

January 27, 2021

Mr. Tim Crockett, P.E.  
Crockett Engineering  
1000 West Nifong Boulevard, Building 1  
Columbia, MO 65203

RE: Traffic Impact Study  
Proposed Residential Development – Zumwalt Tract  
Richland Road between Rolling Hills Road and Olivet Road  
Columbia, Missouri  
CBB Job No. 008-20

Dear Mr. Crockett:

As requested, CBB has completed a traffic impact study pertaining to a residential development, known as the Zumwalt Tract, generally located on the south side of Richland Road approximately three-fourths mile east of Rolling Hills Road in Columbia, Missouri. The location of the site relative to the surrounding area is depicted in **Figure 1**.

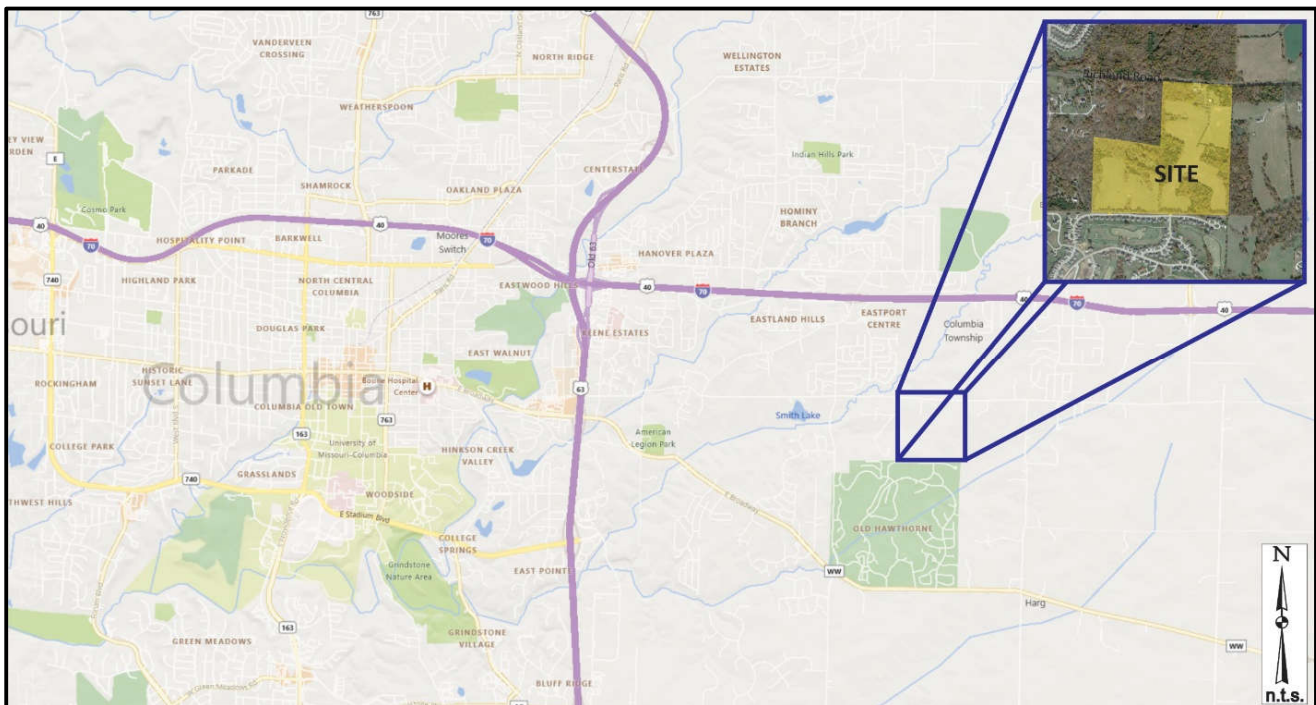


Figure 1: Project Location Map



Based on the site plan provided, the proposed development will include approximately 157 single-family homes with access proposed via one new drive on Richland Road. Cross access is also proposed via the existing stub streets off Ivory Lane within the Old Hawthorne development south of the proposed development. In addition, three stub streets are shown to connect to future development to the east. A schematic of the concept plan provided is shown in **Exhibit 1**.

The purpose of this study was to determine the number of additional trips that would be generated by the proposed development, assign the trips to the adjoining roadways, evaluate the impact of the additional trips on the operating conditions for the adjacent roadways, and determine the ability of motorists to safely enter and exit the site. If necessary, roadway improvements (lane additions and/or traffic control modifications) would be recommended to mitigate the impact of the development and to accommodate the additional traffic. The focus of this study was the AM and PM peak hours of a typical weekday.

CBB discussed the scope of work for this traffic study with the City of Columbia and Boone County at the commencement of the traffic study process. CBB also provided the City and Boone County a Technical Memo summarizing the proposed site trip generation and directional distribution estimates, as well as the Base traffic conditions and gained their consensus on the assumptions prior to completing the traffic analyses.

As requested by the City, the following key intersections were included in the study:

- Richland Road and Rolling Hills/Grace Lane (all-way stop);
- Richland Road and Olivet Road (side-street stop); and
- Richland Road and Proposed subdivision entrance (side-street stop).

As requested, the traffic impact study evaluated the following analysis scenarios for the weekday AM and PM peak hours:

- 2020 Base Conditions (2020 existing traffic volumes plus approved but not built developments); and
- 2020 Build Conditions (2020 Base plus proposed Zumwalt development trips).

The following report presents the methodology and findings relative to the Existing/Base and 2020 Build conditions.

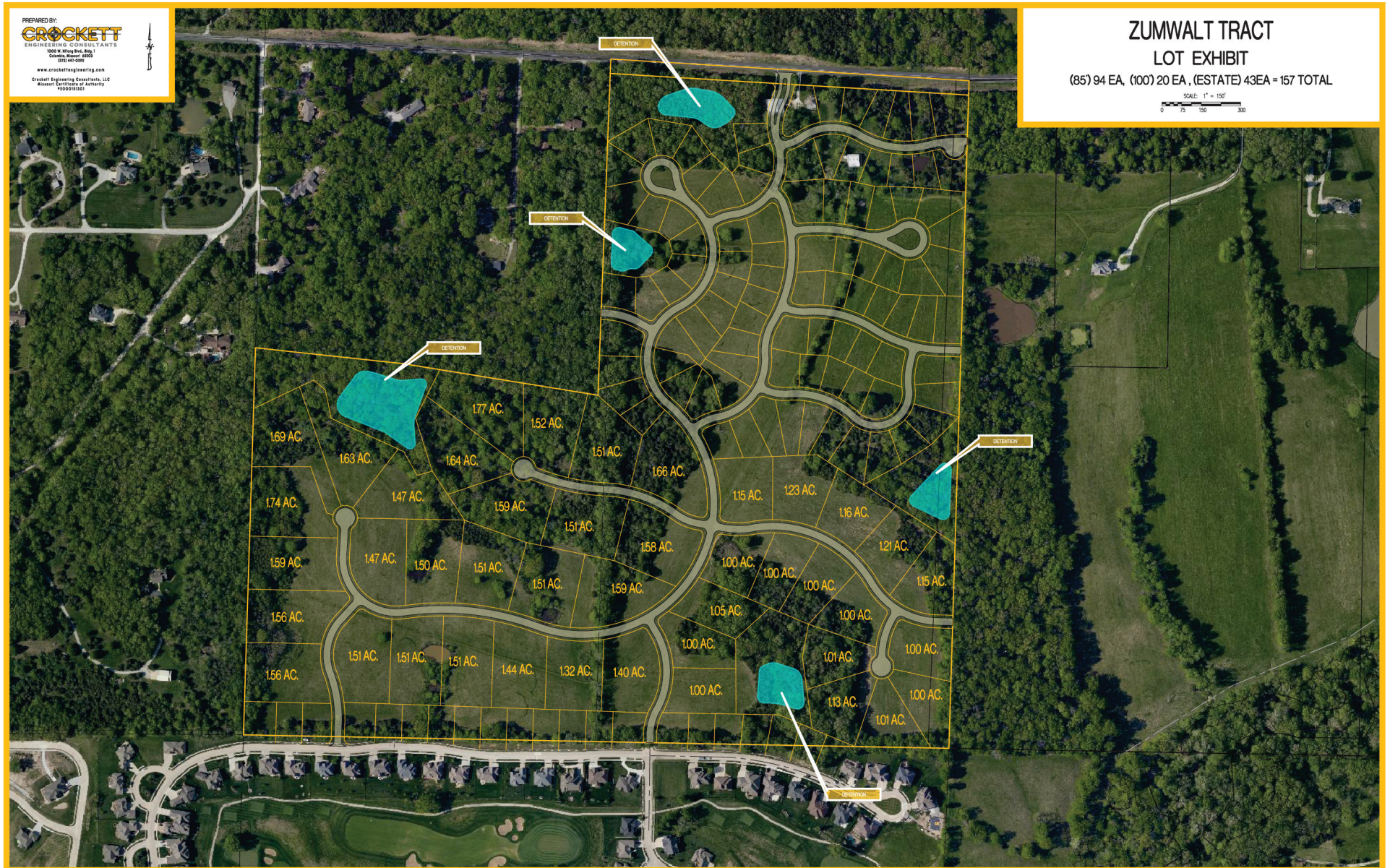


Exhibit 1: Conceptual Site Plan (provided by others)



## EXISTING CONDITIONS

**Area Roadway System Area Roadway System: Richland Road** is a local east-west roadway owned and maintained by Boone County. Within the study area, Richland Road provides two travel lanes, one lane in each direction, and connects St. Charles Road on the west side to Rangeline Road to the east. Richland Road has a posted speed limit of 45 miles per hour (mph). Shoulders, sidewalks, and marked bike lanes are not provided along the roadway.

**Rolling Hills Road** is two-lane roadway that runs north/south along the east side of Columbia and connects to Highway 63 approximately 4.75 miles to the south. Rolling Hills Road consists of a 30-foot cross-section with two travel lanes, one lane in each direction, with curb and gutter. Sidewalk is provided along the east side of the roadway to near Highway WW. The posted speed on Rolling Hills Road south of Richland Road is 35 mph.

Rolling Hills Road north of Richland Road changes names to **Grace Lane** to the north to St. Charles Road. Sidewalk is provided adjacent to some of the developed areas. Grace Lane has two travel lanes, one lane in each direction. Some sidewalk is also provided along Grace lane between Peeble Beach Drive/Volunteer Drive to Olivia Ray Drive. The posted speed on Grace Lane is 30 mph.

**Olivet Road** is a local, north-south, two-way roadway (one lane in each direction) from Richland Road to New Haven Road. The posted speed limit is 45 mph. Shoulders, sidewalks, and marked bike lanes are not provided along the roadway.

The intersection of Rolling Hills Road/Grace Lane and Richland Road is currently controlled as an All-Way STOP. A separate left-turn lane and shared through/right-turn lane is provided on northbound Rolling Hills Road and eastbound Richland Road, while a single lane approach (shared left/through/right-turn lane) is provided for westbound Richland Road and southbound Grace Lane. **Figure 2** provides an aerial view of the Richland Road and Rolling Hills Road/Grace Lane intersection.

The intersection of Richland Road and Olivet Road is a side-street stop control with Olivet Road stopping at Richland Road. All approaches consist of a single lane. **Figure 3** provides an aerial view of the Richland Road and Olivet Road intersection.



Figure 2: Aerial View of the Richland Road and Rolling Hills Road Intersection



Figure 3: Aerial View of the Richland Road and Olivet Intersection



**Existing Traffic Volumes:** Video, turning movement traffic counts were conducted during the third week of March 2020. A 13-hour turning movement count (6:00 a.m. - 7:00 p.m.) at the intersection of Richland Road and Rolling Hills Road and the morning commuter peak period (7:00 - 9:00 a.m.) and afternoon commuter peak period (4:00 - 6:00 p.m.) at the intersection of Richland Road and Olivet Road were collected. Both the University of Columbia and the Columbia public school academic calendars were reviewed to ensure the data was collected during normal school operations. Based on the traffic data collected, the morning peak hour occurred between 7:15 and 8:15 a.m. and the afternoon peak hour occurred between 4:30 and 5:30 p.m. The existing peak hour volumes are summarized in **Exhibit 2**.

It should be noted that these counts were collected just before the region was significantly impacted by the COVID-19 pandemic. As such, CBB's 2020 traffic counts were compared to traffic counts collected by CBB in May 2014 for The Brooks development at Rolling Hills Road and Richland Road to verify that the 2020 volumes are reasonably accurate. The 2020 traffic counts are slightly higher than the 2014 traffic volumes, therefore the recent counts collected in March 2020 were used for this traffic impact study.

Given the traffic characteristics in the area and the anticipated trip generation for the proposed development, the weekday AM and PM peak periods would 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.

#### **APPROVED DEVELOPMENTS – THE VINEYARDS AND THE BROOKS PHASE 1 & PHASE 2**

There are three residential developments in the immediate area that are currently approved but not fully built out. These include The Vineyards, generally in the southwest quadrant of Rolling Hills Road and Broadway; The Brooks Phase 1, generally located on the west side of Rolling Hills Road between Broadway and Richland Road; and The Brooks Phase 2, generally located on the north side of Broadway west of Rolling Hills Road. The approved developments are graphically shown in **Figure 4**. Based on information provided by Crockett Engineering, it is our understanding that as of March 2020 (the time of the traffic counts) the Vineyards development had 273 homes remaining to be built, the Brooks Phase 1 had 22 homes remaining to be built and the Brooks Phase 2 had 373 homes remaining to be built for a total of 668 homes that are approved but not built when the counts were performed.

In order to account for these approved but not built developments, the trip generation for the remaining homes within the three developments were estimated and assigned to the two study area intersections. The amount of traffic the approved but not built developments would generate during the weekday AM and PM peak hours was estimated based upon information provided in the latest edition of the *Trip Generation Manual*. The estimates for the approved developments were based upon Land Use: 210 – Single-Family Detached Housing.



Exhibit 2: Existing Traffic Volumes (2020)



Figure 4: Approved Developments in Area

The fitted equation data provided for Peak Hour of the Adjacent Street was used for the traditional weekday AM and PM peak hour forecasts. Based on this data, the trip generation forecast for the approved but not yet built homes are shown in **Table 1**.

Based on the previous traffic impact studies, 35% of the overall residential approved but not built development traffic was assigned to and from the north on Rolling Hills Road. The trips at Rolling Hills Road and Richland Road were assigned with 10% to/from the west on Richland Road, 15% to/from the east on Richland Road, and 75% to/from the north on Rolling Hills Road. As shown, the approved developments would generate a total of 170 trips during the AM peak hour and 230 trips during the PM peak hour traveling to/from the north on Rolling Hills Road.





Table 1: Trip Estimate – Approved Developments

Land Use (ITE Code)	Unit	ADT (VPD)	Weekday AM Peak Hour			Weekday PM Peak Hour		
			In	Out	Total	In	Out	Total
The Vineyards Single-Family Homes (210)	273 Homes	2,619	50	149	199	167	99	266
Brooks – Phase 1 Single-Family Homes (210)	22 Homes	258	5	15	20	15	9	24
Brooks – Phase 2 Single-Family Homes (210)	373 Homes	3,491	67	203	270	226	134	360
Total Approved Developments	668 Homes	6,368	122	367	489	408	242	650
35% to/from North (Rolling Hills) *		2,230	40	130	170	145	85	230

\* Rounded to nearest 5

The site-generated trips for the approved but not fully built developments (i.e., The Vineyards and The Brooks Phase 1 and 2) were assigned to the study intersections as shown in **Exhibit 3**. The site-generated trips for the approved but not yet built homes (Exhibit 3) were added to the 2020 Existing Traffic Volumes (Exhibit 2) to develop the 2020 Base Traffic Volumes. The 2020 Base Traffic Volumes for the AM and PM peak hours are shown in **Exhibit 4**.



Exhibit 3: Approved but not Built Developments

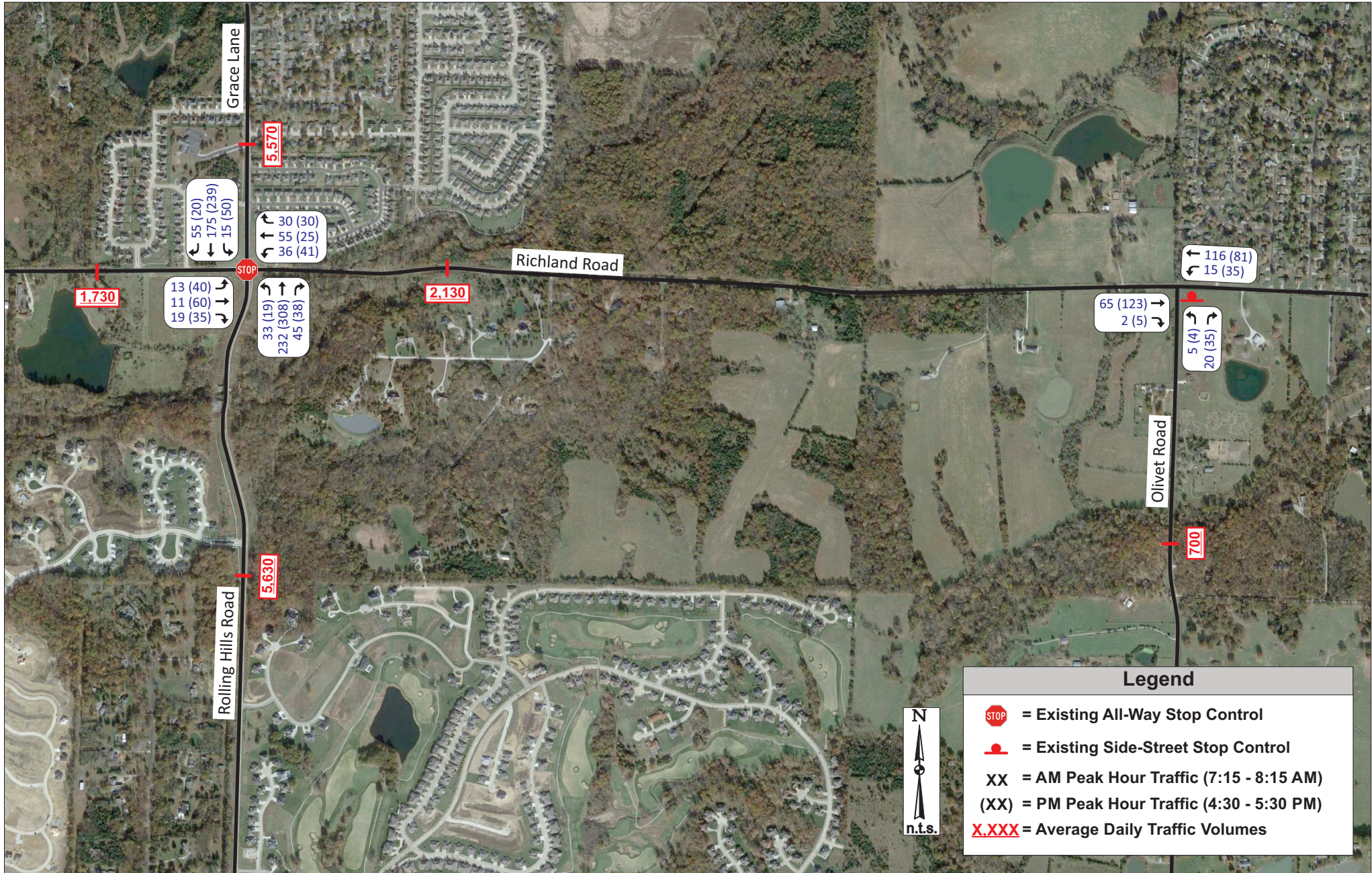


Exhibit 4: Base Traffic Volumes (2020 Volumes + Approved but not Built Homes)



## PROPOSED SITE

Once the base traffic volumes within the study area were established, we then considered the traffic associated with the proposed Zumwalt Tract development.

**Proposed Land Use:** Based upon the concept plan provided by Crockett Engineering Consultants, previously shown in Exhibit 1, a single-family residential development is proposed south of Richland Road between Rolling Hills Road and Olivet Road. The site consists of approximately 157 single family homes. It is our understanding the site is currently in Boone County but will be incorporated in the City of Columbia once developed.

**Site Access:** As shown on the concept plan, access to the proposed subdivision would be provided via a new road on the south side of Richland Road approximately three-fourths mile east of Rolling Hills Road. As part of the project, the proposed subdivision would have cross access connections through to the adjacent Old Hawthorn subdivision to the south (one via the stub street opposite Cutters Corner Lane plus a new connection west of Cutters Corner Lane). Future cross access connections are also shown to the future development to the east.

**Intersection Sight Distance:** Based on 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*, the intersection sight distance requirement for the proposed drive on Richland Road is 555 feet (assuming a 45 mph posted speed limit and 50 mph design speed). Note that the sight distance was not measured in the field to evaluate the available sight distance at the proposed site drive. It is recommended the site design engineer verify adequate sight distance is provided at the proposed site drive.

Furthermore, careful consideration should be given to sight distance obstructions when planning any future aesthetic enhancements, such as berms, fencing and landscaping, at any of the subdivision entrances to ensure that these improvements do not obstruct the view of entering and exiting traffic at the site intersections with the public roads. It is generally recommended that all improvements wider than two inches (posts, tree trunks, etc.) and 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 weekday AM and PM peak periods. These forecasts were based upon information provided in the latest edition of the *Trip Generation Manual*. Estimates for the proposed development were based upon Land Use: 210 – Single-Family Detached Housing.

The data provided for Peak Hour of the Adjacent Street was used for the traditional weekday AM and PM peak hour forecasts. Based on this data, the trip generation forecast for the



proposed Zumwalt Tract development is shown in **Table 2**. As shown, the proposed Zumwalt Tract subdivision would generate a total of 115 trips during the weekday AM peak hour and 160 trips during the weekday PM peak hour.

**Table 2: Trip Estimate – Zumwalt Tract**

ITE Code	Land Use	Unit	ADT (VPD)	Weekday AM Peak Hour			Weekday PM Peak Hour		
				In	Out	Total	In	Out	Total
210	Single-Family Homes	157 Homes	1,575	30	85	115	100	60	160

\* Rounded to nearest 5

**Trip Distribution:** The site-generated trips for the proposed Zumwalt Tract residential development were then assigned into and out of the site based upon an estimated directional distribution. Based upon the existing travel patterns in the area, it is anticipated the distribution of site-generated trips for the Zumwalt Tract development would be as follows:

- To/from the south via Cross Access Connections ..... 15%
- To/from the east on Richland Road ..... 15%
- To/from the west on Richland Road ..... 70%
  - a. To/from the west on Richland Road ..... 20%
  - b. To/from the north on Rolling Hills Road ..... 40%
  - c. To/from the south on Rolling Hills Road ..... 10%

The site-generated trips were assigned to the adjacent roadway for the weekday AM and PM peak hours and are shown in **Exhibit 5**.

As shown in Exhibit 5, the Zumwalt Tract is expected to add approximately 46 trips (12 in and 34 out) in the AM peak hour and 64 trips (40 in and 24 out) in the PM peak hour to/from the north on Grace Lane. The Zumwalt Tract is expected to add approximately 23 trips (6 in and 17 out) in the AM peak hour and 32 trips (20 in and 12 out) in the PM peak hour to/from the west on Richland Road. This nominal increase is not expected to have a significant impact to the operations at the intersection of Richland Road and St. Charles Road or the intersection of Grace Lane at St. Charles Road.

**2020 Build Traffic Volumes (2020 Base plus Zumwalt Tract Trips):** The assigned traffic volumes resulting from the trip distribution for the proposed Zumwalt Tract development (Exhibit 5) were added to the 2020 Base traffic volumes (Exhibit 4) to determine the total volumes in the forecasted scenario. The forecasted, 2020 Build, traffic volumes for the weekday AM and PM peak hours are shown in **Exhibit 6**.

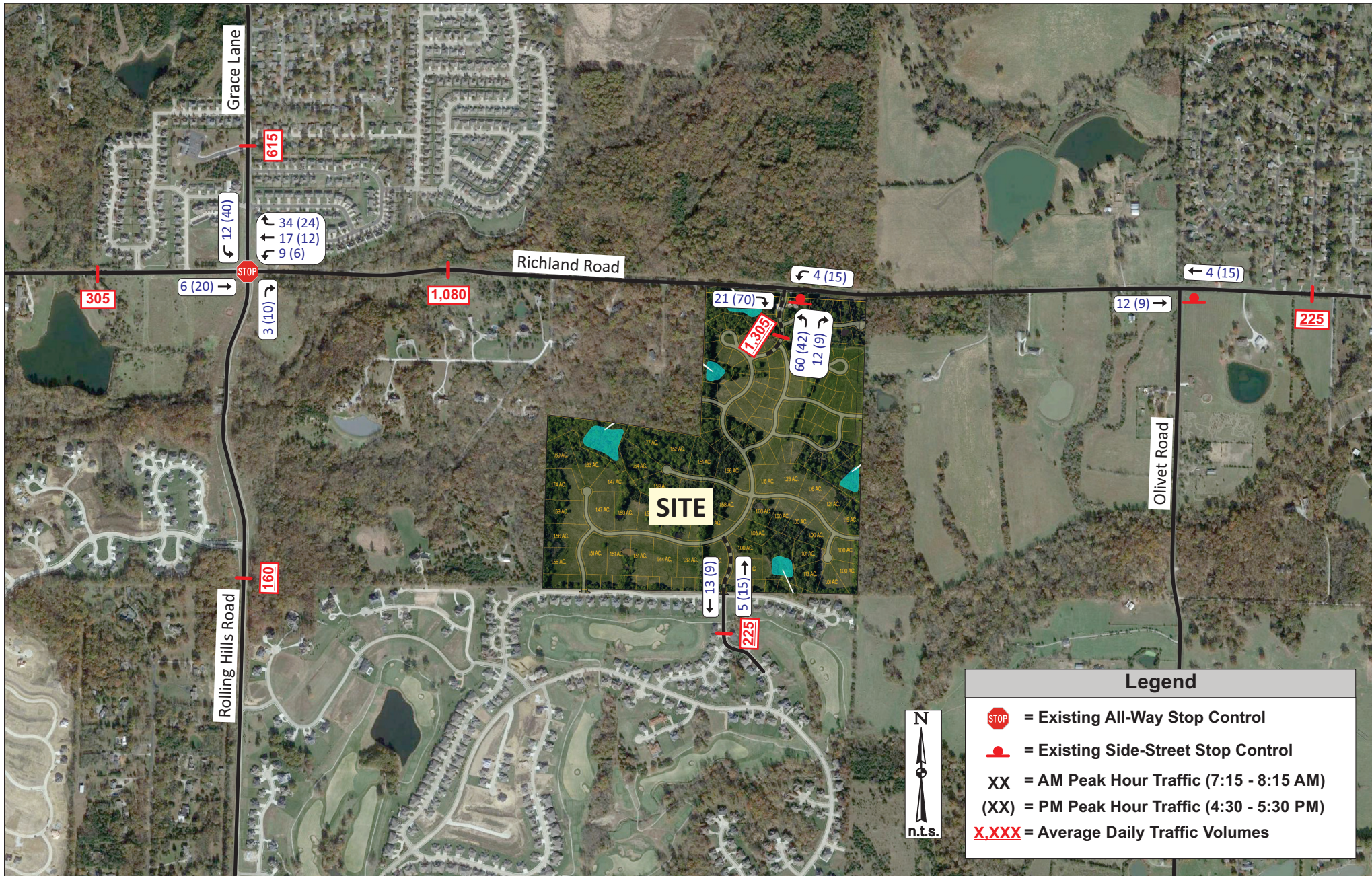


Exhibit 5: Site-Generated Trips



Exhibit 6: 2020 Build Traffic Volumes



## TRAFFIC ANALYSIS

**Study Procedures:** The 2020 Base and 2020 Build operating conditions were analyzed using SYNCHRO 10, a macro-level analytical traffic flow model. SYNCHRO is based on study procedures outlined in the *Highway Capacity Manual*, published by the Transportation Research Board. This manual, which is used universally by traffic engineers to measure roadway capacity, establishes six levels of traffic service: Level A ("Free Flow"), to Level F ("Fully Saturated"). 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 often considered acceptable for peak period conditions in urban and suburban areas.

The thresholds that define level 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 then 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.

Level of service is directly related to control delay. At signalized intersections, the level of service criteria differ from that at unsignalized intersections primarily because varying transportation facilities create different driver expectations. The expectation is that a signalized intersection is designed to carry higher traffic volumes, and consequently may experience greater delay than an unsignalized intersection. **Table 3** summarizes the thresholds used in the analysis for signalized and unsignalized intersections.

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





**2020 Build Auxiliary Turn Lane Needs:** The need for auxiliary turn lanes on Richland Road at the proposed site drive was evaluated using MoDOT’s Access Management Guidelines (AMG). 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 MoDOT method provides volume guidelines for the consideration of separate right-turn lanes by comparing the total advancing volume (which includes all turning traffic) to the number of right-turns during the design hour with respect to the major road speed.

Utilizing MoDOT’s AMG *Right-Turn Lane Guideline for Two-lane Roadway* nomograph, a separate westbound right-turn lane is not warranted on Richland Road at the proposed drive, see **Figure 5**.

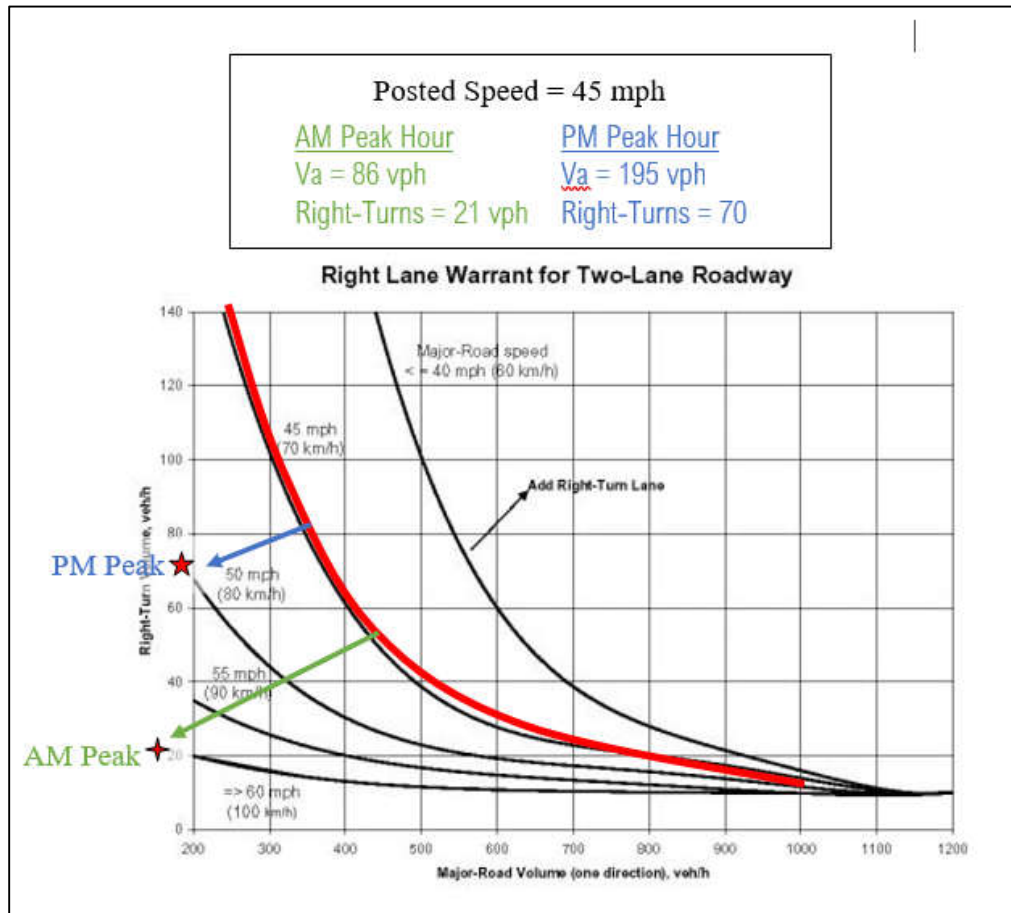


Figure 5: Eastbound Right-Turn Lane Warrant – Richland Road at Site Drive



The need for a westbound left-turn lane on Richland Road at the proposed site drive was evaluated using MoDOT's AMG *Left-Turn Lane Guideline for Two-Lane Roadways (less or equal to 45 mph)* nomograph. **Figure 6** graphically illustrates the left-turn evaluation assuming the 2020 Build traffic volumes. A left-turn lane should be considered when the plotted point lies to the right of the percent lefts line on the graph. As depicted, a separate westbound left-turn lane is not warranted on Richland Road at the proposed site drives due to the low traffic volumes.

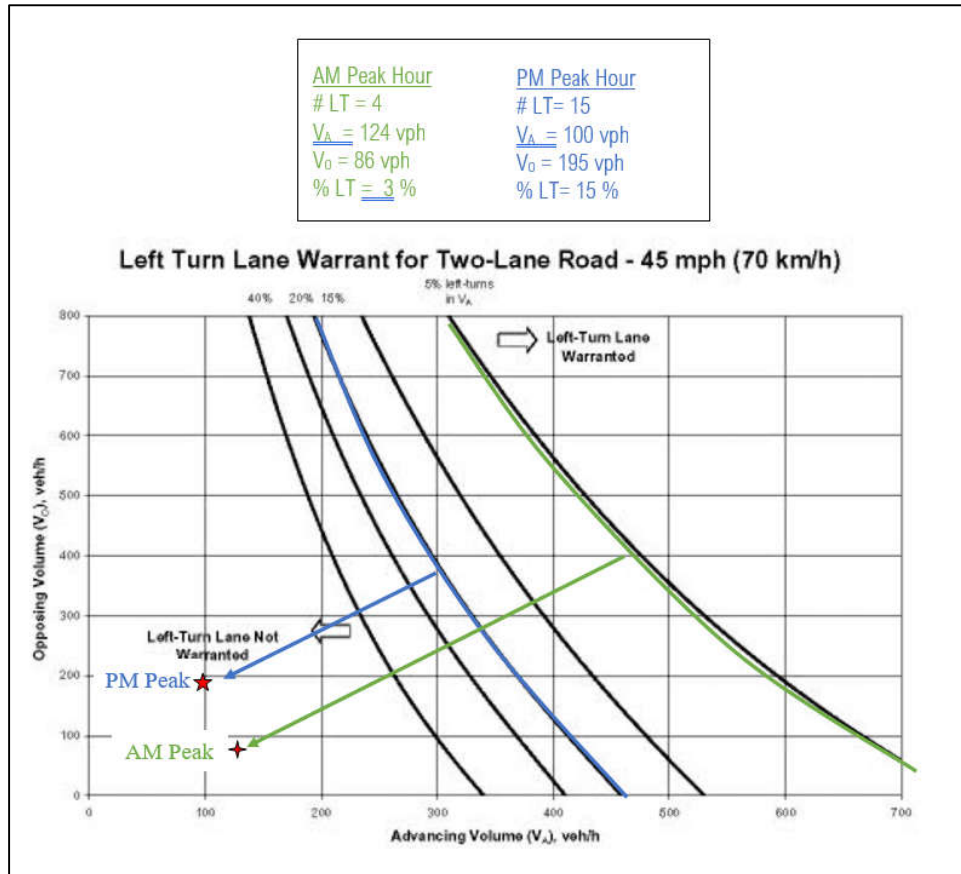


Figure 6: Westbound Left-Turn Lane Warrant – Richland Road at Site Drive

**Operating Conditions:** The study intersections were evaluated using the methodologies described previously. The proposed site drive was assumed to have one lane exiting and one lane entering.

**Table 4** summarizes the results of these analyses, which reflect the 2020 Base and 2020 Build operating conditions and average delay for each of the study intersections during the weekday AM and PM peak hours. As shown, all of the study intersections currently operate at favorable levels of service overall (LOS C or better) and would continue to operate at favorable levels of service during the peak hours for the 2020 Build conditions.



**Table 4: 2020 Base and 2020 Build Capacity Analysis Summary**

Intersection / Approach	Weekday AM Peak Hour		Weekday PM Peak Hour	
	2020 Base	2020 Build	2020 Base	2020 Build
<b>Richland Road and Rolling Hills Road/Grace Lane (All-Way Stop)</b>				
Eastbound Richland Road Approach	A (8.3)	A (8.7)	B (10.2)	B (11.5)
Westbound Richland Road Approach	B (10.8)	B (12.2)	B (11.9)	B (13.9)
Northbound Rolling Hills Road Approach	B (10.9)	B (11.9)	C (17.1)	C (22.1)
Southbound Grace Lane Road Approach	B (12.0)	B (13.2)	C (17.7)	C (25.2)
<b>Overall</b>	<b>A (11.1)</b>	<b>A (12.2)</b>	<b>C (15.7)</b>	<b>C (20.4)</b>
<b>Richland Road and Olivet Road (Side-Street STOP Control)</b>				
Eastbound Richland Road Approach	Free Flow	Free Flow	Free Flow	Free Flow
Westbound Richland Road Approach	A (<1.0)	A (<1.0)	A (2.4)	A (2.3)
Northbound Olivet Road Approach	A (9.0)	A (9.1)	A (9.3)	A (9.8)
<b>Richland Road and Proposed Site Drive (Side-Street STOP Control)</b>				
Eastbound Richland Road Approach		Free Flow		Free Flow
Westbound Richland Road Approach		A (<1.0)		A (1.2)
Northbound Site Drive Approach		B (10.0)		B (10.5)

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



**CATSO Roadway Plan:** The proposed residential development was evaluated to determine if the proposed site plan provides an appropriate internal roadway network considering future developments and the City’s CATSO Roadway Plan. **Figure 7** depicts the planned roadways near the proposed Zumwalt Tract. As depicted, the CATSO Roadway Map shows a Major Collector Roadway running along the south side of the proposed development area along the Old Hawthorne subdivision that would connect the two north/south Minor Arterials, Rolling Hills Road and Olivet Road. The CATSO Roadway Map also shows a Major Collector Roadway running along the west side of the proposed Zumwalt Tract that would connect the CATSO collector on the southside of the Zumwalt Tract up to Richland Road.

However, as illustrated in **Figure 8**, the existing development to the west of the Zumwalt Tract prohibits the ability to connect a new east/west “Collector” roadway to Rolling Hills Road. And without an east-west collector between the Zumwalt Tract and Old Hawthorne, there is no need for a north/south collector road on the west side of the Zumwalt Tract property. Furthermore, the forecasted average daily traffic volumes on Richland Road, the nearest east/west roadway that would have to handle the traffic from the CATSO planned east/west collector roadway, are just over 3,200 vpd which is well below the theoretical capacity of a two-lane roadway.

The CATSO Roadway Map also shows a Minor Arterial roadway running along the east side of the proposed Zumwalt Tract that would connect Richland Road and Broadway. It is our understanding that future development to the east of the Zumwalt Tract would be responsible for incorporating this planned Arterial roadway into their plan.





## SUMMARY

CBB completed the preceding study to address the anticipated traffic impacts associated with the proposed Zumwalt Tract development generally located on the south side of Richland Road approximately three-fourths mile east of Rolling Hills Road in Columbia, Missouri.

The additional trips associated with the proposed Zumwalt Tract residential development would have minimal impact on the operating conditions at the adjacent intersections and would not warrant any roadway improvements to accommodate the proposed development.

We trust this traffic impact study adequately describes the forecasted traffic conditions that should be expected as a result of the proposed Zumwalt Tract residential development. If additional information is desired, please feel free to contact me at 314-449-9572 or [swhite@cbbtraffic.com](mailto:swhite@cbbtraffic.com).

Sincerely,

Shawn Lerai White, P.E., PTOE  
Associate - Senior Traffic Engineer