

HARDIN VALLEY ROAD APARTMENTS TRAFFIC IMPACT STUDY

HARDIN VALLEY ROAD AT WILLOW POINT WAY
KNOXVILLE, TN

CCI PROJECT NO. 01782-0001

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TIS Version 1
4/29/2024



PREPARED FOR:
DGA Residential, LLC
6305 Kingston Pike
Knoxville, TN 37919

SUBMITTED BY
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10025 Investment Drive
Knoxville, TN 37932
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APRIL 26
2024

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TABLE OF CONTENTS

SECTION 1	EXECUTIVE SUMMARY	1
<hr/>		
SECTION 2	INTRODUCTION & PURPOSE OF STUDY	2
<hr/>		
SECTION 3	EXISTING CONDITIONS	4
<hr/>		
SECTION 4	BACKGROUND CONDITIONS	8
<hr/>		
SECTION 5	FUTURE CONDITIONS	10
<hr/>		
SECTION 6	EVALUATIONS	14
<hr/>		
SECTION 7	CONCLUSIONS & RECOMMENDATIONS	15
<hr/>		
SECTION 8	APPENDIX	16
<hr/>		

TABLE OF CONTENTS

FIGURES

FIGURE 1	LOCATION MAP	2
FIGURE 2	CONCEPTUAL SITE PLAN	3
FIGURE 3	EXISTING SITE CONDITIONS	4
FIGURE 4	2024 EXISTING TRAFFIC VOLUMES	6
FIGURE 5	2026 BACKGROUND TRAFFIC VOLUMES	9
FIGURE 6	TRIP DISTRIBUTION	11
FIGURE 7	TRIP ASSIGNMENT	12
FIGURE 8	2026 COMBINED TRAFFIC VOLUMES	13

TABLES

TABLE 1	ANNUAL AVERAGE DAILY TRAFFIC COUNT SUMMARY	5
TABLE 2	TRIP GENERATION SUMMARY	10
TABLE 3	CAPACITY ANALYSIS SUMMARY	14

APPENDICES

APPENDIX A	TRAFFIC DATA
APPENDIX B	TRIP GENERATION
APPENDIX C	ANALYSES

EXECUTIVE SUMMARY

This report provides a summary of a traffic impact study that was performed for a proposed multi-family residential development to be located along Hardin Valley Road at the intersection of Willow Point Way, in northwest Knox County, Tennessee. The project site is located on the south side of Hardin Valley Road directly opposite Willow Point Way and Creek Side Professional Park. The development plan for this project proposes a multi-family apartment complex with 84 dwelling units. The project proposes one full access driveway. The driveway will become the fourth leg to the Hardin Valley Road / Willow Point Way intersection.

The purpose of this study was the evaluation of the traffic operational and safety impacts of the proposed development upon roadways in the vicinity of the site. Of particular interest was the intersection of Hardin Valley Road at Willow Point Way and the proposed site access driveway. Appropriate intersection evaluations were conducted at this location for existing and future conditions, both with and without traffic volumes generated from the proposed development, in order to determine the anticipated impacts and to establish recommended measures to mitigate these impacts. These evaluations included intersection capacity analyses, turn lane analyses reviews and others as appropriate.

The primary conclusion of this study is that traffic generated from the proposed development will not have major impacts on the study intersection of Hardin Valley Road and Willow Point Way. The intersection is anticipated to continue to operate at a level-of-service of LOS "D" in the A.M. peak, while during the P.M. peak the intersection is anticipated to operate at a LOS "E" under full buildout conditions. The following is a summary of the improvements that are recommended to be implemented with the construction of this project:

1. Install STOP sign control on the proposed site driveway approach to Hardin Valley Road.
2. Maintain intersection corner sight distances for the site driveway by ensuring that new site signage and landscaping is appropriately located.

INTRODUCTION & PURPOSE OF STUDY

This report provides a summary of a traffic impact study that was performed for a proposed multi-family residential development to be located along Hardin Valley Road at the intersection of Willow Point Way, in northwest Knox County, Tennessee. The project site is located on the south side of Hardin Valley Road directly opposite Willow Point Way and Creek Side Professional Park. FIGURE 1 is a location map identifying the major roadways in the vicinity of the site.



FIGURE 1
LOCATION MAP

The development plan for this project proposes a multi-family apartment complex with 84 dwelling units. The project proposes one full access driveway. The driveway will become the fourth leg to the Hardin Valley Road / Willow Point Way intersection. FIGURE 2 is a Conceptual Site Plan which details the proposed site configuration.

The purpose of this study was the evaluation of the traffic operational and safety impacts of the proposed development upon roadways in the vicinity of the site. Of particular interest was the intersection of Hardin Valley Road at Willow Point Way and the proposed site access driveway. Appropriate intersection evaluations were conducted at this location for existing and future conditions, both with and without traffic volumes generated from the proposed development, in order to determine the anticipated impacts and to establish recommended measures to mitigate these impacts. These evaluations included intersection capacity analyses, turn lane analyses reviews and others as appropriate.

INTRODUCTION & PURPOSE OF STUDY | SECTION 2

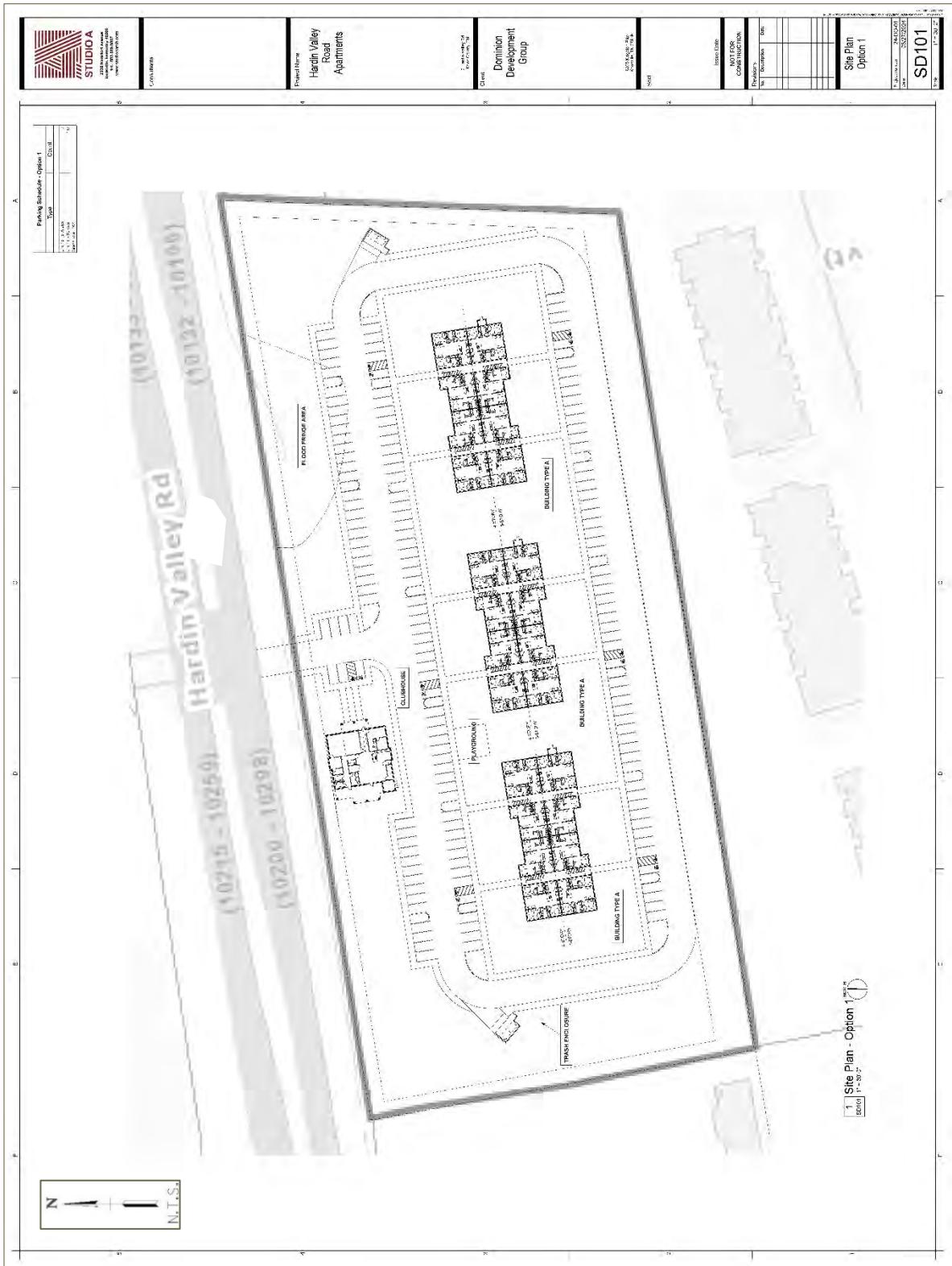


FIGURE 2
CONCEPTUAL SITE PLAN

EXISTING CONDITIONS

EXISTING ROADWAY CONDITIONS

Hardin Valley Road is a major arterial roadway that provides east - west access through the Karns and Hardin Valley communities, stretching west from Ball Camp Byington Road to Hickory Creek Road / East Gallaher Ferry Road. West of Solway Road, Hardin Valley Road is a minor arterial. In the vicinity of the proposed development, the roadway consists of two travel lanes in each direction separated by a raised grassed median. An existing median opening is located at the study intersection of Willow Point Way with left-turn storage lanes provided in both the eastbound and westbound directions. The speed limit on Hardin Valley Road is posted as 45 mph both to the east and west of the site. The 2022 ADT on Hardin Valley Road was 27,100.

Willow Point Way is a two-lane private street (JPE) providing access to the Creek Side Professional Park. Willow Point Way is approximately 1,400 feet in length and has "stop sign" control on the southbound approach to Hardin Valley Road.

EXISTING SITE CONDITIONS

The proposed development site is located on the south side of Hardin Valley Road directly across from the Willow Point Way intersection. This unsignalized intersection lies between the two signalized intersections of Bertelkamp Lane, approximately 1,300 feet to the west, and Westcott Boulevard, approximately 675 feet to the east. The proposed site is surrounded by residential development to the south and commercial, office, and industrial uses to the east, west, and north. Development patterns of the surrounding area are shown in FIGURE 3.



FIGURE 3
EXISTING SITE CONDITION

EXISTING TRAFFIC DATA

Existing traffic data was gathered for this study. The Knoxville / Knox County MPO collects annual average daily traffic data (AADT) on roadways in the study area. One count station location on Hardin Valley Road, located to the west of the site, was felt to have relevance for this study. The most currently available data from this count station is contained in TABLE 1.

In addition to the available AADT data, an intersection turning movement traffic count was performed to determine the current A.M. and P.M. peak hour operating volumes for the intersection of Hardin Valley Road and Willow Point Way. The existing traffic count is summarized in FIGURE 4 for each of the peak traffic hours, and the raw data traffic count summary sheets are contained in APPENDIX A.

TABLE 1 ANNUAL AVERAGE DAILY TRAFFIC COUNT SUMMARY	
COUNT YEAR	TPO COUNT STA.093M381 HARDIN VALLEY ROAD WEST OF CHERAHALA BLVD.
2022	27,100
2021	23,330
2020	22,740
2019	26,400
2018	-
2017	24,410
2016	22,520
2015	23,940
2014	22,420
2013	20,820

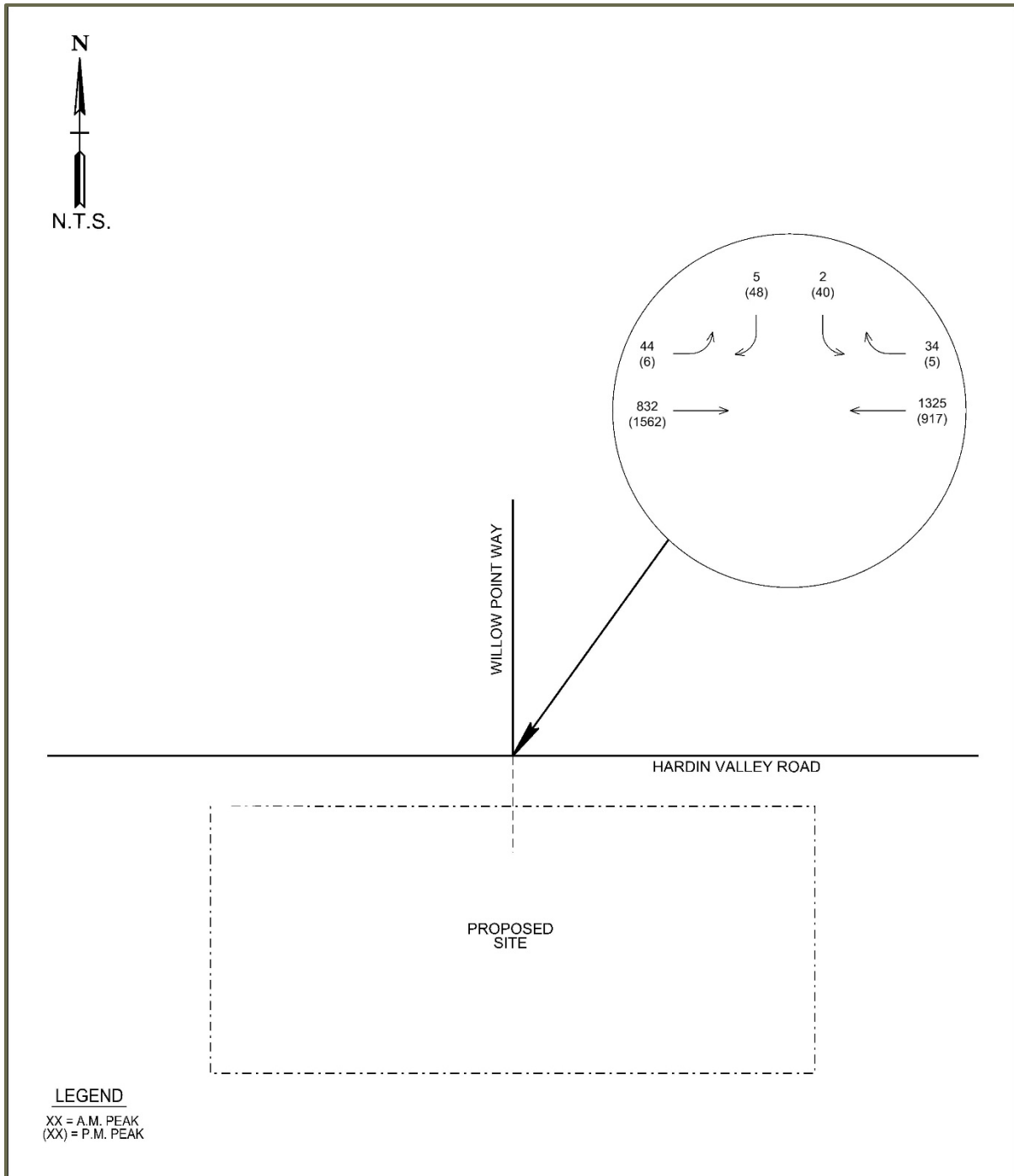


FIGURE 4
2024 EXISTING TRAFFIC VOLUMES

EXISTING CAPACITY ANALYSES / LEVELS-OF-SERVICE

Capacity analyses employing the methods of the Highway Capacity Manual (7th Edition) were conducted for the existing study intersection of Hardin Valley Road and Willow Point Way. The analyses were performed with the 2024 existing traffic volumes and existing intersection traffic control and lane configurations. The intersection of Hardin Valley Road and Willow Point Way was found to operate at fair levels-of-service "D" during the A.M. and P.M. peak hours. The EVALUATIONS section of this report may be referenced for tabular summaries and discussion of these analyses, while more detailed summaries are presented on the computer printouts contained in APPENDIX C. Also contained in APPENDIX C is a section entitled "Capacity and Level of Service Concepts", which provides a description of the utilized procedures.

4.0 BACKGROUND CONDITIONS

BACKGROUND TRAFFIC GROWTH

The proposed development is anticipated to be constructed in the next 2 years with a completed buildout in the year 2026. Therefore, the year 2026 was established as the evaluation year for this project. To determine traffic volumes resulting solely from background traffic growth to year 2026, it was necessary to establish an annual growth rate for existing traffic. The ADT values previously discussed, as well as knowledge of the area, were used to determine an approximate annual growth rate. Based on the available data, a background annual growth rate of 2.0% was assumed. FIGURE 5 contains the background traffic volumes that would result from a 2.0% annual growth rate from year 2024, when the counts were conducted, to year 2026. The background traffic volumes shown on FIGURE 5 represent the year 2026 background growth conditions without traffic related to the proposed development. These volumes will be carried forward and used as the basis for developing future traffic volumes that include traffic from the proposed development.

BACKGROUND CAPACITY ANALYSES / LEVELS-OF-SERVICE

Appropriate capacity analyses as described in the Existing Conditions section of this report were conducted utilizing the year 2026 background volumes (FIGURE 5) for the complete buildout for analysis of future conditions. The analyses were performed with existing intersection traffic control and lane configurations. The intersection of Hardin Valley Road and Willow Point Way was found to continue to operate at a level-of-service "D" during both peak analysis periods under 2026 background conditions. The EVALUATIONS section of this report may be referenced for tabular summaries and discussion of these analyses, while more detailed summaries are presented on the computer printouts contained in APPENDIX C.

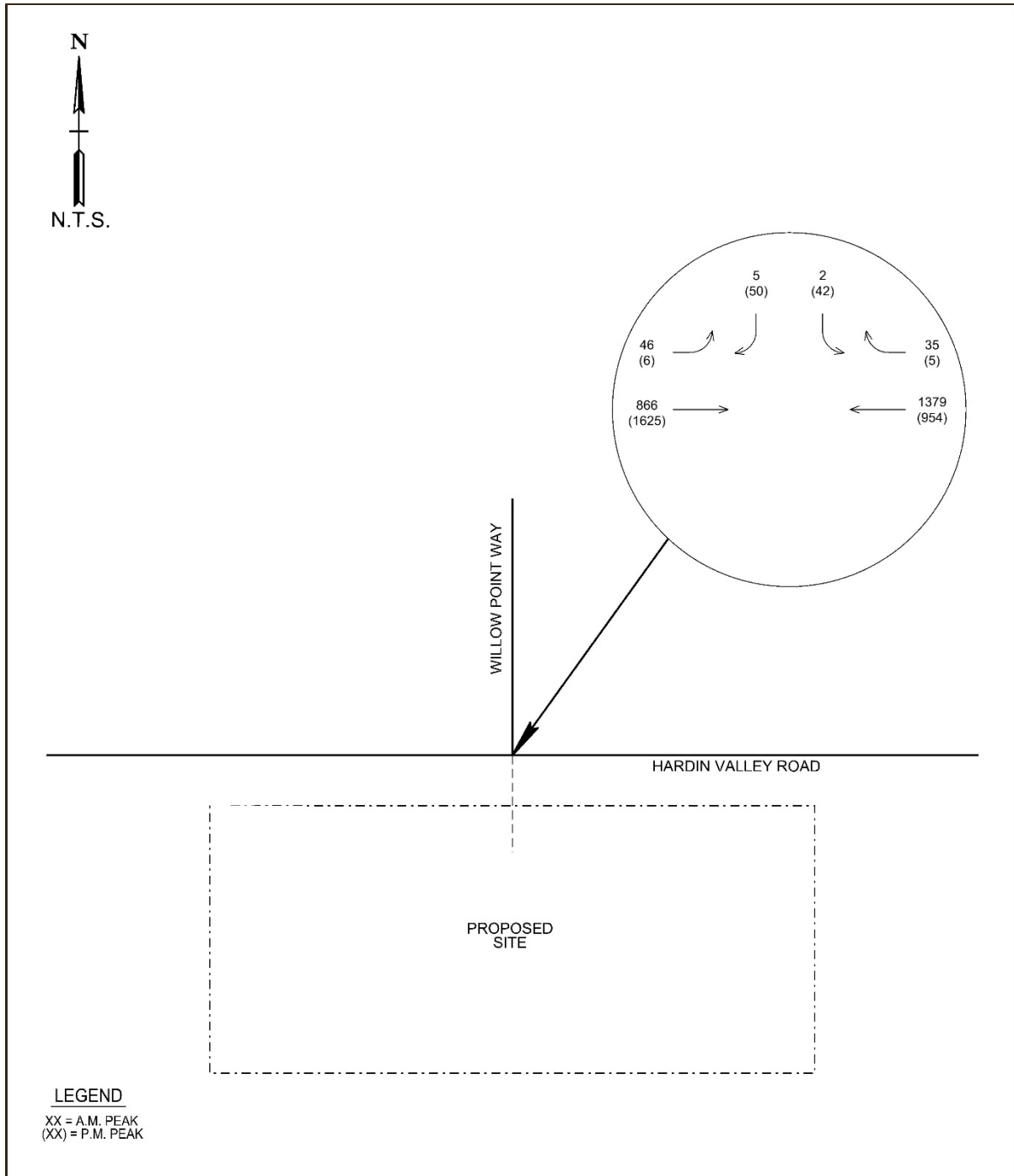


FIGURE 5
2026 BACKGROUND TRAFFIC VOLUMES

5.0 FUTURE CONDITIONS

TRIP GENERATION

In order to estimate the expected traffic volumes to be generated by the proposed multi-family residential development, the procedures recommended by the Institute of Transportation Engineers were utilized. Local trip generation rates developed by the Knoxville-Knox County Metropolitan Planning Commission for multi-family apartment type developments within the region were utilized to generate the estimated trips. The generated traffic volumes were determined based on the data for the weekday, AM peak hour, and PM peak hour. The development will consist of 84 residential units. TABLE 2 provides a summary of the anticipated newly generated traffic from the completion of the proposed development. More detailed information related to land use and trip generation is contained in APPENDIX B.

TABLE 2 TRIP GENERATION SUMMARY					
LAND USE	ITE CODE	SIZE	WEEKDAY (TRIPS/DAY)	AM PEAK HOUR (TRIPS/HR)	PM PEAK HOUR (TRIPS/HR)
Apartments					
Entering Trips			438	10	36
Exiting Trips	Local	84 units	<u>438</u>	<u>35</u>	<u>30</u>
Total Trips			876	45	66

TRIP DISTRIBUTION AND ASSIGNMENT

FIGURE 6 provides a summary of the vehicle trip distribution patterns assumed for this study. These patterns were based on the existing traffic patterns derived from the traffic counts, United States Census Bureau data, and knowledge of the area. FIGURE 7 provides a summary of the anticipated vehicle trips associated with the development as assigned to the study intersection utilizing the trip generation data from TABLE 2 and the distribution patterns shown on FIGURE 6.

Future projected traffic volumes for the development were developed by adding the generated trips shown in FIGURE 7 to the 2026 background traffic volumes (FIGURE 5) developed in the previous section. The year 2026 combined volumes can be seen in FIGURE 8. These combined year volumes reflect the existing traffic, the background traffic growth, and the newly generated traffic from the proposed development. The volumes shown in FIGURES 8 are the combined volumes used in the analysis of the future conditions.

FUTURE CAPACITY ANALYSES / LEVELS-OF-SERVICE

Capacity analyses as described in the Existing Conditions section of this report were conducted for the completed project conditions utilizing the Year 2026 combined volumes shown in FIGURE 8. The analysis was conducted using the existing lane configurations for Hardin Valley Road and Willow Point Way / Site Access. The EVALUATIONS section of this report may be referenced for tabular summaries and discussion of these analyses, while more detailed summaries are presented on the computer printouts contained in APPENDIX C.

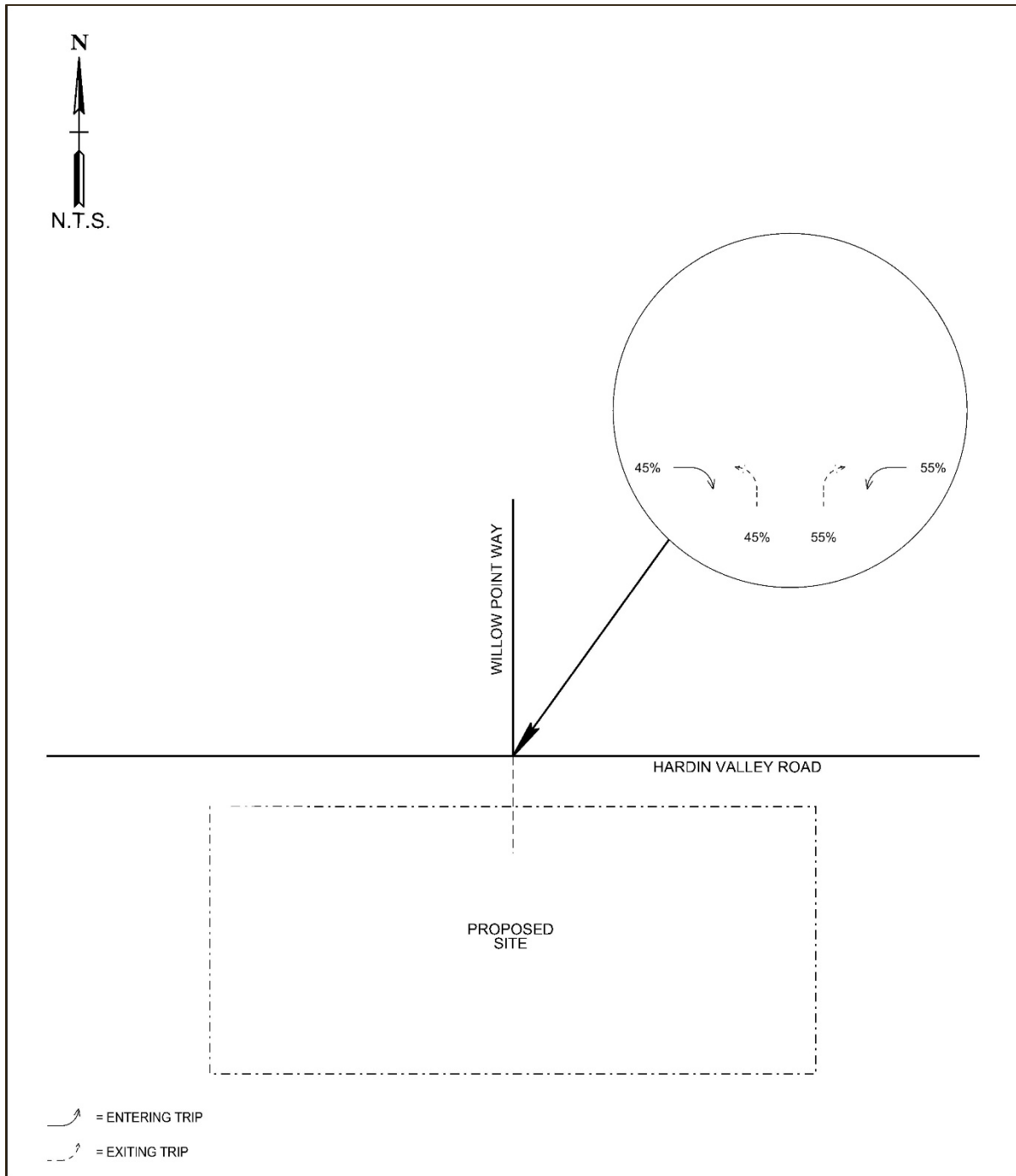
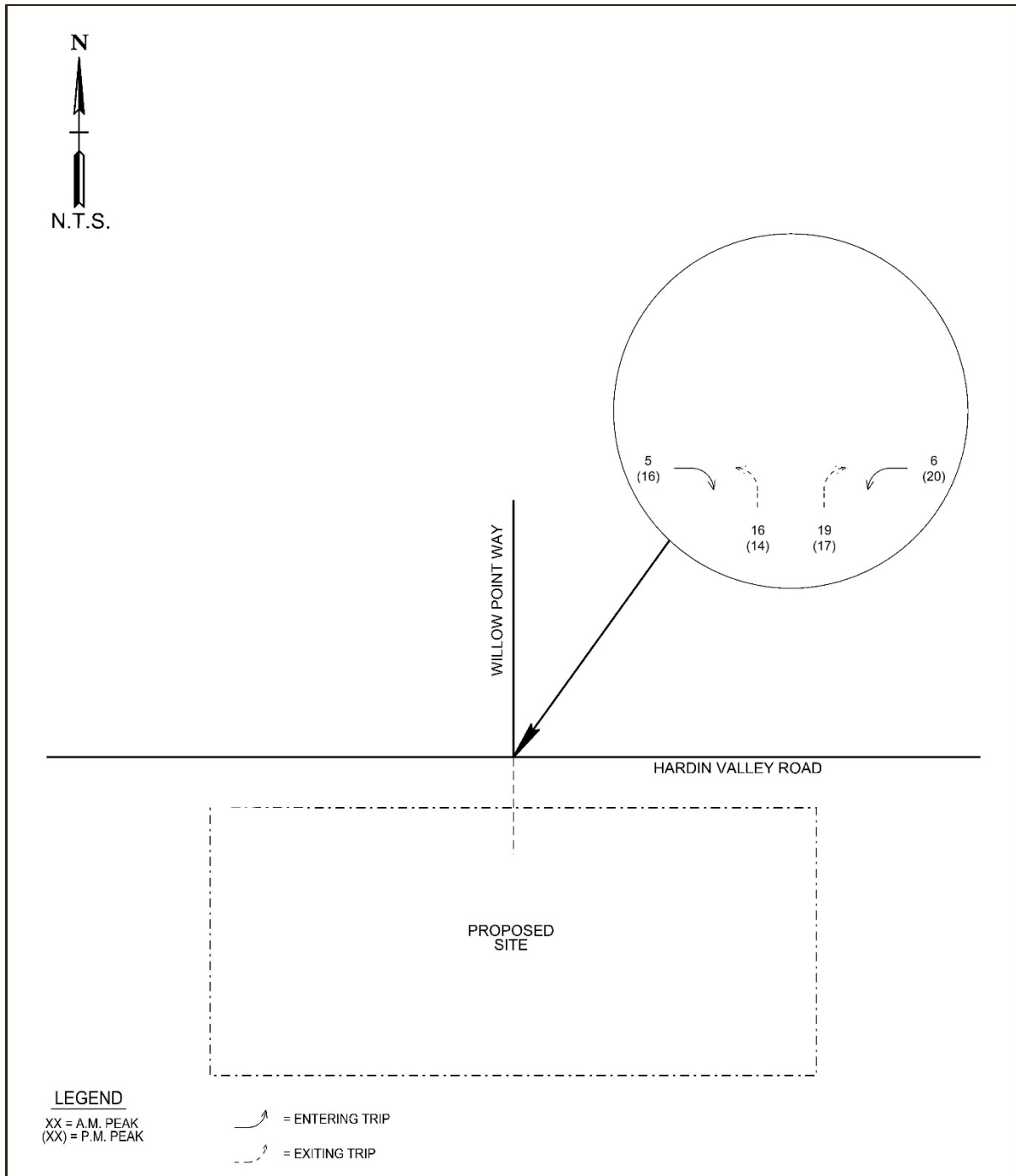


FIGURE 6
TRIP DISTRIBUTION



**FIGURE 7
 TRIP ASSIGNMENT**

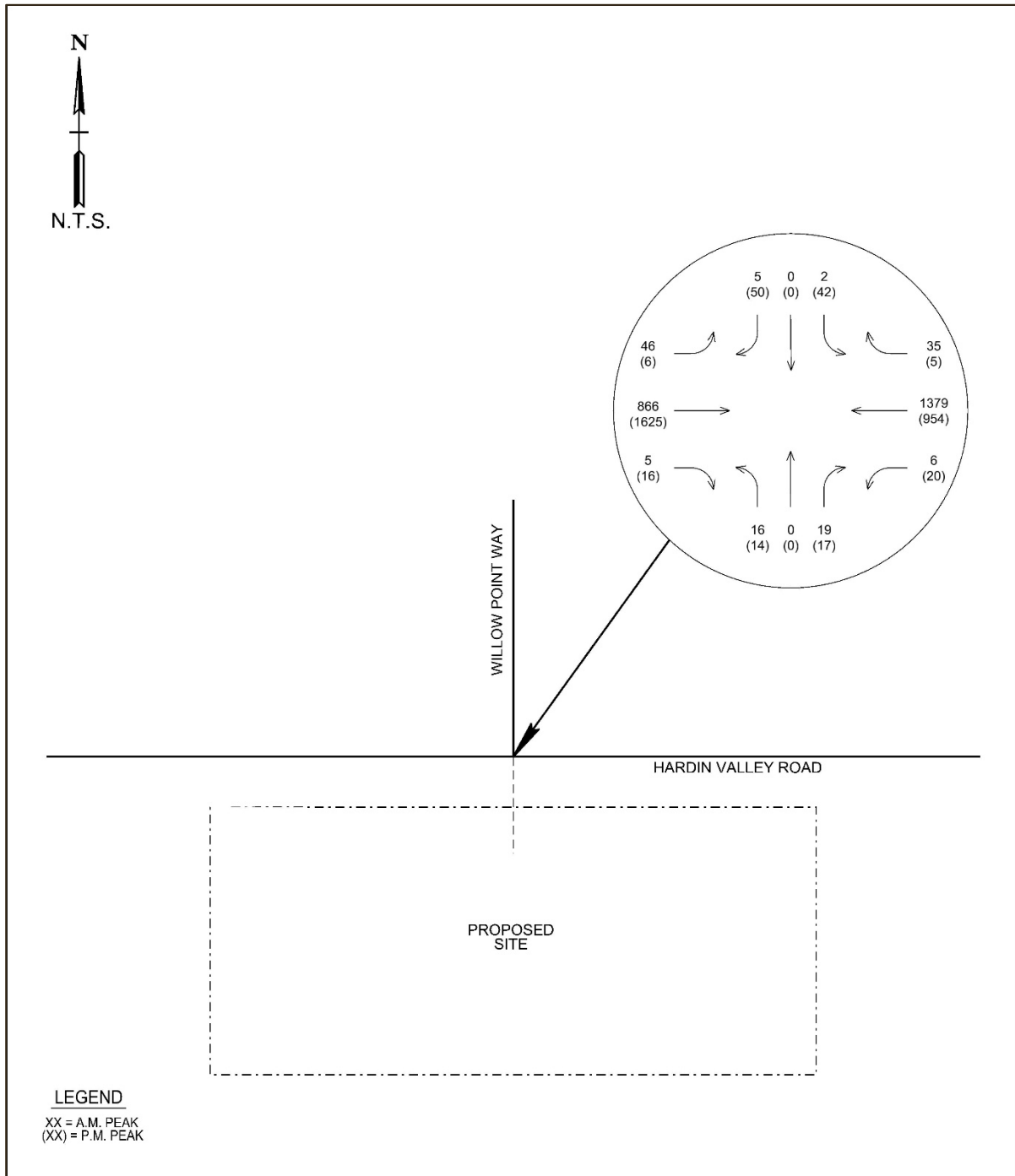


FIGURE 8
2026 COMBINED TRAFFIC VOLUMES

6.0 EVALUATIONS

INTERSECTION CAPACITY ANALYSES:

TABLE 3 CAPACITY ANALYSIS SUMMARY				
INTERSECTION	TIME PERIOD	YEAR 2024 EXISTING (LOS/DELAY)	YEAR 2026 BACKGROUND (LOS/DELAY)	YEAR 2026 COMBINED (LOS/DELAY)
Hardin Valley Road at Willow Point Way / Site Access (SIDE STREET STOP) ¹	A.M.	D 25.6	D 27.3	D 28.6
	P.M.	D 29.1	D 32.3	E 49.5

The results summarized in TABLE 3 for year 2026 combined conditions with the addition of development related traffic indicate that the intersection of Hardin Valley Road and Willow Point Way / Site Access is anticipated to continue to operate at level-of-service "D" during the AM peak hour. The intersection is anticipated to operate at a level-of-service "E" during the PM peak hour.

TURN LANE ASSESSMENT

The study intersection of Hardin Valley Road and Willow Point Way / Site Access was reviewed for the need for right and left-turn lanes into the proposed site driveway. A westbound left-turn lane currently exists on Hardin Valley Road at this intersection.

Criteria from the [Knox County Access Control and Driveway Design Policy](#) were used to evaluate the need for an eastbound right turn lane at the proposed site driveway location. Based on anticipated Year 2026 Combined volumes, an eastbound right-turn lane is not warranted at site driveway intersection location. The turn lane assessment worksheet is located in APPENDIX C.

SIGHT DISTANCE ASSESSMENT

Intersection corner sight distance was reviewed for the proposed site driveway location on Hardin Valley Road. The proposed driveway intersection is located on a relatively straight section of roadway with minimal site limiting features. Sight distance observations from the proposed site driveway location were approximately 700 feet looking to the left (west) and in excess of 900 feet looking to the right (east). Thus, sight distances were found to be more than adequate for the driveway location and well in excess of the required 500 feet (passenger car) for a Hardin Valley Road speed limit of 45 mph. This will continue to be the case if new site features such as signs and landscaping are appropriately located.

7.0 CONCLUSIONS & RECOMMENDATIONS

The primary conclusion of this study is that traffic generated from the proposed development will not have major impacts on the study intersection of Hardin Valley Road and Willow Point Way. The intersection is anticipated to continue to operate at a level-of-service of LOS "D" in the A.M. peak, while during the P.M. peak the intersection is anticipated to operate at a LOS "E" under full buildout conditions. The following is a summary of the improvements that are recommended to be implemented with the construction of this project:

1. Install STOP sign control on the proposed site driveway approach to Hardin Valley Road.
2. Maintain intersection corner sight distances for the site driveway by ensuring that new site signage and landscaping is appropriately located.

8.0 APPENDIX

APPENDIX A | TRAFFIC DATA

APPENDIX B | TRIP GENERATION

APPENDIX C | ANALYSES

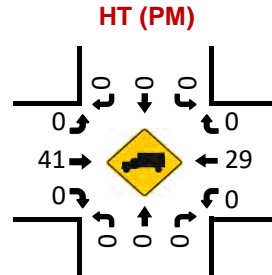
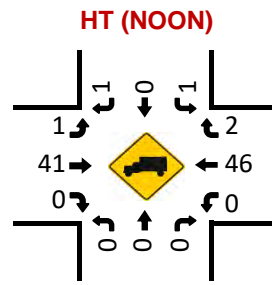
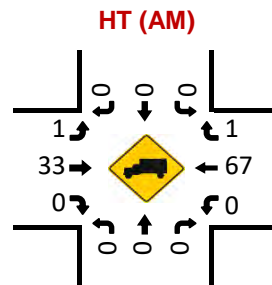
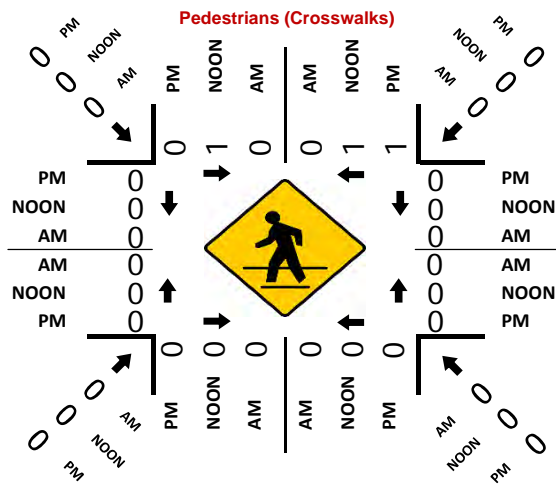
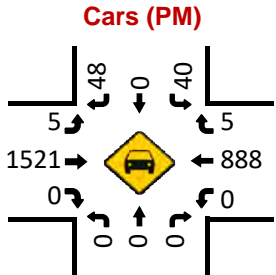
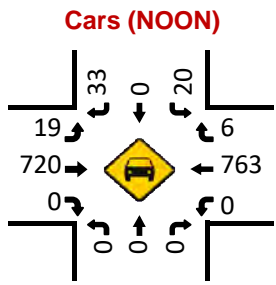
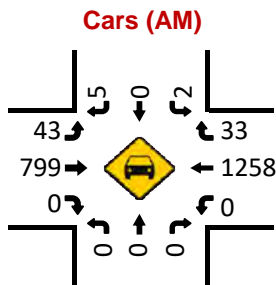
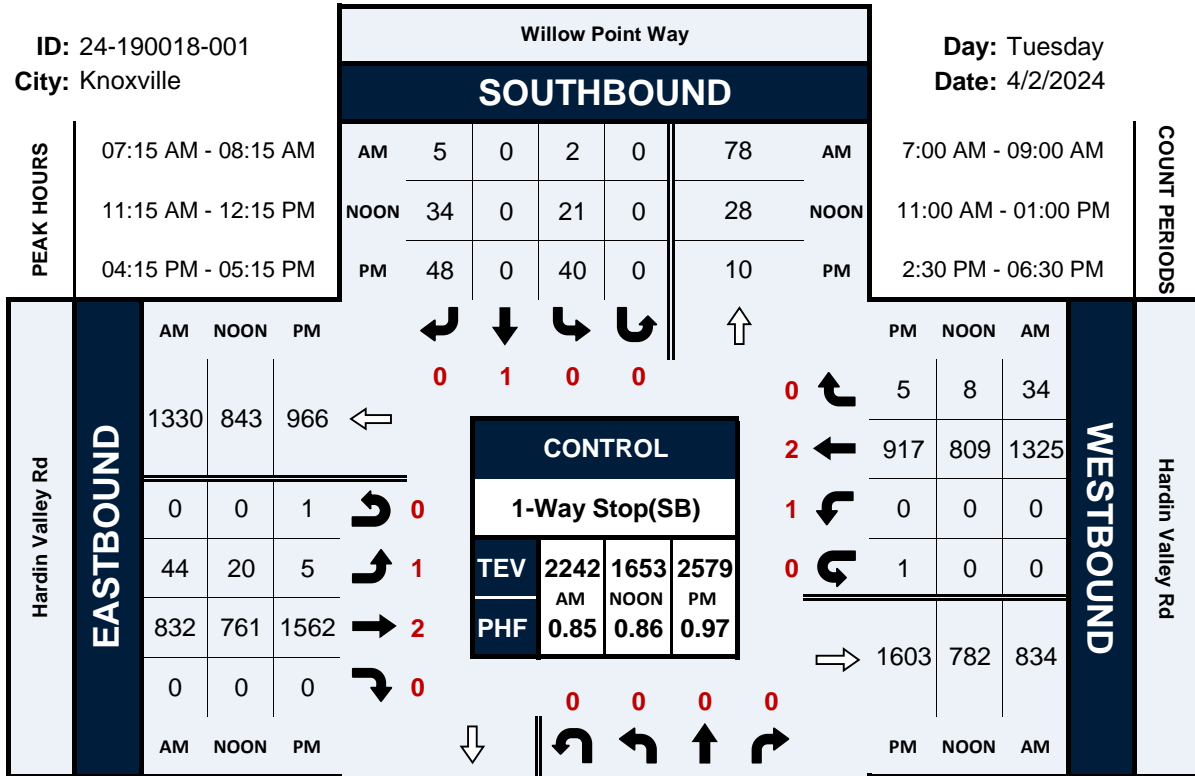
APPENDIX A | TRAFFIC DATA

Willow Point Way & Hardin Valley Rd

Peak Hour Turning Movement Count

ID: 24-190018-001
City: Knoxville

Day: Tuesday
Date: 4/2/2024



Project ID: 24-190018-001
 Location: Willow Point Way & Hardin Valley Rd
 City: Knoxville

Day: Tuesday
 Date: 4/2/2024

Groups Printed - Cars, PU, Vans - Heavy Trucks

Start Time	Willow Point Way Northbound						Willow Point Way Southbound						Hardin Valley Rd Eastbound						Hardin Valley Rd Westbound								
	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total			
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	147	0	0	0	0	0	148	0	270	0	0	0	277	425
7:15 AM	0	0	0	0	0	0	1	0	0	0	0	1	5	197	0	0	0	0	202	0	325	6	0	0	0	331	534
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	9	214	0	0	0	0	223	0	322	5	0	0	0	327	550
7:45 AM	0	0	0	0	0	0	1	0	2	0	0	3	18	226	0	0	0	0	244	0	395	14	0	0	0	409	656
Total	0	0	0	0	0	0	2	0	2	0	0	4	33	784	0	0	0	0	817	0	1312	32	0	0	0	1344	2165
8:00 AM	0	0	0	0	0	0	0	0	3	0	0	3	12	195	0	0	0	0	207	0	283	9	0	0	0	292	502
8:15 AM	0	0	0	0	0	0	1	0	5	0	0	6	6	185	0	1	0	0	192	0	282	8	0	0	0	290	488
8:30 AM	0	0	0	0	0	0	1	0	3	0	0	4	3	172	0	0	0	0	175	0	293	8	0	0	0	301	480
8:45 AM	0	0	0	0	0	0	3	0	5	0	0	8	7	162	0	0	0	0	169	0	214	11	0	0	0	225	402
Total	0	0	0	0	0	0	5	0	16	0	0	21	28	714	0	1	0	0	743	0	1072	36	0	0	0	1108	1872
BREAK																											
11:00 AM	0	0	0	0	0	0	4	0	6	0	0	10	5	159	0	0	0	0	164	0	170	6	0	0	0	176	350
11:15 AM	0	0	0	0	0	0	3	0	8	0	1	11	5	201	0	0	0	0	206	0	173	0	0	0	0	173	390
11:30 AM	0	0	0	0	0	0	5	0	12	0	1	17	8	217	0	0	0	0	225	0	236	4	0	0	0	240	482
11:45 AM	0	0	0	0	0	0	8	0	8	0	0	16	2	182	0	0	0	0	184	0	213	1	0	0	0	214	414
Total	0	0	0	0	0	0	20	0	34	0	3	54	20	759	0	0	0	0	779	0	792	11	0	0	0	803	1636
12:00 PM	0	0	0	0	0	0	5	0	6	0	0	11	5	161	0	0	0	0	166	0	187	3	0	0	0	190	367
12:15 PM	0	0	0	0	0	0	2	0	4	0	0	6	5	194	0	0	0	0	199	0	152	5	0	0	0	157	362
12:30 PM	0	0	0	0	0	0	2	0	10	0	0	12	8	200	0	0	0	0	208	0	196	5	0	0	0	201	421
12:45 PM	0	0	0	0	0	0	3	0	3	0	0	6	10	163	0	0	0	0	173	0	171	4	0	0	0	175	354
Total	0	0	0	0	0	0	12	0	23	0	0	35	28	718	0	0	0	0	746	0	706	17	0	0	0	723	1504
BREAK																											
2:30 PM	0	0	0	0	0	0	3	0	6	0	0	9	1	196	0	1	0	0	198	0	185	2	1	0	0	188	395
2:45 PM	0	0	0	0	0	0	3	0	3	0	0	6	6	292	0	0	0	0	298	0	184	6	0	0	0	190	494
Total	0	0	0	0	0	0	6	0	9	0	0	15	7	488	0	1	0	0	496	0	369	8	1	0	0	378	889
3:00 PM	0	0	0	0	0	0	5	0	9	0	0	14	9	280	0	0	0	0	289	0	191	2	0	0	0	193	496
3:15 PM	0	0	0	0	0	0	3	0	5	0	0	8	8	225	0	0	0	0	233	0	217	4	0	0	0	221	462
3:30 PM	0	0	0	0	0	0	5	0	13	0	0	18	6	290	0	0	0	0	296	0	262	2	1	0	0	269	583
3:45 PM	0	0	0	0	0	0	8	0	5	0	0	13	5	338	0	0	0	0	343	0	222	0	2	0	0	224	580
Total	0	0	0	0	0	0	21	0	32	0	0	53	28	1133	0	0	0	0	1161	0	896	8	3	0	0	907	2121
4:00 PM	0	0	0	0	0	0	5	0	11	0	0	16	4	349	0	0	0	0	353	0	217	3	0	0	0	220	589
4:15 PM	0	0	0	0	0	0	8	0	5	0	1	13	2	400	0	0	0	0	402	0	210	1	0	0	0	211	626
4:30 PM	0	0	0	0	0	0	11	0	16	0	0	27	1	385	0	0	0	0	386	0	226	2	1	0	0	229	642
4:45 PM	0	0	0	0	0	0	9	0	11	0	0	20	1	404	0	1	0	0	406	0	237	1	0	0	0	238	664
Total	0	0	0	0	0	0	33	0	43	0	1	76	8	1538	0	1	0	0	1547	0	890	7	1	0	0	898	2521
5:00 PM	0	0	0	0	0	0	12	0	16	0	0	28	1	373	0	0	0	0	374	0	244	1	0	0	0	245	647
5:15 PM	0	0	0	0	0	0	2	0	4	0	0	6	1	354	0	0	0	0	355	0	221	0	1	0	0	222	583
5:30 PM	0	0	0	0	0	0	4	0	2	0	0	6	1	311	0	0	0	0	312	0	218	0	0	0	0	218	536
5:45 PM	0	0	0	0	0	0	2	0	2	0	0	4	2	319	0	0	0	0	321	0	248	0	0	0	0	248	573
Total	0	0	0	0	0	0	20	0	24	0	0	44	5	1357	0	0	0	0	1362	0	931	1	1	0	0	933	2339
6:00 PM	0	0	0	0	0	0	5	0	3	0	0	8	0	241	0	0	0	0	241	0	188	0	1	0	0	189	438
6:15 PM	0	0	0	0	0	0	1	0	0	0	0	1	0	248	0	0	0	0	248	0	158	0	0	0	0	158	407
Total	0	0	0	0	0	0	6	0	3	0	0	9	0	489	0	0	0	0	489	0	346	0	1	0	0	347	845
Grand Total	0	0	0	0	0	0	125	0	186	0	4	311	157	7980	0	3	0	0	8140	0	7314	120	7	0	0	7441	15892
Approach %	0.0	0.0	0.0	0.0	0.0	0.0	40.2	0.0	59.8	0.0	1.3	2.0	1.9	98.0	0.0	0.0	0.0	0.0	0.0	0.0	98.3	1.6	0.1	0.0	0.0	46.8	
Total %	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	1.2	0.0	0.0	2.0	1.0	50.2	0.0	0.0	0.0	0.0	51.2	0.0	46.0	0.8	0.0	0.0	0.0	46.8	
Cars, PU, Vans	0	0	0	0	0	0	123	0	182	0	0	305	155	7663	0	3	0	0	7821	0	6955	115	7	0	0	7077	15203
% Cars, PU, Vans	0.0	0.0	0.0	0.0	0.0	0.0	98.4	0.0	97.8	0.0	0.0	98.1	98.7	96.0	0.0	100.0	0.0	96.1	96.1	0.0	95.1	95.8	100.0	0.0	95.7	95.7	
Heavy trucks	0	0	0	0	0	0	2	0	4	0	0	6	2	317	0	0	0	0	319	0	359	5	0	0	0	364	689
% Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	2.2	0.0	0.0	1.9	1.3	4.0	0.0	0.0	0.0	3.9	3.9	0.0	4.9	4.2	0.0	0.0	4.9	4.3	

Project ID: 24-190018-001
 Location: Willow Point Way & Hardin Valley Rd
 City: Knoxville

PEAK HOURS

Day: Tuesday
 Date: 4/2/2024

AM

Start Time	Willow Point Way Northbound				Willow Point Way Southbound				Hardin Valley Rd Eastbound				Hardin Valley Rd Westbound						
	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	App. Total	Int. Total	
Peak Hour Analysis from 07:00 AM - 09:00 AM																			
Peak Hour for Entire Intersection Begins at 07:15 AM																			
7:15 AM	0	0	0	0	1	0	0	0	1	197	0	0	0	202	0	325	6	0	331
7:30 AM	0	0	0	0	0	0	0	0	0	214	0	0	0	223	0	322	5	0	327
7:45 AM	0	0	0	0	1	0	2	0	3	18	226	0	0	244	0	395	14	0	409
8:00 AM	0	0	0	0	0	0	3	0	3	12	195	0	0	207	0	283	9	0	292
Total Volume	0	0	0	0	2	0	5	0	7	44	832	0	0	876	0	1325	34	0	1359
% App. Total	0.0	0.0	0.0	0.0	28.6	0.0	71.4	0.0	100	0.593	0.0	0.0	0.0	100	0.0	97.5	2.5	0.0	100
PHF	0.898																		
Cars, PU, Vans	0	0	0	0	2	0	5	0	7	43	799	0	0	842	0	1258	33	0	1291
% Cars, PU, Vans	0.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0	100.0	97.7	96.0	0.0	0.0	96.1	0.0	94.9	97.1	0.0	95.0
Heavy trucks	0	0	0	0	0	0	0	0	0	1	33	0	0	34	0	67	1	0	68
% Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	4.0	0.0	0.0	3.9	0.0	5.1	2.9	0.0	5.0

NOON

Start Time	Willow Point Way Northbound				Willow Point Way Southbound				Hardin Valley Rd Eastbound				Hardin Valley Rd Westbound						
	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	App. Total	Int. Total	
Peak Hour Analysis from 11:00 AM - 01:00 PM																			
Peak Hour for Entire Intersection Begins at 11:15 AM																			
11:15 AM	0	0	0	0	3	0	8	0	11	5	201	0	0	206	0	173	0	0	173
11:30 AM	0	0	0	0	5	0	12	0	17	8	217	0	0	225	0	236	4	0	240
11:45 AM	0	0	0	0	8	0	8	0	16	2	182	0	0	184	0	213	1	0	214
12:00 PM	0	0	0	0	5	0	6	0	11	5	161	0	0	166	0	187	3	0	190
Total Volume	0	0	0	0	21	0	34	0	55	20	761	0	0	781	0	809	8	0	817
% App. Total	0.0	0.0	0.0	0.0	38.2	0.0	61.8	0.0	100	2.6	97.4	0.0	0.0	100	0.0	99.0	1.0	0.0	100
PHF	0.868																		
Cars, PU, Vans	0	0	0	0	20	0	33	0	53	19	720	0	0	739	0	763	6	0	769
% Cars, PU, Vans	0.0	0.0	0.0	0.0	95.2	0.0	97.1	0.0	96.4	95.0	94.6	0.0	0.0	94.6	0.0	94.3	75.0	0.0	94.1
Heavy trucks	0	0	0	0	1	0	1	0	2	1	41	0	0	42	0	46	2	0	48
% Heavy trucks	0.0	0.0	0.0	0.0	4.8	0.0	2.9	0.0	3.6	5.0	5.4	0.0	0.0	5.4	0.0	5.7	25.0	0.0	5.9

PM

Start Time	Willow Point Way Northbound				Willow Point Way Southbound				Hardin Valley Rd Eastbound				Hardin Valley Rd Westbound						
	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	Left	Thru	Rgt	Uturn	App. Total	Int. Total	
Peak Hour Analysis from 02:30 PM - 06:30 PM																			
Peak Hour for Entire Intersection Begins at 04:15 PM																			
4:15 PM	0	0	0	0	8	0	5	0	13	2	400	0	0	402	0	210	1	0	211
4:30 PM	0	0	0	0	11	0	16	0	27	1	385	0	0	386	0	226	2	1	229
4:45 PM	0	0	0	0	9	0	11	0	20	1	404	0	1	406	0	237	1	0	238
5:00 PM	0	0	0	0	12	0	16	0	28	1	373	0	0	374	0	244	1	0	245
Total Volume	0	0	0	0	40	0	48	0	88	5	1562	0	1	1568	0	917	5	1	923
% App. Total	0.0	0.0	0.0	0.0	45.5	0.0	54.5	0.0	100	0.3	99.6	0.0	0.1	100	0.0	99.3	0.5	0.1	100
PHF	0.786																		
Cars, PU, Vans	0	0	0	0	40	0	48	0	88	5	1521	0	1	1527	0	888	5	1	894
% Cars, PU, Vans	0.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0	100.0	100.0	97.4	0.0	100.0	97.4	0.0	96.8	100.0	100.0	96.9
Heavy trucks	0	0	0	0	0	0	0	0	0	0	41	0	0	41	0	29	0	0	29
% Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	2.6	0.0	3.2	0.0	0.0	3.1

TRAFFIC GROWTH

Source:	Knox TPO
Location:	Hardin Valley Rd Knox Co.
Route #:	
Route Type:	
Station:	093M381
Capacity:	

Count Year	Volume	Growth Rate
2002		
2003		#DIV/0!
2004		#DIV/0!
2005		#DIV/0!
2006	13730	#DIV/0!
2007	20280	47.71
2008	18480	-8.88
2009	18110	-2.00
2010	18130	0.11
2011	18720	3.25
2012	20620	10.15
2013	20820	0.97
2014	22420	7.68
2015	23940	6.78
2016	22520	-5.93
2017	24410	8.39
2018	24410	0.00
2019	26400	8.15
2020	22740	-13.86
2021	23330	2.59
2022	27100	16.16

Avg. 1 Year Rate 2002-2022	#DIV/0!
Avg. 1 Year Rate 2012-2022	3.74
Avg. 1 Year Rate 2017-2022	3.57

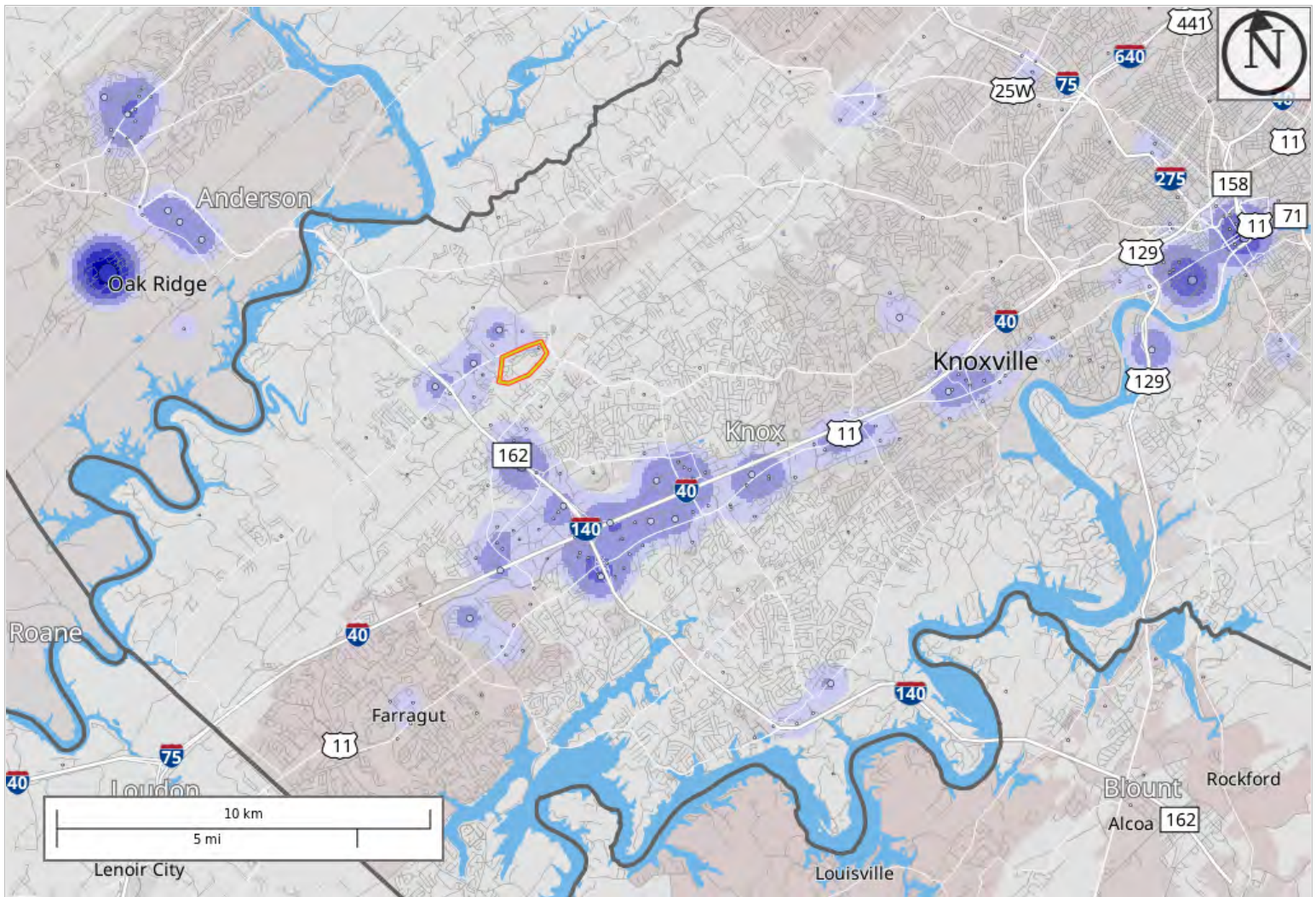
Distance/Direction Analysis

Workers: Living in the Custom Area

Showing: Employment locations

Created by the U.S. Census Bureau's OnTheMap <https://onthemap.ces.census.gov> on 04/25/2024

Counts and Density of Work Locations for All Jobs in Home Selection Area in 2021 All Workers



Map Legend

Job Density [Jobs/Sq. Mile]

- 5 - 10
- 11 - 27
- 28 - 56
- 57 - 95
- 96 - 147

Job Count [Jobs/Census Block]

- 1 - 3
- 4 - 10
- 11 - 23
- 24 - 40
- 41 - 63

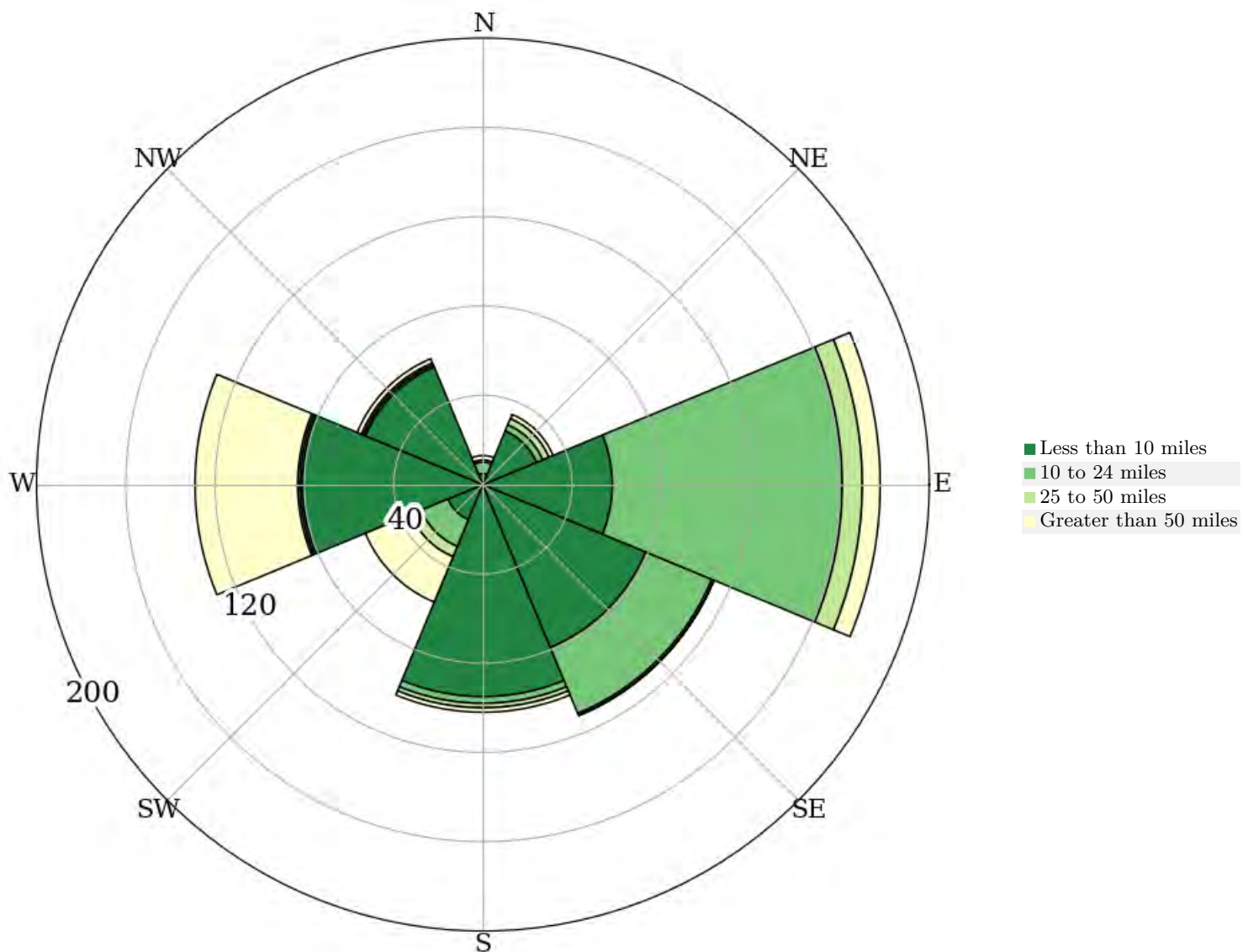
Selection Areas

- ▭ Home Area



All Jobs for All Workers in 2021

Distance and Direction from Home Census Block to Work Census Block, Living in Selection Area



All Jobs for All Workers in 2021

Distance from Home Census Block to Work Census Block, Living in Selection Area

Distance	2021	
	Count	Share
Total All Jobs	686	100.0%
Less than 10 miles	418	60.9%
10 to 24 miles	161	23.5%
25 to 50 miles	23	3.4%
Greater than 50 miles	84	12.2%

Additional Information

Analysis Settings

Analysis Type	Distance/Direction
Selection area as	Home
Year(s)	2021
Job Type	All Jobs
Selection Area	Selection Area Freehand Drawing
Selected Census Blocks	2
Analysis Generation Date	04/25/2024 12:30 - OnTheMap 6.23.5
Code Revision	61ba66adb1494f11636f474452a03e1039f6f3a0
LODES Data Vintage	20231016_1512

Data Sources

Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2021).

Notes

1. Race, Ethnicity, Educational Attainment, and Sex statistics are beta release results and are not available before 2009.
2. Educational Attainment is only produced for workers aged 30 and over.
3. Firm Age and Firm Size statistics are beta release results for All Private jobs and are not available before 2011.

APPENDIX B | TRIP GENERATION

TRIP GENERATION

01782-0001 Hardin Valley Apartments

Knoxville MPC
APARTMENT

84 Dwelling Units

WEEKDAY

$$T = 15.193(X)^{0.899}$$

$$T = 876$$

50% ENTERING = 438 trips

50% EXITING = 438 trips

876 trips

AM PEAK

$$T = 0.758(X)^{0.924}$$

$$T = 45$$

22% ENTERING = 9.9 trips

78% EXITING = 35.1 trips

45 trips

MID-DAY PEAK (AM Peak of the Generator)

T = NO RATE GIVEN FOR MID-DAY

T =

0% ENTERING = 0 trips

0% EXITING = 0 trips

0 trips

PM PEAK

$$T = 0.669(X) + 10.069$$

$$T = 66$$

55% ENTERING = 36.3 trips

45% EXITING = 29.7 trips

66 trips

KNOX COUNTY
LOCAL APARTMENT TRIP GENERATION STUDY

PURPOSE

A Traffic Impact Study (TIS) is currently required in Knox County when a proposed development is projected to generate in excess of 750 trips per day. The determinations of when the threshold is met as well as all subsequent analyses in the TIS are performed using the rates and equations given in the Institute of Transportation Engineers (ITE) Trip Generation Manual. Local governmental agencies rely heavily on the accuracy of these trip generation rates in order to correctly predict the impacts of a proposed development on the transportation system. Therefore, in certain instances, it is logical to verify whether the "national" rates and equations given in the ITE Trip Generation Manual are appropriate for use in a specific local area or region.

The decision was made to study the local trip-making characteristics of apartments because of the discrepancy between the trip generation rates for apartments and single family residential land uses as given in the ITE Trip Generation Manual. While these two land uses are similar in nature, the Trip Generation Manual predicts about three less trips per dwelling unit generated by apartments for the average weekday. Additionally the Trip Generation Manual points out that due to the age of their database, which dates back to the 1960's, "the rates for apartments probably had changed over time". It is also assumed that some of the ITE data had come from larger metropolitan areas with denser development and greater transit use than Knox County, which would contribute to lower trip generation rates. Therefore, this study will be used to either verify the rates given in the Trip Generation Manual or generate new ones that can be applied to locally proposed apartment developments.

PROCEDURE

The procedures recommended by ITE in conducting local trip generation studies were generally followed for this study, along with some important assumptions that have made. ITE has published a proposed recommended practice entitled "Trip Generation Handbook" which specifically outlines procedures for conducting local trip generation studies and establishing new rates and equations.

The first step in the study was to define the number and location of the sites to be studied, as well as the counting methodology. Initially 14 sites were selected, although one apartment complex – the College Park Apartments – was later omitted due to uncharacteristically high traffic generation numbers. The number of sites used in this study far exceeds the recommended minimum amount suggested by ITE, which is five sites. Traffic counts were taken for week-long periods at 15-minute intervals between July 22, 1996 and August 9, 1996 at the access points to the apartment complexes. A Technical Appendix to this report contains the traffic count data collected at each apartment complex.

RESULTS

The traffic count data was analyzed using spreadsheets in order to determine the weighted average rates and regression equations. In order to be considered valid, the local rates and equations for each time period of analysis that were generated must meet certain statistical criteria. First, the standard deviation of the independent variable (dwelling units) should be no more than 110 percent of the weighted average rate; and secondly, the regression equations require a computed coefficient of determination (R^2) value of at least 0.75 before good data fit is indicated. This statistical criteria is met by the local data results, and in fact it often exceeds the level of data fit given by their counterparts in the ITE Trip Generation Manual. Finally, in order to simplify the use of the local data, plots were generated that appear identical to the actual ones in the ITE Trip Generation Manual.

The resulting rates and equations calculated from the local data indicate that the average weekday trip generation of apartments in this area is well above the national rates reported in the ITE manual. For example, the locally computed average rate for number of trips generated during a weekday is 35% higher than the rate given by ITE (increase from 6.63 trips per dwelling unit to 9.03 trips per dwelling unit). The trip generation rates do not increase as much for the AM and PM peak hours however. The local rate is roughly 8% higher for the AM peak, and 16% higher for the PM peak. The plots from the ITE Trip Generation Manual are included in the Technical Appendix for comparison purposes.

ASSUMPTIONS MADE

Some important assumptions have been made which may affect the results of the local data that was collected:

- It is important to note that the local trip generation rates were computed for the *total* number of dwelling units in the apartment complex, and not necessarily for the number of *occupied* dwelling units. There are several reasons why this was done, chiefly because of the need for comparability with the rates given in ITE Trip Generation Manual, as it does not specify whether the dwelling units are occupied. According to ITE procedures the selected sites must only be of "reasonably full occupancy (i.e. at least 85%)". The Apartment Association of Greater Knoxville (AAGK) publishes quarterly reports on occupancy levels of apartment complexes, and the report covering the period of the data collection was reviewed to determine occupancy levels. According to the AAGK report from July 1, 1996 – September 30, 1996 all of the apartment complexes surveyed in this study met the minimum 85% occupancy level, with an average occupancy rate for all sites studied of 94%.
- The count data that was collected at each apartment complex was used "raw" meaning that it was not factored for possible daily or seasonal variations. Once again, according to an ITE representative it is not known whether the data used in the Trip Generation Manual was factored or not, so therefore in order to be able to compare

local rates to those in the manual you must assume that count data should not be factored. Additionally, it was felt that apartment complexes would generally not be as susceptible to major seasonal fluctuations as other land uses might be. The local rates were also developed using count data that was collected and averaged over an entire week, which should limit some of the daily variations. Finally, reliable local daily and seasonal variation factors do not truly exist.

CONCLUSION

The local apartment study methodology and results were distributed for comment to a group of local transportation professionals who are directly responsible for either preparing or reviewing traffic impact studies. A meeting was held between this group on February 16, 2000 in order to gather comments and discuss the study in greater detail. The following conclusions are based on the discussion and consensus reached at this meeting:

1. The trip generation rates and equations meet statistical requirements and resulted from a study that followed accepted procedures; therefore they should be adopted for future use. Furthermore, the rates and equations are recommended for use in reviewing the traffic impact of any development termed as "multi-family", such as townhouse and condominium developments due to their similarity to apartment complexes.
2. The Traffic Access and Impact Study Guidelines and Procedures adopted by MPC should be amended with the language that local data should be used when available, which will allow the implementation of these new multi-family trip generation rates.
3. The following suggestions were made for future consideration:
 - This study should be updated with data collected from local townhouse and condominium developments in order to further justify the use of the new trip generation rates.
 - A statistical comparison should be made between any newly developed rates and the ITE single family trip generation rates to determine if there is a significant difference. If there is no difference then perhaps ITE single-family rates could be used for any residential development proposed in Knox County.

Local Apartment Trip Generation Study

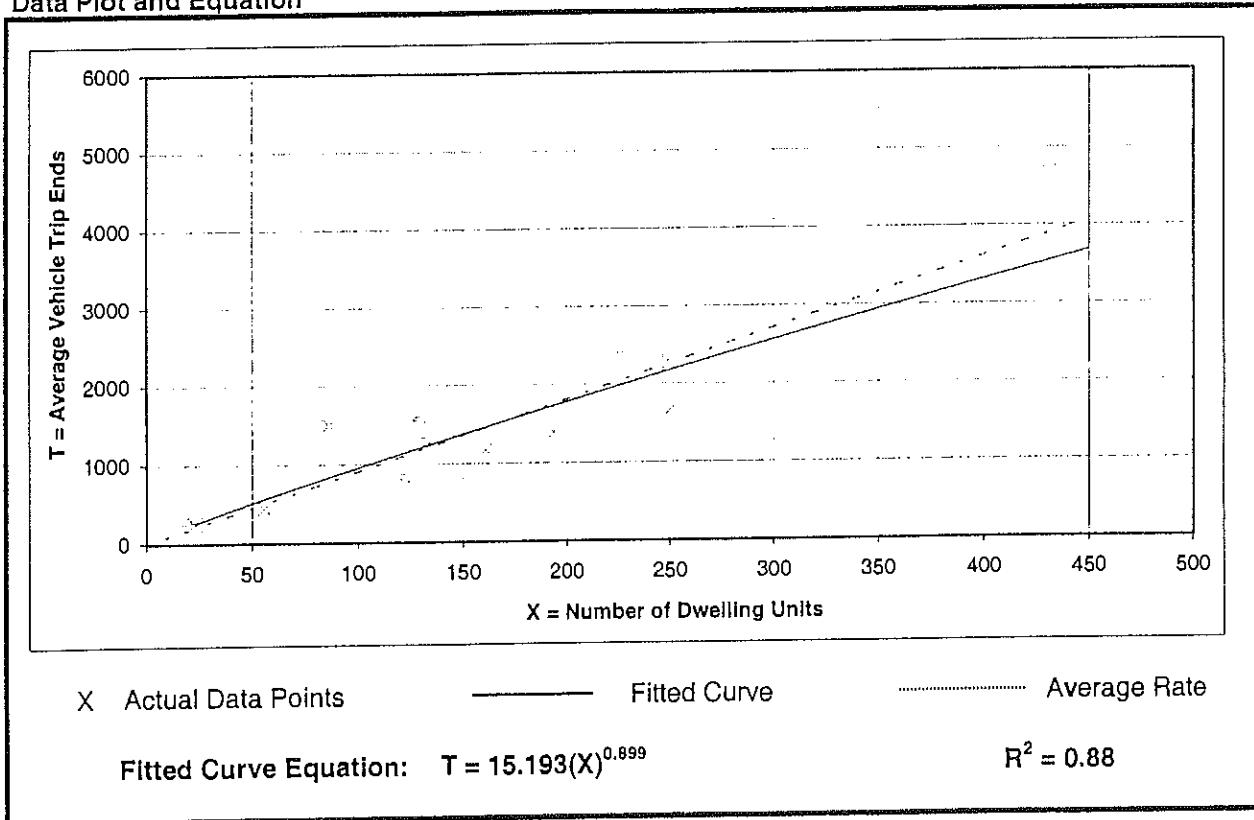
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 13
Average Number of Dwelling Units: 193
Directional Distribution: 50% entering, 50% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
9.03	6.59 - 17.41	2.47

Data Plot and Equation



Local Apartment Trip Generation Study

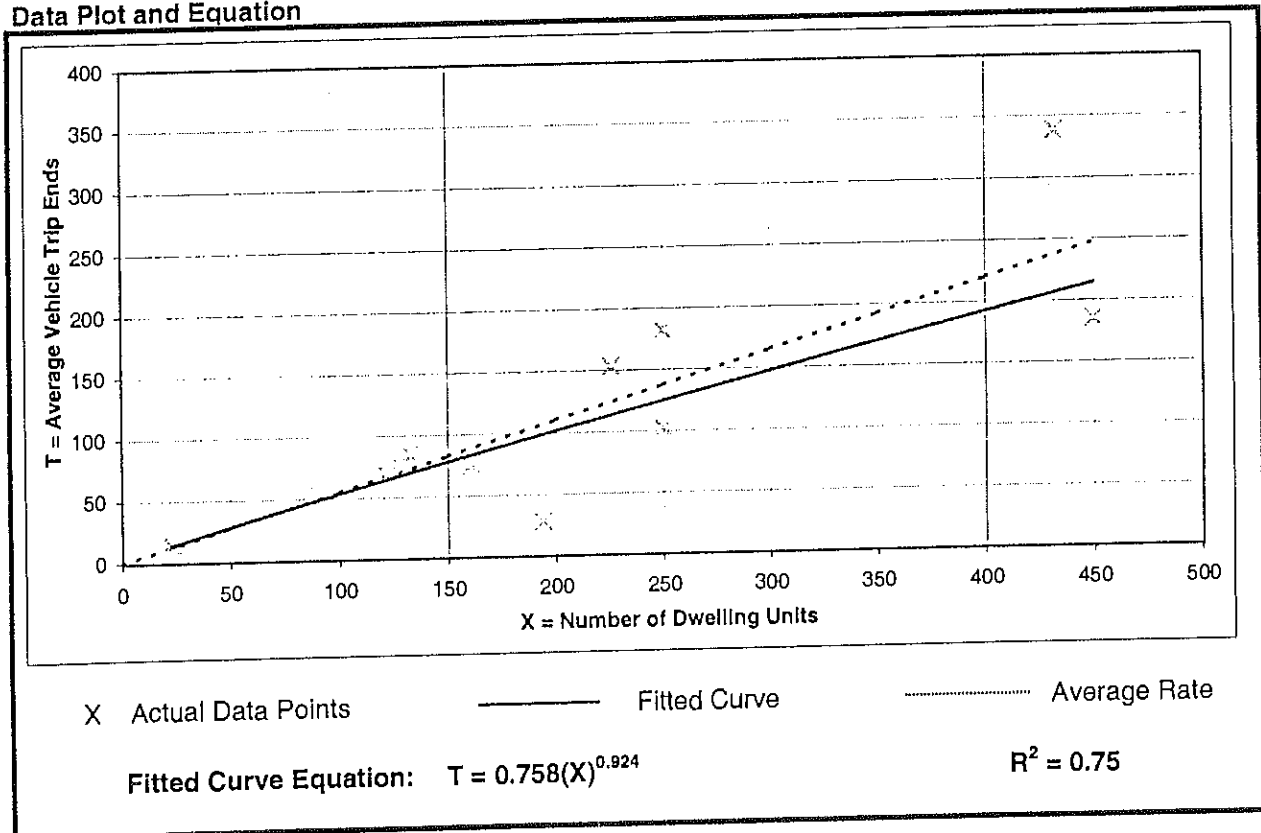
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 7 and 9 a.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 22% entering, 78% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.55	0.14 - 0.78	0.18

Data Plot and Equation



Local Apartment Trip Generation Study

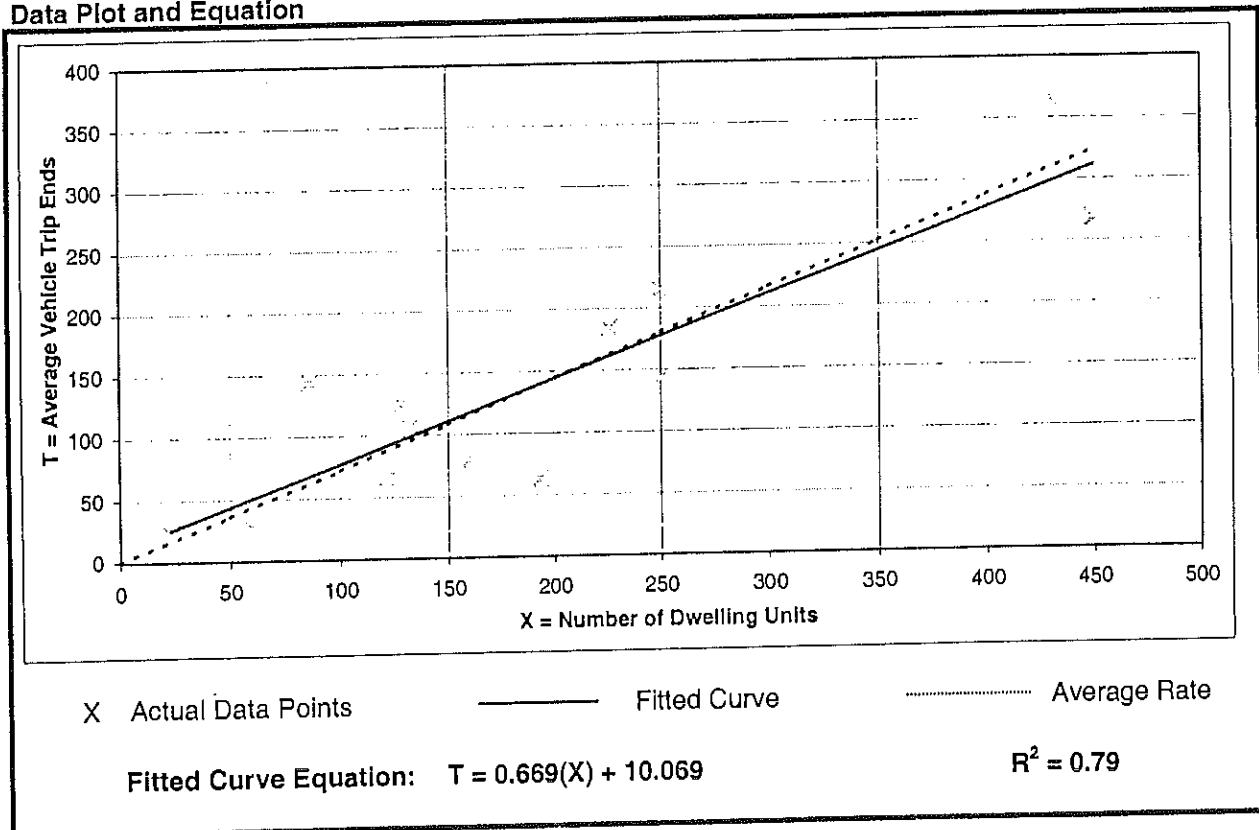
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 55% entering, 45% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.72	0.32 - 1.66	0.25

Data Plot and Equation



APPENDIX C | ANALYSES

CAPACITY AND LEVEL-OF-SERVICE CONCEPTS

In a general sense, a roadway is similar to a pipeline or other material carrying conduit in that it has a certain capacity for the amount of material (vehicles) that it can efficiently carry. As the number of vehicles in a given time period gradually increases, the quality of traffic flow gradually decreases. On roadway sections this results in increasing turbulence in the traffic stream, and at intersections it results in increasing stops and delay. As the volumes begin to approach the capacity of the facility, these problems rapidly magnify, with resulting serious levels of congestion, stops, delay, excess fuel consumption, pollutant emissions, etc.

The Transportation Research Board has published the Year 2010 Highway Capacity Manual (HCM2010), which establishes theoretical techniques to quantify the capacity conditions on all types of roadways, intersections, ramps, pedestrian facilities, etc. A basic concept that is applicable to most of these techniques is the idea of level of service (LOS). This concept establishes a rating system that quantifies the quality of traffic flow, as perceived by motorists and/or passengers. The general system is similar to a school grade scale, and is outlined as follows:

Level of Service (LOS)	General Quality of Traffic Flow	Description of Corresponding Conditions
A	Excellent	Roadways – Free flow, high maneuverability Intersections – Very few stops, very low delay
B	Very Good	Roadways – Free flow, slightly lower maneuverability Intersections – Minor stops, low delay
C	Good	Roadways – Stable flow, restricted maneuverability Intersections – Significant stops, significant delay
D	Fair	Roadways – Marginally stable flow, congestion seriously restricts maneuverability Intersections – High stops, long but tolerable delay
E	Poor	Roadways – Unstable flow*, lower operating speeds, congestion severely restricts maneuverability Intersections – All vehicles stop, very long queues and very long intolerable delay
F	Very Poor	Roadways – Forced flow, stoppages may be lengthy, congestion severely restricts maneuverability Intersections – All vehicles stop, extensive queues and extremely long intolerable delay

*Unstable flow is such that minor fluctuations or disruptions can result in rapid degradation to LOS F.

LOS CRITERIA: SIGNALIZED & UNSIGNALIZED INTERSECTIONS

LOS	CONTROL DELAY (S/VEH)		
	SIGNALIZED	UNSIGNALIZED	ROUNDAABOUT
A	≤10	≤10	≤10
B	>10-20	>10-15	>10-15
C	>20-35	>15-25	>15-25
D	>35-55	>25-35	>25-35
E	>55-80	>35-50	>35-50
F	>80	>50	>50

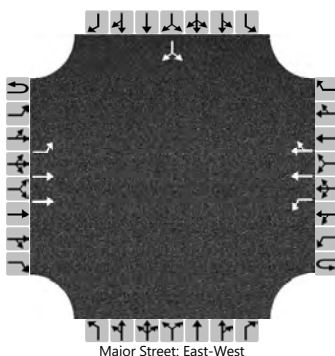
Another measure of intersection capacity that is often used in the evaluation of intersection operations is the volume to capacity (V/C) ratio. This ratio is defined as “the ratio of flow rate to capacity”, and is a good measure of how much of an intersection’s available capacity has been used up by the analysis volumes. Conversely, it also provides an indication of the reserve capacity available for future growth in traffic volumes.

The Intersection Capacity Utilization (ICU) is another measure that expresses a value similar to the V/C ratio. Specifically, the ICU method “sums the amount of the time required to serve all movements at saturation for a given cycle length and divides by that reference cycle length.” The ICU is considered a more accurate measure of volume to capacity conditions for a signalized intersection, primarily because it accounts for the effects of the signal timing on intersection capacity.

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	RCB			Intersection	Hardin Valley Road at Willow Point Way		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	4/25/2024			East/West Street	Hardin Valley Road		
Analysis Year	2024			North/South Street	Willow Point Way		
Time Analyzed	2024 AM - Existing			Peak Hour Factor	0.85		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	01782-0001 Hardin Valley Apartments TIS						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	1	2	0	0	1	2	0		0	0	0		0	1	0
Configuration		L	T			L	T	TR							LR	
Volume (veh/h)	0	44	832		0	0	1325	34						2		5
Percent Heavy Vehicles (%)	3	3			3	3								3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type Storage					Left + Thru								1			

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1								7.5		6.9
Critical Headway (sec)		4.16				4.16								7.56		6.96
Base Follow-Up Headway (sec)		2.2				2.2								3.5		3.3
Follow-Up Headway (sec)		2.23				2.23								3.53		3.33

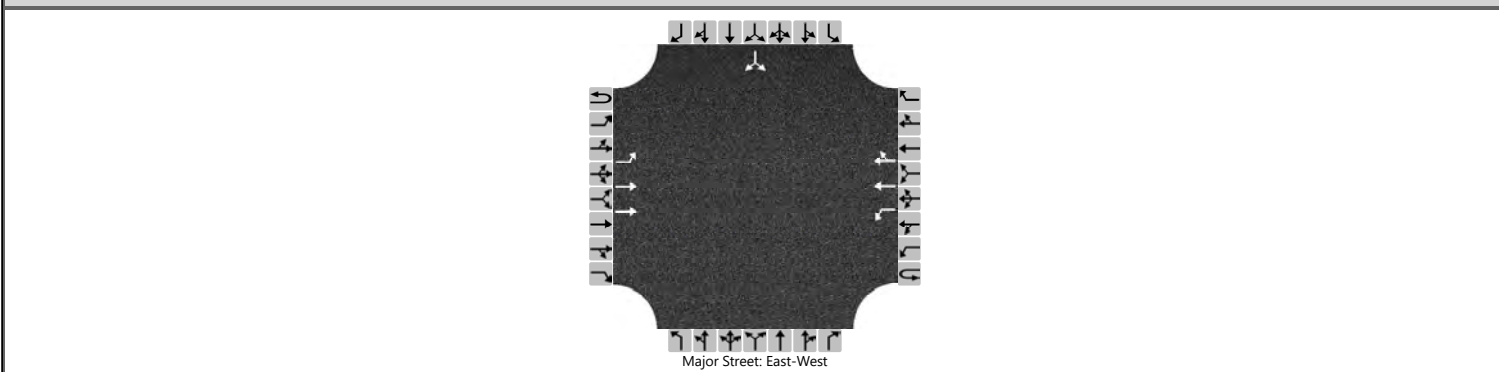
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		52				0									8	
Capacity, c (veh/h)		401				695									183	
v/c Ratio		0.13				0.00									0.05	
95% Queue Length, Q ₉₅ (veh)		0.4				0.0									0.1	
Control Delay (s/veh)		15.3				10.2									25.6	
Level of Service (LOS)		C				B									D	
Approach Delay (s/veh)	0.8				0.0								25.6			
Approach LOS	A				A								D			

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	RCB			Intersection	Hardin Valley Road at Willow Point Way		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	4/25/2024			East/West Street	Hardin Valley Road		
Analysis Year	2024			North/South Street	Willow Point Way		
Time Analyzed	2024 PM - Existing			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	01782-0001 Hardin Valley Apartments TIS						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	1	2	0	0	1	2	0		0	0	0		0	1	0
Configuration		L	T			L	T	TR							LR	
Volume (veh/h)	0	6	1562		0	0	917	5						40		48
Percent Heavy Vehicles (%)	3	3			3	3								3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type Storage					Left + Thru								1			

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1								7.5		6.9
Critical Headway (sec)		4.16				4.16								7.56		6.96
Base Follow-Up Headway (sec)		2.2				2.2								3.5		3.3
Follow-Up Headway (sec)		2.23				2.23								3.53		3.33

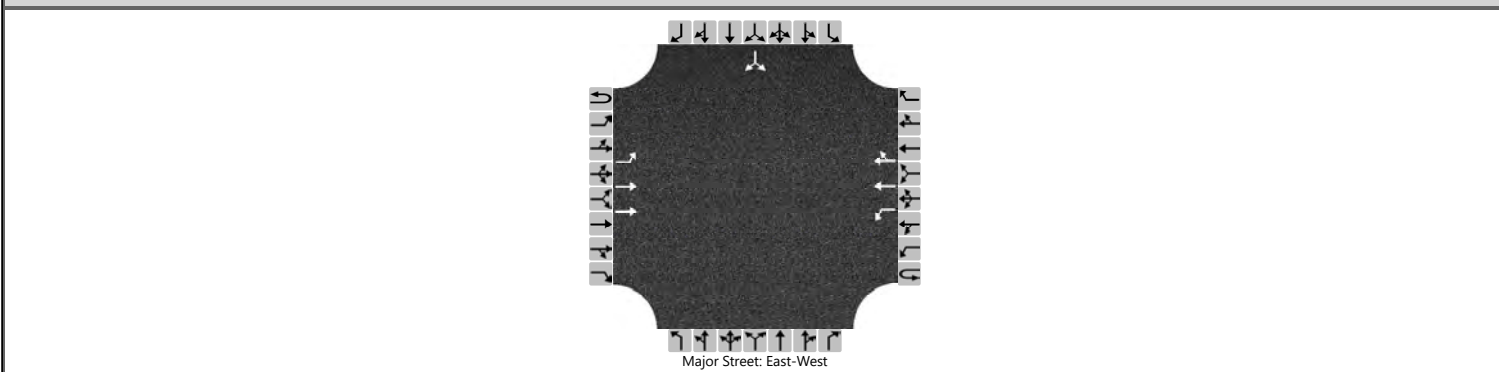
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		7				0										96	
Capacity, c (veh/h)		681				367										243	
v/c Ratio		0.01				0.00										0.39	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0										1.8	
Control Delay (s/veh)		10.3				14.8										29.1	
Level of Service (LOS)		B				B										D	
Approach Delay (s/veh)		0.0				0.0								29.1			
Approach LOS		A				A								D			

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	RCB			Intersection	Hardin Valley Road at Willow Point Way		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	4/25/2024			East/West Street	Hardin Valley Road		
Analysis Year	2026			North/South Street	Willow Point Way		
Time Analyzed	2026 AM - Background			Peak Hour Factor	0.85		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	01782-0001 Hardin Valley Apartments TIS						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	1	2	0	0	1	2	0		0	0	0		0	1	0
Configuration		L	T			L	T	TR							LR	
Volume (veh/h)	0	46	866		0	0	1379	35						2		5
Percent Heavy Vehicles (%)	3	3			3	3								3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type Storage					Left + Thru								1			

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1								7.5		6.9
Critical Headway (sec)		4.16				4.16								7.56		6.96
Base Follow-Up Headway (sec)		2.2				2.2								3.5		3.3
Follow-Up Headway (sec)		2.23				2.23								3.53		3.33

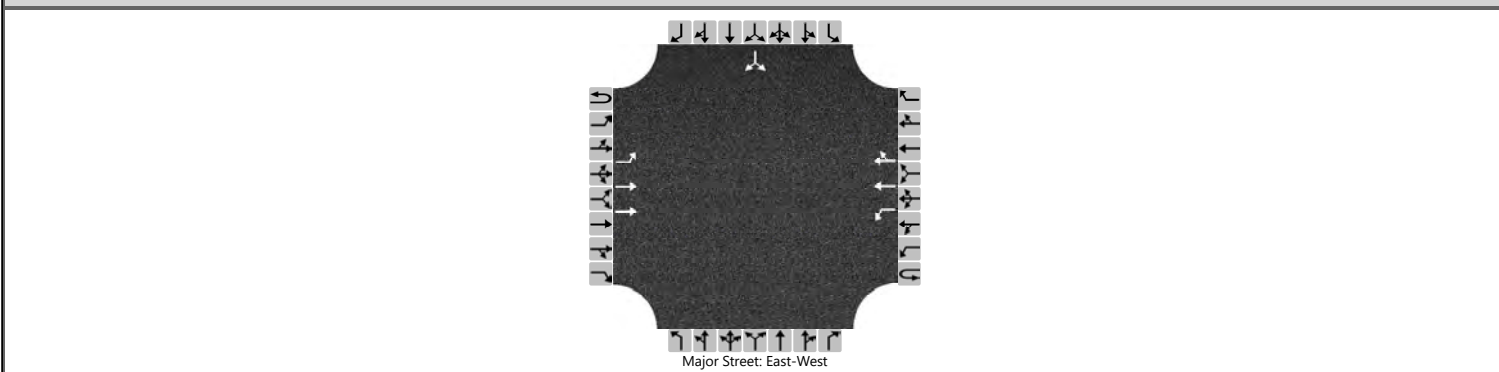
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		54				0										8	
Capacity, c (veh/h)		378				671										169	
v/c Ratio		0.14				0.00										0.05	
95% Queue Length, Q ₉₅ (veh)		0.5				0.0										0.2	
Control Delay (s/veh)		16.1				10.4										27.3	
Level of Service (LOS)		C				B										D	
Approach Delay (s/veh)		0.8				0.0								27.3			
Approach LOS		A				A								D			

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	RCB			Intersection	Hardin Valley Road at Willow Point Way		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	4/25/2024			East/West Street	Hardin Valley Road		
Analysis Year	2026			North/South Street	Willow Point Way		
Time Analyzed	2026 PM - Background			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	01782-0001 Hardin Valley Apartments TIS						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	1	2	0	0	1	2	0		0	0	0		0	1	0
Configuration		L	T			L	T	TR							LR	
Volume (veh/h)	0	6	1625		0	0	954	5						42		50
Percent Heavy Vehicles (%)	3	3			3	3								3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type Storage					Left + Thru								1			

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1								7.5		6.9
Critical Headway (sec)		4.16				4.16								7.56		6.96
Base Follow-Up Headway (sec)		2.2				2.2								3.5		3.3
Follow-Up Headway (sec)		2.23				2.23								3.53		3.33

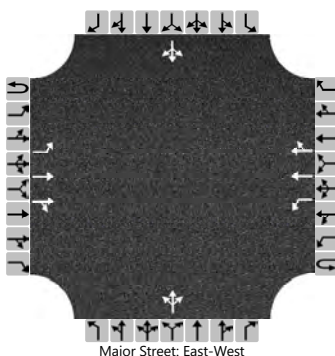
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		7				0									100	
Capacity, c (veh/h)		657				345									229	
v/c Ratio		0.01				0.00									0.44	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0									2.1	
Control Delay (s/veh)		10.5				15.4									32.3	
Level of Service (LOS)		B				C									D	
Approach Delay (s/veh)	0.0				0.0				32.3							
Approach LOS	A				A				D							

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	RCB			Intersection	Hardin Valley Road at Willow Point Way		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	4/25/2024			East/West Street	Hardin Valley Road		
Analysis Year	2026			North/South Street	Willow Point Way		
Time Analyzed	2026 AM - Combined			Peak Hour Factor	0.85		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	01782-0001 Hardin Valley Apartments TIS						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)	0	46	866	5	0	6	1379	35		16	0	19		2	0	5
Percent Heavy Vehicles (%)	3	3			3	3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type Storage	Left + Thru								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.16				4.16				7.56	6.56	6.96		7.56	6.56	6.96
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.23				2.23				3.53	4.03	3.33		3.53	4.03	3.33

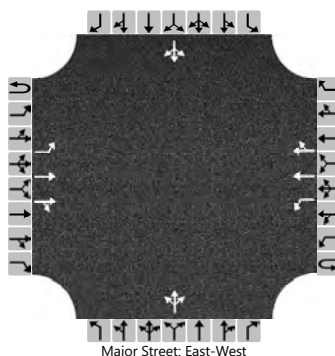
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		54				7					41					8	
Capacity, c (veh/h)		378				667					193					165	
v/c Ratio		0.14				0.01					0.21					0.05	
95% Queue Length, Q ₉₅ (veh)		0.5				0.0					0.8					0.2	
Control Delay (s/veh)		16.1				10.5					28.6					27.9	
Level of Service (LOS)		C				B					D					D	
Approach Delay (s/veh)		0.8				0.0				28.6				27.9			
Approach LOS		A				A				D				D			

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	RCB			Intersection	Hardin Valley Road at Willow Point Way		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	4/25/2024			East/West Street	Hardin Valley Road		
Analysis Year	2026			North/South Street	Willow Point Way		
Time Analyzed	2026 PM - Combined			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	01782-0001 Hardin Valley Apartments TIS						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	1	2	0	0	1	2	0		0	1	0		0	1	0
Configuration		L	T	TR		L	T	TR			LTR				LTR	
Volume (veh/h)	0	6	1625	16	0	20	954	5		14	0	17		42	0	50
Percent Heavy Vehicles (%)	3	3			3	3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type Storage	Left + Thru								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.5	6.5	6.9		7.5	6.5	6.9
Critical Headway (sec)		4.16				4.16				7.56	6.56	6.96		7.56	6.56	6.96
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.23				2.23				3.53	4.03	3.33		3.53	4.03	3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		7				22					34					100	
Capacity, c (veh/h)		657				340					114					204	
v/c Ratio		0.01				0.06					0.30					0.49	
95% Queue Length, Q ₉₅ (veh)		0.0				0.2					1.1					2.4	
Control Delay (s/veh)		10.5				16.3					49.5					38.5	
Level of Service (LOS)		B				C					E					E	
Approach Delay (s/veh)		0.0				0.3				49.5				38.5			
Approach LOS		A				A				E				E			

TABLE 5B KNOX COUNTY RIGHT-TURN LANE VOLUME THRESHOLDS FOR 2-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH	Project No: 01782-0001 Project Name: Hardin Valley Apts Notes: 2026 Combined Volumes
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RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	< 100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25						
25 - 49						
50 - 99						
100 - 149						
150 - 199						
200 - 249						Yes
250 - 299					Yes	Yes
300 - 349				Yes	Yes	Yes
350 - 399			Yes	Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499		Yes	Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
Fewer Than 25						
25 - 49					Yes	Yes
50 - 99				Yes	Yes	Yes
100 - 149			Yes	Yes	Yes	Yes
150 - 199		Yes	Yes	Yes	Yes	Yes
200 - 249	Yes	Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists

Intersection	Time Period	** Single Lane Through Volume	Right-Turn Volume	Right-Turn Lane Warranted (Yes / No)
HV @ Site Access	AM	455	5	NO
HV @ Site Access	PM	853	16	NO

** Single lane equivalent for multi-lane approach = (Through Volume x 1.05) / 2