



ALDRIDGE TRANSPORTATION CONSULTANTS
Advanced Transportation Planning

John M.W. Aldridge, P.E.
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May 4, 2020

Mr. Eric Pearson
Cage Civil Engineering
999 18th St. S2110
Denver, CO 80202

RE: Transportation Impact Study
The Aurora Highlands Filings 7 Phases 1-3 I

Dear Mr. Pearson:

Aldridge Transportation Consultants (ATC) is pleased to provide professional engineering services for the proposed residential development of Filings 7 Phases 1-3 I.

ATC is a professional service firm specializing in transportation engineering. ATC's principal, John M.W. Aldridge is a Colorado Licensed Professional Engineer. For over 20 years, ATC has prepared over 1,200 traffic impact studies, designed over 100 traffic signals, and has provided expert witness testimony on engineering design and access issues on multi-million-dollar interchange and highway projects in Kansas and Colorado.

We acknowledge that City of Aurora's review of this study is only for general performance with submittal requirements, current design criteria, and standard engineering principles and practice.

ATC appreciates the opportunity to be of service. Please call if you have any questions. We can be reached at 303-703-9112.

Respectfully submitted,

Aldridge Transportation Consultants, LLC

John M.W. Aldridge, P.E.
Principal



Comments 6/8/2020:

- 1) A figure is needed to illustrate trip distribution/assignment showing percentages of trip generation relative to O/D splits assumed.
- 2) Exiting/Entering trips assigned to/from the site do not match projected In vs Out trips shown in Trip Generation Worksheet, page 4.
- 3) For 2040, long-range, full-build out analysis, no trips were assigned to access TAH Pkwy, when a fully built out street network shall be assumed.
- 4) It is cited that the FHU study assumes a higher trip generation rate than will be the case for the full build out condition of TAH. The FHU study is representative of an approved, planned use of the land available. To justify a reduction in background trip generation analyzed, the master study would need to be modified accordingly. This is despite the fact that these particular early phases of development resulted in fewer units planned than the original master study estimated.
- 5) Due to the extensive scope of outstanding comments to be addressed on trip distribution/assignment as well as the assumed street network for each analysis period, traffic operation analysis (LOS/delay) was not reviewed at this time but will be reviewed when the Trip Distribution & network issues have been resolved.
- 6) See other comments throughout.



The **Aurora Highlands Traffic Impact Study** prepared by FHU in July 2018 provides an overall examination of the approximate 3,100-acre development plan shown in Figure 1. The FHU study focused on the long-term (2040) transportation needs not only for the full-build out but also for the areas that surround Aurora Highlands. The long-term analysis was based on the DRCOG planning using the Compass model and 2040 NEATS travel demand modeling. The **Northeast Area Transportation Study** (NEATS) transportation plan refresh was completed in October 2018 and is inclusive of the Aurora Highlands master development plan again as depicted in Figure 1. While adjustments to the land use and street layout are inevitable, these documents nonetheless provide a sound foundation and basis for this study and its improvement recommendations.

Per the FHU study, more refined traffic impact study could be prepared for each individual development application, such as this, to refine the specifics needed as development occurs. The FHU study sets the stage with respect to the roadway needs and classifications.

The sections that are the subject of this development application are shown in Figure 2



Figure 2 Subject Area and Streets

The proposed development plan features 1,030 units on approximately 203.5 acres. The density is about 5.1 du/ac. Of the 1,030 units, 288 are duplex lots and 742 are single-family.

EXISTING CONDITIONS

Access to the site is restricted to one street now, 26th Ave. Main St. is under construction and will connect 26th Ave. to 38th Ave. and a future interchange with E-470. Most of the traffic will be oriented to/from the west on 26th Ave. crossing over E-470 to Picadilly Road. Gun Club Road from 26th Ave to 42nd Ave. parallels E-470. This road serves the E-470 office/maintenance complex. Gun Club Road may provide limited access to E-470 through the complex in the near-term.

26th Ave. is a 2-Lane Minor Arterial that extends from Picadilly Road to Watkins Road. It is undivided and in the subject area includes a 6-foot gravel shoulder. There is no sidewalk on either side. **It carries approximately 1,000 ADT per NEATS**, and the posted speed limit is 45 mph.

Traffic counts (TMC) for Picadilly & 26th is provided as an addition to the end of this document to help aid in build year analysis. Escalate these numbers accordingly (from 2018 to build year)

26th Ave. west of E-470 is currently undergoing dynamic growth while there's no concurrent growth/development on the east side. Applying west side growth factors to the east side is a false equivalence.



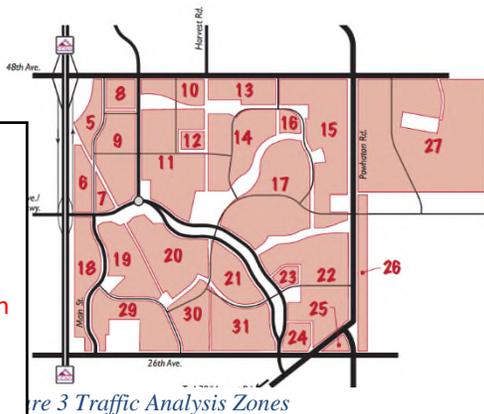
ACCESS LOCATIONS

There will be five access locations from the perimeter arterials. Four on 26th Ave. and one on Main St. On 26th Ave. the primary access will be with a collector road, West Village Ave. This road will curve westward and connect with Main St. The other three access locations are with local type 1 roadways. These are yet to be named and identified in this analysis as Access Roads A, B, and C. In the future and in subsequent phases, the Aurora Highlands Parkway will provide access on the east side of the development. The intersection will not be constructed in this phase.

LAND USE and TRIP GENERATION

The site will be developed with 288 duplex units and 742 single-family units. The trip generation rates are from the *ITE Trip Generation Manual, 10th Edition*. The following worksheet provides the ADT and AM/PM Peak Hour traffic volumes. The planning areas are subtotaled by the incremental traffic analysis zones (TAZ) as established in the FHU master traffic study. Figure 3 following the worksheet depicts the applicable zones and zone number.

Trip Generation Worksheet											
ITE CODE	PLANNING AREA	LAND USE	UNIT	QUANTITY	ADT	AM			PM		
						IN	OUT	TOTAL	IN	OUT	TOTAL
220	64-1	Duplex/Townhome	DU	90	7.32	0.11	0.35		0.35	0.21	
					659	10	32	41	32	19	51
210	64-2	Single-Family Detached	DU	239	9.44	0.19	0.55		0.63	0.37	
					2256	45	131	177	151	88	239
TAZ 29 Sub-Total					2915	55	163	218	182	107	290
220	65-1	Duplex/Townhome	DU	48	7.32	0.11	0.35		0.35	0.21	
					351	5	17	22	17	10	27
210	65-3	Single-Family Detached	DU	219	9.44	0.19	0.55		0.63	0.37	
					2067	42	120	162	138	81	219
220	65-2	Duplex/Townhome	DU	52	7.32	0.11	0.35		0.35	0.21	
					381	6	18	24	18	11	29
TAZ 30 Sub-Total					2799	52	156	208	173	102	275
220	80-1	Duplex/Townhome	DU	98	7.32	0.11	0.35		0.35	0.21	
					717	10	35	45	35	21	55
210	80-2	Single-Family Detached	DU	284	9.44	0.19	0.55		0.63	0.37	
					2681	54	156	210	179	105	284
TAZ 31 Sub-Total					3398	64	191	255	213	126	339
Total Trips					12511	236	701	937	783	461	1243



There are no development plans for the west side of TAZ 29. This study can be amended when development plans for the west side are submitted.

In comparing the zone data, the FHU traffic study programmed 1,855 units (553 multi-family and 1,302 single-family) that generated 16,077 trips. This application is less at 1,030 units, 12,511 daily trips.

The directional split is the cardinal direction from which traffic is entering and exiting. In this case we assume that 70 to/from the west and 30 percent to/from the east.

TRAFFIC DISTRIBUTION & ASSIGNMENT
Initially, the traffic distribution will be oriented to/from the west on 26th Ave. with an estimated 70/30 directional split. This is a small share from Gun Club Road that comes from the E-470 access through the Authority's

In FHU's study, TAZ 29 included development of land adjacent to Main St, which area is not included in this study. Future development of TAZ 29 would then allow for the remainder (approximately 825 total units) for a future filing.

Assuming "directional" means in vs out, this should be a 75/25 split, per ITE trip gen rates.



office/maintenance complex. 20 percent of the 70 percent to/from the west are anticipated to use Main St. to West Village Ave. Figures 4 and 5 show the trip assignment for the AM and PM peak hours, respectively.

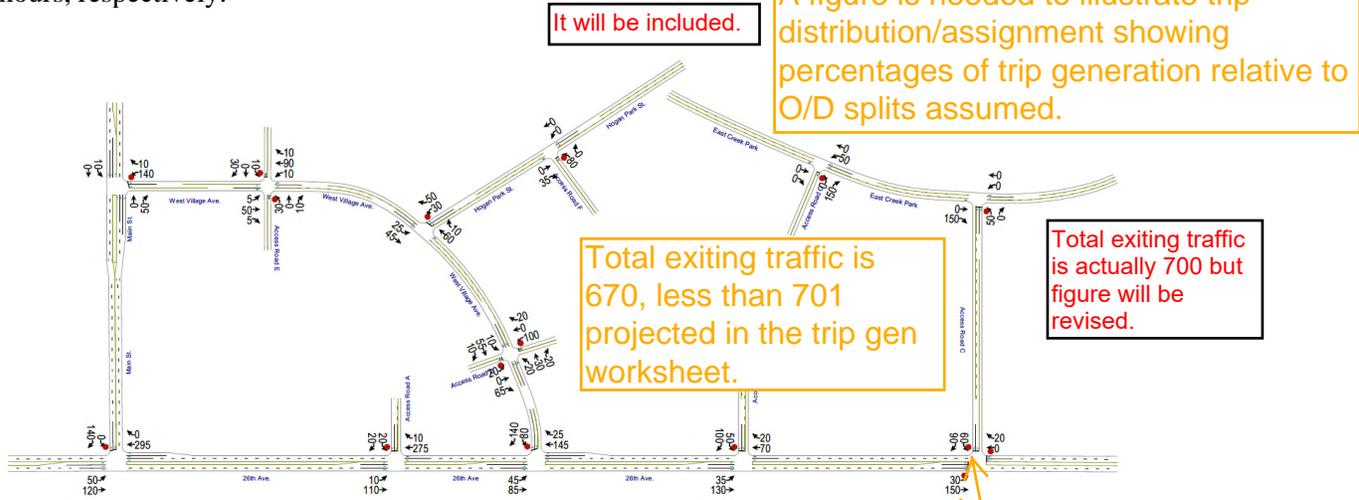


Figure 4 AM Peak Hour Site Generated Trip Assignment

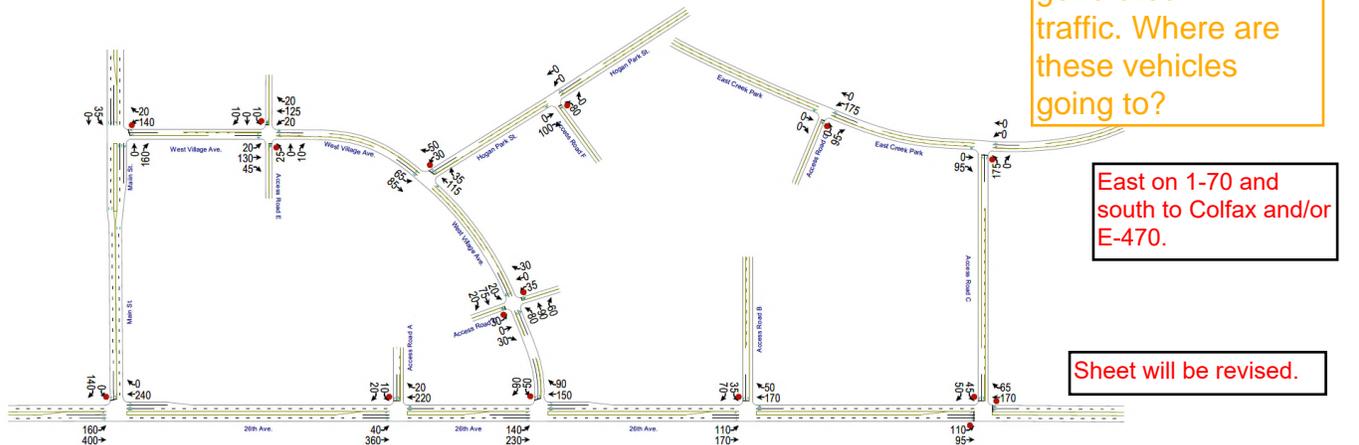


Figure 5 PM Peak Hour Site Generated Trip Assignment

Total exiting traffic is 580, more than 461 projected in the trip gen worksheet.

Total entering traffic in this figure is 740, less than the 783 projected in the trip gen worksheet.

FUTURE TRAFFIC VOLUMES

The future (2040) traffic volumes for The Aurora Highlands have been established through the FHU study and NEATS travel modeling. The forecast volumes include the full build of The Aurora Highlands and land uses surrounding the Aurora Highlands area. These were heavily vetted with city staff in the preparation of the NEATS travel model according to the FHU study. Figure 6 is from the FHU study and shows the 2040 Total Traffic. It should be noted that while the FHU study projects 19-21,000 ADT on 26th Ave. NEATS projects about half that at 11,900 ADT. FHU

We assume that some will still want to travel east on I-70 and south to Colfax and/or south on E-470.

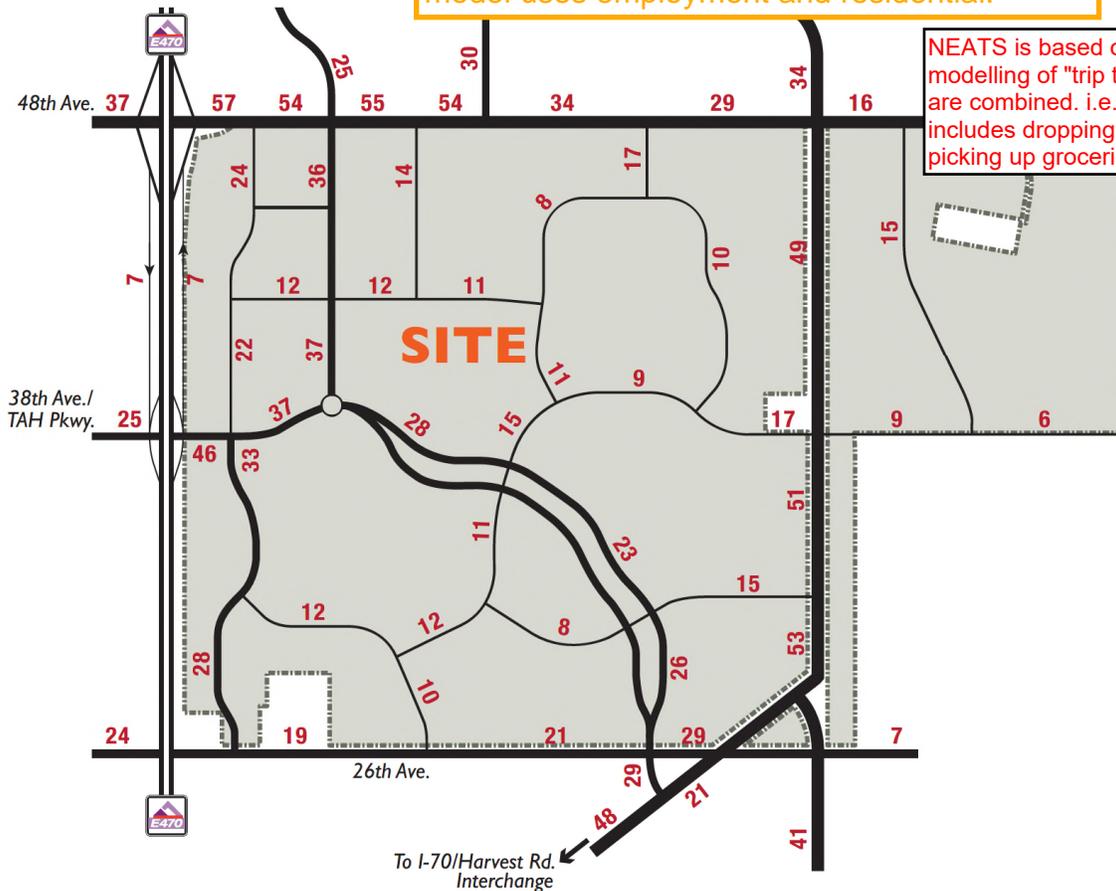
It appears that this assignment presumes full build out of TAH street network, given the high percentage of trips traveling to the east of this site on 26th, but this assumption was not stated in the text. If this assumes full build out condition, what is the trip distribution/assignment for the interim condition where access to the Metro region is limited to primarily only 26th Ave?



explains that their travel modelling assumes build out of Aurora Highlands to its maximum potential although not a likely scenario. They did so to give the developer flexibility in the development of each planning area and to meet the City's requirement in preparing a traffic impact study. To wit, the zones in this phase are being developed with 1,030 units vs. the 1,855 units programmed by FHU. Overall, the FHU study forecast 203,000 trips generated by the full build out. NEATS on the other hand forecast 117,000 trips from the same traffic analysis zones.

Yes, TISs use Trip Generation & the NEATS model uses employment and residential.

NEATS is based on DRCOG's travel modelling of "trip tours" where trips are combined. i.e. a trip to work includes dropping kids at school and picking up groceries on the way.



LEGEND

XXXX = Volumes in 1000's

----- = Aurora Highlands

Figure 6 2040 Total Traffic per the FHU Study

The FHU study is representative of an approved, planned use of the land available. To justify a reduction in background trip generation analyzed, the master study would need to be modified accordingly. This is despite the fact that these particular early phases of development resulted in fewer units planned than the original master study estimated.

In both documents, however, the 2040 street network assumes that both Main St. and West Village Ave. will be 4-Lane Arterials. Moreover, based on the daily volumes traffic signal control is required at Main St./26th Ave. and at West Village Ave./26th Ave.

The FHU study includes caveats for change or refinements based on development proposals and the NEATS study.

In Phases 1-3, the background traffic on 26th Ave. is not expected to see any increases. But to be conservative in this analysis we have doubled the existing traffic on 26th Ave. For 2040, the volume on 26th Ave. is a balance between the FHU study and NEATS given the lower number of units proposed for Phases 1-3. The 2040 ADT in this study is approximately 15,000 ADT. The following graphics show the movement volumes for the Near-Term Phases 1-3 and the 2040 AM and PM peak hours.

Provide count sheets of existing traffic that was doubled. Illustrate existing traffic in a figure.

It's only one road with that volume. Note sure that an illustration is necessary.

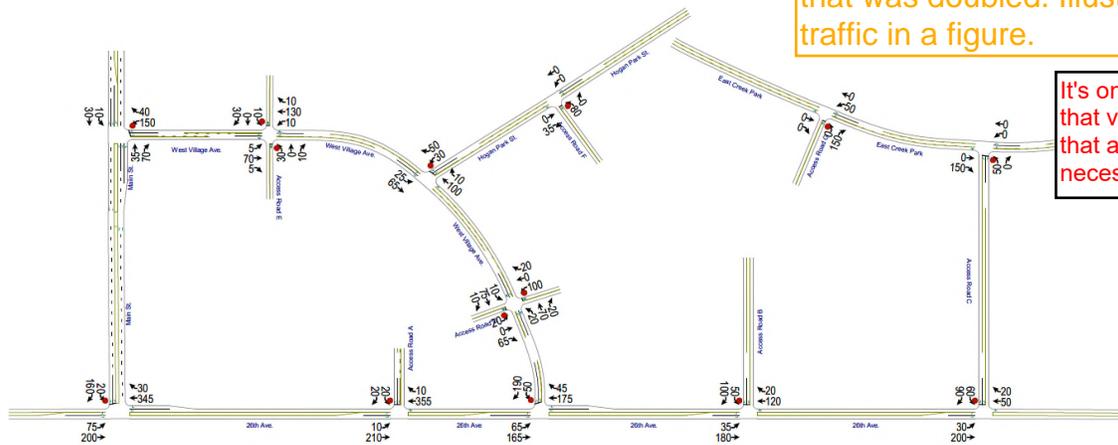


Figure 7 Near-Term Phases 1-3 AM Total

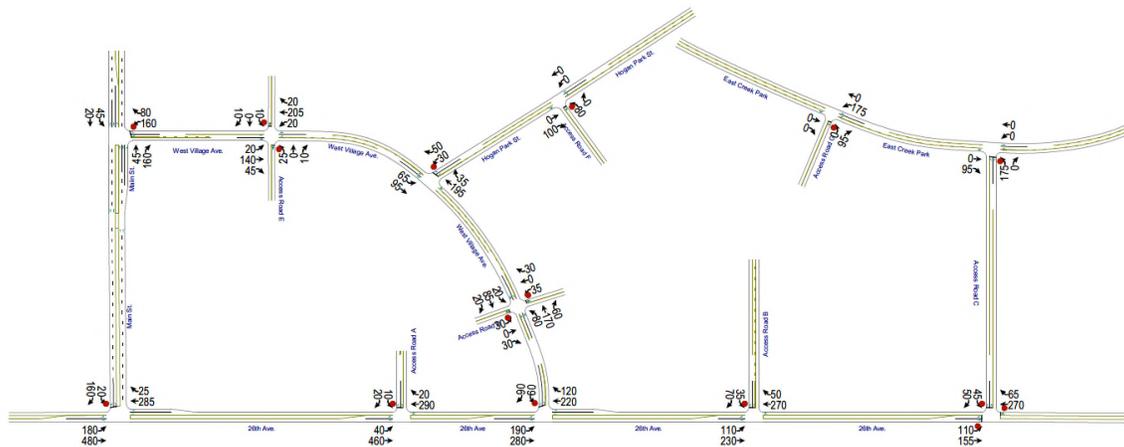


Figure 8 Near Term Phases 1-3 PM Total



No trips coming from/going to The Aurora Highlands Pkwy in the 2040 scenario (AM or PM).

These will be populated when development plans for the adjacent TAZs are submitted. The revised figures provide some estimates.

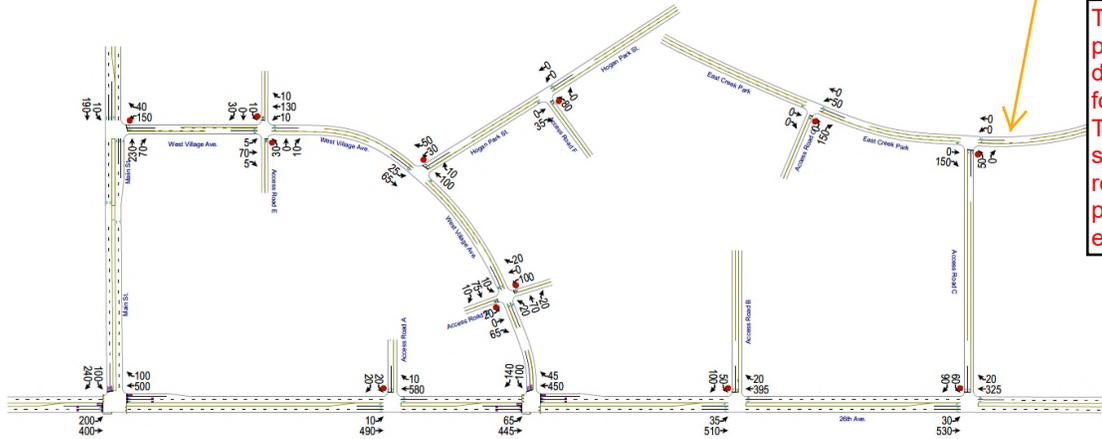
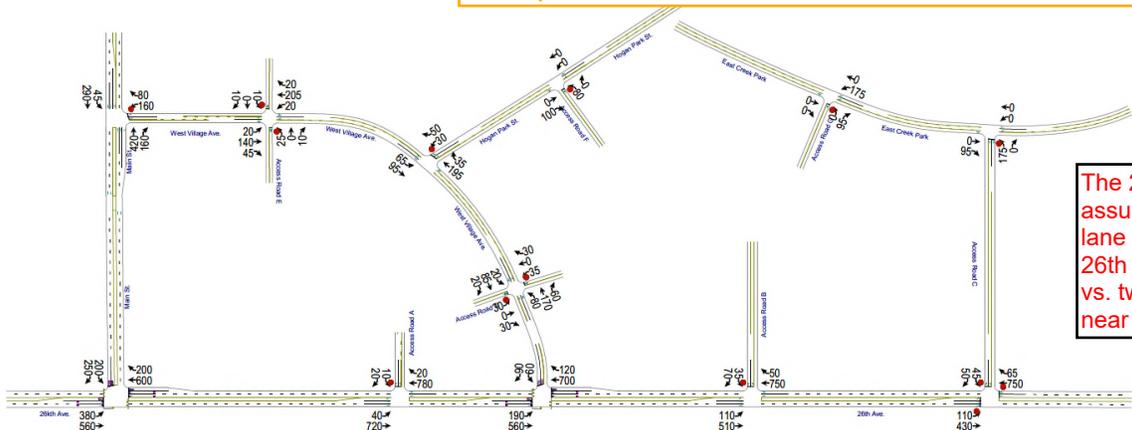


Figure 9 2040 AM Total

A final build out street network shall be assumed for an accurate 2040 analysis of traffic operations. This should differ from trip distribution/assignment on the more limited, near-phase street network.



The 2040 network assumes a four-lane arterial on 26th and Main St. vs. two-lanes in the near term.

Figure 10 2040 PM Total

PEAK HOUR INTERSECTION LEVEL OF SERVICE

ATC uses Synchro v.10 for operations analyses. The Synchro methodology is based on the 6th Edition of the Highway Capacity Manual (HCM). The table summarizes the AM and PM peak hour LOS and the 95th%ile queue lengths for the near-term Phases 1-3 and the long term 2040 AM and PM peaks hours. As there are no existing intersections in the subject area, no analysis of the exiting conditions or background conditions is possible. Synchro reports for each timeframe are provided in the appendix.

The HCM states that, "LOS is used to translate complex numerical performance rating into a simple A-F system representative of the travelers' perception of the quality of service provided by a facility or service. Practitioners and decision makers alike must understand that the LOS letter



"little to no delay"

result hides much of the complexity of facility performance¹." LOS is a letter rating from A to F. LOS A indicates free-flow traffic conditions and no delay at intersections. LOS F is heavy traffic congestion with significant delay. LOS is provided for the overall operations at signalized intersections. LOS D is generally the benchmark for acceptable signalized intersection operations during the weekday peak hours. The critical movement, not the overall, indicates the LOS rating for unsignalized intersections, which is generally a left turn out from the minor street approach. Caution must be used when evaluating the LOS at unsignalized intersections particularly when LOS F is shown. In case of LOS F, the HCM recommends that other evaluation methods should be considered such as the volume over capacity ratios, the 95th percentile queue length, and duration of LOS F to make the most effective traffic control decision². LOS F at unsignalized intersections is typically normal during the weekday peak hours as the duration of the LOS F condition is relatively short.

Unsignalized Intersection LOS & 95%ile Summary					
LOS (Control Delay (secs) A=0-10, B=>10-15, C=>15-25, D=>25-35, E=>35-50, F=>50) / 95%ile Q (veh)					
Intersection	Movement	Near Term Phases 1-3		2040	
		AM	PM	AM	PM
26th Ave./West Village Ave.	Critical Movement SBL	B/.4	D/1.1	Signal	Signal
West Village Ave/ Road E	Critical Movement NBL	B/.2	B/.2	B/.2	B/.2
West Village Ave/ Road D	Critical Movement WBL	B/.7	B/.5	B/.7	B/.5
26th Ave./Road A	Critical Movement SBL	B/.2	C/.1	C/.3	D/.3
Main St./West Village Ave.	Critical Movement WBL	A/.6	B/.8	B/1.1	D/2.7
26th Ave./Road B	Critical Movement SBL	B/.3	C/.4	C/.6	E/1.3
26th Ave./Road C	Critical Movement SBL	B/.3	C/.5	C/.7	F/1.7
West Village Ave./Hogan Park	Critical Movement WBL	B/.1	B/.2	B/.1	B/.2
26th Ave./Main St.	Critical Movement SBL	C/.2	D/.4	Signal	Signal

Signalized Intersection LOS Summary				
LOS/Control Delay (secs) A=0-10, B=>10-20, C=>20-35, D=>35-55, E=>55-80, F=>80				
Intersection	Near-Term Phs. 1-3		2040 Total	
	AM	PM	AM	PM
26th Ave./West Village Ave.	Unsig.	Unsig.	C/22.0	B/11.5
26th Ave. /Main St.	Unsig.	Unsig.	B/16.1	C/21.8

The operations analysis demonstrates that all collector/collector, collector/local, and arterial/local intersections will operate as unsignalized intersections at an acceptable LOS with one exception at 26th Ave. and Road C. It will operate at LOS F, however the 95thile queue is minimal at 1.7 vehicles. The arterial/collector intersection, Main St./West Village Ave. will also operate acceptably remaining unsignalized. The critical movement, the westbound left out in the heaviest traffic time the 2040 PM condition operates at LOS D with a 95%ile of 2.7 vehicles. The two other

¹ HCM version 6, Chapter 5, pages 5-3 – 5-6.

² ditto



arterial/collector intersections at 26th Ave./West Village Ave. and 26th Ave./Main St. are projected to meet a traffic signal warrant per the next section. The traffic signals will provide acceptable overall LOS and delay at these intersections.

TRAFFIC SIGNAL WARRANTS

The City staff in comments dated March 27, 2020 is requiring "...signal warrant analysis of intersection with western "Collector" roadway with 26th Ave. Warrant 1,2,3 all to be included (collect 72 hr. tube counts for analysis)." This comment cannot be satisfied as traffic volume cannot be counted on non-existent roadways.

Use projected traffic to determine if signal warrants are likely to be met in the near-term or 2040 analysis.

Generally, a traffic signal in a residential area is warranted by warrant 1 and or 2 on actual hourly volume counts. Warrant 3 is not applicable in residential areas and is reserved for unusual per the MUTCD. Typically, in order to meet an eight-hour warrant (Warrant 1) or four-hour warrant (Warrant 2) the average daily volume on the minor street approach needs to exceed 2,000. This is projected to be the case in the 2040 condition at the intersections of Main St./26th Ave. and 26th Ave./West Village Ave. No other intersections in the development meet this criterion.

We have. The projected traffic at Main/26th and 26th/West Village are likely candidates for signalization. No others in this study come close.

TRAFFIC CALMING

Also, in the March 27, 2020 comments City staff is requiring a discussion of the application of elements from the Traffic Calming Toolbox. In the toolbox or as in many other sources including FHWA's Traffic Calming ePrimer, there are a considerable number of traffic calming techniques to address a myriad of traffic related problems including speeding, cut-through traffic, and pedestrian safety. However, there first needs to be identification of a problem or perception of a problem to be resolved. Most importantly there needs to be consensus among the residents that would be affected and agreements with the public agency on maintenance of i.e. landscaping or streetscape features.

The intent of the comment is to require that consideration be given to typical street network features that encourage aggressive driving behaviors, such as speeding. This comment does not require that a problem exists that needs to be mitigated, only that consideration is given to such roadway designs that, per FHWA's Traffic Calming ePrimer, lend themselves to future need. The paragraph shared below refers to the retrofitting of existing roadways. Consensus among residents is not a requirement unless the proposed traffic calming mitigation is a retrofit of an existing roadway.

be demonstrated by a formal mechanism (such as a petition) that reflects a specified number of residents, property owners, or businesses."

The City has a Neighborhood Traffic Calming Program that allows neighborhoods to apply for traffic calming program that aims to reduce speeding and cut-through traffic on residential streets and improve the neighborhood's quality of life. The application requires a neighborhood organization to list the exact location of the concern and to describe issues to be resolved including speeding, cut-through traffic, problems crossing the street, drivers not obeying regulations, etc. Once an application is received the City has a 10 step process to work with the neighborhood to determine eligibility, get support from all affected neighbors, develop cost estimates, determine effectiveness, determine impact on traffic patterns, and identify funding for the implementation of the approved measure.

We are constructing roadways and intersections per the COA standards. No conflicts are foreseen.

The Neighborhood Traffic Calming Program is for exclusive use to retrofit existing roadways, not to prepare and plan for potential conflicts while planning out future roadway networks.



Calming options to reduce speed include, but not limited to, automated speed radar signs, curb extensions, speed humps, roundabouts, chicanes, and raised crosswalks. These vary in effectiveness. Speed humps (cushions, tables, etc.) can be very effective, but also dangerous if not used properly. Automated speed radar signs are only marginally effective and unenforceable.

Once the project is fully developed and should problems arise, the City’s program for traffic calming embodies a sound process to work with neighborhoods on implementing appropriate measures to resolve problems such as speeding, cut-through traffic, and pedestrian safety.

See comments above.

MITIGATION

West Village Ave. is a three-lane collector roadway with a center left turn lane. Per the City of Aurora Engineering Standards for roadway design and construction, exclusive right turn lanes on this type of roadway are not allowed. Table 2 from COA’s Urban Street Standards is copied below. Note that a 3-Lane Collector is classified as a “Main Street” in the table and should not be confused with the arterial named Main St.

Table 2 - Intersection and Mid-Block Approach Design Matrix

Table with 8 columns: Boulevard, Multi-Way Boulevard, Main Street - Four Lanes with Median, Main Street - Two Lanes with Median/Ce nter Turn Lane, Main Street - Two Lanes with Median/Ce nter Turn Lane (Mid-Block), Main Street - Two Lanes with Parallel Parking, Main Street - Two Lanes with Parallel Parking (Mid-Block). Rows include Curb Extensions, Corner Radii, Exclusive Left Turn Lanes Allowed, Exclusive Right Turn Lanes Allowed, Standard Markings, Colored Paving, Pavers, High Visibility Markings, and Pedestrian Refuge Islands.

Mitigations proposed will be reviewed in further detail as the comments about near-term and 2040 trip distribution and assignment are addressed.

ok

Exclusive left and right turn lanes will be allowed on Main St. and 26th Ave. as they are designated as Boulevards (Arterials). There are four intersections on 26th Ave., Access Roads A, B, C, and West Village Ave., and one on Main St. at West Village Ave. Assuming that there will a raised median with a width of 14 feet, the left turn at Access Roads A, B, and C should have a transition taper length of 110 feet and a 100-foot tangent section for storage. An exclusive right turn lane at these locations is not necessary as the turning volumes in the peak hour are relatively light. At the West Village Ave. intersection on 26th Ave., the left turn lane should have a 110-foot transition taper and 150-foot long tangent for storage. The same dimensions would apply to the right turn



lane. At the West Village Ave. and Main St. intersection, the left and right turn lanes should have a 110-foot transition taper and a 150-foot tangent for storage.

The roadways will be constructed to City standards which are designed to accommodate pedestrian and bicycle activity. The Aurora Highlands master plan will augment the standard with additional infrastructure to enhance bicycle ridership. Programs include widened sidewalks, two-way bike tracks, and off-street trail connections.

CONCLUSIONS & RECOMMENDATIONS

The analysis and recommendations contained herein demonstrate that the development of Filing 7, Phases 1-3 is consistent with the approved land use planning and roadway and intersection improvement recommendations in the FHU study and NEATS. This refined operations analysis show that the proposed roadways and intersections will function at an acceptable level of service.

Conclusions & Recommendations will be reviewed once previous comments are addressed.