

August 14, 2020

Mr. Vic Alston
RevivalSTL
5501 Pershing Avenue
St. Louis, Missouri 63112

RE: Traffic Impact Study for Proposed Mixed-Use Development
8400 Delmar Boulevard at Delcrest Drive (West)
University City, Missouri
CBB Job Number 95-2019-1

Dear Mr. Alston:

As requested, CBB has prepared a traffic impact study for the proposed Mixed-Use Development at 8400 Delmar Boulevard in University City, Missouri. **Figure 1** identifies the general location of the site relative to the surrounding area.



Figure 1: Site Location Map



It is our understanding that the mixed-use development would consist of a mixture of apartment units, a hotel and a small amount of retail/restaurant space. Primary access to the site is currently provided via as two driveways on Delmar Boulevard and two driveways on Delcrest Drive (West). It is our understanding that the site is currently underutilized, and those existing uses would be removed as part of the proposed redevelopment.

The proposed development plan removes the two existing full access curb cuts on Delmar Boulevard as requested by St. Louis County Department of Transportation (SLCDOT) and proposes one full access driveway on Delcrest Drive (West), approximately 290 feet south of Delmar Boulevard (center to center) at a parking garage access for the development and a pick-up/drop-off loop is proposed off Delcrest Drive (West) south of Delmar Boulevard. Trash pick-up is expected via one new curb cut on the Ladue Crossing Access Road (private road). **Figure 2** illustrates the conceptual site plan provided by others.

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.

Most of the existing commercial/retail buildings on the site are currently vacant; therefore, no trip reductions were made for the removal of current uses, which generate a small amount of traffic today.

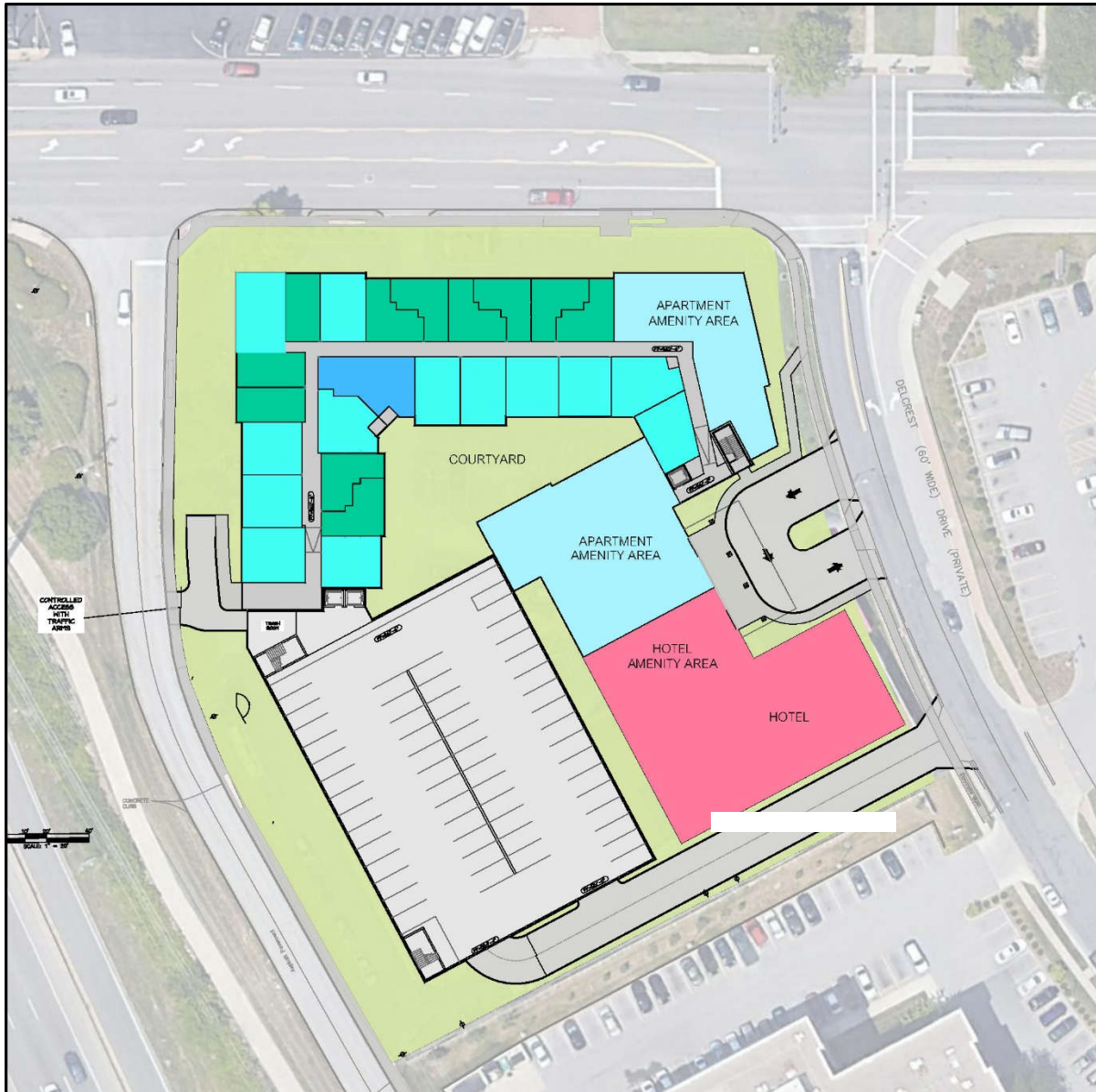


Figure 2: Conceptual Site Plan (provided by others)



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.

Existing Road Conditions

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 within the study area 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 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 is 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. Delmar Boulevard transitions to a major collector west of I-170/McKnight Place to Price Road consisting of a two-lane cross section. Within the study area, sidewalks are provided along both sides of Delmar Boulevard, and traffic signals are located at the southbound I-170 ramps, the northbound I-170 ramps, Delcrest West Drive and Old Bonhomme Road.

McKnight Road is a minor arterial road owned and maintained by SLCDOT that runs north-south from Delmar Boulevard to Olive Boulevard then transitions to Woodson Road north of Olive Boulevard. McKnight Road generally provides two lanes, one lane in each direction, but widens out near the signal for the I-170 northbound on-ramp and at the approach to Delmar Boulevard. The posted speed limit is 30 mph along McKnight Road with sidewalks provided along both sides of the road. Additionally, the Centennial Greenway crosses McKnight Road at the northbound I-170 on-ramp signal and travels along the east side of McKnight Road to the signal with Delmar Boulevard, then parallels the Ladue Crossing access road, south of Delmar Boulevard.

Ladue Crossing Access Road is a private road that runs parallel to I-170 and provides access into the Ladue Crossing development north of Ladue Road. The single lane northbound approach to Delmar Boulevard is signed with a “No Left-Turns” from 4:00 to 6:00 PM Monday through Friday. The private road lies on this site for a short distance south of Delmar Boulevard, and we understand this property enjoys legal access rights to 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 3**. Both the northbound and southbound I-170 off-ramps operate under signal control. The southbound I-170 off-ramp approach has one dedicated left-turn and one shared left/through/right-turn lane. Crosswalks and pedestrian accommodations are provided across the north, south and west legs of the signalized intersection.

The northbound I-170 off-ramp approach has a dedicated left-turn, a short through lane with a channelized right-turn lane. Southbound McKnight Road at Delmar Boulevard has separate southbound left-turn and right-turn lanes. Crosswalks and pedestrian accommodations are provided across the north, south and east legs of the signalized intersection. As previously noted, the Centennial Greenway trail uses the east leg to cross the intersection. The recent Centennial Greenway improvements are shown on the aerial in Figure 3.

Delmar Boulevard has a westbound left-turn lane on the bridge at the southbound I-170 ramps as well as an eastbound left-turn lane on the bridge to feed the separate left-turn lane on McKnight Road/northbound I-170. A separate eastbound right-turn lane is also provided on eastbound Delmar Boulevard at the southbound I-170 on-ramp.

The eastbound and westbound left-turn movements from Delmar Boulevard at the I-170 southbound ramps and at I-170 Northbound off-ramp/McKnight Road operate with protected-plus-permissive phasing. The northbound left-turn from McKnight Road to northbound I-170 operates under protected-plus-permissive phasing with Flashing Yellow Arrow (FYA) control.

The northbound I-170 left-turn, the northbound I-170 through movement, and the southbound McKnight Road left-turns operate with protected-only phasing, while the southbound right-turn operates under permissive-only phasing.

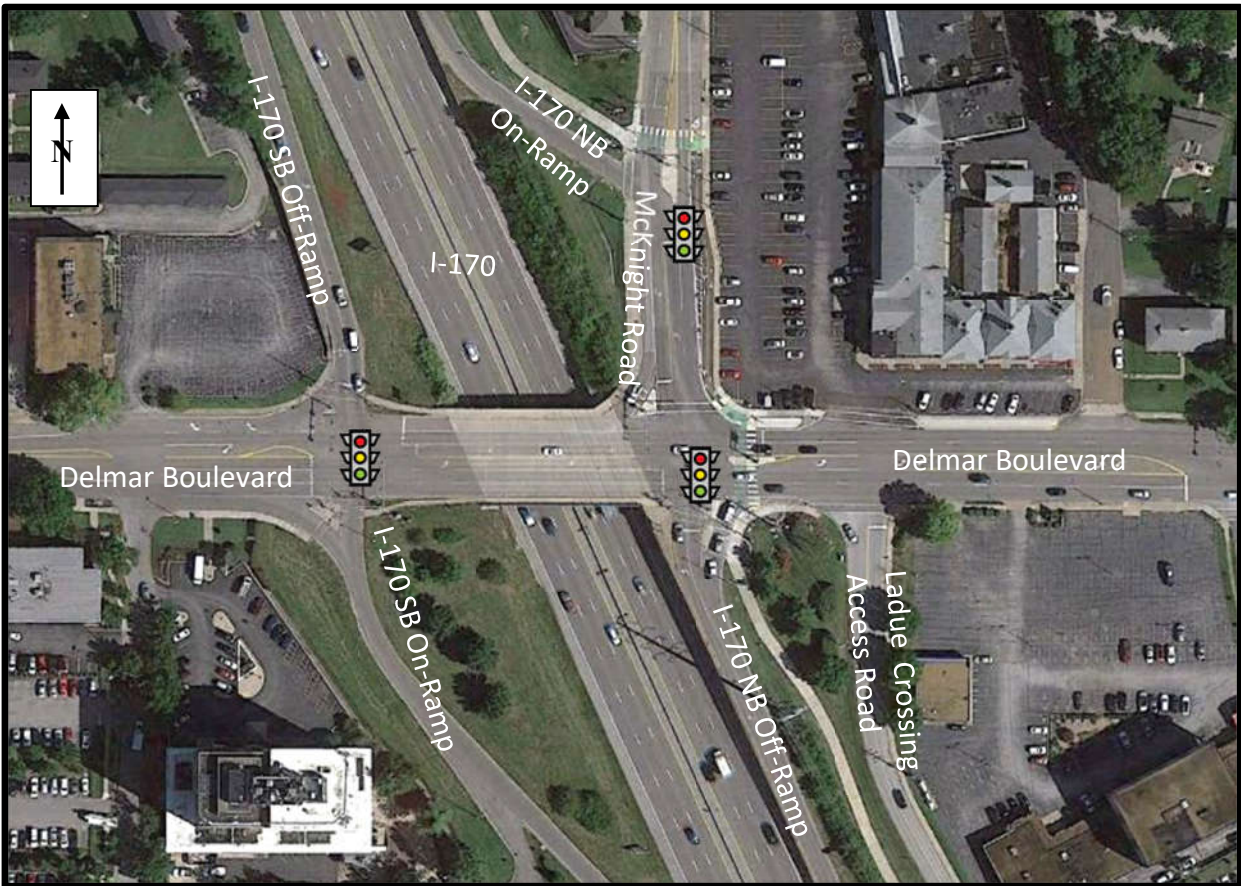


Figure 3: I-170 and Delmar Boulevard Interchange Area

Delcrest Drive (West) is a two-lane local road providing access to the Walgreens on the southeast quadrant of the intersection as well as multi-family residential, congregate care, and office uses south of Delmar Boulevard. Delcrest Drive is a U-Shaped street and connects to Delmar Boulevard at a second intersection to the east.

The intersection of Delmar Boulevard and Delcrest Drive (West) is controlled by a traffic signal. The westbound approach provides one left-turn lane and two through lanes, while the eastbound approach provides one through lane and one shared through/right-turn lane. The northbound approach to the intersection provides one left-turn lane and one right-turn lane. The westbound left-turn movement operate under protected-plus-permissive phasing with FYA's. Crosswalks and pedestrian accommodations are provided across the south and east legs of the signalized intersection. An aerial view of the Delmar Boulevard at Delcrest Drive (West) intersection is shown in **Figure 4**.

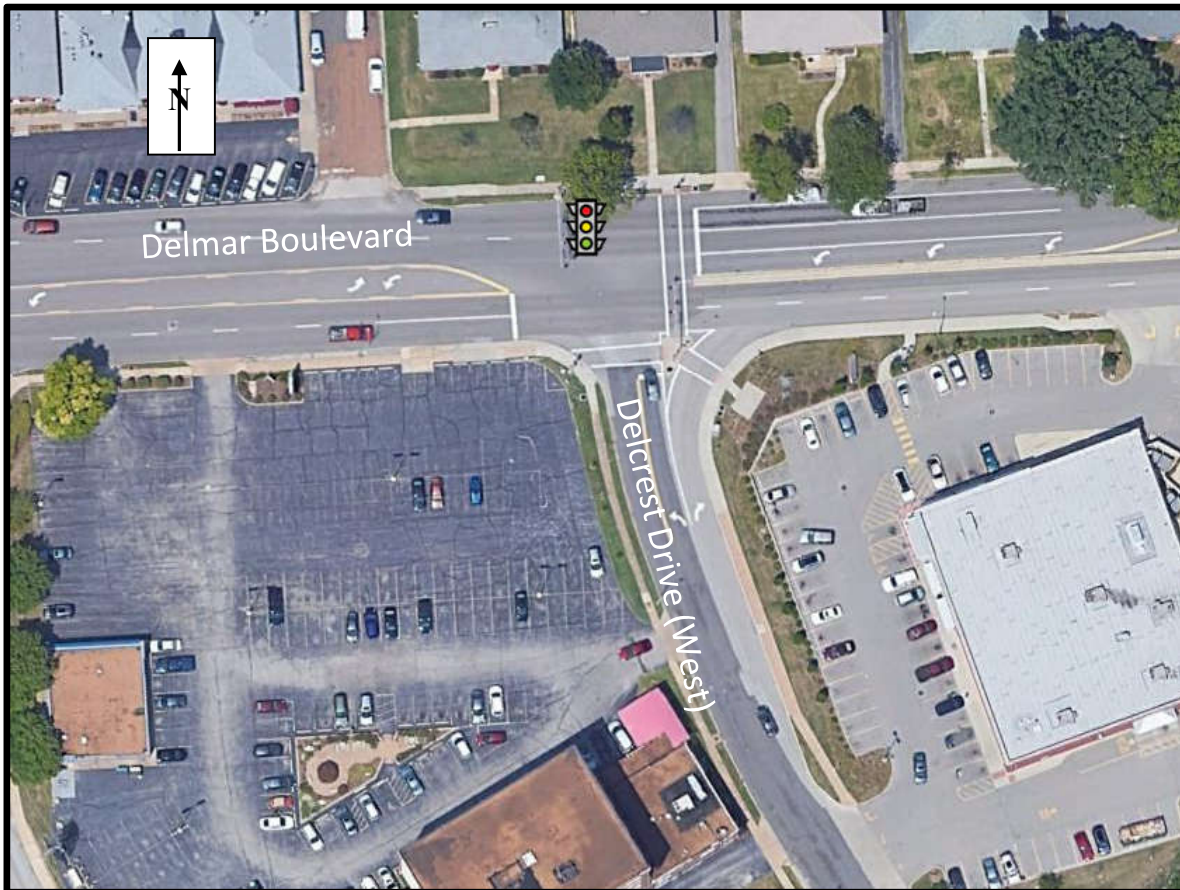


Figure 4: Delmar Boulevard at Delcrest Drive (West) Intersection

Old Bonhomme Road is a north-south urban collector that extends from about 0.6 miles north of Delmar Boulevard at Groby Road and extends approximately 0.25 miles to the south of Delmar Boulevard, where it changes names to Forsyth Boulevard and goes into the Clayton CBD. Old Bonhomme Road is generally two lanes and widens at the signalized intersection with Delmar Boulevard to provide auxiliary turn lanes.

The intersection of Delmar Boulevard and Old Bonhomme Road is also controlled by a traffic signal. The eastbound and westbound approaches provide one left-turn lane, one through lane and a shared through/right-turn lane. The northbound approach to the intersection provides one left-turn lane and a shared through/right-turn lane, while the southbound approach provides one left-turn lane, one through lane and one right-turn lane. The east-west left-turn movement operate under permissive-only phasing, while the north and south left-turns operate with protected-plus-permissive phasing. Crosswalks and pedestrian accommodations are provided across all legs of the signalized intersection. An aerial view of the Delmar Boulevard at Old Bonhomme Road intersection is shown in **Figure 5**.

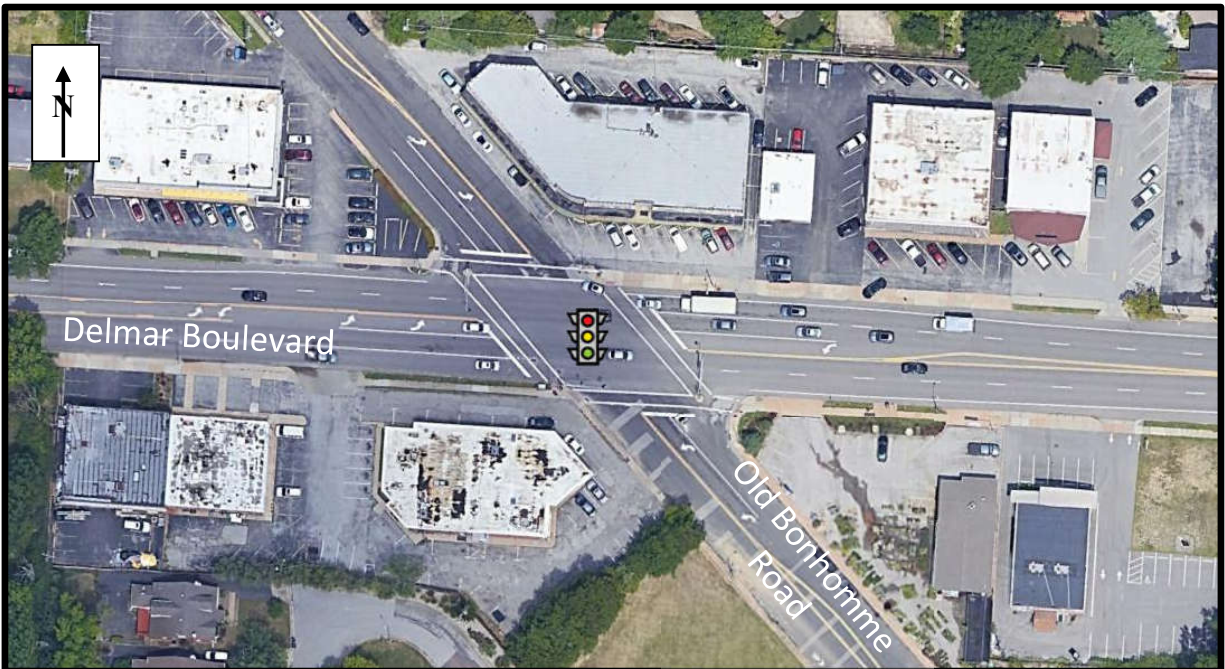


Figure 5: Delmar Boulevard and Old Bonhomme Road Intersection

Existing Traffic Volumes

To establish existing traffic conditions, video traffic counts were conducted at the following intersections during the weekday morning (7:00 - 9:00 a.m.) and afternoon (4:00-6:00 p.m.) peak periods on Tuesday, February 18, 2020:

- Delmar Boulevard and I-170 Southbound ramps (signalized);
- Delmar Boulevard and I-170 Northbound ramps/McKnight Road (signalized);
- McKnight Road at I-170 On-Ramp (signalized);
- Delmar Boulevard and Ladue Crossing private access road (unsignalized);
- Delmar Boulevard and Delcrest Drive (West) (signalized); and
- Delmar Boulevard and Old Bonhomme (signalized).

It should be noted that all traffic counts were performed while local schools were in session. The existing weekday AM and PM peak hour traffic volumes are summarized in **Exhibit 1**. Based on the traffic data collected, the AM peak hour occurred between 7:30 and 8:30 a.m. and the PM peak hour occurred between 5:00 and 6:00 p.m.

Given the traffic characteristics in the area and the anticipated trip generation for the proposed development, the weekday AM and PM peak periods would likely represent a “worst-case scenario” with regards to the traffic impact. If traffic operations are acceptable during these peak periods, it can be reasoned that conditions would be acceptable throughout the remainder of the day.

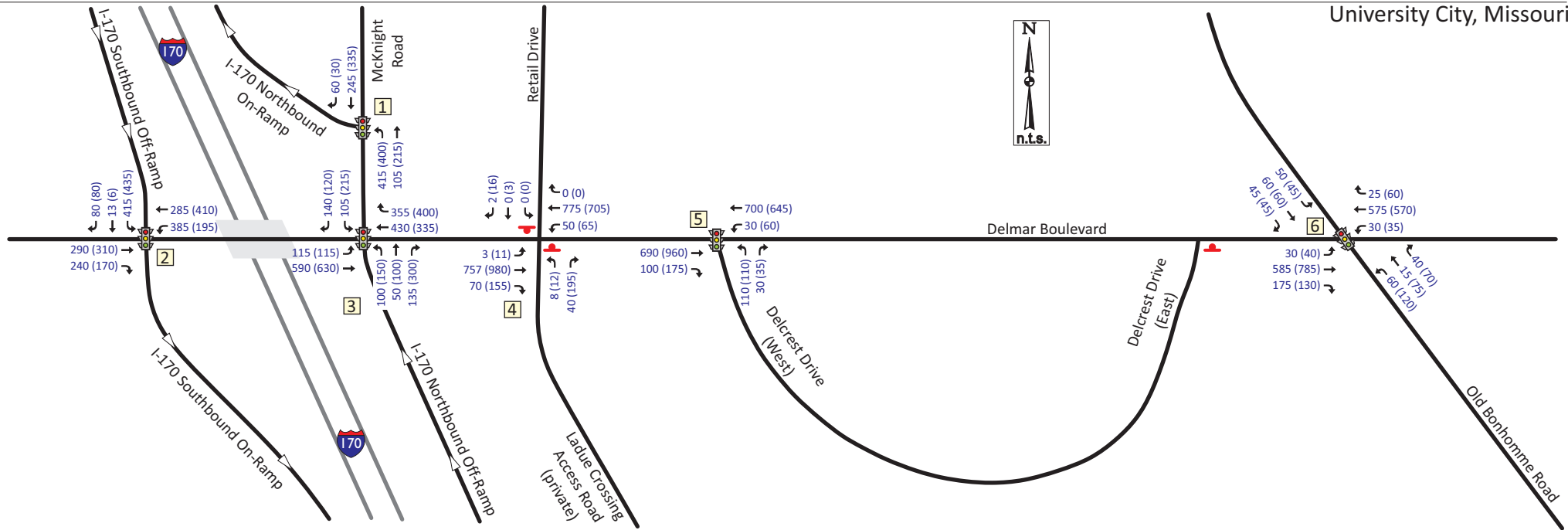


Exhibit 1: Existing Traffic Volumes



Proposed Development

The proposed mixed-use development at 8400 Delmar Boulevard will include a 133-room hotel, a 252-unit apartment building, and 4,000 Square Feet (SF) of retail/restaurant space. **Figure 2** illustrates the preliminary site plan provided by the developer. Based on the site plans provided, the proposed development plan removes the two existing full access curb cuts on Delmar Boulevard and proposes one full access on Delcrest Drive (West), approximately 290 feet south of Delmar Boulevard (center to center) at a parking garage access and a pick-up/drop-off loop is proposed on Delcrest Drive (West) south of Delmar Boulevard. Trash pick-up is proposed via one new curb cut on the Ladue Crossing Access Road (private road). It should also be noted that the proposed garage access onto Delcrest Drive (West) is located as far to the south as practical.

It is recommended that the site civil engineer evaluate the proposed driveways to ensure that adequate sight distance is provided at the public traveled 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.

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 including both of the drop-off/pick-up lanes. 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

As a primary step in this analysis, traffic forecasts were prepared to estimate the amount of traffic that the proposed mixed-use development would generate during the peak hours. These forecasts were based upon information provided in the "Trip Generation Manual", Tenth Edition, published by the Institute of Transportation Engineers (ITE). This manual, which is a standard resource for transportation engineers, is based on a compilation of nationwide studies documenting the traffic characteristics of various land uses.

The peak hour of adjacent street traffic, one hour between 7:00 and 9:00 AM, was utilized for the AM peak hour, and peak hour of adjacent street traffic, one hour between 4:00 and 6:00 PM, was utilized for the PM peak hour. ITE Land Use 310: Hotel was used for the proposed hotel, ITE Land Use: 221 – Multifamily Housing (Mid Rise) was used for the proposed apartments, and ITE Land Use: 932 – High-Turnover (Sit-Down) Restaurant was used for the proposed retail/restaurant. The ITE trip generation rates for the high-turnover sit-down restaurant are higher than the trip generation rates for the general retail (ITE Land Use 820); therefore, the restaurant trips were used in this analysis to evaluate a worst-case scenario.



It should be noted that not all of the trips to the restaurant/retail would represent *new* traffic on the adjacent roadways. Specifically, some traffic attracted to this site would already be traveling on Delmar Boulevard as part of another trip; i.e., “pass-by” trips. Statistical information provided in the *Trip Generation Handbook*, 3rd Edition, published by ITE, estimates a pass-by percentages of 43% during the PM peak hour for a high-turnover sit-down restaurant. However, no pass-by trips were applied to the trip generation estimate to provide a conservative analysis.

Table 1 summarizes the trip estimate for the proposed mixed-use development. As can be seen, the mixed-use development is expected to generate 195 total vehicular trips during the AM peak hour and 230 total vehicular trips during the PM peak hour.

Table 1: Trip Generation for the Proposed Mixed-Use Development*

Land Use	Size	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
Multi-Family Housing (Mid-Rise) (ITE Code 221)	252 units	25	65	90	65	45	110
Hotel (ITE Code 310)	133 Rooms	40	25	65	40	40	80
HTSD Restaurant (ITE Code 932)	4,000 ft ²	20	20	40	25	15	40
Total Trips		85	110	195	130	100	230

* Trip Generation 10th Edition, Rounded to nearest 5

The traffic generated by the proposed mixed-use development was assigned to the adjoining roadway system based on existing and projected traffic patterns and the proposed access plan for the site. All vehicular traffic to the site was assigned to the garage entrance. The directional distribution for the site trips were assigned as follows:

- 55% to/from the west on Delmar Boulevard
 - 25% to/from the north on I-170;
 - 15% to/from the south on I-170;
 - 5% to/from the south on Ladue Crossing Access;
 - 5% to/from the north on McKnight Road (north of the I-170 ramp); and
 - 5% to/from the far west on Delmar Boulevard.
- 45% to/from the east on Delmar Boulevard;
 - 30% to/from the east on Delmar Boulevard;
 - 10% to/from the south on Old Bonhomme Road; and
 - 5% to/from the north on Old Bonhomme Road.

The trip distribution above was applied to the site-generated traffic volumes and assigned to the roadways, as shown in **Exhibit 2**.



Build Traffic Volumes

The traffic generated by the proposed mixed-use development (Exhibit 2) was aggregated with the Existing Traffic Volumes (Exhibit 1) to reflect the forecasted build traffic volumes. **Exhibit 3** reflects the Build Traffic Volumes.

Build Auxiliary Turn Lane Warrants:

It is our understanding that the City of University City does not have specific warrants for auxiliary turn lanes; therefore, auxiliary turn lane needs along Delcrest Drive (West) were evaluated using MoDOT's Access Management Guidelines (AMG) criteria for a two-lane roadway. It should be noted that MoDOT and SLCDOT's turn lane criteria are the same. These guidelines consider auxiliary lanes 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.

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.

The southbound right-turn from Delcrest Drive (West) at the proposed driveway is expected to be 85 to 130 vph. Utilizing the Build traffic volumes and the right-turn lane volume nomograph, a separate southbound right-turn lane is NOT warranted on Delcrest Drive (West) at the parking garage entrance due to the relatively low through traffic volumes, see **Figure 6**.

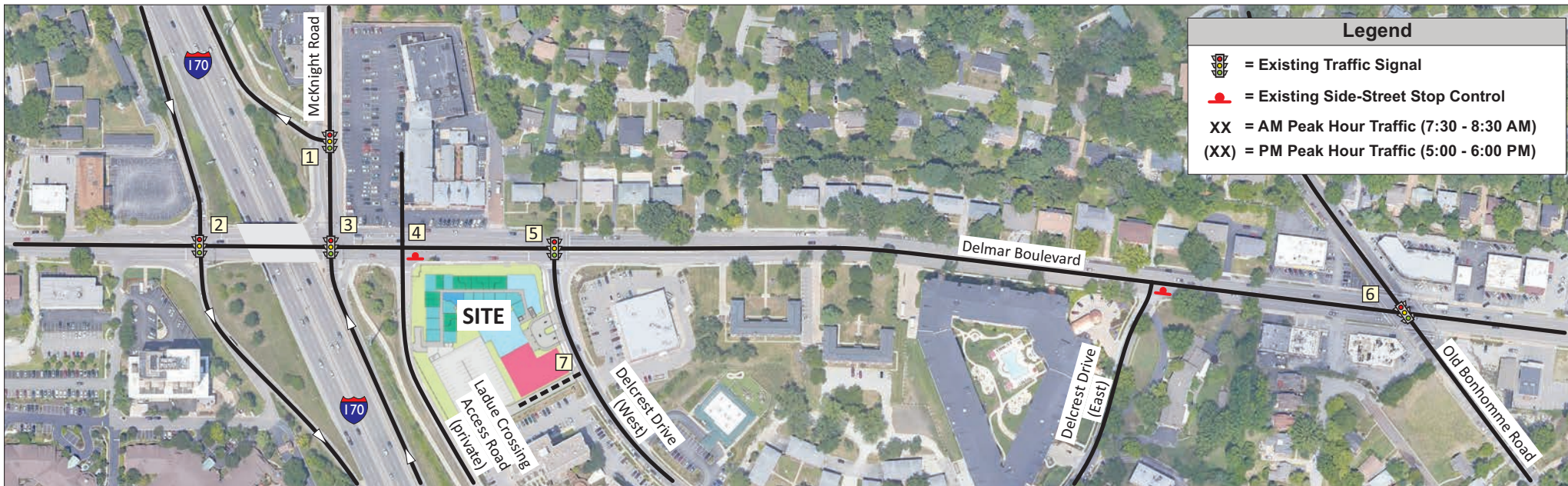
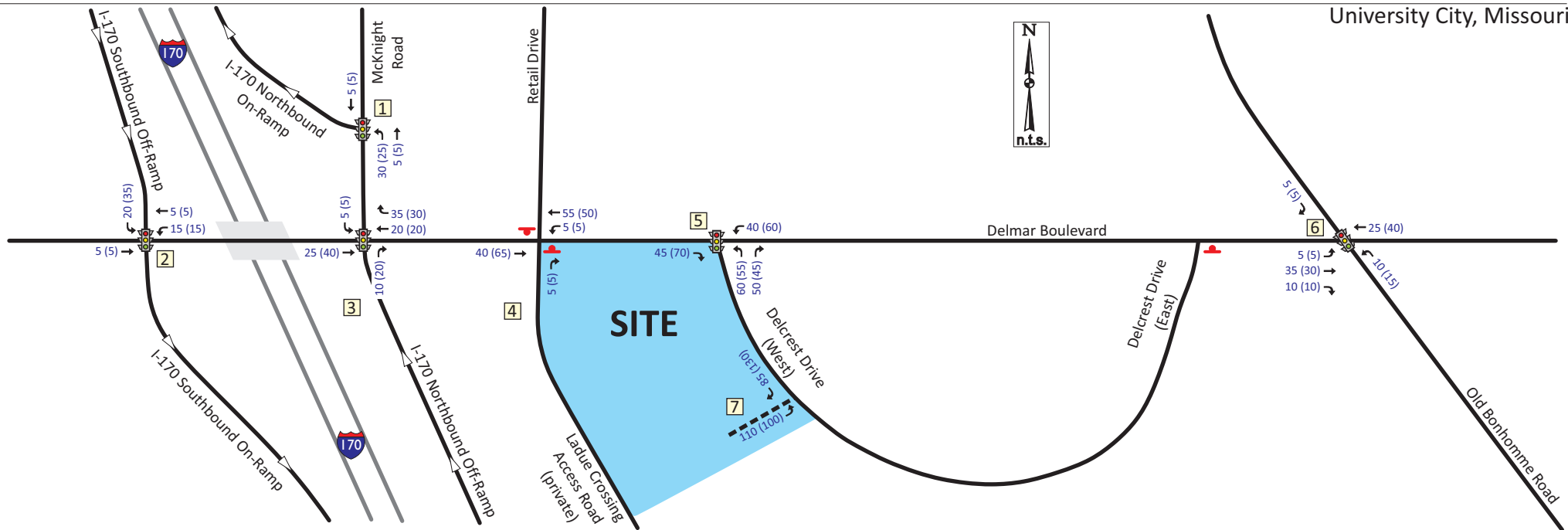


Exhibit 2: Site-Generated Traffic Volumes

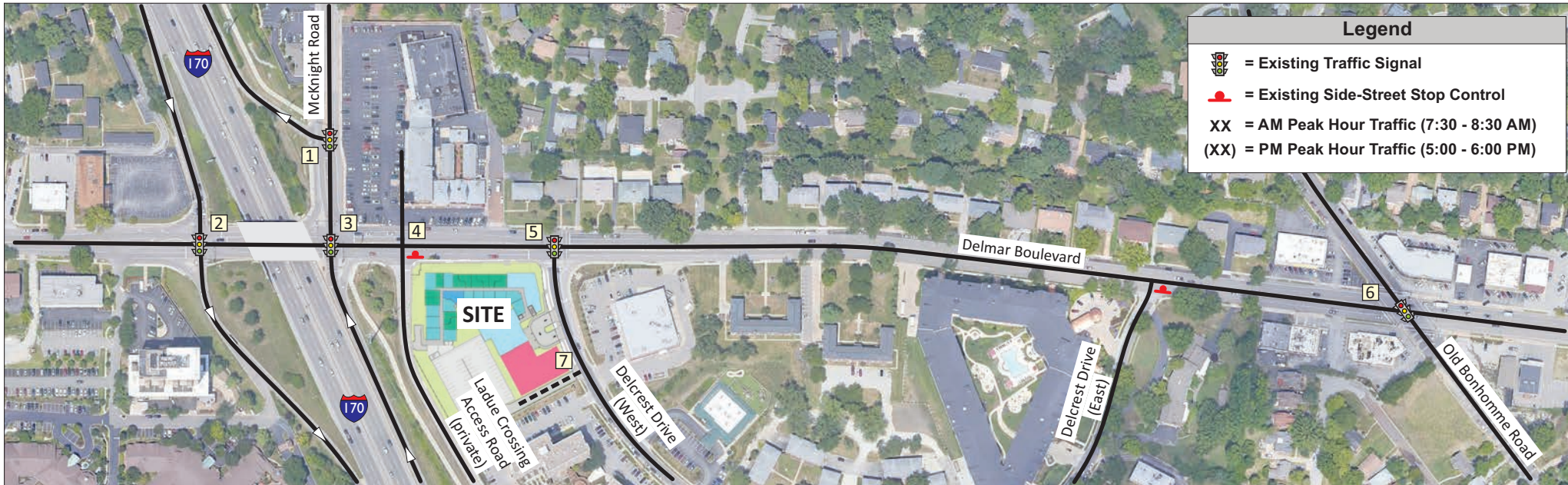
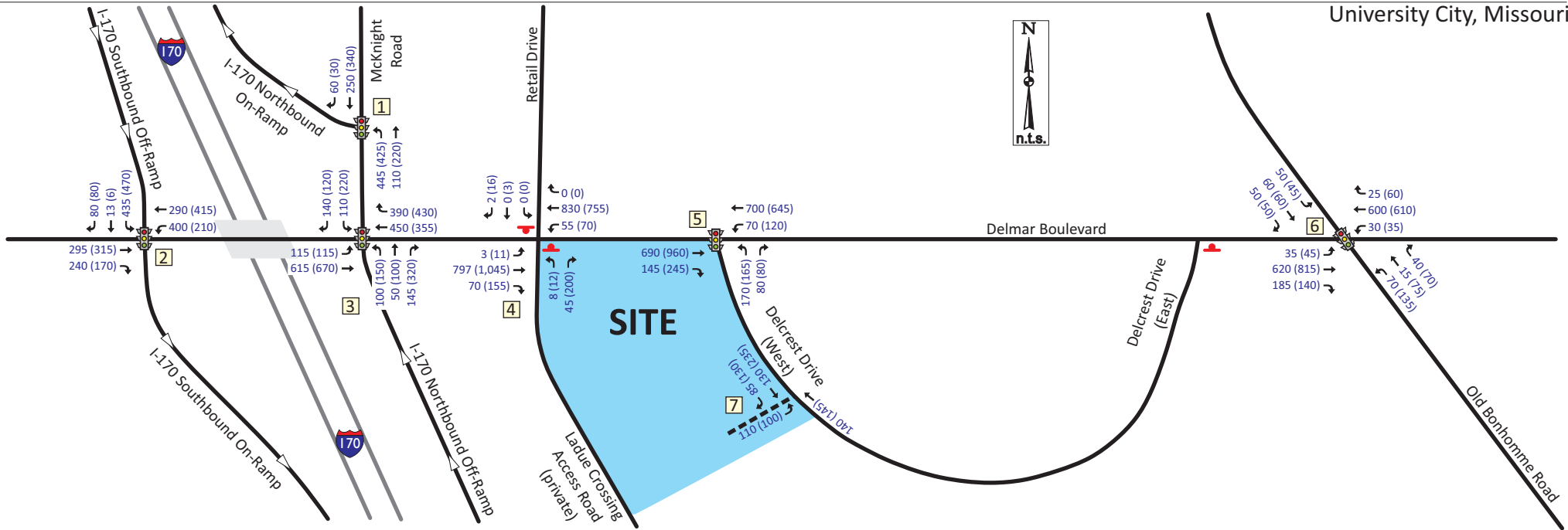


Exhibit 3: Build Traffic Volumes

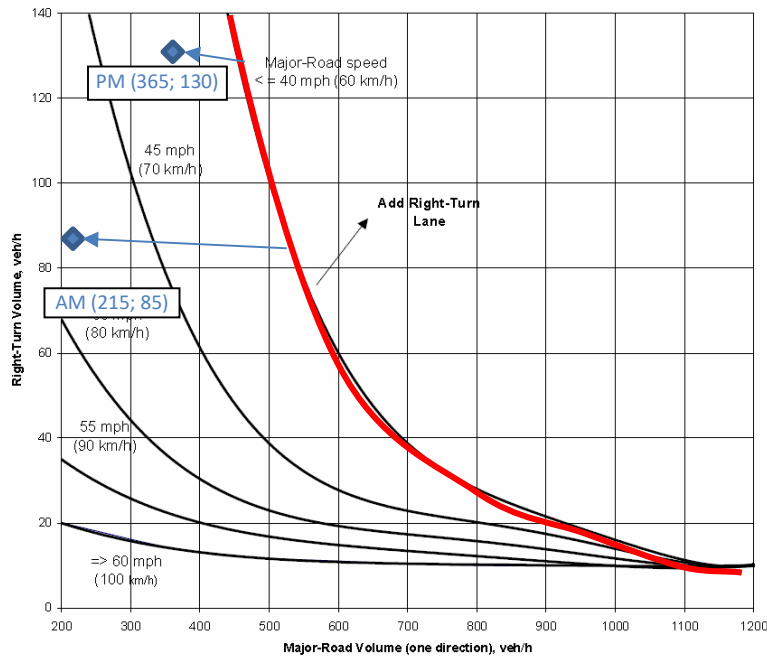


Figure 6: Right-Turn Lane Warrants along Delcrest Drive (West) at Proposed Garage Entrance

Operating Conditions

The operating conditions for the study 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 analyses include 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 in urban and suburban areas. **Table 2** summarizes the thresholds used in the analysis for signalized and unsignalized intersections.

It should also be acknowledged that the perception of acceptable traffic service varies widely by area. Specifically, more delay is usually tolerated in urban regions compared to rural areas.



Based on the character of this area, we believe that LOS D would be an appropriate target for overall peak period traffic operations.

Table 2: Level of Service Thresholds

<i>Level of Service (LOS)</i>	<i>Control Delay per Vehicle (sec/veh)</i>	
	<i>Signalized Intersections</i>	<i>Unsignalized Intersections</i>
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

The study intersections were evaluated using the methodologies described above. The results of the SYNCHRO evaluations are summarized for the Existing and Build Conditions along Delmar Boulevard at the study intersections in **Table 3**. These conditions were evaluated and compared to determine the impacts of the proposed development.

As can be seen, the overall operating conditions at the study intersections are acceptable (LOS D or better). The approach levels of service are also acceptable (LOS D or better), except for the northbound and the southbound approaches of McKnight Road/I-170 Northbound Off-Ramp at Delmar Boulevard during the PM peak hour. The northbound through volume from the I-170 off-ramp is relatively light (100 vph during the PM peak hour) and many times does not block the heavier northbound right-turn. Since the northbound right-turn can get by the northbound through queue much of the peak hour, the analysis software overestimates the northbound delays, and the operations are actually better (as observed in the field) than shown in the table. If MoDOT determines this to be a concern, then the existing signal timing could be adjusted to provide additional green time to the northbound and southbound approaches of the intersection by taking a small amount of green time away from the east-west movements to obtain acceptable levels.

Build Traffic Conditions: As can be seen from the Build column in Table 3, the proposed mixed-use development will have minimal additional impact or change in the operating conditions at the study intersections as compared to the Base condition. The development is expected to add less than 3 seconds of overall delay at any one study intersection when compared to the Base condition. Should MoDOT determine that the impacts of this development justify additional green time for the southbound I-170 off-ramp, the northbound I-170 off-ramp, or southbound McKnight Road at Delmar Boulevard during the PM peak hour, signal timing changes could be made to obtain acceptable levels of service.



Table 3: Existing and Build Operating Conditions

Traffic Movement	AM Peak Hour		PM Peak Hour	
	Existing	Build	Existing	Build
Delmar Boulevard at Southbound I-170 (signalized)				
Eastbound Delmar Boulevard Approach	B (13.1)	B (13.5)	C (21.0)	C (21.4)
Westbound Delmar Boulevard Approach	B (10.3)	B (11.5)	A (6.9)	A (7.0)
Southbound I-170 Off Ramp Approach	D (45.8)	D (45.5)	D/E (54.6)	E (57.8)
Overall	C (22.0)	C (22.6)	C (26.8)	C (28.4)
Delmar Boulevard at Northbound I-170/McKnight Road (signalized)				
Eastbound Delmar Boulevard Approach	A (3.9)	A (4.2)	B (14.6)	B (15.5)
Westbound Delmar Boulevard Approach	B (17.4)	B (18.4)	B (16.5)	B (17.6)
Northbound I-170 Off Ramp Approach	C (32.0)	C (32.1)	E/F (80.0)	F (88.8)
Southbound McKnight Road Approach	C (30.5)	C (30.9)	E (73.2)	E (77.6)
Overall	B (16.6)	B (17.2)	D (38.6)	D (41.4)
McKnight Road at I-170 On-Ramp (signalized)				
Northbound I-170 off Ramp Approach	A (3.6)	A (4.2)	A (3.2)	A (3.5)
Southbound McKnight Road Approach	A (2.5)	A (2.6)	A (4.0)	A (4.4)
Overall	A (3.2)	A (3.6)	A (3.5)	A (3.8)
Delmar Boulevard at Ladue Crossing Access Road (unsignalized)				
Northbound Ladue Crossing Access App.	B (14.5)	C (15.0)	D (29.2)	D (34.2)
Eastbound Delmar Boulevard Left-Turn	A (9.6)	A (9.9)	A (9.0)	A (9.4)
Westbound Delmar Boulevard Left-Turn	B (10.2)	B (10.5)	B (11.4)	B (12.6)
Southbound Retail Center Approach	B (11.2)	B (11.5)	B (12.6)	B (16.1)
Delmar Boulevard at Delcrest Drive (West) (signalized)				
Eastbound Delmar Boulevard Approach	A (8.3)	B (12.6)	B (11.4)	B (16.3)
	95 th Q=170' TH	95 th Q=215' TH	95 th Q=260' TH	95 th Q=370' TH
Westbound Delmar Boulevard Approach	A (4.9)	A (6.2)	A (4.3)	A (5.7)
Northbound Delcrest Dr. (West) Approach	C (30.2)	C (31.3)	C (33.7)	D (35.6)
	95 th Q=95' LT Ave Q = 55' LT	95 th Q=160' LT Ave Q = 90' LT	95 th Q=115' LT Ave Q = 55' LT	95 th Q=170' LT Ave Q = 95' LT
Overall	A (8.7)	B (12.5)	B (10.4)	B (14.7)
Delmar Boulevard at Old Bonhomme Road (signalized)				
Eastbound Delmar Boulevard Approach	A (7.3)	A (7.4)	B (11.2)	B (11.4)
Westbound Delmar Boulevard Approach	A (7.3)	A (7.4)	B (10.3)	B (10.5)
Northbound Old Bonhomme Rd.	C (29.6)	C (31.1)	D (43.0)	D (45.1)
Southbound Old Bonhomme Rd.	C (31.3)	C (30.8)	C (25.1)	C (24.5)
Overall	B (11.3)	B (11.5)	B (16.5)	B (17.0)

X (XX.X) - Level of Service (Vehicular delay in seconds per vehicle)
 XXX' AA = 95th percentile queue and the critical movement of the approach



The proposed access driveway on Delcrest Drive (West) will provide approximately 225 feet of storage for northbound Delcrest Drive (West) between the stop bar at Delmar Boulevard and the centerline of the driveway. As seen in Table 3, the 95th percentile queue for the northbound left-turn is expected to reach 170 feet during the PM peak hour with average queues around 95 feet. Since the driveway is located farther than the 95th percentile queue, the driveway is not expected to be impacted by the northbound Delcrest Drive (West) queues. Additionally, the proposed driveway is located as far away from the signal as practical.

Table 4 summarizes the operating conditions at the proposed site garage driveway. As can be seen, the site driveway is expected to operate at highly desirable levels with no added turn lanes.

Table 4: Operating Conditions at Proposed Site Garage Driveway

Traffic Movement	AM Peak Hour		PM Peak Hour	
	Existing	Build	Existing	Build
<i>Delcrest Drive (West) at Proposed Parking Garage (unsignalized)</i>				
Northbound Delcrest Drive (West)	N/A	A (7.6)	N/A	A (8.1)
Eastbound Proposed Garage Approach	N/A	B (12.9)	N/A	B (14.9)
Westbound Walgreens Approach	N/A	A (9.8)	N/A	A (9.8)
Southbound Delcrest Drive (West)	N/A	A (7.5)	N/A	A (7.5)

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

Design Year Conditions

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 20-Year No-Build scenario was developed to evaluate design-year baseline conditions and provide a basis of comparison between the 20-Year No-Build and Build conditions.

20-Year 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 20-Year No-Build traffic volumes are shown in **Exhibit 4**.

20-Year Build Traffic Volumes

The proposed development site-generated trips (Exhibit 2) were aggregated with the 20-No Build Traffic Volumes (Exhibit 4). **Exhibit 5** reflects the 20-Year Build Traffic Volumes.



20-Year No-Build and Build Traffic Conditions

The 20-Year No-Build and Build Traffic Volumes were reanalyzed using the same methodologies applied to the Existing and Build Year Traffic Volumes. The forecasted levels of service and average delays at each study intersection for the 20-Year No-Build and 20-Year 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 over the No-Build conditions. In fact, the overall increases in delay are four seconds or less.

As previously noted, should MoDOT determine that the impacts of this development warrants additional green time for the southbound I-170 off-ramp, the northbound I-170 off-ramp, or southbound McKnight Road at Delmar Boulevard during the PM peak hour, minor changes could be made to the signal timing to obtain acceptable levels of service for those northbound or southbound approaches.

Table 6 summarizes the operating conditions at the proposed site garage driveway. As can be seen, the site driveway is expected to operate at highly desirable levels.

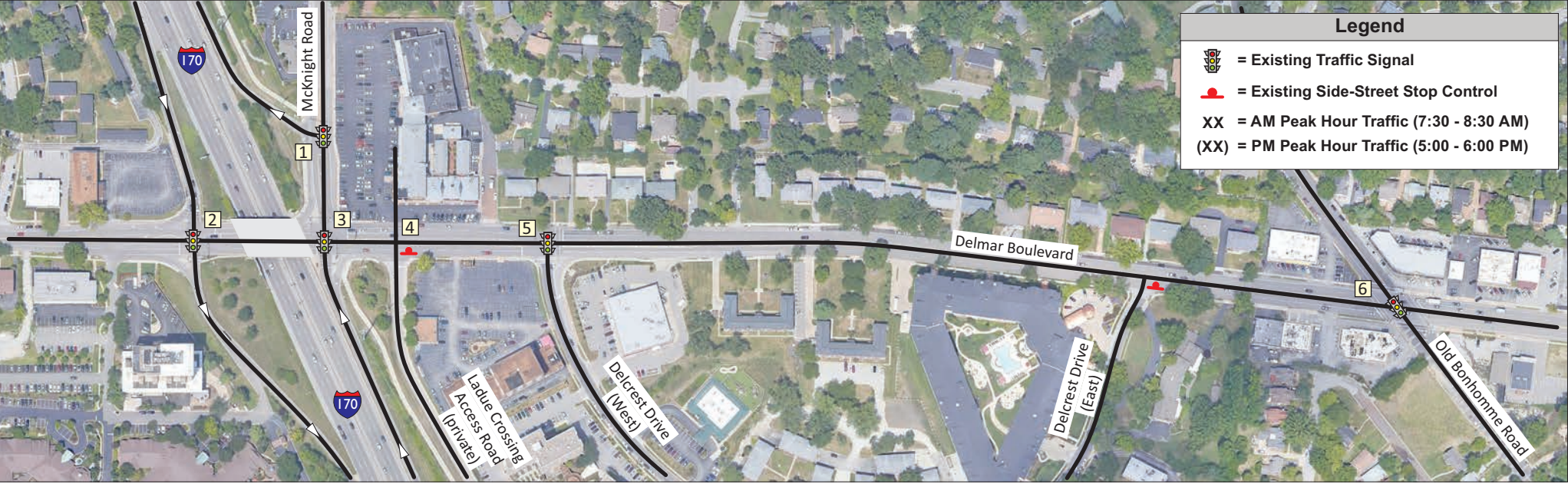
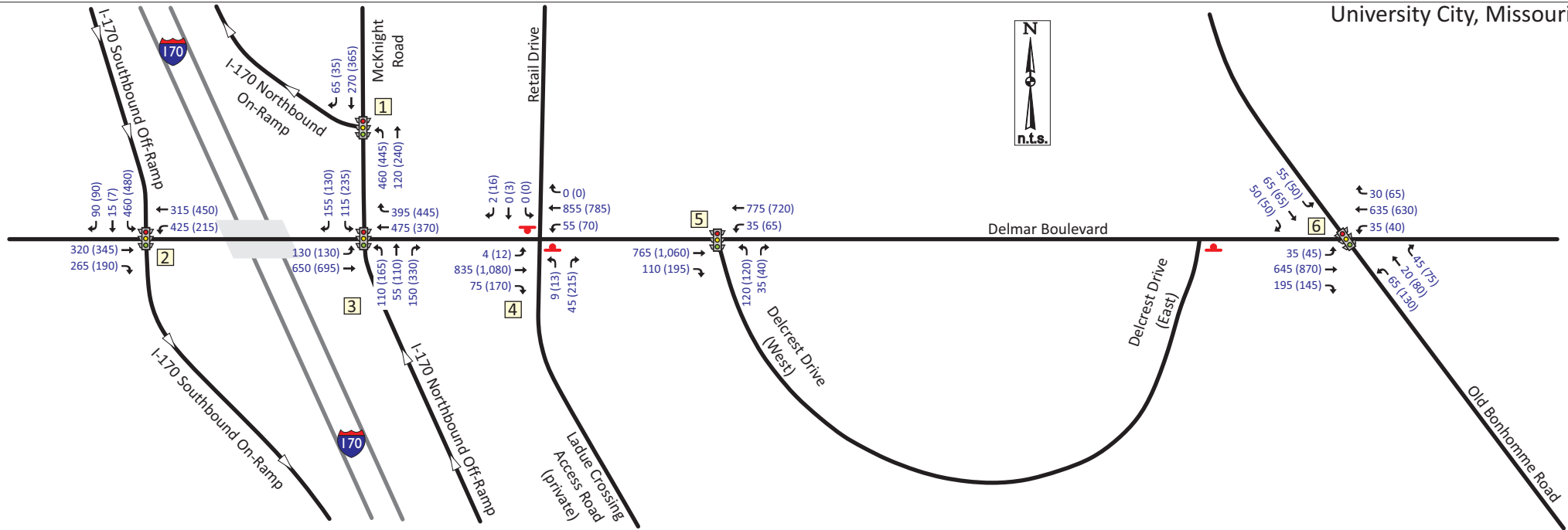
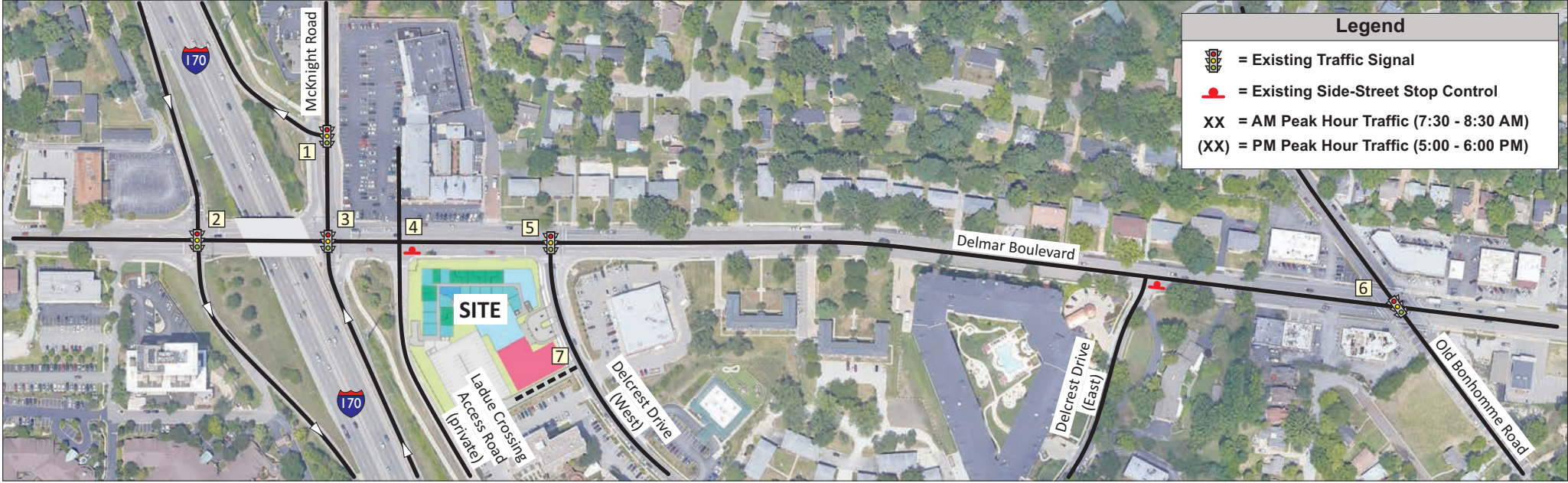
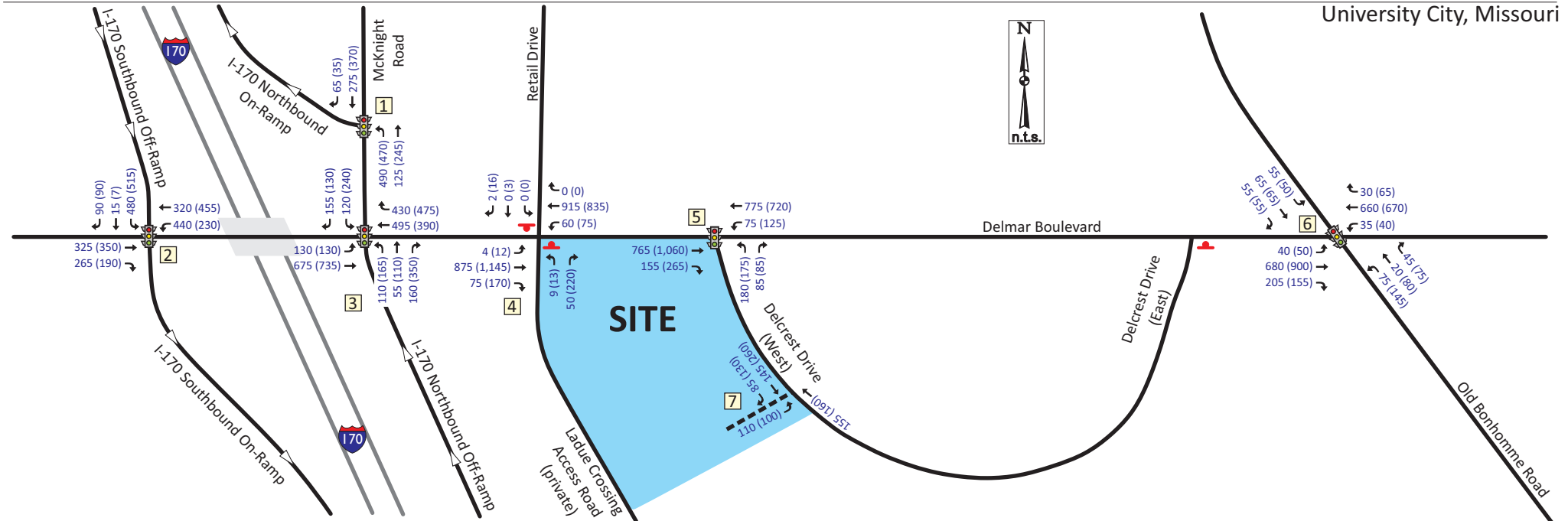


Exhibit 4: 20 Year No-Build Traffic Volumes



Legend

- = Existing Traffic Signal
- = Existing Side-Street Stop Control
- XX** = AM Peak Hour Traffic (7:30 - 8:30 AM)
- (XX)** = PM Peak Hour Traffic (5:00 - 6:00 PM)

Exhibit 5: 20 Year Build Traffic Volumes



Table 5: 20-Year Operating Conditions

Traffic Movement	AM Peak Hour		PM Peak Hour	
	20-Year No-Build	20-Year Build	20-Year No-Build	20-Year Build
Delmar Boulevard at Southbound I-170 (signalized)				
Eastbound Delmar Boulevard Approach	B (14.2)	B (14.5)	C (21.6)	C (22.1)
Westbound Delmar Boulevard Approach	B (14.7)	B (17.1)	A (7.6)	A (7.7)
Southbound I-170 Off Ramp Approach	D (44.5)	D (45.0)	E (59.6)	E (63.1)
Overall	C (23.7)	C (25.0)	C (28.9)	C (30.6)
Delmar Boulevard at Northbound I-170 (signalized)				
Eastbound Delmar Boulevard Approach	A (5.0)	A (5.5)	B (18.1)	B (16.5)
Westbound Delmar Boulevard Approach	C (20.4)	C (21.7)	C (21.1)	C (20.2)
Northbound I-170 Off Ramp Approach	C (34.2)	C (34.6)	F (108.6)	F (125.0)
Southbound McKnight Road Approach	C (30.5)	C (31.0)	E (84.3)	F (85.0)
Overall	B (18.5)	B (19.3)	D (49.0)	D (51.4)
McKnight Road at I-170 On-Ramp (signalized)				
Northbound I-170 off Ramp Approach	A (4.7)	A (5.8)	A (4.2)	A (4.1)
Southbound McKnight Road Approach	A (2.6)	A (2.9)	A (5.0)	A (5.4)
Overall	A (4.0)	A (4.8)	A (4.5)	A (4.6)
Delmar Boulevard at Ladue Crossing Access Road (unsignalized)				
Northbound Ladue Crossing Access App.	C (15.9)	C (16.5)	E (43.7)	F (54.4)
Eastbound Delmar Boulevard Left-Turn	A (9.9)	B (10.3)	A (9.6)	A (9.8)
Westbound Delmar Boulevard Left-Turn	B (10.7)	B (11.0)	B (13.0)	B (13.7)
Southbound Retail Center Approach	B (11.7)	B (12.0)	C (16.9)	C (18.2)
Delmar Boulevard at Delcrest Drive (West) (signalized)				
Eastbound Delmar Boulevard Approach	A (9.9) 95 th Q=200' TH	B (13.4) 95 th Q=250' TH	B (12.5) 95 th Q=315' TH	B (18.8) 95 th Q=445' TH
Westbound Delmar Boulevard Approach	A (5.2)	A (6.6)	A (4.5)	A (6.6)
Northbound Delcrest Dr. (West) Approach	C (31.2) 95 th Q=115' LT Ave Q = 60' LT	C (31.6) 95 th Q=175' LT Ave Q = 95' LT	C (35.0) 95 th Q=120' LT Ave Q = 65' LT	C (35.3) 95 th Q=180' LT Ave Q =100' LT
Overall	A (9.7)	B (13.0)	B (11.2)	B (16.2)
Delmar Boulevard at Old Bonhomme Road (signalized)				
Eastbound Delmar Boulevard Approach	A (7.7)	A (7.9)	B (12.3)	B (12.6)
Westbound Delmar Boulevard Approach	A (7.6)	A (7.7)	B (11.1)	B (11.4)
Northbound Old Bonhomme Rd. App.	C (29.8)	C (31.2)	D (43.8)	D (46.2)
Southbound Old Bonhomme Rd. App.	C (31.7)	C (31.4)	C (24.7)	C (24.3)
Overall	B (11.7)	B (11.9)	B (17.3)	B (17.8)

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

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



Table 6: 20-Year Operating Conditions – Proposed Site Garage Driveway

Traffic Movement	AM Peak Hour		PM Peak Hour	
	20-Year No-Build	20-Year Build	20-Year No-Build	20-Year Build
Delcrest Drive (West) at Proposed Parking Garage (unsignalized)				
Northbound Delcrest Drive (West)	N/A	A (7.7)	N/A	A (8.1)
Eastbound Proposed Garage Approach	N/A	B (13.4)	N/A	C (15.9)
Westbound Walgreens Approach	N/A	B (10.0)	N/A	B (10.0)
Southbound Delcrest Drive (West)	N/A	A (7.6)	N/A	A (7.6)

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

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

Conclusions

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 Delcrest Drive (West) in University City, Missouri. The following is a summary of the findings:

- The proposed mixed-use development proposes full access on Delcrest Drive (West), south of Delmar Boulevard to a parking garage and a pick-up/drop-off loop along Delcrest Drive (West) south of Delmar Boulevard.
- Trash pick-up and loading will occur via a separate new curb cut on the Ladue Crossing Access Road (private road). However, no resident, patron or visitor access to the site will be provided via the private road.
- The proposed mixed-use development is expected to generate a total of 195 trips during the weekday AM peak hour and 230 trips during the weekday PM peak hour.
- The study intersections currently operate at desirable levels of service during both peak hours, except for the northbound and southbound approaches of I-170/McKnight Road at Delmar Boulevard during the PM weekday commuter peak hour.
 - The northbound through volume from the I-170 off-ramp is relatively during the PM peak hour and does not block the heavy right-turn volumes each cycle. Since the northbound right-turns can get past the northbound through queue a lot of the time, the operations are better (as verified by field observations) than shown herein. If MoDOT is concerned about these approaches, then the signal timing could be adjusted slightly to provide additional green time to the northbound and southbound approaches to achieve acceptable operating conditions.



- The additional trips generated by the mixed-use development can be accommodated at the adjacent signalized and unsignalized intersections with minimal increases in delay when compared to the Existing counts and 20-Year Base conditions.
 - Again, should MoDOT determine that the impacts of this development justify additional green time for the side-streets during the PM peak hour, the signal timing could be adjusted to achieve acceptable levels of service.
- The unsignalized intersection providing direct access to the site parking garage is expected to operate at desirable levels of service (LOS B or better) during both the AM and PM peak hours.
- Adequate sight distance is needed for safe operations at the garage access points for safe operations. The site designer should show sight distance triangles on the site plan to verify adequate sight distance will be provided in accordance with SLCDOT standards.
- Beyond minor traffic signal timing adjustments noted above, it is our professional traffic engineering opinion that impacts from the proposed site do not warrant any physical roadway improvement for mitigation.

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 in our St. Louis office (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

RLC:bjr