Traffic Impact Study

QuikTrip 4283

Aurora, Colorado

If signal is warranted opening year then project is expected to build signal with project and escrow is not needed. Don't have enough information from this report to know if the signal is needed.

Thank you for the review and comments provided to the traffic study. Please see individual responses throughout this document.

Based on the pre-application notes, the applicant shall be responsible for payment of 25% of the traffic signalization costs for the intersection of 64th Avenue and Gun Club Road intersection, if and when traffic signal warrants are satisfied. Based on the four-hour vehicle volume figure warrant, this intersection is expected to meet warrants for signalization upon build out of the project.

Prepared for:

QuikTrip Cor

Kimley»Horn

T R A F F I C I M P A C T S T U D Y

QuikTrip 4283

Aurora, Colorado

Prepared for
QuikTrip Corporation
12000 Washington Street
Suite 175
Thornton, Colorado 80241

Prepared by
Jeffrey R. Planck, P.E.
Kimley-Horn and Associates, Inc.
6200 South Syracuse Way
Suite 300
Greenwood Village, Colorado 80111
(303) 228-2300

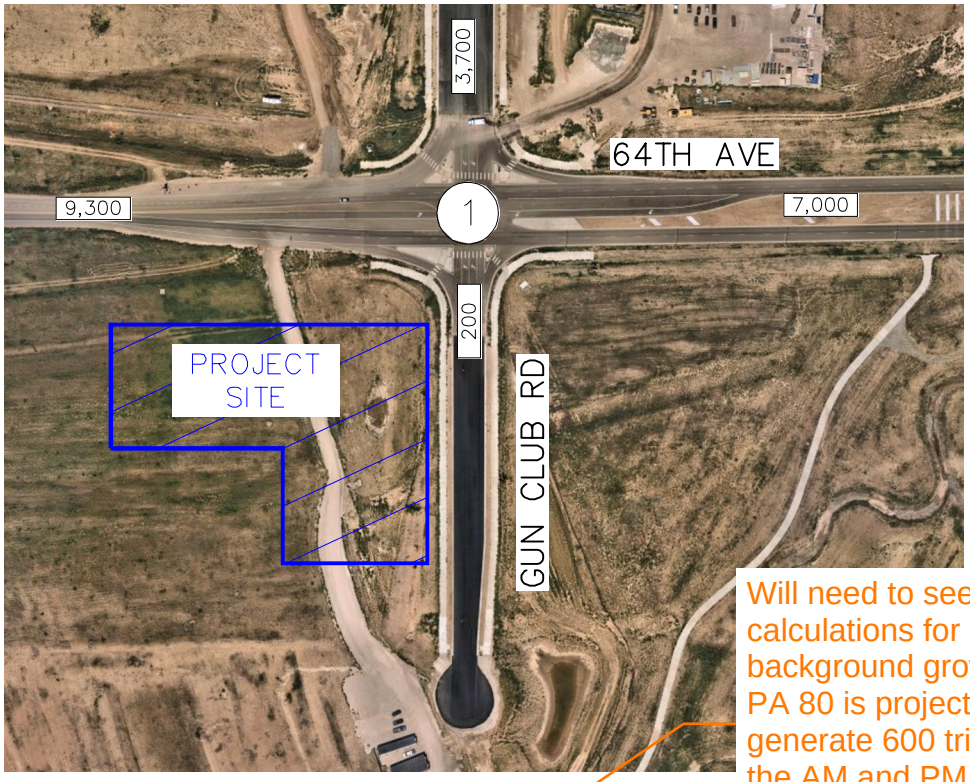
March 2024

TABLE OF CONTENTS

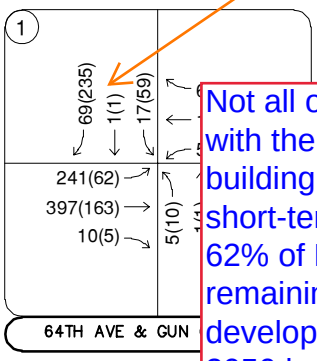
APPENDICES

Provide Denali Logistic park information that you used for background growth.

The traffic volume estimates for the Denali Logistic Park and description for obtaining these estimates are now included in the appendix of the revised study.



Will need to see calculations for background growth. PA 80 is projected to generate 600 trips in the AM and PM. This looks to be only 300 trips.



Not all of PA-80 was assumed to be built out with the short-term horizon. Only the current building under construction was included in the short-term which consists of approximately 62% of PA-80. Of note, all of PA-80 and all remaining development within the High Point development was included in the long-term 2050 horizon.

LEGEND

(X) Study Area Key Intersection

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

XX,X00 Estimated Daily Traffic Volume

FIGURE 4
QUIKTRIP 4283
AURORA, COLORADO
2026 BACKGROUND TRAFFIC VOLUMES

ITE description of a truck stop. A truck stop is a facility located adjacent to an interstate highway interchange that provides commercial vehicle fueling, space and supplies for self-service vehicle maintenance, and other services specific to the needs of truckers (e.g., showers, on-site truck parking area). The facility typically contains a convenience store, restroom facilities, and one or more restaurants (either fast-food or high-turnover sit-down). Gasoline/service station (Land Use 944) and convenience store/gas station (Land Use 945) are related uses.

PROJECT TRAFFIC CHARACTERISTICS

tes are determined through a process known as trip generation. plied to the proposed land use to estim... traffic generated by the c time interval. The acknowledged sou... is ublished by the Institute of Transporta... has nwide studies of similar land uses. For ...sed ort average rates that apply to Conven... TE uck Stop (ITE Land Use Code 950) f... the

From the description it doesn't seem like it is a truck stop but just has pumps for trucks. Will need to make argument on why this should be used.

rcial development, pass-by trips are expected. These pass-by trips are vehicles already on the street network that will be attracted to the project site en route to a fi... "Trip Generation Manual", E...tage of 76 percent and an a...ence store/gas station land u...026 buildout horizon, pass-by trips were only applied to the 2050 long-term horizon to provide a conservative analysis in 2026.

We agree that truck stop does not fully fit the characteristics of the truck fueling positions. As such, the updated study has been evaluated with only ITE Land Use Code 945 Convenience Store and Gas Station. The fueling positions for this use has been increased from 16 vfp to 20 vfp to account for the four truck fueling positions.

QuikTrip 4283 is expected to generate approximately 5,010 daily weekday driveway trips, with 489 of these trips occurring in the morning peak hour and 426 trips occurring in the afternoon peak hour. Accounting for pass-by, expected net new (non pass-by) trips to the surrounding street network for the 2050 horizon results in approximately 1,924 weekday daily trips, of which 160 trips and 154 trips are anticipated during the weekday morning and afternoon peak hours, respectively. Calculations were based on the procedure and information provided in the ITE *Trip Generation Manual, 11th Edition – Volume 1: User's Guide and Handbook*, 2021. **Table 1** summarizes the estimated trip generation for the QuikTrip 4283. The trip generation worksheets are included in **Appendix D**.

[1] Institute of Transportation Engineers, *Trip Generation Manual*, Eleventh Edition, Washington DC, 2021.

Table 1 – QuikTrip 4283 Traffic Generation

Land Use and Size	Weekday Vehicle Trips						
	Daily	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Convenience Store/Gas Station (ITE 945) – 16 Fueling Positions / 5,312 Square Feet	4,114	216	217	433	182	182	364
Truck Stop (ITE 950) – 4 Truck Fueling Positions	896	27	29	56	33	29	62
Total Project Trips	**5,010**	**243**	**246**	**489**	**215**	**211**	**426**
Total Project Trips with Pass-By	**1,924**	**79**	**81**	**160**	**79**	**75**	**154**

Add a line for pass-by trips.

This is non pass-by trips. Not sure if it is right. Verify numbers.

4.2 Trip D

Distributio system was based on f racteristics, existing traffic patterns, existing and anticipated surroundin demographic information, and the proposed access system for the project. The directional distribution of traffic is a means to quantify the percentage of from a given direction and departs the site b ject trip distribution for the proposed develop

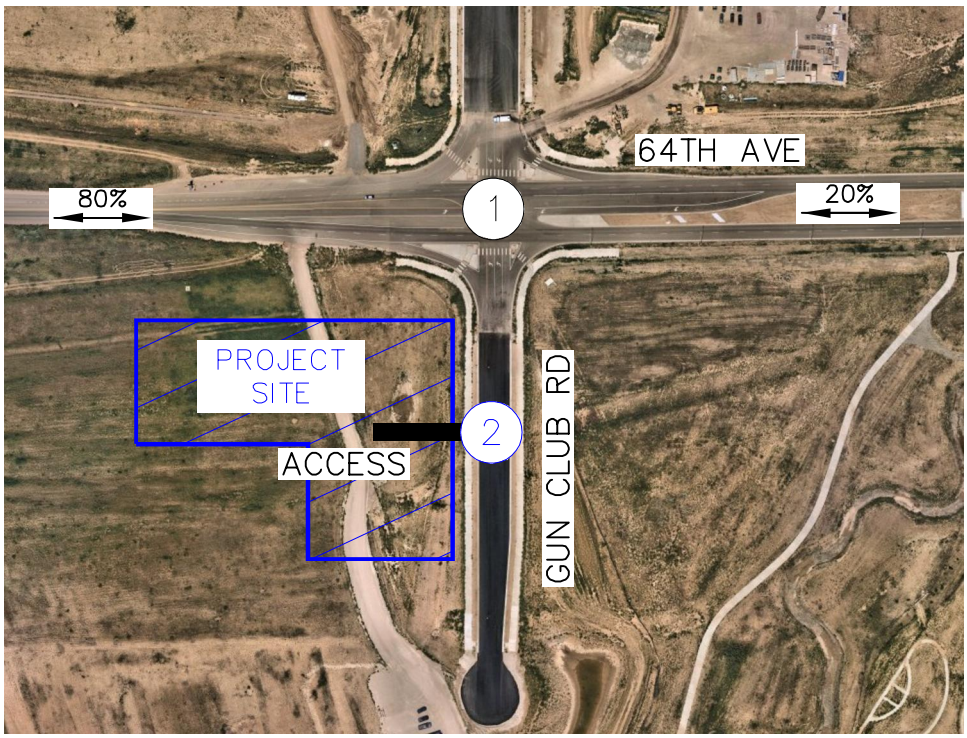
Additional clarification has been provided to the trip generation table which now includes a row for non pass-by new trips, pass-by trips, and total project trips.

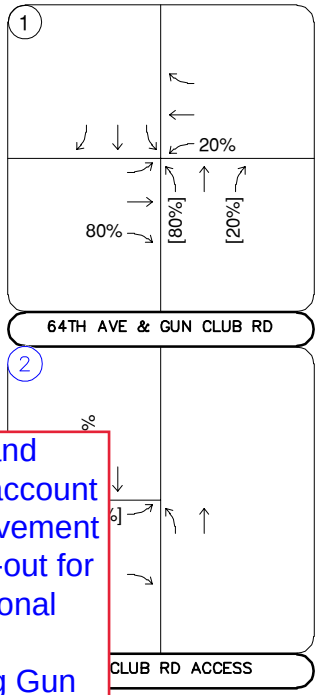
Since the project is a commercial development, a certain amount of traffic attracted to the gas station will already be passing by the site. This pass-by distribution is a means to quantify the amount of traffic arriving to the site from a given direction and then leaving the site in the same original direction of travel, continuing the driver's trip. The expected weekday morning and afternoon peak hour pass-by trip distributions were calculated based on 2050 background traffic volumes at the 64th Avenue and Gun Club Road intersection. Directional differences in the morning and afternoon peak hours were accounted for in the pass-by distributions as shown in **Figures 7** and **8**, respectively. Due to the low through volumes along 64th Avenue during the 2026 buildout horizon, pass-by trips were only applied to the 2050 long-term horizon.

4.3 Traffic Assignment and Total (Background Plus Project) Traffic

The project traffic assignment was obtained by applying the project trip distribution to the estimated traffic generation of the development shown in **Table 1**. Project non pass-by traffic assignment is shown in **Figure 9** for the 2026 horizon and **Figure 10** for the 2050 horizon. **Figure 11** illustrates the expected 2050 pass-by traffic assignment. Site traffic volumes were added to the background volumes to represent estimated traffic conditions for the short-term 2026 buildout horizon and long-term 2050 twenty-year planning horizon. These total traffic volumes for the study area are illustrated for the 2026 and 2050 horizon years in **Figures 12** and **13**, respectively.

Kimley»Horn
NORTH
NTS 096888045





Will need a 2050 distribution for the project access will be a right in right out when Gun Club gets extended to the south.

Separate trip distribution figures and evaluation has been provided to account for the north access being full movement at build-out and then right-in/right-out for the long-term horizon when additional development occurs to the south. Therefore, the south access along Gun Club Road has now been evaluated for the long-term 2050 horizon.

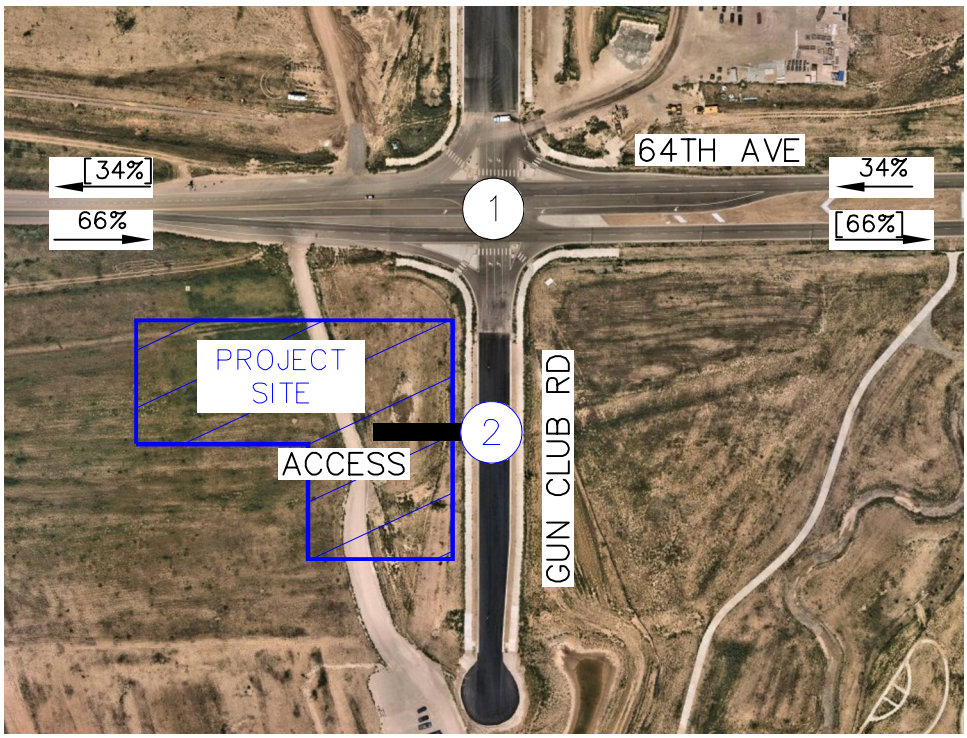
LEGEND

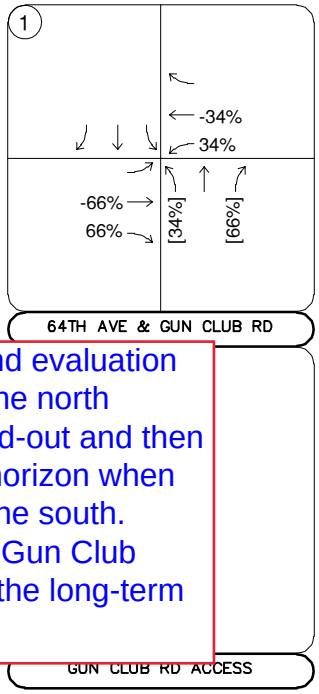
(X)	Study Area Key Intersection
(X)	Project Access Intersection
XX%	External Trip Distribution Percentage
XX%[XX%]	Entering[Exiting] Trip Distribution Percentage

FIGURE 6
QUIKTRIP 4283
AURORA, COLORADO
NON PASS-BY PROJECT TRIP DISTRIBUTION

Kimley»Horn

Kimley»Horn
NORTH
NTS 096888045





Traffic will not be able to make the left out of the access in 2050.

Separate trip distribution figures and evaluation has been provided to account for the north access being full movement at build-out and then right-in/right-out for the long-term horizon when additional development occurs to the south. Therefore, the south access along Gun Club Road has now been evaluated for the long-term 2050 horizon.

LEGEND

(X) Study Area Key Intersection

(X) Project Access Intersection

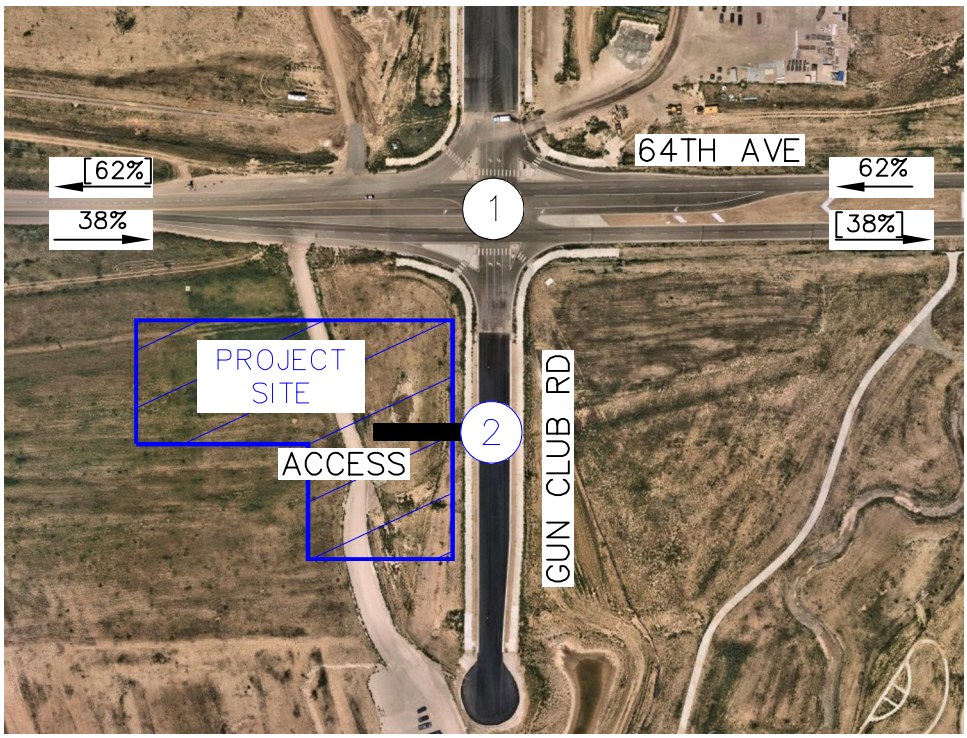
XX% External Trip Distribution Percentage

XX%[XX%] Entering[Exiting] Trip Distribution Percentage

FIGURE 7
QUIKTRIP 4283
AURORA, COLORADO
2050 AM PASS-BY PROJECT TRIP DISTRIBUTION

Kimley»Horn

Kimley»Horn
NORTH
NTS 096888045



Please see previous responses regarding the north access having movement restrictions for the long-term horizon.

Project traffic has now been distributed to and from the north along Gun Club Road for the 2050 horizon. The distribution to the south in the master study was only serving private development as Gun Club Road does not provide through connectivity to the south. To conservatively evaluate the intersection of 64th Avenue and Gun Club Road, a capture rate was not provided to and from the overall development to the south. Nominal volumes were added in addition traffic assignment to account for all movements.

Traffic will not be able to make the left out of the access in 2050.

Distribution in the master study had 6% went north and 8% went south.

LEGEND

(X) Study Area Key Intersection

(X) Project Access Intersection

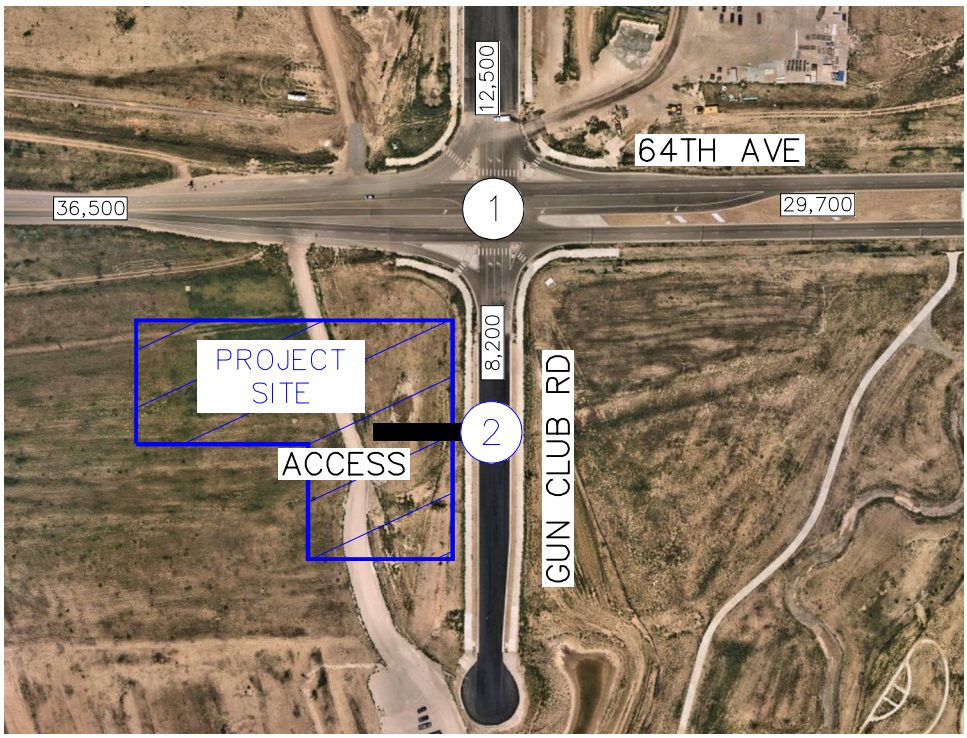
XX% External Trip Distribution Percentage

XX%[XX%] Entering[Exiting] Trip Distribution Percentage

FIGURE 8
QUIKTRIP 4283
AURORA, COLORADO
2050 PM PASS-BY PROJECT TRIP DISTRIBUTION

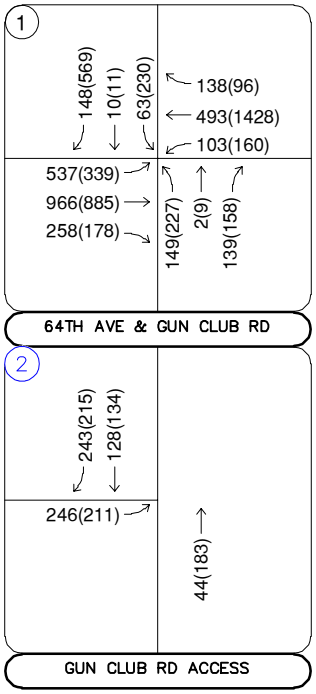
Kimley»Horn

Kimley»Horn
NORTH
NTS 096888045



The total traffic volume projections have been updated for the long-term horizon. There were issues with linking the EBR and NBL volumes for 2050 as well as subtracting the previous site volumes and adding back in the current site pass-by volumes since pass-by was only utilized in the short-term (because existing through volumes too low to pull 76% pass-by). This all has been corrected.

With the most recent master traffic study, the background volumes for the long-term 2050 horizon have also been increased.



The difference between 2026 and 2050 for NB trips needs some thinking. Specifically the AM NBL 50 less vehicles in 2050 than 2026.

LEGEND

X	Study Area Key Intersection
X	Project Access Intersection
XXX(XXX)	Weekday AM(PM) Peak Hour Traffic Volumes
XX,X00	Estimated Daily Traffic Volume

FIGURE 13
QUIKTRIP 4283
AURORA, COLORADO
2050 TOTAL TRAFFIC VOLUMES

Kimley»Horn

Kimley-Horn's analysis of traffic operations in the site vicinity was conducted to determine potential capacity deficiencies in the 2026 and 2050 development horizons at the identified key intersection. The acknowledged source for determining overall capacity is the *Highway Capacity Manual (HCM)*[2].

This paragraph seems to go under 5.1 and not 4.3

5.1 Analysis Methodology

Capacity analysis results are listed in terms of Level of Service (LOS). LOS is a qualitative term describing operating conditions a driver will experien[illegible] street or highway during a specific time interval. It ranges fro[illegible]s and congestion). According to City of Aurora guidelin[illegible]ividual movements may be allowed to fall to LOS E, but in most cases the overall intersection must operate (or be projected to operate) at a LOS D or better during AM and PM peak periods. If the existing LOS for an intersection is worse than LOS D, potential alternatives to improve the intersection to achieve LOS D should be provided or maintain the existing critical lane volume with the addition of site generated traffic. Minor movements at unsignalized intersections, such as left turns onto a major arterial from a side street, may be allowed to fall below LOS D pending the specific conditions. Movements which have a light traffic demand, and a viable travel alternative may be allowed to fall below LOS D. **Table 2** shows the definition of level of service for signalized and unsignalized intersections.

This is our typical template; however, this has been relocated in the revised traffic study.

Table 2 – Level of Service Definitions

Level of Service	Signalized Intersection Average Total Delay (sec/veh)	Unsignalized Intersection Average Total Delay (sec/veh)
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Definitions provided from the Highway Capacity Manual, Sixth Edition, Transportation Research Board, 2016.

[2] Transportation Research Board, *Highway Capacity Manual*, Sixth Edition, Washington DC, 2016.

Study area intersections were analyzed based on average total delay analysis for signalized and unsignalized intersections. Under the unsignalized analysis, the LOS for a two-way stop-controlled intersection is determined by the computed or measured control delay and is defined for each minor movement. LOS for a two-way stop-controlled intersection is not defined for the intersection as a whole. LOS for signalized and all-way stop controlled intersections are defined for each approach and for the overall intersection.

5.2 Key Intersection Operational Analysis

Calculations for the operational level of service at the key intersection for the study area are provided in **Appendix E**. The existing year analysis is based on the lane geometry and intersection control shown in **Figure 2.** Existing peak hour factors were utilized in the existing, 2026, and 2050 horizon analysis years. The existing heavy vehicle percentages obtained from the turning movement counts were also used in each horizon year. Synchro traffic analysis software was used to analyze the signalized and unsignalized key intersection for HCM level of service.

Add the Synchro version and build.

The version of Synchro has been provided in the revised study.

Therefore, the additional vehicles are not waiting a full cycle and lower the average delay for this movement. **Table 3** provides the results of the LOS analysis conducted at this intersection.

Table 3 – 64th Avenue & Gun Club Road LOS Results

Scenario	AM Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
2024 Existing				
Northbound Left	11.2	B	10.1	B
Northbound Through	0.0	A	0.0	A
Northbound Right	0.0	A	0.0	A
Eastbound Left	7.5	A	8.3	A
Westbound Left	8.2	A	7.5	A
Southbound Left	9.9	A	11.5	B
Southbound Through	10.8	B	0.0	A
Southbound Right	8.6	A	9.6	A
2026 Background				
Northbound Left	26.9	D		
Northbound Through	22.7	C		
Northbound Right	10.2	B		
Eastbound Left	8.2	A		
Westbound Left	8.9	A	7.6	A
Southbound Left	18.9	C		
Southbound Through	19.5	C		
Southbound Right	9.0	A		
2026 Background Plus Project				
Northbound Left	241.2	F		
Northbound Through	24.0	C	14.8	B
Northbound Right	10.6	B	9.0	A
Eastbound Left	8.2	A	9.1	A
Westbound Left	9.1	A	7.7	A
Southbound Left	24.2	C	18.3	C
Southbound Through	23.1	C	15.2	C
Southbound Right	9.0	A	13.3	B
2026 Background Plus Project #	**42.6**	**D**	**53.1**	**D**
Eastbound Approach	37.5	D	49.8	D
Eastbound Left	66.3	E	72.9	E
Eastbound Through	20.0	B	41.0	D
Eastbound Right	0.0	A	0.0	A
Westbound Approach	41.7	D	51.7	D
Westbound Left	78.7	E	75.9	E
Westbound Through	27.5	C	49.3	D
Westbound Right	0.0	A	0.0	A
Northbound Approach	58.1	E	58.3	E
Northbound Left	58.2	E	58.6	E
Northbound Through	28.4	C	10.8	B
Northbound Right	0.0	A	0.0	A
Southbound Approach	59.1	E	62.0	E
Southbound Left	60.3	E	62.8	E
Southbound Through	35.9	D	12.8	B
Southbound Right	0.0	A	0.0	A

Highlight all movements with LOS E or F.

All LOS E & F have been highlighted in the revised study.

Project Access

With completion of the QuikTrip 4283 project, access will be provided a new full movement access along the west side of Gun Club Road located approximately 450 feet south of 64th Avenue, measured center to center. It is recommended that a R1-1 "STOP" sign be installed on the eastbound exiting approach of this project access. **Table 4** provides the results of the level of service for this project access. As shown in the table, the project access intersection is anticipated to have all movements operate acceptably with LOS C or better during the peak hours in both the buildout year 2026 and the 2050 long-term horizons.

Table 4 – Project Access Level of Service Results

Intersection	2026 Total				2050 Total			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS	Delay (sec/ veh)	LOS
Gun Club Rd Access								
Eastbound Approach	11.4	B	10.8	B	13.1	B	15.3	C

5.3 Vehicle Queuing Analysis

A vehicle queuing analysis was conducted for the study area key intersection. The queuing analysis was performed using Synchro presenting the results of the 95th percentile queue lengths. Results are shown in the following **Table 5**

64th Ave is an arterial and shall meet SHAC deceleration criteria.

With the City of Aurora defaulting to CDOT standards for turn lanes, the turn lanes along 64th Avenue with project related movements have been evaluated with guidelines set forth in the State Highway Access Code.

La

Intersection Turn Lane	Existing Turn Lane Length (feet)	Calculated Queue (feet)	2026 Recommended Length (feet)	Calculated Queue (feet)	2050 Recommended Length (feet)
64th Ave & Gun Club Rd					
Eastbound Left	350'	279'	350'	277'	350' **DL**
Eastbound Right	100'/375'	56'	100'/375'	51'	100'/375'
Westbound Left	375'	89'	375'	209'	375'
Westbound Right	175'	25'	175'	31'	175'
Northbound Left	150'/325' DL	122'	150'/325' DL	141'	150'/325' DL
Northbound Right	25'	25'	25'	68'	25'
Southbound Left	200' DL	47'	200' DL	162'	200' DL
Southbound Right	250'/C DR	25'	250'/C DR	376'	250'/C DR

DL = Dual Left Turn Lanes; DR = Dual Right Turn Lanes; **Blue** Text = Recommendation

As shown in the table above, all vehicle q... remain within the existing turn ... horizon...

The queuing table now identifies when 95th percentile volumes exceeds capacity in the Synchro queuing output sheets.

Synchro printout show that it exceeds 95th Percentile capacity. Please add # to all that have it.

APPENDIX B

Intersection Count Sheets

Where is the 72 hour counts needed for the signal warrant analysis? This was asked for in the Pre Application meeting.

KH has worked through with the City of Aurora only collecting four-hour turning movements counts and providing four-hour vehicular volume warrants. Four-hour vehicular volume warrants is the industry standard. 72-hour tube counts do not provide turning movements or tell the entire story of an intersection especially when half of right-turn movements are removed from minor approaches in the signal warrant evaluation. However, for this study, existing turning movement counts were collected on a weekday for 12 hours at the intersection of 64th Avenue and Gun Club Road.

Further, in this case, 72-hour count data does not provide any relevant data along the minor approaches of Gun Club Road due these roadways only servicing construction traffic at this time.

Timings
1: Gun Club Rd &

EBL and WBL could be protected permitted as long as it is a single lane. It looks to have a good sight distance.

phase 2 should be eastbound. Fix the rest of the phasing.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	241	397	204	54	143	60	202	1	51			
Future Volume (vph)	241	397	204	54	143	60	202	1	51			
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	pt+ov			
Protected P					8		5	2	2 3			
Permitted P						8						
Detector Ph				8	8		5	2	2 3			
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	9.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5		9.5	22.5	
Total Split (s)	33.0	49.0	49.0	17.0	33.0	33.0	30.0	42.0		12.0	24.0	
Total Split (%)	27.5%	40.8%	40.8%	14.2%	27.5%	27.5%	25.0%	35.0%		10.0%	20.0%	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5					
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0					
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead					
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes					
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None					

Agreed, this has been updated to protected-permissive left turn phasing.

Phase 2 of the signal splits has been updated to be the eastbound approach.

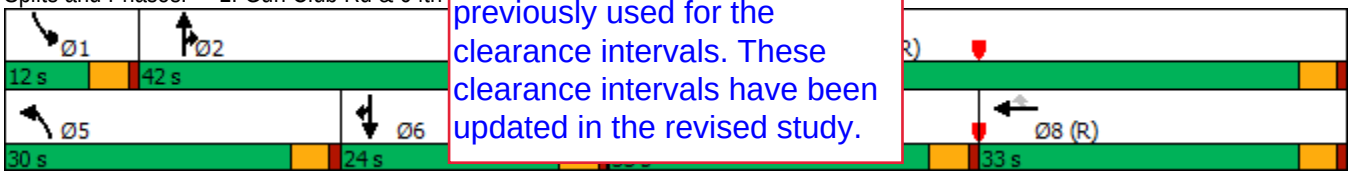
why are there overlaps?

NBR overlap has been removed.

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

This is not correct clearance times. apply to all scenarios.

Splits and Phases: 1: Gun Club Rd & 64th



The Synchro defaults were previously used for the clearance intervals. These clearance intervals have been updated in the revised study.

TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS (2026 Total)

Manual on Uniform Traffic Control Devices (2009 Edition)

INTERSECTION NAME: 64th Ave & Gun Club Rd COUNT DATE: 2026 Total

MAJOR STREET: 64th Ave # OF APPROACH LANE 2

MINOR STREET: Gun Club Rd # OF APPROACH LANE 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): N

	MAJOR ST BOTH APPROACHES	MINOR ST HIGHEST APPROACH	Warrant 1 - Condition A			Warrant 1 - Condition B			WARRANT 2	WARRANT 3
			MAJOR STREET	MINOR STREET	BOTH MET	MAJOR STREET	MINOR STREET	BOTH MET		
THRESHOLD VALUES →			600	150		900	75			
06:00 AM TO 07:00 AM	0	0								
07:00 AM TO 08:00 AM	989	206	Y	Y	**Y**	Y	Y	**Y**	**Y**	
08:00 AM TO 09:00 AM	1,099	229	Y	Y	**Y**	Y	Y	**Y**	**Y**	
09:00 AM TO 10:00 AM	989	206	Y	Y	**Y**	Y	Y	**Y**	**Y**	
10:00 AM TO 11:00 AM	890	186	Y	Y	**Y**		Y		**Y**	
11:00 AM TO 12:00 PM	0	0								
12:00 PM TO 01:00 PM	0	0								
01:00 PM TO 02:00 PM	0	0								
02:00 PM TO 03:00 PM	0	0								
03:00 PM TO 04:00 PM	828	183								
04:00 PM TO 05:00 PM	920	204								
05:00 PM TO 06:00 PM	828	183								
06:00 PM TO 07:00 PM	746	165								
07:00 PM TO 08:00 PM	0	0								
08:00 PM TO 09:00 PM	0	0								
09:00 PM TO 10:00 PM	0	0								
	7,289	1,562			**8**			**4**	**5**	**0**
			8 HOURS NEEDED **SATISFIED**			8 HOURS NEEDED **NOT SATISFIED**			4 HRS NEEDED **SATISFIED**	1 HR NEEDED **NOT SATISFIED**

The signal warrant evaluation has been updated to the four-hour vehicular volume warrant figure. 90 percent factors were previously utilized to calculate the 5th - 8th hours; however, eight-hour warrant has not been utilized in the revised study.

how are all these numbers generated?

WARRANT 1 - Condition A -- Minimum Vehicular Volu

WARRANT 1 - Condition B -- Interruption of Continuous Traffic Warrant (8 hours)

WARRANT 2 -- Four Hour Volume Warrant - Figure 4C-1

WARRANT 3 -- Peak Hour Volume Warrant - Figure 4C-3

The four hour warrant was previously satisfied. This has been converted to the four-hour warrant figures.

Text talks about the 4 hour and 1 hour warrants but they are not included in this.