



June 6, 2025

QuikTrip Corporation  
12000 Washington Street, Ste 175  
Thornton, CO 80241

Attn: Ms. Jessica Glavas  
Real Estate Project Manager

**Re: The Bubble Bath Carwash Station 60 | Aurora, Colorado  
Traffic Compliance Letter**

Dear Ms. Glavas:

This traffic study letter documents the results of a trip generation comparison analysis for the Bubble Bath Carwash development proposed within the overall Station 60 project located on the northwest corner of the Colfax Avenue (US-40) and Airport Boulevard intersection in Aurora, Colorado. The purpose of the trip generation comparison is to identify traffic compliance with the originally completed master traffic study for the overall development. Lot 4, Filing No. 2, the project site, is proposed to be approximately 1.7 acres is specifically located on the northwest corner of the right-in/right-out private access located along Colfax Avenue. The proposed development will include an approximate 4,300 square foot carwash building with one tunnel and is located west of the existing QuikTrip site. A conceptual site plan for the project is attached.

#### **ORIGINAL TRAFFIC STUDY DETAILS**

A previously approved Traffic Impact Study (TIS) for the Station 60 Master Plan was completed by Kimley-Horn and Associates in June 2022. The original traffic study was evaluated to assume development of 228 multifamily affordable housing units, 14,400 square feet of Medical-Dental Office, 86,000 square feet of shopping plaza use, a 7,500 square foot sit down restaurant, and a gas station with convenience market. The affordable housing residential development has already been constructed on the north side of the site and the gas station with convenience market has been constructed on the southeast side of the site. The most applicable use remaining from the original traffic study that would have a comparable lot size would be the 7,500 square foot sit down restaurant; therefore, the calculated trips generated by the proposed carwash were compared to the calculated trips generated by the previously studied sit down restaurant to determine if the project is traffic compliance with the original master traffic study. Applicable documents from the original traffic study are attached for reference.

#### **EXISTING ROADWAY NETWORK AND ACCESS**

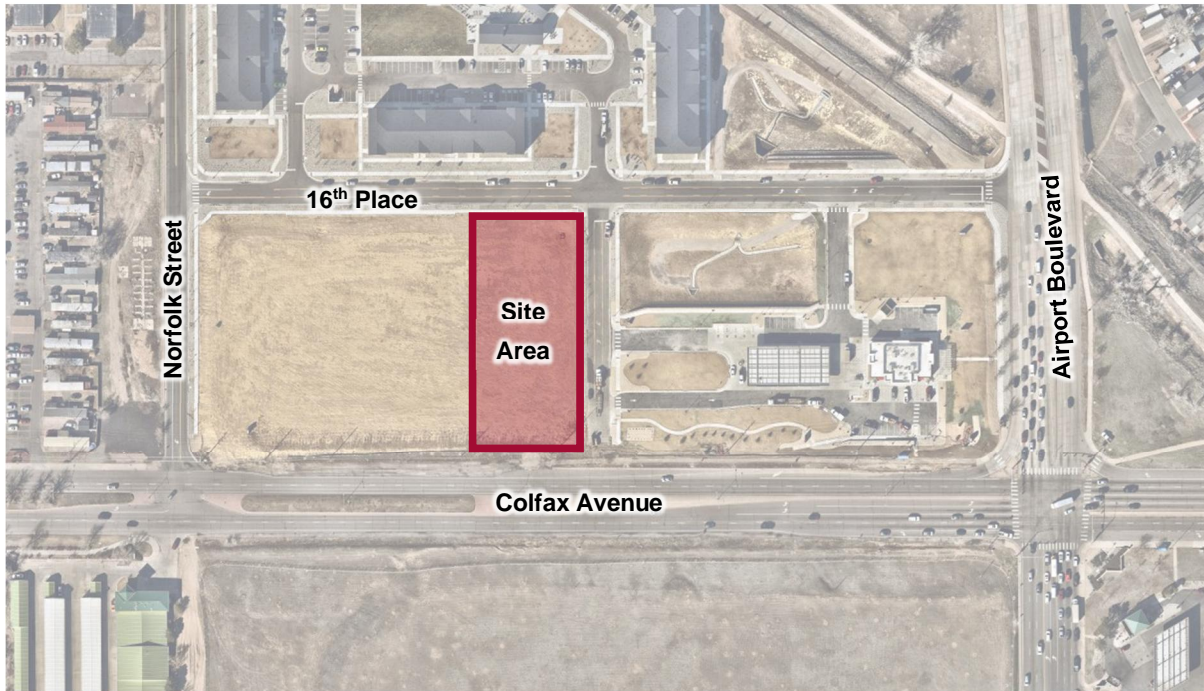
Colfax Avenue extends east/west with a posted speed limit of 45 miles per hour westbound and a posted speed limit of 55 miles per hour eastbound with two through lanes in each direction within the study area. The project site is approximately 750 feet west of Airport Boulevard (measured center to center). Airport Boulevard provides three through lanes in each direction, a northbound posted speed limit of 45 miles per hour, and a southbound speed limit of 40 miles per hour.

The signalized intersection of Colfax Avenue and Airport Boulevard operates with protected left turn phasing on all legs. Southbound Airport Boulevard provides a left lane, three through lanes, and a right turn lane while the northbound approach provides dual left turn lanes, two through lanes, and a through/right lane. The eastbound and westbound approaches of this intersection both provide dual left turn lanes, two through lanes, and a right turn lane.

The Colfax Avenue and Norfolk Street intersection provides stop control on the southbound Norfolk Street approach and the northbound private access approach. The eastbound Colfax Avenue approach provides a left turn lane, one through lane, and a shared through/right turn lane while the westbound approach provides a through lane and a through/right lane. The northbound private access approach provides a single shared movement lane, whereas southbound Norfolk Street provides a left turn lane and a shared through/right lane.

Approximately 675 feet to the west of the signalized Colfax Avenue and Airport Boulevard intersection and approximately 625 feet to the east of the Colfax Avenue and Norfolk intersection (measured from center to center), there is an existing right-in/right-out access to the proposed site. This access is anticipated to serve as the primary access point for the westbound traffic to and from the Bubble Bath Carwash site while access (16<sup>th</sup> Place) along both Airport Boulevard and Norfolk Street will also be used to access this site. Approximately 475 feet north of the Colfax Avenue and Airport Boulevard intersection, the intersection of 16<sup>th</sup> Place and Airport Boulevard provides right-in/right-out access to internal roads connected to the site. Likewise, the 16<sup>th</sup> Place and Norfolk Street intersection provides full turning movements and will provide access to the site. With this variety of existing access, it is believed that there is sufficient access to and from the site.

Direct access into the project site is proposed via a full movement access along the south side of 16<sup>th</sup> Place and a right-out only access along the west side of the north-south private roadway. An aerial image of the site and its vicinity is provided below (north is up).



Site Area

## TRIP GENERATION COMPARISON

The Bubble Bath Carwash is proposed to include an automated carwash with a 4,300 square foot building and one tunnel. The purpose of this letter is to compare the trip generation from the now proposed carwash to the assumed restaurant development from the original traffic study for this same area.

Site-generated traffic estimates are determined through a process known as trip generation. Rates and equations are applied to the proposed land use to estimate traffic generated by the development during a specific time interval. The acknowledged source for trip generation rates is the *Trip Generation Manual*<sup>1</sup> published by the Institute of Transportation Engineers (ITE). ITE has established trip rates in nationwide studies of similar land uses. Trip generation was previously based on ITE Trip Generation, 11<sup>th</sup> Edition equations for High Turnover Sit-Down Restaurant (ITE Land Use Code 932). For this proposed project, trip generation was based on ITE Trip Generation, 11<sup>th</sup> Edition equations for Automated Carwash (ITE Land Use Code 948). The following table compares the trip generation of the original restaurant use from the original traffic study to the proposed carwash use. The trip generation calculations from the original traffic study, as well as for the current proposal are attached for reference.

<sup>1</sup> Institute of Transportation Engineers, *Trip Generation Manual*, Eleventh Edition, Washington DC, 2021.

**The Bubble Bath Carwash  
Trip Generation Comparison: Original Study vs. Current Proposal**

Land Use and Size	Weekday Vehicles Trips						
	Daily	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Previous Land Use – Sit-Down Restaurant							
Sit-Down Restaurant (ITE 932) – 7,500 Square Feet	804	40	32	72	41	27	68
Proposed Land Use – Automated Carwash							
Automated Carwash (ITE 948) ~ 4,300 Square Feet	* 620	** 16	** 16	** 32	31	31	62
Net Difference in Trips	-184	-24	-16	-40	-10	+4	-6

\* Daily trips estimated as ten times the afternoon peak hour volume

\*\* Morning peak hour trips assumed as 50 percent of afternoon peak hour volume

As summarized in the table above, the 7,500 square foot High Turnover Sit-Down Restaurant is calculated to generate 804 weekday daily trips, with 72 of these trips occurring during the morning peak hour and 68 trips occurring during the afternoon peak hour. The proposed carwash is expected to generate 620 weekday daily trips, with 32 trips occurring during the morning peak hour and 62 trips occurring during the afternoon peak hour. Therefore, the proposed use results in 184 fewer daily trips, 40 fewer morning peak hour trips, and six (6) fewer trips in the afternoon peak hour than the use previously evaluated in the original master traffic study. Based on the anticipated decrease in project traffic volumes from the previous use studied, it is believed that the Bubble Bath Carwash is in traffic compliance with the original traffic study.

It is worthy of noting that the trip generation was calculated for the proposed carwash based on the square footage of the building/tunnel. Additionally, the ITE *Trip Generation Manual* only publishes average rates for the weekday afternoon peak hour. There are no data or equations provided for the weekday daily or morning peak hour. To provide a comparison, the daily trip generation was assumed to be 10 times the afternoon peak hour volumes while the morning peak hour trip generation was assumed to be 50 percent of the afternoon peak hour volumes. Of note, the assumptions for the AM peak hour trips were referenced from a study, *Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region*, which collected hourly traffic generation data for various uses. The results from this study indicated AM and PM peak trip rate is four (4) percent and nine (9) percent of the daily trips for a carwash site. This data suggests that the AM peak hour trips are less than half (44%) of the PM peak hour trips; therefore, the AM peak hour trips were assumed to be half of the PM peak hour trips in this study. Applicable pages from this referenced study are attached.

### VEHICLE CIRCULATION AND QUEUING ANALYSIS

Vehicles will enter the carwash site from the driveway along the south side of 16<sup>th</sup> Place and either enter a drive aisle on the west side of the site for the carwash operations or a drive aisle centrally located within the site designated for the vehicle vacuuming area. The west drive aisle for the carwash operations can stack approximately nine (9) vehicles southbound prior to circulating eastbound to the three order/payment boards drive aisles. After the pay station, traffic will reduce from three lanes to one lane while circulating to a northbound



direction prior to entry into the carwash tunnel. Vehicles will be washed through the building moving south to north. Upon exit from the carwash tunnel, vehicles will make a slight left. At this access, it is recommended that R5-1 "DO NOT ENTER" signs be posted facing the west for drivers who enter the vacuum area. The drivers can now choose to exit the site by turning right to the site access on 16<sup>th</sup> Place or turn left to access the vacuum area. The vacuum areas are located to the west of the building.

There is also an exit only driveway in the southeast area of the site along the north-south private road. This second access is intended for vehicles that unintentionally enter the carwash area but don't intend to go through the carwash tunnel or for a second point of access for emergency vehicles. At this access, it is recommended that R5-1 "DO NOT ENTER" signs be posted facing east for drivers traveling along the north/south private access roadway extending from Colfax Avenue.

The site can accommodate a total of approximately 25 vehicles to queue from the start of the carwash tunnel to the end of the southbound queue area prior the west internal intersection on site (queuing exhibit attached). This design meets the 85<sup>th</sup> percentile queue of seven (7) vehicles best practice standard for carwash as referenced in the ITE Summer 2012, *Drive-Through Queue Generation, 1<sup>st</sup> Edition*, published by Mike Spack. Although not typically designed for the worst-case scenarios, the site also meets the maximum data point from the previously referenced publication of 10 vehicles being queued in a carwash drive-through area. Therefore, the designated carwash tunnel drive through area should not obstruct the internal intersections to the carwash site or 16<sup>th</sup> Place. Applicable pages from the drive-through queuing publication are attached.

## CONCLUSIONS

The Bubble Bath Carwash proposed within the Station 60 development on the northwest corner of the Colfax Avenue and Airport Boulevard intersection is anticipated to generate less traffic than the applicable use previously studied in the original traffic study. Therefore, The Bubble Bath Carwash project is believed to be in traffic compliance with the overall development traffic study. Lastly, vehicle queues for the carwash operations are expected to be successfully contained internal to the site without spilling back to 16<sup>th</sup> Place or the internal intersections to the carwash site.

If you have any questions or require anything further, please feel free to call me.

Sincerely,

KIMLEY-HORN AND ASSOCIATES, INC.

Jeffrey R. Planck, P.E.  
Project Manager - Traffic



Concept Site Plan



K:\COS\_Civil\09688060\_BubbleBath - Aurora (61405)\CADD\PlanSheets\Site Plan\09688060\_SP\_05P.dwg Lundberg, Andrew 6/4/2025 4:02 PM

## NOTES:

1. PAVEMENT DIMENSIONS AND RADI ARE TO FACE OF CURB, UNLESS OTHERWISE NOTED. SIDEWALK DIMENSIONS ARE FROM BACK OF CURB.
2. WARNING SIGNS ARE REQUIRED TO BE PLACED UNDER THE OVERHEAD ELECTRIC LINES TO MAKE ALL PERSONNEL AWARE OF THE ELECTRIC HAZARD.
3. REFER TO THE MEP PLANS FOR SITE LIGHTING ELECTRICAL PLAN.
4. REFER TO ARCHITECTURAL AND STRUCTURAL PLANS TO VERIFY ALL BUILDING DIMENSIONS
5. EVERY HANDICAP ACCESSIBLE PARKING SPACE SHALL BE IDENTIFIED BY A SIGN CENTERED 5 FEET ABOVE THE PARKING SURFACE, AT THE HEAD OF THE PARKING SPACE. THE SIGN MUST INCLUDE THE INTERNATIONAL SYMBOL OF ACCESSIBILITY AND STATE RESERVED, OR EQUIVALENT LANGUAGE. SUCH SIGNS SHALL NOT BE OBSOURED BY A VEHICLE PARKED IN THE SPACE.
6. CONTRACTOR TO FIELD VERIFY LOCATION AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
7. CAUTION:DO NOT PLACE THE STAGING ARE IN CLOSE PROXIMITY TO OVERHEAD ELECTRIC LINES.
8. SLOPES ON ACCESSIBLE ROUTES MAY NOT EXCEED 1:20 UNLESS DESIGNED AS A RAMP.
9. THE MAXIMUM SLOPE OF A RAMP IN A NEW CONSTRUCTION IS 1:12. THE MAXIMUM RISE FOR ANY RAMP RUN IS 30 IN.
10. ACCESSIBLE ROUTES MUST HAVE A CROSS-SLOPE NO GREATER THAN 1:50
11. ALL STANDARD PARKING STALLS ARE 9' WIDE BY 18' DEEP TO FACE OF CURB. ALL VACUUM PARKING STALLS ARE 12.5' WIDE BY 22.0' DEEP TO FACE OF CURB.
12. ALL PARKING DIMENSIONS ARE MEASURED FROM CENTERLINE OF PAVEMENT MARKING TO CENTERLINE OF PAVEMENT MARKING OR CENTERLINE OF PAVEMENT MARKING TO FACE OF CURB.
13. ALL LIGHTING FIXTURES SHALL BE DESIGNED TO COMPLETELY CONCEAL AND FULLY SHIELDS, WITHIN AN OPAQUE HOUSING, THE LIGHT SOURCE FROM VISIBILITY FROM ANY STREET RIGHT-OF-WAY. THE CONE OF LIGHT SHALL NOT CROSS ANY ADJACENT PROPERTY LINE. ONLY INCANDESCENT, FLUORESCENT, COLOR-CORRECTED HIGH-PRESSURE SODIUM OR METAL HALIDE MAY BE USE. ALL VEHICLES OR PEDESTRIAN ACCESS SHALL BE SUFFICIENTLY LIGHTED TO ENSURE SECURITY OR PROPERTY AND PERSONS.
14. ALL ROOF, WALL, AND GROUND MOUNTED MECHANICAL EQUIPMENT MUST BE SCREENED. IF ROOF AND WALL MOUNTED EQUIPMENT OF ANY TYPE INCLUDING DUCT WORK AND LARGE VENTS IS PROPOSES IT SHALL BE SHOWN ON THE SITE PLAN AND SCREENING IDENTIFIED. SCREENING OF MECHANICAL EQUIPMENT SHALL RESULT IN THE MECHANICAL EQUIPMENT BLENDING IN WITH THE PRIMARY BUILDING AND NOT APPEARING SEPARATE FROM THE BUILDING AND SHALL BE SCREENED FROM VIEW OF ANY RIGHTS-OF-WAY OR ADJOINING PROPERTIES.
15. THE DUMPSTER ENCLOSURES MUST BE ONE (1) FOOT ABOVE THE HEIGHT OF THE WASTE CONTAINER. USE PROTECTIVE POLES IN CORNERS AND AT IMPACT AREAS. FENCE POSTS OF RUST PROTECTIVE METAL OR CONCRETE. A MINIMUM 6" SLAB IS REQUIRED AND MUST BE SLOPED TO A DRAIN; THE ENCLOSURE MUST HAVE STEEL FRAMED GATES WITH SPRING LOADED HINGES AND FASTENERS TO KEEP CLOSED. SCREENING MUST BE ON ALL FOUR SIDES BY MASONRY WALL OR APPROVED FENCE OR SCREENING WITH OPAQUE GATES.

CAUTION!!!:THE CONTRACTOR SHALL BE REQUIRED TO LOCATE ALL PUBLIC OR PRIVATE UTILITIES INCLUDING BUT NOT LIMITED TO:WATER, SEWER, TELEPHONE AND FIBER OPTIC LINES, SITE LIGHTING, ELECTRIC, SECONDARY ELECTRIC, PRIMARY ELECTRICAL DUCTBANCK, LANDSCAPE IRRIGATION FACILITIES, AND GAS LINES. ANY UTILITY CONFLICTS THAT ARISE SHOULD BE COMMUNICATED TO THE ENGINEER IMMEDIATELY AND PRIOR TO CONSTRUCTION. THER CONTRACTOR SHALL CONTACT 1-800-DIG-TESS A MINIMUM OF 48 HOURS PRIOR TO THE SATART OF CONSTRUCTION. ANY DAMAGE TO EXUISATING UTILITIES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND THE REPAIR OF SHALL BE AT THE CONTRACTYOR'S SOLE EXPENSE WHETHER THE UTILITY IS SHOWN ON THESE PLANS OR NOT.

ACCESSIBILITY NOTE FOR COMMERCIAL PROJECTS BUILT UNDER THE 2009 IBC:

- ACCESSIBLE EXTERIOR ROUTES SHALL BE PROVIDED FROM PUBLIC TRANSPORTATION STOPS, ACCESSIBLE PARKING AND ACCESSIBLE PASSENGER LOADING ZONES AND PUBLIC SIDEWALKS TO 60% OF THE ACCESSIBLE BUILDING ENTRANCES THEY SERVE. THE ACCESSIBLE ROUTE BETWEEN ACCESSIBLE PARKINGF AND ACCESSIBLE BUILDING ENTRANCES SHALL BE THE MOST PRACTICAL DIRECT ROUTE. THE ACCESSIBLE ROUTE MUST BE LOCATED WITHIN A SIDEWALK. NO SLOPE ALONG THIS ROUTE MAY EXCEED 1:20 WITHOUT PROVIDING A RAMP WITH A MAXIMUM SLOPE OF 1:12 AND HANDRAILS. CROSSWALKS ALONG THIS TRROUTE SHALL BE WIDE ENOUGH TO WHOLLY CONTAIN THE CURB RAMP WITH A MINIMUM WIDTH OF 36" AND SHALL BE PAINTED WITH WHITE STRIPES. THE CITY OF AURORA ENFORCES HANDICAPPED ACCESSIBILITY REQUIREMENTS BASED ON THE 2009 INTERNATIONAL BUILDING CODE, CHAPTER 11, AND THE AMERICAN NATIONAL STANDARDS INSTITUTE (ICC/ANSI) A117-2003.

ADDRESSING:

- ALL BUILDING ADDRESS NUMBERS SHALL COMPLY WITH THE AURORA CITY CODE, ARTICLE VII-NUMBERING OF BUILDINGS.

AIRCRAFT NOISE REDUCTION (LDN):

- ATTENTION BUILDING DIVISION: PER ARTICLE XI, C.O.A. BUILDING AND ZONING CODE, SECTION 22-425 THROUGH 22-434, AN ACOUSTIC ANALYSIS, PREPARED BY AN ACOUSTIC EXPERT THAT WILL IDENTIFY BUILDING DESIGN FEATURES NECESSARY TO ACCOMPLISH EXTERIOR NOISE REDUCTION TO ACHIEVE INTERIOR NOISE LEVELS NOT EXCEEDING\_\_\_\_ (LDN VALUE TO BE DETERMINED FOR EACH PROJECT) UNDER WORSE CASE NOISE CONDITIONS.

AMERICANS WITH DISABILITIES ACT:

- THE APPLICANT HAS THE OBLIGATION TO COMPLY WITH ALL APPLICABLE REQUIRMENTS OF THE AMERICANS WITH DISABILITIES ACT.

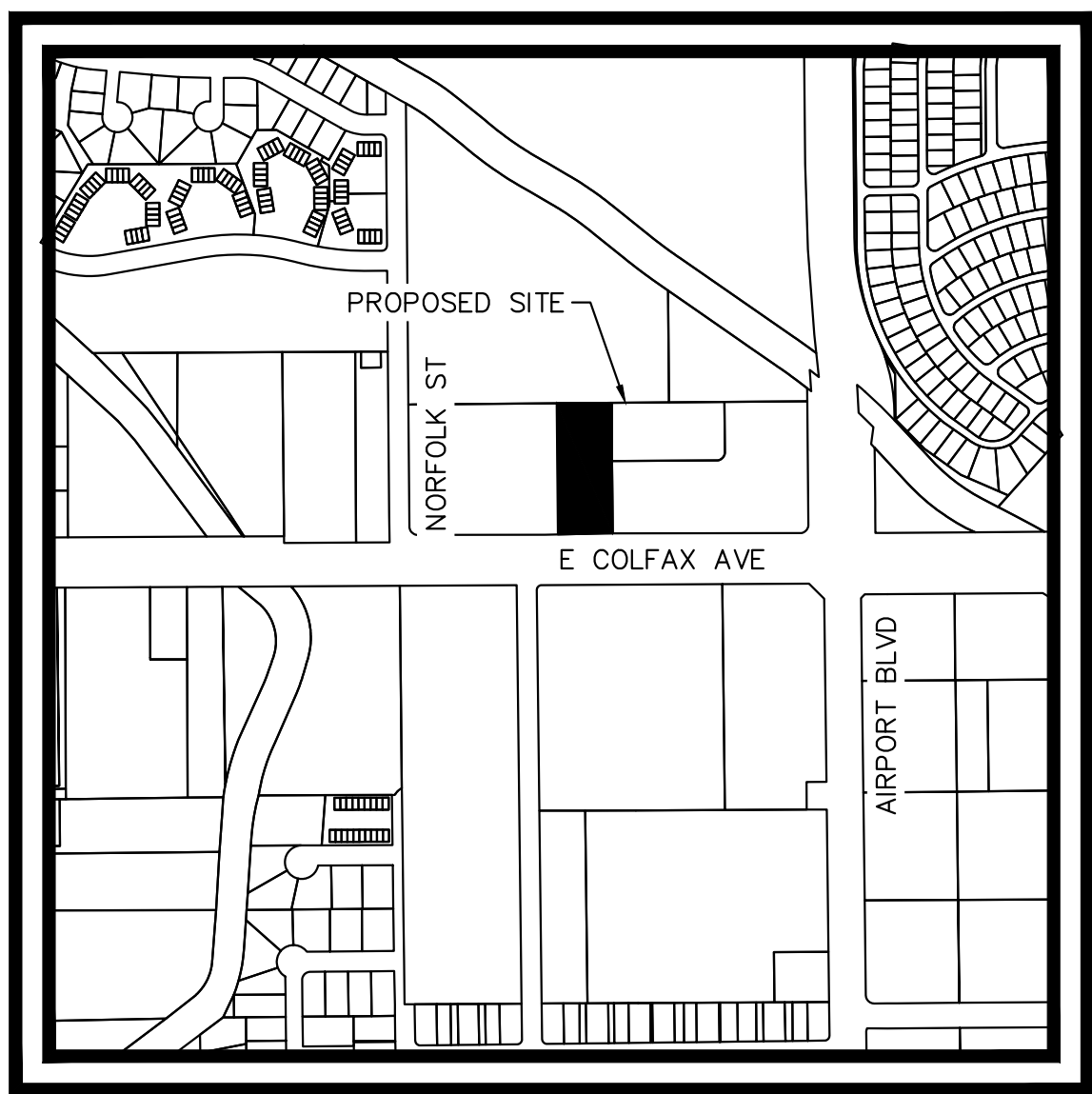
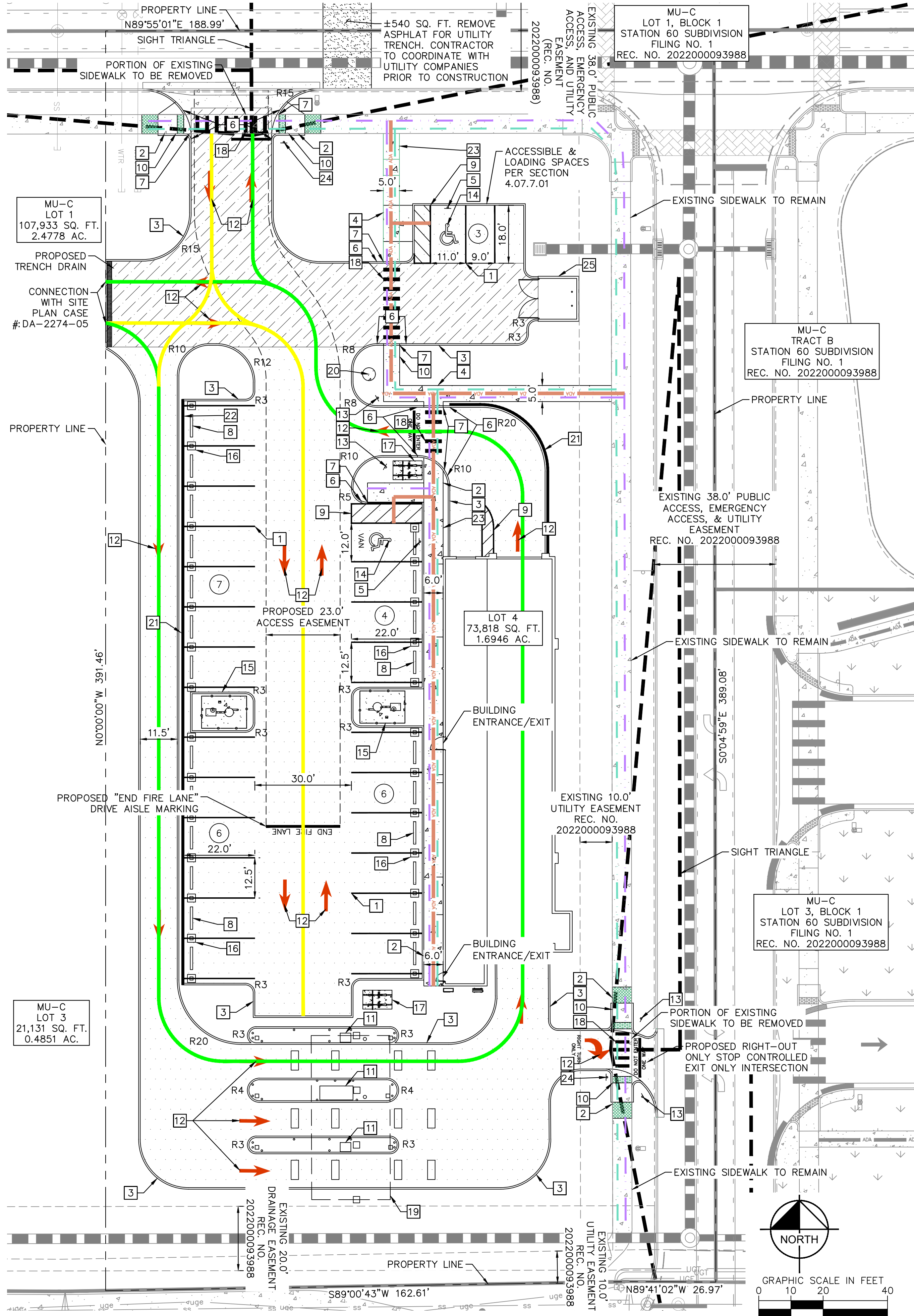
EMERGENCY INGRESS AND EGRESS:

- THE EMERGENCY INGRESS AND EGRESS RIGHT OF WAY IS GRANTED OVER, ACROSS, ON AND THROUGH ANY AND ALL PRIVATE ROADS AND WAYS NOW OR HEREAFTER ESTABLISHED ON THE DESCRIBED PROPERTY, AND THE SAME ARE HEREBY DESIGNATED AS "SERVICE/EMERGENCY AND EASEMENTS" AND SHALL BE POSTED "NO PARKING-FIRE LANE"

THE 2015 INTERNATIONAL FIRE CODE (IFC), REQUIRES ALL BUILDINGS TO BE ASSESSED FOR ADEQUATE EMERGENCY RESPONDER RADIO COVERAGE (ERRC). AT THE TIME THE STRUCTURE IS AT FINAL FRAME AND FINAL ELECTRICAL INSPECTIONS, THE GENERAL CONTRACTOR (GC) WILL BE REQUIRED TO HIRE A QUALIFIED INDEPENDENT 3RD PARTY TO ASSES THE RADIO FREQUENCY LEVELS WITHIN THE STRUCTURE. ONCE COMPLETED, THE 3RD PARTY WILL PROVIDE THE RESULTS OF THE TEST TO BOTH THE GC AND THE AURORA BUILDING DIVISION AS TO WHETHER THE STRUCTURE PASSED OR FAILED THE PRELIMINARY RADIO SURVEILLANCE. A STRUCTURE THAT HAS PASSED THIS SURVEILLANCE REQUIRES NO FURTHER ACTION BY THE GC. A FAILED RADIO SURVEILLANCE WILL REQUIRE A LICENSED CONTRACTOR TO SUBMIT PLANS TO THE AURORA BUILDING DIVISION TO ABTAIN A BUILDING PERMIT FOR THE INSTALLATION AN ERRC SYSTEM PRIOR TO INSTALLATION. THIS ASSESSMENT AND INSTALLATION IS AT THE OWNER OR DEVELOPERS EXPENSE. FURTHER INTERIOR OR EXTERIOR MODIFICATIONS AFTER THE ORIGINAL CERTIFICATE OF OCCUPANCY IS ISSUED WILL REQUIRE A REASSESSMENT FOR ADEQUATE RADIO FREQUENCY COVERAGE.

THE DEVELOPER IS RESPONSIBLE FOR SIGNING AND STRIPING ALL PUBLIC STREETS. THE DEVELOPER IS REQUIRED TO PLACE TRAFFIC CONTROL, STREET NAME, AND GUIDE SIGNS ON ALL PUBLIC STREETS AND PRIVATE STREETS APPROACHING AN INTERSECTION WITH A PUBLIC STREET. SIGNS SHALL BE FURNISHED AND INSTALLED PER THE MOST CURRENT EDITIONS OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND CITY STANDARDS, AND SHOWN ON THE SIGNING AND STRIPING PLAN FOR THE DEVELOPMENT.

EVERGREEN DEV CO., INC, 2390 E CAMELBACK RD, SUITE 410, PHOENIX, ARIZONA 85016, (602)808-8600, SHALL BE RESPONSIBLE FOR PAYMENT OF 50% OF THE TRAFFIC SIGNALIZATION COSTS FOR THE INTERSECTION OF COLFAX AVENUE AND NORFOLK STREET, IF AND WHEN TRAFFIC SIGNAL WARRANTS ARE SATISFIED. TRAFFIC SIGNAL WARRANTS TO CONSIDER SHALL BE AS DESCRIBED IN THE MOST RECENTLY ADOPTED VERSION OF MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, AS OF THE DATE OR DATES OF ANY SUCH WARRANT STUDIES. FOR WARRANT PURPOSES, THE MINOR STREET APPROACH TRAFFIC SHALL TYPICALLY BE COMPRISED OF ALL THOUGH AND LEFT TURN MOVEMENT AND 50% OR RIGHT MOVEMENTS UNLESS OTHERWISE DETERMINED BY THE TRAFFIC ENGINEER. PURSUANT TO 147-37.5 OF CITY CODE, THE PERCENTAGE OF TRAFFIC SIGNALIZATION COSTS IDENTIFIED ABOVE SHALL BE PAID TO THE CITY BY THE APPLICANT/OWNER, TO BE HELD IN ESCROW FOR SUCH PURPOSE, PRIOR TO THE ISSUANCE OF A BUILDING PERMIT FOR THE RELATED DEVELOPMENT OR AS OTHERWISE REQUIRED BY CITY CODE. THE PERCENTAGE ABOVE WILL BE APPLIED TO THE ENTIRE TRAFFIC SIGNALIZATION COST AS ESTIMATED AT THE TIME OF ESCROW DEPOSIT TO CALCULATE SPECIFIC DOLLAR FUSING REQUIREMENT.



VICINITY MAP  
N.T.S.

## LEGEND

---	PROPERTY LINE
---	ADJACENT PROPERTY LINE
---	EASEMENT LINE
---	EXISTING WATER LINE
---	EXISTING SANITARY LINE
---	EXISTING UNDERGROUND COMM LINE
---	EXISTING UNDERGROUND ELECTRIC LINE
---	SIGHT DISTANCE TRIANGLE
---	ACCESSIBLE ROUTE
---	BICYCLE PATHWAY
---	PEDESTRIAN PATHWAY
---	PROPOSED VEHICLE PATH 1
---	PROPOSED VEHICLE PATH 2
---	EXISTING CONCRETE SIDEWALK
---	PROPOSED CONCRETE SIDEWALK

## KEYNOTE LEGEND

1	TYPICAL PARKING STRIPING
2	PROPOSED 6' CONCRETE SIDEWALK
3	MONOLITHIC CURB
4	PROPOSED 5' CONCRETE SIDEWALK
5	HANDICAP SIGN (PER SEC. 4.07.7.01)
6	2' CURB TRANSITION
7	RIBBON CURB
8	WHEEL STOP
9	CROSS HATCH STRIPING (SEE COA S9.0 FOR DETAILS)
10	PEDESTRIAN RAMP (SEE COA S9.0 FOR DETAILS)
11	PAY TERMINAL
12	TRAFFIC ARROWS
13	DO NOT ENTER SIGN
14	HANDICAP PARKING SYMBOL (PER SEC. 4.07.7.01)
15	VACUUM ENCLOSURE (REFER TO ARCH. PLANS)
16	VACUUM CANOPIES
17	BICYCLE RACK
18	CROSSWALK STRIPING
19	XPT CANOPY
20	FLAG POLE
21	RETAINING WALL (REFER TO GRADING PLANS)
22	CURB FLU
23	RAMP WITH HANDRAIL
24	STOP SIGN
25	DUMPSTER ENCLOSURE (REFER TO ARCH. PLANS)
#	PARKING COUNT

BUBBLE BATH CAR WASH  
STATION 60 FILING NO. 2, LOT 4  
AURORA, CO 80011

PRELIMINARY

FOR REVIEW ONLY  
NOT FOR  
CONSTRUCTION  
Kimley»Horn  
Kimley-Horn and Associates, Inc.

PROJECT NO.  
09688060

SHEET

Kimley»Horn

© 2025 KIMLEY-HORN AND ASSOCIATES, INC.  
2 North Nevada Avenue, Suite 900  
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: AJL  
DRAWN BY: AJL  
CHECKED BY: EUG  
DATE: 06/02/2025

NO. REVISION DATE BY



## Original Traffic Study Excerpts



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

## Station 60

Aurora, Colorado

**Prepared for**  
**QuikTrip Corporation**  
5725 Foxridge Drive  
Mission, KS 66202

**Prepared by**  
**Kimley-Horn and Associates, Inc.**  
4582 South Ulster Street  
Suite 1500  
Denver, Colorado 80237  
(303) 228-2300



June 2022

*This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.*

**Table 1 – Station 60 Traffic Generation**

Land Use	Weekday Vehicle Trips						
	Daily	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Multifamily Affordable Housing (ITE 223) – 228 Units	1,098	24	58	82	62	43	105
Medical-Dental Office Building (ITE 720) – 14,400 SF	520	36	9	45	17	40	57
Shopping Plaza (ITE 821) – 86,000 SF	5,806	92	57	149	219	227	446
High-Turnover (Sit-Down) Restaurant (ITE 932) – 7,500 SF	804	40	32	72	41	27	68
Super Convenience Market w/ Gas Station (ITE 945) – 5,312 SF & 20 Fueling Positions	6,818	242	243	485	209	210	419
<b>Total Trips</b>	<b>15,046</b>	<b>434</b>	<b>399</b>	<b>833</b>	<b>548</b>	<b>547</b>	<b>1,095</b>
<b>Total Trip After Internal Capture</b>	<b>13,146</b>	<b>385</b>	<b>350</b>	<b>735</b>	<b>449</b>	<b>448</b>	<b>897</b>

#### 4.2 Trip Distribution

Distribution of project traffic on the street system was based on the area street system characteristics, existing traffic patterns, existing and anticipated surrounding development areas, and the proposed access system for the project. The directional distribution of traffic is a means to quantify the percentage of site-generated traffic that approaches the site from a given direction and departs the site back to the original source. The project trip distribution is illustrated in **Figure 8**. Of note, since Station 60 includes commercial uses, it would be expected that pass-by trips would be attracted to the development from traffic driving along Colfax Avenue (US-40) and Airport Boulevard. However, a pass-by trip reduction was not accounted for in this traffic study to be more consistent with CDOT procedure. This will provide an overall conservative traffic analysis.

#### 4.3 Traffic Assignment

Traffic assignment was obtained by applying the project trip distribution to the estimated traffic generation of the project shown in **Table 1**. Project traffic assignment is shown in **Figure 9**.

#### 4.4 Total (Background Plus Project) Traffic

Project traffic volumes were added to the background volumes to represent estimated traffic conditions for the short term 2023 horizon and long term 2040 horizon. These total traffic volumes for the site are illustrated for the 2023 and 2040 horizon years in **Figures 10** and **11**, respectively.

# Trip Generation Planner (ITE 11th Edition) - Summary Report



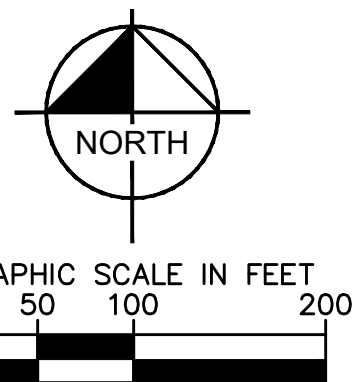
Weekday Trip Generation  
Trips Based on Average Rates/Equations

Project Name  
Project Number

Station 60 - Trolley Station  
096888020

ITE Code	Internal Capture Land Use	Land Use Description	Independent Variable	Setting/Location	No. of Units	Avg Rate or Eq	Rates			Total Trips								Net Trips after Internal Capture							
							Daily Rate	AM Rate	PM Rate	Daily Trips	AM Trips	PM Trips	AM Trips In	AM Trips Out	PM Trips In	PM Trips Out	Daily Trips	AM Trips	PM Trips	AM Trips In	AM Trips Out	PM Trips In	PM Trips Out	AM Trips In	AM Trips Out
223	Residential	Multifamily Affordable Housing	Dwelling Unit(s)	General Urban/Suburban	228	Avg	4.81	0.36	0.46	1,098	82	105	24	58	62	43	706	71	44	23	48	27	17		
720	Office	Medical-Dental Office Building	1,000 Sq Ft	General Urban/Suburban	14.4	Avg	36.00	3.10	3.93	520	45	57	36	9	17	40	352	30	39	29	1	9	30		
821	Retail	Shopping Plaza	1,000 Sq Ft	General Urban/Suburban	86	Avg	67.52	1.73	5.19	5,806	149	446	92	57	219	227	5,400	142	403	90	53	200	203		
932	Restaurant	High-Turnover (Sit-Down) Restaurant	1,000 Sq Ft	General Urban/Suburban	7.5	Avg	107.20	9.57	9.05	804	72	68	40	32	41	27	346	28	32	6	22	22	10		
945	Retail	Gasoline Station w/ Convenience Market	1,000 Sq Ft	General Urban/Suburban	5.3	Avg	1283.38	91.35	78.95	6,818	485	419	242	243	209	210	6,342	464	379	237	226	191	188		
Grand Total										15,046	833	1,095	434	399	548	547	13,146	735	897	385	350	449	448		





CHECKED BY: XX  
DRAWN BY: XX

**OWNER:**  
HIKTRIP CORPORATION  
105 S. 129TH EAST AVE  
TULSA, OK 74134-7005  
913-905-2026

DATE:  
0/2021 SUBMITTAL 1  
0/2021 SUBMITTAL 2

SHEET TITLE:  
OVERALL  
BUILDOUT

## Trip Generation Worksheet

### Car Wash Trip Generation Hourly Data

Project Bubble Bath Car Wash Station 60 - Aurora  
 Subject Trip Generation for Automated Car Wash  
 Designed by JRP Date June 04, 2025 Job No. 096888060  
 Checked by \_\_\_\_\_ Date \_\_\_\_\_ Sheet No. 1 of 1

## **TRIP GENERATION MANUAL TECHNIQUES**

ITE Trip Generation Manual 11th Edition, Average Rate Equations

Land Use Code - Automated Car Wash (948)

Independent Variable - 1000 Square Feet Gross Floor Feet (X)

Gross Floor Area = 4,300

X = 4.3

T = Average Vehicle Trip Ends

### **Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m. (Used Half PM Peak Hour Rates)**

From Attached Traffic Generation Hourly Rates Document

Directional Distribution: 50% ent. 50% exit.

T = 7.1(X)

T = 31 Average Vehicle Trip Ends

T = 7.1 \* 4.3

16 entering 16 exiting

### **Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m. (900 Series Page 931)**

Directional Distribution: 50% ent. 50% exit.

T = 14.20(X)

T = 62 Average Vehicle Trip Ends

T = 14.20 \* 4.3

31 entering 31 exiting

### **Weekday (10% K-Factor from PM Peak Hour)**

Average Weekday

Directional Distribution: 50% ent. 50% exit.

(T) = PM Peak Total / K Factor 0.1

T = 620 Average Vehicle Trip Ends

310 entering 310 exiting

310 + 310 = 620



(NOT SO)

# BRIEF GUIDE OF VEHICULAR TRAFFIC GENERATION RATES FOR THE SAN DIEGO REGION

APRIL 2002



401 B Street, Suite 800  
San Diego, California 92101  
(619) 699-1900 • Fax (619) 699-1950

NOTE: This listing only represents a *guide* of average, or estimated, traffic generation "driveway" rates and some very general trip data for land uses (emphasis on acreage and building square footage) in the San Diego region. These rates (both local and national) are subject to change as future documentation becomes available, or as regional sources are updated. For more specific information regarding traffic data and trip rates, please refer to the San Diego Traffic Generators manual. *Always check with local jurisdictions for their preferred or applicable rates.*

LAND USE	TRIP CATEGORIES [PRIMARY:DIVERTED:PASS-BY] <sup>p</sup>	ESTIMATED WEEKDAY VEHICLE TRIP GENERATION RATE (DRIVEWAY)	HIGHEST PEAK HOUR % (plus IN:OUT ratio) Between 6:00-9:30 A.M. Between 3:00-6:30 P.M.				TRIP LENGTH (Miles) <sup>l</sup>
AGRICULTURE (Open Space)	[80:18:2]	2/acre**					10.8
AIRPORT	[78:20:2]	60/acre, 100/flight, 70/1000 sq. ft. * ** 6/acre, 2/flight, 6/based aircraft * ** 100/acre**	5% 9%	(6:4) (7:3)	6% 15%	(5:5) (5:5)	12.5
AUTOMOBILE <sup>s</sup>							
Car Wash							
Automatic		900/site, 600/acre**	4%	(5:5)	9%	(5:5)	
Self-serve		100/wash stall**	4%	(5:5)	8%	(5:5)	
Gasoline	[21:51:28]						2.8
with/Food Mart		160/vehicle fueling space**	7%	(5:5)	8%	(5:5)	
with/Food Mart & Car Wash		155/vehicle fueling space**	8%	(5:5)	9%	(5:5)	
Older Service Station Design		150/vehicle fueling space, 900/station**	7%	(5:5)	9%	(5:5)	
Sales (Dealer & Repair)		50/1000 sq. ft., 300/acre, 60/service stall * **	5%	(7:3)	8%	(4:6)	
Auto Repair Center		20/1000 sq. ft., 400/acre, 20/service stall*	8%	(7:3)	11%	(4:6)	
Auto Parts Sales		60/1000 sq. ft. **	4%		10%		
Quick Lube		40/service stall**	7%	(6:4)	10%	(5:5)	
Tire Store		25/1000 sq. ft., 30/service stall**	7%	(6:4)	11%	(5:5)	
CEMETERY		5/acre*					
CHURCH (or Synagogue)	[64:25:11]	9/1000 sq. ft., 30/acre** (quadruple rates for Sunday, or days of assembly)	5%	(6:4)	8%	(5:5)	5.1
COMMERCIAL/RETAIL <sup>s</sup>							
Super Regional Shopping Center (More than 80 acres, more than 800,000 sq. ft., w/usually 3+ major stores)		35/1000 sq. ft., <sup>c</sup> 400/acre*	4%	(7:3)	10%	(5:5)	
Regional Shopping Center	[54:35:11]	50/1000 sq. ft., <sup>c</sup> 500/acre*	4%	(7:3)	9%	(5:5)	5.2
(40-80acres, 400,000-800,000 sq. ft., w/usually 2+ major stores)							
Community Shopping Center	[47:31:22]	80/1000 sq. ft., 700/acre* **	4%	(6:4)	10%	(5:5)	3.6
(15-40 acres, 125,000-400,000 sq. ft., w/usually 1 major store, detached restaurant(s), grocery and drugstore)							
Neighborhood Shopping Center (Less than 15 acres, less than 125,000 sq. ft., w/usually grocery & drugstore, cleaners, beauty & barber shop, & fast food services)		120/1000 sq. ft., 1200/acre* **	4%	(6:4)	10%	(5:5)	
Commercial Shops	[45:40:15]						
Specialty Retail/Strip Commercial		40/1000 sq. ft., 400/acre*	3%	(6:4)	9%	(5:5)	4.3
Electronics Superstore		50/1000 sq. ft**			10%	(5:5)	
Factory Outlet		40/1000 sq. ft.**	3%	(7:3)	9%	(5:5)	
Supermarket		150/1000 sq. ft., 2000/acre* **	4%	(7:3)	10%	(5:5)	
Drugstore		90/1000 sq. ft.**	4%	(6:4)	10%	(5:5)	
Convenience Market (15-16 hours)		500/1000 sq. ft.**	8%	(5:5)	8%	(5:5)	
Convenience Market (24 hours)		700/1000 sq. ft.**	9%	(5:5)	7%	(5:5)	
Convenience Market (w/gasoline pumps)		850/1000 sq. ft., 550/vehicle fueling space**	6%	(5:5)	7%	(5:5)	
Discount Club		60/1000 sq. ft., 600/acre* **	7%	(7:3)	9%	(5:5)	
Discount Store		60/1000 sq. ft., 600/acre**	3%	(6:4)	8%	(5:5)	
Furniture Store		6/1000 sq. ft., 100/acre**	4%	(7:3)	9%	(5:5)	
Lumber Store		30/1000 sq. ft., 150/acre**	7%	(6:4)	9%	(5:5)	
Home Improvement Superstore		40/1000 sq. ft.**	5%	(6:4)	8%	(5:5)	
Hardware/Paint Store		60/1000 sq. ft., 600/acre**	2%	(6:4)	9%	(5:5)	
Garden Nursery		40/1000 sq. ft., 90/acre**	3%	(6:4)	10%	(5:5)	
Mixed Use: Commercial (w/supermarket)/Residential		110/1000 sq. ft., 2000/acre* (commercial only) 5/dwelling unit, 200/acre* (residential only)	3% 9%	(6:4) (3:7)	9% 13%	(5:5) (6:4)	
EDUCATION							
University (4 years)	[91:9:0]	2.4/student, 100 acre*	10%	(8:2)	9%	(3:7)	8.9
Junior College (2 years)	[92:7:1]	1.2/student, 24/1000 sq. ft., 120/acre* **	12%	(8:2)	9%	(6:4)	9.0
High School	[75:19:6]	1.3/student, 15/1000 sq. ft., 60/acre* **	20%	(7:3)	10%	(4:6)	4.8
Middle/Junior High	[63:25:12]	1.4/student, 12/1000 sq. ft. 50/acre**	30%	(6:4)	9%	(4:6)	5.0
Elementary	[57:25:10]	1.6/student, 14/1000 sq. ft., 90/acre* **	32%	(6:4)	9%	(4:6)	3.4
Day Care	[28:58:14]	5/child, 80/1000 sq. ft.**	17%	(5:5)	18%	(5:5)	3.7
FINANCIAL <sup>s</sup>	[35:42:23]						3.4
Bank (Walk-In only)		150/1000 sq. ft., 1000/acre* **	4%	(7:3)	8%	(4:6)	
with Drive-Through		200/1000 sq. ft., 1500/acre*	5%	(6:4)	10%	(5:5)	
Drive-Through only		250 (125 one-way)/lane*	3%	(5:5)	13%	(5:5)	
Savings & Loan		60/1000 sq. ft., 600/acre**	2%		9%		
Drive-Through only		100 (50 one-way)/lane**	4%		15%		
HOSPITAL	[73:25:2]						8.3
General		20/bed, 25/1000 sq. ft., 250/acre*	8%	(7:3)	10%	(4:6)	
Convalescent/Nursing		3/bed**	7%	(6:4)	7%	(4:6)	
INDUSTRIAL							
Industrial/Business Park (commercial included)	[79:19:2]	16/1000 sq. ft., 200/acre* **	12%	(8:2)	12%	(2:8)	9.0
Industrial Park (no commercial)		8/1000 sq. ft., 90/acre**	11%	(9:1)	12%	(2:8)	
Industrial Plant (multiple shifts)	[92:5:3]	10/1000 sq. ft., 120/acre*	14%	(8:2)	15%	(3:7)	11.7
Manufacturing/Assembly		4/1000 sq. ft., 50/acre**	19%	(9:1)	20%	(2:8)	
Warehousing		5/1000 sq. ft., 60/acre**	13%	(7:3)	15%	(4:6)	
Storage		2/1000 sq. ft., 0.2/vault, 30/acre*	6%	(5:5)	9%	(5:5)	
Science Research & Development		8/1000 sq. ft., 80/acre*	16%	(9:1)	14%	(1:9)	
Landfill & Recycling Center		6/acre	11%	(5:5)	10%	(4:6)	

(OVER)

MEMBER AGENCIES: Cities of Carlsbad, Chula Vista, Coronado, Del Mar, El Cajon, Encinitas, Escondido, Imperial Beach, La Mesa, Lemon Grove, National City, Oceanside, Poway, San Diego, San Marcos, Santee, Solana Beach, Vista and County of San Diego.  
ADVISORY/LIAISON MEMBERS: California Department of Transportation, County Water Authority, U.S. Department of Defense, S.D. Unified Port District and Tijuana/Baja California.

LAND USE	TRIP CATEGORIES [PRIMARY:DIVERTED:PASS-BY] <sup>P</sup>	ESTIMATED WEEKDAY VEHICLE TRIP GENERATION RATE (DRIVEWAY)	HIGHEST PEAK HOUR % (plus IN:OUT ratio) Between 6:00-9:30 A.M.    Between 3:00-6:30 P.M.				TRIP LENGTH (Miles) <sup>L</sup>
<b>LIBRARY</b> .....	[44:44:12]	50/1000 sq. ft., 400/acre**	2%	(7:3)	10%	(5:5)	3.9
<b>LODGING</b> .....	[58:38:4]						7.6
Hotel (w/convention facilities/restaurant)		10/occupied room, 300/acre	6%	(6:4)	8%	(6:4)	
Motel		9/occupied room, 200/acre*	8%	(4:6)	9%	(6:4)	
Resort Hotel		8/occupied room, 100/acre*	5%	(6:4)	7%	(4:6)	
Business Hotel		7/occupied room**	8%	(4:6)	9%	(6:4)	
<b>MILITARY</b> .....	[82:16:2]	2.5/military & civilian personnel*	9%	(9:1)	10%	(2:8)	11.2
<b>OFFICE</b>							
Standard Commercial Office .....	[77:19:4]	20/1000 sq. ft., <sup>O</sup> 300/acre*	14%	(9:1)	13%	(2:8)	8.8
(less than 100,000 sq. ft.)							
Large (High-Rise) Commercial Office .....	[82:15:3]	17/1000 sq. ft., <sup>O</sup> 600/acre*	13%	(9:1)	14%	(2:8)	10.0
(more than 100,000 sq. ft., 6+ stories)							
Office Park (400,000+ sq. ft.)		12/1000 sq.ft., 200/acre* **	13%	(9:1)	13%	(2:8)	
Single Tenant Office		14/1000 sq. ft., 180/acre*	15%	(9:1)	15%	(2:8)	8.8
Corporate Headquarters		7/1000 sq. ft., 110/acre*	17%	(9:1)	16%	(1:9)	
Government (Civic Center) .....	[50:34:16]	30/1000 sq. ft.**	9%	(9:1)	12%	(3:7)	6.0
Post Office							
Central/Walk-In Only		90/1000sq. ft.**	5%		7%		
Community (not including mail drop lane)		200/1000 sq. ft., 1300/acre*	6%	(6:4)	9%	(5:5)	
Community (w/mail drop lane)		300/1000 sq. ft., 2000/acre*	7%	(5:5)	10%	(5:5)	
Mail Drop Lane only		1500 (750 one-way)/lane*	7%	(5:5)	12%	(5:5)	
Department of Motor Vehicles		180/1000 sq. ft., 900/acre**	6%	(6:4)	10%	(4:6)	
Medical-Dental .....	[60:30:10]	50/1000 sq. ft., 500/acre*	6%	(8:2)	11%	(3:7)	6.4
<b>PARKS</b> .....	[66:28:6]		4%		8%		5.4
City (developed w/meeting rooms and sports facilities)		50/acre*	13%	(5:5)	9%	(5:5)	
Regional (developed)		20/acre*					
Neighborhood/County (undeveloped)		5/acre (add for specific sport uses), 6/picnic site* **					
State (average 1000 acres)		1/acre, 10/picnic site**					
Amusement (Theme)		80/acre, 130/acre (summer only)**			6%	(6:4)	
San Diego Zoo		115/acre*					
Sea World		80/acre*					
<b>RECREATION</b>							
Beach, Ocean or Bay .....	[52:39:9]	600/1000 ft. shoreline, 60/acre*					6.3
Beach, Lake (fresh water)		50/1000 ft. shoreline, 5/acre*					
Bowling Center		30/1000 sq. ft., 300/acre, 30/lane **	7%	(7:3)	11%	(4:6)	
Campground		4/campsite**	4%		8%		
Golf Course		7/acre, 40/hole, 700/course* **	7%	(8:2)	9%	(3:7)	
Driving Range only		70/acre, 14/tee box*	3%	(7:3)	9%	(5:5)	
Marinas		4/berth, 20/acre* **	3%	(3:7)	7%	(6:4)	
Multi-purpose (miniature golf, video arcade, batting cage, etc.)		90/acre	2%		6%		
Racquetball/Health Club		30/1000 sq. ft., 300/acre, 40/court*	4%	(6:4)	9%	(6:4)	
Tennis Courts		16/acre, 30/court**	5%		11%	(5:5)	
Sports Facilities							
Outdoor Stadium		50/acre, 0.2/seat*					
Indoor Arena		30/acre, 0.1/seat*					
Racetrack		40/acre, 0.6 seat*					
Theaters (multiplex w/matinee) .....	[66:17:17]	80/1000 sq. ft., 1.8/seat, 360/screen*	1/3%		8%	(6:4)	6.1
<b>RESIDENTIAL</b> .....	[86:11:3]						7.9
Estate, Urban or Rural		12/dwelling unit * <sup>R</sup>	8%	(3:7)	10%	(7:3)	
(average 1-2 DU/acre)							
Single Family Detached		10/dwelling unit * <sup>R</sup>	8%	(3:7)	10%	(7:3)	
(average 3-6 DU/acre)							
Condominium		8/dwelling unit * <sup>R</sup>	8%	(2:8)	10%	(7:3)	
(or any multi-family 6-20 DU/acre)							
Apartment		6/dwelling unit * <sup>R</sup>	8%	(2:8)	9%	(7:3)	
(or any multi-family units more than 20 DU/acre)							
Military Housing (off-base, multi-family)							
(less than 6 DU/acre)		8/dwelling unit	7%	(3:7)	9%	(6:4)	
(6-20 DU/acre)		6/dwelling unit	7%	(3:7)	9%	(6:4)	
Mobile Home							
Family		5/dwelling unit, 40/acre*	8%	(3:7)	11%	(6:4)	
Adults Only		3/dwelling unit, 20/acre*	9%	(3:7)	10%	(6:4)	
Retirement Community		4/dwelling unit**	5%	(4:6)	7%	(6:4)	
Congregate Care Facility		2.5/dwelling unit**	4%	(6:4)	8%	(5:5)	
<b>RESTAURANT<sup>S</sup></b> .....	[51:37:12]						4.7
Quality		100/1000 sq. ft., 3/seat, 500/acre* **	1%	(6:4)	8%	(7:3)	
Sit-down, high turnover		160/1000 sq. ft., 6/seat, 1000/acre* **	8%	(5:5)	8%	(6:4)	
Fast Food (w/drive-through)		650/1000 sq. ft., 20/seat, 3000/acre* **	7%	(5:5)	7%	(5:5)	
Fast Food (without drive-through)		700/1000 sq. ft.**	5%	(6:4)	7%	(5:5)	
Delicatessen (7am-4pm)		150/1000 sq. ft., 11/seat*	9%	(6:4)	3%	(3:7)	
<b>TRANSPORTATION</b>							
Bus Depot		25/1000 sq. ft.**					
Truck Terminal		10/1000 sq. ft., 7/bay, 80/acre**	9%	(4:6)	8%	(5:5)	
Waterport/Marine Terminal		170/berth, 12/acre**					
Transit Station (Light Rail w/parking)		300/acre, 2 <sup>1/2</sup> /parking space (4/occupied)**	14%	(7:3)	15%	(3:7)	
Park & Ride Lots		400/acre (600/paved acre), 5/parking space (8/occupied)* **	14%	(7:3)	15%	(3:7)	

\* Primary source: *San Diego Traffic Generators*.

\* Other sources: *ITE Trip Generation Report [6th Edition]*, Trip Generation Rates (other agencies and publications), various SANDAG & CALTRANS studies, reports and estimates.

<sup>P</sup> Trip category percentage ratios are daily from local household surveys, often cannot be applied to very specific land uses, and do not include non-resident drivers (draft SANDAG *Analysis of Trip Diversion*, revised November, 1990):

PRIMARY - one trip directly between origin and primary destination.

DIVERTED - linked trip (having one or more stops along the way to a primary destination) whose distance compared to direct distance ≥ 1 mile.

PASS-BY - undiverted or diverted < 1 mile.

<sup>L</sup> Trip lengths are average weighted for all trips to and from general land use site. (All trips system-wide average length = 6.9 miles)

<sup>C</sup> Fitted curve equation:  $\ln(T) = 0.502 \ln(x) + 6.945$  } T = total trips, x = 1,000 sq. ft.

<sup>O</sup> Fitted curve equation:  $\ln(T) = 0.756 \ln(x) + 3.950$  }

<sup>R</sup> Fitted curve equation:  $t = -2.169 \ln(d) + 12.85$  t = trips/DU, d = density (DU/acre), DU = dwelling unit

<sup>S</sup> Suggested PASS-BY [undiverted or diverted < 1 mile] percentages for trip rate reductions only during P.M. peak period (based on combination of local data/review and Other sources\*\*):

COMMERCIAL/RETAIL	
Regional Shopping Center	20%
Community "	30%
Neighborhood " "	40%
Specialty Retail/Strip Commercial (other)	10%
Supermarket	40%
Convenience Market	50%
Discount Club/Store	30%
FINANCIAL	
Bank	25%
AUTOMOBILE	
Gasoline Station	50%
RESTAURANT	
Quality	10%
Sit-down high turnover	20%
Fast Food	40%

<sup>T</sup> Trip Reductions - In order to help promote regional "smart growth" policies, and acknowledge San Diego's expanding mass transit system, consider vehicle trip rate reductions (with proper documentation and necessary adjustments for peak periods). The following are some examples:

[1] A 5% daily trip reduction for land uses with transit access or near transit stations accessible within 1/4 mile.

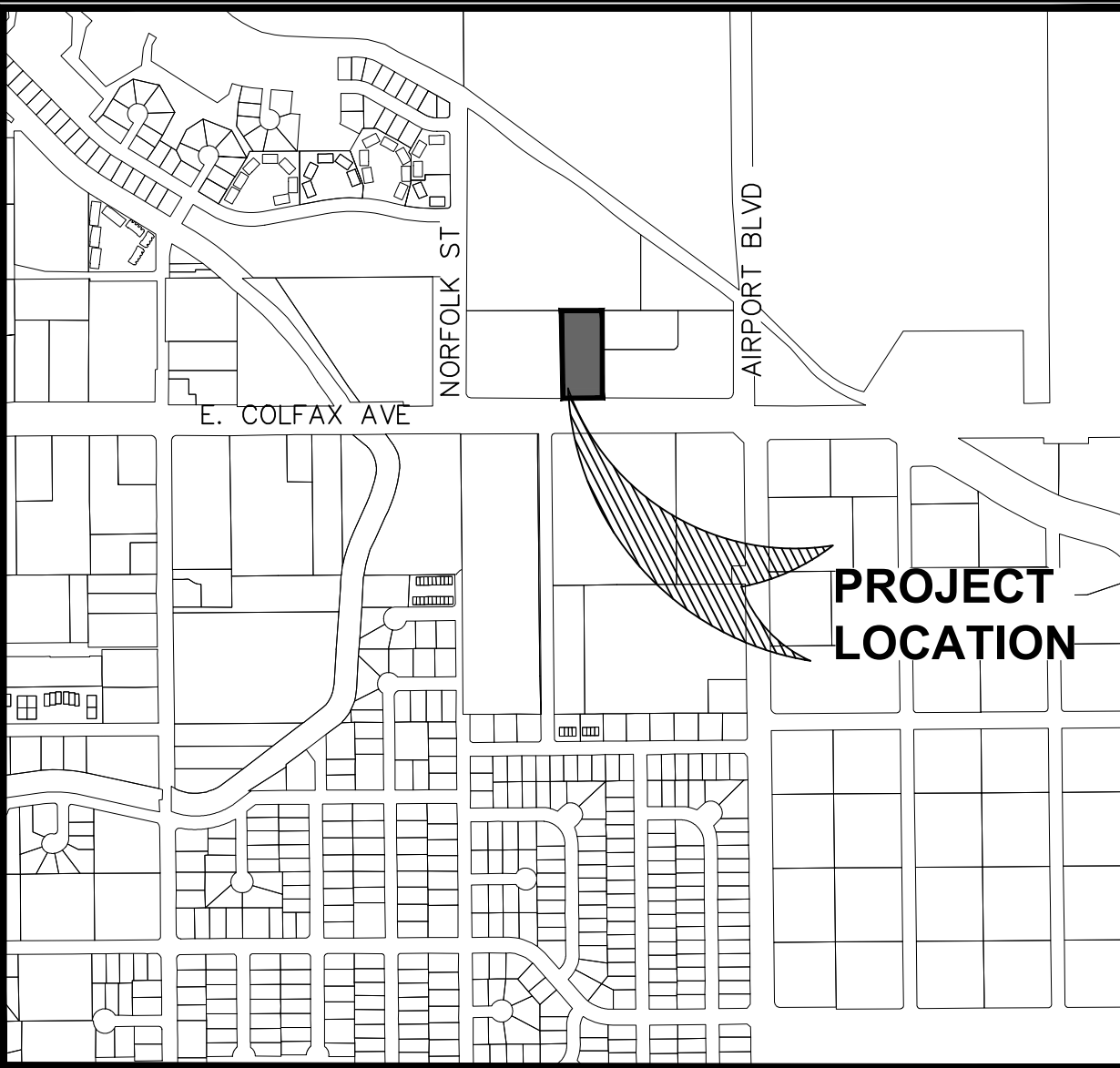
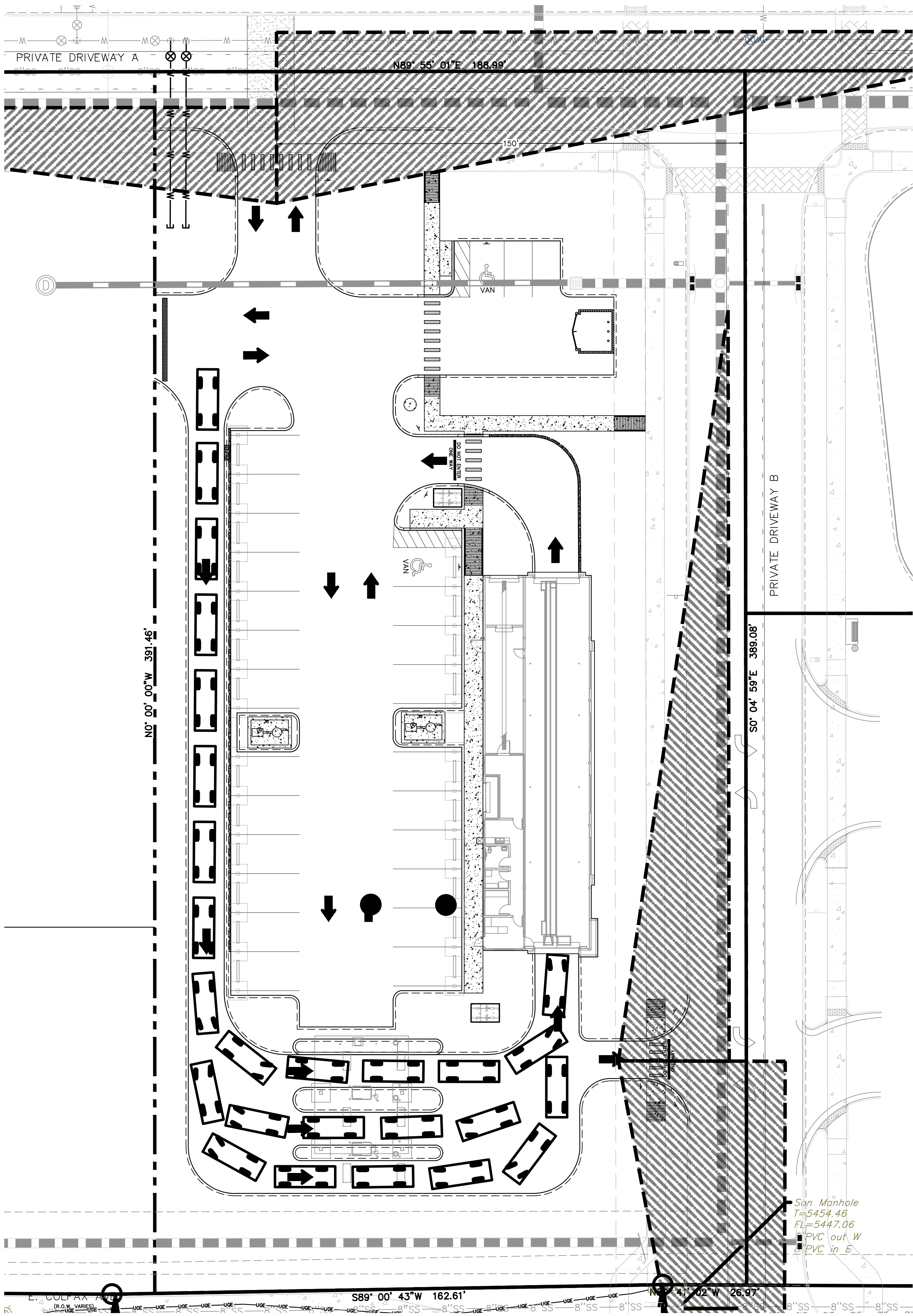
[2] Up to 10% daily trip reduction for mixed-use developments where residential and commercial retail are combined (demonstrate mode split of walking trips to replace vehicular trips).

Vehicle Queuing Exhibit

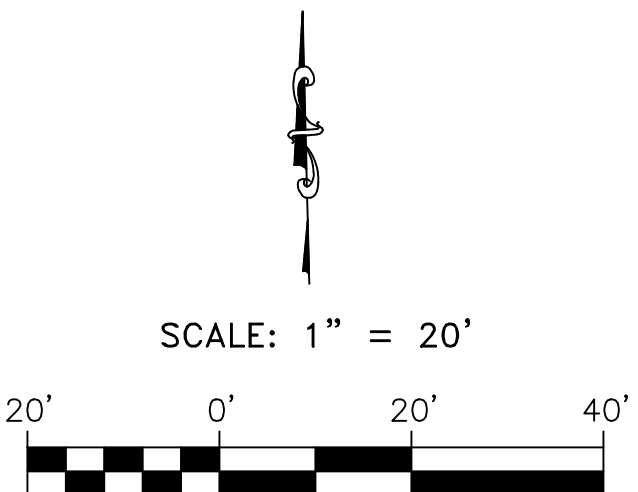
Drive-Through Queue Publication – Mike Spack



Date: Aug 28, 2024, 6:11pm User ID: Dohlio  
File: P:\176\01\04 - Aurora, CO (425)\Civil\Exhibits\Vehicle stacking.dwg



LOCATION MAP  
NOT TO SCALE



LEGEND

- PROPERTY LINE
- ADJACENT PROPERTY LINE
- LIMITS OF CONSTRUCTION
- SITE DISTANCE TRIANGLE
- BENCH MARK
- FOUND 3/4" IRON ROD
- EXISTING OVERHEAD ELECTRIC LINE AND POWER POLE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING 8" SANITARY SEWER
- EXISTING 10" SANITARY SEWER
- EXISTING FENCE
- 8' ZONING BUFFER
- EXISTING SEWER MANHOLE
- EXISTING UTILITY POLE
- CENTERLINE
- EDGE OF ASPHALT
- PROPOSED FIRE HYDRANT
- PROPOSED CURB
- PROPOSED RIBBON CURB
- SAW CUT & REPLACE ASPHALT
- SAW CUT & REPLACE W/CONCRETE
- VEHICLE OUTLINE

STATION 60 FILING NO. 2, LOT 4 BUBBLE BATH CAR WASH AURORA, CO. 80011	
VEHICLE QUEUING EXHIBIT	
REVIEW PURPOSES ONLY NOT FOR CONSTRUCTION	
JOB:	SCALE:
176-01-04	1" = 20'
SHEET NO. EXHIBIT	
NO.	DATE
COMMENTS	

# Drive-Through Queue Generation

Mike Spack, PE, PTOE, Max Moreland, EIT, Lindsay de Leeuw, Nate Hood

## 1.0 Introduction

This report provides queuing data for businesses with drive-through services. It is intended to be an aid for site designers and reviewers, similar to the Institute of Transportation Engineers' *Trip Generation* and *Parking Generation* reports. The data presentation is modeled on the *Parking Generation* report and data is provided based on at least six sites, similar to data sets marked as statistically significant in *Trip Generation*.

Businesses with drive-through lanes are very common in the United States and having data that gives usage information for drive-through lanes will assist designers as well as cities in determining the appropriate amount of storage needed for proposed drive-through businesses. Data for drive-through queues was published by the ITE Technical Council Committee 5D-10 in 1995 based on information collected between the late 1960's and the 1990's. A paper was also published in 2009 by Mark Stuecheli, PTP giving updated information for bank and coffee shop drive-through lanes. The results from the 2009 study are incorporated into this paper (thank you Mark for your assistance).

## 2.0 Data Collection

Data was collected using COUNTcam video recording systems at a total of 30 drive-through locations in Minneapolis, MN and several surrounding suburbs between 2010 and 2012 (26 of the 30 videos were recorded in February of 2012, which should represent peak usage in the cold Minnesota winter). Videos of drive-through lanes were collected at banks, car washes, coffee shops, fast food restaurants and pharmacies. A total of six locations were selected for each of the five different land uses. Each location was recorded for between one and five days where the majority of locations were recorded for two consecutive days. The days of the week that each video was recorded on varies.

The 24-hour videos were watched at high speeds with the PC-TAS counting software and maximum queues throughout the day were noted. Most of the COUNTcams were set up such that the entire queue lane could be seen, but at a few locations the drive-through lanes wrapped around the building in a way that the entire queue length would not be able to be seen. For these situations, the COUNTcams were set up so that the ordering window and back of the queue could be seen and it was noted how many vehicles could fit between the ordering window and the front of the queue. For drive-through locations with multiple lanes, the number of lanes was noted but the maximum queue is defined as the sum of the queues at each lane for any given point in time, not the queue per lane. This approach provides overall demand, which may assist designers in determining how many drive through lanes are appropriate in addition to determining how long they should be.

The data for Kansas banks was collected between 4:30pm and 6:00pm. While many of the maximum queues for the data collected in Minnesota were between these times, maximum queues occurred between 8:30am and 5:30pm so it is possible that some of the Kansas data does not capture the actual maximum queues for the day.

The number of available lanes at banks, not including the ATM lane, ranged from two to seven lanes (though the most open at one time was five lanes). Even though plenty of lanes were available, cars often stacked at the lane closest to the building, thus additional lanes may not result in shorter queues. With an 85<sup>th</sup> percentile maximum queue of eight vehicles, the data suggests that banks with drive-through lanes should be able to accommodate 160 feet of vehicle stacking.

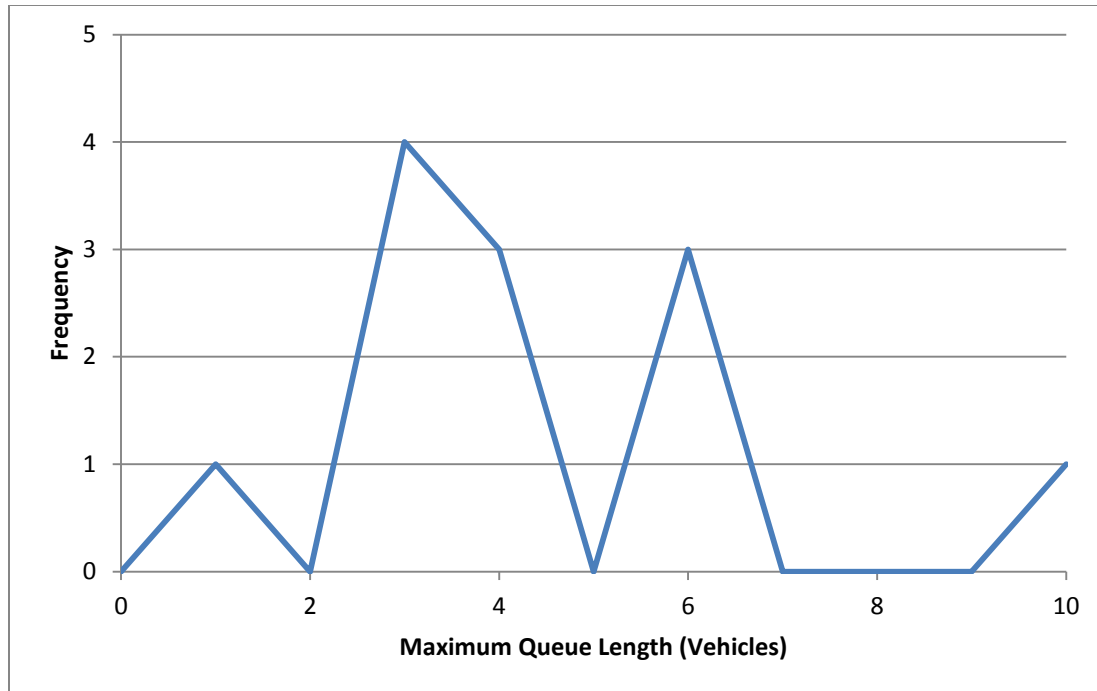
### 3.2 Car Washes

Data collection was done at six car washes with drive-through services (including one full-service car wash) in February 2012. Twelve days of data were collected. The car washes were located in the cities of Falcon Heights, Hopkins, Minneapolis, Roseville and St. Louis Park, MN. Five of the six car washes (excluding the full-service car wash) were located at gas stations. Only the vehicles waiting in line were counted; vehicles being washed were not added to the queue.

**Table 3.2 – Drive-Through Car Wash Maximum Queue Statistics**

<b>Number of Data Points</b>	<b>12</b>
<b>Average Maximum Queue (Vehicles)</b>	<b>4.42</b>
<b>Standard Deviation (Vehicles)</b>	<b>2.31</b>
<b>Coefficient of Variation</b>	<b>52%</b>
<b>Range (Vehicles)</b>	<b>1 to 10</b>
<b>85<sup>th</sup> Percentile (Vehicles)</b>	<b>6.20</b>
<b>33<sup>rd</sup> Percentile (Vehicles)</b>	<b>3.00</b>





**Figure 3.2 – Drive-Through Car Wash Maximum Queue Frequency**

Two of the car washes had two lanes while the other four were one lane car washes. The full-service car wash had two lanes and also produced the highest maximum queue of 10 vehicles. The maximum queues for car washes were spread throughout the afternoon from 12:30pm to 8:30pm. With an 85<sup>th</sup> percentile maximum queue of more than six vehicles, the data suggests that car washes with drive-through lanes should be able to accommodate 140 feet of vehicle stacking throughout the day.

### 3.3 Coffee Shops

Data collection was done at six coffee shops with drive-through services in November 2010, August 2011 and February 2012. Fourteen days of data were collected. The coffee shops were located in the cities of Edina, Hopkins, Minneapolis, Roseville and St. Louis Park, MN. Vehicles being served were counted as being in the queue. Twelve days of data from the Kansas City, Kansas area is also included.

**Table 3.3 – Drive-Through Coffee Shop Maximum Queue Statistics**

	Minnesota Data	Minnesota + Kansas Data
Number of Data Points	14	26
Average Maximum Queue (Vehicles)	11.00	10.23
Standard Deviation (Vehicles)	2.25	2.76
Coefficient of Variation	20%	27%
Range (Vehicles)	7 to 16	3 to 16
85th Percentile (Vehicles)	13.50	13.00
33rd Percentile (Vehicles)	10.00	9.91