Renaissance Infrastructure Consulting

100% EMPLOYEE OWNED

TRAFFIC IMPACT STUDY

Heartland Market

Lee's Summit, MO

Prepared For:

Great American Dream LLC

Prepared By:

Renaissance Infrastructure Consulting

November 2022

November 23, 2022

Great American Dream LLC
Jack Hopkins
PO BOX 200
Raymore, MO 64083

RE: NE Colbern Road & NE Rice Road C-Store - Traffic Impact Study
Lee's Summit, MO

Dear Jack Hopkins,

In response to your request, RIC has completed a traffic impact study for a proposed Convenience Store to be located northeast of NE Colbern Road & Rice Road in Lee's Summit, MO. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. The following report documents our analysis and recommendations.

Please do not hesitate to contact us should you have any questions.

Sincerely,

Renaissance Infrastructure Consulting

Grant Niehus, PE, PTOE
Traffic Engineer

Contents

1 Introduction

In response to your request, Renaissance Infrastructure Consulting (RIC) has completed the following Traffic Impact Study (TIS) for a proposed development in Lee's Summit, MO. The purpose of this study was to assess the impact of the proposed development on the existing roadway network. To evaluate the increase of traffic on adjacent streets, the number of trips in the AM and PM peak periods were estimated. Existing traffic counts were collected to conduct a capacity analysis at the study intersections. The study also includes analysis on access management and provides recommendations for proposed geometric and traffic control improvements that may be necessary for the proposed development.

Figure 1 – Project Location

2 Study Scope

Guidance provided by the City of Lee's Summit Access Management Code and MoDOT's Engineering Policy Guide were used in the development of this study and its associated scope.

2.1 Study Area

Based on discussions with the city and MoDOT, the study area for this TIS includes the following intersections:

- *Missouri Route 291 Northbound Ramp & NE Colbern Road*
- *NE Colbern Road & NE Rice Road*
- *NE Colbern Road & NE Todd George Parkway*
- *NE Colbern Road & Lucky Road*
- *NE Rice Road & Ikerd Road*
- *Lucky Road & Proposed East Driveway*

2.2 Analysis Scenarios

For this traffic study, analysis was completed for the following scenarios:

- *Existing Conditions*
- *Existing Plus Proposed Conditions*

2.3 Analysis Methodology

For all study intersections, trip generation estimates were developed for both the AM and PM peak hours using ITE's Trip Generation Manual, 11th Edition. Intersection Capacity Analysis was performed using PTV VISTRO 2022 which uses Highway Capacity Manual (HCM) methodology for the analysis.

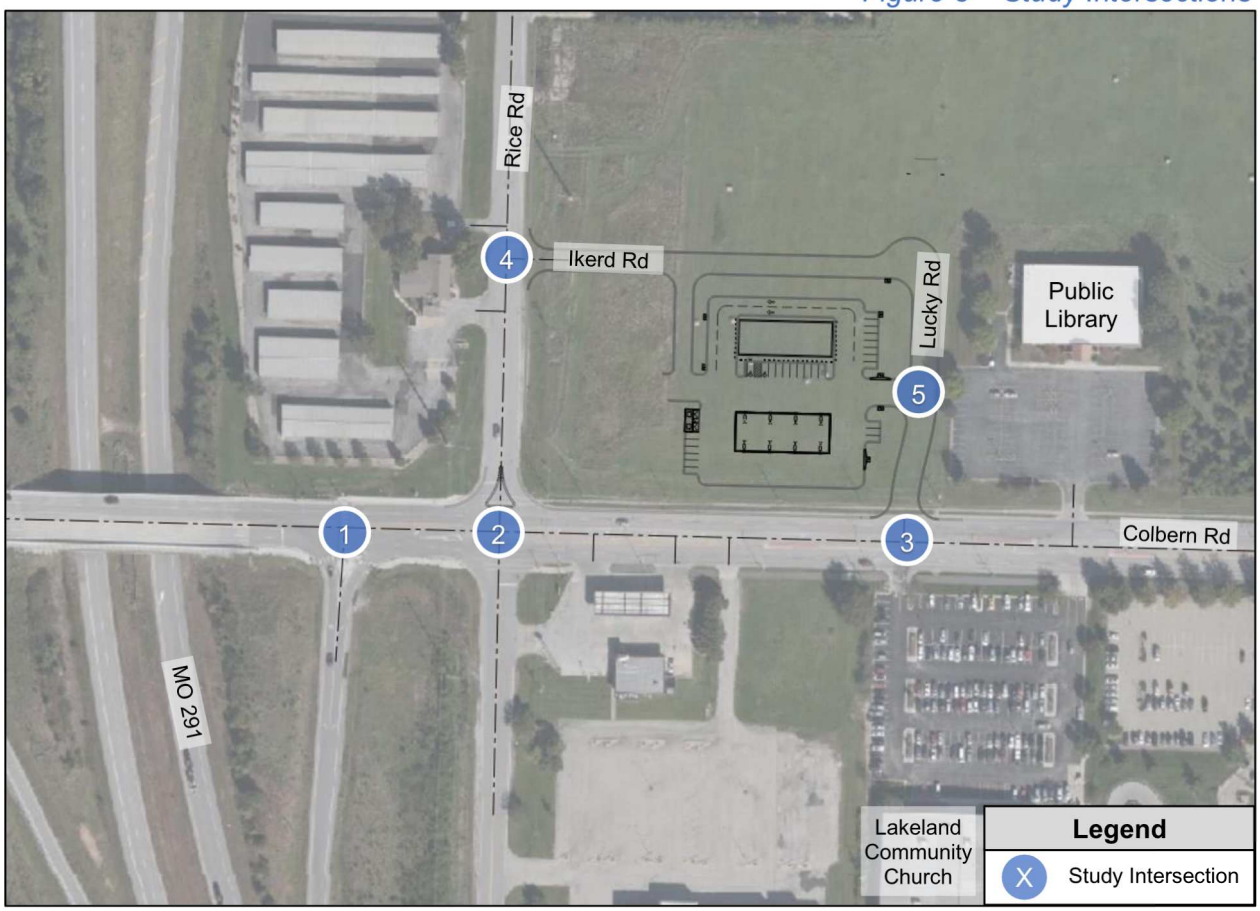
3 Project Description

The proposed development is located northeast of Colbern Road and Rice Road in Lee's Summit, MO. It will include a gas station with 16 fueling stations and an associated convenience store on an approximately 1.70 acre lot. The site plan for the proposed development is included in **Appendix A**.

The proposed development will be accessed through two driveways, one on a yet to be built public road that extends east from Rice Road, north of Colbern Road. The other driveway is located on another yet to be built public road that extends north from Colbern Road. Both public roads are

proposed to be constructed by the master developer of the larger property. Lucky Road will intersect Colbern Road approximately 511 feet east of Rice Road measured center-to-center, aligning with the existing driveway of Lakeland Community Church, located south of Colbern Road. The other proposed public road, Ikerd Road is located approximately 352 feet north of Colbern Road, measured center-to-center.

Figure 3 – Study Intersections



Note: NE Colbern Road & NE Todd George Parkway is located further east beyond the limits of the figure

3.1 Existing Street Network and Land Uses

Missouri Route 291 runs north/south and is located to the west of the proposed development. It is 4-lane divided roadway with a posted speed limit of 55 mph. It is classified as 'Other Principal Arterial' by MoDOT's Functional Classification Map and merges with Interstate 470 north of Colbern Road.

Northeast Colbern Road is located to the south of the proposed development. It is a 4-lane divided roadway supporting eastbound and westbound traffic with median openings and exclusive left turn lanes at each intersection. It is classified as 'Major Arterial' in Lee's Summit's Roadway Classification Map and has a posted speed limit of 40 mph.

Northeast Rice Road is located to the west of the proposed development. It is a 2-lane roadway supporting northbound and southbound traffic. It is classified as 'Commercial/ Industrial Collector' in Lee's Summit's Roadway Classification Map and has a posted speed limit of 45 mph to the north and 25 mph to the south of Colbern Road.

Table 3.1 – Roadway Characteristics

Roadway	Functional Classification	Posted Speed	Travel Lanes	Sidewalks
MO Route 291	Other Principal Arterial	55	4	No
NE Colbern Road	Major Arterial	40	4	Both Sides
NE Rice Road	Commercial/ Industrial Collector	45(1)	2	No

(1) 25 mph south of Colbern Road

The lot for the proposed development is currently vacant and is zoned as 'Planned Community Commercial (CP-2)' according to Lee's Summit's zoning map.

3.2 Existing Traffic Volumes

Traffic Counts were collected on August 9th, 2022, between 7:00 - 9:00 AM and 4:00 - 6:00 PM. The collected traffic data revealed that all the intersections had a peak hour window of 7:15 – 8:15 AM and 4:30 – 5:30 PM. A summary of existing traffic counts is included in **Appendix B.**

Traffic counts were also collected at the Public Library driveway on Colbern Road on October 4th and 6th between 7:00 – 9:00 AM and 4:00 – 6:00 PM.

3.3 Planned Colbern Road Improvements

Improvements to Colbern Road have been proposed by the master developer of the property that the Convenience Store/Gas Station is proposed to be located on. Those improvements include constructing a raised median on Colbern Road that restricts north and south Rice Road to right only movements. The median is planned to extend from Rice Road to Paradise Park Drive, with a break at the planned intersection of Lucky Road to provide a full-access intersection with eastbound and westbound left turn lanes. Note that the recommendations included in this study only include the projected traffic for the proposed gas station parcel, it does not account for future development in the larger site or surrounding area.

4 Proposed Conditions

4.1 Trip Generation

Trip generation estimates developed for this study are based on the 11th Edition of the Trip Generation Manual published by the Institute of Transportation Engineers (ITE). The Manual is the most widely used industry resource for this type of data. The trip generation data are organized by land use types, with more than 170 different categories of land uses. For each category, the manual provides a data set for use in estimating the number of vehicle and person trips generated by a site based on its characteristics such as physical size or intensity. Trips may be estimated by direction (entering or exiting the site) and for time periods typically pertaining to a full day (weekday or weekend), peak hours of the adjacent roadway, and peak hours of the particular land use. Used properly, the Trip Generation Manual provides an objective basis for estimating trips generated by a proposed development.

The ITE category Convenience Store/Gas Station was used to project traffic volumes for the proposed development using the listed intensity for the development. Both the AM and PM Peak hour trips were estimated based on projections from various studies included in ITE's Trip Generation Manual for the hours of 7-9 am & 4-6 pm, respectively. An average of 6,930 vehicles per day are expected to access the development for the Existing plus Proposed scenario.

Table 4a – Trip Generation

Land Use	Intensity	ITE Code	Weekday Trips	AM Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total
C-Store/Gas Station	5,400 S.F. 16 Fueling Positions	945	6,930	246	247	493	213	213	426

Convenience Store/Gas Station's typically generate significant pass-by vehicle trips, which represent trips which have other final destinations that are interrupted to visit the proposed development. Hence, pass-by trips do not add new traffic to the adjoining street system. The ITE Trip Generation Manual recommends an average pass-by rate of 76% for the AM Peak Hours and 75% for the PM Peak Hours for ITE Land Use 945, Convenience Store/Gas Station. For simplicity, an average pass-by rate of 75% for both the AM and PM peak periods was applied in this study.

As a general guideline, the number of pass-by trips assumed for a site should not exceed 10% of the adjacent street traffic. To check this, the calculated number of pass-by trips were compared to two-way volume on Colbern Road adjacent to the project site for each analysis hour. No more than 136 pass-by trips should be assumed for the AM peak hour analysis (10% of 1359), and 174 for the PM peak hour analysis (10% of 1733). The results of the pass-by reduction are included in **Table 3**.

Table 4b – Trip Generation w/ Pass-By Trip Reduction								
Land Use	Intensity	ITE Code	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
C-Store/Gas Station	5,400 S.F.	945	246	247	493	213	213	426
Pass-by Trips (1)			-68	-68	-136	-87	-87	-174
Total New Development Trips			**178**	**179**	**357**	**126**	**126**	**252**

(1) Pass-by Trips are reported as 10% of the adjacent, two-way, traffic on Colbern Road.

4.2 Trip Distribution

The traffic generated by the proposed development was distributed to the adjacent roadway system based on engineering judgement. It is anticipated that a significant portion of the primary trips (trips navigating to a destination and returning back to their original departure location) will be arriving on Colbern Road from the east and west directions. Remaining traffic will arrive from the north and south directions using Rice Road as shown in **Figure 4.2a**. PM trip distribution is higher to the west due to increased peak hour volume on nearby I-470.

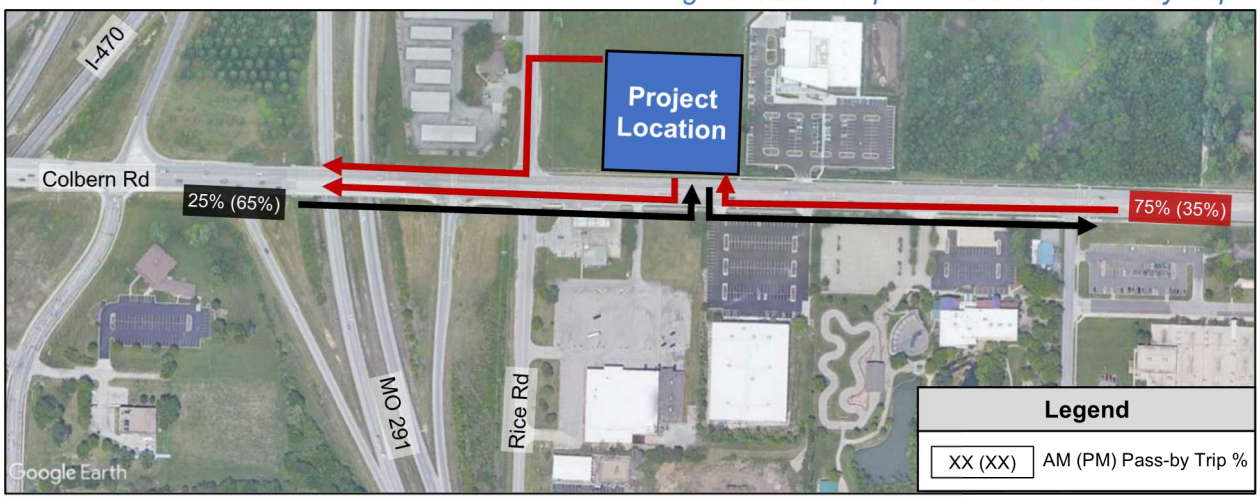
The trips arriving from the west and south directions will be required to use Lucky Road to access the development due to the right-in/right-out restriction at Rice Road. The trips from the north will access the development via Ikerd Road.

Figure 4.2a – Trip Distribution – Primary Trips

The pass-by trip percentage distribution for both AM and PM peak hours was based on adjacent street traffic volume on Colbern Road as shown in **Figure 4.2b**. All pass-by trips are expected to enter via Lucky Road. Traffic exiting and going east will be required to use Lucky Road and traffic

exiting to go west is expected to have a 50/50 split between Lucky Road and Rice Road.

Figure 4.2b – Trip Distribution - Pass-by Trips



4.3 Access Management

The curb radius requirements for the two proposed private driveways, one on Lucky Road and the other on Ikerd Road were analyzed against the Lee's Summit's design criteria. A minimum curb radius of 35 feet measured at the back of the curb is required for a driveway on a Commercial Collector. Both driveways are proposed with a 35-foot curb radius and meet city requirements.

The curb return of Lucky Road intersecting Colbern Road is currently proposed with a 25-foot radius. In order to meet city requirements for a Commercial Collector, the radius should be increased to 35 feet.

Lee's Summit requires a 28 ft. driveway width for a Low Volume approach and 42 ft. for a Medium Volume approach based on their Access Management Code. The driveway on Ikerd is expected to fall under the Low Volume approach classification and the driveway on Lucky Road is expected to fall under the Medium Volume driveway classification. Both driveways meet city requirements for driveway width.

The access spacing criteria for both proposed driveways were analyzed based on guidelines in Lee's Summit Access Management Code. The proposed driveway on Ikerd Road should be located at least 125 feet from Rice Road to meet city requirements for spacing on Commercial Local roads. The driveway on Ikerd Road, measured at approximately 225 feet from Rice Road, measured center-to-center, exceeds the minimum required spacing.

The proposed driveway on Lucky Road is located approximately 180 feet north of Colbern Road and does not meet the city spacing requirement of 300 feet, measured center-to-center, for a

Commercial Collector. It is recommended that a raised median be constructed on Lucky Road to prevent northbound left-turn vehicles into the development. The current spacing of approximately 180 feet would provide enough stacking distance for vehicles on the southbound approach of Colbern Road & Lucky Road. The raised median should be at least 4 feet in width. Through and turn lanes should be 12 feet in width for a total cross section of 44 feet, measured at back of curb.

Minimum throat length for each driveway was analyzed against Lee's Summit Access Management Code. The driveway on Ikerd Road should have a minimum throat length of 75 feet and the driveway on Lucky Road should have a minimum throat length of 100 feet based on the projected peak hour trips accessing each driveway and using an adjacent Roadway Classification of Collector. The throat length of the driveway on Ikerd Road, measured at 120 feet, exceeds the minimum requirement. However, the proposed driveway on Lucky Road, measured at 50 feet, does not meet the minimum requirement of 100 feet. However, with a restricted median proposed on Lucky Road, the queueing for exiting vehicles will be limited to traffic taking a right-turn from the development. Our analysis shows a 95th percentile queue length of 25 feet which is lower than the proposed throat length.

4.3.1 Turn Lane Requirements

All intersections within the study area were analyzed for turn lane requirements.

4.3.1.1 Colbern Road & Lucky Road

Lee's Summit's Access Management Code requires a minimum of 200 feet plus taper for left turn lanes on Arterial streets intersecting Collectors. The westbound left turn lane is currently proposed with a storage length of 122.5 feet. The storage length should be increased to 200 feet to meet city requirements. The taper should be designed with two 150-foot reverse curves.

The westbound left turn lane is currently proposed with a storage length of 81.61 feet. The storage length should be increased to 200 feet to meet city requirements. The taper should be designed with two 150-foot reverse curves. Due to the proposed limited access intersection at Colbern Road & Rice Road, it is expected that a significant amount of traffic will attempt a U-Turn maneuver at Lucky Road. It is recommended that the intersection be designed to support U-Turn movements by conducting a swept path analysis.

The projected volume for right turns onto Lucky Road from Colbern Road exceeds the threshold for constructing a right turn lane on Major Arterial Streets. The peak hour right-turn volume of 78 vehicles in the AM Peak hour and 56 vehicles in the PM Peak hour are greater than the 30 vehicles per hour threshold as documented in the city's Access Management Code. It is recommended that a right turn lane be constructed with a storage length of 150 feet and taper length of 150 feet. The taper should start prior to the existing library driveway and extend through it.

4.3.1.2 Colbern Road & Rice Road

The westbound left turn lane at Colbern Road & Rice Road will not have enough room to construct a full 200-foot left turn lane if a full 200-foot eastbound left turn is constructed at Lucky Road. The results of the capacity analysis showed a larger expected queue length for the left turn lane at Lucky Road so it is recommended that the full 200-foot length be provided there and a storage length of 135 feet be provided for the westbound left turn lane at Rice Road.

4.3.1.3 Colbern Road & MO-291 NB Ramp

There are no turning movements on Colbern Road at this intersection, so no changes are recommended.

4.3.1.4 Lucky Road & Ikerd Road

The projected volume for northbound left turns at Lucky Road & Ikerd Road is above 30 vehicles per hour which is above the city's threshold for providing an auxiliary left turn lane on a collector. The proposed available storage space of 170 feet between Colbern Road and Ikerd Road will not allow the full storage length of 150 feet to be provided to the northbound left turn lane and southbound turn lane at Colbern Road. Based on the operational analysis, it is recommended that a storage length of 60 feet be provided for the northbound left turn lane and 125 feet for the southbound left turn lane at Colbern Road.

No other turn lane modifications or additions are recommended.

5 Intersection Capacity Analysis

To analyze the existing traffic, operating conditions were analyzed using PTV Vistro, a macroscopic analysis and optimization software. PTV Vistro is based on study procedures outlined in the Highway Capacity Manual, 7th edition. The analysis determines the "Level of Service" of the intersections and is based on factors such as the number and types of lanes, signal timing, traffic volumes, pedestrian activity, etc. 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").

Table 5 – Level of Service Criteria		
Level of Service	**Signalized Intersection (sec/veh)**	**Unsignalized Intersection (sec/veh)**
A	< 10 seconds	< 10 seconds
B	< 20 seconds	< 15 seconds
C	< 35 seconds	< 25 seconds
D	< 55 seconds	< 35 seconds
E	< 80 seconds	< 50 seconds
F	≥ 80 seconds	≥ 50 seconds

Level of Service "D" is typically considered the minimum acceptable LOS, however in some cases Level of Service "E" is acceptable in peak times. The above table shows the thresholds for Levels of Service A through F for unsignalized intersections.

Intersection capacity analysis was performed for Existing Conditions and Existing + Proposed Conditions scenarios. Detailed capacity analysis can be found in **Appendix C**.

5.1 MO-291 Northbound Ramp & NE Colbern Road

Table 5.1 summarizes the LOS, control delay, and 95th percentile queue lengths at the existing ramp off MO-291.

Table 5.1 – MO-291 Northbound Ramp & NE Colbern Road

Condition	Measure	NB		EB	WB	Intersection
		NBL	NBR	EBT	WBT	LOS (Delay)
AM Peak Hour						
Existing Conditions	LOS (Delay)	D (46.6)		A (3.1)	A (4.7)	A (8.3)
	95% Queue	173'	173'	28'	124'	
Existing plus Proposed Conditions	LOS (Delay)	D (46.6)		A (3.3)	A (5.2)	A (8.1)
	95% Queue	172'	172'	38'	156'	
PM Peak Hour						
Existing Conditions	LOS (Delay)	B (16.7)		A (6.3)	A (5.7)	A (6.8)
	95% Queue	42'	42'	43'	30'	
Existing plus Proposed Conditions	LOS (Delay)	B (16.7)		A (6.3)	A (5.8)	A (6.8)
	95% Queue	41'	41'	43'	30'	

As shown in **Table 5.1**, the intersection is expected to operate with acceptable conditions in both the Existing conditions and Existing and Proposed conditions scenarios.

5.2 NE Colbern Road & NE Rice Road

Table 5.2 summarizes the LOS, control delay, and 95th percentile queue lengths at the intersection of Colbern Road and Rice Road.

Table 5.2 – NE Colbern Road & NE Rice Road

Condition	Measure	NB	SB	EB			WB		
		NBLTR	SBLTR	EBL	EBT	EBTR	WBL	WBT	WBTR
AM Peak Hour									
Existing Conditions	LOS (Delay)	D (31.4)	C (17.1)	A (0.8)			A (0.1)		
	95% Queue	25'	25'	25'	25'	25'	25'	25'	25'
Existing plus Proposed Conditions	LOS (Delay)	B (10.3)*	C (16.9)*	-	A (0.0)		A (0.3)		
	95% Queue	25'*	33*	-	25'	25'	25'	25'	25'
PM Peak Hour									
Existing Conditions	LOS (Delay)	F (108.7)	D (33.7)	A (0.5)			A (0.2)		
	95% Queue	70'	53'	25'	25'	25'	25'	25'	25'
Existing plus Proposed Conditions	LOS (Delay)	C (15.6)*	B (12.1)*	-	A (0.0)		A (0.7)		
	95% Queue	25'*	25'*	-	25'	25'	25'	25'	25'

* Restricted to right-in/right-out access.

As shown in **Table 5.2**, the northbound approach operatses with a LOS D and F in the Existing Condition scenario for the AM and PM peak period, respectively.

In the Existing plus Proposed Conditions, the southbound and northbound approach is planned to operate as a right-in/right-out approach due to the proposed raised median and is expected to operate with an acceptable LOS.

5.3 NE Colbern Road & NE Lucky Road

Table 5.3 summarizes the LOS, control delay, and 95th percentile queue lengths at the intersection of Colbern Road and Lucky Road.

Table 5.3 – NE Colbern Road & Lucky Road

Condition	Measure	NB	SB		EB			WB			Intersection
		NBLTR	SBLT	SBR	EBL	EBT	EBTR	WBL	WBT	WBR	LOS (Delay)
AM Peak Hour											
Existing plus Proposed Conditions (Stop Controlled)	LOS (Delay)	F (81.1)	F (288.7)		B (11.4)			A (0.0)			
	95% Queue	25'	168'	25'	98'	25'	25'	25'	25'	25'	
Existing plus Proposed Conditions (Signalized)	LOS (Delay)	A (0.0)	C (20.3)		A (8.2)			B (16.0)			B (13.8)
	95% Queue	25'	26'	28'	37'	35'	35'	25'	210'	25'	

Condition	Measure	NB	SB		EB			WB			Intersection
		NBLTR	SBLT	SBR	EBL	EBT	EBTR	WBL	WBT	WBR	LOS (Delay)
PM Peak Hour											
Existing plus Proposed Conditions (Stop Controlled)	LOS (Delay)	F (551.0)	F (1232.8)		A (2.7)			A (0.0)			
	95% Queue	61'	409'	25'	50'	25'	25'	25'	25'	25'	
Existing plus Proposed Conditions (Signalized)	LOS (Delay)	C (23.1)	B (13.4)		B (11.7)			B (16.2)			B (13.2)
	95% Queue	25'	44'	25'	48'	168'	168'	25'	110'	25'	

As shown in **Table 5.4**, both northbound and southbound approaches are expected to have a LOS F, with the southbound approach having an average delay per vehicle of over 15 minutes.

A second scenario was developed that modeled the intersection as a signal. (See Section 6 for Signal Warrant Analysis) The intersection is expected to operate with an acceptable LOS in this scenario.

5.4 NE Rice Road & NE Ikerd Road

Table 5.4 summarizes the LOS, control delay, and 95th percentile queue lengths at the intersection of Rice Road and Ikerd Road.

Table 5.4 – NE Rice Road & Ikerd Road

Condition	Measure	NB	SB	WB
		NBLTR	SBLTR	WBLTR
AM Peak Hour				
Existing plus Proposed Conditions	LOS (Delay)	A (0.0)	A (2.1)	A (9.5)
	95% Queue	25'	25'	25'
PM Peak Hour				
Existing plus Proposed Conditions	LOS (Delay)	A (0.0)	A (2.5)	A (9.7)
	95% Queue	25'	25'	25'

As shown in **Table 5.4**, the intersection is expected to operate with acceptable conditions for the Existing Conditions and Existing Conditions plus Proposed scenario.

5.5 NE Colbern Road & NE Todd George Parkway

Table 5.5 summarizes the LOS, control delay, and 95th percentile queue lengths at the intersection of Colbern Road and Todd George Parkway.

Table 5.5 – NE Colbern Rd & NE Todd George Parkway

Condition	Measure	NB			SB			EB			WB			Intersection
		NBL	NBT	NBR	SBL	SBT	SBTR	EBL	EBT	EBR	WBL	WBT	WBTR	LOS (Delay)
AM Peak Hour														
Existing Conditions	LOS (Delay)	B (13.8)			B (13.0)			B (13.5)			B (15.4)			B (14.5)
	95% Queue	87'	129'	25'	25'	25'	25'	25'	35'	25'	25'	183'	175'	
Existing plus Proposed Conditions	LOS (Delay)	B (14.0)			B (13.2)			B (13.5)			B (15.5)			B (14.6)
	95% Queue	88'	131'	25'	25'	25'	25'	25'	40'	25'	25'	191'	182'	
PM Peak Hour														
Existing Conditions	LOS (Delay)	B (15.0)			B (14.1)			B (16.6)			B (14.6)			B (15.3)
	95% Queue	41'	118'	25'	79'	79'	78'	25'	170'	46'	25'	96'	92'	
Existing plus Proposed Conditions	LOS (Delay)	B (15.3)			B (14.4)			B (16.7)			B (14.7)			B (15.4)
	95% Queue	42'	120'	25'	81'	80'	79'	25'	178'	46'	25'	103'	98'	

As shown in **Table 5.3**, the intersection is expected to operate with acceptable conditions in both the Existing Conditions and Existing plus Proposed Conditions scenarios.

5.6 NE Lucky Road & Proposed East Driveway

Table 5.6 summarizes the LOS, control delay, and 95th percentile queue lengths at the intersection of NE Lucky Road & Proposed East Driveway.

Table 5.6 – NE Lucky Road & Proposed East Driveway

Condition	Measure	NB	SB	EB
		NBT	SBTR	EBR
AM Peak Hour				
Existing plus Proposed Conditions	LOS (Delay)	A (0.0)	A (0.0)	A (9.2)
	95% Queue	25'	25'	25'
PM Peak Hour				
Existing plus Proposed Conditions	LOS (Delay)	A (0.0)	A (0.0)	A (9.2)
	95% Queue	25'	25'	25'

As shown in **Table 5.6**, the intersection is expected to operate with acceptable conditions in the Existing plus Proposed Conditions scenario.

6 Signal Warrant Analysis

Traffic signal warrants were evaluated for the intersection of Colbern Road & Lucky Road for the Existing + Proposed scenario. To warrant traffic signalization, an intersection must satisfy one or more of the nine warrants presented in the MUTCD. However, the satisfaction of a signal warrant shall not in itself require the installation of a traffic signal.

The nine warrants outlined in the MUTCD are as follows:

- *Warrant 1, Eight-Hour Vehicular Volume*
- *Warrant 2, Four-Hour Vehicular Volume*
- *Warrant 3, Peak Hour*
- *Warrant 4, Pedestrian Volume*
- *Warrant 5, School Crossing*
- *Warrant 6, Coordinated Signal System*
- *Warrant 7, Crash Experience*
- *Warrant 8, Roadway Network*
- *Warrant 9, Intersection Near a Grade Crossing*

For the purpose of this study process, the traffic signal warrant evaluation was limited to Signal Warrant 3 for the existing plus proposed condition. Warrant 1 and 2 were not evaluated since the intersections were analyzed for a future proposed scenario. A brief description of the warrant, based on traffic volumes, as presented in the MUTCD is provided as follows:

6.1 Signal Warrant 3 - Peak-hour volume

The Peak Hour Signal Warrant is intended for use at a location where traffic conditions are such that for a minimum of one hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. This warrant is intended to apply for unusual cases where a facility generates or attracts an unusual amount of traffic over a short time.

Colbern Road & Lucky Road was analyzed against this warrant, and it was observed that a signal was warranted for the Existing + Proposed scenario. The signal warrant analysis was conducted in accordance with the methodology presented in Chapter 4C of the MUTCD. A detailed summary of the Signal Warrant Analysis is included in **Appendix D**.

Figure 6.1 – Peak Hour Warrant

Warrant 3: Peak Hour Volume **100%**

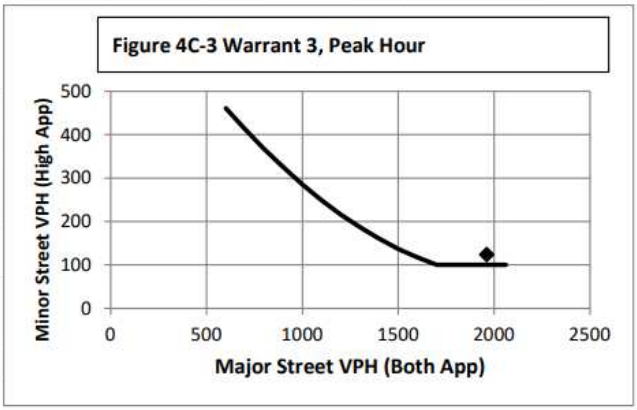
Warrant Evaluated? Yes **Warrant Satisfied? Yes** **Manually Set To:**

Condition justifying use of warrant:

Criteria		Met?
Delay on Minor Approach	4	
Volume on Minor Approach	100	Yes
Total Entering Volume (veh/h)	800	

Manually Set Peak Hour? No

Peak Hour	Major Road Vol. (Both App.)	Minor Road Vol. (High App.)
16:00	1961	124



7 Summary

RIC completed the preceding analysis to study the traffic impacts associated with a proposed development located northeast of NE Colbern Road & Rice Road in Lee's Summit, MO.

Based on the traffic analysis completed for the Existing Conditions scenario, the following summary is provided:

- All study intersections currently operate with an acceptable LOS except for the northbound approach at Colbern Road and Rice Road, with a LOS F for the PM Peak Hour.

Based on the traffic analysis completed for the Existing plus Proposed Conditions scenario, the following summary is provided.

- The curb return of Lucky Road intersecting Colbern Road is currently proposed with a 25-foot radius. To meet city requirements for a Commercial Collector, the radius should be increased to 35 feet, measured at the back of curb.

- The proposed location of the gas station driveway on Lucky Road does not meet the city requirement of 300 feet spacing for driveways on Commercial Collectors. It is recommended that a raised median be constructed on Lucky Road to restrict left turns from the development and northbound left-turn vehicles into the development. The current spacing of approximately 180 feet would provide enough stacking distance for vehicles on the southbound approach of Colbern Road & Lucky Road. The raised median should be at least 4 feet in width. Through and turn lanes should be 12 feet in width for a total cross

section of 44 feet, measured at back of curb.

- The throat length of the proposed driveway on Lucky Road does not meet the minimum requirement of 100 feet. However, the 95th percentile queue length for exiting vehicles from the development was determined to be 25 feet, lower than the proposed throat length of 50 feet.

- The westbound left-turn lane at Colbern Road and Rice Road should be constructed with a storge length of 135 feet and a taper with two 150-foot reverse curves.

- A northbound left turn lane should be constructed on Lucky Road & Ikerd Road with a storage length of 60 feet.

- The southbound left turn lane on Lucky Road & Colbern Road should have a storage length of 125 feet.

- The westbound and eastbound left-turn lanes at Colbern Road & Lucky Road should be constructed with a storage length of 200 feet and a taper with two 150-foot reverse curves.

- It is recommended that the intersection of Colbern Road & Lucky Road be designed to support eastbound left U-Turn movements.

- A right-turn lane is required to be constructed at Colbern Road & Lucky Road to meet city requirements. A storage length of 150 feet plus 150-foot straight lane taper should be provided. The taper should start prior to the existing library driveway and extend through it.

- The proposed intersection of Colbern Road & Lucky Road meets peak hour signal warrants and is recommended to be designed as a signalized intersection.

- All study intersections are expected to operate with acceptable conditions for the Existing plus Proposed conditions with recommended improvements.