Site Traffic Analysis
for Fortuna Rd Coffee Shop

Draft Report

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Accelerated Development Services

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EXECUTIVE SUMMARY

The following contains a Site Traffic Analysis (STA) for a coffee shop located on Fortuna Rd in Albuquerque, NM. This report has been completed by Lee Engineering for Accelerated Development Services. All analyses and items contained herein conform to scoping requirements set forth in a scoping meeting held on January 6, 2020.

BACKGROUND

A coffee shop is to be located on Coors Blvd & Fortuna Rd. Surrounding major intersections include Coors Blvd & Hanover Rd and Coors Blvd & Los Volcanes.

In total, the site is anticipated to generate 85 ingress and 85 egress trips in the AM peak hour. Due to the nature of the development, the PM peak hour was not analyzed. A detailed site plan is included in Figure 1 of this report. Access to the site is to be taken directly from Fortuna Rd. One dedicated driveway and a shared driveway located north through the parking lot of the adjacent commercial development is to be used as access to the site. Details and recommendations for this driveway's placement are included in the body of this report. Study intersections, as shown in Figure 2, include:

- Coors Blvd & Fortuna Rd
- Fortuna Rd & Site Access Driveway
- Coors Blvd & North Existing Shared Access Driveway

Construction is anticipated to begin in 2020 with full completion of the Development in 2020. The development is to be constructed in a single phase.

Analysis scenarios for this study include:

1. Existing (2020) – with existing signal timings and roadway network geometry
2. Full Build (2020) - with existing signal timings and roadway network geometry (except for project site). Traffic volumes from 2020 background plus project site trip generation.

Existing turning movement counts were collected on November 19, 2019, for all study intersections. These volumes were used in the existing conditions analysis. As the site is to be constructed within the same year, existing conditions volumes were used in buildout analysis scenarios.

Site trips for the Development site were generated based on data gathered from similar coffee shop facilities operating across the country. Site trips were added to existing traffic volumes to create buildout traffic volumes.

SUMMARY OF RECOMMENDATIONS

Reproduced from the end of this report, recommendations are as follows:

- No capacity or queueing issues are observed or anticipated at the study intersection. Therefore, no capacity recommendations are made.
- Sight distance for the site driveway on Fortuna Rd is recommended to be maintained.
    - It is also recommended that AASHTO sight distances, as detailed in the sight distance section of this report, be adhered to as closely as possible.
- Based on the queueing studies performed by Spack Consulting and site-specific conditions/operations, the site's queueing capacity of 18 vehicles within the drive-through lanes is found to be appropriate.

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

LIST OF APPENDICIES

INTRODUCTION

This report details the procedures and findings of a Site Traffic Analysis (STA) performed by Lee Engineering for Accelerated Development Services. This report and the analyses contained herein were performed for a coffee shop development, to be constructed on US Coors Blvd & Fortuna Rd in Albuquerque, NM. The purpose of this study is to examine the impacts of the development on surrounding traffic conditions and discuss the placement of a site access driveway on Fortuna Dr.

The scope of this report and the analyses performed were completed in agreement with the scoping requirements set forth by the NMDOT. Scoping meeting notes, from the scoping meeting held on January 6, 2019, are included in Appendix A. Analysis procedures, conclusions, and recommendations for this study were developed according to the *Highway Capacity Manual 6th Edition, and Manual on Uniform Traffic Control Devices 2009 Edition*.

Construction is anticipated to begin in 2020 with full completion of the Development in 2020 in one phase. As shown in Figure 1, the site is to include a coffee shop with a drive-through constructed with a counterclockwise flow of operations. Traffic generated by the site is anticipated to be 85 ingress and 85 egress trips in the AM peak hours. Due to the nature of the development, the PM peak hour was not analyzed. Analysis procedures included in this report were performed for the following scenarios:

1. Existing (2020) – with existing signal timings and roadway network geometry
2. Full Build (2020) - with projected Dutch Bros Coffee traffic, existing signal timings and roadway network geometry

PROJECT LOCATION & SITE PLAN

Dutch Bros Coffee Shop is to be located on the northeast corner of Coors Blvd & Fortuna Rd. Figure 1: Site Plan shows the site plan and Figure 2 shows the site location, study intersections, and surrounding area. Surrounding major intersections include Coors Blvd & Hanover Rd and Coors Blvd & Los Volcanes. The project area is bordered by existing commercial businesses on Coors Blvd to the north and south of the development, and undeveloped land southwest of the development.

Dutch Bros is to re-develop approximately 0.5668 acres of land into approximately 862 SF of permanent structure.

SITE ACCESS

Access to the site is to be taken directly from Fortuna Rd via a full access driveway. Additionally, site access is to be connected to an existing driveway north of the site accessing Coors Blvd via a right-in/right-out driveway.

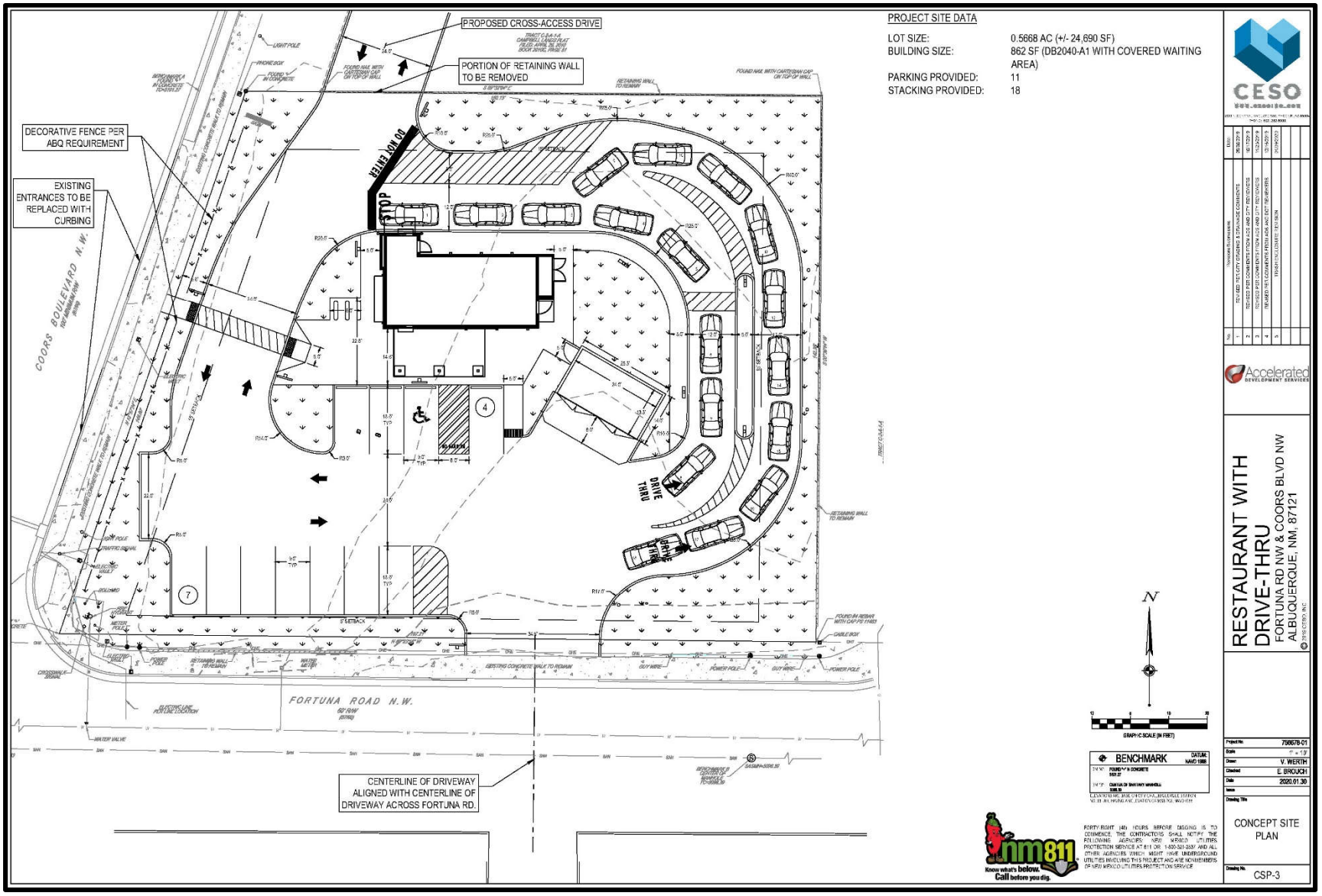

Figure 1: Site Plan

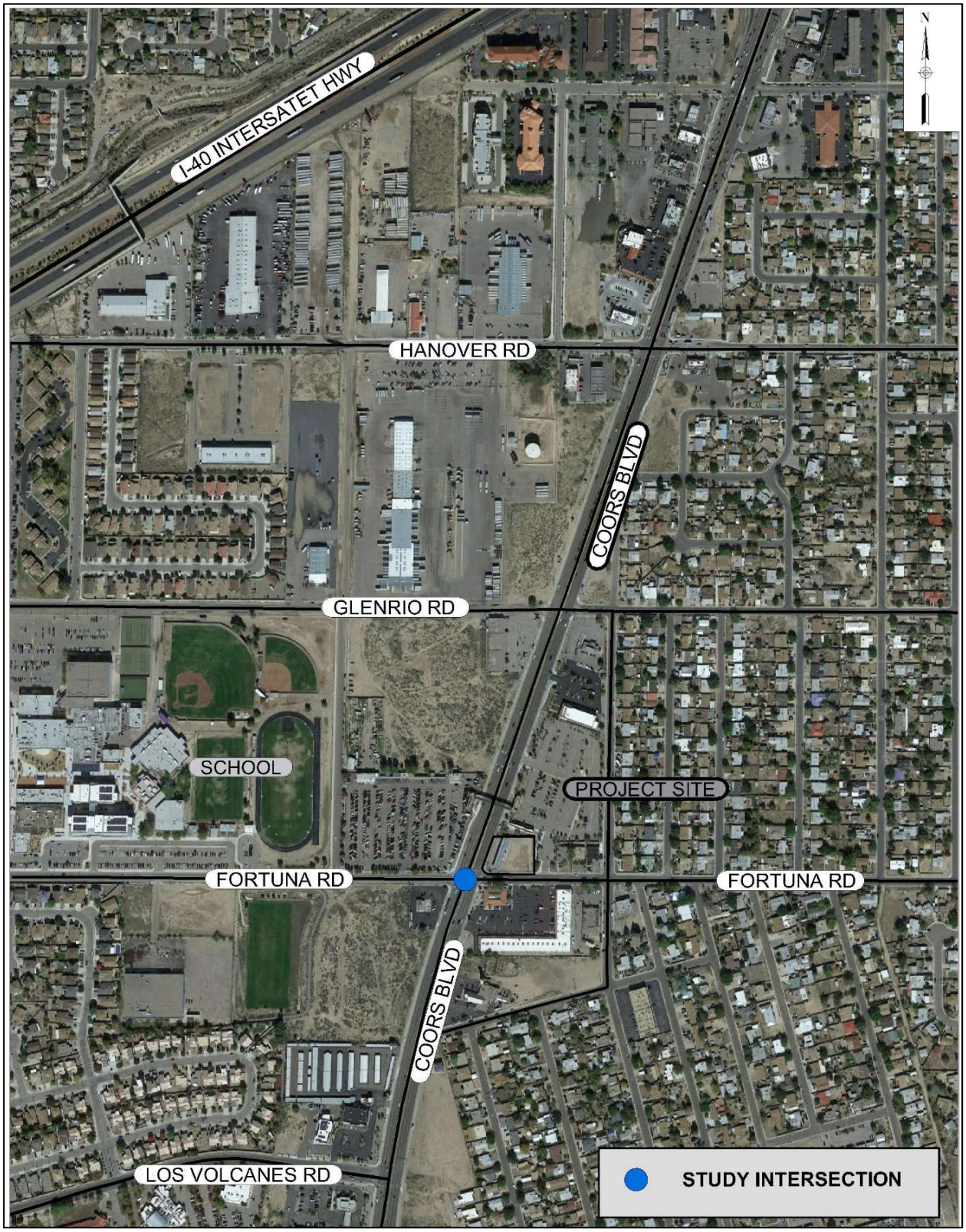

Figure 2: Vicinity Map.

STUDY AREA, AREA LAND USE, AND STREETS NARRATIVE SUMMARY

STUDY AREA

The study area is defined as Coors Blvd & Fortuna Rd. The following intersections were identified and agreed upon in the scoping meeting, and will serve as the study intersections for this report:

- Coors Blvd & Fortuna Rd

AREA LAND USE

As described, the development is to be located on the northeast corner of Coors Blvd & Fortuna Rd. Adjacent to and surrounding the project site are land uses consisting of the following:

- Commercial: The majority of the surrounding land use is commercial in nature. Immediately surrounding the site commercial businesses have been constructed on both sides of Coors Blvd. These developments include restaurants, stores, auto park, and a used car dealer.
- Residential: A large area of single-family homes are located to the east.
- Educational: West Mesa High School(public) facility is located directly west of the site location.
- Undeveloped/Not Improved: A large portion of the surrounding land use southwest and northwest of the site is undeveloped.

STREETS

The following details the characteristics and features of streets included in the study area:

Coors Blvd is a City of Albuquerque maintained six-lane street currently classified as a Principal Arterial running north and south through the southwest quadrant of Albuquerque, NM. Travel lanes are 11 feet wide and the roadway is divided by a 20-foot-wide raised median. The roadway incorporates curb, gutter, and sidewalk on both sides of the road and is signed for a speed limit of 45 MPH. No paved shoulder nor dedicated bicycle facilities are present along the roadway. Access is restricted to right turn only driveways spaced 300 to 700 feet apart. The most recently available (2018) from Mid-Region Council of Governments (MRCOG) traffic count data reports the annual average daily traffic (AADT) of Coors Blvd in the study area to be approximately 47,400 vehicles per day.

Fortuna Rd is a City of Albuquerque maintained two-lane roadway classified as a major collector by the NMDOT running east and west through the southwest quadrant of Albuquerque, NM. East of Coors Blvd, the roadway is 33 feet wide with a dividing stripe. The roadway incorporates curb, gutter, and sidewalk. Bicycle facilities are not present on either side of the road. West of Coors Blvd, the roadway is 27 feet wide with a dividing stripe. The roadway incorporates curb, gutter, and sidewalk with bicycle facilities for both sides of the roadway. Access east and west of Coors Blvd is generally un-restricted with driveways permitted full access to the roadway and spaced approximately 100 to 200 feet apart and the roadway is signed for a speed limit of 25 MPH. The most recent (2018) data from MRCOG reports the AADT to be approximately 4,400 vehicles per day.

INTERSECTIONS

The following details the traffic control and characteristics of existing intersections in the study area:

Coors Blvd & Fortuna Rd is a 4-legged signalized intersection maintained by the City of Albuquerque. Signalization consists of protected/permitted left turns with the exception of the westbound left turn which does not have a protected/permitted phase due to the shared through/right lane configuration. Signal detection is present for all lanes and approaches and the signal operates with time-of-day coordination. Pedestrian crosswalks are present on all approaches of the intersection and U-turns are not restricted for any approaches.

Transit

Currently, the Albuquerque bus system (ABQ RIDE) regularly uses Coors Blvd to serve the west side of Albuquerque, NM. Route 155 provides local all-day service along Coors Blvd with the multiple stops, the nearest being about 40 feet north from the study area.

Multimodal Connectivity

Currently, bicycle facilities are present immediately near the development on Fortuna Rd west of Coors Blvd.

Current Adjacent Projects

As discussed in the scoping meeting, there are currently no known adjacent projects in the vicinity of the site.

DATA COLLECTION

The following details data collection used in subsequent analyses of this report. Data discussed below was collected via field observations, video recordings, and aerial drone video recordings.

Field Data Collection

RIGHT TURN ON RED

Right turn on red vehicle volumes were collected at Coors Blvd & Fortuna Rd in conjunction with turning movement counts (see Turning Movement Counts and Demand Volumes section below). Right turn on red volumes were used in capacity analyses and are provided in Appendix B.

ON STREET PARKING

During field visits, on-street parking was not observed to occur on Fortuna Rd. However, it is noted that on-street parking is not restricted near the project site. On-street parking is not provided for Coors Blvd.

BUS STOPPING IN TRAVEL LANE

One nearby bus stop is present north of the project site on Coors Blvd. Configuration of the bus stop is such that the bus remains in the northbound travel lane when stopped to load and unload passengers. "Stopping Time" of the bus blocking the travel lane was sampled from aerial drone video recordings and is shown below in Table 1. It is noted that the bus stop is located north of the Coors Blvd & Fortuna Rd intersection and was not observed to impact the intersection nor were vehicles observed to queue through the traffic signal.

Table 1: Bus Stopping Time

Bus stoping time		
Sample	Stopping time	Average
Bus #1	11 seconds	13.7 seconds
Bus #2	20 seconds	
Bus #3	10 seconds	

HEAVY VEHICLES

Heavy vehicle proportions were collected at Coors Blvd & Fortuna Rd in conjunction with turning movement counts (see Turning Movement Counts and Demand Volumes section below). Heavy Vehicle proportions were used in capacity analyses and are provided in Appendix B.

LANE UTILIZATION

Lane utilization for northbound and southbound movements with multiple lanes of the same movement were sampled from aerial drone video recordings and is shown below in Table 2 and Table 3. Lane utilization proportions were used in capacity analyses detailed in subsequent sections of this report.

Table 2: Northbound Lane Utilization Sample

Northbound				
Sample Period	Through Lane 1	Through Lane 2	Through Lane 3/Right	
			Through	Right
AM (7:00 -7:20)	107	131	128	11
PM (3:15 -3:35)	131	126	148	8
Proportion	30%	33%	35%	

Table 3: Southbound Lane Utilization Sample

Southbound			
Sample Period	Through Lane 1	Through Lane 2	Through Lane 3
AM (7:00 -7:20)	66	116	70
PM (3:15 -3:35)	171	214	132
Proportion	31%	43%	26%

PEDESTRIANS AND BICYCLES

Pedestrian and Bicycle Volumes were collected at Coors Blvd & Fortuna Rd in conjunction with turning movement counts (see Turning Movement Counts and Demand Volumes section below). Pedestrian and bicycle hourly volumes were used in capacity analyses and are provided in Appendix B.

INTERSECTION LANE CONFIGURATION

Intersection lane configuration is detailed in the intersection description section of this report and is provided in detail in Figure 3.

SIGNAL TIMINGS

Signal timings for the signalized intersection of Coors Blvd & Fortuna Rd were provided by the City of Albuquerque Traffic Department. Signal timing sheets were used in capacity analyses and are provided in Appendix C.

SATURATION FLOW RATES

Saturation flow rates were sampled for Coors Blvd & Fortuna Rd using aerial drone video. Procedures followed HCM chapter 31 recommendations. Table 4 below shows the samples and calculated flow rates.

Table 4: Saturation Flow Rate Samples

Cycle	Count of Cars (vehicles)	Time (seconds)	Headway (seconds)	Saturated Flow (vplph)
1	5	10	2.00	1800
2	8	16	2.00	1800
3	3	7	2.33	1543
4	8	14	1.75	2057
5	5	10	2.00	1800
6	4	8	2.00	1800
7	3	4	1.33	2700
8	5	11	2.20	1636
9	5	10	2.00	1800
10	2	3	1.50	2400
11	2	3	1.50	2400
12	6	10	1.67	2160
13	2	4	2.00	1800
14	2	3	1.50	2400
15	3	6	2.00	1800
			Average	1993

ARRIVAL ON "GREEN" PROPORTIONS

Vehicles arriving during the green phases of Coors Blvd & Fortuna Rd were sampled for directional approaches using aerial drone video recordings. Arrival on green proportions were used in the capacity analysis and are provided below in Table 5.

Table 5: Arrivals on Green Sampled Proportions

Direction	Sample	AM peak hour			PM peak hour		
		Arrival on Green	Arrival on red	Proportion Arriving on Green	Arrival on Green	Arrival on red	Proportion Arriving on Green
Northbound	Cycle1	24	27	60%	17	15	73%
	Cycle2	36	12		55	8	
	Cycle3	18	25		27	19	
	Cycle4	44	17		26	4	
Southbound	Cycle1	29	11	72%	57	17	84%
	Cycle2	19	10		41	4	
	Cycle3	23	10		50	12	
	Cycle4	33	9		61	6	
Eastbound	Cycle1	5	9	32%	2	4	41%
	Cycle2	4	11		4	5	
	Cycle3	3	5		1	2	
	Cycle4	0	1		2	2	
Westbound	Cycle1	1	7	19%	3	8	18%
	Cycle2	0	5		3	12	
	Cycle3	3	13		1	5	
	Cycle4	3	5		0	6	

Turning Movement Counts

Turning movement counts for the study intersection were collected for 3 separate 3-hour periods from 6:00 AM to 9:00 AM, 11:00 AM to 2:00 PM and 3:00 PM to 6:00 PM on November 19, 2019. Additionally, aerial drone video was collected during the AM and PM peak hours. Turning movement volumes collected at the study intersection show a typical commuter type distribution with observable AM and PM peak hour periods. Table 6 below shows the peak hours for the study intersection. AM and PM peak hour turning movement counts, lane geometry, and traffic control for the study intersections are presented in Figure 3. Full turning movement count output sheets can be found in Appendix B.

Table 6: AM and PM Intersection Peak Hours

Intersection	AM Peak Hour	PM Peak Hour
Coors Blvd & Fortuna Rd	7:00 AM to 8:00 AM	3:15 PM to 4:15 PM

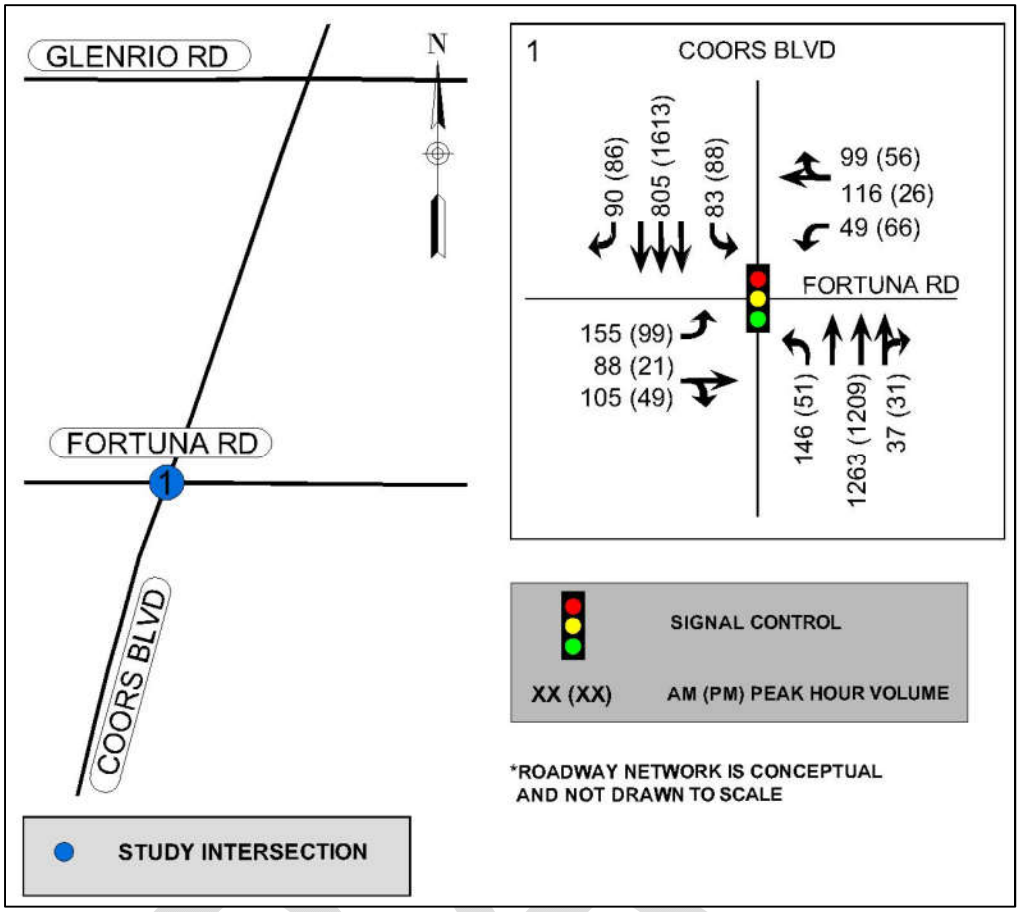

Figure 3: Peak Hour Turning Movement Counts

Demand Volumes

Per the HCM 6th Edition, turning movement counts were supplemented with observations from drone video to obtain demand volumes. A spreadsheet detailing turning movement counts, residual queueing, and resulting demand volumes included in Appendix B. AM and PM peak hour demand volumes, lane geometry, and traffic control for the study intersection is presented in Figure 4.

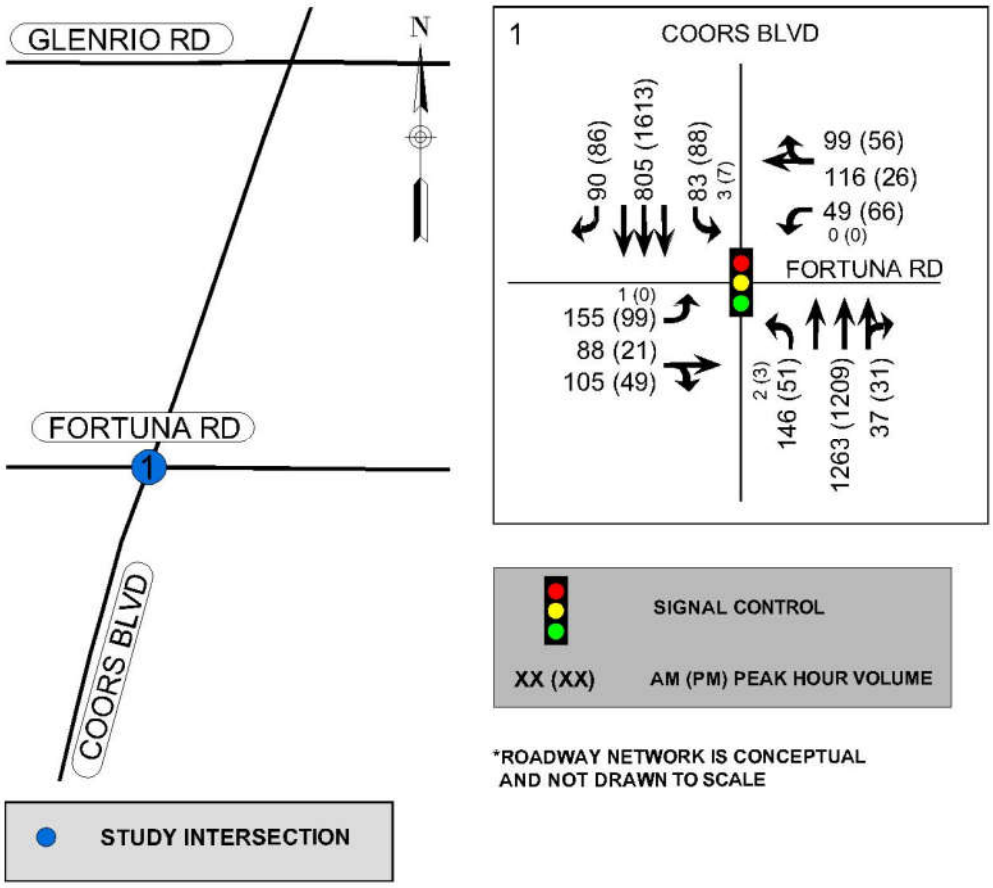

Figure 4: Peak Hour Demand Volumes

EXISTING CONDITIONS LEVEL OF SERVICE, CAPACITY AND QUEUEING ANALYSIS

ANALYSIS VOLUMES

Due to the am peak hour-oriented nature of this development and as discussed in the scoping meeting, only the AM peak hour was analyzed for level of service, capacity, and queueing. HCM Chapter 19 Approach A (b) (peak hour volume divided by peak hour factor) was used with demand volumes of Figure 3 to determine analysis volumes.

As stated in the HCM on page 19-19: "(Approach A (b)) is preferred when hourly project volumes are used or when hourly projected volumes are added to existing volumes." Subsequent analysis in this report uses hourly project volumes, in the form of trip generations, added to existing volumes. Therefore, this approach was used.

ANALYSIS

Intersection capacity, Level of Service (LOS), and Queueing Analysis was performed according to the methods and procedures provided in the Highway Capacity Manual, 6th Edition (HCM6). Highway Capacity Software was used to facilitate the analysis. Field data, detailed in previous sections, and analysis volumes, detailed above were used in the Highway Capacity Software to produce analysis results. Analysis volumes in an initial analysis model did not return any movements with a volume to capacity ratio (v/c ratio) of greater than 1. Therefore, a multiple period analysis was not used.

Per the Highway Capacity Manual, LOS is presented as a letter grade (A through F) based on the calculated average delay for an intersection or movement. Delay is calculated as a function of several variables including

signal phasing operations, cycle length, traffic volumes and opposing traffic volumes, but is a measurement of the average wait time a driver can expect when moving through an intersection. Factors such as total cycle time (for all movements), queueing restrictions, and vehicle volumes can affect measurements of delay, especially for lower volume movements and side streets. Generally, these factors are only realized when delays reach or exceed LOS E thresholds. In such cases, a narrative is offered in subsequent sections specific to the individual movement in question.

Table 7 below, reproduced from the Highway Capacity Manual, shows delay thresholds and the associated Level of Service assigned to delay ranges. Generally, a LOS of D or better is considered an acceptable level of service.

Table 7: LOS Criteria and Descriptions

Level of Service	Average Control Delay (sec/vehicle)	General Description (Signalized Intersections)
A	≤10	Free flow
B	>10 – 20	Stable flow (slight delays)
C	>10 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F	>80	Forced flow (jammed)

Queueing is reported in feet and indicates possible lengths of waiting vehicles during "red" times for specific movements. Queues are reported for queue measurements falling within the 95th percentile. It should be noted that 95th percentile queues are statistically expected to occur during only 5% of the peak hour's sign cycles. It is also noted that un-reported average queueing at an intersection would statistically be much shorter than 95th percentile queueing.

Table 8 below summarizes intersection capacity, LOS and queueing analysis performed for existing conditions. Detailed capacity output sheets can be found in Appendix C. Existing signal timings for Coors Blvd & Fortuna Rd, as provided by the City of Albuquerque, were used in the existing conditions analysis.

For the purposes of this analysis, acceptable levels of service (LOS) are defined to be a LOS D or better. Based on procedures outlined in the Highway Capacity Manual, intersection delay and level of service for stop-controlled intersections are reported as the delay and level of service for the worst-case movement at each intersection. Detailed output sheets can be found in Appendix C.

Table 8: Existing Conditions Capacity Analysis and Queueing Summary

Level of Service, Capacity Analysis, and 95th Percentile Queueing						
Study Intersection	Movement	Existing Storage Length	AM Existing Conditions			
			Delay[1]	V/C	LOS[2]	95th Percentile Queue (ft)
Coors Blvd & Fortuna Rd	NBL	226	4.6	0.378	A	32.0
	NBT/R		13.7	0.518	B	279.2
	SBL	170	3.8	0.356	A	14.3
	SBT		8.8	0.412	A	112.9
	SBR	180	7.9	0.128	A	36.7
	EBL	196	25.6	0.649	C	148.0
	EBT/R		30.3	0.412	C	195.0
	WBL	100	39.7	0.241	D	62.4
	WBT/R		44.0	0.827	D	258.3
	Intersection LOS		B			
	Intersection Delay		16.6			

[1]Average delay in seconds per vehicle.

[2]LOS stands for Level of Service.

[3]LOS and Queue not reported for unrestricted movements

[4]Queue not reported for unrestricted movements

From the summary table above, no capacity or level of service issues are observed for Coors Blvd & Fortuna in the AM analysis hour. Additionally, all queues are observed to be accommodated by existing storage lengths.

BUILD YEAR ANALYSIS

The following sections detail the methods and calculations used to obtain traffic volumes for each analysis scenario. Figures at the end of this section show the resulting traffic volumes determined for each analysis scenario.

BUILD YEAR BASE TRAFFIC VOLUMES

Construction is anticipated to begin in the current year with full completion of the development by the end of the year. Therefore, as discussed in the scoping meeting, current year demand volumes were used in the build year analysis.

TRIP GENERATION

Trip generation and entering/exiting distributions for the development were obtained from the ITE Trip Generation manual. ITE category 938 – Coffee Shop with Drive Through and No Indoor Seating most closely resembles the development. However, trip generation rates contain few data points with high variation between studies. Therefore, a recent KD Anderson & Associates survey of Dutch Bros. coffee Shops was used for determining site trips. This survey related trip generation rates to adjacent street traffic volumes finding that approximately 3.35 AM peak hour trips were generated per thousand side street vehicles. Adjacent

street average daily traffic volume was obtained from the Mid-Region Council of Government's online traffic count maps. A growth rate was applied to adjacent street ADT as the most recent available ADT of 42,304 is from 2017. This growth rate was found to be approximately 6% per year and was obtained by comparing previous years ADT's. ITE entering/exiting percentages from ITE Land Use Category 938 were used. Table 9 below shows the trip generation and associated calculations.

Table 9: Trip Generation

Use	Generation Rates			TRIPS			
				Adjacent Street Vehicles	AM Peak		
	Rate	Enter	Exit		Total	In	Out
Dutch Bros. Coffee Shop	3.35 (per thousand vehicles)	50%	50%	50,385	170	85	85

*Trip values rounded up to nearest whole trip

Trip Distribution and Assignment

Trip Distribution was determined based on an analysis of existing intersection demand characteristics within the study area. Overall, trips were distributed within the roadway network to and from the development based on the proportions of existing turning movement counts/demands collected at the study intersections. Trip routing was based on logical trip attractions and destinations for commercial based trips. To facilitate a conservative analysis a "worst-case" trip distribution was used. For this development and road network, "worst-case" was determined to be a scenario in which all vehicles enter through a single driveway. **Error! Reference source not found.** shows the trip distribution and assignment for the development. Trips were then assigned to the background roadway network shown in Figure 4 to create a buildout network shown in Figure 6.

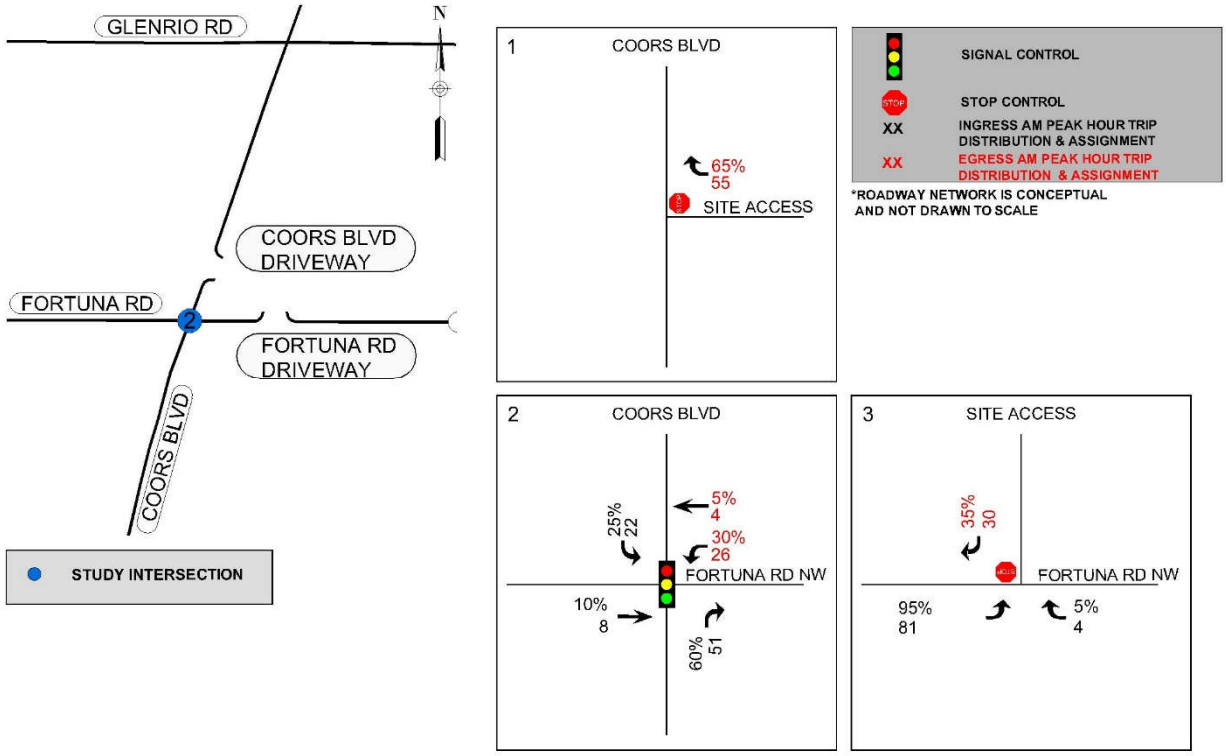

Figure 5: Trip Distribution Assignment

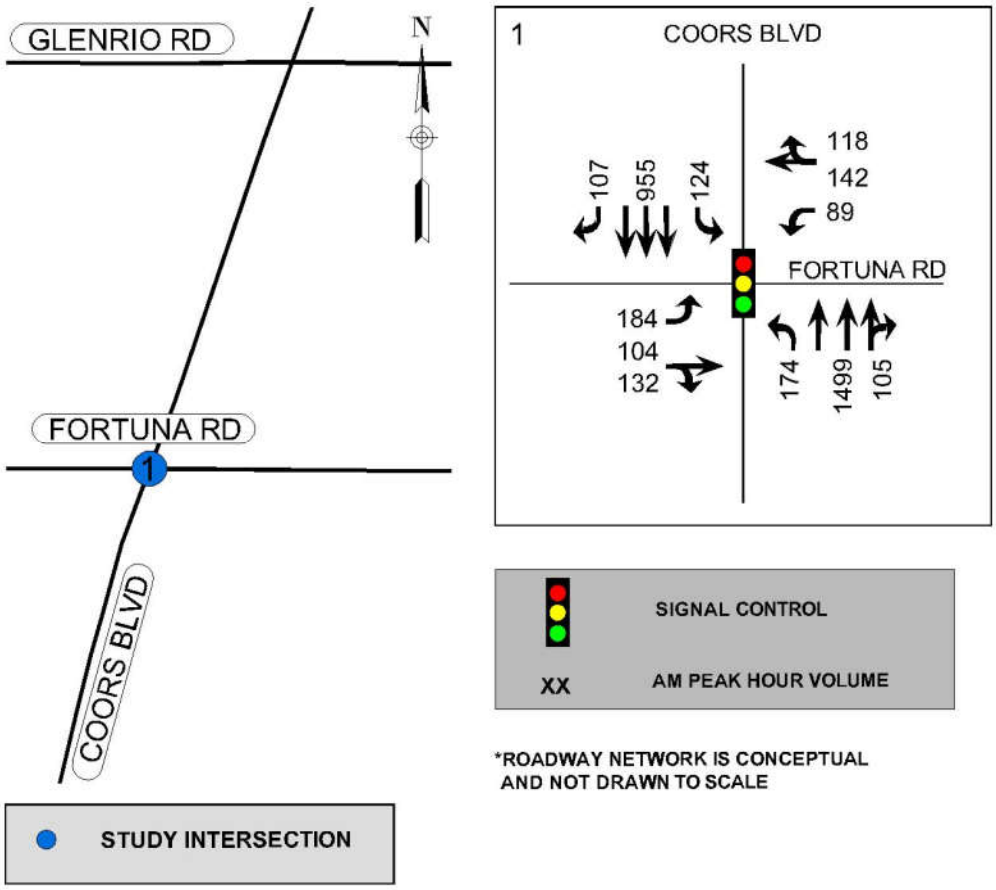

Figure 6: Buildout Demand Volumes

Level of Service Analysis, Capacity Analysis, and Queueing Analysis

As performed for existing conditions, a Level of Service (LOS) and capacity analysis was performed for all buildout analysis scenarios using the same procedures, field data, and assumptions. Signal timings used in the existing conditions analysis were retained and used for buildout conditions analysis.

Table 10 below summarizes the intersection delay level of service and queueing under buildout conditions. Detailed capacity output sheets showing all individual movements can be found in Appendix C.

Table 10: Buildout Capacity Analysis Summary

Level of Service, Capacity Analysis, and 95th Percentile Queueing										
Study Intersection	Movement	Existing Storage Length	AM Existing Conditions				AM Buildout Conditions			
			Delay[1]	V/C	LOS[2]	95th Percentile Queue (ft)	Delay[1]	V/C	LOS[2]	Queue (ft)
Coors Blvd & Fortuna Rd	NBL	226	4.6	0.378	A	32.0	4.8	0.379	A	33.3
	NBT/R		13.7	0.518	B	279.2	14.3	0.556	B	290.5
	SBL	170	3.8	0.356	A	14.3	4.0	0.437	A	18.0
	SBT		8.8	0.412	A	112.9	8.9	0.414	A	113.4
	SBR	180	7.9	0.128	A	36.7	7.9	0.129	A	36.8
	EBL	196	25.6	0.649	C	148.0	25.4	0.647	C	147.3
	EBT/R		30.3	0.412	C	195.0	30.3	0.421	C	200.1
	WBL	100	39.7	0.241	D	62.4	40.7	0.360	D	96.8
	WBT/R		44.0	0.827	D	258.3	43.9	0.826	D	261.9
	Intersection LOS		B				B			
	Intersection Delay		16.6				17.1			

[1]Average delay in seconds per vehicle.

[2]LOS stands for Level of Service.

[3]LOS and Queue not reported for unrestricted movements

[4]Queue not reported for unrestricted movements

Capacity Mitigations and Street Improvements

As shown in the above section, capacity issues are not anticipated in the study area under buildout conditions. Therefore, no capacity mitigations are recommended.

SAFETY ANALYSIS

The following presents a safety analysis of the site divided into four facets: Internal Queueing, Sight Access Sight Distance, Crash Data Summary, and Highway Safety Manual (HSM) Predictive Crash Analysis.

Site Access Sight Distance

FIELD REVIEW OF SIGHT DISTANCE

A field review of sight distance was performed for the site driveway on Fortuna Rd. Figure 7 and Figure 8 show available sight distance for right turns and left turns from the driveway. At the time of the review, a chain-link fence around the site prohibited a traditional sight distance review where the reviewer is placed 14.5 feet back from the edge of curb. Therefore, it is noted that true sight distance provided may vary. As measured under current field conditions, approximate sight distance was measured to be as follows:

Table 11: Field Review of Sight Distances

Turning Direction	Field Measured Sight Distance
Right Turn	Approx. 335 feet to next intersection (Estancias Dr)
Left Turn	Approx. 165 feet to next intersection (Coors Blvd)

Figure 7: Right Turn Sight Distance Field Review

Figure 8: Left Turn Sight Distance Field Review

AASHTO RECOMMENDED SIGHT DISTANCE

The following presents recommended intersection sight distance requirements for the development. Intersection sight distance requirements were calculated based on the 2011 AASHTO "Green Book" chapter 9.5. Two sight distance cases were used for this analysis:

- Case B1 – A stopped vehicle turning left from a minor street approach onto a major road.
- Case B2 – A stopped vehicle turning right from a minor street approach onto a major road.

Intersection sight distances were calculated based on the following assumptions:

- Required intersection sight distance for Case B1 on Fortuna Rd was calculated based on the design vehicle crossing one lane of traffic and no median.

- Required intersection sight distance for Case B2 on Fortuna Rd was calculated based on the design vehicle crossing into the first lane of the roadway.

Values shown below in Table 12 were rounded up to the nearest 5-foot increment. Formulas, values, and calculations used in the sight distance analysis can be found in the Appendix.

Table 12: Sight Distance Requirements

Case	Roadway	Speed	Sight Distance
Case B1 – Turning Left	Fortuna Rd	25 MPH	280 Feet
Case B2 – Turning Right			240 Feet

Although the site plan is currently in the preliminary stages, pending the position of the site's access driveway as detailed in a subsequent section, it is recommended that all development driveways adhere to the sight distance provisions detailed in the AASHTO "Green Book". An area bounded by the above sight distances with the decision point placed 14.5 feet back from the edge of the shoulder midway between the outbound driving lane should be maintained clear of any obstructions. Due to the proximity of Coors Blvd, it is recommended that existing sight distance to the west be maintained.

Internal Site Queueing

Site Operations & Queue Management Traffic Control Plan

When high customer volume is anticipated at any shops (whether it be for grand openings or promotional activities), Dutch Bros creates a customized traffic control action plan with team members and signage to properly address and mitigate the traffic.

Site specific features at this location include a pair of ordering kiosks and drive through lanes that converge into one pickup window. Additionally, an "escape lane", as shown in Figure 1, is used to allow vehicles that have received their order via a "drink runner" (see description below) to exit the queue and leave the site before reaching the pickup window.

Team Members

The following team members play a vitally important role during high volume times:

- Traffic Controller (top priority): a barista whose primary responsibility during high volume times is to direct traffic safely and effectively and/out of the location.
- Linebuster (second priority): a barista whose responsibility during high volume times is to take orders and payments from customers mobile-ly (outside of the shop) to reduce gaps in the order line(s) and expedite orders.
- Drink Runner (third priority): a barista whose responsibility during high volume times is to deliver completed orders to customers currently waiting in the line; this improves delivery times to customers and redirects customers out of the line via an escape lane.

Staffing and Scheduling

Schedules are written well in advance and consider peak sale times, staffing strategies, promotions, trends, local events, and weather. Pre-shift communication occurs frequently with team leads and shift managers to address any potential additions or changes that need to take place in staffing requirements to properly handle high customer volume.

Signage

Custom signage is incorporated into all new Dutch Bros shop locations which are designed specifically to provide customers clear and concise instructions on how to enter and exit the property, choosing the shortest line, and directing customers to please pull forward. (Some restrictions do apply based on city codes but Dutch Bros does perform extensive research to address and adhere to these codes while providing customers with clear information.) Additionally, directional signage can be expanded upon by utilizing temporary A-frame signs to help aid customers in properly navigating the property entrances, exits, and stacking areas.

ON-SITE QUEUEING

As shown in Figure 1, the site is to incorporate a dual drive through lane with queueing capacity for 18 vehicles. A study of drive-through queueing for coffee shop developments performed by Spack Consulting in St Louis Park, Minnesota and published online at www.countingcars.com provides the following data:

- Range of queues: 3 to 16 vehicles.
- Average queue: 11 vehicles.
- 85th percentile queue: 13 vehicles.

It is noted that queueing rates above were observed for "standard" drive through lanes/developments and do not accommodate for specific site operations such as dual kiosks/lines, escape lanes, and site operations as discussed in the previous section. It is estimated that site specific conditions of this location potentially reduce queueing by approximately 40%. With this reduction, site specific maximum queue length is estimated to be approximately 10 to 11 vehicles.

Based on this information, the queueing capacity of 18 vehicles within the drive-through lanes is found to be appropriate.

CRASH DATA SUMMARY

At the request of the NMDOT, a crash summary for the intersection of Coors Blvd & Fortuna Rd has been completed. The purpose of this analysis is to highlight trends and observations from summarized crash data. Crash data was provided by NMDOT for the years 2015 to 2018 in aggregate form and is summarized in Table 13.

Table 13: Crash Summary

Crash Summary		Coors Blvd & Fortuna Rd
	Total Crashes	97
By Year	2015	26
	2016	31
	2017	25
	2018	15
By Type	Other Vehicle - From Same Direction/Rear End Collision	10
	Fixed Object	3
	Other Vehicle - All Others/Entering At Angle	1
	Other Vehicle - Both Going Straight/Entering At Angle	6
	Other Vehicle - From Opposite Direction	21
	Other Vehicle - From Opposite Direction/Both Going Straight	2
	Other Vehicle - From Opposite Direction/One Left Turn	3
	Other Vehicle - From Same Direction/Both Going Straight	19
	Other Vehicle - From Same Direction/Both Turn Right	1
	Other Vehicle - From Same Direction/Both Right Turn	2
	Other Vehicle - From Same Direction/One Stopped	1
	Other Vehicle - From Same Direction/Sideswipe Collision	1
	Other Vehicle - From Same Direction/Vehicle Backing	1
	Other Vehicle - One Left Turn/Entering At Angle	8
	Other Vehicle - One Right Turn/Entering At Angle	2
	Invalid Code/Left Blank	16
	% Other Vehicle - From Opposite Direction	22%
	% Other Vehicle - From Same Direction/Both Going Straight	20%
	% Other Vehicle - From Same Direction/Rear End Collision	10%
By Lighting Conditions	Day	*70*
	Dawn/Dusk	*5*
	Dark	*17*
	Invalid Code/Not Specified	*5*
	% Dark + Dawn/Dusk	*23%*
By Severity	PDO	73
	Injury	23
	Fatality	1
	% Property Damage Only	75%
	% Injury	24%
By Cause	Alcohol/Drugs	4
	Animal	0
	Avoid No Contact - Vehicle	1
	Disregarded Traffic Signal	11
	Driver Inattention	20
	Excessive Speed	6
	Failed to Yield Right of Way	8
	Following Too Closely	11
	Improper Lane Change	3
	Made Improper Turn	1
	Other - No Driver Error	1
	Speed Too Fast for Conditions	1
	Other Improper Driving	2
	Other Mechanical Defect	1
	None	1
	No Information	26
	% Driver Inattention	*21%*
	% Following Too Closely	*11%*
	% Disregarded Traffic Signal	*11%*
	% Failed to Yield Right of Way	*8%*

From the above table, the following observations are made:

- For the intersection of Coors Blvd and Fortuna Rd:
  - Within the years of 2015 to 2018, total of 97 crashes were reported.
  - The most common classification of crash is observed to be Other Vehicle – From Opposite Direction.
  - Most of the crashes at this intersection occurred during daylight hours with 23% occurring at night or during dawn/dusk.
  - One fatal crash was reported from 2015 to 2018.
    - This crash is was reported on December 24th, 2018 and occurred at approximately 8:00 PM. The crash was classified as an "Other Vehicle" crash and listed with a crash analysis as "Other Vehicle – One Turn Left/Entering at Angle". The highest contributing factor was listed to be "Alcohol/Drug Involved" with clear weather and Dark-Lighted conditions.
  - The most common cause of crashes, other than no information, is observed to be Driver Inattention.

Highway Safety Manual Predictive Crash Analysis

Using existing roadway configurations and existing traffic conditions, an Interactive Highway Safety Design Manual (IHSDM) model, based on Highway Safety Manual Safety Performance Functions (SPF), was developed for the intersection of Coors Blvd & Fortuna Rd. Crash rates and total expected crash frequencies were predicted for a 4-year period to be consistent with historical crash data review period in the previous section. Table 14 shows the results of the IHSDM analysis and compares the calculated results to crash data detailed in the intersection crash analysis section of this report. Output sheets from the IHSDM software can be found in the Appendix.

Table 14: IHSDM Predictive Crash Analysis

Location	IHSDM Analysis		Crash Data (From Intersection Crash Summary)	
	Predicted Total Crashes in 4 Year Period	Predicted No. of Crashes/Year	Total Crashes in 4 Year Period	Average Crash Rate (crashes/year)
Coors Blvd & Fortuna Rd	92.64	23.16	97	24.25

As shown in Table 14, Coors Blvd & Fortuna Rd observed to have slightly higher actual crash rates and total crashes than are predicted by the IHSDM software. It is noted that IHSDM software uses various factors as default inputs that are based on national trends and the state of New Mexico has not yet developed local calibration adjustments. This lack of calibration would explain some of the differences between observed and predicted crash frequencies. In addition, the predictive model is focused primarily on the volume of demand, traffic control, and lane geometry. However, it does not account for other local factors that may impact crash frequency.

SUMMARY OF RECOMMENDATIONS

A brief summary of the proposed recommendations is as follows:

- No capacity or queueing issues are observed or anticipated at the study intersection. Therefore, no capacity recommendations are made.
- Sight distance for the site driveway on Fortuna Rd is recommended to be maintained.
    - It is also recommended that AASHTO sight distances, as detailed in the sight distance section of this report, be adhered to as closely as possible.
- Based on the queueing studies performed by Spack Consulting and site-specific conditions/operations, the site's queueing capacity of 18 vehicles within the drive-through lanes is found to be appropriate.