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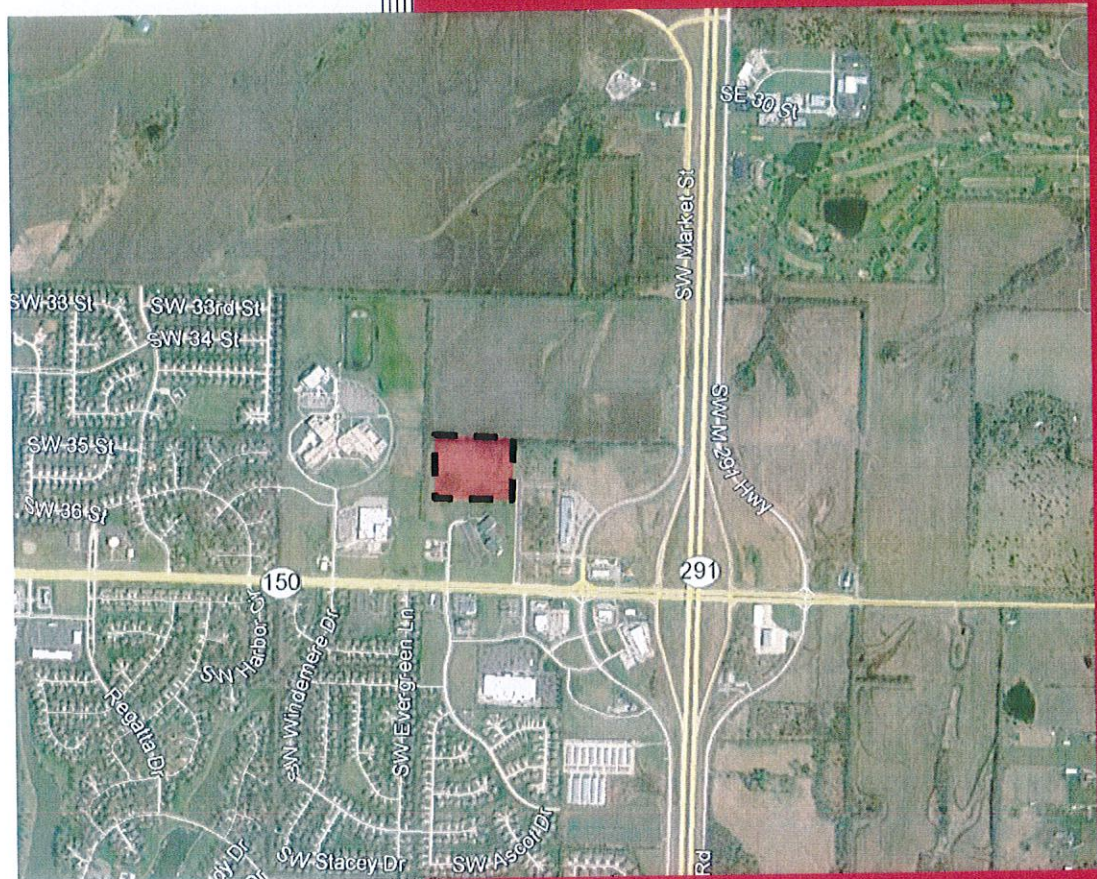
AUG - 5 2016

Planning & Codes Admin

Kenbridge Crossing Traffic Impact Study

M-150 Highway and Cheddington Drive
Lee's Summit, Missouri

-2016-149



Prepared for:
NSPJ Architects

Prepared by TranSystems
July 2016



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July 20, 2016

Mr. Brick Owens
NSPJ Architects
3515 W. 75th Street
Prairie Village, Kansas 66208

**RE: Kenbridge Crossing Traffic Impact Study
M-150 Highway and Cheddington Drive
Lee's Summit, Missouri**

Dear Mr. Owens:

In response to your request and authorization, TranSystems has completed a traffic impact study for the proposed multi-family residential development to be located generally north and east of the M-150 Highway and Cheddington Drive intersection in Lee's Summit, Missouri. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

Included in this study is a discussion of the anticipated impact of the proposed development on the adjacent street network and identified improvements to mitigate deficiencies for the following scenarios:

- ▶ Existing Conditions
- ▶ Existing plus Approved Development Conditions
- ▶ Existing plus Approved plus Proposed Development Conditions

We trust that the enclosed information proves beneficial to you and the City of Lee's Summit in this phase of the development process. We appreciate the opportunity to be of service to you and will be available to review this study at your convenience.

Sincerely,
TRANSYSTEMS

By: 
Jeffrey J. Wilke, PE, PTOE

JJW/jw/PI01160241
Enclosure

Introduction

TranSystems has completed a traffic impact study for the proposed multi-family residential development to be located generally north and east of the M-150 Highway and Cheddington Drive intersection 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 location of the development site relative to the major streets in the area is shown on **Figure A-1** in **Appendix A**. This study also contains a description of the proposed development and the surrounding transportation infrastructure along with trip generation estimates, trip distribution estimates, capacity analyses, and a summary of the findings.

Proposed Development Plan

The proposed development consists of 243 apartments with a clubhouse and amenities. Access to the site will be provided from one new driveway on Hollywood Drive and from one new driveway on Cheddington Drive. Cheddington Drive will be extended to the north to make the connection to the site driveway. A copy of the proposed site plan showing the access points is included on **Figure A-2** in **Appendix A** for reference.

Study Area

To assess the impacts of the proposed development, the intersections listed below were identified for study during the A.M. and P.M. periods.

- ▶ M-150 Highway and Cheddington Drive
- ▶ M-150 Highway and Hollywood Drive

Traffic Counts

Turning-movement traffic volume counts were collected at the study intersections on Wednesday, June 29, 2016. The counts were collected at each intersection from 7:00 to 9:00 A.M. and from 4:00 to 6:00 P.M. The A.M. peak hour occurred between 7:00 and 8:00 A.M., while the P.M. peak hour occurred between 4:45 and 5:45 P.M. The existing lane configurations, traffic control devices, and peak hour traffic volumes have been illustrated on **Figure A-3**.

Surrounding Street Network and Land Uses

The development site is located immediately north of the Aldersgate United Methodist Church, on the north side of M-150 Highway between Cheddington Drive and Hollywood Drive. To the west of the site there is an elementary and a middle school. To the north of the site, the land is undeveloped, with agricultural land uses. East of the site there is some undeveloped land with a few commercial businesses farther to the east.

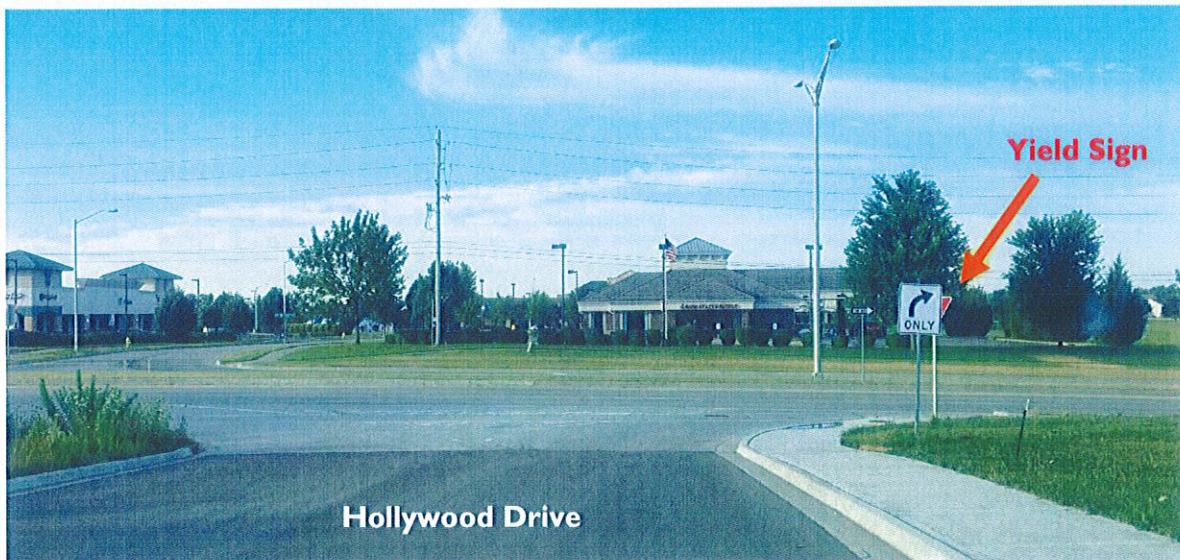
M-150 Highway is a four-lane divided principal arterial roadway with curbs and gutters and sidewalks. It has a posted speed limit of 35 mph adjacent to the development site. The roadway was recently improved to include a raised median for access control. There is no median break at the intersection

with Hollywood Drive, so it is limited to right-turns only. The intersection with Cheddington Drive is signalized and provides full access.

Hollywood Drive is classified as a local street that is 36 feet wide, measured between the back of curbs. The street has two lanes with sidewalks and curbs and gutter along both sides of the street.

At the intersection with M-150 Highway, southbound traffic on Hollywood Drive is controlled with a Yield sign. According to the Manual on Uniform Traffic Control Devices (MUTCD), Stop signs should be used to control the minor-street approach to an intersection where the vehicular traffic volume exceeds 6,000 vehicles per day on the through street. As such, a Stop sign should be installed in place of the Yield sign.

Additionally, the Yield sign is obscured from a southbound driver's view by an intersection lane control sign mounted in advance of the Yield sign as shown in the image below. The MUTCD states that intersection lane control signs are only to be installed overhead. Therefore, the sign is not installed correctly at this intersection and should be removed. One-way signs and/or no left-turn signs should be installed at locations that are in accordance with the MUTCD to convey the turn restriction.



Southbound Driver's view of the existing Yield sign is obscured by an intersection lane control sign

North of M-150 Highway, Cheddington Drive is a two-lane street that is 28 feet wide, measured between the backs of curbs. Near the intersection with M-150 Highway the street widens to provide a southbound left-turn lane. There are curbs and gutters along the street, but there are no sidewalks. Because Cheddington Drive is not continuous, it currently functions similar to a driveway providing access to a bank and the church. According to the Lee's Summit street classification map Cheddington Drive is a commercial collector, and is planned to be extended north in the future.

Approved Development

In 2013, the City approved a 162,000 square foot Wal-Mart Supercenter, gas kiosk, and 20,000 square feet of other retail uses to be located on undeveloped land between Hollywood Drive and Market Street. City staff provided the traffic impact study for this approved development, dated December 18, 2012. During the approval process, the developer proposed to construct Hollywood Drive as an alternate route for traffic circulation in the area. Since Hollywood Drive was not included in the original development proposal, it was not included in the 2012 traffic impact study either. At the time of this study the Wal-Mart Supercenter is under construction, and Hollywood Drive is completed and open to traffic.

Analysis

The scope of analysis for the assessment of the proposed development's impact on the surrounding transportation system is based in large part on the recommended practices of the Institute of Transportation Engineers (ITE), as outlined in their Traffic Engineering Handbook. ITE is a nationally-recognized organization of transportation professionals with members from both private and public sectors. The analysis of the proposed development's impact included development of trip generation and trip distribution estimates as well as a traffic operations assessment for each study scenario. Each of the analysis methodologies and findings are described in the subsequent sections.

Trip Generation

Trip generation estimates were prepared using the Institute of Transportation Engineer's Trip Generation, 9th Edition. **Table 1** below shows the expected trips to be generated by the proposed development.

Table 1 Trip Generation									
Land Use	Intensity	ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
				Total	In	Out	Total	In	Out
Apartments	243 du	220	1,596	123	25	98	151	98	53

Trip Distribution

The estimated trips generated by the proposed development were distributed onto the surrounding street network based on the trip distributions summarized on the following page in **Table 2**. These distributions are based on existing travel patterns and engineering judgment. The detailed distribution patterns through the study intersections are shown in **Appendix B**.

Table 2
Trip Distribution

Direction To/From	Percentage
East on M-150 Highway	50%
West on M-150 Highway	45%
South on Cheddington Drive	5%
Total	100%

Traffic Operation Assessment

An assessment of traffic operations was made for the scenarios listed below.

- ▶ Existing Conditions
- ▶ Existing plus Approved Development Conditions
- ▶ Existing plus Approved plus Proposed Development Conditions

The study intersections were evaluated using the Synchro traffic analysis software package. Calculations were performed based on the methodologies outlined in the Highway Capacity Manual (HCM), 2000 Edition, which is published by the Transportation Research Board. The operating conditions at an intersection are graded by the “level of service” experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from “A” to “F”. LOS A represents the least congested condition with free-flow movement of traffic and minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. **Table 3** shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 3
Intersection Level of Service Delay Thresholds

Level of Service (LOS)	Signalized	Unsignalized
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

While LOS measurements apply to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole.

Unsignalized intersections, in contrast, are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are the left turns off of the major street and the side-street approaches for two-way stop-controlled intersections. At unsignalized intersections lower LOS ratings (D, E and F) do not, in themselves, indicate the need for additional improvements. Many times there are convenient alternative routes to avoid the longer delays. Other times the volumes on the unsignalized approaches are relatively minor when compared to the major street traffic, and improvements such as traffic signal installation may increase the average delay to all users of the intersection.

Traffic queues are also evaluated as part of the analyses. Long traffic queues which extend beyond the amount of storage available, either between intersections or within turn lanes, can have significant impacts on operations. The projected vehicular queues are 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 LOS rating deemed acceptable varies by community, facility type and traffic control device. The City of Lee's Summit has designated LOS C as the minimum desirable standard for signalized intersections. At unsignalized intersections LOS D, E, or even F are often considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

Existing Conditions

The results of the Existing Conditions intersection analyses are summarized in **Table 4**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figure A-3**. Current traffic signal timings were used for the analysis of the signalized intersection. The Synchro output files are included in **Appendix C**.

Table 4 Intersection Operational Analysis Existing Conditions					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
M-150 Highway and Cheddington Drive	Traffic Signal	A	9.1	B	14.9
M-150 Highway and Hollywood Drive	Southbound Right-Turn	B	11.4	B	11.0

1 – Level of Service

2 – Delay in seconds per vehicle

As shown in the table, all movements at the study intersections currently operate within acceptable levels of service during the peak hours.

Existing plus Approved Development Conditions

The development trips generated by the Wal-Mart development were compiled to determine the effects of traffic from the approved development which is yet to be completed. Some of the approved development trips were redistributed to Hollywood Drive since it was not included in the traffic study for the Wal-Mart development.

The results of the Existing plus Approved Development Conditions intersection analyses are summarized in **Table 5**. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figure A-4**. Current traffic signal timings were used for the analysis of the signalized intersection. The Synchro output files are included in **Appendix C**.

Table 5 Intersection Operational Analysis Existing plus Approved Development Conditions					
Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
M-150 Highway and Cheddington Drive	Traffic Signal	A	9.0	B	15.4
M-150 Highway and Hollywood Drive	Southbound Right-Turn	B	11.8	B	11.8

1 – Level of Service
2 – Delay in seconds per vehicle

As shown in the table, all movements at the study intersections are projected to operate within acceptable levels of service with the addition of traffic from the Wal-Mart development.

Existing plus Approved plus Proposed Development Conditions

The results of the existing plus approved plus proposed development conditions intersection analyses are summarized on the next page in **Table 6**. This study scenario assessed the street system with the additional traffic generated by the proposed development. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on **Figure A-5**. Current traffic signal timings were used for the analysis of the signalized intersection. The Synchro output files are included in **Appendix C**.

The results in **Table 6** indicate that all movements at the study intersections are projected to operate within acceptable levels of service with the addition of traffic from the proposed development. All 95th percentile queue lengths are projected to be contained within the available storage of the existing turn lanes.

Table 6
Intersection Operational Analysis
Existing plus Approved plus Development Conditions

Intersection	Movement	A.M. Peak Hour		P.M. Peak Hour	
		LOS ¹	Delay ²	LOS ¹	Delay ²
M-150 Highway and Cheddington Drive	<i>Traffic Signal</i>	B	11.4	B	16.3
M-150 Highway and Hollywood Drive	<i>Southbound Right-Turn</i>	B	12.1	B	12.1

1 – Level of Service
2 – Delay in seconds per vehicle

Access Management

Lee's Summit's Access Management Code (AMC) provides guidance on turn lane requirements, throat lengths, and spacings of intersections and driveways on streets maintained by the City. All proposed site access points are adequately spaced per the AMC. The throat lengths of the access points are both roughly 50 feet, which is the minimum per the AMC. The AMC also states that longer throat lengths are desired adjacent to collector streets, such as Cheddington Drive. This access point is projected to have a low volume of traffic, and the 50-foot throat length should be sufficient to prevent inbound vehicles from queuing back onto Cheddington Drive.

Traffic volumes are projected to be low at the access points, and no turn lanes are necessary at these intersections per the AMC. When Cheddington Drive is extended north in the future, a southbound left-turn lane may be beneficial. Therefore, it would be appropriate to reserve the right-of-way to allow Cheddington Drive to be widened in the future.

Warranting criteria from MoDOT's Engineering Policy Guide (EPG) were used to evaluate the need for a westbound right-turn lane on M-150 Highway at Cheddington Drive. Projected traffic volumes were plotted relative to the applicable curve on Figure 940.9.9 of the EPG. The volumes are well below the threshold for a right-turn lane. The warrant analysis figure is included in **Appendix C**.

Summary

TranSystems has completed a traffic impact study for the proposed multi-family residential development to be located generally north and east of the M-150 Highway and Cheddington Drive intersection 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 existing signing on the southbound approach to the M-150 Highway and Hollywood Drive intersection is not in accordance with the MUTCD. A Stop sign should be installed for southbound traffic, instead of the existing Yield sign. The existing intersection lane control sign mounted in advance of the Yield sign is not installed in conformance with the MUTCD and should be removed. One-way

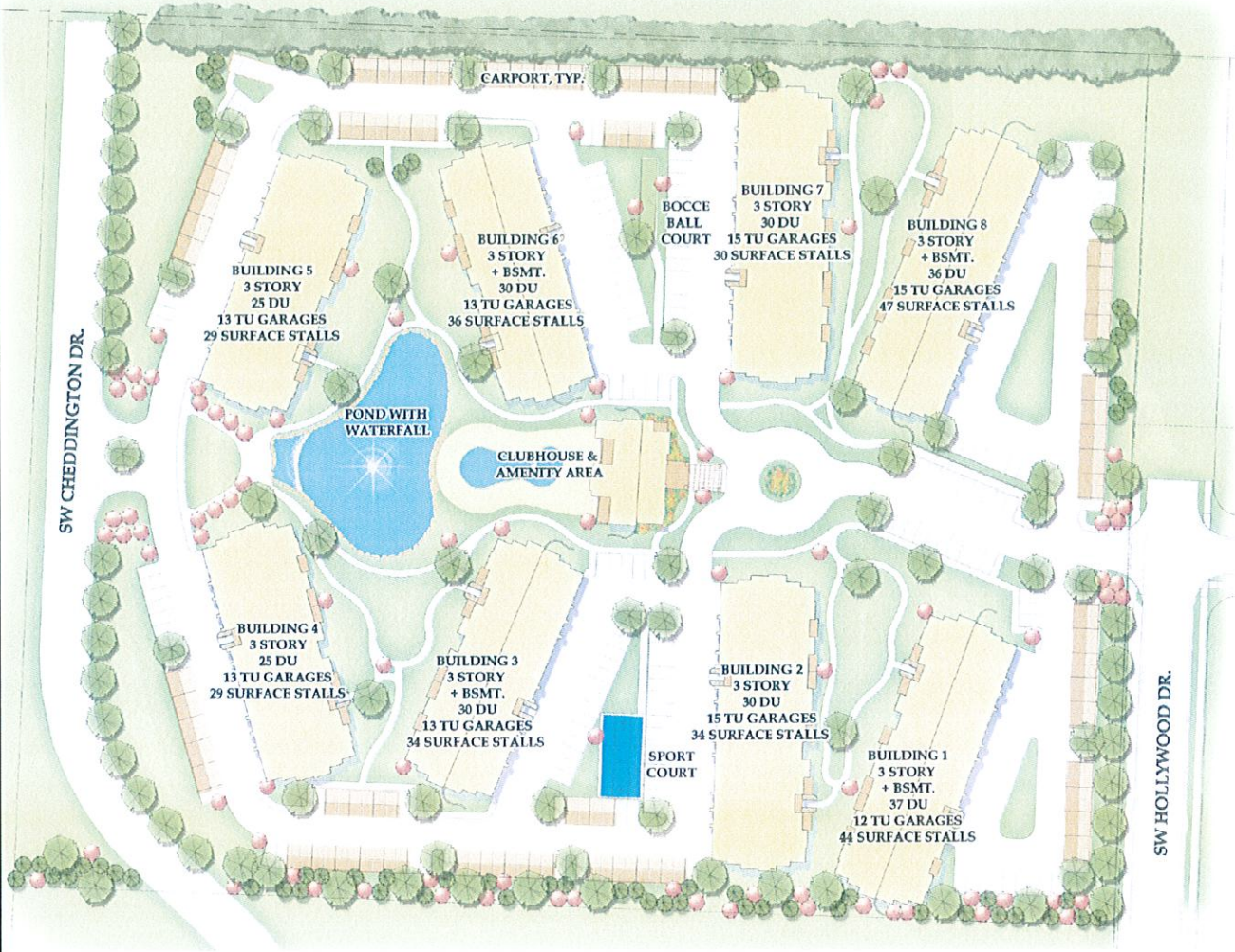


signs and/or no left-turn signs should be installed at locations that are in accordance with the MUTCD to convey the turn restriction.

The proposed development is projected to generate 123 and 151 new trips during the A.M. and P.M. peak hours, respectively. The analysis results indicate that the existing street system surrounding the proposed development can accommodate the projected development traffic, and operate within desirable levels of service during the A.M. and P.M. peak hours. As such, no improvements are identified to mitigate traffic generated by the proposed development. When Cheddington Drive is extended north in the future, a southbound left-turn lane may be beneficial on this collector street. Therefore, it would be appropriate to reserve the right-of-way to allow Cheddington Drive to be widened in the future.



	LOCATION MAP		Kenbridge Crossing Traffic Impact Study Lee's Summit, Missouri		July 2016	Figure A-1
					No Scale	



July 2016

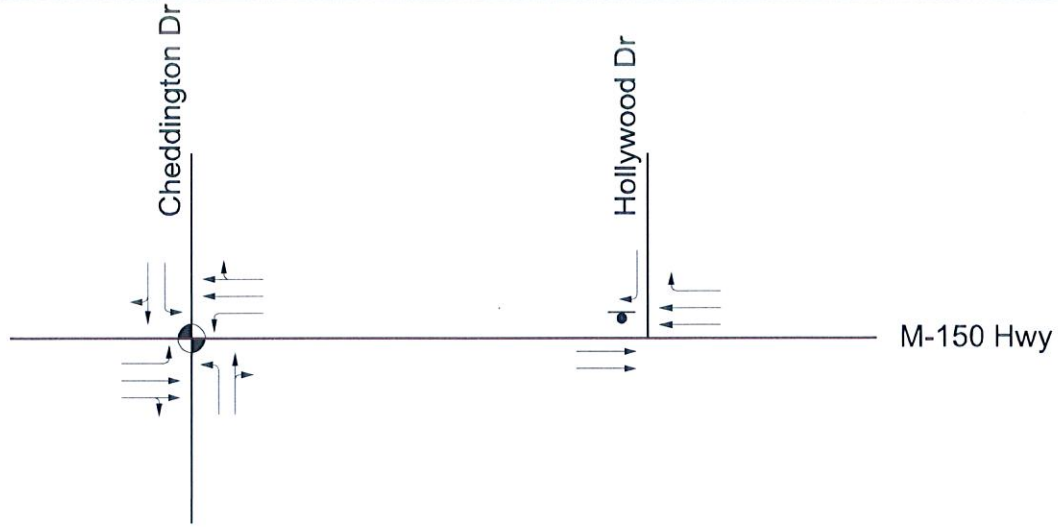
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Kenbridge Crossing
Traffic Impact Study
Lee's Summit, Missouri

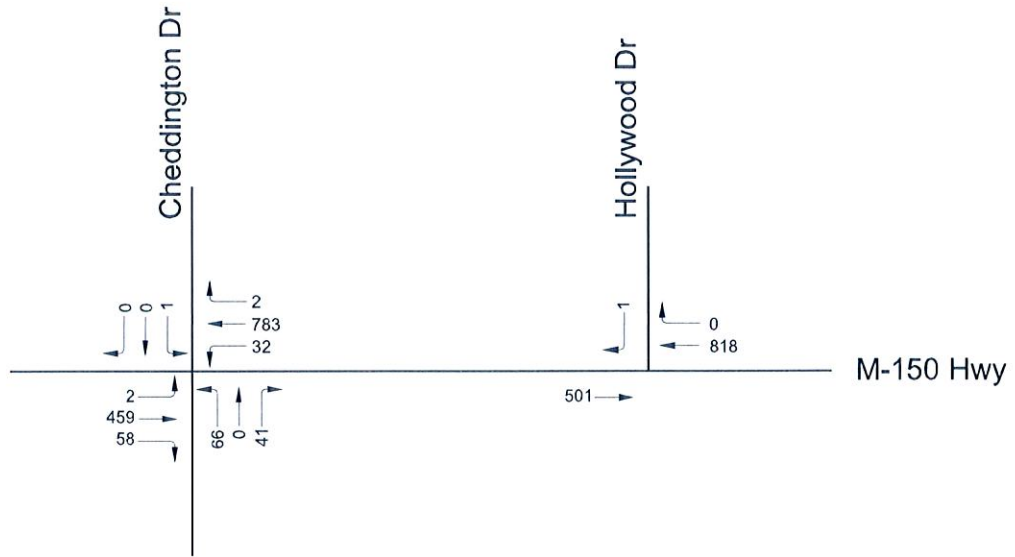
SITE PLAN

Figure A-2

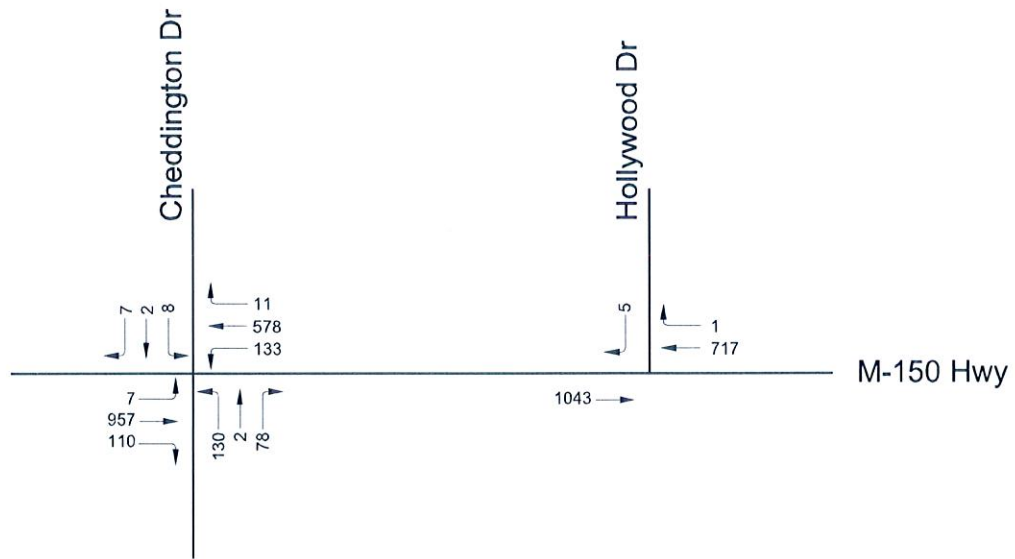




LANE CONFIGURATIONS

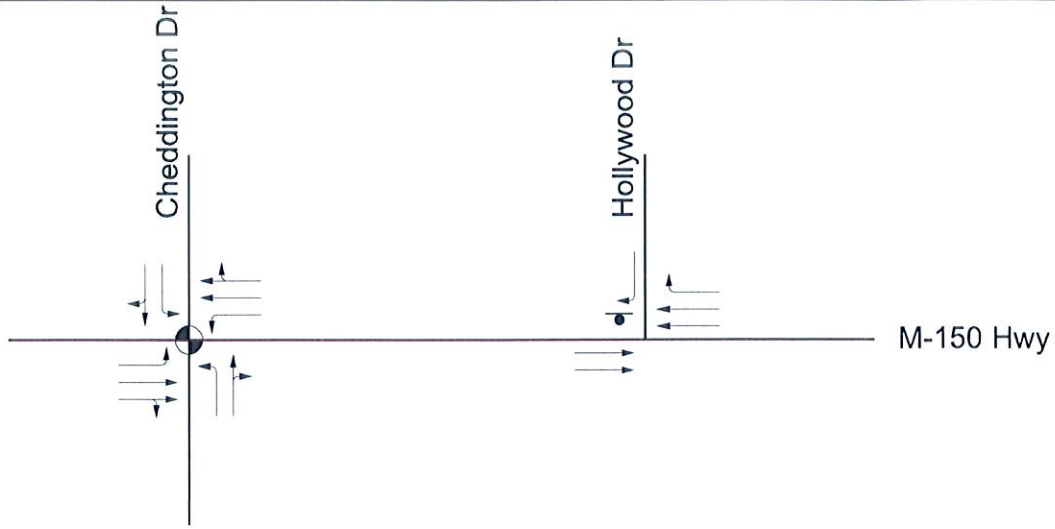


A.M. PEAK HOUR TRAFFIC VOLUME

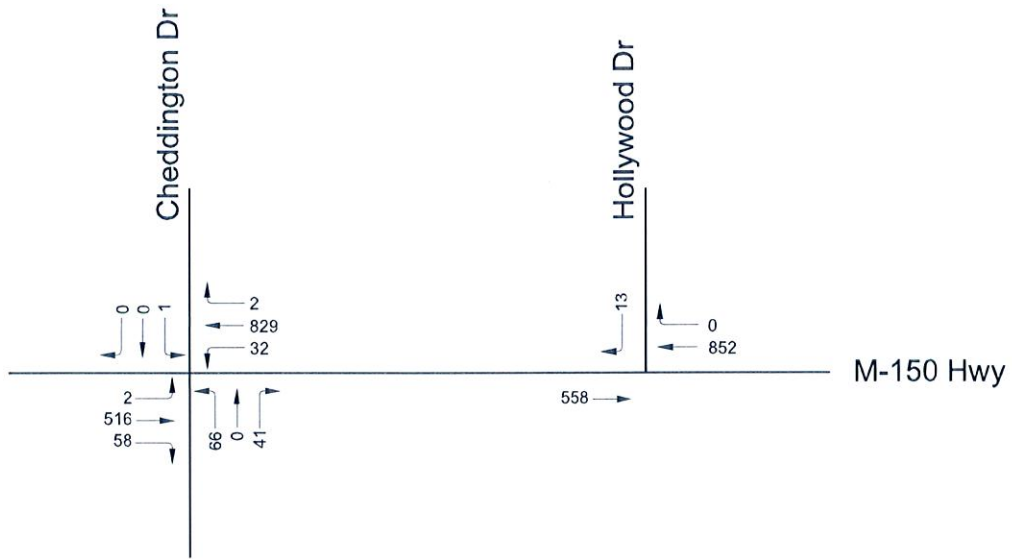


P.M. PEAK HOUR TRAFFIC VOLUME

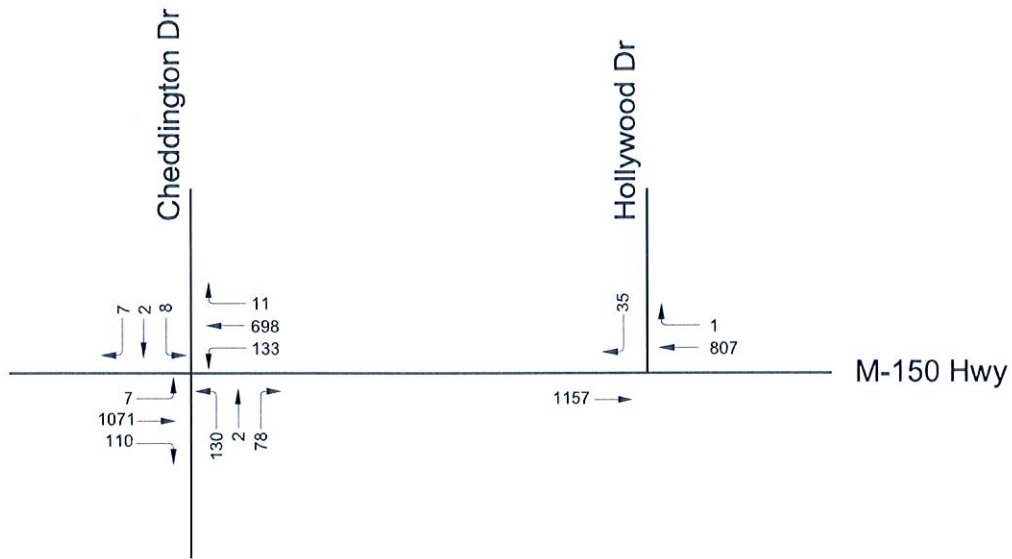
July 2016 No Scale	Kenbridge Crossing Traffic Impact Study Lee's Summit, Missouri	EXISTING CONDITIONS		Figure A-3



LANE CONFIGURATIONS



A.M. PEAK HOUR TRAFFIC VOLUME



P.M. PEAK HOUR TRAFFIC VOLUME

Figure A-4

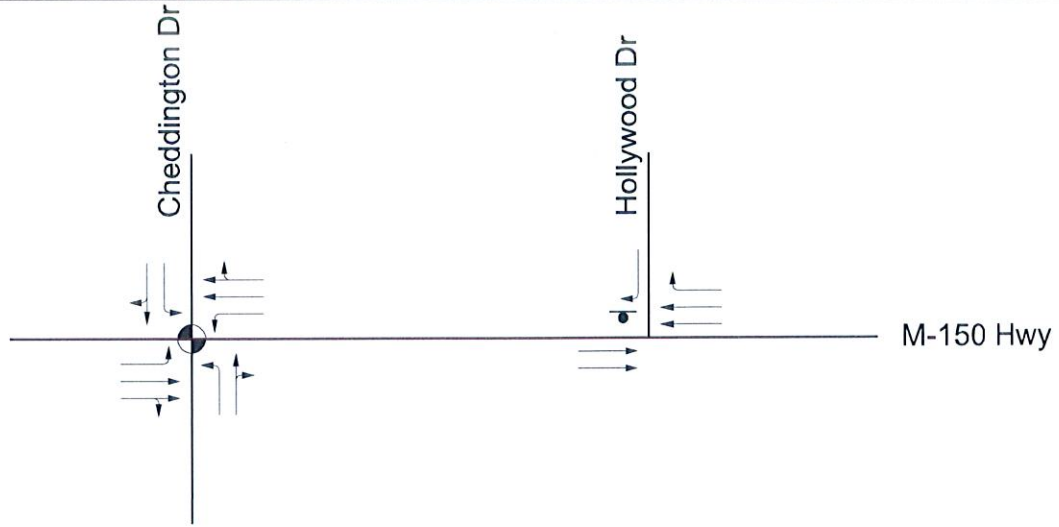
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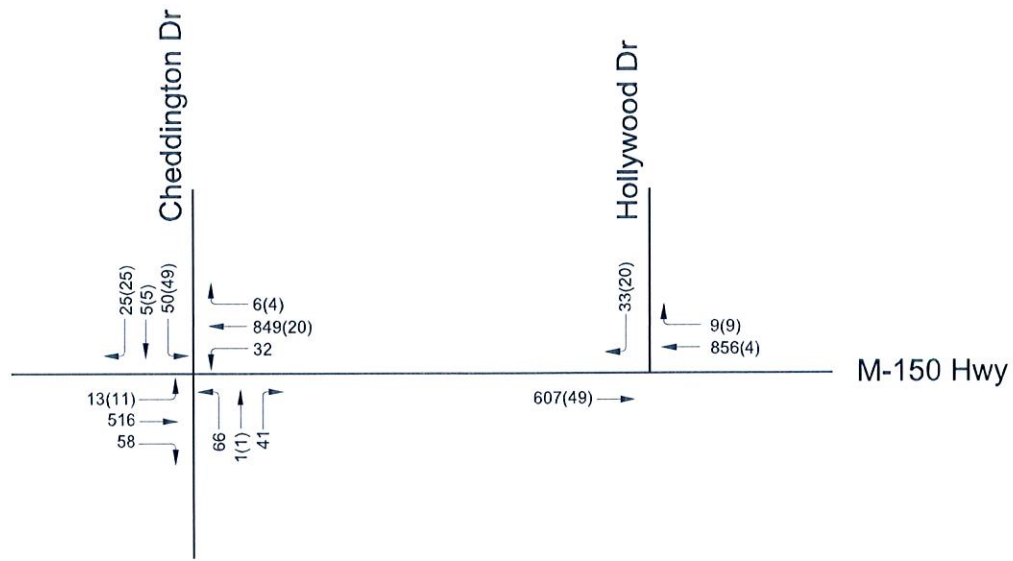
Kenbridge Crossing
Traffic Impact Study
Lee's Summit, Missouri

EXISTING PLUS APPROVED DEVELOPMENT

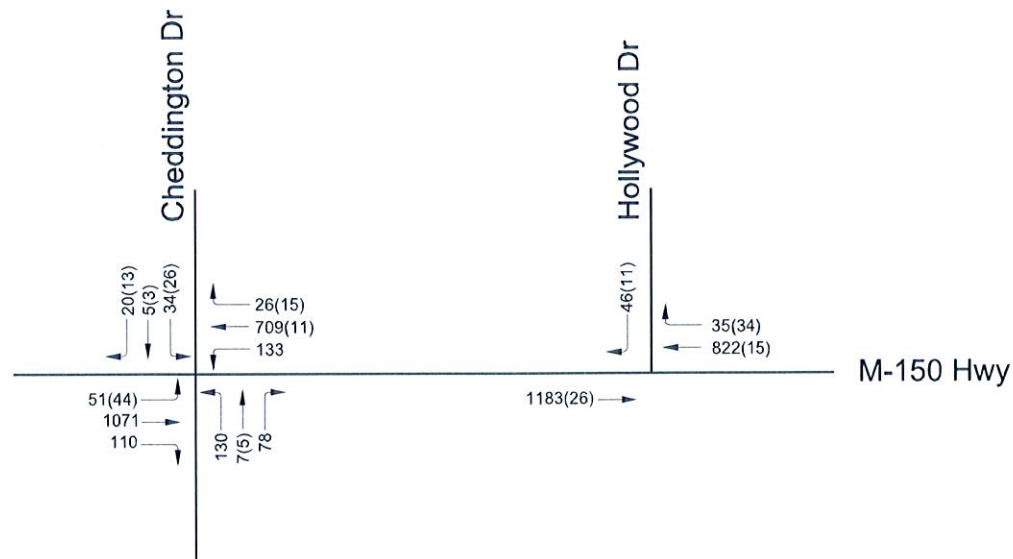




LANE CONFIGURATIONS



A.M. PEAK HOUR TRAFFIC VOLUME



P.M. PEAK HOUR TRAFFIC VOLUME

EXISTING PLUS APPROVED PLUS PROPOSED DEVELOPMENT

July 2016

No Scale

Kenbridge Crossing Traffic Impact Study Lee's Summit, Missouri

Figure A-5





Appendix B – Trip Generation and Distribution

See attached worksheets.

Kenbridge Crossing TIS

Lee's Summit, Missouri

Trip Generation

Land Use	Intensity	ITE Code	Daily (Weekday)	A.M. Peak Hour			P.M. Peak Hour						
				Total	% In	% Out	Total	% In	% Out				
Apartments	243 du	220	1,596	123	20%	80%	25	98	151	65%	35%	98	53
Total Development Trips				1,596	123		25	98	151			98	53

Notes:

Trip estimates for this study were developed using ITE's Trip Generation, 9th Edition.