

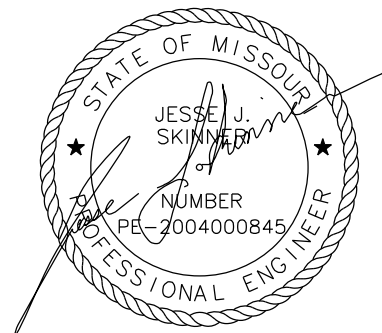
# Arborwalk Lot #5

## TRAFFIC IMPACT STUDY

February 22, 2023

Prepared For:  
Christie Development Associates, LLC  
7217 W. 110<sup>th</sup> Street  
Overland Park, KS 66210

Prepared By:  
Priority Engineers, Inc.  
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2-22-23



February 22, 2023

Mr. Garrett Fugate  
Christie Development Associates, LLC  
7217 W. 110<sup>th</sup> Street  
Overland Park, KS 66210

Re: Arborwalk Lot #5 – Lee's Summit, MO

Dear Mr. Fugate:

In response to your request, Priority Engineers, Inc. has completed a traffic impact study for the above referenced project. The purpose of the analysis is to determine the potential traffic impacts associated with this development on the intersections and streets surrounding this site, primarily during the AM and PM peak hours. The following report documents our analysis and recommendations.

We appreciate the opportunity to work with you on this project. Please contact us with any questions or if you require additional information.

Sincerely,

PRIORITY ENGINEERS, INC.

A blue ink handwritten signature, appearing to read 'Jesse J. Skinner', is written over a white rectangular background.

Jesse J. Skinner, P.E., PTOE  
Senior Transportation Engineer

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## 1) INTRODUCTION

The purpose of this study is to examine the potential traffic impacts associated with the proposed Arborwalk Lot # 5 development located at the northwest corner of SW Arboridge Drive and Missouri Route 150. The site is located within the municipal city limits of Lee's Summit, Missouri.

The study area is shown in Figure 1. The site layout is shown in Figure 2.

## 2) EXISTING CONDITIONS

The existing site is located on the northwest corner of SW Arboridge Drive and Missouri Route 150. The property is currently vacant.

Missouri Route 150 is a four-lane roadway with curb and gutter and median separation. It has a posted speed limit of 45 MPH. The Mid America Regional Council (MARC) has assigned this roadway a functional classification of Principal Arterial. The City of Lee's Summit's Thoroughfare Master Plan identifies Missouri Route 150 as a Major Arterial.

SW Pryor Road, near the intersection with Missouri Route 150, is a two-lane roadway with paved shoulders and an open drainage system. To the north of Missouri Route 150, SW Pryor Road has a posted speed limit of 45 MPH and to the south of Missouri Route 150, it's posted speed limit is 35 MPH. MARC has assigned this roadway a functional classification of Minor Arterial whereas the City of Lee's Summit's Thoroughfare Master Plan identifies it as a Major Arterial.

SW Arborlake Drive is a two-lane road with curb and gutter and an enclosed drainage system. It has a posted speed limit of 25 MPH. SW Stoney Creek Drive is located south of SW Arborlake Drive on the opposite side of Missouri Route 150. It also has a two-lane cross section with curb and gutter and an enclosed drainage system. It has a posted speed limit of 30 MPH. MARC has assigned both roadways a functional classification of Local Road by default. Lee's Summit has previously indicated that SW Arborlake Drive is a commercial collector.

SW Arboridge Drive is a two-lane roadway with curb and gutter and an enclosed drainage system. SW Arboridge Drive has a posted speed limit of 25 MPH. MARC has assigned this roadway a functional classification of Local Road by default, whereas the City has previously indicated that the roadway a classification of commercial collector.

The intersections of SW Pryor Road and Missouri Route 150 and SW Arborlake Drive and Missouri Route 150 are both currently controlled by traffic signals. The intersection of Missouri Route 150 and SW Arboridge Drive is controlled by STOP control on the minor movements.

Peak Hour turning movement traffic counts for the intersections of Missouri Route 150 and Pryor Road, Missouri Route 150 and Arboridge, and Missouri Route 150 and Arborlake Drive were collected on August 10<sup>th</sup> of 2022 between the hours of 7:00 and 9:00 AM and from 4:00 to 6:00 PM. The peak hours were determined to be 7:15 to 8:15 AM and from 4:30 to 5:30 PM. The complete traffic counts are shown in Appendix II. The peak hour traffic volumes and existing lane configurations are shown in Figures 3-7.

### 3) APPROVED DEVELOPMENT

The City of Lee's Summit has identified the following previously approved developments with as impacting the study area.

#### Raintree Village

Raintree Village is located to the east of the proposed development on the east side of SW Arboridge Drive. The approved development is approximately 0.1 miles east of the proposed development. The approved development will have a 214-bed assisted living complex when completed. The approved development will have two access points, both on SW Arborwalk Boulevard between SW Arboridge Drive and SW Arborlake Drive. A TIS was not required for this development.

#### McBee's Coffee N Carwash

This approved development is located in the northeast quadrant of Missouri Route 150 and SW Arborlake Drive, east of the existing Phillips 66. The approved development is approximately 0.4 miles east of the proposed development. The approved development will have a ingress access point from Missouri Route 150 and egress will be accomplished via an access point onto SW Arborwalk Boulevard. The approved development will have an automated carwash when completed. A TIS was not required for this development.

#### Market Street Center

This approved development is located north of Missouri Route 150 and west of Missouri Route 291 on the south side of SW Market Street. The approved development is approximately 1.75 miles east of the proposed development. When the approved development is constructed, there will be 7,200 SF of commercial building space. The site will have two access points, both onto SW Market Street. A TIS was not provided by the City for this development.

#### Osage (Allera) Residential Development

This approved residential development is located near the southwest quadrant of Missouri Route 150 and SW Pryor Road. The approved development consists of 160 units of single family detached housing. The approved development is approximately 0.5 miles west of the approved development. The TIS was performed for this development and the improvements listed for the intersection of SW Pryor Road and Missouri Route 150 and have already been constructed.

#### Journey Church International

This approved development consists of an expansion of the existing Church facility located 1601 SW Missouri Route 150. The approved development is approximately 0.1 miles south of the proposed development. The approved development consists of an expansion to the church campus to increase the capacity from a 320-seat auditorium to a 1,200-seat auditorium. The construction of this approved development has already occurred. The approved development has a TIS and the recommended improvements to the intersection of Missouri Route 150 and SW Arboridge Drive have already been constructed. The proposed development was completed prior to collection of turning movement counts at Missouri Route 150 and SW Arboridge Drive.

#### **4) PROPOSED DEVELOPMENT**

The proposed site plan is shown in Figure 2. The site will contain a 10,000 SF child care facility, a 4,575 SF convenience store, and a 1,800 SF Automotive Oil Changing facility with six stalls. The convenience store is located adjacent to Missouri Route 150 and the proposed childcare facility is located to the north of the convenience store. The vehicle maintenance building is located to the west of the convenience store.

The proposed site plan provides access to the convenience store and the vehicle maintenance building from a Right In / Right Out drive on Missouri Route 150 and from a shared access drive that connects both properties to Arboridge Drive. The proposed site plan provides access to the childcare facility from a drive located on the north side of the property. This access point connects to the current drive to Holy Spirit Catholic Church from Arboridge Drive.

The RI/RO drive is shown on the proposed site plan approximately 300' west of the intersection of Arboridge Drive and Missouri Route 150. The RI/RO access point is shared between the convenience store and the fast-food restaurant. The proposed shared drive onto SW Arboridge Drive located between the convenience store and the daycare and is approximately 370' north of the intersection. The Daycare's north drive, which shares access with the Holy Spirit Catholic Church, is located approximately 550' north of the intersection of Arboridge Drive and Missouri Route 150. Additional discussion on these drives is found in Section 9 of this TIS.

#### **5) TRIP GENERATION (APPROVED DEVELOPMENT)**

The vehicle trips generated by the approved development were estimated using the Institute of Transportation Engineers' Trip Generation Manual, 11<sup>th</sup> Edition. The following Land Uses were utilized: Adult Living Center (Land Use 254), Automated Car Wash (Land Use 948), and Strip Retail Plaza < 40 K (Land Use 822). Since the Journey Church International expansion was completed prior to collection of turning movement counts for this project, additional trip generation was not estimated for this development. The estimated AM and PM peak hour traffic volumes associated with these uses are shown in Table 1.

<b>Table 1: Trip Generation (Approved Development)</b>								
<b>Land Use</b>	<b>Intensity</b>	<b>ITE CODE</b>	<b>AM Peak</b>			<b>PM Peak</b>		
			<b>Total</b>	<b>In</b>	<b>Out</b>	<b>Total</b>	<b>In</b>	<b>Out</b>
Assisted Living (Raintree Village)	214 beds	254	39	23	16	51	20	31
Automated Car Wash (McBee's Coffe N Carwash)	6,502 SF	948				92	46	46
Strip Retail Plaza < 40K (Market Street Center)	7,200 SF	822	23	14	9	62	31	31
Single Family Detached Housing (10th edition)	160 units	210	119	30	89	160	101	59
<b>Total</b>		<b>2234</b>	<b>181</b>	<b>67</b>	<b>114</b>	<b>365</b>	<b>198</b>	<b>167</b>

**6) TRIP GENERATION (PROPOSED DEVELOPMENT)**

The vehicle trips generated by the proposed development were estimated using the Institute of Transportation Engineers' Trip Generation Manual, 11<sup>th</sup> Edition. The following Land Uses were utilized: Day Care Center (Land Use 565), Quick Lubrication Vehicle Shop (Land Use 941), and Convenience Store / Gas Station (Land Use 945). With the 11<sup>th</sup> Edition of the Trip Generation Manual, there are two subcategories associated with the Land Use 945 (GFA) and (VFP). It was determined that for this development that the estimate based upon the subcategory for the vehicle fueling positions had a more conservative (larger) trip generation estimate than the subcategory associated with the size of the building. The more conservative trip generation estimate was selected. Similarly, Land Use 941 has several independent variables, of which service positions was found to generate the most conservative trip generation estimates. The estimated AM and PM peak hour traffic volumes associated with these uses are shown in Table 2.

<b>Table 2: Trip Generation (Subcategory VFP)</b>								
<i>Land Use</i>	<i>Intensity</i>	<i>Daily</i>	<i>AM Peak</i>			<i>PM Peak</i>		
			<i>Total</i>	<i>In</i>	<i>Out</i>	<i>Total</i>	<i>In</i>	<i>Out</i>
Day Care Center	10,000 SF	476	110	58	52	111	52	59
Quick Lubrication Vehicle Shop	6 Servicing Positions	240	18	12	6	29	16	13
Convenience Store/Gas Station (VFP 9-15)	4,575 SF	3118	259	129	130	250	125	125
<b>Total</b>		<b>3834</b>	<b>387</b>	<b>199</b>	<b>188</b>	<b>390</b>	<b>193</b>	<b>197</b>

Pass-by trips are made as intermediate stops on the way from an origin to a primary trip destination without a route diversion. For this site, pass-by trips are those drivers who are already traveling eastbound and westbound on Missouri Route 150 who will stop at this development. Pass-by trips were estimated utilizing the Tables provided in Chapter 10 of the Trip Generation Handbook, 3<sup>rd</sup> Edition. In regards to Land Use 945, ITE data indicates that 75 percent of the PM Peak Hour trips and 76 percent of the AM Peak Hour trips are pass by in nature. Table 3 below shows the anticipated new trips generated by this development after accounting for pass-by.

<b>Table 3: Trip Generation (Pass-By)</b>								
<i>Land Use</i>	<i>Intensity</i>	<i>ITE Code</i>	<i>AM Peak</i>			<i>PM Peak</i>		
			<i>Total</i>	<i>In</i>	<i>Out</i>	<i>Total</i>	<i>In</i>	<i>Out</i>
Day Care Center	10,000 SF	565	110	58	52	111	52	59
Quick Lubrication Vehicle Shop	6 Servicing Positions	240	18	12	6	29	16	13
Convenience Store/Gas Station (VFP 9-15)	4,575 SF	945	259	129	130	250	125	125
			-197	-98	-99	-188	-94	-94
<b>Subtotal</b>			<b>387</b>	<b>199</b>	<b>188</b>	<b>390</b>	<b>193</b>	<b>197</b>
<i>Pass-By Trips</i>			-197	-98	-99	-188	-94	-94
<b>Total New Trips</b>			<b>190</b>	<b>101</b>	<b>89</b>	<b>202</b>	<b>99</b>	<b>103</b>



## 7) TRIP DISTRIBUTION

Trip generation for the approved developments was distributed via the distribution in the approved TIS when available. For approved developments without a TIS, the development trips were distributed onto the TIS study intersection based upon a review of the surrounding area using the distribution identified for the proposed development.

For the Raintree Village development, it was assumed that 25 percent of the trips would be distributed to SW Arboridge Drive and the remaining trips would be distributed to SW Arborlake Drive before being further distributed.

For the McBee's Coffee N Carwash it was assumed that ten percent of the traffic was assumed to come to and from the intersection of SW Ward Road and SW Arborwalk Boulevard. The remaining traffic was distributed into and out of the study area via the intersection at SW Arborlake Drive with the exception of westbound entering traffic entering from it's shared drive from Missouri Route 150.

For the Market Street development, it was assumed that thirty percent of the trips would be entering and exiting the site from the west on Missouri Route 150 and were distributed across the study area accordingly. The approved development trips are shown in Figures 7 and 8 of Appendix I.

Trips generated by the Arborwalk Lot # 5 development were distributed based on existing traffic flows and a general analysis of the surrounding area. The trips were distributed onto the existing street system approximately as follows:

- 10 percent to/from the north on SW Pryor Road
- 10 percent to/from the south on SW Pryor Road
- 5 percent to/from the north on SW Arborlake Drive
- 5 percent to/from the south on SW Stoney Creek Drive
- 10 percent to/from the north on SW Arboridge Drive
- 30 percent to/from the west on Missouri Route 150
- 30 percent to/from the east on Missouri Route 150

The proposed development trips are shown in Figures 11 and 12 of Appendix I.

## 8) LEVEL OF SERVICE AND VOLUME/CAPACITY ANALYSES

Capacity analysis was used to quantify the impacts of the increased traffic on the intersections studied. The methodology outlined in the Highway Capacity Manual, 6<sup>th</sup> Edition, was used as a basis to perform the analysis for this study with the exception of the intersection of SW Pryor Road and Missouri Route 150. At this location, a previous TIS has distributed RI/RO traffic from an entrance onto Missouri 150 to the west of the intersection. At the intersection some of this traffic makes a U-turn maneuver to travel westbound. Subsequent revisions to the HCM beyond the 2000 edition do not support U-turning maneuver analysis necessitating the 2000 edition being considered for the approved, proposed and future scenarios. Capacity analysis defines the quality of traffic operation for an intersection using a grading system called Level of Service (LOS). The LOS is defined in terms of average vehicle delay. Levels of service A through F have been established with A representing the best and F the worst.

<b>Table 4: Level of Service Definitions</b>		
<b>Level of Service</b>	<b>Unsignalized Intersection</b>	<b>Signalized Intersection</b>
A	< 10 Seconds	< 10 Seconds
B	< 15 Seconds	< 20 Seconds
C	< 25 Seconds	< 35 Seconds
D	< 35 Seconds	< 55 Seconds
E	< 50 Seconds	< 80 Seconds
F	≥ 50 Seconds	≥ 80 Seconds

The study intersections were evaluated using Synchro, an analysis package based in part on Highway Capacity Manual methods. The analysis reports are included in Appendix II. Signal timing at the intersection of SW Pryor Road and Missouri Route 150 and SW Arborlake Drive / SW Stoney Creek Drive and Missouri Route 150 was based upon observed cycle lengths with optimized splits.

**Existing Conditions**

The levels of service, lane configuration, and queue lengths for existing conditions are shown in Figures 5 and 6 in Appendix I.

The overall levels of service at each of the signalized intersections was a C or better in both the AM and PM Peak Hour. At the unsignalized intersection of SW Arboridge and Missouri Route 150, both northbound and southbound left turning movement groups have an undesirable level of service in the PM Peak Hour. It is not uncommon for stop controlled minor movements to have undesirable levels of service during peak periods on the major route. The anticipated design queue length associated with both left turning movement groups is one vehicle.

**Approved Conditions**

The levels of service, lane configuration, and queue lengths for existing conditions are shown in Figures 9 and 10 in Appendix I.

Both Signalized intersections continue to have an overall level of service of C or greater in both Peak Hours. At the unsignalized intersection of SW Arboridge and Missouri Route 150 the left turning minor movement groups continue to have an undesirable level of service without increases in design queue length.

**Proposed Conditions**

The levels of service, lane configuration, and queue lengths for the proposed conditions are shown in Figures 12 and 13 in Appendix I.

Both existing Signalized intersections continue to have an overall level of service of C or greater in both Peak Hours. The proposed signalized intersection of SW Arboridge and Missouri Route 150 performs with a level of Service A in both Peak hours. Additional discussion on signalization is found in section 10 of this TIS.

All proposed unsignalized intersections perform with an acceptable level of service for STOP controlled minor movements.

### **Future Conditions**

MARC 2040 data predicts an overall population growth rate of approximately one percent per year for the thirty-year period between the 2010 census and a horizon year of 2040. For the purposes of performing a 20-year horizon for this project, the background growth rate was increased to two percent per year for the twenty-year period to account for the large amounts of undeveloped land found to the north and south sides of the Missouri Route 150 corridor further to the west.

Figures 15 through 18 of Appendix I show the Peak Hour traffic volumes, lane configurations and levels of service associated with the 2042 future conditions.

All signalized intersections continue to operate with an acceptable overall level of service.

## **9) TURN LANES & ACCESS MANAGEMENT**

### **Missouri 150 RI/RO**

This intersection was reviewed for a right turn lane using MoDOT EPG section 940.9.9. In the proposed AM Peak Hour there are 1051 advancing vehicles with 103 vehicles turning right. The major road posted speed is 45 MPH, a right turn lane is warranted. In the proposed PM Peak Hour, there are 771 advancing vehicles with 59 of the vehicles turning right. A right turn lane is also warranted for this time period. EPG Section 233.2 requires a 120' turn lane plus an additional 100' taper.

Section 940.15 was reviewed for the spacing of RI/RO drives. The proposed drive is desirable in that it is a shared access drive located on the property line, reducing the number of drives accessing Missouri Route 150. The proposed spacing is approximately 310'. The EPG requires a spacing of 220' to 330' for RI/RO drives.

The drive meets EPG section 940.16.4 criteria for a Medium Volume Commercial Drive and should have a width of 28' to 42' excluding medians contained within the driveway. The proposed site plan has an approximate width of 36' and meets these criteria.

EPG section 940.16.3 suggest a right-turn approach radius for commercial driveways, in urban areas, with a posted speed limit of 45 MPH or less to be 25'. The proposed site plan has a right turn radius of approximately 25' and complies with the suggested design.

EPG section 940.16.8 specifies a minimum desirable throat length for medium volume commercial / industrial drives to be 60'. The measured throat length is approximately 60'.

### **South Drive**

The shared access south drive onto SW Arboridge Drive is approximately 370' north of the intersection of SW Arboridge and Missouri Route 150. The Lee's Summit Access Management Code (AMC) section 16.1.C requires all non-residential collectors with a left turn lane volume of greater than or equal to 30 VPH to have a left turn lane. A left turn lane is warranted. AMC Section 16.1.H requires a minimum left turn lane of 150' plus taper. AMC section 15.1.B requires that connections shall be sufficiently separated to accommodate turn lanes. AMC section 16.1.L dictates that a taper should not encroach the functional area of an intersection.

AMC section 16.2.B requires a right turn lane for collectors with a right turn volume of 100 VPH or greater. A right turn lane is not warranted.

The proposed site plan has a driveway width of approximately 32' and a throat length of approximately 165'. AMC Table 18-1 requires a width of 28' for a low volume drive. The throat length exceeds AMC Table 18-2 requirements. The minimum curb radius allowed by the City of Lee's Summit Design and Construction Manual is 35' for a commercial collector whereas the AMC requires a maximum of 50'. The access point has curb radii of 15' and does not meet the radius requirements.

### **North Drive**

The north drive was compared to the AMC. A left turn lane is warranted and is required to be 150' plus taper. A right turn lane is not warranted. The north drive is approximately 180' from the south drive. AMC Section 15.1.D.3 requires a minimum spacing of 300' and a variance will need to be sought for this non-conformity. The north drive has a throat length of approximately 36' and does not conform with the AMC. While the throat length is nonconforming it does place vehicles entering the site furthest from the daycare facility and the design queue length is contained within the throat length. The drive has an approximate width of 24'. While this width does not meet the AMC, it matches the approximate width of the existing drive into the Holy Spirit Catholic Church.

## **10) SIGNAL WARRANT ANALYSIS**

The intersection of SW Arboridge and Missouri Route 150 was evaluated for a signalization. EPG section 902.3.4 (Warrant 2, Four Hour Vehicular Volumes) was applied to this intersection. Since the posted speed limit is 45 MPH, the 70% factor is appropriate to consider. The maximum point on the curve is a major street volume of 1,000 VPH with a minor street volume of 80 VPH.

Current traffic count data at this intersection was collected between the hours of 7 and 9 AM and 4 and 6 PM with the Peak Hours found to be 7:15 to 8:15 and 4:30 to 5:30. While the current ITE trip generation manual has hourly trip data, there is significant variance between the Trip Generation Manual's anticipated Peak of the Adjacent Street and the hourly predicted volumes. For this reason, the Peak Hour of the Adjacent Street trip generation was applied to both AM and PM hours counted. The resulting anticipated traffic volumes are shown in Figure 19 of Appendix 1. The seventy percent factor, four-hour warrant is met. If this intersection was to remain unsignalized the left turning movements, which are undesirable in the existing peak hour would have excessive delays exceeding 300 seconds.

The intersection of SW Arboridge and Missouri Route 150 is approximately 2,100 feet east of the signalized intersection with SW Ward Road and approximately 1,400' west of the signalized intersection with SW Arborlake Drive / SW Stoney Creek Drive.

## **11) RECOMMENDATIONS & CONCLUSIONS**

This study documents the impact of the proposed Arborwalk Lot # 5 development on adjacent intersections during the AM and PM peak hours.

The existing intersection of SW Arboridge Drive and Missouri Route 150 has an undesirable level of service in the PM Peak Hour for minor road left turning movement groups. When the proposed development traffic is added to this intersection, the associated delay becomes excessive in both Peak Hours. The proposed development traffic will exceed the minor route minimum threshold for signalization under Warrant 2, Four Hour Vehicular Volumes. The existing traffic on the major route already exceeds the major route threshold for this warrant. A

signal should be installed at this location in conjunction with the construction of the proposed development. If a signal is not installed in conjunction with the proposed development, consideration should be given to restricting left turn movements at this intersection. This would be accomplished by extending the existing median on Missouri Route 150 through the intersection.

The proposed RI/RO on Missouri meets MoDOT requirements for a right turn lane and a 120' long turn lane plus with a 100' taper should be constructed in conjunction with the development.

The proposed north and south drives do not conform with the Lee's Summit AMC and a variance for non-conformity will be required for aspects of the design of each drive. At the south drive, the radii of the proposed connection is less than minimum requirements of City of Lee's Summit Design and Construction Manual and the left lane taper extends into the functional area of the future signalized intersection of SW Arboridge and Missouri Route 150. The north drive's spacing from the south drive is less than required by the AMC and the throat length is also less than required.

A left turn lane is warranted at both the north drive and the south drive to meet the AMC's requirements.

There will be geometric modification on SW Arboridge associated with the construction of the south entrance. The City of Lee's Summit Design and Construction Manual specifies a minimum horizontal curvature radii of 200' for Commercial or Residential Local Streets. When the design of the drive is finalized, minimum curvature on SW Arboridge should be met and site distance verified for the proposed drive.