

July 23, 2020

Mr. Christopher Leonard
Vice President of Development & Construction
GateCo Development
One McKnight Place
St. Louis, Missouri 63124

RE: Traffic Impact Study for Proposed Mixed-Use Development
Delmar Boulevard at McKnight Place
University City, Missouri
CBB Job Number 033-20

Dear Mr. Leonard:

As requested, CBB has prepared a traffic impact study for the proposed Mixed-Use Apartment Development at Delmar Boulevard and McKnight Place in University City, Missouri. **Figure 1** identifies the general location of the site relative to the surrounding area.

It is our understanding that the mixed-used development would consist of approximately 258 apartment units with integrated structured parking and a separate 2,098 square-foot (SF) coffee shop with drive-through service. Primary access to the site is proposed via two new full-access driveways on Delmar Boulevard. As part of the development plan, McKnight Place would be realigned to remove the slight curve in the roadway near Delmar Boulevard.

The purpose of this study was to identify how much traffic would be generated by the proposed mixed-use development; evaluate the ability of motorists to safely enter and exit the site at each access point; determine the impact of the additional trips on the adjacent roads; and recommend improvements, as needed, to mitigate the impact of the additional traffic and provide safe ingress and egress at each access drive. Based on the proposed uses, the focus of our analysis was the AM and PM commuter peak hours of a typical weekday.

A scoping meeting was held via video conference call with staff from the St. Louis County Department of Transportation (SLCDOT) and University City on May 20, 2020 to confirm the scope of this traffic study.





Figure 1: Project Location Map

The focus of this study was the AM and PM peak hours of a typical weekday, and the following intersections were included:

- Delmar Boulevard at the I-170 Southbound Ramps (signalized);
- Delmar Boulevard at McKnight Place (Side-Street STOP);
- Delmar Boulevard at Geoffry Lane (One-Way Northbound Entrance Only);
- Delmar Boulevard at Canterbury Road (Side-Street STOP – One-Way Southbound);
- Delmar Boulevard at Leper Street/Kingdel Drive (Side-Street STOP); and
- All proposed access driveways to the site.

The following analysis scenarios were considered:

- 2020 Baseline Conditions (current traffic counts plus known planned development);
- 2020 Build Conditions (Baseline plus site trips);
- 2040 No-Build Conditions (Baseline plus 20-year background growth); and
- 2040 Build Conditions (2040 No-Build plus site trips).



The following report presents the methodology and findings relative to the 2020 Baseline, 2020 Build conditions, and 2040 Forecasted conditions.

EXISTING CONDITIONS

In order to identify the traffic impacts associated with the proposed redevelopment, it was first necessary to quantify the existing roadway, traffic and operating conditions. To that end, an operational analysis of existing traffic volumes on the current surrounding road system was performed.

Area Roadway System: Interstate 170 (I-170) is a freeway that runs north-south between I-270 and I-64. The highway is owned and maintained by MoDOT. The interstate generally provides three lanes in each direction. Northbound and southbound ramps are provided at Delmar Boulevard as an unconventional diamond interchange, with the northbound I-170 on-ramp accessed off McKnight Road, just north of Delmar Boulevard.

Delmar Boulevard is an east-west minor arterial that runs from Price Road on the west end into the City of St. Louis City on the east end. The road is a major collector to the west of I-170/McKnight Place consisting of a two-lane cross section. The segment of Delmar Boulevard within the study area is owned and maintained by SLCDOT. The posted speed limit is 30 miles per hour (mph). Delmar Boulevard provides five-lanes, two lanes in each direction plus a center left-turn lane (left-turn lanes at signals) from I-170 to west of Old Bonhomme Road. Within the study area, sidewalks and on-street parking are provided along both sides of Delmar Boulevard, and traffic signals are located at the southbound and northbound I-170 ramps.

McKnight Place is a local road owned and maintained by University City that runs north-south and provides access from Delmar Boulevard to existing senior residential facilities. McKnight Place generally provides two lanes, one in each direction. The posted speed limit is 25 mph along McKnight Place. Sidewalks are provided along the west side of the road.

Geoffry Lane is a local road owned and maintained by University City that runs one way northbound from Delmar Boulevard before merging with Canterbury Road to the north. The road provides access to residential uses. Geoffry Lane provides one northbound lane. The posted speed limit is 25 mph. Sidewalks are provided along the both sides of the road.

Canterbury Road is a local road owned and maintained by University City that runs one way with one southbound lane between Geoffry Lane and Delmar Boulevard. The road becomes two-way north-south to the north of Geoffry Lane and provides one lane in each direction. The road provides access to residential uses. The posted speed limit is 25 mph, and sidewalks are provided along the both sides of the road.



Kingdel Drive is a local road owned and maintained by University City that runs north-south and provides access to residential uses to the south of Delmar Boulevard. Kingdel Drive provides two lanes, one in each direction. The posted speed limit is 25 mph. Sidewalks are not provided along the roadway.

Lepere Street is a local road owned and maintained by University City that runs north-south and provides access to residential uses to the north of Delmar Boulevard. Lepere Street provides two lanes, one in each direction. The posted speed limit is 25 mph, and sidewalks are provided along the west side of the road.

The I-170 and Delmar Boulevard interchange configuration is a diamond configuration, but with the northbound I-170 on-ramp access shifted to the north on a two-way segment of McKnight Road at a traffic signal. An aerial view of the interchange area is shown in **Figure 2**. Both the northbound and southbound I-170 off-ramps operate under signal control.

The southbound I-170 off-ramp approach provides one dedicated left-turn and one shared left/through/right-turn lane. The eastbound Delmar Boulevard approach at the southbound I-170 ramps provides three through lanes and one right-turn lane with a right-turn channelizing island. The westbound approach provides two through lanes and one left-turn lane. Crosswalks and pedestrian accommodations are provided across the north, south and west legs of the signalized intersection. The westbound left-turn movements from Delmar Boulevard at the I-170 southbound ramps operate with protected-plus-permissive phasing.

The intersection of Delmar Boulevard at McKnight Place is controlled by a side-street stop. The eastbound approach provides one shared lane, but the road widens to provide four eastbound lanes on the other side of the intersection. The westbound approach provides one left-turn lane, one through lane, and one right-turn lane. The northbound and southbound approaches each provide one shared lane.

The remaining study intersections in the study area to the west (Delmar Boulevard intersections with Geoffry Lane, Canterbury Road, Kingdel Drive, and Lepere Street) operate under side-street stop control. Each intersection approach provides one shared lane.

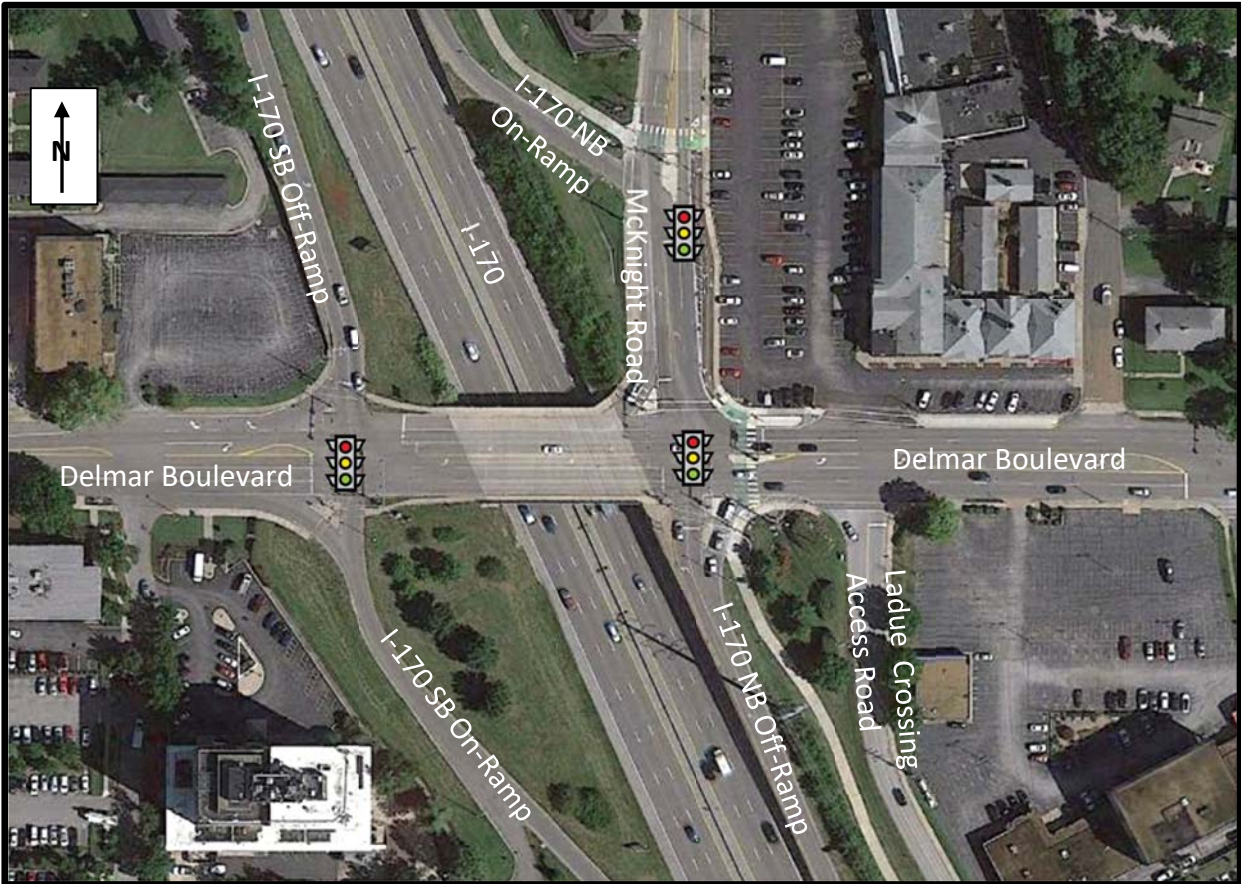


Figure 2: I-170 and Delmar Boulevard Interchange Area

Existing Traffic Volumes: Since traffic volumes are currently at reduced levels due to COVID-19, CBB was unable to collect representative turning movement counts at the study intersections. To represent typical traffic conditions, CBB obtained traffic data from an external service (StreetLight Data) which uses anonymous cell phone and GPS data to estimate traffic volume data with accuracy. Summarizing average weekday data over the months of March, April, September, and October in 2019 (considered to have typical traffic with schools in session), intersection counts were produced for the following intersections:

- Delmar Boulevard at McKnight Place (Side-Street STOP);
- Delmar Boulevard at Geoffry Lane (One-Way Northbound Entrance Only);
- Delmar Boulevard at Canterbury Road (Side-Street STOP – One-Way Southbound); and
- Delmar Boulevard at Lepere Street/Kingdel Drive (Side-Street STOP).

Based on this data, the AM peak hour was determined to occur from 8:00 a.m. to 9:00 a.m., and the PM peak hour was determined to occur from 5:00 p.m. to 6:00 p.m. It should be noted that counts were only available in one-hour increments; therefore, it was not possible to calculate peak hour factors from this data.



Traffic count data was collected by CBB at the intersection of Delmar Boulevard with the I-170 Ramps for a previously completed project in February 2020.

Baseline Traffic Volumes: CBB previously completed a traffic impact study for a planned mixed-use development on Delmar Boulevard to the east of I-170. While this development is expected to generate minimal through traffic on Delmar Boulevard to the west of I-170, expected trips from this planned development were added to existing traffic volumes along Delmar Boulevard to establish base traffic conditions for the proposed site studied herein. Ten total trips during each peak hour are expected to be generated by the planned development along Delmar Boulevard to the west of I-170. Additionally, 35 total trips during the AM peak hour and 45 total trips during the PM peak hour are forecasted to travel between the I-170 southbound ramps and the planned development to the west on Delmar Boulevard.

The Baseline peak hour traffic volumes are summarized in **Exhibit 1**. Given the traffic characteristics in the area, the peak hours would be expected to represent a “worst-case scenario” with regards to the traffic operations. If traffic operations are acceptable during these peak hours, it can be reasoned that conditions would be acceptable throughout the remainder of the day.



Exhibit 1: 2020 Baseline Traffic Volumes



PROPOSED SITE

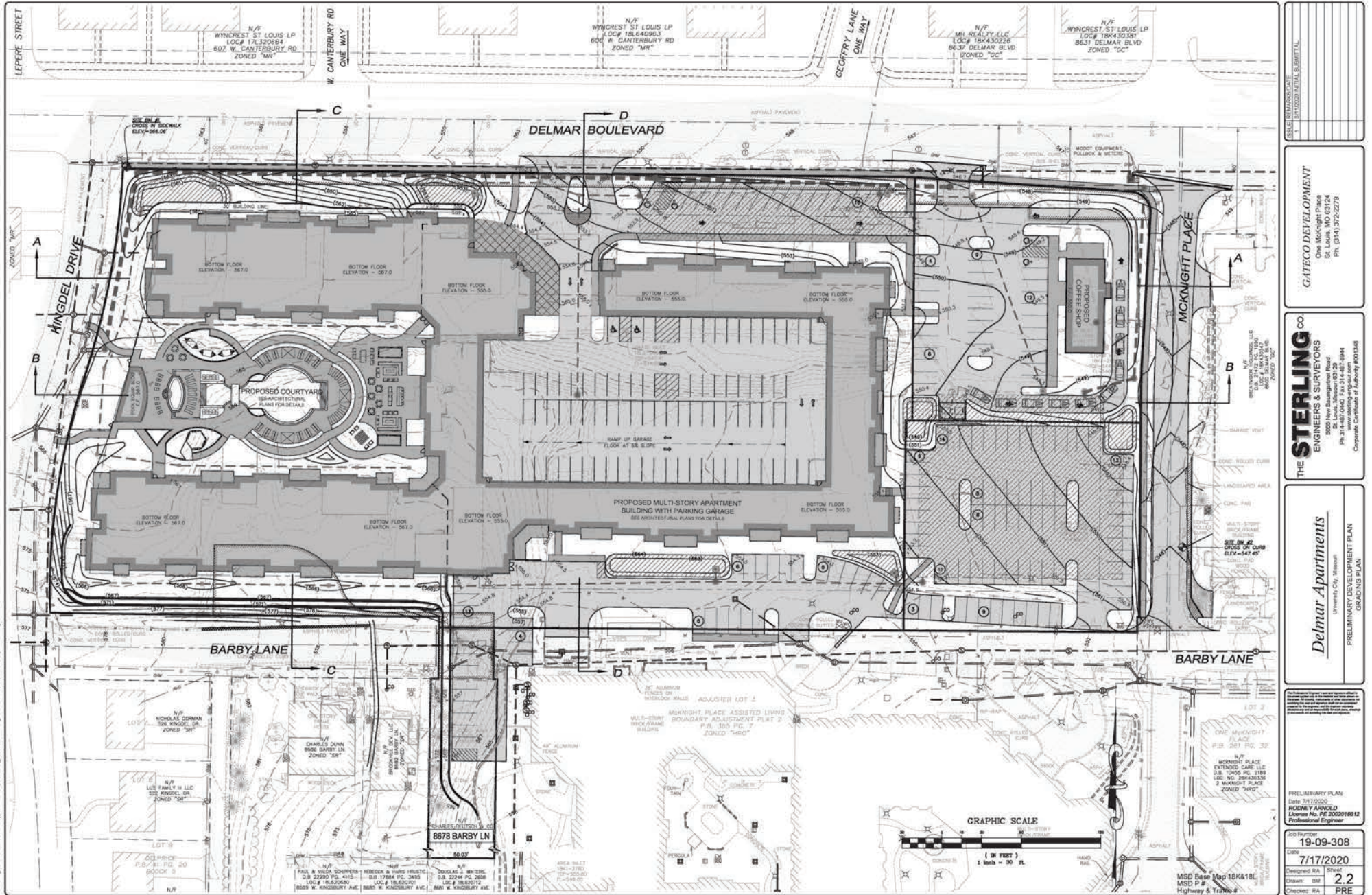
Proposed Land Use: Based upon the site plan (provided by others), 258 apartment units with integrated structured parking and a 2,098 square-foot coffee shop with drive-through service are proposed on the site. The existing uses on the site, including eight multi-family residential units, an office use, and a surface parking lot, will be removed.

Site Access: Primary access to the site is proposed via two new full-access driveways on Delmar Boulevard (See attached site plan – **Exhibit 2**). It is expected that most trips to and from the residential development will use the west driveway on Delmar Boulevard, which allows access to the garage, and most trips to and from the coffee shop will use the east driveway.

It is recommended that the site civil engineer evaluate the proposed driveways to ensure that adequate sight distance is provided at the public roads. The acceptable sight distance should be based on the guidelines published in *A Policy on Geometric Design of Highways and Streets* published by the American Association of State Highway and Transportation Officials (AASHTO) often referred to as the *Green Book* and SLCDOT blue book standards using the design speed of the road.

Careful consideration should be given to sight distance obstructions when planning any future aesthetics enhancements, such as berms, fencing and landscaping for the proposed development to ensure that these improvements do not obstruct the view of entering and exiting traffic at the proposed entrances. It is generally recommended that all improvements higher than 3.5 feet above the elevation of the nearest pavement edge be held back at least 20 feet from the traveled roadway.

Trip Generation: Forecasts were prepared to estimate the amount of traffic that the proposed development would generate during the AM and PM peak hours. Traffic forecasts for the proposed site were developed using standard land uses listed in the *Trip Generation Manual*, Tenth Edition, published by the Institute of Transportation Engineers (ITE). The ITE manual, which is a standard resource for transportation engineers, is based on a compilation of nationwide studies documenting the trip generation characteristics of various land uses. Specifically, ITE Code 221 (Multifamily Housing – Mid-Rise) and ITE Code 937 (Coffee/Donut Shop with Drive-Through Window) were used. **Table 1** provides a summary of the trip generation data found in the *Trip Generation Manual*.



SCALE	1" = 30' PL.
DATE	7/17/2020
DESIGNED BY	BM
DRAWN BY	BM
CHECKED BY	PRE

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Delmar Apartments
 University City, Missouri
 PRELIMINARY DEVELOPMENT PLAN
 GRADING PLAN

PRELIMINARY PLAN
 Date: 7/17/2020
 ROONEY ARNEOLD
 License No. PE 2002018812
 Professional Engineer

Job Number: 19-09-308
 Date: 7/17/2020
 Designed RA
 Drawn: BM
 Checked: RA
 Sheet: 2.2
 PRE

Exhibit 2: Preliminary Site Plan (provided by others)





Table 1: Trip Generation Estimate – Proposed Mixed-Used Development

ITE Code	Land Use	Size	Weekday AM Peak Hour			Weekday PM Peak Hour		
			In	Out	Total	In	Out	Total
221	Multifamily Housing – Mid-Rise	258 units	25	65	90	65	45	110
937	Coffee/Donut Shop with Drive-Through Window	2,098 SF	100	95	195	45	50	95
Total			125	160	285	110	95	205
Pass-By Trips (Coffee Shop)			20	20	40	10	10	20
Diverted Link Trips (Coffee Shop)			30	30	60	15	15	30
New Trips			75	110	185	85	70	155

Based on the ITE manual, the proposed development is estimated to generate 285 total trips during the AM peak hour and 205 total trips during the PM peak hour (turning movements at the site driveways).

It should also be noted that not all the proposed coffee shop trips would represent *new* traffic on the adjacent roadways. Specifically, a portion of the traffic attracted to this site would already be traveling on Delmar Boulevard as part of another trip; i.e., “pass-by”. Those trips would not increase traffic on Delmar Boulevard, but they would increase the turning movements at the entrances.

In addition, since this development is adjacent to I-170, it is also expected that the coffee shop would also draw patrons that are currently accessing the I-170 ramps to and from the east to utilize the facility and return to their original path. These trips are referred to as diverted-link trips. Unlike pass-by trips, these trips would be new to the studied section of Delmar Boulevard and the proposed access intersections. Therefore, at the study intersections, they would effectively be added as new trips, albeit oriented differently arriving and departing in opposite directions at the interstate ramps.

The proposed coffee shop is estimated to generate 40 pass-by trips during the AM peak hour and 20 pass-by trips during the PM peak hour from traffic already traveling on the adjacent Delmar Boulevard.

The proposed coffee shop is also estimated to generate 60 diverted-link trips during the AM peak hour and 30 diverted-link trips during the PM peak hour from the I-170 ramp intersections.



Trip Distribution: The site-generated trips for the proposed development were assigned into and out of the site based upon an estimated directional distribution, as summarized in **Table 2**.

Table 2: Trip Distribution Assumptions

<i>Land Use</i>	<i>Site Trips</i>
To/from the south on I-170	40%
To/from the north on I-170	30%
To/from the east on Delmar Boulevard	20%
To/from the west on Delmar Boulevard	10%

The site-generated trips (new, pass-by, and diverted) for the weekday AM and PM peak hours are shown in **Exhibit 3**.

2020 Build Traffic Volumes: The increased traffic volumes resulting from the trip assignment for the proposed mixed-use development (Exhibit 3) were aggregated with the 2020 Baseline Traffic Volumes (Exhibit 1) to determine the total volumes in the 2020 Build scenario. The 2020 Build Traffic Volumes for the weekday AM and PM peak hours are shown in **Exhibit 4**.



Exhibit 3: Site-Generated Traffic Volumes



Exhibit 4: 2020 Build Traffic Volumes



Auxiliary Turn Lane Warrants

Auxiliary turn lanes are considered an asset in promoting safety and improved traffic flow at relatively high conflict locations. Separate turn lanes are intended to remove turning vehicles from the through lanes to reduce the potential number of rear-end collisions at intersections. SLCDOT's turn lane criteria is the same as MoDOT's; therefore, auxiliary turn lane needs along Delmar Boulevard at the proposed site driveways were evaluated using MoDOT's Access Management Guidelines (AMG) criteria for a two-lane roadway.

The turn lane method provides volume guidelines for the consideration of separate turn lanes by comparing the total advancing volume (which includes all turning traffic), the total opposing volume (which includes all turning traffic) to the number of right and left-turns during the design hour with respect to a given major road speed and number of travel lanes.

Utilizing MoDOT's AMG *Left-Turn Lane Guideline for Two-Lane Road (Less Than or Equal to 40 mph)* nomograph, shown in **Figure 3**, a westbound left-turn lane is warranted along Delmar Boulevard at the proposed East (Coffee Shop) site driveway under 2020 Build Conditions based on both the AM and PM peak hour volumes.

Utilizing MoDOT's AMG *Right Lane Warrant for Two-Lane Roadway*, shown in **Figure 4**, an eastbound right-turn lane is not warranted along Delmar Boulevard at the proposed East (Coffee Shop) site driveway.

Utilizing MoDOT's AMG *Left-Turn Lane Guideline for Two-Lane Road (Less Than or Equal to 40 mph)* nomograph, shown in **Figure 5**, a westbound left-turn lane is warranted along Delmar Boulevard at the proposed West (Main Apartment Garage) site driveway under 2020 Build Conditions based on PM peak hour volumes.

Typically, separate left or right-turn lanes are not needed for turning volumes less than 10 vph. Since right turns at the proposed West (Main Apartment Garage) entrance are less than 10 vph during both peak hours, a separate eastbound right-turn lane is not warranted at the proposed west driveway.

To accommodate the warranted left-turn lanes, CBB recommends implementing a two-way left-turn lane between McKnight Place and the proposed West (Main Apartment) site driveway, which will remove on-street parking from the south side east of Kingdel Drive.

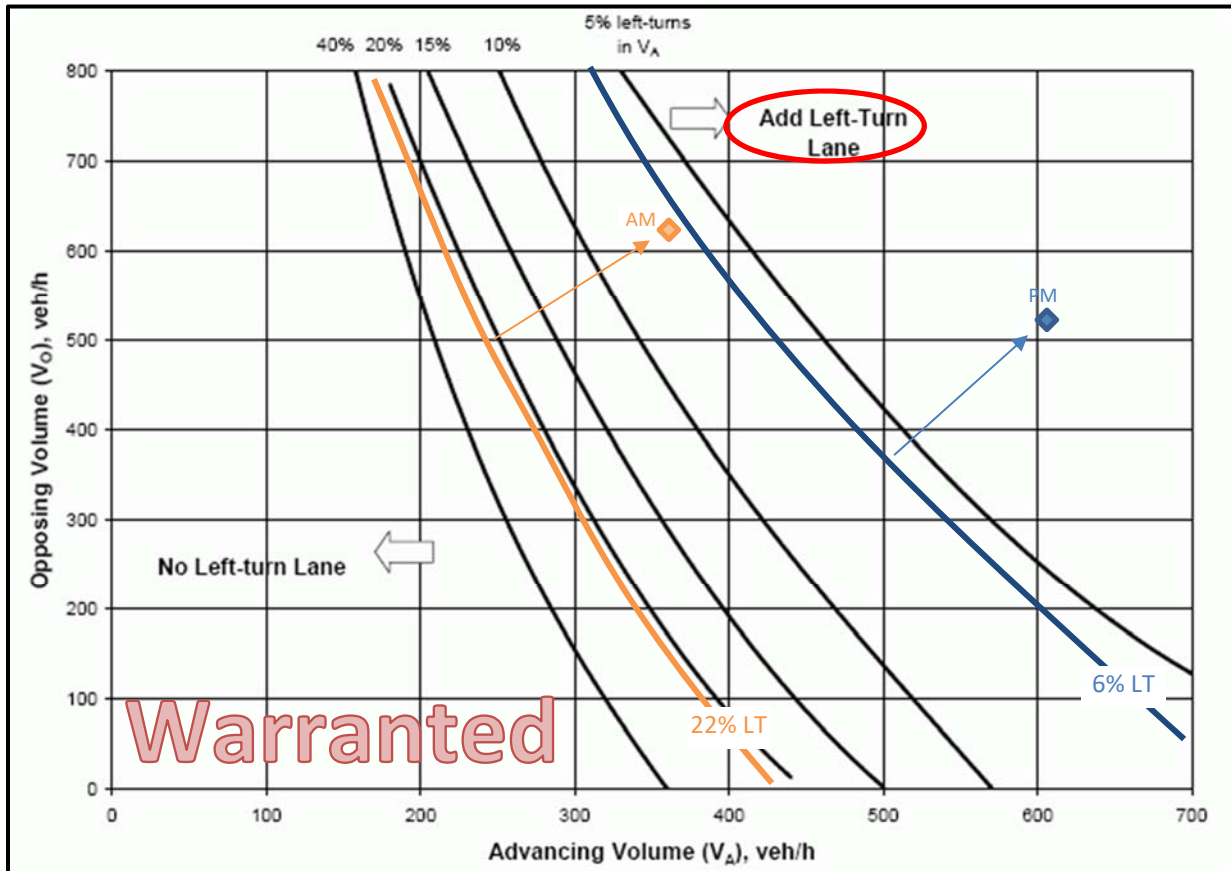


Figure 3: Left-Turn Lane Warrants for Delmar Boulevard at Proposed East (Coffee Shop) Site Driveway

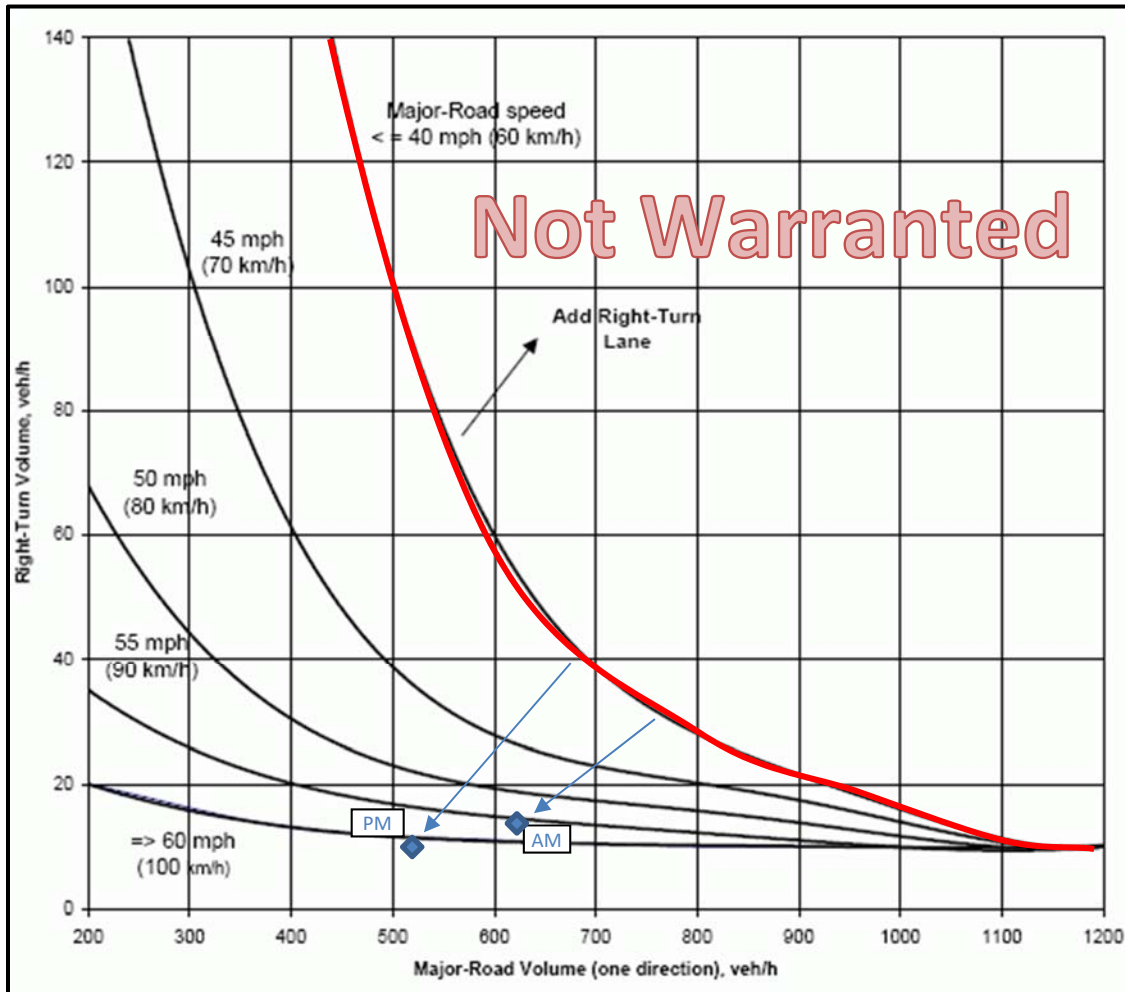


Figure 4: Right-Turn Lane Warrants for Delmar Boulevard at Proposed East (Coffee Shop) Site Driveway

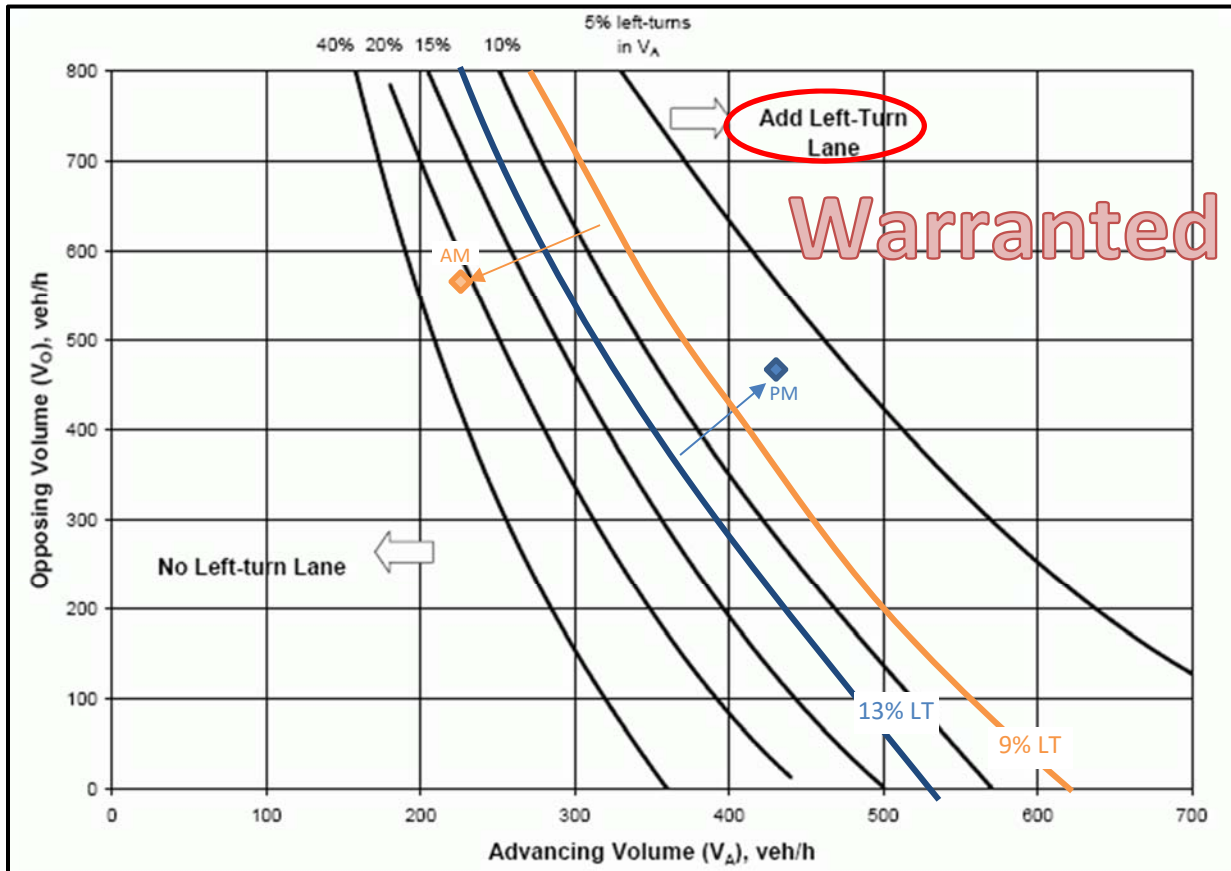


Figure 5: Left-Turn Lane Warrants for Delmar Boulevard at Proposed West (Main Apartment Garage) Site Driveway



TRAFFIC ANALYSES

Study Procedures: The 2020 Baseline and 2020 Build operating conditions for the study area intersections were evaluated using SYNCHRO 10, which is based on procedures outlined in the *Highway Capacity Manual* to determine estimates of capacity and operational performance of signalized and unsignalized intersections. Our traffic operations analysis below includes measures of effectiveness generated by the SYNCHRO software.

The operating conditions were graded in accordance with six levels of traffic service (Level A "Free Flow" to Level F "Fully Saturated") established by the *Highway Capacity Manual*. Levels of service (LOS) are measures of traffic flow which consider such factors as speed, delay, traffic interruptions, safety, driver comfort, and convenience. Level C, which is normally used for highway design, represents a roadway with volumes ranging from 70% to 80% of its capacity. However, Level D is generally considered acceptable for peak period conditions.

The thresholds that define levels of service at an intersection are based upon the type of control used (i.e., whether it is signalized or unsignalized) and the calculated delay. For signalized and all-way stop intersections, the average control delay per vehicle is estimated for each movement and aggregated for each approach and the intersection as a whole. At intersections with partial (side-street) stop control, delay is calculated for the minor movements only since motorists on the main road are not required to stop. Furthermore, criteria differ for the two, since control types create different driver expectations. **Table 3** summarizes the level of service thresholds used in this analysis.

Table 3: Level of Service Thresholds

Level of Service (LOS)	Control Delay per Vehicle (sec/veh)	
	Signalized Intersections	Unsignalized Intersections
A	≤ 10	0-10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50



Operating Conditions: The study intersections were evaluated using the methodologies described above. **Table 4** summarizes the results of these analyses, which reflect the Existing and 2020 Build operating conditions and average delays for each of the study intersections during the weekday AM and PM peak hours.

Table 4: 2020 Baseline and 2020 Build Operating Conditions

Intersection/Approach	AM Peak Hour		PM Peak Hour	
	2020 Baseline	2020 Build	2020 Baseline	2020 Build
Delmar Boulevard at I-170 Southbound Ramps (signalized)				
Eastbound Delmar Boulevard Approach	B (13.5)	B (14.2)	C (21.8)	C (21.8)
Eastbound 95 th Percentile Queue	80' TH	100' TH	95' TH	110' TH
Westbound Delmar Boulevard Approach	B (11.4)	B (14.1)	A (4.5)	A (4.5)
Southbound I-170 Off-Ramp Approach	D (45.5)	D (43.7)	E (57.1)	E (57.9)
Overall	C (22.6)	C (22.6)	C (27.2)	C (26.9)
Delmar Boulevard at McKnight Place (Side-Street STOP)				
Westbound Delmar Boulevard Left-Turn	A (9.4)	B (10.2)	A (8.4)	A (8.7)
95 th Percentile Left-Turn Queue	<20'	<20'	<20'	<20'
Northbound McKnight Place Approach	D (28.7)	C (18.9)	C (18.9)	C (15.1)
Delmar Boulevard at Geoffry Lane (Side-Street STOP)				
Eastbound Delmar Boulevard Approach/Left-Turn	A (<1.0)	A (8.0)	A (<1.0)	A (9.0)
Delmar Boulevard at Canterbury Road (Side-Street STOP)				
Westbound Delmar Boulevard Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Canterbury Road Approach	C (15.3)	C (15.7)	C (19.1)	C (19.6)
Delmar Boulevard at Kingdel Drive (Side-Street STOP)				
Westbound Delmar Boulevard Approach	A (<1.0)	A (<1.0)	A (1.0)	A (1.0)
Northbound Kingdel Drive Approach	B (11.7)	B (11.7)	B (14.9)	C (15.1)
Delmar Boulevard at Lepere Street (Side-Street STOP)				
Eastbound Delmar Boulevard Approach	A (<1.0)	A (<1.0)	A (1.0)	A (1.0)
Southbound Lepere Street Approach	C (16.1)	C (16.1)	C (19.1)	C (19.4)
Delmar Boulevard at Proposed East (Coffee Shop) Site Driveway (Side-Street STOP)				
Westbound Delmar Boulevard Left-Turn		A (9.4)		A (8.7)
95 th Percentile Left-Turn Queue		<20'		<20'
Northbound Site Driveway Approach		C (15.6)		B (13.3)
Delmar Boulevard at Proposed West (Main Apartment Garage) Site Driveway (Side-Street STOP)				
Westbound Delmar Boulevard Left-Turn		A (8.9)		A (8.7)
95 th Percentile Left-Turn Queue		<20'		<20'
Northbound Site Driveway Approach		B (13.7)		B (12.2)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)

XXX' AA = 95th percentile queue and the critical movement of the approach



As can be seen in Table 4, the overall operating conditions at all study intersections are acceptable (LOS D or better) under 2020 Baseline conditions. The approach levels of service are also acceptable (LOS D or better), except for the southbound I-170 off-ramp approach at Delmar Boulevard, which currently operates at LOS E during the PM peak hour. Approximately 145 feet of queuing space is available between the eastbound Delmar Boulevard stop bar at the I-170 southbound ramps and the McKnight Place centerline. This spacing can accommodate the 95th percentile eastbound queue of 95 feet during the PM peak hour.

Build Traffic Conditions: The recommended two-way left turn lane between McKnight Place and the proposed west (Main Apartment Garage) site driveway was included in CBB's 2020 Build analyses to accommodate the warranted left-turn lanes into the proposed site driveways.

The proposed mixed-use development will have minimal additional impact or change in the operating conditions at the study intersections as compared to the 2020 Baseline conditions. The development is expected to add less than three seconds of overall delay at any one study intersection approach when compared to the 2020 Baseline conditions. Both proposed site driveways are expected to operate at desirable levels of service.

The recommended two-way left-turn lane along Delmar Boulevard would also improve the northbound McKnight Place approach at Delmar Boulevard from LOS D to LOS C during the AM peak hour since northbound left-turning vehicles would have the ability to complete the turning movement in two stages.

It should be noted that at the side-street stop intersections where left-turn lanes were added, the 2020 Build results show the operations for the individual left-turn movement since they are separated from the free-flow through/right-turn lane in the Build Condition.

Drive Through Queuing Analysis

Based on the University City's code of ordinances (Section 400.2140 Schedule of Off-Street Parking Space Requirements), non-restaurant land uses providing drive-through service must provide five stacking spaces for each service window. Based on the most current site plan, approximately 200 feet of stacking is provided from the pick-up window to the end of the queuing lane without impacting the site's internal drive aisles and blocking parking spaces. This would provide space for approximately ten vehicles which well exceeds the code minimum.

Studies at similar coffee shop sites with drive-through service indicate that a typical peak drive-through peak queues of ten to twelve vehicles can occur, which would usually be accommodated by the proposed service lane on the site plan. Even if that peak were to be occasionally exceeded, several more vehicles could be stacked on the site's internal roadways before impacting the surrounding public roadways, though some parking spaces would be blocked temporarily.



Approximately sixteen total vehicles could be stacked before impacting movements at the first internal intersection to the south of Delmar Boulevard at the proposed east site driveway.

Based on this information, the proposed 200 feet of storage (10 vehicles) along with a buffer in the parking lot of 120 feet (six vehicles) provided on site is expected to provide more than adequate storage to accommodate the typical and peak queues expected in the drive-through lane.

DESIGN YEAR ANALYSES

Before analyzing the 20-year future impact of the proposed mixed-use development, it was necessary to establish a baseline forecast to reflect the 20-year design horizon traffic conditions without the development. To that end, a 2040 No-Build scenario was developed to evaluate design-year baseline conditions and provide a basis of comparison between the 2040 No-Build and Build conditions.

2040 No-Build Traffic Volumes:

A linear background growth rate was used to develop 20-year traffic volume projections for the “design year”. An annual growth rate of 0.5% per year was used to account for 20 years of background growth in the area (or 10.5% overall). The 2040 No-Build traffic volumes are shown in **Exhibit 5**. It should be noted that the proposed Delcrest Apartments traffic to the west was already included in the base scenario.

2040 Build Traffic Volumes: The proposed development site-generated trips (Exhibit 3) were aggregated with the 2040 No Build traffic volumes (Exhibit 5). **Exhibit 6** reflects the 2040 Build traffic volumes.

2040 No-Build and Build Traffic Conditions: The 2040 No-Build and Build traffic volumes were reanalyzed using the same methodologies applied to the 2020 Baseline and 2020 Build traffic volumes. The forecasted levels of service and average delays at each study intersection for the 2040 No-Build and 2040 Build Conditions are summarized in **Table 5**.

As can be seen, the study intersections would have very slight increases in delay at the signalized intersections in the Build condition as compared to the No-Build conditions. All study intersections, as well as the proposed site driveways, are expected to operate at acceptable levels of service overall under 2040 Build conditions. The recommended two-way left-turn lane along Delmar Boulevard would also improve the northbound McKnight Place approach at Delmar Boulevard from LOS E to LOS C during the AM peak hour since northbound left-turning vehicles would have the ability to complete the turning movement in two stages.



Exhibit 5: 2040 No-Build Traffic Volumes



Exhibit 6: 2040 Build Traffic Volumes



Table 5: 2040 No-Build and 2040 Build Operating Conditions

Intersection/Approach	AM Peak Hour		PM Peak Hour	
	2040 No-Build	2040 Build	2040 No-Build	2040 Build
Delmar Boulevard at I-170 Southbound Ramps (signalized)				
Eastbound Delmar Boulevard Approach	B (14.5)	B (15.1)	C (22.4)	C (22.5)
Eastbound 95 th Percentile Queue	90' TH	110' TH	105' TH	120' TH
Westbound Delmar Boulevard Approach	C (21.6)	D (38.6)	A (4.7)	A (5.2)
Southbound I-170 Off-Ramp Approach	D (44.8)	D (43.9)	E (60.8)	E (62.7)
Overall	C (26.7)	C (32.4)	C (28.7)	C (29.0)
Delmar Boulevard at McKnight Place (Side-Street STOP)				
Westbound Delmar Boulevard Left-Turn	A (9.8)	B (10.6)	A (8.6)	A (8.9)
95 th Percentile Left-Turn Queue	<20'	<20'	<20'	<20'
Northbound McKnight Place Approach	E (40.1)	C (21.4)	C (23.3)	C (16.6)
Delmar Boulevard at Geoffry Lane (Side-Street STOP)				
Eastbound Delmar Boulevard Approach/Left-Turn	A (<1.0)	A (8.0)	A (<1.0)	A (9.2)
Delmar Boulevard at Canterbury Road (Side-Street STOP)				
Eastbound Delmar Boulevard Approach	A (<1.0)	A (<1.0)	A (<1.0)	A (<1.0)
Southbound Canterbury Road Approach	C (16.9)	C (17.4)	C (23.7)	C (24.8)
Delmar Boulevard at Kingdel Drive (Side-Street STOP)				
Westbound Delmar Boulevard Approach	A (<1.0)	A (<1.0)	A (1.1)	A (1.1)
Northbound Kingdel Drive Approach	B (12.2)	B (12.3)	C (16.3)	C (16.7)
Delmar Boulevard at Lepere Street (Side-Street STOP)				
Eastbound Delmar Boulevard Approach	A (<1.0)	A (<1.0)	A (1.1)	A (1.1)
Southbound Lepere Street Approach	C (17.4)	C (17.9)	C (22.4)	C (22.7)
Delmar Boulevard at Proposed East (Coffee Shop) Site Driveway (Side-Street STOP)				
Westbound Delmar Boulevard Left-Turn		A (9.7)		A (8.9)
95 th Percentile Left-Turn Queue		<20'		<20'
Northbound Site Driveway Approach		C (16.9)		B (14.0)
Delmar Boulevard at Proposed West (Main Apartment) Site Driveway (Side-Street STOP)				
Westbound Delmar Boulevard Left-Turn		A (9.1)		A (8.9)
95 th Percentile Left-Turn Queue		<20'		<20'
Northbound Site Driveway Approach		B (14.5)		B (12.8)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)

XXX' AA = 95th percentile queue and the critical movement of the approach



SUMMARY

CBB completed the preceding study to address the anticipated traffic impacts associated with the proposed mixed-use development located in the southwest quadrant of Delmar Boulevard and McKnight Place in University City, Missouri. The following is a summary of the findings:

- The proposed mixed-use development includes 258 apartment units with integrated structured parking and a 2,098 square-foot coffee shop with drive-through service.
- Primary access to the site is proposed via two new full-access driveways on Delmar Boulevard.
- The proposed mixed-use development is expected to generate 285 total trips during the AM peak hour and 205 total trips during the PM peak hour.
- The proposed coffee shop is estimated to generate 40 pass-by trips during the AM peak hour and 20 pass-by trips during the PM peak hour from traffic already traveling on the adjacent Delmar Boulevard.
- The proposed coffee shop is also estimated to generate 60 diverted-link trips during the AM peak hour and 30 diverted-link trips during the PM peak hour from the I-170 ramp intersections.
- Under 2020 Baseline conditions, all study intersections operate at acceptable levels of service, overall and individual approaches, except for the southbound I-170 off-ramp approach at Delmar Boulevard, which operates at LOS E during the PM peak hour.
- Based on 2020 Build volumes, a separate westbound left-turn lane is warranted on Delmar Boulevard at both site entrances. CBB recommends restriping to add a center two-way left-turn lane along Delmar Boulevard between McKnight Place and the proposed west (Main Apartment) site driveway by removing on-street parking from the south side.
 - Separate eastbound right-turn lanes are not warranted at either site driveway.
- Under 2020 Build conditions, significant operational issues are not expected, and all study intersections are expected to operate at acceptable levels of service overall if the recommended left-turn lane restriping improvements along Delmar Boulevard are implemented.
- The proposed 200 feet of storage (10 vehicles capacity) plus a buffer in the parking lot of 120 feet (six vehicles) provided on site is expected to provide adequate storage to well exceed the City requirement (five vehicles capacity) and also accommodate the typical and peak queues expected in the coffee shop drive-through lane.



- Under 2040 No-Build conditions, all study intersections and individual approaches are forecasted to operate acceptably overall except the southbound I-170 exit ramp approach at Delmar Boulevard during the PM peak hour and the northbound McKnight Place approach at Delmar Boulevard. These increases in delay would be a result of background traffic growth alone.
- All study intersections, as well as the proposed site driveways, are expected to operate at acceptable levels of service under 2040 Build conditions.
- It is CBB's opinion that no other physical improvements are necessary to accommodate the proposed development beyond the recommendations noted above for a two-way left-turn lane restriping along Delmar Boulevard.

We trust that you will find this report useful in evaluating the potential traffic impacts associated with the proposed mixed-use development in University City, Missouri. Please contact me at (314) 308-6547 or lcannon@cbbtraffic.com should you have any questions or comments concerning this material.

Sincerely,

Lee Cannon, P.E., PTOE
Principal – Traffic Engineer