

COPPER TRACE DEVELOPMENT

TRAFFIC IMPACT STUDY

COPPER RIDGE ROAD
KNOX COUNTY, TN

CCI PROJECT NO. 01293-0000

REV. 1



PREPARED FOR:
First Commercial Real Estate
P.O. Box 10,226
Knoxville, TN 37939

SUBMITTED BY
Cannon & Cannon, Inc.
8550 Kingston Pike
Knoxville, TN 37919
865.670.8555

REVISED
FEBRUARY 24

2017

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REVISION 1 (2/24/17)

This report replaces the original traffic impact study dated 12/27/16, and is prepared to increase the number of units from 125 to 135.

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EXECUTIVE SUMMARY

This report provides a summary of a traffic impact study that was performed for a proposed residential development to be located off of Copper Ridge Road in Northwest Knox County. This development was originally studied in 2012, and this study provides an update to that original study. The project site is approximately one-half mile north of Emory Road (State Route 131) on the east side of Copper Ridge Road. The current plans for this proposed subdivision development provide for a maximum of 135 single family dwelling units at full build-out. The development entrance will be a new three-leg intersection on Copper Ridge Road located approximately one-half mile north of Emory Road.

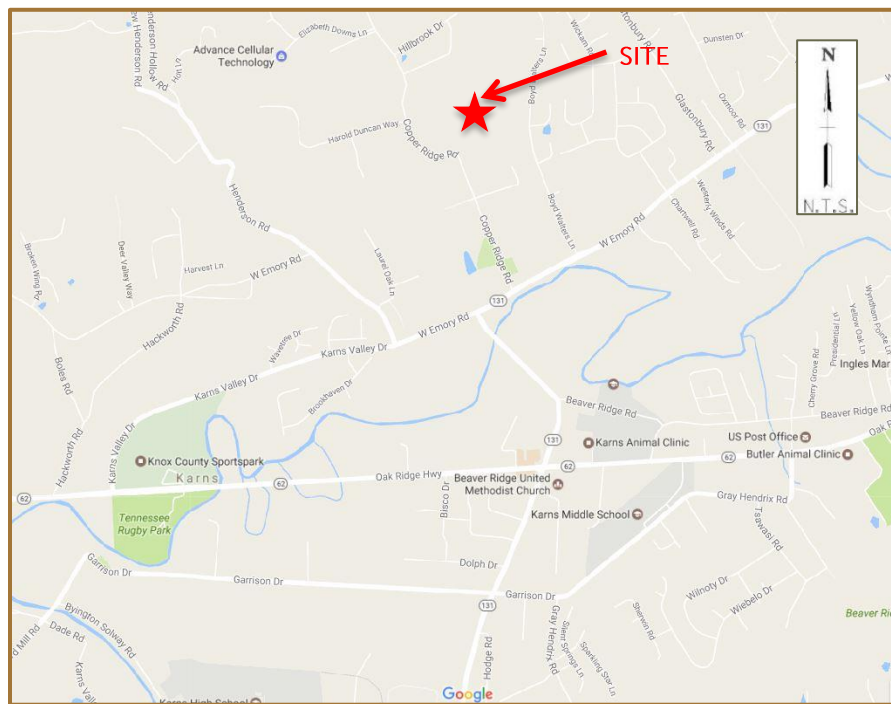
The primary conclusion of this study is that the traffic generated by the proposed development will result in traffic operational impacts in the project area, especially during peak traffic hours at the intersection of Emory Road and Copper Ridge Road. The resulting recommendation is that consideration should be given to implementing turning lane improvements at this location, with the following issues being considered in determining improvement scope and responsibility:

1. An eastbound left-turn lane on Emory Road will be justified during both the AM and PM peak traffic hours after full project build-out based on satisfying Knox County left-turn lane volume thresholds. It is worth noting, however, that such a lane is currently justified during existing PM peak hour conditions.
2. The southbound approach capacity analyses of unimproved year 2021 combined traffic conditions identified level-of-service "F" operation for the A.M peak hour. With the addition of a southbound right-turn lane on Copper Ridge Road approaching Emory Road, the resulting average delay values are greatly reduced, from 179.0 sec. to 50.3 sec. Although this value constitutes a marginal level-of-service (LOS) "F" condition, the associated delay would actually be anticipated to be a reduction of the year 2021 background/unimproved value (55.8 sec).
3. Existing roadway right-of-way on both Emory Road and Copper Ridge Road at this intersection appears to be on the order of 50 feet and is not under the control of the project developer.

Other traffic related issues evaluated for this project included corner sight distance for the proposed subdivision access roadway intersection with Copper Ridge Road, and the general width and condition of Copper Ridge Road between Emory Road and the project site. These evaluations concluded that corner sight distance requirements will be satisfied, and that although Copper Ridge Road is narrow, its width does meet or exceed the eighteen foot minimum typically preferred by Knox County.

INTRODUCTION & PURPOSE OF STUDY

This report provides a summary of a traffic impact study that was performed for a proposed residential development to be located off of Copper Ridge Road in Northwest Knox County. This development was originally studied in 2012, and this study provides an update to that original study. The project site is approximately one-half mile north of Emory Road (State Route 131) on the east side of Copper Ridge Road. FIGURE 1 is a location map that identifies the project site in relation to the roadways in the vicinity of the proposed development.



**FIGURE 1
LOCATION MAP**

The current plans for this proposed subdivision development provide for a maximum of 135 single family dwelling units at full build-out. FIGURE 2 is a conceptual site plan showing the proposed site layout with access to Copper Ridge Road. The development entrance will be a new three-leg intersection on Copper Ridge Road located approximately one-half mile north of Emory Road.

The purpose of this study was to update the original study evaluation of the traffic operational and safety impacts of the proposed development upon the adjacent portion of Copper Ridge Road with the current site plan and the acquisition of current traffic data. Of particular interest was the intersection of the proposed site entrance roadway with Copper Ridge Road, as well as the intersection of Emory Road at Copper Ridge Road. This evaluation was performed assuming full build-out of all units of the subdivision, with existing and background growth conditions also evaluated for purposes of comparison.

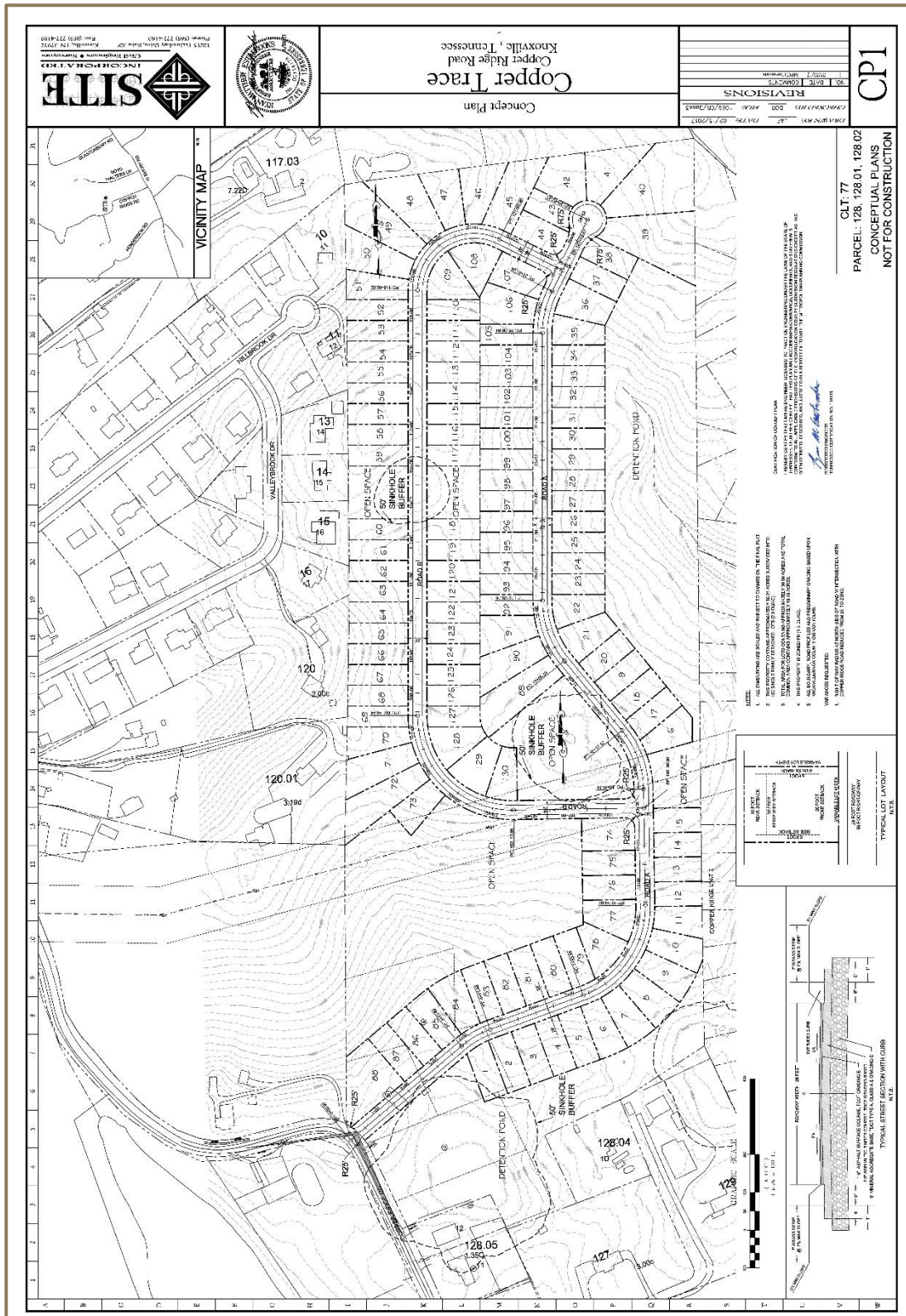


FIGURE 2
CONCEPTUAL SITE PLAN

EXISTING CONDITIONS

EXISTING ROADWAY CONDITIONS

Copper Ridge Road is a Local access roadway that is maintained by Knox County. The roadway pavement is approximately 20 feet in width, and is striped with a center double yellow line delineating two traffic lanes of approximately 8.5 to 9.0 feet. Minimal shoulders are located beyond the white pavement edgelines. The study section of Copper Ridge Road was constructed under older design standards, and thus possesses significant horizontal curvature and non-standard roadside ditches. The posted speed limit on Copper Ridge Road is 30 mph.

EXISTING TRAFFIC DATA

A traffic count station for collecting average daily traffic data (ADT) is located on Emory Road approximately three miles east of Copper Ridge Road. The most recent data from this station was provided by the Tennessee Department of Transportation, with resulting ADTs shown in TABLE 1.

TABLE 1: AVERAGE DAILY TRAFFIC COUNT SUMMARY

COUNT YEAR	TDOT COUNT STATION 047 EMORY ROAD (S.R. 131) WEST OF CLINTON HIGHWAY
2015	10,074
2014	8,866
2013	9,480
2012	9,336
2011	9,006
2010	9,512

In order to collect more refined data, and to establish a basis for trip distribution patterns, turning movement traffic counts were collected at the existing three-leg intersection of Emory Road at Copper Ridge Road. These counts were conducted during the A.M. and P.M. peak traffic hours. Raw data count summaries are contained in the APPENDIX.

In addition to helping establish trip distribution patterns, these turning movement counts were used to establish the existing traffic volumes for this study, as displayed in FIGURE 3.

EXISTING CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual (HCM 2010) were used to evaluate the intersection of Emory Road at Copper Ridge Road for the existing roadway and traffic conditions. This intersection was chosen as the most critical of the two study intersections

SECTION 3

EXISTING CONDITIONS

from a capacity and level-of-service perspective. The results indicate that the Emory Road left-turn traffic movement is currently operating at level-of-service (LOS) "B" during the AM peak hour and LOS "A" during the PM peak hour with Copper Ridge Road turning movements operating at LOS "E" during the AM peak and LOS "B" during the PM peak. These results are summarized in detail on the "Two Way Stop Control Summary" printouts contained in the APPENDIX. Also see the APPENDIX for a discussion of Intersection Capacity and Level of Service Concepts.

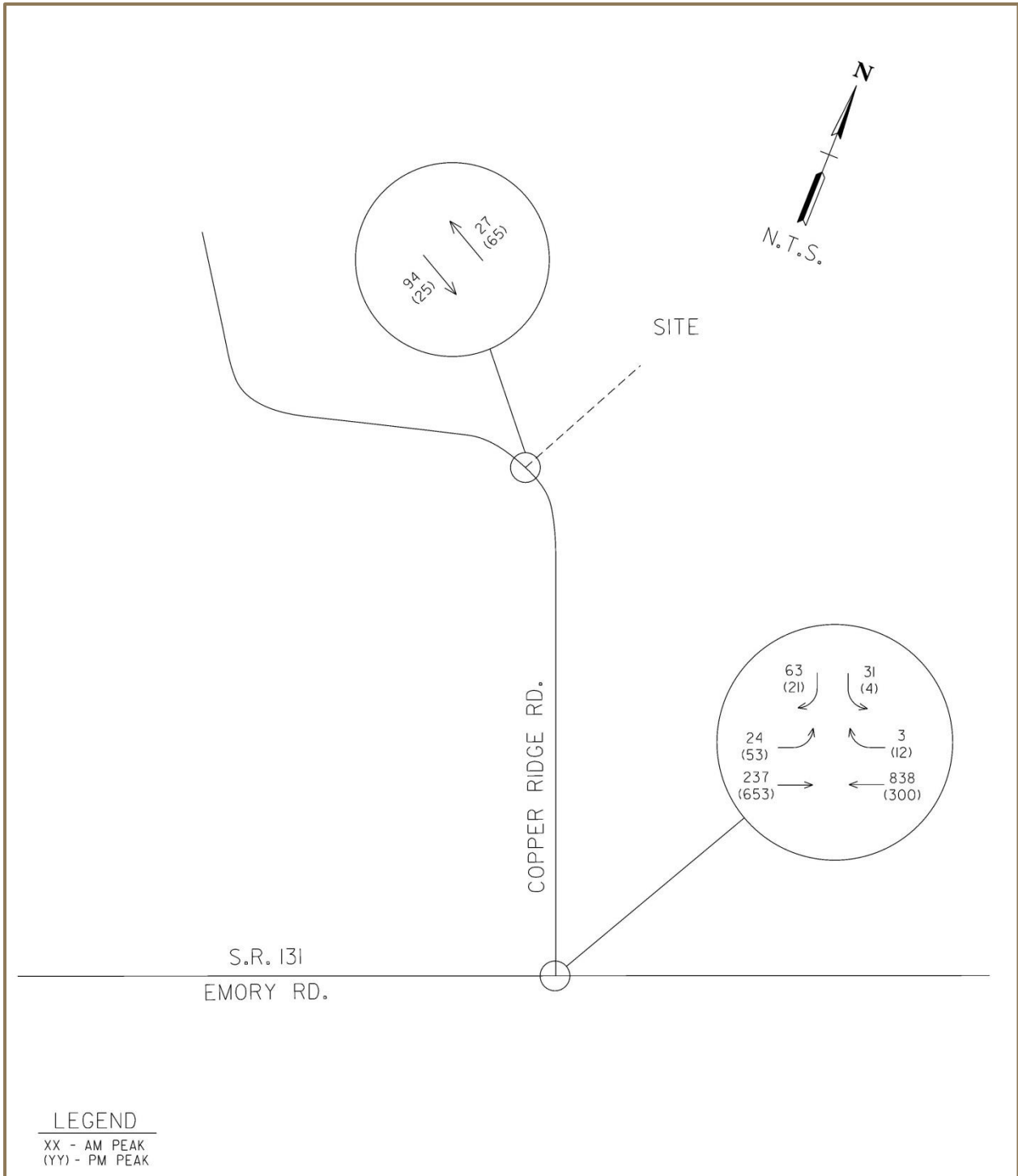


FIGURE 3
2016 EXISTING TRAFFIC VOLUMES

BACKGROUND CONDITIONS

BACKGROUND TRAFFIC GROWTH

The anticipated time for full build-out of the Copper Trace Development is estimated as five years. Therefore, year 2021 was established as the appropriate design/analysis year for this study. In order to determine traffic volumes resulting solely from background traffic growth to year 2021, it was necessary to establish an annual growth rate for existing traffic. The ADT values given previously in TABLE 1, along with engineering judgment, were used to arrive at a rate of 2 percent for this development. FIGURE 4 contains the background traffic volumes that would result from this 2 percent annual growth to year 2021.

BACKGROUND CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual (HCM 2010) were used to evaluate the study intersection of Emory Road and Copper Ridge Road for the background (2021) traffic conditions, shown on FIGURE 4. The results indicate that Emory Road left-turn traffic movement would be expected to operate at level-of-service "B" during the AM peak hour and "A" during the PM peak hour, and Copper Ridge Road movements would operate at a level-of-service "F" during the AM peak hour and "B" during the PM peak hour, if the proposed development is not constructed. These results are summarized in detail on the "Two-Way Stop Control Summary" printouts contained in the APPENDIX. Also see the APPENDIX for a discussion of intersection capacity and level-of-service concepts.

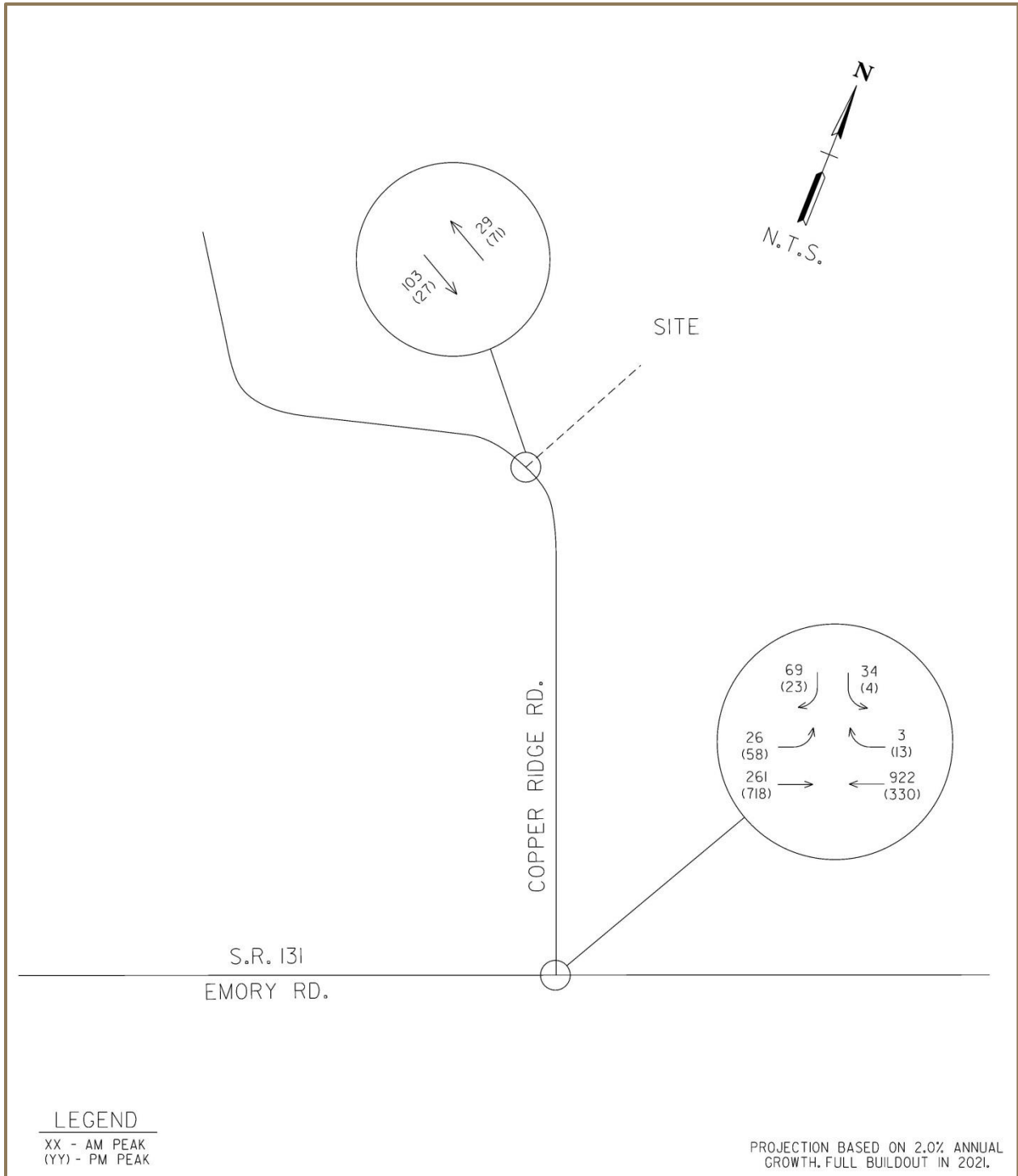


FIGURE 4
2021 BACKGROUND TRAFFIC VOLUMES

FUTURE CONDITIONS

TRIP GENERATION

In order to estimate the expected traffic volumes to be generated by full build-out of the proposed development, the data and procedures of *Trip Generation, Ninth Edition* (Institute of Transportation Engineers, 2012) were utilized. The generated traffic volumes were determined based on the total weekday morning and evening peak hour of adjacent street traffic trip generation rates for single-family detached housing (Land Use Code 210, Volume 2, pages 296 to 298). As noted earlier in this report, the anticipated maximum number of units upon full build-out is 135, which was used to determine the number of new trips generated. TABLE 2 summarizes the number and directional split of entering and exiting trips for the proposed development.

TABLE 2: TRIP GENERATION SUMMARY

LAND USE	ITE CODE	SIZE	WEEKDAY (TRIPS/DAY)	AM PEAK HOUR (TRIPS/HR)	PM PEAK HOUR (TRIPS/HR)
Single Family Detached Housing					
Entering Trips	210	135 units	692	26	87
Exiting Trips			692	78	51
TOTAL					
Entering Trips	-	-	692	26	87
Exiting Trips			692	78	51

TRIP DISTRIBUTION AND ASSIGNMENT

FIGURE 5 provides a summary of the trip distribution patterns developed for the study intersections, which were derived from the existing traffic patterns. In addition, FIGURE 6 provides the generated traffic volumes as assigned to the local roadway network in accordance with these distribution patterns. FIGURE 7 shows the combined year 2021 volumes reflecting the existing traffic, the background traffic growth, and the newly generated traffic from the Copper Trace Development. These are the volumes used in the analysis of full build-out conditions.

FUTURE CAPACITY ANALYSES / LEVELS-OF-SERVICE

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual were used to evaluate the intersection of Emory Road at Copper Ridge Road for the year 2021 combined traffic volume conditions (FIGURE 7). The results indicate that with existing intersection turn lane geometry, the Emory Road left-turn traffic movement would be expected to operate at level-of-service "B" during the AM peak hour and "A" during the PM peak hour, and Copper Ridge Road movements would operate at a level-of-service "F" during the AM peak hour and "C" during the PM peak hour. These results are summarized in detail on the "Two-Way Stop Control Summary" printouts contained in the

APPENDIX. The APPENDIX may also be referenced for a discussion of intersection capacity and level-of-service concepts.

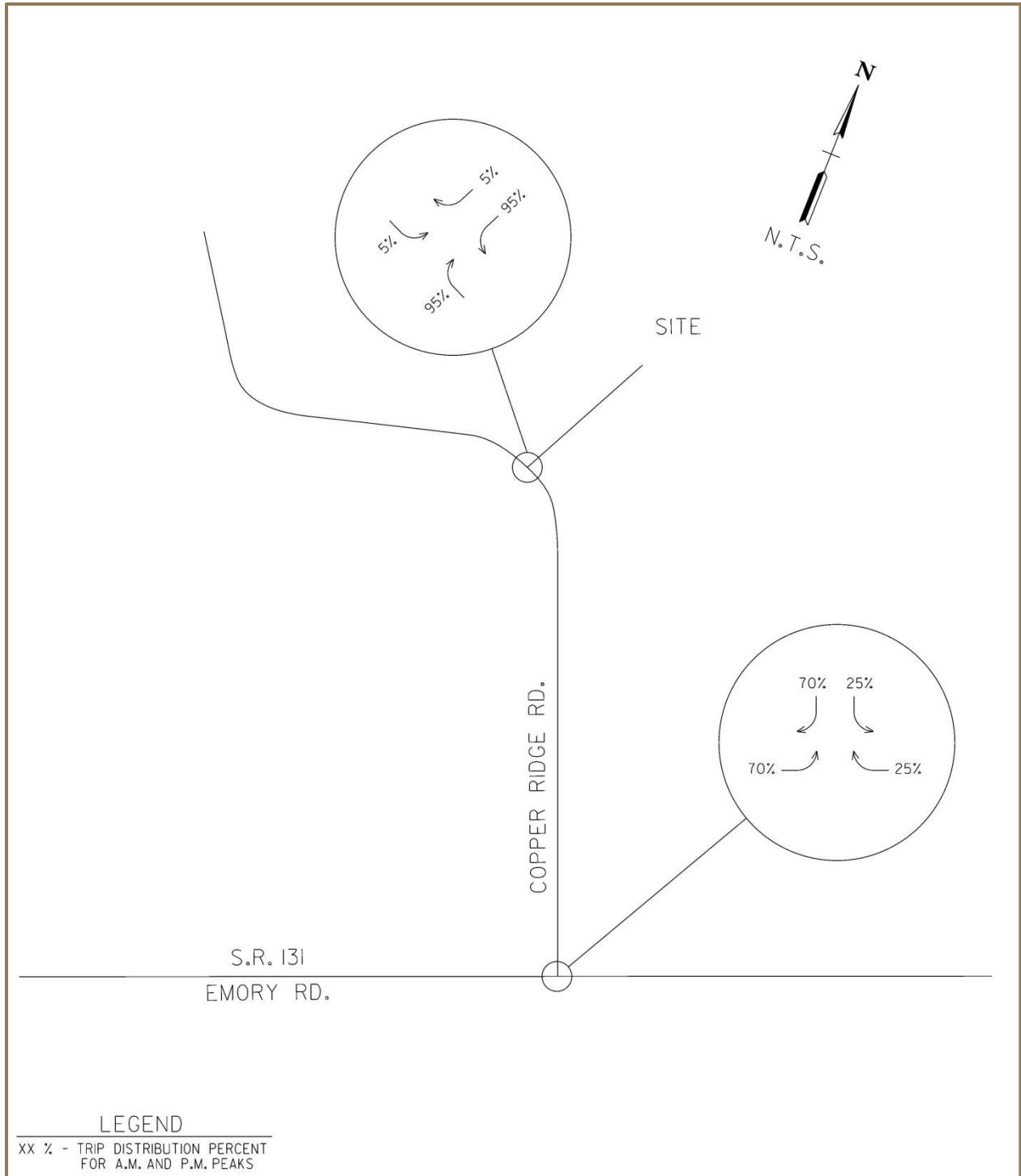


FIGURE 5
TRIP DISTRIBUTION PATTERNS

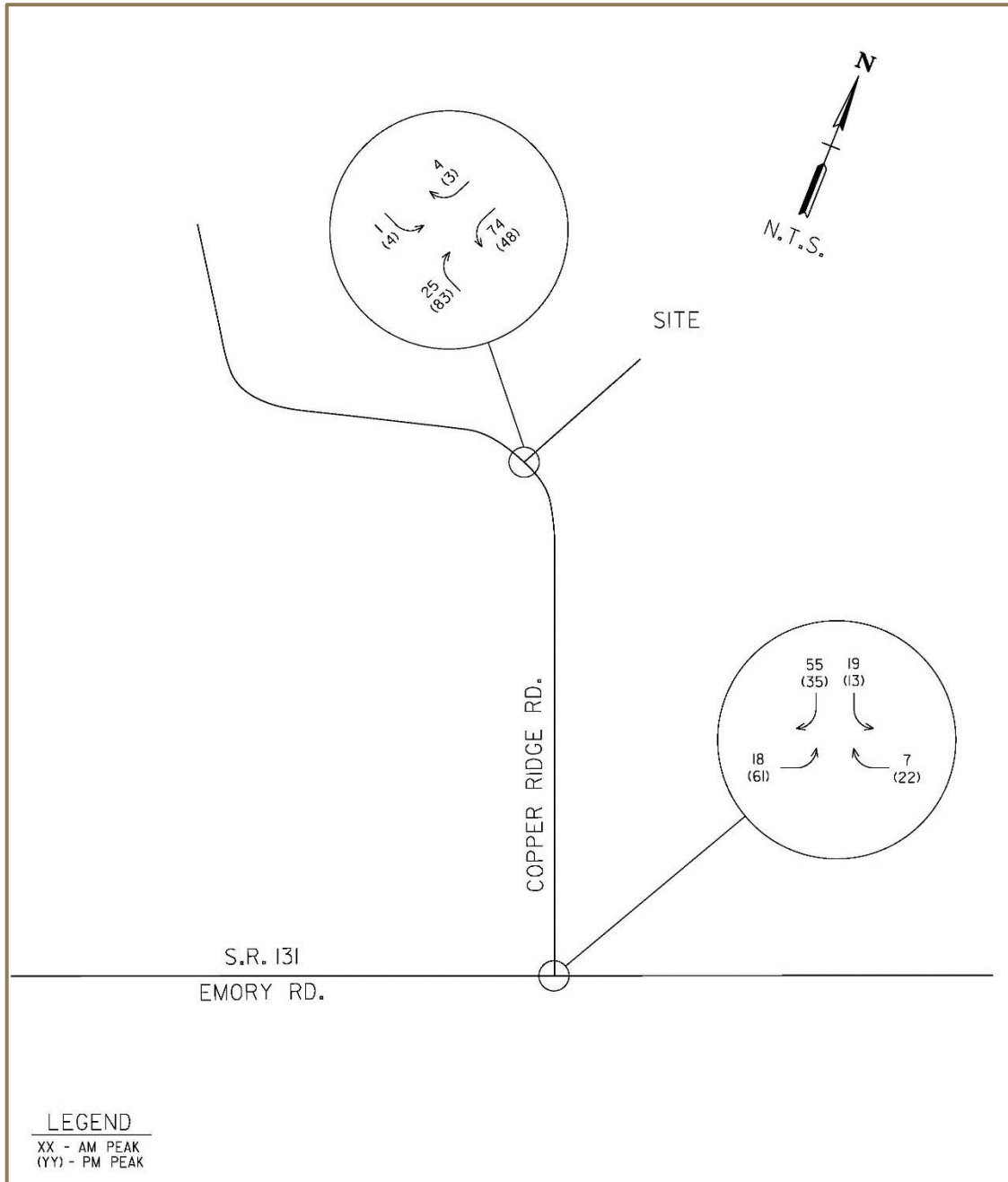


FIGURE 6
GENERATED TRIPS

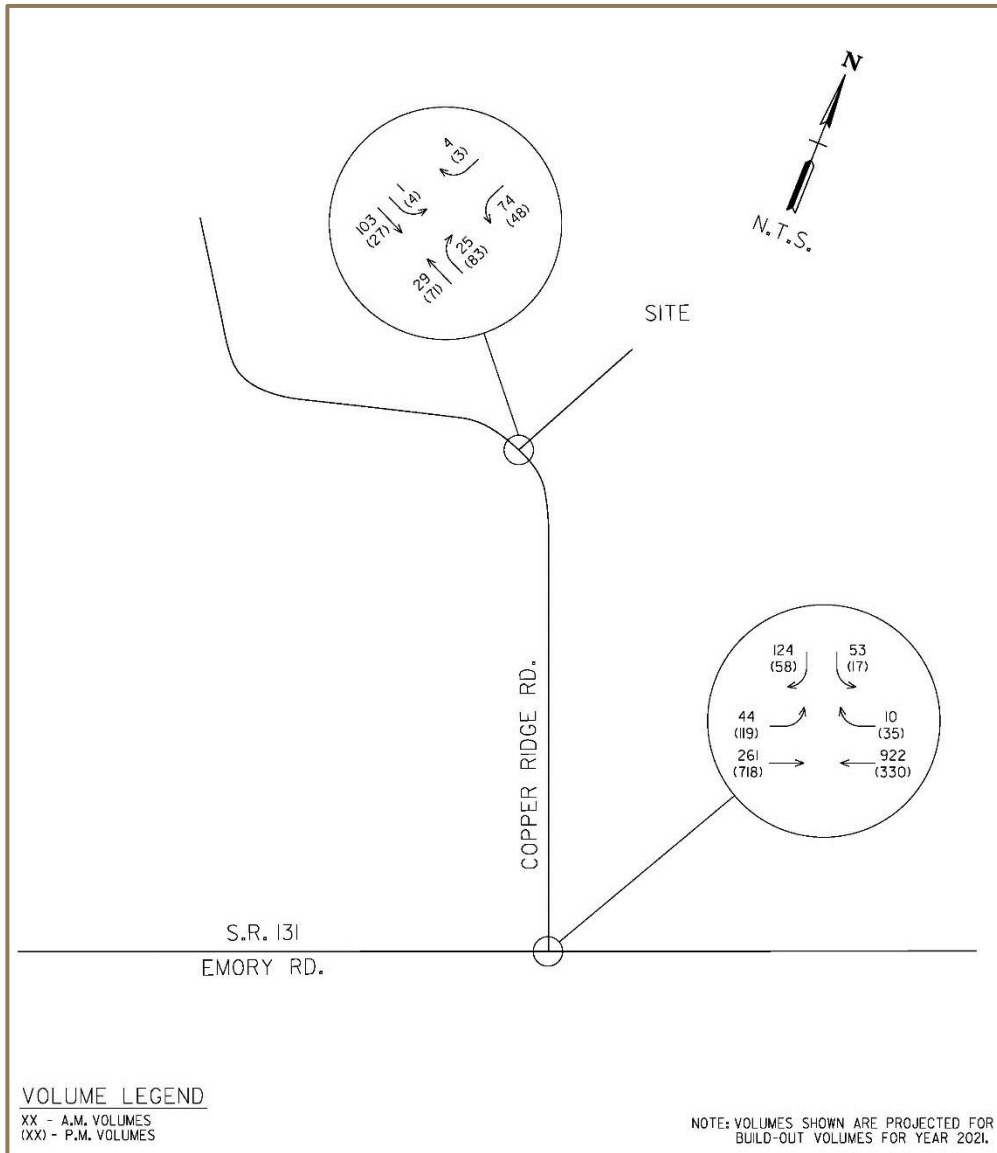


FIGURE 7
2021 COMBINED TRAFFIC VOLUMES

EVALUATIONS

INTERSECTION CAPACITY ANALYSES

As discussed in the preceding sections of this report, capacity analyses employing the methods of the Highway Capacity Manual (HCM) were conducted for the study intersections. These analyses were performed for existing, background, and anticipated 2021 combined traffic conditions. Existing geometry and traffic control were used in the analyses of the intersection of Emory Road at Copper Ridge Road for existing, background, and combined conditions. In addition, this intersection was evaluated with the addition of an eastbound left-turn lane and a southbound right-turn lane for Year 2021 Combined Conditions. A summary of the capacity analysis results for the Year 2016 Existing Conditions, Year 2021 Background Conditions, and Year 2021 Combined Conditions is shown in TABLE 3.

TABLE 3: CAPACITY ANALYSES SUMMARY

EVALUATION CONDITION	LEVEL-OF-SERVICE (AVG. DELAY)	
	SOUTHBOUND APPROACH (COPPER RIDGE RD.)	EASTBOUND LEFT TURN (EMORY RD.)
Existing (2016) – AM	E 37.5	B 10.6
Existing (2016) – PM	B 12.3	A 8.1
Background (2021) – AM	F 55.8	B 11.2
Background (2021) – PM	B 12.9	A 8.2
Combined w/ Existing Lanes (2021) – AM	F 179.0	B 11.5
Combined w/ Existing Lanes (2021) – PM	C 18.2	A 8.5
Combined w/ EBLT & SBRT (2021) – AM	F 50.3*	B 11.5
Combined w/ EBLT & SBRT (2021) – PM	C 16.5*	A 8.5

* Southbound Breakdown by Lane:
 AM – Left-turn lane – F(73.6), Right-turn lane – E(40.2)
 PM – Left-turn lane – E(36.1), Right-turn lane – B(11.0)

As shown in TABLE 3, the southbound approach at this intersection currently operates at level-of-service “E” during the AM peak hour. This LOS will worsen to “F” during Year 2021 Background Conditions without traffic from the proposed development. With traffic from the proposed development added to the intersection, the southbound approach delay will worsen from an average delay of 55.8 seconds to 179.0 seconds. The addition of a southbound right-turn lane will improve the LOS grade to a very marginal LOS “F” during Year 2021 Combined Conditions.

SIGHT DISTANCE ASSESSMENT

The proposed project development entrance on Copper Ridge Road was evaluated for corner sight distance. Based on the posted 30 mph speed limit, the required minimum sight distance in accordance with Knox County regulations would be 300 feet. Field reviews indicate that this requirement will be met at this intersection, as available sight distance was measured in excess of 450 feet looking south

and approximately 385 feet looking north. The sight distance to the north was measured looking through a horizontal curve and chain link fence. FIGURE 8 shows looking both south and north along Copper Ridge Road from the proposed development entrance.



FIGURE 8
SIGHT DISTANCE ASSESSMENT

TURN LANE ASSESSMENT

Turn lane warrant analyses were conducted for the intersection of Emory Road at Copper Ridge Road under proposed development conditions. These analyses employed Tables 5A and 5B from the [Knox County Access Control and Driveway Design Policy](#), which are based on turn lane warrants developed by Harmelink. The results were that an eastbound left-turn lane on Emory Road at Copper Ridge Road is expected to be warranted during both peak traffic hours. As a basis of comparison, existing traffic conditions were also analyzed, with the result that the eastbound left-turn lane currently satisfies warranting conditions for the P.M. peak. A westbound right-turn lane on Emory Road was not found to be warranted. Copies of Tables 5A and 5B are located in the APPENDIX for review.

CONCLUSIONS & RECOMMENDATIONS

The primary conclusion of this study is that the traffic generated by the proposed development will result in short-term impacts on traffic operational conditions in the project area. Of particular concern is the existing intersection of Emory Road at Copper Ridge Road, through which the vast majority of traffic to this development will travel. The issues at this location include the fact that an eastbound left-turn lane will be clearly warranted during both AM and PM peak traffic hours, and during the AM peak hour the southbound traffic will experience level-of-service "F" operation under current intersection geometry.

The primary conclusion of this study is that the traffic generated by the proposed development will result in traffic operational impacts in the project area, especially during peak traffic hours at the intersection of Emory Road and Copper Ridge Road. The resulting recommendation is that consideration should be given to implementing turning lane improvements at this location, with the following issues being considered in determining improvement scope and responsibility:

1. An eastbound left-turn lane on Emory Road will be justified during both the AM and PM peak traffic hours after full project build-out based on satisfying Knox County left-turn lane volume thresholds. It is worth noting, however, that such a lane is currently justified during existing PM peak hour conditions.
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3. Existing roadway right-of-way on both Emory Road and Copper Ridge Road at this intersection appears to be on the order of 50 feet and is not under the control of the project developer.

Other traffic related issues evaluated for this project included corner sight distance for the proposed subdivision access roadway intersection with Copper Ridge Road, and the general width and condition of Copper Ridge Road between Emory Road and the project site. These evaluations concluded that corner sight distance requirements will be exceeded, and that although Copper Ridge Road is narrow, its width does meet or exceed the eighteen feet minimum typically preferred by Knox County.

APPENDIX

APPENDIX A – TRAFFIC DATA

APPENDIX B – TRIP GENERATION

APPENDIX C - ANALYSES

APPENDIX A – TRAFFIC DATA

Groups Printed - Cars, PU, Vans - Heavy Trucks

Start Time	Copper Ridge Rd Northbound					Copper Ridge Rd Southbound					W Emory Rd (SR 131) Eastbound					W Emory Rd (SR 131) Westbound					Int. Total
	Left	Thru	Rgt	Peds	App. Total	Left	Thru	Rgt	Peds	App. Total	Left	Thru	Rgt	Peds	App. Total	Left	Thru	Rgt	Peds	App. Total	
7:00 AM	0	0	0	0	0	4	0	13	0	17	1	45	0	0	46	0	162	0	0	162	225
7:15 AM	0	0	0	0	0	7	0	18	0	25	6	56	0	0	62	0	214	0	0	214	301
7:30 AM	0	0	0	0	0	8	0	17	0	25	7	65	0	0	72	0	267	0	0	267	364
7:45 AM	0	0	0	0	0	12	0	17	0	29	8	64	0	0	72	0	183	1	0	184	285
Total	0	0	0	0	0	31	0	65	0	96	22	230	0	0	252	0	826	1	0	827	1175
8:00 AM	0	0	0	0	0	4	0	11	0	15	3	52	0	0	55	0	174	2	0	176	246
8:15 AM	0	0	0	0	0	2	0	9	0	11	4	57	0	0	61	0	138	0	0	138	210
8:30 AM	0	0	0	0	0	2	0	7	0	9	6	55	0	0	61	0	98	2	0	100	170
8:45 AM	0	0	0	0	0	2	0	5	0	7	4	51	0	0	55	0	97	0	0	97	159
Total	0	0	0	0	0	10	0	32	0	42	17	215	0	0	232	0	507	4	0	511	785
BREAK																					
4:00 PM	0	0	0	0	0	2	0	3	0	5	11	143	0	0	154	0	50	3	0	53	212
4:15 PM	0	0	0	0	0	3	0	7	0	10	12	143	0	0	155	0	59	4	0	63	228
4:30 PM	0	0	0	0	0	6	0	5	0	11	6	157	0	0	163	0	63	1	0	64	238
4:45 PM	0	0	0	0	0	3	0	3	0	6	13	163	0	0	176	0	49	1	0	50	232
Total	0	0	0	0	0	14	0	18	0	32	42	606	0	0	648	0	221	9	0	230	910
5:00 PM	0	0	0	0	0	1	0	4	0	5	14	154	0	0	168	0	64	1	0	65	238
5:15 PM	0	0	0	0	0	0	0	6	0	6	11	183	0	0	194	0	77	6	0	83	283
5:30 PM	0	0	0	0	0	0	0	6	0	6	16	174	0	0	190	0	76	2	0	78	274
5:45 PM	0	0	0	0	0	3	0	5	0	8	12	142	0	0	154	0	83	3	0	86	248
Total	0	0	0	0	0	4	0	21	0	25	53	653	0	0	706	0	300	12	0	312	1043
Grand Total	0	0	0	0	0	59	0	136	0	195	134	1704	0	0	1838	0	1854	26	0	1880	3913
Apprch %	0.0	0.0	0.0	0.0	0.0	30.3	0.0	69.7	0.0	0.0	7.3	92.7	0.0	0.0	0.0	0.0	98.6	1.4	0.0	0.0	
Total %	0.0	0.0	0.0	0.0	0.0	1.5	0.0	3.5	0.0	5.0	3.4	43.5	0.0	0.0	47.0	0.0	47.4	0.7	0.0	48.0	
Cars, PU, Vans	0	0	0	0	0	59	0	136	0	195	134	1704	0	0	1838	0	1854	26	0	1880	3913
% Cars, PU, Vans	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0	100.0	100.0	100.0	0.0	0.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
%Heavy Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Project ID: 16-10039-001

Location: Copper Ridge Rd & W Emory Rd (SR 131)
City: Knoxville

PEAK HOURS

Day: Wednesday
Date: 12/14/2016

AM

Start Time	Copper Ridge Rd Northbound				Copper Ridge Rd Southbound				W Emory Rd (SR 131) Eastbound				W Emory Rd (SR 131) Westbound				Int. Total
	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	
Peak Hour Analysis from 07:00 AM to 09:00 AM																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
7:15 AM	0	0	0	0	7	0	18	25	6	56	0	62	0	214	0	214	301
7:30 AM	0	0	0	0	8	0	17	25	7	65	0	72	0	267	0	267	364
7:45 AM	0	0	0	0	12	0	17	29	8	64	0	72	0	183	1	184	285
8:00 AM	0	0	0	0	4	0	11	15	3	52	0	55	0	174	2	176	246
Total Volume	0	0	0	0	31	0	63	94	24	237	0	261	0	838	3	841	1196
% App. Total	0.0	0.0	0.0	0.0	33.0	0.0	67.0	100	9.2	90.8	0.0	100	0.0	99.6	0.4	100	
PHF	0.000				0.810				0.906				0.787				
Cars, PU, Vans	0	0	0	0	31	0	63	94	24	237	0	261	0	838	3	841	1196
% Cars, PU, Vans	0.0	0.0	0.0	0.0	100.0	0.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	100.0	100.0	100.0
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PM

Start Time	Copper Ridge Rd Northbound				Copper Ridge Rd Southbound				W Emory Rd (SR 131) Eastbound				W Emory Rd (SR 131) Westbound				Int. Total
	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	Left	Thru	Rgt	App. Total	
Peak Hour Analysis from 04:00 PM to 06:00 PM																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
5:00 PM	0	0	0	0	1	0	4	5	14	154	0	168	0	64	1	65	238
5:15 PM	0	0	0	0	0	0	6	6	11	183	0	194	0	77	6	83	283
5:30 PM	0	0	0	0	0	0	6	6	16	174	0	190	0	76	2	78	274
5:45 PM	0	0	0	0	3	0	5	8	12	142	0	154	0	83	3	86	248
Total Volume	0	0	0	0	4	0	21	25	53	653	0	706	0	300	12	312	1043
% App. Total	0.0	0.0	0.0	0.0	16.0	0.0	84.0	100	7.5	92.5	0.0	100	0.0	96.2	3.8	100	
PHF	0.000				0.781				0.910				0.907				
Cars, PU, Vans	0	0	0	0	4	0	21	25	53	653	0	706	0	300	12	312	1043
% Cars, PU, Vans	0.0	0.0	0.0	0.0	100.0	0.0	100.0	100.0	100.0	100.0	0.0	100.0	0.0	100.0	100.0	100.0	100.0
Heavy Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ITM Peak Hour Summary

Prepared by:

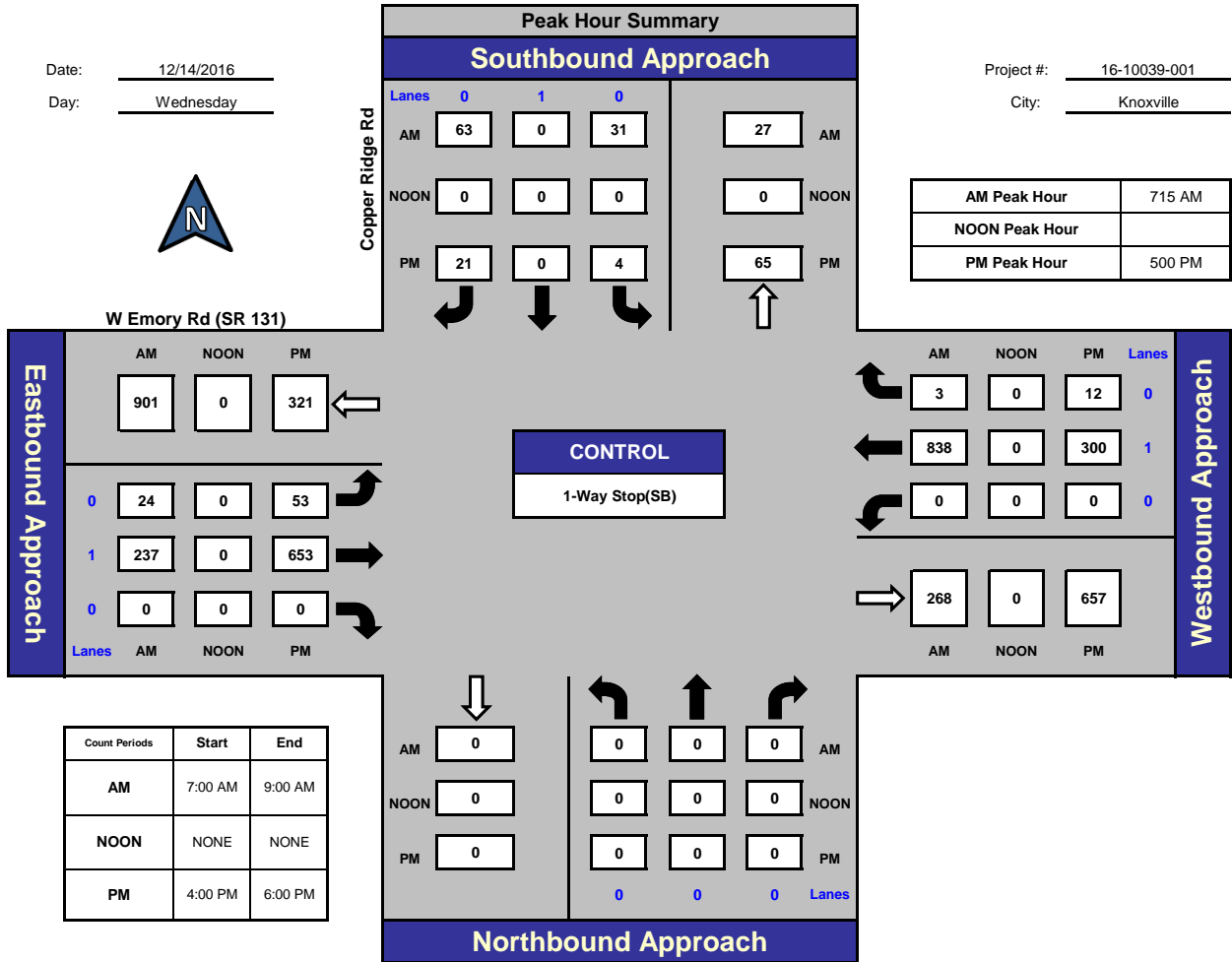


National Data & Surveying Services

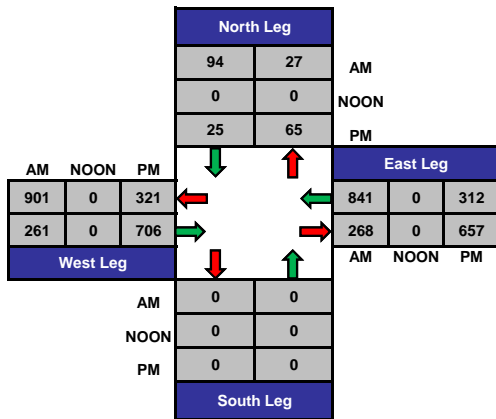
Copper Ridge Rd and W Emory Rd (SR 131), Knoxville

Date: 12/14/2016
Day: Wednesday

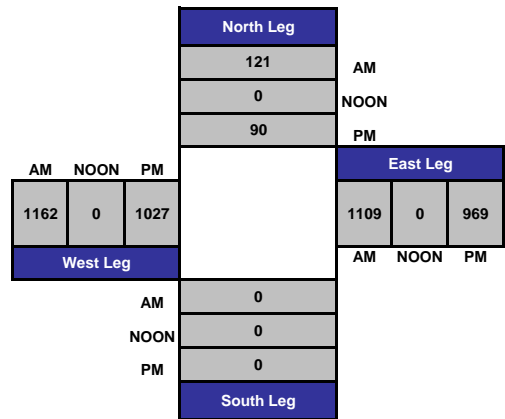
Project #: 16-10039-001
City: Knoxville



Total Ins & Outs



Total Volume Per Leg





Traffic History

Station # County Location Route #
 000047 Knox NEAR ANDERSON CO LINE SR131

Record Year AADT

1	2015	10074
2	2014	8866
3	2013	9480
4	2012	9336
5	2011	9006
6	2010	9512
7	2009	9426
8	2008	8792
9	2007	9077
10	2006	8872
11	2005	9140
12	2004	8467
13	2003	8368
14	2002	7948
15	2001	7419
16	2000	7819
17	1999	7541
18	1998	6908
19	1997	6865
20	1996	6427
21	1995	5941
22	1994	5995
23	1993	5993
24	1992	5370
25	1991	5283
26	1990	4554
27	1989	4910
28	1988	4542

3-Year growth: $10074 = 9336 (1+x)^3$ $x = 2.57\%$

5-Year growth: $10074 = 9512 (1+x)^5$ $x = 1.15\%$

10-Year growth: $10074 = 9140 (1+x)^{10}$ $x = 0.98\%$

Use 2% Annual Growth Rate

5-Year Buildout (2021)

Factor: 1.10

Record Year AADT

29	1987	4514
30	1986	4261
31	1985	3919

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APPENDIX B – TRIP GENERATION

TRIP GENERATION

COPPER TRACE DEVELOPMENT

ITE TRIP GENERATION (210) - SINGLE FAMILY DETACHED HOUSING

135 DWELLING UNITS

WEEKDAY

$$\text{LN}(T) = 0.92 * \text{LN}(X) + 2.72$$

$$T = 1384$$

50% ENTERING = 692

50% EXITING = 692

AM PEAK

$$T = 0.70 * (X) + 9.74$$

$$T = 104$$

25% ENTERING = 26

75% EXITING = 78

PM PEAK

$$\text{LN}(T) = 0.90 * \text{LN}(X) + 0.51$$

$$T = 138$$

63% ENTERING = 87

37% EXITING = 51

Land Use: 210

Single-Family Detached Housing

Description

Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.

Additional Data

The number of vehicles and residents had a high correlation with average weekday vehicle trip ends. The use of these variables was limited, however, because the number of vehicles and residents was often difficult to obtain or predict. The number of dwelling units was generally used as the independent variable of choice because it was usually readily available, easy to project and had a high correlation with average weekday vehicle trip ends.

This land use included data from a wide variety of units with different sizes, price ranges, locations and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Single-family detached units had the highest trip generation rate per dwelling unit of all residential uses because they were the largest units in size and had more residents and more vehicles per unit than other residential land uses; they were generally located farther away from shopping centers, employment areas and other trip attractors than other residential land uses; and they generally had fewer alternative modes of transportation available because they were typically not as concentrated as other residential land uses.

The peak hour of the generator typically coincided with the peak hour of the adjacent street traffic.

The sites were surveyed between the late 1960s and the 2000s throughout the United States and Canada.

Source Numbers

1, 4, 5, 6, 7, 8, 11, 12, 13, 14, 16, 19, 20, 21, 26, 34, 35, 36, 38, 40, 71, 72, 84, 91, 98, 100, 105, 108, 110, 114, 117, 119, 157, 167, 177, 187, 192, 207, 211, 246, 275, 283, 293, 300, 319, 320, 357, 384, 435, 550, 552, 579, 598, 601, 603, 611, 614, 637, 711, 735

Single-Family Detached Housing (210)

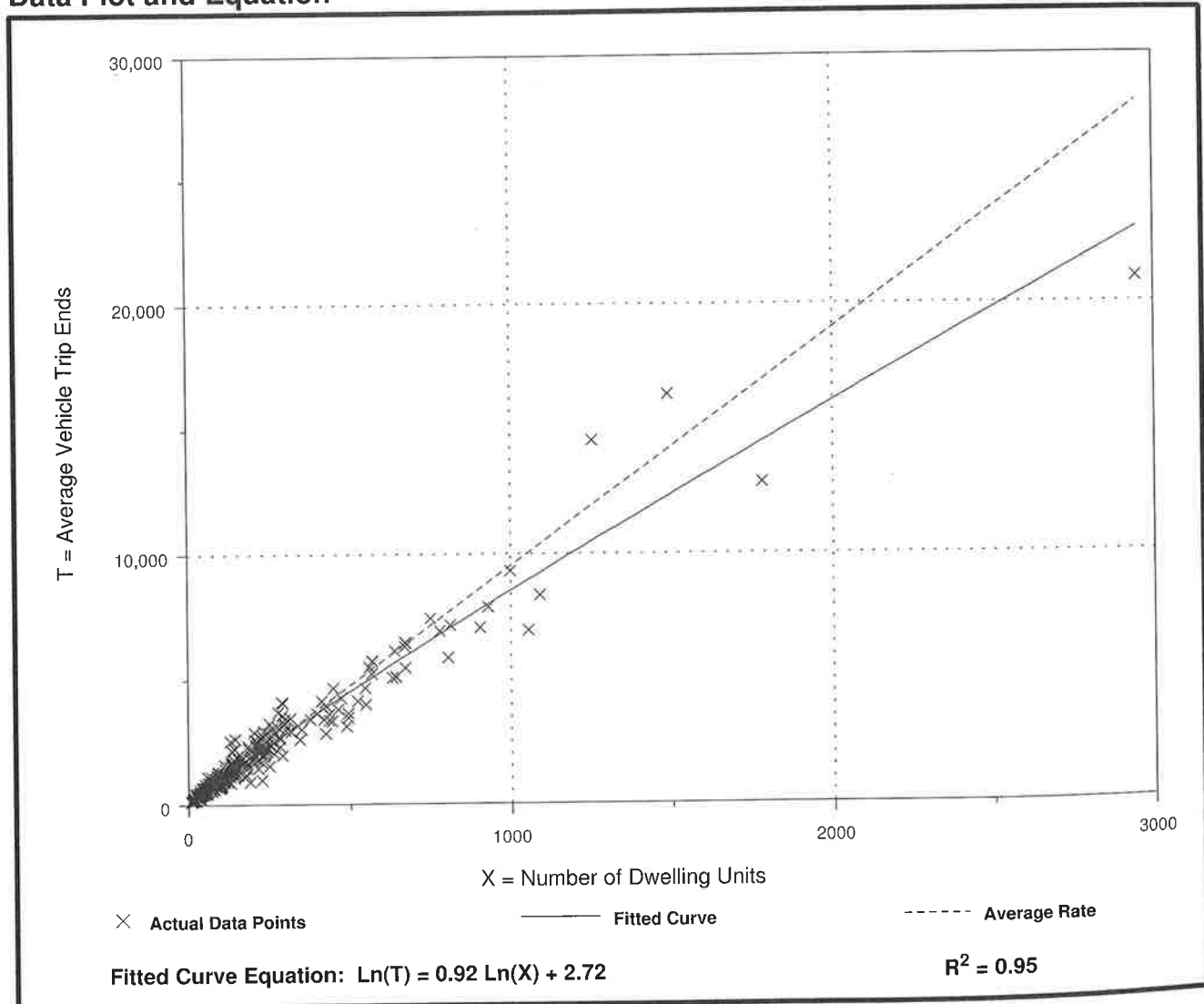
**Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday**

Number of Studies: 355
 Avg. Number of Dwelling Units: 198
 Directional Distribution: 50% entering, 50% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.52	4.31 - 21.85	3.70

Data Plot and Equation



Single-Family Detached Housing (210)

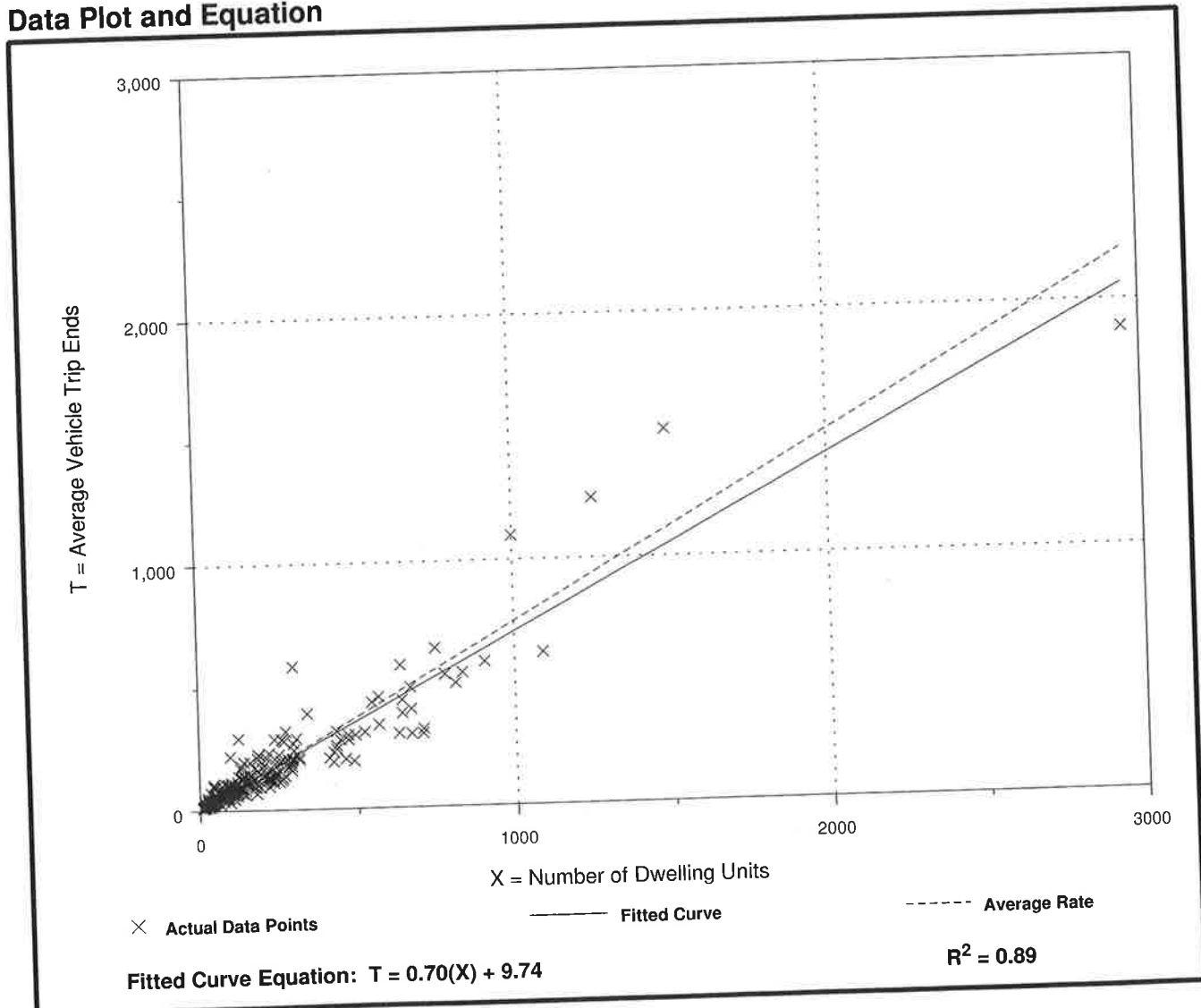
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 292
 Avg. Number of Dwelling Units: 194
 Directional Distribution: 25% entering, 75% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.75	0.33 - 2.27	0.90

Data Plot and Equation



Single-Family Detached Housing (210)

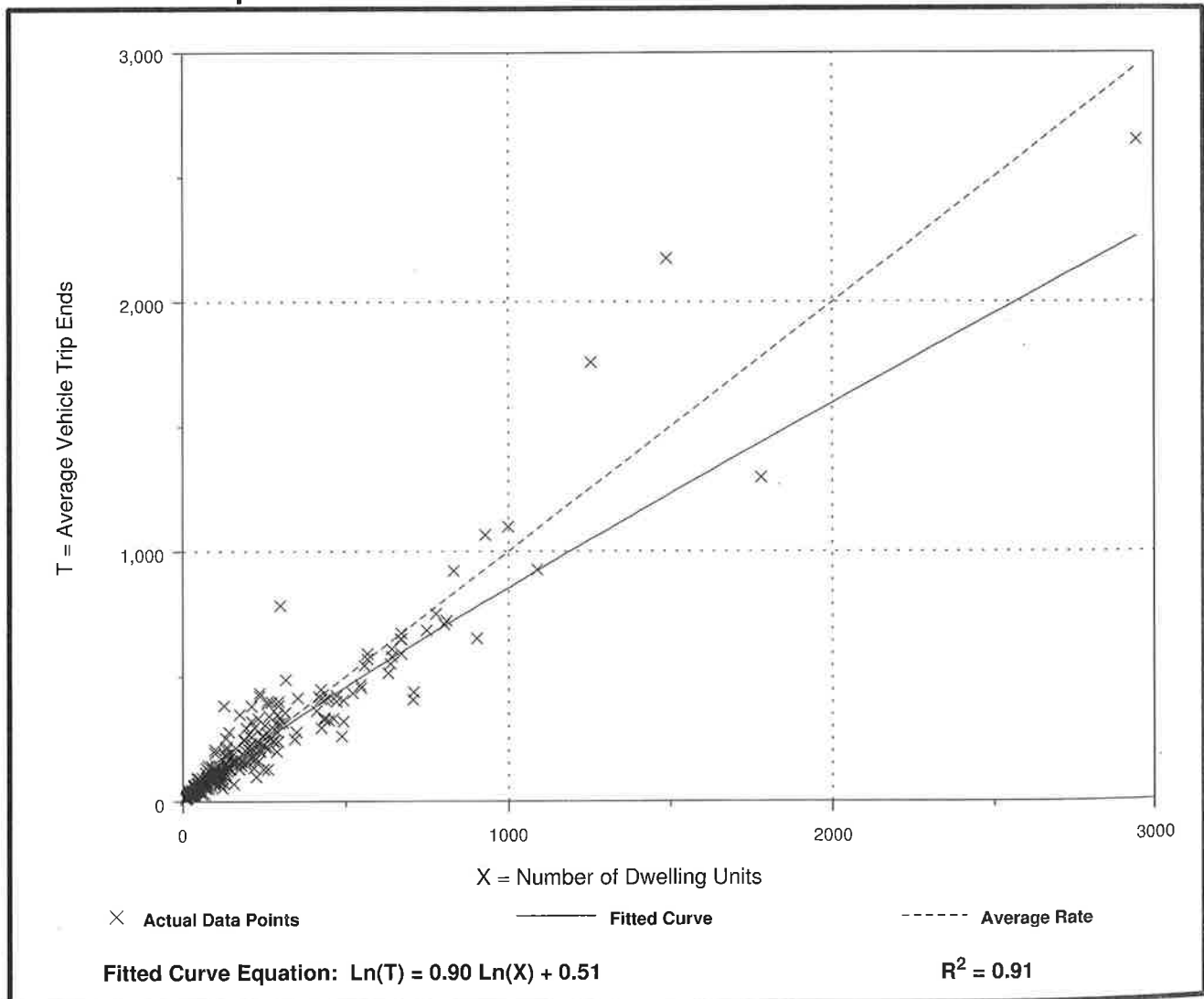
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 321
 Avg. Number of Dwelling Units: 207
 Directional Distribution: 63% entering, 37% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
1.00	0.42 - 2.98	1.05

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	ROUNDBABOUT
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

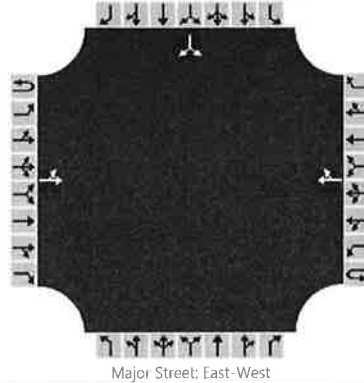
Another measure of intersection capacity that is often used in the evaluation of intersection operations is the volume to capacity (V/C) ratio. This ratio is defined as “the ratio of flow rate to capacity”, and is a good measure of how much of an intersection’s available capacity has been used up by 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 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	TSN	Intersection	Emory / Copper Ridge
Agency/Co.	CCI	Jurisdiction	Knox County
Date Performed	12/22/2016	East/West Street	W. Emory Road
Analysis Year	2016	North/South Street	Copper Ridge Road
Time Analyzed	A.M. - Existing	Peak Hour Factor	0.82
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Existing Geometry		

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	
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0	
Configuration		LT						TR							LR		
Volume, V (veh/h)		24	237				838	3						31		63	
Percent Heavy Vehicles (%)		3												3		3	
Proportion Time Blocked																	
Percent Grade (%)														0			
Right Turn Channelized		No				No				No				No			
Median Type/Storage		Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																	
Critical Headway (sec)																	
Base Follow-Up Headway (sec)																	
Follow-Up Headway (sec)																	

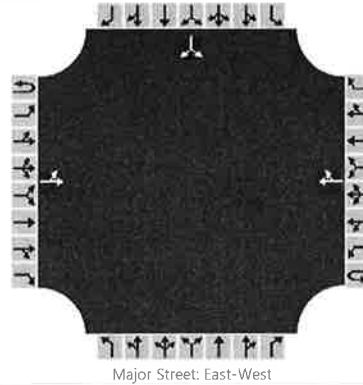
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		29															115
Capacity, c (veh/h)		672															222
v/c Ratio		0.04															0.52
95% Queue Length, Q ₉₅ (veh)		0.1															2.7
Control Delay (s/veh)		10.6															37.5
Level of Service, LOS		B															E
Approach Delay (s/veh)		1.5												37.5			
Approach LOS														E			

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	TSN	Intersection	Emory / Copper Ridge
Agency/Co.	CCI	Jurisdiction	Knox County
Date Performed	12/22/2016	East/West Street	W. Emory Road
Analysis Year	2016	North/South Street	Copper Ridge Road
Time Analyzed	P.M. - Existing	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Existing Geometry		

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								
Priority									7	8	9		10	11	12	
Number of Lanes	0	0	1	0	0	0	1	0	0	0	0		0	0	0	
Configuration		LT						TR							LR	
Volume, V (veh/h)		53	653				300	12						4		21
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized			No				No				No				No	
Median Type/Storage				Undivided												

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

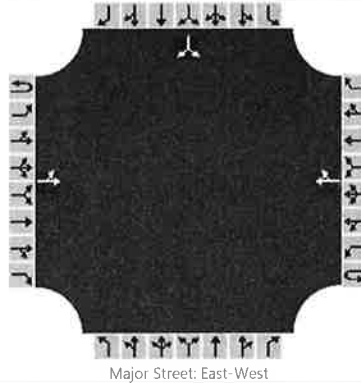
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		58														27
Capacity, c (veh/h)		1213														519
v/c Ratio		0.05														0.05
95% Queue Length, Q ₉₅ (veh)		0.2														0.2
Control Delay (s/veh)		8.1														12.3
Level of Service, LOS		A														B
Approach Delay (s/veh)			1.2													12.3
Approach LOS																B

HCS 2010 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	TSN			Intersection	Emory / Copper Ridge		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	12/22/2016			East/West Street	W. Emory Road		
Analysis Year	2021			North/South Street	Copper Ridge Road		
Time Analyzed	A.M. - Background			Peak Hour Factor	0.82		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	Existing Geometry						

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	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR								LR
Volume, V (veh/h)		26	261				922	3						34		69
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)																0
Right Turn Channelized		No			No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

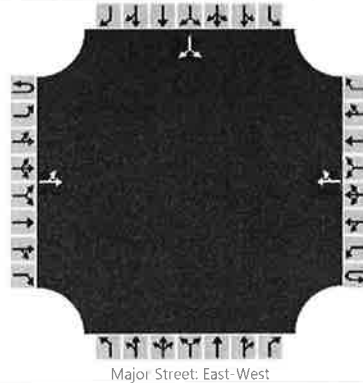
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		32														125	
Capacity, c (veh/h)		615														188	
v/c Ratio		0.05														0.67	
95% Queue Length, Q ₉₅ (veh)		0.2														4.0	
Control Delay (s/veh)		11.2														55.8	
Level of Service, LOS		B														F	
Approach Delay (s/veh)		1.7												55.8			
Approach LOS														F			

HCS 2010 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	TSN			Intersection	Emory / Copper Ridge		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	12/22/2016			East/West Street	W. Emory Road		
Analysis Year	2021			North/South Street	Copper Ridge Road		
Time Analyzed	P.M. - Background			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	Existing Geometry						

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	
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0	
Configuration		LT						TR								LR	
Volume, V (veh/h)		58	718				330	13						4		23	
Percent Heavy Vehicles (%)		3												3		3	
Proportion Time Blocked																	
Percent Grade (%)																0	
Right Turn Channelized		No			No				No			No					
Median Type/Storage		Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																	
Critical Headway (sec)																	
Base Follow-Up Headway (sec)																	
Follow-Up Headway (sec)																	

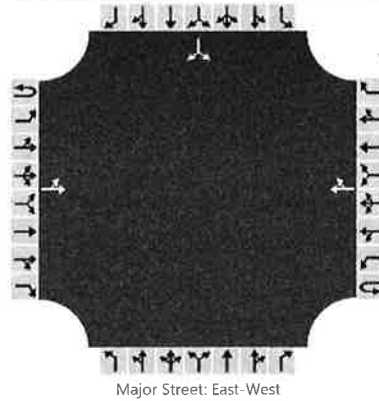
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		63															29
Capacity, c (veh/h)		1179															484
v/c Ratio		0.05															0.06
95% Queue Length, Q ₉₅ (veh)		0.2															0.2
Control Delay (s/veh)		8.2															12.9
Level of Service, LOS		A															B
Approach Delay (s/veh)		1.3												12.9			
Approach LOS		B															

HCS 2010 Two-Way Stop-Control Report

General Information				Site Information			
Analyst	TSN			Intersection	Emory / Copper Ridge		
Agency/Co.	CCI			Jurisdiction	Knox County		
Date Performed	2/23/2017			East/West Street	W. Emory Road		
Analysis Year	2021			North/South Street	Copper Ridge Road		
Time Analyzed	A.M. - Combined			Peak Hour Factor	0.82		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	Existing Geometry						

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	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR							LR	
Volume, V (veh/h)		44	261				922	10						53		124
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No			No				No			No				
Median Type/Storage	Undivided															

Critical and Follow-up Headways

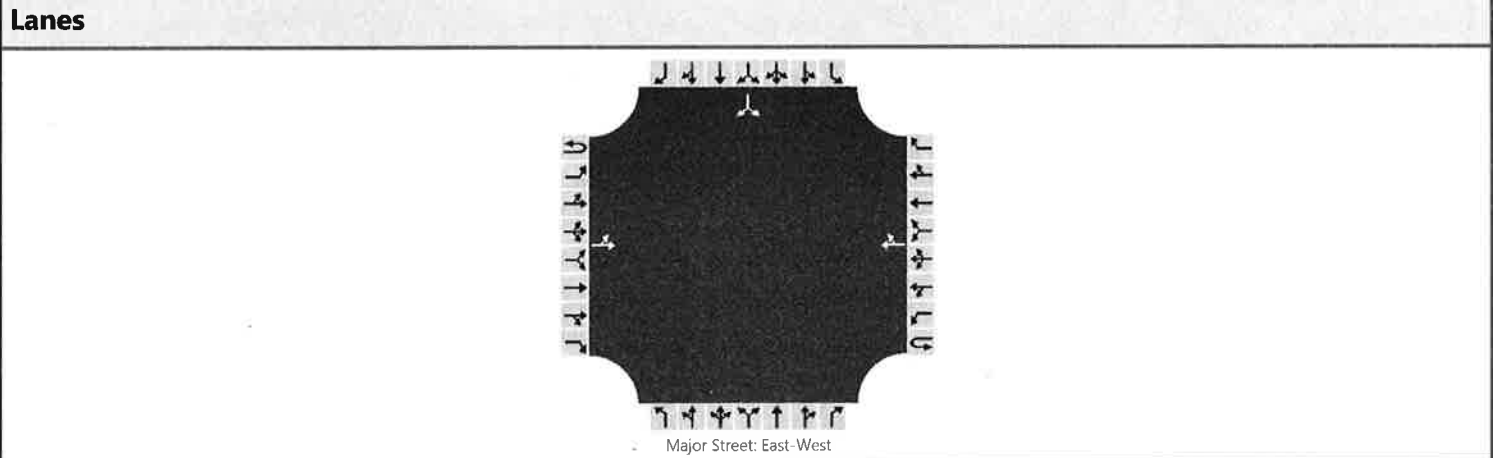
Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		54														216
Capacity, c (veh/h)		611														182
v/c Ratio		0.09														1.19
95% Queue Length, Q ₉₅ (veh)		0.3														11.4
Control Delay (s/veh)		11.5														179.0
Level of Service, LOS		B														F
Approach Delay (s/veh)	2.7												179.0			
Approach LOS													F			

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	TSN	Intersection	Emory / Copper Ridge
Agency/Co.	CCI	Jurisdiction	Knox County
Date Performed	2/23/2017	East/West Street	W. Emory Road
Analysis Year	2021	North/South Street	Copper Ridge Road
Time Analyzed	P.M. - Combined	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Existing Geometry		



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
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		LT						TR								LR
Volume, V (veh/h)		119	718				330	35						17		58
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)																0
Right Turn Channelized		No			No				No			No				
Median Type/Storage		Undivided														

Critical and Follow-up Headways

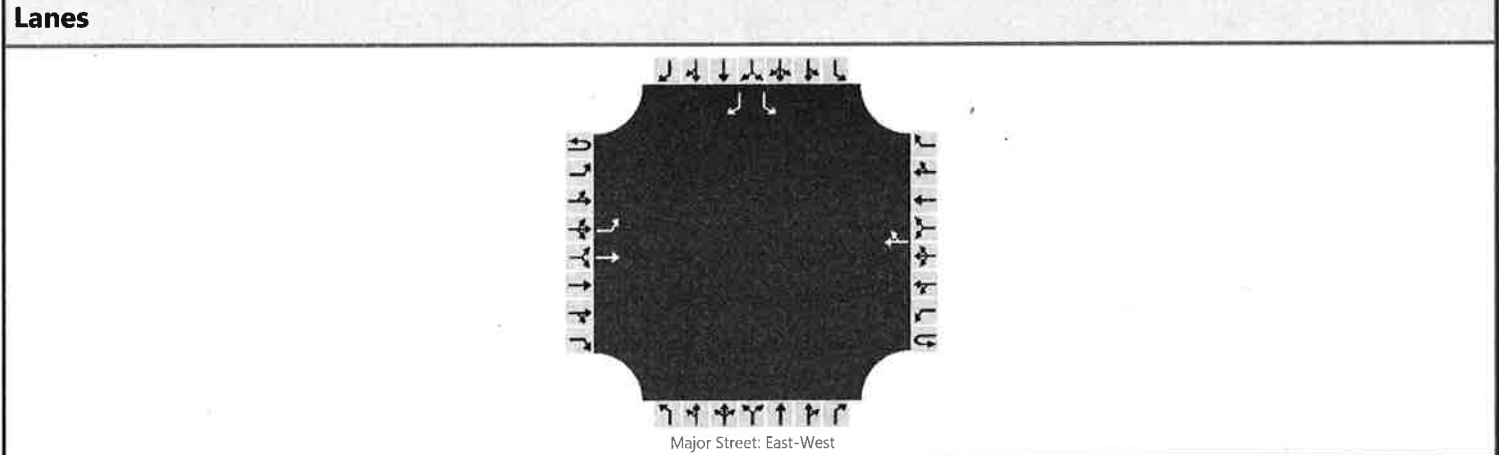
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		129														81	
Capacity, c (veh/h)		1155														353	
v/c Ratio		0.11														0.23	
95% Queue Length, Q ₉₅ (veh)		0.4														0.9	
Control Delay (s/veh)		8.5														18.2	
Level of Service, LOS		A														C	
Approach Delay (s/veh)		2.6												18.2			
Approach LOS														C			

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	TSN	Intersection	Emory / Copper Ridge
Agency/Co.	CCI	Jurisdiction	Knox County
Date Performed	2/23/2017	East/West Street	W. Emory Road
Analysis Year	2021	North/South Street	Copper Ridge Road
Time Analyzed	A.M. - Combined	Peak Hour Factor	0.82
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Eastbound Left and Southbound Right-Turn 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	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		44	261				922	10						53		124
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)																0
Right Turn Channelized		No			No				No				No			
Median Type/Storage		Undivided														

Critical and Follow-up Headways

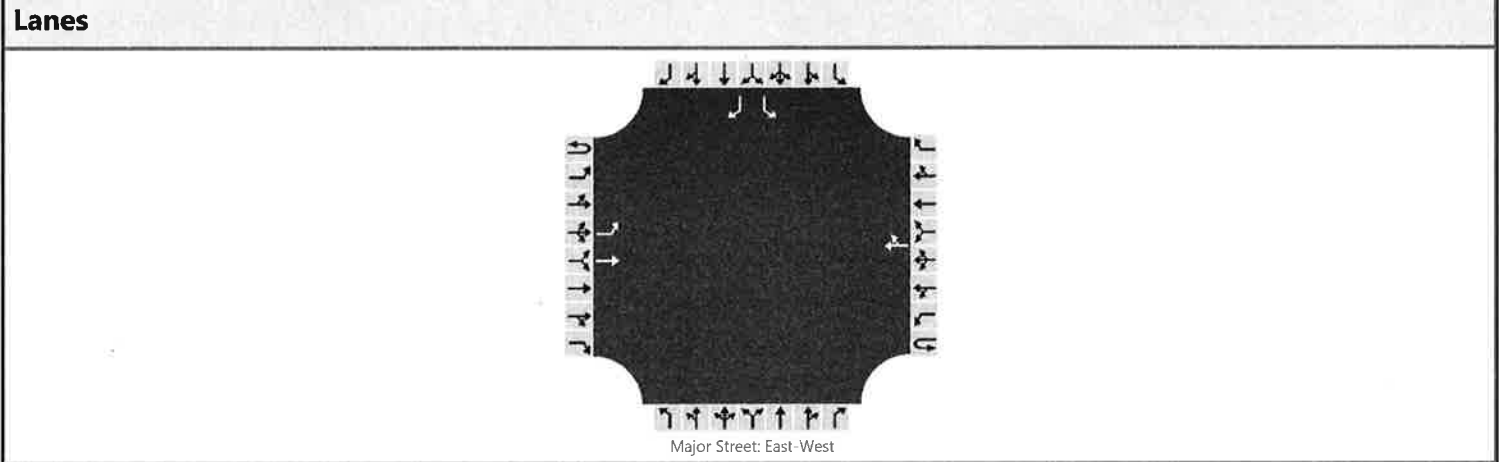
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		54												65		151	
Capacity, c (veh/h)		611												113		247	
v/c Ratio		0.09												0.58		0.61	
95% Queue Length, Q ₉₅ (veh)		0.3												2.8		3.6	
Control Delay (s/veh)		11.5												73.6		40.2	
Level of Service, LOS		B												F		E	
Approach Delay (s/veh)		1.7												50.3			
Approach LOS														F			

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	TSN	Intersection	Emory / Copper Ridge
Agency/Co.	CCI	Jurisdiction	Knox County
Date Performed	2/23/2017	East/West Street	W. Emory Road
Analysis Year	2021	North/South Street	Copper Ridge Road
Time Analyzed	P.M. - Combined	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Eastbound Left and Southbound Right-Turn 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	1	0	0	0	1	0	0	0	0		1	0	1	
Configuration		L	T					TR						L		R
Volume, V (veh/h)		119	718				330	35						17		58
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized		No			No				No				No			
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		129												18		63	
Capacity, c (veh/h)		1155												134		666	
v/c Ratio		0.11												0.13		0.09	
95% Queue Length, Q ₉₅ (veh)		0.4												0.5		0.3	
Control Delay (s/veh)		8.5												36.1		11.0	
Level of Service, LOS		A												E		B	
Approach Delay (s/veh)		1.2												16.5			
Approach LOS														C			

Emory Road (SR 131) at Copper Ridge Road
 Westbound Right-Turn Lane Warrant Assessment
 TABLE 5B

RIGHT-TURN LANE VOLUME THRESHOLDS
 FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH

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					* PM	
100 - 149 150 - 199						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	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 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99				Yes	Yes Yes	* AM Yes Yes
100 - 149 150 - 199		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	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.

* The above based on Combined (20d1) Traffic

Westbound Right-Turn Lane Not Warranted.

Emory Road (SR 131) at Copper Ridge Road
 Eastbound Left-Turn Lane Warrant Assessment
 TABLE 5A

LEFT-TURN LANE VOLUME THRESHOLDS
 FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25 ¹	25 ³	20	20

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	70	60	50	45	40	35
150 - 199	60	55	45	40	35	30
200 - 249	55	50	40	35	30	30
250 - 299	50	45	35	30	30	30
300 - 349	45	40	35	30	25	25 ²
350 - 399	40	35	30	25	25	20 ⁴
400 - 449	35	30	30	25	20	20
450 - 499	30	25	25	20	20	20
500 - 549	25	25	20	20	20	15
550 - 599	25	20	20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

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

- Existing (2016) A.M. Peak - Volume = 24, Required = 25 - Not Warranted
- Existing (2016) P.M. Peak - Volume = 53, Required = 25 - Warranted
- Combined (2021) A.M. Peak - Volume = 44, Required = 25 - Warranted
- Combined (2021) P.M. Peak - Volume = 119, Required = 20 - Warranted