	0	150	1662	71
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, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	32	118	100	674	450		290	2285		204	1714	532
Arrive On Green	0.02	0.07	0.07	0.07	0.08	0.00	0.17	0.48	0.00	0.04	0.24	0.24
Sat Flow, veh/h	1668	1752	1485	3237	1752	1485	1668	4782	1485	3237	4782	1485
Grp Volume(v), veh/h	26	85	90	649	121	0	165	1283	0	150	1662	71
Grp Sat Flow(s),veh/h/ln	1668	1752	1485	1618	1752	1485	1668	1594	1485	1618	1594	1485
Q Serve(g_s), s	1.9	5.7	5.1	24.0	7.8	0.0	10.9	23.0	0.0	5.5	41.3	3.7
Cycle Q Clear(g_c), s	1.9	5.7	5.1	24.0	7.8	0.0	10.9	23.0	0.0	5.5	41.3	3.7
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	32	118	100	674	450		290	2285		204	1714	532
V/C Ratio(X)	0.81	0.72	0.90	0.96	0.27		0.57	0.56		0.74	0.97	0.13
Avail Cap(c_a), veh/h	97	234	198	674	496		290	2285		270	1714	532
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	1.00	1.00	0.88	0.88	0.00	1.00	1.00	0.00	0.09	0.09	0.09
Uniform Delay (d), s/veh	58.6	54.8	27.7	55.4	44.4	0.0	45.4	22.4	0.0	56.5	45.0	21.2
Incr Delay (d2), s/veh	35.7	7.9	22.6	23.6	0.3	0.0	2.6	1.0	0.0	0.7	2.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.0	5.0	5.9	18.1	6.5	0.0	8.3	13.5	0.0	3.0	19.3	2.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	94.3	62.7	50.3	79.0	44.7	0.0	48.0	23.4	0.0	57.2	47.5	21.2
LnGrp LOS	F	E	D	E	D		D	C		E	D	C
Approach Vol, veh/h		201			770	A		1448	A		1883	
Approach Delay, s/veh		61.2			73.6			26.2			47.3	
Approach LOS		E			E			C			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.5	63.3	30.0	14.1	26.9	49.0	7.3	36.8				
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	6.0	* 6	5.0	6.0				
Max Green Setting (Gmax), s	10.0	47.0	25.0	16.0	14.0	* 43	7.0	34.0				
Max Q Clear Time (g_c+I1), s	7.5	25.0	26.0	7.7	12.9	43.3	3.9	9.8				
Green Ext Time (p_c), s	0.1	10.1	0.0	0.4	0.0	0.0	0.0	0.6				

Intersection Summary

HCM 6th Ctrl Delay	45.5
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

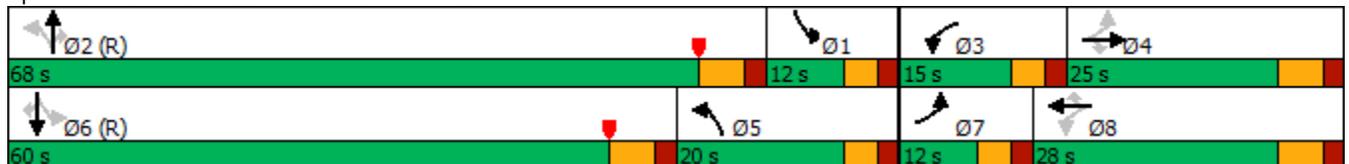
Timings
8: N-S Collector & 38th Ave

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	181	88	111	212	112	194	307	72	82	387	172
Future Volume (vph)	46	181	88	111	212	112	194	307	72	82	387	172
Turn Type	pm+pt	NA	Perm									
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	9.5	22.0	22.0	9.5	22.0	22.0	9.5	22.0	22.0	9.5	22.0	22.0
Total Split (s)	12.0	25.0	25.0	15.0	28.0	28.0	20.0	68.0	68.0	12.0	60.0	60.0
Total Split (%)	10.0%	20.8%	20.8%	12.5%	23.3%	23.3%	16.7%	56.7%	56.7%	10.0%	50.0%	50.0%
Yellow Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?	Yes											
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min						
Act Effct Green (s)	27.9	19.0	19.0	37.1	25.6	25.6	63.7	51.5	51.5	71.3	55.3	55.3
Actuated g/C Ratio	0.23	0.16	0.16	0.31	0.21	0.21	0.53	0.43	0.43	0.59	0.46	0.46
v/c Ratio	0.19	0.72	0.25	0.41	0.62	0.27	0.49	0.45	0.11	0.15	0.53	0.24
Control Delay	23.5	56.8	4.1	31.7	48.5	3.1	16.4	19.0	0.4	13.4	27.8	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.5	56.8	4.1	31.7	48.5	3.1	16.4	19.0	0.4	13.4	27.8	5.2
LOS	C	E	A	C	D	A	B	B	A	B	C	A
Approach Delay		37.1			32.5			15.8			19.9	
Approach LOS		D			C			B			B	

Intersection Summary

Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 115 (96%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.72
 Intersection Signal Delay: 24.3
 Intersection LOS: C
 Intersection Capacity Utilization 65.1%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 8: N-S Collector & 38th Ave



HCM 6th Signalized Intersection Summary
8: N-S Collector & 38th Ave

ATEC
11/15/2019

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	181	88	111	212	112	194	307	72	82	387	172
Future Volume (veh/h)	46	181	88	111	212	112	194	307	72	82	387	172
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	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752	1752
Adj Flow Rate, veh/h	50	197	96	121	230	122	211	334	78	89	421	187
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, %	10	10	10	10	10	10	10	10	10	10	10	10
Cap, veh/h	165	232	196	208	304	258	617	387	328	725	481	408
Arrive On Green	0.01	0.04	0.04	0.08	0.17	0.17	0.33	0.22	0.22	0.39	0.27	0.27
Sat Flow, veh/h	1668	1752	1485	1668	1752	1485	1668	1752	1485	1668	1752	1485
Grp Volume(v), veh/h	50	197	96	121	230	122	211	334	78	89	421	187
Grp Sat Flow(s),veh/h/ln	1668	1752	1485	1668	1752	1485	1668	1752	1485	1668	1752	1485
Q Serve(g_s), s	3.1	13.4	3.9	7.3	15.0	3.7	6.6	22.0	4.1	0.0	27.5	10.4
Cycle Q Clear(g_c), s	3.1	13.4	3.9	7.3	15.0	3.7	6.6	22.0	4.1	0.0	27.5	10.4
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	165	232	196	208	304	258	617	387	328	725	481	408
V/C Ratio(X)	0.30	0.85	0.49	0.58	0.76	0.47	0.34	0.86	0.24	0.12	0.87	0.46
Avail Cap(c_a), veh/h	204	277	235	220	321	272	617	905	767	725	788	668
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.91	0.91	0.91	1.00	1.00	1.00	0.88	0.88	0.88	0.99	0.99	0.99
Uniform Delay (d), s/veh	44.4	56.2	13.9	40.0	47.1	7.9	27.9	45.0	23.7	22.3	41.6	24.6
Incr Delay (d2), s/veh	0.9	17.4	1.7	3.5	9.3	1.3	0.3	19.6	1.5	0.1	19.3	3.6
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	2.4	11.7	5.3	5.7	11.8	5.7	7.7	16.9	3.6	2.8	20.6	7.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.4	73.6	15.6	43.5	56.5	9.2	28.2	64.5	25.2	22.3	60.9	28.3
LnGrp LOS	D	E	B	D	E	A	C	E	C	C	E	C
Approach Vol, veh/h		343			473			623			697	
Approach Delay, s/veh		53.2			41.0			47.3			47.2	
Approach LOS		D			D			D			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	51.5	32.5	14.1	21.9	45.0	39.0	9.1	26.9				
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0				
Max Green Setting (Gmax), s	7.0	62.0	10.0	19.0	15.0	54.0	7.0	22.0				
Max Q Clear Time (g_c+I1), s	2.0	24.0	9.3	15.4	8.6	29.5	5.1	17.0				
Green Ext Time (p_c), s	0.1	2.5	0.0	0.5	0.3	3.4	0.0	0.8				
Intersection Summary												
HCM 6th Ctrl Delay			46.8									
HCM 6th LOS			D									

