

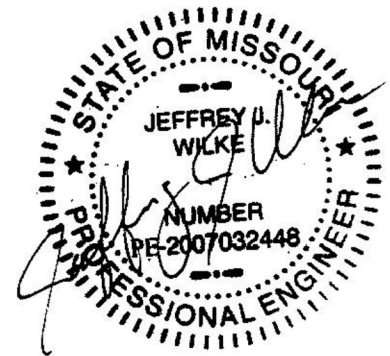
Traffic Impact Study

TriStar at Lee's Summit



LEE'S SUMMIT, MISSOURI

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Contents

1.0 INTRODUCTION.....	5
1.1 REPORT PURPOSE AND OBJECTIVES.....	5
2.0 EXISTING CONDITIONS.....	6
2.1 STREET NETWORK.....	6
2.2 STUDY AREA.....	6
2.3 SURROUNDING LAND USES.....	7
3.0 APPROVED DEVELOPMENT.....	8
4.0 PROPOSED DEVELOPMENT.....	9
4.1 SITE LOCATION.....	9
4.2 SITE CIRCULATION.....	9
4.3 TRIP GENERATION.....	9
4.4 PROJECT TRIP DISTRIBUTION AND ASSIGNMENT.....	9
5.0 ACCESS MANAGEMENT.....	11
5.1 ACCESS SPACING.....	11
5.2 TURN LANE ANALYSIS.....	11
5.3 SIGHT DISTANCE.....	11
6.0 INTERSECTION CAPACITY ANALYSIS.....	13
6.1 LEVEL OF SERVICE OVERVIEW.....	13
6.2 EXISTING LEVEL OF SERVICE ANALYSIS.....	14
6.3 EXISTING + APPROVED LEVEL OF SERVICE ANALYSIS.....	14
6.4 EXISTING + APPROVED + DEVELOPMENT LEVEL OF SERVICE ANALYSIS.....	15
7.0 CONCLUSIONS AND RECOMMENDATIONS.....	17
Appendix.....	18

TABLES

TABLE 1: TRIP GENERATION	9
TABLE 2: TRIP DISTRIBUTION.....	10
TABLE 3: INTERSECTION SIGHT DISTANCES	12
TABLE 4: LEVEL OF SERVICE	13
TABLE 5: EXISTING PEAK HOUR CONDITIONS	14
TABLE 6: EXISTING + APPROVED PEAK HOUR CONDITIONS.....	15
TABLE 7: EXISTING + APPROVED + DEVELOPMENT PEAK HOUR CONDITIONS.....	16

EXHIBITS (SEE APPENDIX A)

- EXHIBIT 1: PROJECT SITE LOCATION AND STUDY AREA
- EXHIBIT 2: EXISTING GEOMETRY AND INTERSECTION CONTROL
- EXHIBIT 3: EXISTING YEAR (2022) PEAK HOUR TRAFFIC VOLUMES
- EXHIBIT 4: EXISTING PLUS APPROVED PEAK HOUR TRAFFIC PROJECTIONS
- EXHIBIT 5: SITE TRIP DISTRIBUTION
- EXHIBIT 6: PROJECT TRAFFIC
- EXHIBIT 7: EXISTING PLUS APPROVED PLUS DEVELOPMENT PEAK HOUR TRAFFIC PROJECTIONS

1.0 INTRODUCTION

This report serves as the traffic analysis for the TriStar at Lee's Summit development, located east of Route 291 and north of Route 150 in Lee's Summit, Missouri. The location of the development is shown on **Exhibit 1** in **Appendix A**.

1.1 REPORT PURPOSE AND OBJECTIVES

The purpose of this study is to address traffic and transportation impacts of the proposed development on surrounding streets and intersections. This traffic impact study was prepared based on criteria set forth by the City of Lee's Summit *Access Management Code* and the Missouri Department of Transportation (MoDOT) *Engineering Policy Guide*. The following information is provided.

- A description and map of the existing and proposed street network to be affected by the proposed development. This information includes existing and proposed roadway characteristics and existing traffic volumes.
- Inclusion of traffic generated by the approved but unbuilt Cobey Creek Development near the proposed site.
- Trip generation calculations based on the Institute of Traffic Engineers (ITE) Trip Generation Manual, 11th Edition, for the proposed development. In addition, projected trip distributions onto the street network are provided.
- Analysis of impacts of the traffic generated by the proposed development on the street network, including analysis of peak period levels of service (LOS), delay times, and queuing at study area intersections.
- Evaluation of compliance with access management guidelines.
- Discussion of potential improvements and traffic management measures identified to mitigate operational concerns.

In summary, the study is to determine the trip generation of the TriStar at Lee's Summit development, assign new development trips to the street network, analyze various scenarios to determine the impacts of proposed site traffic, and identify potential mitigation measures needed to achieve acceptable operations at the study intersections.

2.0 EXISTING CONDITIONS

2.1 STREET NETWORK

The existing street network within the study area includes Route 291, East Outer Road, Hook Road, and Route 150. The following provides a summary of the existing street network within the study area:

Route 291 (Missouri 291) is a north-south roadway located to the west of the proposed development site. Route 291 is a four-lane divided highway with paved shoulders. Access is controlled along Route 291, which is part of the state highway system. According to the MoDOT Kansas City Functional Classification System Map, Route 291 is classified as an Other Principal Arterial. The 2020 AADT is approximately 26,200 vehicles per day (vpd) according to MoDOT Traffic Volume Maps. The posted speed limit is 60 mph.

East Outer Road is a north-south frontage road along the east side of Route 291 that is maintained by MoDOT. East Outer Road is a 22-foot-wide undivided two-lane roadway with sections of paved and aggregate shoulders. No pedestrian or bike facilities are provided on East Outer Road. According to the City of Lee's Summit Thoroughfare Master Plan, East Outer Road is classified as a Commercial Collector. The 2020 Annual Average Daily Traffic (AADT) is approximately 440 vehicles per day (vpd) according to the MoDOT Traffic Volume Maps. The posted speed limit is 45 miles per hour (mph).

Hook Road is a two-lane east-west road with a rural cross section. There is a short section of Hook Road that is only 90 feet in length, measured between the edges of Route 291 and the East Outer Road. Access is limited at the Hook Road intersection with Route 291. Right-turns are allowed from all approaches, but the only left-turn allowed is in the southbound direction. East-west through movements are also restricted.

According to the Lee's Summit Thoroughfare Master Plan, Hook Road is classified as a Minor Arterial and is to be realigned north in the future with a diamond interchange at Route 291. There is no timeline or funding for the interchange at the time of this study. The 2020 AADT is approximately 2,500 vpd to the west of Route 291 according to the MoDOT Traffic Volume Maps. The posted speed limit is 45 mph.

Route 150 (Missouri 150) is an east-west roadway located south of the proposed development. Route 150 is a four-lane divided highway. The four-lane section includes curbs and gutters with paved 10-foot shoulders but no pedestrian or bike facilities. To the east of the intersection with East Outer Road, the roadway narrows to a two-lane undivided section. The curbs, gutters, and paved shoulders end as the roadway transitions to the rural cross section. According to the MoDOT Kansas City Functional Classification System Map, Route 150 is classified as a Minor Arterial. The 2020 AADT is approximately 12,500 vpd according to the MoDOT Traffic Volume Maps. The posted speed limit is 45 mph.

2.2 STUDY AREA

Through discussion with City and MoDOT staff, the following intersections were included within the study area for the traffic analysis. The list provides the existing intersection control for each of the study intersections.

- Route 150 & East Outer Road (Signalized)
- East Outer Road & Hook Road (Two-Way Stop)
- Route 291 & Hook Road (Two-way Stop)

Exhibit 2 shows the existing geometry and intersection control at the study intersections.

Turning Movement Counts (TMCs) were collected at all three study intersections on Thursday, January 20th, 2022. **Appendix B** provides the raw turning movement counts. Counts collected for this study were compared to the traffic counts from the *Cobey Creek Development Traffic Impact Study*. Based on this comparison, the 2022 TMCs had significantly lower westbound through volumes along Route 150 in the AM peak hour and lower eastbound through volumes along Route 150 in the PM peak hour. The respective movements from the 2022 TMCs were grown to equal the volumes from the Cobey Creek study. The existing conditions turning movement counts, adjusted for analysis are shown on **Exhibit 3**.

2.3 SURROUNDING LAND USES

The development site currently consists of 54 acres of undeveloped land. The properties to the east and the southwest of the site are also undeveloped land. To the north of the site is the Shamrock Hills golf course. To the southeast of the site is existing single-family residential housing in the adjacent city of Greenwood. Directly south of the site is the Cobey Creek Development, which will include single-family housing adjacent to the development site.

3.0 APPROVED DEVELOPMENT

The Cobey Creek development has been approved but is not fully constructed or occupied at the time of this study. The approved Cobey Creek development is located to the south of the development site as shown on **Exhibit 1**. Cobey Creek includes three commercial pad sites and an assisted living facility along Route 150. The remainder of the site includes 225 single-family homes and 112 multifamily housing units.

A traffic impact study for the development was prepared in March 2018. The development trips from that study for the full build out of Cobey Creek were added to the existing conditions traffic volumes. These trips impacted the study intersections by increasing the through volume on Route 150 and on Route 291. **Exhibit 4** illustrates the existing year plus approved conditions peak hour traffic volumes. No improvements were identified at any of the common study intersections to mitigate traffic from the Cobey Creek development.

4.0 PROPOSED DEVELOPMENT

4.1 SITE DESCRIPTION

The proposed TriStar at Lee's Summit development includes multifamily residential land uses, located east of Route 291 and north of Route 150 in Lee's Summit, Missouri. Two styles of multifamily housing are proposed in the eastern portion of the site. A total of 112 four-plex units and 156 townhomes are proposed. The western portion of the site is narrow in width and contains a new street used to access the site. The proposed site plan is included in **Appendix C** for reference.

4.2 SITE CIRCULATION

The proposed development will be accessed from a new street that will extend roughly 2,000 feet east from the East Outer Road. This street will serve as the site driveway. The street will be designed to collector standards for the first 1,300 feet east from East Outer Road, where a north-south collector street will intersect in the future. The street will continue east to the development as a local street.

Several new local streets are proposed within the development. These streets include several street stubs that will connect to the adjacent parcels on the north and south as they develop.

4.3 TRIP GENERATION

Trip generation estimates were prepared using the *ITE Trip Generation Manual, 11th Edition*. **Table 1** shows the expected trips to be generated by the proposed development. The total trip generation is anticipated to be 1,793 daily trips, 106 trips during the AM peak hour (25 entering and 81 exiting), and 136 trips during the PM peak hour (86 entering and 50 exiting).

TABLE 1: TRIP GENERATION

Land Use Description	ITE LUC	Intensity / Units	Daily	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
Multifamily Housing (Low-Rise)	220	268 Dwelling Units	1,793	25	81	106	86	50	136

Appendix D provides the ITE Trip Generation Manual calculations used to determine the trip generation of the proposed site.

4.4 PROJECT TRIP DISTRIBUTION AND ASSIGNMENT

The estimated trips generated by the proposed development were assigned to the street network based on the trip distribution summarized in **Table 2**. This distribution is based on existing traffic patterns and engineering judgment, along with information from previous traffic impact studies. The detailed distribution patterns through the study intersections are shown in **Exhibit 5**.

TABLE 2: TRIP DISTRIBUTION

Direction To/From	Percentage
North on Route 291	70%
West on Route 150	25%
East on Route 150	5%
Total	100%

Exhibit 6 shows the development trip assignment. Trips to/from the south on Route 291 are expected to use the interchange with Route 150 and are a part of the distribution to/from the east on Route 150.

No development trips were distributed through the internal street network of the Cobey Creek development. Only local residential streets will connect between the developments. There will be several intersections and turns within Cobey Creek before reaching Route 150. Eventually a north-south collector street from the Cobey Creek development will connect between Route 150 and the TriStar site driveway. The collector will pass through the adjacent property to the west before reaching the site driveway. There are no known plans to develop that property and complete the north-south collector street at this time.

The development trip assignments were added to the existing year plus approved conditions traffic volumes. **Exhibit 7** illustrates the existing year plus approved plus development peak hour traffic volumes.

5.0 ACCESS MANAGEMENT

MoDOT has access management guidelines in the *Engineering Policy Guide (EPG)* that address the location and design of access points. The guidelines were used to review various aspects of the proposed development in the following sections. MoDOT criteria was used to evaluate the site access, since the East Outer Road is maintained by MoDOT.

5.1 ACCESS SPACING

The *EPG* includes minimum spacing criteria between intersections and driveways. For a minor roadway, such as the East Outer Road, the minimum spacing between intersections is 660 feet to 1,320 feet and the minimum spacing between driveways is 220 feet to 330 feet. To the south along East Outer Road, the closest intersection is Route 150, which is roughly 3,000 feet away. To the north, there is a gated driveway for the golf course maintenance area roughly 140 feet north of the site driveway. The driveways to the golf course parking lot are about 1,000 feet to the north.

The intersection and driveway spacing criteria from the *EPG* are satisfied, except for to the golf course maintenance facility. It is worth noting that the maintenance facility driveway is seldom used, as it is gated and not open to the public. Therefore, the spacing between the site access drive and the golf course maintenance driveway is not expected to be a safety or operational concern.

5.2 TURN LANE ANALYSIS

The need for turn lanes was determined based on the warranting criteria listed in the *EPG*. Turn lane analyses were completed at the study intersections for each turning movement that will be impacted by development traffic. Only movements without existing turn lanes were analyzed.

Turn lane analyses were completed for the following movements:

- Route 150 & East Outer Road – Westbound Right Turn
- Route 150 & East Outer Road – Southbound Right Turn
- East Outer Road & Site Driveway – Northbound Right Turn
- East Outer Road & Site Driveway – Southbound Left Turn

For each movement, the Existing, Existing plus Approved, and Existing plus Approved plus Development conditions were analyzed for both the AM & PM peak hours. None of the volumes warrant turn lanes.

Appendix F provides turn lane analysis graphs for each turning movement analyzed.

5.3 SIGHT DISTANCE

Intersection sight distance is provided at intersections to allow the drivers of stopped vehicles to depart from their approach and enter or cross the uncontrolled street. These distances are generous, allowing enough distance for the stopped driver to complete their turning or crossing maneuver without requiring through traffic on the uncontrolled street to reduce their speed. Recommended intersection sight distances are provided in *A Policy on Geometric Design of Highways and Streets (7th Edition)*, also referred to as the AASHTO Green Book published by the American Association of State Highway and Transportation Officials (AASHTO).

Sight distances were measured in the field at the proposed site driveway intersection along East Outer Road and are provided in **Table 3**. The 45-mph speed limit was used to evaluate the recommended sight distance. All measured intersection sight distances exceed the AASHTO recommended distances.

TABLE 3: INTERSECTION SIGHT DISTANCES

Intersection	Direction Looking	Intersection Sight Distance (feet)	
		Field Measurement	Recommended
East Outer Road & Site Driveway	North	> 600	500
	South	> 600	430

6.0 INTERSECTION CAPACITY ANALYSIS

6.1 LEVEL OF SERVICE OVERVIEW

Intersection capacity analysis was performed at the study intersections for the following three scenarios:

- Existing year 2022
- Existing plus approved
- Existing plus approved plus development

The capacity analysis was performed for the weekday AM and PM peak hours using Synchro traffic modeling software to determine intersection delay and level of service (LOS). Calculations were performed based on the methodologies outlined in the *Highway Capacity Manual (HCM)*, 6th Edition, which is published by the Transportation Research Board.

LOS is a quantitative measure used by traffic engineers to describe the operations of an intersection. It ranges from A to F, with A being the best and F being the worst level of operation. LOS A conditions are characterized by minimal vehicle delay and free-flow conditions, while LOS F is characterized by long vehicle delay – usually when demand exceeds available roadway capacity. Although LOS E is defined as at-capacity, LOS D is generally considered the minimum acceptable level of operation at an intersection. For two-way stop-controlled intersections, LOS was reported for the worst approach. This was done to ensure that the mainline LOS did not hide any potential issues on the minor street.

Table 4 shows the definition of LOS for unsignalized and signalized intersections. The LOS rating deemed acceptable varies by community, facility type and traffic control device. Lee's Summit has identified LOS C as the minimum desirable goal for signalized and unsignalized intersections. However, LOS D may be deemed acceptable. At unsignalized intersections LOS D, E, or even F are often considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

TABLE 4: LEVEL OF SERVICE

Level of Service	Average Control Delay (seconds/vehicle) at:	
	Unsignalized Intersections	Signalized Intersections
A	0 – 10	0 – 10
B	> 10 – 15	> 10 – 20
C	> 15 – 25	> 20 – 35
D	> 25 – 35	> 35 – 55
E	> 35 – 50	> 55 – 80
F	> 50	> 80

Traffic queues were also evaluated as part of the analyses. Long traffic queues which extend beyond the amount of storage available, either between intersections or within turn lanes, can have significant impacts on operations. The projected vehicular queues were analyzed to ensure the analyses are reflective of the physical constraints of the study intersections and to identify if additional storage is needed for turn lanes.

6.2 EXISTING LEVEL OF SERVICE ANALYSIS

Capacity analysis was conducted for existing traffic conditions at the study intersections to determine baseline conditions for the existing analysis year and to calibrate the models. The analysis was performed for weekday AM and PM peak hours and is based on the lane configurations and traffic volumes shown in **Exhibits 2 and 3**. The Synchro reports are provided in **Appendix E**.

Table 5 provides a summary of the capacity analysis at the study intersections. For two-way stop control intersections, the intersection delay was reported as the worst approach delay.

TABLE 5: EXISTING PEAK HOUR CONDITIONS

Intersection	Approach	Operational Analysis Results									
		AM Peak Hour					PM Peak Hour				
		Delay (sec/veh)	LOS	95% Queue	Intersection		Delay (sec/veh)	LOS	95% Queue	Intersection	
Delay (sec/veh)	LOS				Delay (sec/veh)	LOS					
Route 150 & East Outer Road (Traffic Signal)	EB LT	7.6	A	< 50'	10.4	B	9.6	A	< 50'	15.6	B
	EB RT/Thru	6.9	A	73'			14.3	B	378'		
	WB LT	6.7	A	< 50'			10.8	B	< 50'		
	WB RT/Thru	10.1	B	302'			11.3	B	160'		
	NB LT	18.3	B	112'			34.4	C	125'		
	NB RT/Thru	17.9	B	< 50'			36.0	D	< 50'		
	SB LT	22.2	C	< 50'			36.8	D	71'		
	SB RT/Thru	23.7	C	< 50'			39.6	D	< 50'		
East Outer Road & Hook Road	NB LT	7.3	A	< 50'	8.6	A	7.3	A	< 50'	8.7	A
	EB RT	8.6	A	< 50'			8.7	A	< 50'		
Route 291 & Hook Road	WB RT	16.7	C	< 50'	16.7	C	13.5	B	< 50'	13.5	B
	SB LT	15.1	C	< 50'			12.1	B	< 50'		

Based on the analysis, all intersections are anticipated to operate at acceptable LOS with manageable queues. No queues exceed the length of their respective turn lanes, and no queues extend back to adjacent intersections. There are a few individual movements at the Route 150 & East Outer Road intersection that operate at LOS D. These are movements from the minor street approaches, and the longer delay results from evaluating the signal with a 120-second cycle length. It is important to note that the overall intersection operates at LOS B.

6.3 EXISTING + APPROVED LEVEL OF SERVICE ANALYSIS

Capacity analysis was conducted for existing plus approved traffic conditions at the study intersections to determine baseline conditions with the approved development that is anticipated to impact volumes at the study intersections. The analysis was performed for weekday AM and PM peak hours and is based on the traffic volumes shown in **Exhibit 4**. The lane configurations and traffic controls for the analysis remain the same as in the existing conditions scenario. The Synchro reports are provided in **Appendix E**.

Table 6 provides a summary of the capacity analysis at the study intersections. For two-way stop control intersections, the intersection delay was reported as the worst approach delay.

TABLE 6: EXISTING + APPROVED PEAK HOUR CONDITIONS

Intersection	Approach	Operational Analysis Results									
		AM Peak Hour					PM Peak Hour				
		Delay (sec/veh)	LOS	95% Queue	Intersection		Delay (sec/veh)	LOS	95% Queue	Intersection	
Delay (sec/veh)	LOS				Delay (sec/veh)	LOS					
Route 150 & East Outer Road (Traffic Signal)	EB LT	7.7	A	< 50'	10.6	B	9.6	A	< 50'	16.2	B
	EB RT/Thru	6.6	A	77'			15.6	B	457'		
	WB LT	6.4	A	< 50'			11.8	B	< 50'		
	WB RT/Thru	10.2	B	338'			11.5	B	175'		
	NB LT	20.7	C	122'			34.8	C	127'		
	NB RT/Thru	20.0	B	< 50'			36.5	D	< 50'		
	SB LT	24.8	C	< 50'			37.3	D	72'		
	SB RT/Thru	28.2	C	< 50'			40.1	D	< 50'		
East Outer Road & Hook Road	NB LT	7.3	A	< 50'	8.6	A	7.3	A	< 50'	8.7	A
	EB RT	8.6	A	< 50'			8.7	A	< 50'		
Route 291 & Hook Road	WB RT	17.3	C	< 50'	17.3	C	13.5	B	< 50'	13.5	B
	SB LT	15.7	C	< 50'			12.1	B	< 50'		

Based on the analysis, all intersections are anticipated to continue operating at acceptable LOS. Queues are nominally impacted by the addition of development traffic. Several individual side street movements are projected to operate at LOS D at the Route 150 & East Outer Road intersection, as they did in the previous scenario. The overall intersection is projected to continue operating at LOS B.

6.4 EXISTING + APPROVED + DEVELOPMENT LEVEL OF SERVICE ANALYSIS

Capacity analysis was conducted for existing plus approved plus development traffic conditions at the study intersections to determine the impacts of the proposed site traffic. The analysis was performed for weekday AM and PM peak hours and is based on the traffic volumes shown in **Exhibit 7**. The lane configurations and traffic controls for the analysis remain the same as in the existing conditions scenario. The Synchro reports are provided in **Appendix E**.

Table 7 provides a summary of the capacity analysis at the study intersections. For side street stop control intersections, the intersection delay was reported as the worst approach delay.

The analysis results in **Table 7** indicate that the addition of development trips is projected to have a negligible impact on delays and queuing at the study intersections. The nominal increase in traffic from the proposed development is not anticipated to change the intersection LOS at any of the study intersections. The site driveway intersection along the East Outer Road is projected to operate at LOS A during peak times.

TABLE 7: EXISTING + APPROVED + DEVELOPMENT PEAK HOUR CONDITIONS

Intersection	Approach	Operational Analysis Results									
		AM Peak Hour					PM Peak Hour				
		Delay (sec/veh)	LOS	95% Queue	Intersection		Delay (sec/veh)	LOS	95% Queue	Intersection	
Delay (sec/veh)	LOS				Delay (sec/veh)	LOS					
Route 150 & East Outer Road (Traffic Signal)	EB LT	7.9	A	< 50'	10.9	B	9.6	A	< 50'	16.6	B
	EB RT/Thru	6.7	A	78'			15.5	B	457'		
	WB LT	6.6	A	< 50'			12.1	B	< 50'		
	WB RT/Thru	10.5	B	348'			12.7	B	176'		
	NB LT	20.9	C	124'			35.9	D	127'		
	NB RT/Thru	20.4	C	< 50'			37.6	D	< 50'		
	SB LT	24.9	C	< 50'			38.1	D	75'		
	SB RT/Thru	26.9	C	< 50'			41.1	D	< 50'		
East Outer Road & Hook Road	NB LT	7.4	A	< 50'	8.7	A	7.3	A	< 50'	9.0	A
	EB RT	8.7	A	< 50'			9.0	A	< 50'		
Route 291 & Hook Road	WB RT	20.5	C	< 50'	20.5	C	14.5	B	< 50'	14.5	B
	SB LT	16.3	C	< 50'			13.2	B	< 50'		
East Outer Road & Site Driveway	WB	9.0	A	< 50'	9.0	A	9.2	A	< 50'	9.2	A
	SB LT	7.3	A	< 50'			7.4	A	< 50'		

7.0 CONCLUSIONS AND RECOMMENDATIONS

A traffic impact study for the TriStar at Lee's Summit development has been prepared by Kimley-Horn. The proposed site is located east of Route 291 and north of Route 150 in Lee's Summit, Missouri. Existing, Existing plus Approved, and Existing plus Approved plus Development traffic conditions were analyzed. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. The following provides a summary of the analysis.

Intersection capacity analysis was performed at the study intersections for the following three scenarios:

- Existing year 2022
- Existing plus approved
- Existing plus approved plus development

Counts were collected in January 2022 to serve as the baseline for analysis. All study intersections were found to currently be operating at acceptable levels of service.

In the Existing plus Approved scenario, traffic was added from the full-build out of the nearby Cobey Creek development that is approved but unbuilt at the time of this study. With the addition of approved development traffic, all study intersections are projected to continue operating at acceptable levels of service.

The proposed development is projected to generate 1,793 daily trips, 106 trips in the AM peak hour, and 136 trips in the PM peak hour. The nominal increase in traffic from the proposed development is not anticipated to change the intersection LOS at any of the study intersections. The site driveway intersection along the East Outer Road is projected to operate at excellent levels of service during peak times. As such, no improvements are identified to mitigate the addition of development traffic.