Traffic Impact Study

Ovation Residential

Lee’s Summit, Missouri

Prepared For:

Engineering Solutions

Date:

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Lee's Summit, Missouri

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EXHIBITS (SEE APPENDIX A)

1.0 INTRODUCTION

This report serves as the traffic impact study for the Ovation Residential development, located east of Route 291 and south 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, TriStar, and Summit Creek developments 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 conformance 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 Ovation Residential 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 STUDY AREA

The proposed development site is in the southeastern portion of Lee's Summit, Missouri, and consists of approximately 80 acres of undeveloped land.

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 & Market Street/Raintree Drive (Signalized)
- Route 150 & Route 291 Southbound Ramps (Signalized)
- Route 150 & Route 291 Northbound Ramps (Signalized)
- Route 150 & East Outer Road (Signalized)
- Route 150 & Doc Henry Road (Side Street Stop)

2.2 STREET NETWORK

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

Route 291 (Missouri 291) is a north-south four-lane divided highway with paved shoulders located to the west of the proposed development site. Access is controlled along Route 291, which is part of the state highway system. According to the MoDOT Functional Classification System Map, Route 291 is classified as a Principal Arterial. The 2022 Annual Average Daily Traffic (AADT) is approximately 35,700 vehicles per day (vpd) according to MoDOT traffic volume maps. The posted speed limit is 60 mph.

Route 150 (Missouri 150) is an east-west roadway along the north edge of the proposed development site. Route 150 provides access to the regional highway system with a diamond interchange at Route 291. Route 150 is a four-lane divided highway through the interchange area and to the west. 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 a rural cross section. According to the MoDOT Functional Classification System Map, Route 150 is classified as a Minor Arterial. The 2022 AADT is approximately 15,200 vpd. The posted speed limit is 45 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 2022 AADT is approximately 465 vpd north of Route 150 and approximately 2,000 vpd south of Route 150. The posted speed limit is 45 miles per hour (mph).

Market Street/Raintree Drive is a north-south frontage road along the west side of Route 291. North of Route 150, the road is called Market Street and has a three-lane undivided cross section. Sidewalks, curbs, and gutters are provided on both sides of the roadway. South of Route 150, the road is called Raintree Drive and has a two-lane cross section. Near the intersection with Route 150 both Market Street and

Raintree Drive widen for turn lanes and segments of raised medians on Raintree Drive. Raintree Drive has sidewalks on the west side and curb and gutter facilities. According to the City of Lee's Summit Thoroughfare Master Plan, Market Street/Raintree Drive is classified as a Commercial Collector. The 2021 AADT is approximately 5,200 vpd. The posted speed limit is 35 mph north of Route 150 and 45 mph south of Route 150.

2.3 TRAFFIC DATA COLLECTION

Turning movement counts were collected Thursday, January 11th, 2024. The turning movement count data collected is included in **Appendix B**. The AM peak hour occurred between 7:00 AM and 8:00 AM, and the PM peak hour occurred between 4:45 PM and 5:45 PM. The Existing (Year 2024) Conditions peak hour turning movement volumes are shown on **Exhibit 2**. The existing geometry with lane configurations and intersection control at the study intersections is shown on **Exhibit 3**.

3.0 APPROVED DEVELOPMENTS

There are several developments in the vicinity of the study area which have been approved in recent years but were not fully constructed and occupied at the time of this study. These developments are described in the following paragraphs and are shown on **Exhibit 1**.

The development trips from the traffic studies for all three of these developments were added to the Existing Conditions traffic volumes. The resulting Existing plus Approved peak hour traffic volumes are illustrated on **Exhibit 4**. The Existing plus Approved Conditions geometry with lane configurations and intersection control at the study intersections is shown on **Exhibit 5**. These lane configurations include improvements that are to be constructed in conjunction with the approved developments.

3.1 COBEY CREEK

The Cobey Creek development has been approved but is not fully constructed at the time of this study. Several single-family homes have been constructed in the eastern portion of the site. The approved Cobey Creek development is located northeast of the proposed development site, to the north of Route 150. Cobey Creek includes a drive-through bank, a sit-down restaurant, and an automobile parts sales store along Route 150. The remainder of the site includes 274 single-family lots and multifamily apartment buildings. The main access for Cobey Creek along Route 150 is a new collector street to be named Sunset Ridge.

A traffic impact study for the development was prepared in May 2024. The study recommended an eastbound left-turn lane and a westbound right-turn lane on Route 150 at Sunset Ridge. The study also indicates that with the addition of traffic from the Cobey Creek development, traffic signals will be warranted at Route 150 & Doc Henry Road as well as Route 150 & Sunset Ridge. According to MoDOT staff, the signals will not be installed at either intersection in conjunction with the Cobey Creek development, but the turn lanes will be constructed when Sunset Ridge is constructed.

3.2 SUMMIT CREEK

Summit Creek is located directly west of the proposed development site. The development will include 186 multifamily dwelling units. The site plan for Summit Creek does include a collector street extending east-west through the site to the west property line of the proposed development site. No homes have been constructed at this development at the time of this study. A traffic impact study for the development was completed in February 2020. No capacity improvements were identified at any of the study intersections to mitigate traffic from the Summit Creek development.

3.3 TRISTAR

TriStar is located approximately one mile north of the development site, with access along the East Outer Road. The development will include 268 multifamily low-rise homes. No homes have been constructed at this development at the time of this study. A traffic impact study was completed for the development in February 2022. No capacity improvements were identified at any of the study intersections to mitigate traffic from the TriStar development.

4.0 PROPOSED DEVELOPMENT

4.1 SITE DESCRIPTION

The proposed Ovation Residential development includes a variety of land uses. In the northern portion of the site along Route 150, there are 6 low-rise multifamily apartment buildings with 30 units in each building. In the northwest corner of the development site a commercial pad site is planned. There are 51 four-plex buildings located south of the apartments and commercial pad site. In the southern portion of the site there are 112 lots for single-family homes. The total number of residential units proposed for the development is 496. The proposed site plan is included in **Appendix C** for reference.

4.2 SITE CIRCULATION

The development will primarily be accessed from one new intersection on Route 150 in the northeast corner of the site, referred to as Access A for the purposes of this study. The site driveway intersection is proposed to be located approximately 1,500 feet east of the intersection of Route 150 & East Outer Road, which will align with the proposed Sunset Ridge intersection from the Cobey Creek development.

The site driveway extending south of Route 150 will be a north/south collector type street. South of Route 150 the collector street will have two horizontal curves with the apartments located to the west of the street. The collector street will then straighten and bisect the area where the four-plex buildings are located. Several local streets are planned to intersect to the north/south collector street to provide access to the apartments and four-plex buildings. The commercial pad site will be accessed through these local streets

An east-west collector street is planned to extend through the site from the Summit Creek development and will be stubbed at the east edge of the site for a future connection to the east. The north/south collector will terminate at a T-intersection with the east/west collector street. Local streets are planned to intersect the east/west collector street to provide access to the four-plex buildings and the single-family residences.

The single-family residences are accessed from a network of local streets. One of these local streets is planned to connect to the existing Belmont Farms neighborhood to the south at Sorrel Drive. It is anticipated that trips to/from the Belmont Farms neighborhood to the south may travel through the proposed development to access Route 150.

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 4.420 daily trips, 287 trips during the AM peak hour (80 entering and 207 exiting), and 393 trips during the PM peak hour (235 entering and 158 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
Single Family Detached Housing	210	112 Dwelling Units	1,120	21	62	83	70	41	111
Single Family Attached Housing	215	204 Dwelling Units	1,504	25	75	100	70	48	118
Multifamily Housing (Low-Rise)	220	180 Dwelling Units	1,229	19	60	79	62	36	98
Retail (<40k)	822	8,000 Square Feet	567	15	10	25	33	33	66
Total Development Trips			4,420	80	207	287	235	158	393

Appendix D provides the data from the *ITE Trip Generation Manual* that were 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 distributions summarized in **Table 2**. This distribution is based on existing traffic patterns, the surrounding street network, area demographics, and engineering judgement.

TABLE 2: TRIP DISTRIBUTION

Direction To/From	Percentage
North on Route 291	50%
East on Route 150	5%
South on Route 291	5%
South on Raintree Drive	5%
West on Route 150	25%
North on Market Street	10%
Total	100%

A large portion of the traffic generated by the development is expected to travel to/from the north on Route 291. The detailed distribution patterns through the study intersections are shown on **Exhibit 6**. **Exhibit 7** shows the resulting development trip assignment.

The proposed development trip assignments were added to the Existing plus Approved Conditions traffic volumes. **Exhibit 8** illustrates the Existing plus Approved plus Development Conditions peak hour traffic volumes.

5.0 ACCESS MANAGEMENT

The MoDOT *Engineering Policy Guide* (EPG) provides guidance for the design of driveways, access spacing, and the need for turn lanes at intersections. These items are discussed in the following paragraphs.

5.1 ACCESS SPACING

The EPG includes minimum spacing criteria between intersections and traffic signals. For a minor roadway classification, such as Route 150, the minimum spacing between intersections is 660 feet to 1,320 feet, and the minimum spacing between traffic signals is 1,320 feet to 2,640 feet. To the west along Route 150, the closest signalized intersection to Sunset Ridge/Access A is East Outer Road, which exceeds the minimum spacing requirements. To the east along Route 150 the closest intersection is Cobey Creek Drive, which is approximately 900 feet away. In the future, this intersection is to be converted to allow left-in/right-in/right-out only access. Therefore, the spacing from this intersection is adequate.

5.2 AUXILIARY TURN LANES

The EPG also provides turn lane warrants for right- and left-turn lanes based on traffic volumes and operating speeds. Turn lane warrant analyses were prepared for the site access along Route 150. The AM and PM peak hour volumes for the Existing plus Approved plus Development scenarios was analyzed. The results of the turn lane warrant analysis are shown in **Table 3**. **Appendix E** provides the turn lane warrant analysis.

TABLE 3: TURN LANE WARRANT ANALYSIS

Intersection	Movement	Turn Lane Warranted
Route 150 & Sunset Ridge/Access A	EB Right-Turn	YES
	WB Left-Turn	YES

The results in **Table 3** indicate that turn lanes are warranted for both turning movements into the site access.

5.3 CORNER CLEARANCE

The EPG includes minimum spacing criteria between the corner of the intersection of two public roadways and the next private driveway. The requirement along minor arterial streets is 220 to 330 feet. The distance from the intersection at Route 150 & Sunset Ridge/Access A to the nearest internal site driveway is nearly 400 feet. Therefore, the corner clearance is adequate.

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 2024) Conditions
- Existing plus Approved Conditions
- Existing plus Approved plus Development Conditions

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). The signalized intersections were evaluated based on the 2000 Edition of the HCM because the 6th Edition will not evaluate the clustered intersections at the Route 150 and Route 291 Interchange.

LOS is a qualitative 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. **Table 4** shows the definition of LOS for unsignalized and signalized intersections.

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

Levels of service are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are left turns off the major street and the side street approaches for two-way stop-controlled intersections. For signalized intersections each movement grouping is evaluated, and LOS is evaluated for the intersection as a whole.

The City of Lee's Summit has adopted LOS C as the minimum desirable LOS. However, LOS D and E may be considered acceptable for low to moderate traffic volumes, the availability of alternate routes, and the duration of activity resulting in lower LOS.

The decision to install a traffic signal is based on an evaluation of the warrants listed in the 2009 Edition of the *Manual on Uniform Traffic Control Devices* (MUTCD). The warranting criteria are based on traffic volumes, speeds, pedestrian volumes, crash history, and the adjacent street network. The traffic volume warrants were evaluated for this study.

The volume-to-capacity (v/c) ratio is a secondary measure of intersection performance. The v/c ratio represents the sufficiency of an intersection to accommodate the vehicular demand. A v/c ratio less than 0.85 generally indicates that adequate capacity is available, and vehicles are not expected to experience significant queues and delays. As the v/c ratio approaches 1.0, traffic flow may become unstable, and delay and queuing conditions may occur. Once the demand exceeds the capacity (a v/c ratio greater than 1.0), traffic flow is unstable and excessive delay and queuing is expected.

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 95th percentile 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. The 95th percentile queue represents the queue length that has only a 5% chance of being exceeded during the analysis period.

6.2 EXISTING (YEAR 2024) CONDITIONS ANALYSIS

Capacity analysis was conducted for Existing (Year 2024) Conditions at the study intersections to determine baseline conditions for the existing analysis year and to calibrate the models. Existing signal timing and coordination plans were used for this analysis. The analysis was performed for weekday AM and PM peak hours and is based on the traffic volumes, lane configurations, and traffic controls shown on **Exhibits 2** and **3**. The Synchro reports are provided in **Appendix F**.

Table 5 provides a summary of the capacity analysis at the study intersections.

TABLE 5: EXISTING (YEAR 2024) PEAK HOUR CONDITIONS

Intersection	Control	Movement	Operational Analysis Results							
			AM Peak Hour				PM Peak Hour			
			Delay (sec/veh)	LOS	95% Queue	V/C	Delay (sec/veh)	LOS	95% Queue	V/C
Route 150 & Market Street/Raintree Drive	Traffic Signal	EBL	14.7	B	54'	0.24	26.4	C	135'	0.63
		EBT	19.1	B	102'	0.21	37.7	D	243'	0.72
		EBR	17.4	B	< 50'	0.02	28.5	C	< 50'	0.03
		WBL	20.0	C	134'	0.31	64.4	E	417'	0.92
		WBT	28.0	C	265'	0.44	18.8	B	173'	0.47
		WBR	64.9	E	74'	0.11	9.8	A	< 50'	0.14
		NBL	40.3	D	114'	0.44	46.7	D	91'	0.51
		NBT	43.6	D	86'	0.41	45.3	D	84'	0.42
		NBR	41.7	D	66'	0.17	42.9	D	62'	0.15
		SBL	41.4	D	97'	0.49	42.4	D	186'	0.71
		SBT/R	43.5	D	57'	0.22	42.0	D	245'	0.63
		Overall	32.3	C	--	0.48	36.1	D	--	0.76
Route 150 & Route 291 Southbound Ramps	Traffic Signal	EBT	13.8	B	130'	0.28	9.5	A	127'	0.44
		EBR	36.6	D	< 50'	0.06	14.8	B	< 50'	0.13
		WBL	51.7	D	60'	0.19	56.0	E	54'	0.22
		WBT	1.8	A	64'	0.29	1.6	A	50'	0.20
		SBL	34.7	C	< 50'	0.14	39.8	D	115'	0.52
		SBR	34.7	C	< 50'	0.14	39.3	D	89'	0.46
		Overall	15.9	B	--	0.28	18.9	B	--	0.47

Intersection	Control	Movement	Operational Analysis Results							
			AM Peak Hour				PM Peak Hour			
			Delay (sec/veh)	LOS	95% Queue	V/C	Delay (sec/veh)	LOS	95% Queue	V/C
Route 150 & Route 291 Northbound Ramps	Traffic Signal	EBL	28.4	C	200'	0.68	26.3	C	291'	0.75
		EBT	4.7	A	< 50'	0.12	3.4	A	93'	0.41
		WBT	19.8	B	219'	0.39	18.9	B	149'	0.31
		WBR	19.3	B	88'	0.30	17.6	B	< 50'	0.16
		NBL/R	42.9	D	186'	0.65	45.2	D	161'	0.65
		Overall	22.1	C	--	0.52	16.4	B	--	0.56
Route 150 & East Outer Road	Traffic Signal	EBL	9.2	A	< 50'	0.13	7.9	A	< 50'	0.01
		EBT/R	10.4	B	64'	0.19	12.3	B	258'	0.62
		WBL	9.9	A	< 50'	0.01	8.5	A	< 50'	0.01
		WBT/R	14.2	B	211'	0.59	10.1	B	128'	0.34
		NBL	16.5	B	118'	0.46	20.1	C	81'	0.31
		NBT/R	18.8	B	< 50'	0.02	24.5	C	< 50'	0.01
		SBL	27.1	C	< 50'	0.07	24.7	C	< 50'	0.30
		SBT/R	28.6	C	< 50'	0.08	30.1	C	< 50'	0.13
		Overall	13.7	B	--	0.60	12.7	B	--	0.57
Route 150 & Doc Henry Road	Side Street Stop	WBL	7.9	A	< 50'	0.01	10.1	B	< 50'	0.03
		NB	23.3	C	< 50'	0.25	56.4	F	65'	0.53

The results in **Table 5** indicate that the signalized study intersections generally operate at LOS C or better overall. However, during the PM peak hour, the Route 150 & Market Street/Raintree Drive intersection operates at LOS D. There are a number of individual movements at the signalized intersections that operate at LOS D or E. The v/c ratios indicate that most of these movements are under capacity, therefore they are not an operational concern. The longer delays are not uncommon when drivers on side street approaches or drivers making left-turn movements wait for a green indication along a signalized arterial street corridor.

The westbound left-turn movement at the intersection of Route 150 & Market Street/Raintree Drive operates at LOS E and is near capacity due to a high turning movement volume (361 vehicles per hour) in the PM peak hour. The 95th percentile queue length for this movement is 417 feet, which extends beyond the 370-foot length of the left-turn lane. This indicates that additional capacity is needed for this movement. Due to the long green time required to serve the heavy westbound left-turn movement, the eastbound through movement operates at LOS D during the PM peak hour. This movement is under capacity and queues of traffic clear during each cycle of the signal.

The stop controlled northbound approach at the Route 150 & Doc Henry Road intersection currently operates at LOS F during the PM peak hour. Due to this lower level of service, traffic signal warrant analysis was performed for this intersection using the traffic count data collected. The intersection was found to meet only the peak hour traffic signal warrant, but not the eight-hour or four-hour warrants. The peak hour signal warrant is intended for unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time. Therefore, it is not applicable at this intersection and traffic signal installation is not currently warranted. The signal warrant analysis is included in **Appendix G**.

6.3 EXISTING PLUS APPROVED ANALYSIS

Capacity analysis was conducted for Existing plus Approved Conditions at the study intersections to determine baseline conditions with the approved developments that are 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, lane configurations, and traffic controls shown on **Exhibits 4** and **5**. The signal timing and coordination plans for the analysis remain the same as in the Existing Conditions scenario at the signalized study intersections. The Synchro reports are provided in **Appendix F.**

Table 6 provides a summary of the capacity analysis at the study intersections.

TABLE 6: EXISTING PLUS APPROVED PEAK HOUR CONDITIONS

Intersection	Control	Movement	Operational Analysis Results							
			AM Peak Hour				PM Peak Hour			
			Delay (sec/veh)	LOS	95% Queue	V/C	Delay (sec/veh)	LOS	95% Queue	V/C
Route 150 & Market Street/Raintree Drive	Traffic Signal	EBL	22.5	C	54'	0.38	30.1	C	135'	0.70
		EBT	27.6	C	127'	0.35	56.6	D	343'	0.95
		EBR	24.3	C	< 50'	0.02	29.5	C	< 50'	0.03
		WBL	24.0	C	135'	0.41	73.1	E	430'	0.95
		WBT	34.6	C	319'	0.70	21.4	C	196'	0.61
		WBR	68.7	E	75'	0.11	13.4	B	< 50'	0.14
		NBL	31.1	C	111'	0.27	44.6	D	90'	0.44
		NBT	30.8	C	82'	0.17	48.6	D	84'	0.38
		NBR	31.0	C	63'	0.17	43.6	D	62'	0.15
		SBL	40.4	D	97'	0.48	36.5	D	185'	0.60
		SBT/R	38.4	D	56'	0.15	42.7	D	245'	0.56
		Overall	34.1	C	--	0.55	42.0	D	--	0.81
Route 150 & Route 291 Southbound Ramps	Traffic Signal	EBT	9.1	A	157'	0.29	9.7	A	126'	0.57
		EBR	22.9	C	< 50'	0.06	11.5	B	< 50'	0.13
		WBL	52.2	D	65'	0.21	63.6	E	< 50'	0.25
		WBT	0.6	A	< 50'	0.32	1.2	A	< 50'	0.26
		SBL	41.8	D	56'	0.31	38.7	D	148'	0.59
		SBR	40.7	D	< 50'	0.14	41.4	D	155'	0.67
		Overall	14.0	B	--	0.34	18.6	B	--	0.56
Route 150 & Route 291 Northbound Ramps	Traffic Signal	EBL	35.9	D	211'	0.66	26.6	C	256'	0.77
		EBT	5.0	A	52'	0.16	4.8	A	130'	0.57
		WBT	16.5	B	262'	0.43	20.6	C	201'	0.40
		WBR	18.1	B	200'	0.47	19.1	B	57'	0.23
		NBL/R	43.7	D	108'	0.44	34.5	C	85'	0.25
		Overall	21.3	C	--	0.52	15.7	B	--	0.57

Intersection	Control	Movement	Operational Analysis Results							
			AM Peak Hour				PM Peak Hour			
			Delay (sec/veh)	LOS	95% Queue	V/C	Delay (sec/veh)	LOS	95% Queue	V/C
Route 150 & East Outer Road	Traffic Signal	EBL	15.1	B	< 50'	0.20	7.8	A	< 50'	0.08
		EBT/R	18.0	B	104'	0.37	15.2	B	451'	0.73
		WBL	6.9	A	< 50'	0.02	10.8	B	< 50'	0.12
		WBT/R	15.7	B	283'	0.65	11.7	B	185'	0.41
		NBL	25.5	C	201'	0.70	27.0	C	109'	0.48
		NBT/R	21.6	C	< 50'	0.04	31.5	C	< 50'	0.04
		SBL	30.1	C	< 50'	0.07	27.8	C	51'	0.22
		SBT/R	30.8	C	< 50'	0.03	34.6	C	< 50'	0.13
		Overall	17.9	B	--	0.72	15.6	B	--	0.69
Route 150 & Sunset Ridge	Side Street Stop	EBL	10.7	B	< 50'	0.11	9.9	A	< 50'	0.19
		SBL	49.3	E	< 50'	0.40	> 100	F	100'	0.94
		SBR	24.4	C	50'	0.41	15.2	C	< 50'	0.25
Route 150 & Doc Henry Road	Side Street Stop	WBL	8.1	A	< 50'	0.01	10.4	B	< 50'	0.03
		NB	27.8	D	< 50'	0.29	82.2	F	83'	0.65

Based on the analysis, most of the signalized study intersections are projected to operate at LOS C or better overall with the addition of approved development traffic. During the PM peak hour, the Route 150 & Market Street/Raintree Drive intersection is projected to continue operating at LOS D. Several individual movements at the signalized study intersections are projected to continue to operate at LOS D and LOS E but are projected to remain under capacity. These results are fairly consistent with the Existing Conditions analysis results.

The stop controlled northbound approach at the Route 150 & Doc Henry Road intersection is projected to continue operating at LOS F during the PM peak hour. During the AM peak hour, the movement is projected to operate at LOS D. Traffic signal warrant analysis was performed for this intersection using the Existing plus Approved traffic volumes. Time of day distribution factors from the Trip Generation Manual were used to develop hourly volumes for the approved development trips. The intersection was found to meet the peak hour traffic signal warrant, but not the eight-hour or four-hour warrants. Therefore, traffic signal installation is not projected to be warranted at the Route 150 & Doc Henry Road intersection with the addition of approved development traffic. The signal warrant analysis is included in **Appendix G**.

The stop controlled southbound left-turn movement at the Route 150 & Sunset Ridge intersection is projected to operate at LOS F during the PM peak hour, and the volume to capacity ratio indicates that the movement will be approaching capacity. Due to these conditions, traffic signal warrant analysis was performed for the intersection. The intersection was found to meet the eight-hour vehicular volume warrant. The signal warrant analysis is included in **Appendix G**.

6.4 EXISTING PLUS APPROVED PLUS DEVELOPMENT ANALYSIS

Several improvements are needed at the intersection of Route 150 & Sunset Ridge/Access A to the site to accommodate development traffic. A traffic signal is projected to be warranted for Existing plus Approved plus Development Conditions at the intersection. The signal warrant analysis is included in **Appendix G**. A summary of the improvements at the intersection are listed below:

Route 150 & Sunset Ridge/Access A

- Install a traffic signal.
- Construct an eastbound right-turn lane with a minimum storage length of 200 feet plus an appropriate taper.
- Construct a westbound left-turn lane with a minimum storage length of 200 feet plus an appropriate taper.
- Construct two northbound lanes existing the site. The left lane should be designated as a two-way left-turn lane between Route 150 and the first local street intersection to the south of Route 150, a distance of nearly 400 feet.

The lane configurations and geometry for Existing plus Approved plus Development Conditions are shown on **Exhibit 9**.

Capacity analysis was conducted for Existing plus Approved plus Development 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, lane configurations, and traffic controls shown on **Exhibits 8** and **9**. The signal timings for this scenario were optimized during the AM peak hour, but the cycle lengths and offsets remain the same as in the Existing Conditions scenario. The Synchro reports are provided in **Appendix F.**

Table 7 provides a summary of the capacity analysis at the study intersections.

TABLE 7: EXISTING PLUS APPROVED PLUS DEVELOPMENT PEAK HOUR CONDITIONS

Intersection	Control	Movement	Operational Analysis Results							
			AM Peak Hour				PM Peak Hour			
			Delay (sec/veh)	LOS	95% Queue	V/C	Delay (sec/veh)	LOS	95% Queue	V/C
Route 150 & Market Street/Raintree Drive	Traffic Signal	EBL	22.4	C	55'	0.40	32.0	C	140'	0.73
		EBT	27.2	C	134'	0.36	68.0	E	374'	1.01
		EBR	23.8	C	< 50'	0.02	29.7	C	< 50'	0.03
		WBL	25.3	C	144'	0.44	75.7	E	441'	0.96
		WBT	37.8	D	347'	0.72	20.9	C	204'	0.64
		WBR	74.7	E	81'	0.12	14.4	B	< 50'	0.15
		NBL	32.2	C	110'	0.27	44.6	D	90'	0.44
		NBT	32.0	C	82'	0.18	48.6	D	84'	0.38
		NBR	32.2	C	65'	0.18	43.7	D	71'	0.15
		SBL	40.5	D	100'	0.48	37.3	D	196'	0.63
		SBT/R	39.0	D	56'	0.16	42.7	D	245'	0.56
		Overall	36.1	C	--	0.57	46.4	D	--	0.84

Intersection	Control	Movement	Operational Analysis Results							
			AM Peak Hour				PM Peak Hour			
			Delay (sec/veh)	LOS	95% Queue	V/C	Delay (sec/veh)	LOS	95% Queue	V/C
Route 150 & Route 291 Southbound Ramps	Traffic Signal	EBT	10.3	B	161'	0.30	10.6	B	131'	0.64
		EBR	28.5	C	< 50'	0.06	12.4	B	< 50'	0.13
		WBL	55.6	E	81'	0.26	67.0	E	< 50'	0.30
		WBT	0.5	A	< 50'	0.35	1.3	A	< 50'	0.30
		SBL	42.6	D	75'	0.43	39.1	D	197'	0.69
		SBR	41.6	D	61'	0.29	40.1	D	184'	0.70
		Overall	15.0	B	--	0.39	19.2	B	--	0.62
Route 150 & Route 291 Northbound Ramps	Traffic Signal	EBL	36.4	D	206'	0.74	28.2	C	244'	0.78
		EBT	3.4	A	61'	0.20	7.1	A	173'	0.70
		WBT	15.7	B	254'	0.47	23.2	C	230'	0.48
		WBR	18.6	C	228'	0.56	21.3	C	62'	0.28
		NBL/R	43.8	D	114'	0.46	32.6	C	95'	0.26
		Overall	20.3	C	--	0.59	17.2	B	--	0.63
Route 150 & East Outer Road	Traffic Signal	EBL	11.1	B	< 50'	0.24	8.1	A	< 50'	0.09
		EBT/R	10.6	B	114'	0.29	19.3	B	588'	0.85
		WBL	9.4	A	< 50'	0.02	12.7	B	< 50'	0.13
		WBT/R	16.6	B	364'	0.73	12.3	B	234'	0.50
		NBL	31.7	C	203'	0.76	27.4	C	109'	0.49
		NBT/R	24.0	C	< 50'	0.04	31.9	C	< 50'	0.04
		SBL	32.2	C	< 50'	0.07	28.3	C	50'	0.23
		SBT/R	33.0	C	< 50'	0.04	35.0	D	< 50'	0.13
		Overall	17.2	B	--	0.79	17.2	B	--	0.78
Route 150 & Sunset Ridge/Access A	Traffic Signal	EBL	27.8	C	< 50'	0.58	12.7	B	56'	0.28
		EBT	11.0	B	157'	0.29	40.6	D	844'	0.91
		EBR	9.2	A	< 50'	0.05	9.8	A	< 50'	0.16
		WBL	9.8	A	< 50'	0.01	22.9	C	< 50'	0.11
		WBT	34.2	C	767'	0.92	18.0	B	347'	0.69
		WBR	10.2	B	< 50'	0.01	10.8	B	< 50'	0.02
		NBL	34.8	C	228'	0.64	32.8	C	185'	0.47
		NBT/R	36.7	D	< 50'	0.01	38.3	D	< 50'	0.01
		SBL	37.3	D	67'	0.20	33.1	C	64'	0.21
		SBR	43.5	D	< 50'	0.09	40.8	D	73'	0.05
		Overall	29.4	C	--	0.85	28.6	C	--	0.79
Route 150 & Doc Henry Road	Side Street Stop	WBL	7.9	A	< 50'	0.01	10.4	B	< 50'	0.03
		NB	28.6	D	< 50'	0.30	87.1	F	88'	0.67

The results in **Table 7** indicate that the signalized study intersections are projected to operate at LOS C or better overall with the addition of proposed development traffic. The exception is the intersection of Route 150 & Market Street/Raintree Drive, which is projected to continue to operate at LOS E during the PM peak hour. The same movements that operate at lower levels of service in the previous scenarios are projected to do so in this scenario. The westbound left-turn movement at the Route 150 & Market Street/Raintree Drive intersection is projected to have a 95th percentile queue of 441 feet during the PM peak hour. This is an increase of 24 feet, or one vehicle length, when compared to the Existing Conditions scenario. Optimizing the signal timings during the PM peak hour may improve these conditions.

The westbound right-turn movement at the Route 150 & Route 291 northbound ramps intersection was initially projected to have a 95th percentile queue length that exceeded the available storage length during

the AM peak hour. Due to the lengthy queue for the westbound right-turn movement, the split times at the intersection were optimized for the AM peak hour only. With optimized split times, the 95th percentile queue length is now projected to be 228 feet, which is contained within the storage length of the turn lane.

The intersection at Route 150 & Sunset Ridge/Access A intersection is projected to operate at LOS C overall during the AM and PM peak hours. The northbound and southbound movements are projected to operate at LOS D. This is not uncommon for minor street movements at signalized intersections along arterial streets. These movements are projected to operate under capacity. The 95th percentile queue length for the northbound left-turn movement is projected to be 228 feet during the AM peak hour. This queue length can be stored in a two-way left-turn lane that extends to the first local street intersection to the south of Route 150.

Long queues are projected for the westbound and eastbound through movements at the Route 150 & Sunset Ridge/Access A intersection during the AM and PM peak hours, respectively. These movements are both projected to have volume to capacity ratios greater than 0.90 when these queues are long. Though projected to operate at acceptable levels of LOS, additional through lanes in the eastbound and in the westbound direction will be needed along Route 150 to reduce these long queue lengths. Additionally, coordinating the Route 150 & Sunset Ridge/Access A signal with the Route 150 & East Outer Road signal will provide progression for through traffic and reduce queuing in the eastbound direction at the Route 150 & Sunset Ridge/Access A intersection.

The stop controlled northbound approach at the Route 150 & Doc Henry Road intersection is projected to continue operating at LOS F during the PM peak hour. Traffic signal warrant analysis was performed for this intersection using the Existing plus Approved plus Development traffic volumes. Time of day distribution factors from the Trip Generation Manual were used to develop hourly volumes for the development trips. The intersection was found to meet only the peak hour traffic signal warrant, but not the eight-hour or four-hour warrants. Therefore, traffic signal installation is not projected to be warranted with the addition of development traffic. The signal warrant analysis is included in **Appendix G**.

City staff has expressed concern regarding eastbound queues and lane utilization at the Route 150 & East Outer Road intersection. East of the intersection, there is only a short 150-foot section of roadway with two eastbound lanes before it reduces to a single eastbound lane and transitions to the undivided roadway. Therefore, eastbound drivers may not use both eastbound lanes to travel through the intersection. This situation was discussed with City and MoDOT staff. It was determined that extending the pavement section for the two eastbound through lanes to approximately 400 feet east of the intersection before transitioning to the undivided roadway would improve lane utilization. This widening will allow a short eastbound left-turn lane to be provided for the existing fast-food restaurant driveway. Additionally, coordinating the Route 150 & East Outer Road signal with the Route 291 & Route 150 ramp terminal signals will provide progression for eastbound traffic and reduce queuing at the Route 150 & East Outer Road intersection.

7.0 CONCLUSIONS AND RECOMMENDATIONS

A traffic impact study for the Ovation Residential development has been prepared by Kimley-Horn. The proposed site is located east of Route 291 and south of Route 150 in Lee's Summit, Missouri. 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 2024) Conditions
- Existing plus Approved Conditions
- Existing plus Approved plus Development Conditions

The signalized study intersections generally operate at LOS C or better overall. However, during the PM peak hour, the Route 150 & Market Street/Raintree Drive intersection operates at LOS D. There are a number of individual movements at the signalized intersections that operate at LOS D or E. Most of these movements are under capacity, therefore they are not an operational concern.

In the Existing plus Approved scenario, traffic was added from the full-build out of the Cobey Creek, Summit Creek, and TriStar developments that are approved but unbuilt at the time of this study. At the Route 150 & Sunset Ridge intersection, the southbound left-turn movement is projected to operate at LOS F during the PM peak hour. The intersection at Route 150 & Sunset Ridge was found to warrant a traffic signal for Existing plus Approved Conditions. The northbound approach at the Route 150 & Doc Henry Road intersection is projected to operate at lower levels of service during both peak hours, but conditions are not projected to warrant a traffic signal.

The proposed development is projected to generate 4,420 daily trips, 287 trips in the AM peak hour (80 entering and 207 exiting), and 393 trips in the PM peak hour (235 entering and 158 exiting). Site trips will access the site via Access A on Route 150. The access will align with the proposed Sunset Ridge intersection.

Several improvements are needed at the intersection of Route 150 & Sunset Ridge/Access A to the site to accommodate development traffic. A summary of the improvements at the intersection are listed below:

Route 150 & Sunset Ridge/Access A

- Install a traffic signal and interconnect it with the traffic signal at the Route 150 & East Outer Road intersection.
- Construct an eastbound right-turn lane with a minimum storage length of 200 feet plus an appropriate taper.
- Construct a westbound left-turn lane with a minimum storage length of 200 feet plus an appropriate taper.
- Construct two northbound lanes existing the site. The left lane should be designated as a two-way left-turn lane between Route 150 and the first local street intersection to the south of Route 150, a distance of nearly 400 feet.

The intersection at Route 150 & Sunset Ridge/Access A intersection is projected to operate at LOS C overall during the AM and PM peak hours with the aforementioned improvements. The eastbound and westbound through movements are projected to have long queues during the peak hours. Additional

through lanes in the eastbound and in the westbound direction will be needed along Route 150 to reduce these long queue lengths.

The stop controlled northbound approach at the Route 150 & Doc Henry Road intersection is projected to continue operating at LOS F during the PM peak hour with the addition of development traffic. A traffic signal is not projected to be warranted with the addition of development traffic.

City staff has expressed concern regarding eastbound queues and lane utilization at the Route 150 & East Outer Road intersection. It was discussed with City and MoDOT staff that extending the eastbound through lanes to approximately 400 feet east of the intersection would improve lane utilization. Additionally, coordinating the Route 150 & East Outer Road signal with the Route 291 & Route 150 ramp terminal signals will provide progression for eastbound traffic and reduce queuing at the Route 150 & East Outer Road intersection.

The following improvements are identified at the East Outer Road intersection:

Route 150 & East Outer Road

- Extend the pavement section for the two eastbound through lanes to approximately 400 feet east of the intersection before transitioning to the undivided roadway. Construct a new transition from the four-lane divided roadway to the two-lane undivided roadway after that distance.
- Interconnect the traffic signal with the traffic signal at the Route 291 northbound ramps intersection.