TRAFFIC IMPACT STUDY

VINTAGE AT EMORY ROAD RESIDENTIAL DEVELOPMENT

W. EMORY ROAD
KNOXVILLE, TN

CCI PROJECT NO 01109-0003

PREPARED FOR
TDK Construction
1610 South Church Street,
Suite C
Murfreesboro, TN 37130

SUBMITTED BY
CANNON & CANNON INC
CONSULTING ENGINEERS
FIELD SURVEYORS

FEBRUARY 5
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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 W. Emory Road (S.R. 131) in the Powell Community of Knox County. The project site is located on the south side of Emory Road approximately 500 feet west of Central Avenue Pike / Heiskell Road. The conceptual development plan for this project, Vintage at Emory Road, proposes a maximum of 250 residential apartment units. The project is to have a single access driveway onto W. Emory Road, located approximately 850 to 900 feet west of Central Avenue Pike / Heiskell Road and approximately three-quarter mile west of Interstate 75.

The purpose of this study was the evaluation of the traffic operational and safety impacts of the proposed residential development upon roadways in the vicinity of the site. Of particular interest was the signalized intersection of W. Emory Road and Central Avenue Pike / Heiskell Road and W. Emory Road at the proposed site driveway. Appropriate intersection evaluations were conducted at these locations for existing and future conditions, both with and without traffic volumes generated from the proposed residential development, in order to determine the anticipated impacts and to establish recommended measures to mitigate these impacts. These evaluations included intersection capacity analyses, corner sight distance reviews and others as appropriate.

The primary conclusion of this study is that the traffic generated from the proposed multi-family residential development will not have a significant impact on the study intersections. Intersection sight distance at the proposed site driveway location on W. Emory Road is more than adequate for the posted speed limit. Under existing and projected conditions, the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road is anticipated to operate at acceptable levels-of-service, except for the northbound Central Avenue Pike approach during the P.M. peak traffic hour. Long northbound queues during the P.M. peak are anticipated to increase under background conditions and approach 350' without consideration of additional traffic from the nearby Kroger development and 660' with the inclusion of Kroger related trips. The results from the existing and background analyses support recommendations presented within the traffic impact study conducted for the proposed Kroger development which include the addition of an exclusive northbound right-turn lane on Central Avenue Pike at W. Emory Road. The addition of this turn lane would provide relief for existing and anticipated background northbound P.M. peak hour traffic.

The following listing is a summary of the improvements that are recommended in order to address the above issues and appropriately serve the traffic generated by the proposed development:

Site Related

1. Install a STOP sign on the site entrance roadway approach to W. Emory Road.
2. Maintain intersection corner sight distance at the proposed site entrance roadway by ensuring any site landscaping or site signage is properly placed such that sight distance is not restricted.

W. Emory Road at Central Avenue Pike / Heiskell Road

1. Consider installation of an exclusive northbound right-turn lane to address existing and projected northbound vehicle queueing. Design of the right-turn lane should be as recommended by the proposed Kroger development traffic impact study so that site related traffic anticipated to be generated by the development of the former Powell Airport site will be adequately accommodated.

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 W. Emory Road (S.R. 131) in the Powell Community of Knox County. The project site is located on the south side of Emory Road approximately 500 feet west of Central Avenue Pike / Heiskell Road. FIGURE 1 is a location map identifying the major roadways in the vicinity of the site.

FIGURE 1
LOCATION MAP

The conceptual development plan for this project, Vintage at Emory Road, proposes a maximum of 250 residential apartment units. The project is to have a single access driveway onto W. Emory Road, located approximately 850 to 900 feet west of Central Avenue Pike / Heiskell Road and approximately three-quarter mile west of Interstate 75. 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 residential development upon roadways in the vicinity of the site. Of particular interest was the signalized intersection of W. Emory Road and Central Avenue Pike / Heiskell Road and W. Emory Road at the proposed site driveway. Appropriate intersection evaluations were conducted at these locations for existing and future conditions, both with and without traffic volumes generated from the proposed residential development, in order to determine the anticipated impacts and to establish recommended measures to mitigate these impacts. These evaluations included intersection capacity analyses, corner sight distance reviews and others as appropriate.

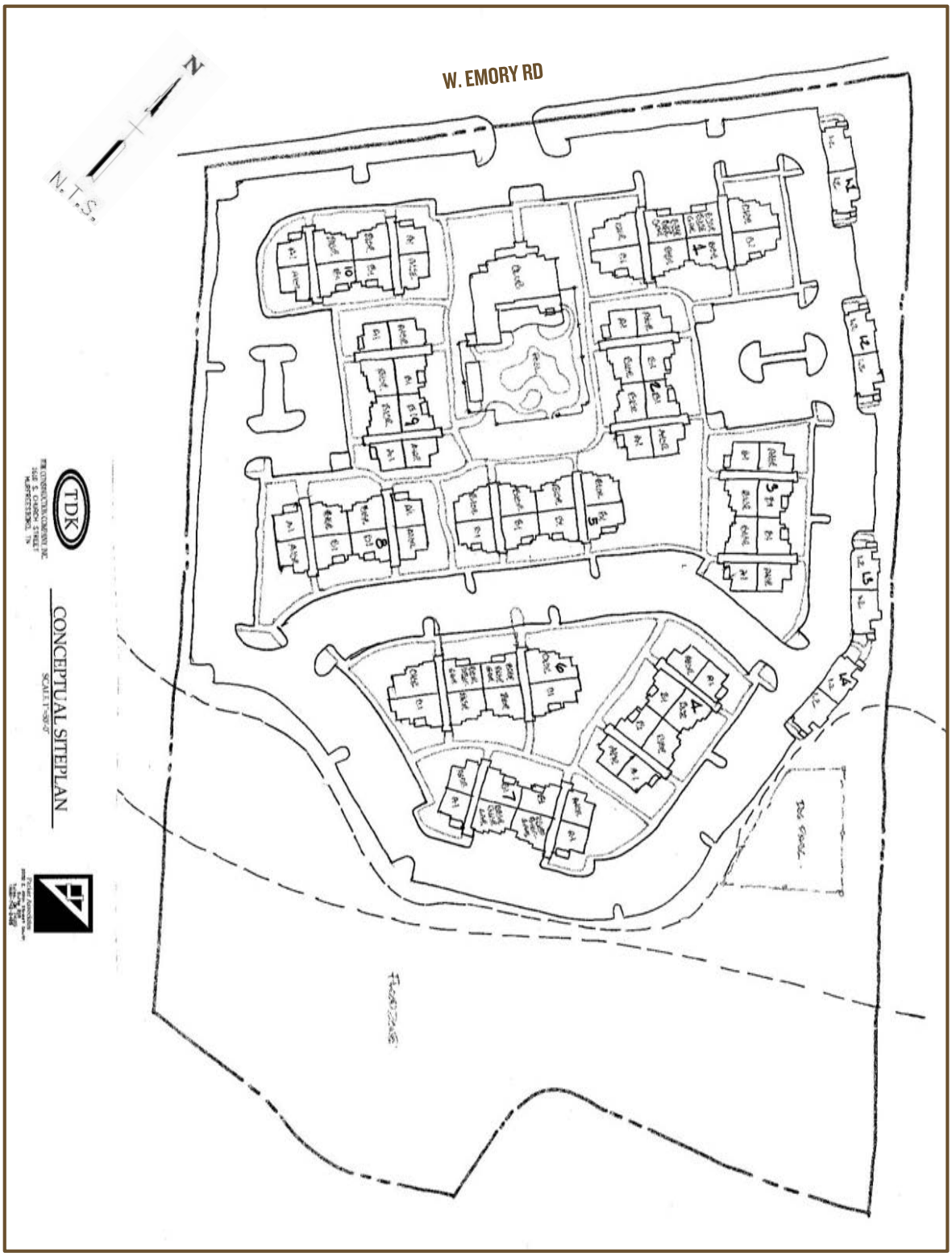


FIGURE 2
CONCEPTUAL SITE PLAN

EXISTING CONDITIONS

EXISTING ROADWAY CONDITIONS

W. Emory Road (S.R. 131) is a Major Arterial roadway that provides east-west access for north Knox County, stretching from Oak Ridge Highway (S.R. 62) to the west, to the Grainger County line to the east. It carries significant traffic to and from residential and commercial areas, and also to and from Interstate 75. In the vicinity of the proposed development, the roadway consists of two through travel lanes in each direction, with a center two-way left-turn lane. Sidewalks are also located along both sides of the roadway. The speed limit on W. Emory Road is posted as 40 mph. The 2013 ADT on W. Emory Road was 14,581.

Central Avenue Pike / Heiskell Road is a two-lane Minor Arterial roadway that has one through travel lane in each direction. Central Avenue Pike stretches from W. Emory Road south to Dutch Valley Road, while Heiskell Road stretches from W.Emory Road north to the Anderson County line. The intersection of W. Emory Road with Central Avenue Pike / Heiskell Road is controlled by a full-actuated traffic signal with left-turn phasing on all approaches. The speed limit on Central Avenue Pike and Heiskell Road is posted as 40 mph. The 2013 ADT's on Central Avenue Pike and Heiskell Road were 7,786 and 5,368, respectively.

EXISTING SITE CONDITIONS

The existing site consists of approximately 17 acres located south of Emory Road and north of Beaver Creek. An existing single-family residence is present on the west side of the site. The site is bordered to the west by wooded undeveloped land, to the south by Beaver Creek, and to the east by residential uses.

FIGURE 3
EXISTING SITE CONDITIONS

EXISTING TRAFFIC DATA

Existing traffic data was gathered for this study. The Tennessee Department of Transportation (TDOT) collects average daily traffic data (ADT) annually on roadways in the study area. Two count stations were found near the project site that were felt to have particular relevance for this study. The most currently available data from these count stations are contained in TABLE 1.

In addition to the available ADT data, an intersection turning movement traffic count from a recent traffic impact study was utilized to determine the current AM and PM peak hour operating volumes for the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road. This intersection was counted in December 2014 as a part of a traffic impact study prepared by CDM Smith for a proposed Kroger development located east of the study location on the former Powell Airport site. The existing traffic count is summarized on FIGURE 4, and the raw data traffic count summary sheets are contained in the APPENDIX.

TABLE 1
ANNUAL AVERAGE DAILY TRAFFIC COUNT SUMMARY

COUNT YEAR	TDOT COUNT STATION 046 EMORY ROAD WEST OF CENTRAL AVE PIKE	TDOT COUNT STATION 043 CENTRAL AVE PIKE SOUTH OF EMORY RD
2013	14,581	7,786
2012	15,042	8,199
2011	13,821	7,870
2010	13,914	7,619
2009	14,139	7,323
2008	14,366	6,682
2007	14,185	6,487
2006	13,679	6,437
2005	12,893	6,096
2004	14,041	7,105

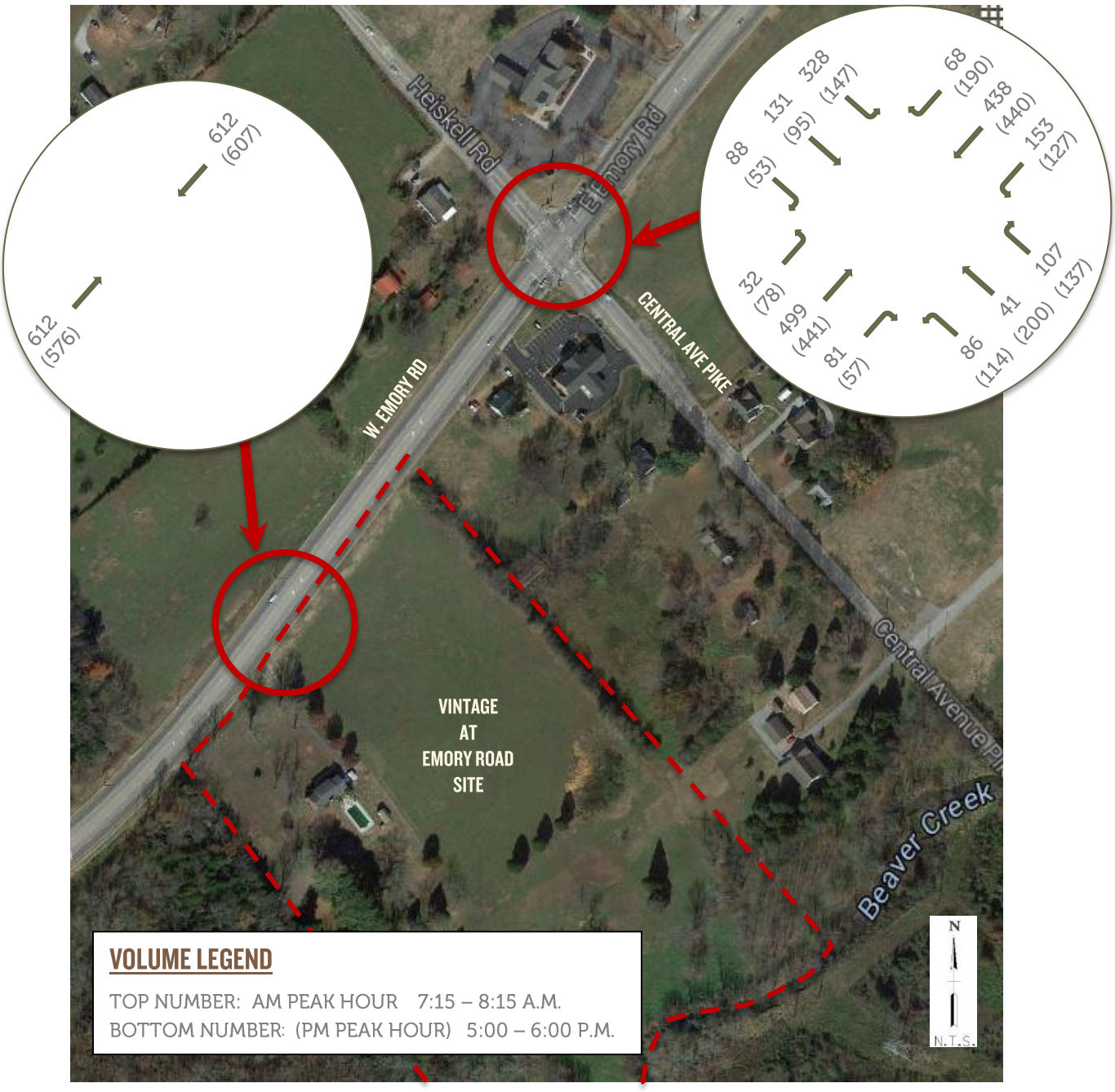


FIGURE 4
2014 EXISTING TRAFFIC VOLUMES

EXISTING CAPACITY ANALYSES / LEVELS-OF-SERVICE

Capacity analyses employing the methods of the Highway Capacity Manual (HCM2010) were conducted for the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road. The analyses were performed with the 2014 existing traffic volumes and existing intersection traffic control, lane configurations and signal timing. Existing analyses indicate that the intersection is operating at an acceptable level-of-service (LOS) "C" during both the A.M. and P.M. peak traffic periods. The analyses did indicate that the northbound shared through / right lane is currently experiencing long queues during the P.M. peak hour. The EVALUATIONS section of this report may be referenced for tabular summaries of these analyses, while more detailed summaries are presented on the computer printouts contained in the APPENDIX. Also contained in the APPENDIX 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

In addition to the proposed multi-family residential development that is the subject of this study, a commercial development is being proposed for the former Powell Airport site located to the east of the study site. The proposed commercial development will include a Kroger grocery store with fuel center, as well as retail shops and outparcels. The Kroger development is anticipated to develop within the same time period as the proposed multi-family residential development and will contribute trips to the study intersections. For the purpose of this study, analyses will be conducted for two traffic scenarios, one without the addition of Kroger related traffic and one including anticipated trips associated with the Kroger development.

In keeping with the design year selected for the Kroger Development traffic impact study, Year 2020 was also selected as the analysis year for this study. The proposed multi-family residential development is anticipated to be constructed in one general phase with anticipated completion and full occupancy expected to be in place within this time frame. In order to determine traffic volumes resulting solely from background traffic growth to year 2020, it was necessary to establish an annual growth rate for existing traffic. The TDOT 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 two percent was assumed. FIGURE 5 contains the background traffic volumes that would result from a two percent annual growth rate from year 2014, when the count was conducted, to year 2020. The background traffic volumes shown on FIGURE 5 represent Year 2020 background growth conditions without traffic related to either the proposed multi-family residential development associated with this study or the Kroger development proposed for the former Powell Airport site.

Since the two developments, the multi-family apartments and the Kroger development, are occurring during the same time period, a second set of background traffic volumes were developed utilizing the trips anticipated to be generated from the Kroger development. Kroger project related trips were obtained from Figure 10C of the traffic impact study prepared by CDM Smith entitled Kroger Store – GA 670 and Retail Development Traffic Impact Study (December 2014, Revised January 2015). A copy of Figure 10C is located in the APPENDIX. The Kroger project trips for the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road were added to the Year 2020 background volumes shown in FIGURE 5 to obtain the Year 2020 background traffic volumes with Kroger development. FIGURE 6 contains Year 2020 background traffic volumes that include anticipated trips associated with the proposed Kroger development. The volumes shown in FIGURES 5 and 6 will be used for analysis of background traffic conditions.

BACKGROUND CAPACITY ANALYSES / LEVELS-OF-SERVICE

Capacity analyses as described in the Existing Conditions section of this report were conducted utilizing the Year 2020 background volumes shown in FIGURES 5 and 6, without and with Kroger development related trips, and existing intersection traffic control and lane configurations. Background capacity analyses indicate that the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road is anticipated to continue to operate at an acceptable LOS "C" under Year 2020 background conditions without the addition of generated trips from the proposed Kroger development (FIGURE 5). However, under 2020 background conditions with the addition of Kroger related trips the analysis indicated the intersection will operate at LOS

"D" during the A.M. peak hour and LOS "E" during the P.M. peak period. While still acceptable under urban conditions, the addition of the Kroger development trips will impact operations at this intersection resulting in an increase in delay and queue lengths for the side street approaches. This analysis supports recommendations presented within the traffic impact study conducted for the proposed Kroger development which include the addition of an exclusive northbound right-turn lane on Central Avenue Pike at W. Emory Road. The addition of this turn lane would provide relief for existing and anticipated background northbound P.M. peak hour queues.

The EVALUATIONS section of this report may be referenced for tabular summaries of these analyses, while more detailed summaries are presented on the computer printouts contained in the APPENDIX.

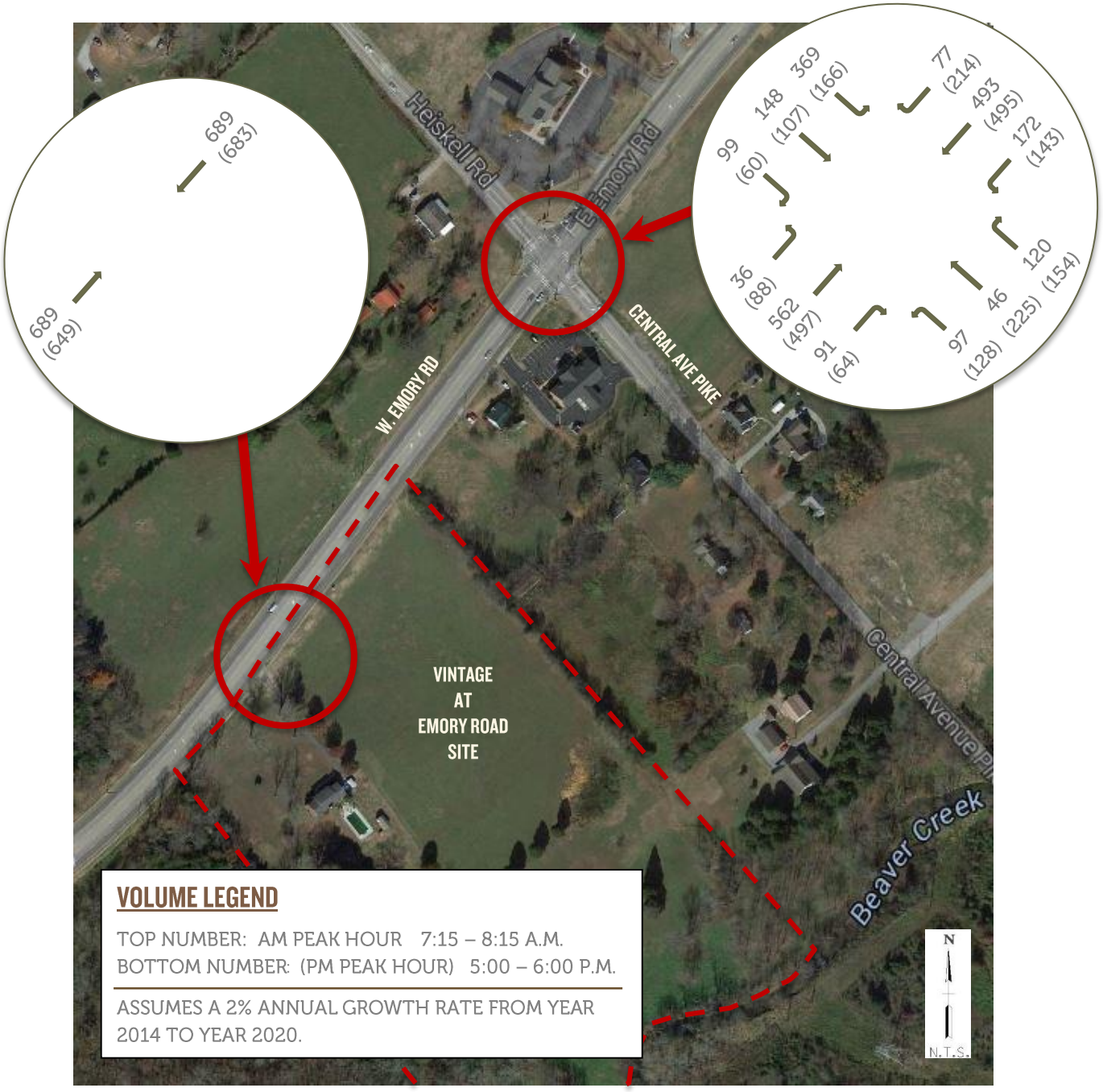


FIGURE 5
2020 BACKGROUND TRAFFIC VOLUMES

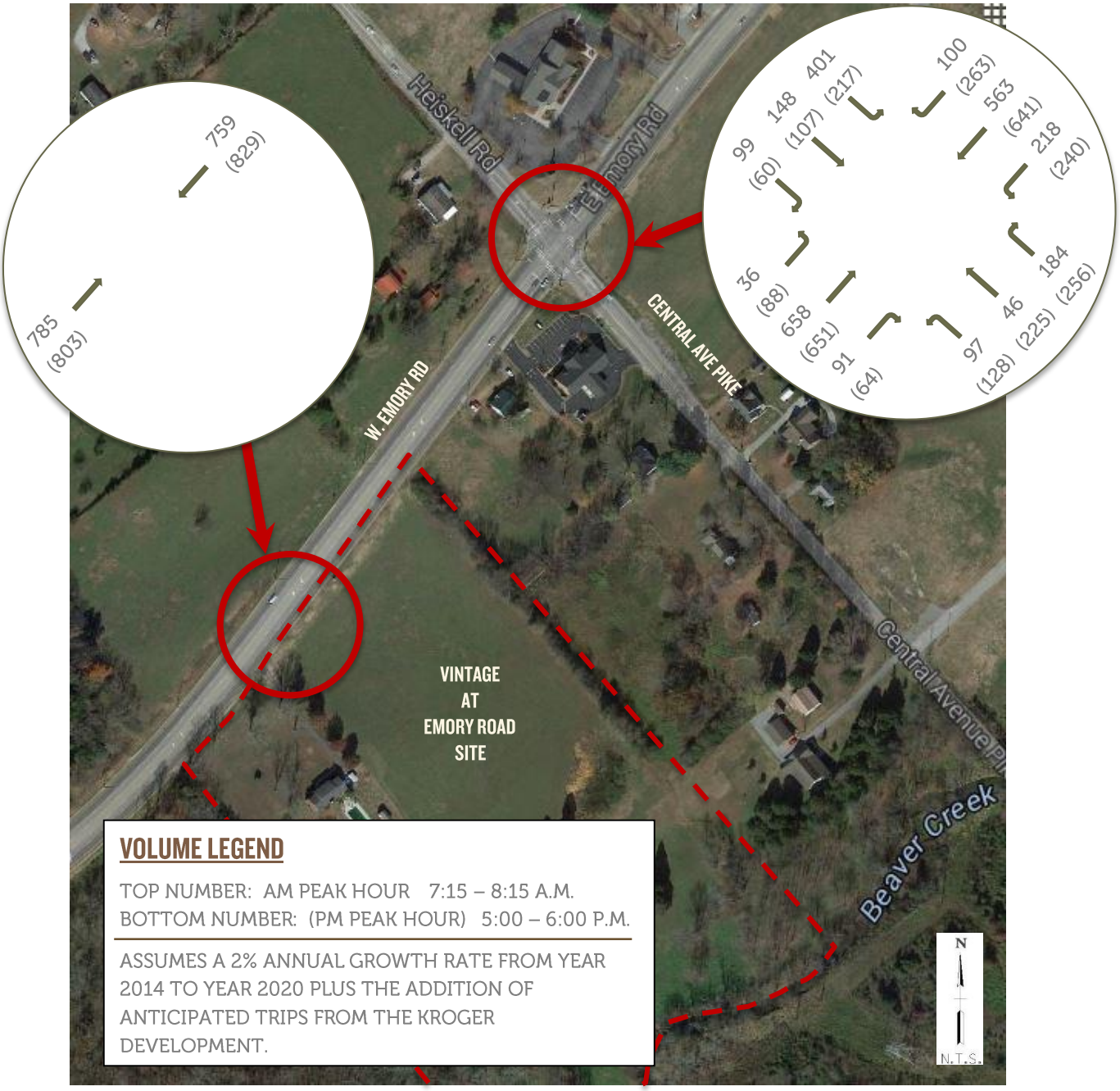


FIGURE 6
2020 BACKGROUND TRAFFIC VOLUMES
WITH KROGER DEVELOPMENT

5.0 FUTURE CONDITIONS

TRIP GENERATION

In order to estimate the expected traffic volumes to be generated by the proposed development, the procedures recommended by the Institute of Transportation Engineers and Knox County were utilized. Local trip generation rates developed by the Knoxville-Knox County Metropolitan Planning Commission for multi-family apartment type developments in Knox County were utilized to generate the estimated trips for the proposed apartments. The generated traffic volumes were determined based on the data for the peak hours of adjacent street traffic. See TABLE 2 for a summary of the traffic generated for this project. More detailed information is contained in the APPENDIX.

TABLE 2
TRIP GENERATION SUMMARY

LAND USE	ITE CODE	SIZE	WEEKDAY (TRIPS/DAY)	AM PEAK HOUR (TRIPS/HR)	PM PEAK HOUR (TRIPS/HR)
Apartments	*	250 Units	2,175	125	177
Entering Trips			1,087	28	97
Exiting Trips			1,087	97	80

* Trip Generation using Knox County Local Apartment Trip Generation Study (7/17/2000).

TRIP DISTRIBUTION AND ASSIGNMENT

FIGURE 7 provides a summary of the trip distribution patterns assumed for this study. These patterns were based on the existing traffic patterns derived from the traffic counts, as well as knowledge of the area. FIGURE 8 provides a summary of the anticipated trips as assigned to the study intersections utilizing the trip generation data from TABLE 2 and the distribution patterns shown on FIGURE 7.

Future projected traffic volumes were developed by adding the generated trips shown in FIGURE 8 to the 2020 background traffic volumes developed in the previous section. These combined year 2020 volumes reflect the existing traffic, the background traffic growth, and the newly generated traffic from the proposed multi-family residential development. FIGURE 9 represents the 2020 combined traffic data with trips generated from the proposed multi-family residential development only, while FIGURE 10 represents the 2020 combined traffic data with anticipated trips from the proposed multi-family residential development and the nearby Kroger development. The volumes shown in FIGURES 9 and 10 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 2020 full build-out conditions utilizing the Year 2020 combined volumes shown in FIGURES 9 and 10, without and with Kroger related trips, and existing intersection traffic control.

Including only trips anticipated to be generated from the multi-family residential development (FIGURE 9), the analyses indicate that under existing intersection traffic control, the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road will continue to operate at an acceptable LOS "C" during both the A.M. and P.M. peak traffic periods. However, as with the background analysis, under 2020 combined conditions including the addition of Kroger related trips the analyses indicate the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road will operate at a LOS "D" during the A.M. peak hour and LOS "E" during the P.M. peak hour.

Capacity analyses were also conducted for the proposed site driveway location on W. Emory Road. The unsignalized capacity analyses included two northbound approach lanes (one left lane and one right lane) for the site driveway with STOP control on the site driveway approach to the intersection. The unsignalized capacity analyses indicate a side street LOS "B" for the site driveway approach for both peak traffic periods under both combined volume scenarios (with and without the inclusion of Kroger development traffic). The EVALUATIONS section of this report may be referenced for tabular summaries of these analyses, while more detailed summaries are presented on the computer printouts contained in the APPENDIX.

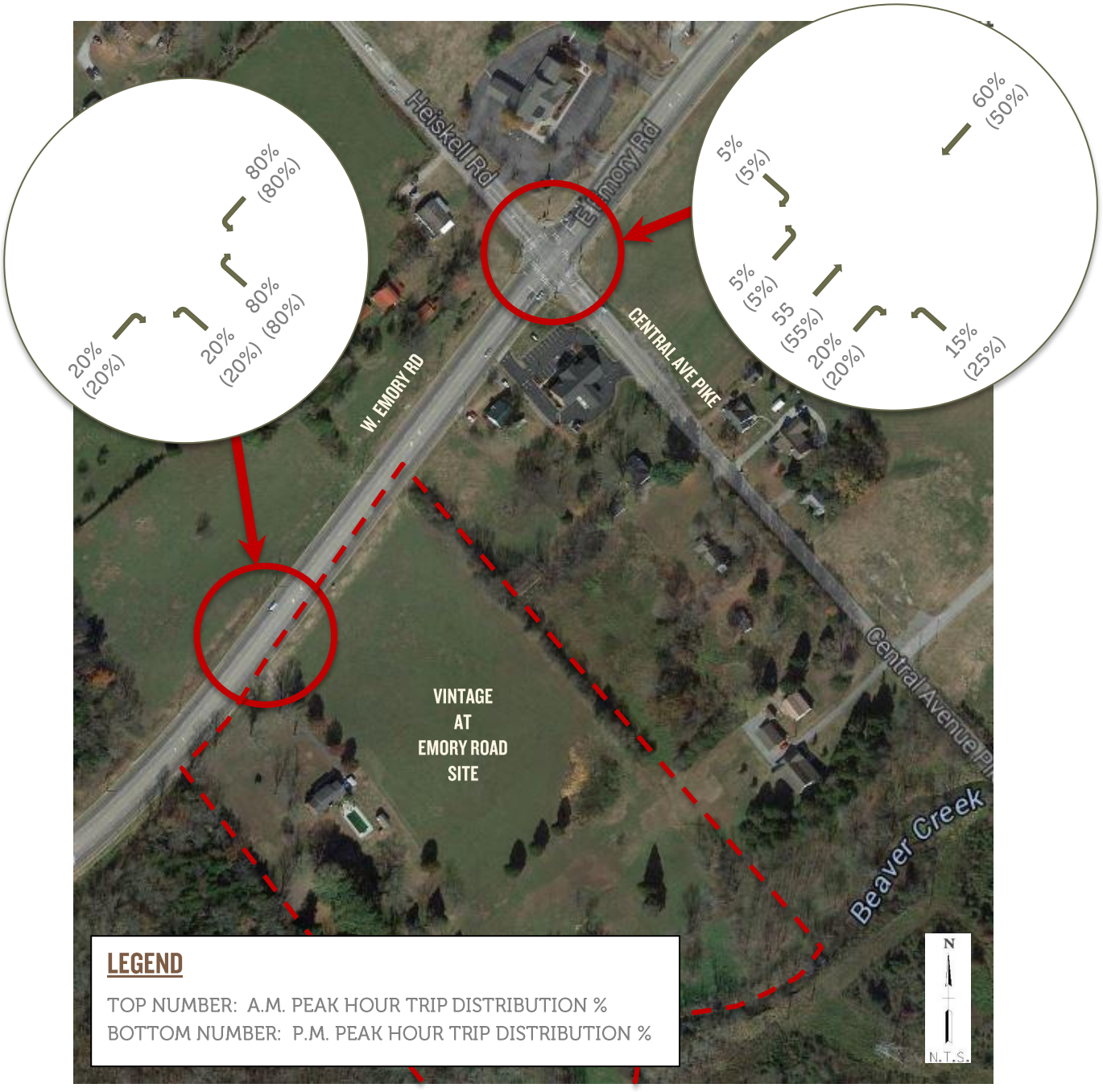


FIGURE 7
TRIP DISTRIBUTION PATTERNS

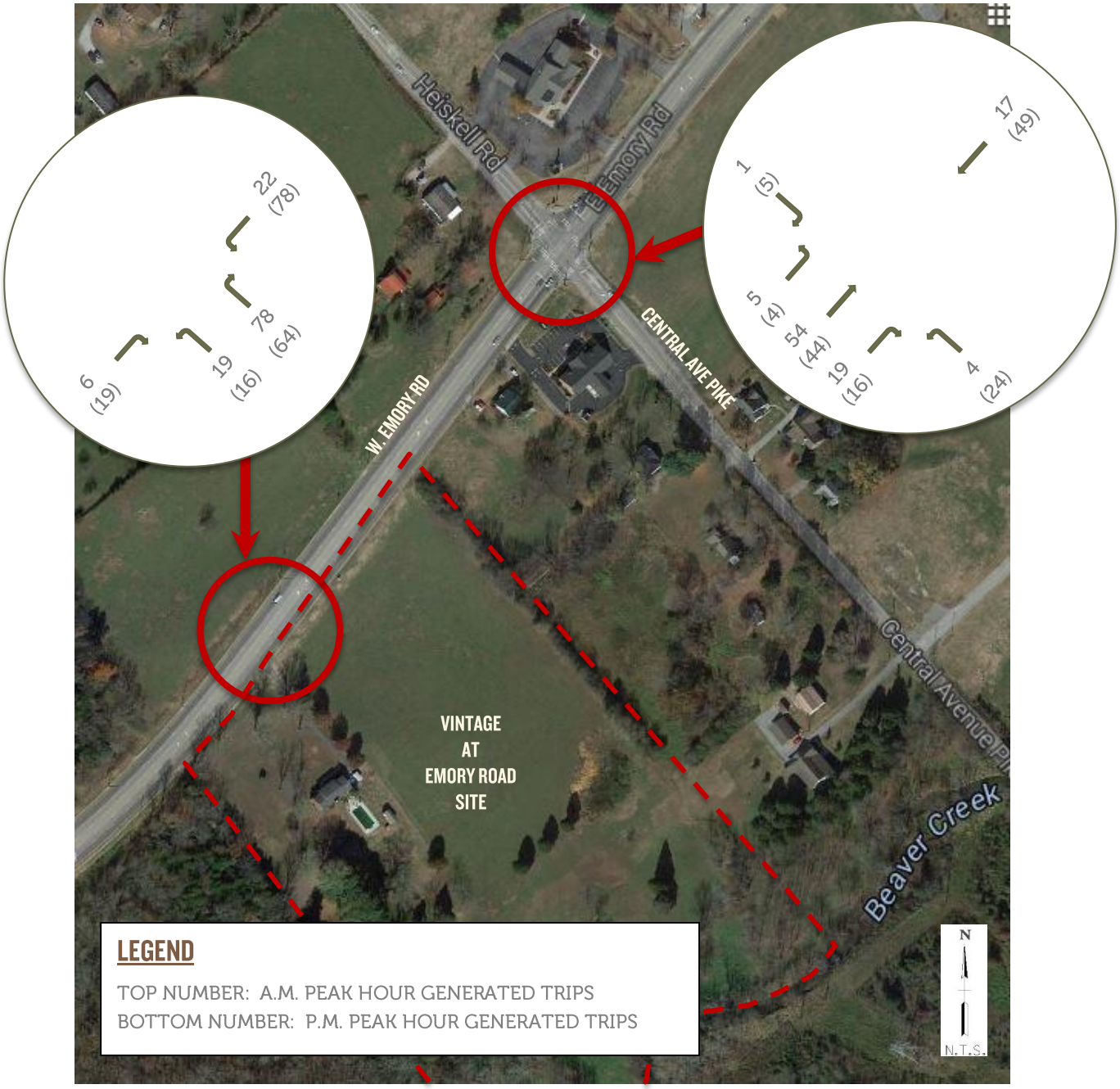


FIGURE 8
GENERATED TRIPS

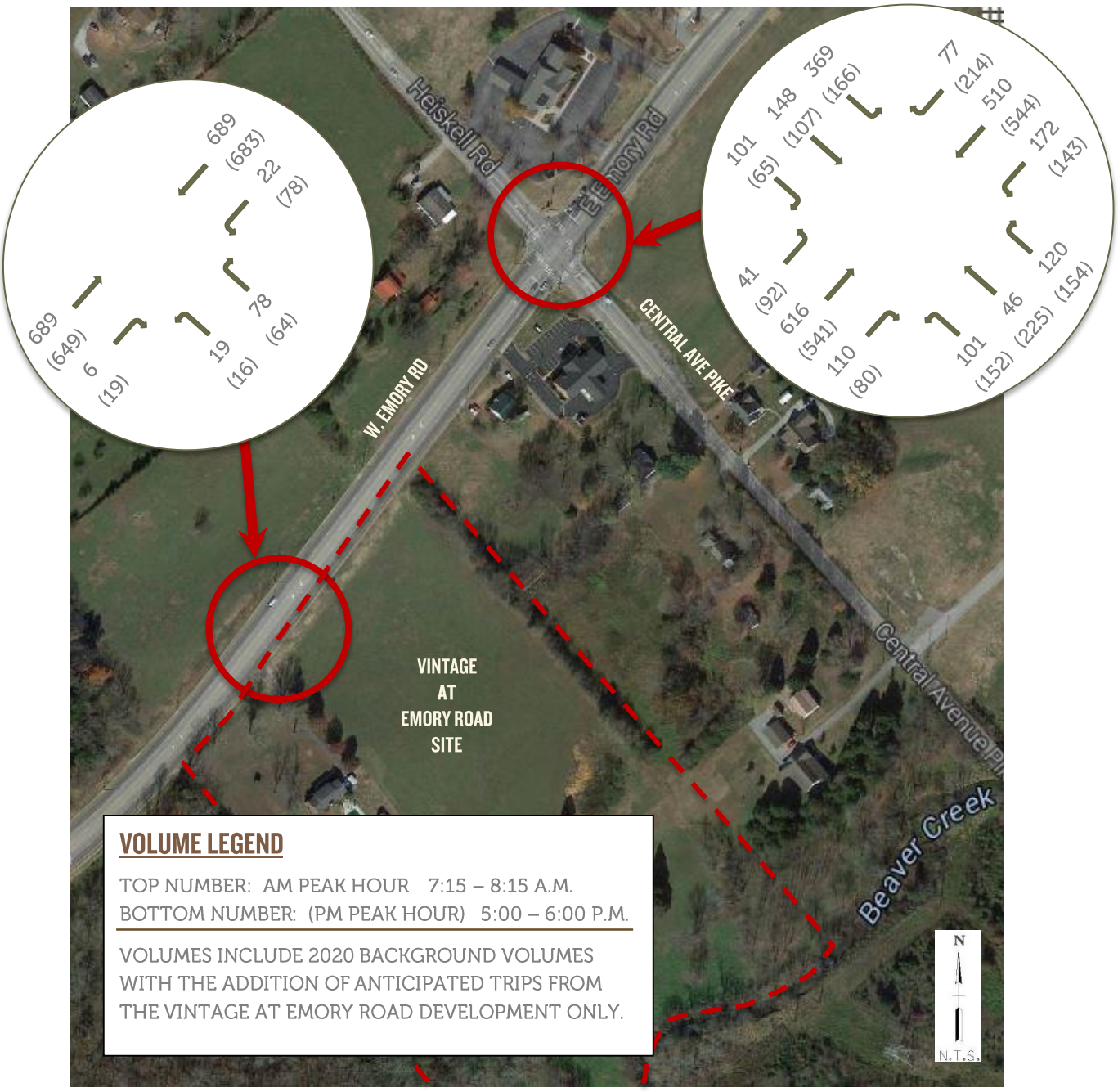


FIGURE 9
2020 COMBINED TRAFFIC DATA

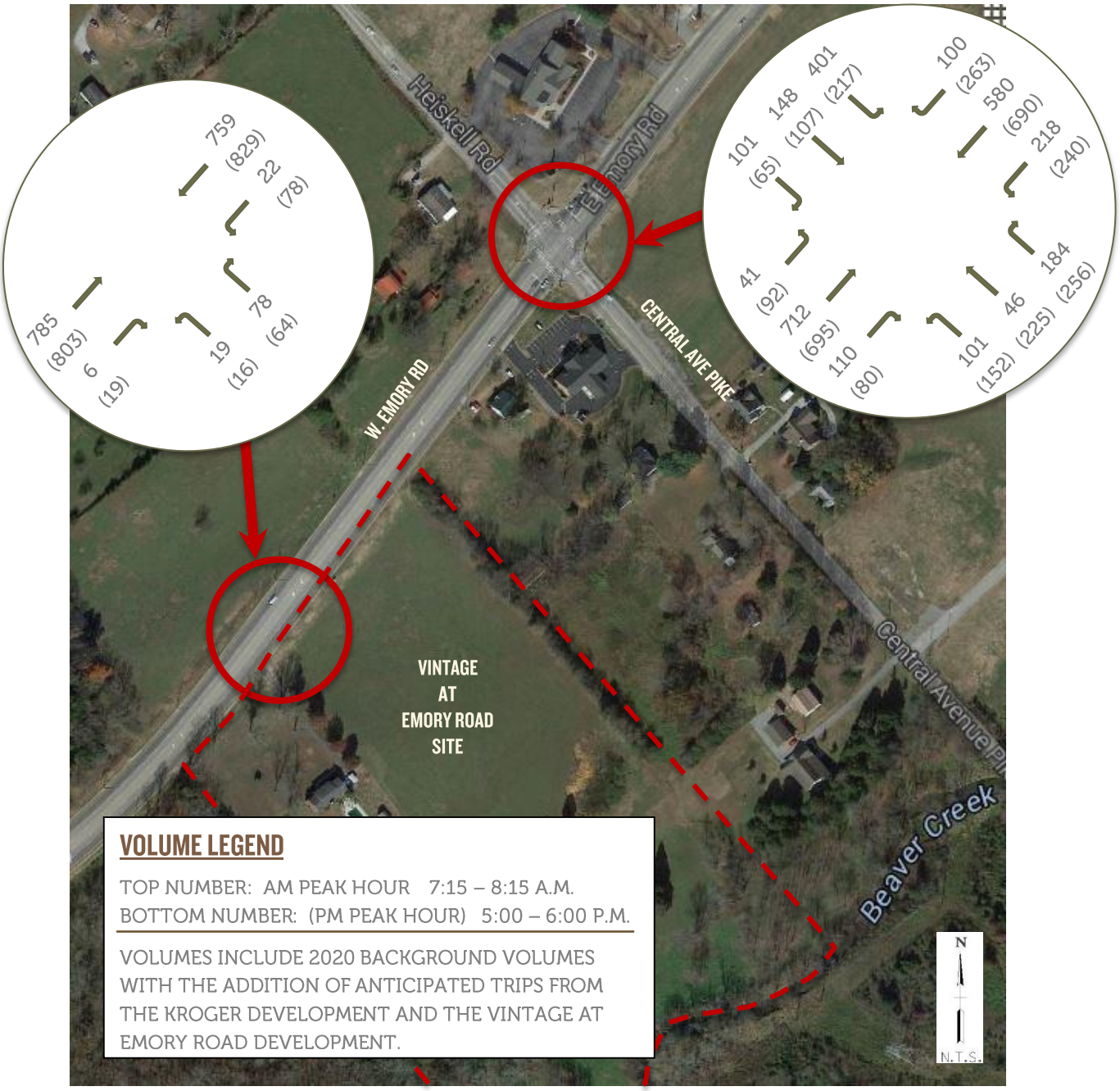


FIGURE 10
2020 COMBINED TRAFFIC DATA
WITH KROGER DEVELOPMENT

6.0 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 2020 combined traffic conditions. Existing geometry and traffic control were used in the analyses of the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road for existing, background, and combined conditions. Additionally, the intersection was analyzed with the inclusion of anticipated trips related to a nearby proposed Kroger development to be located on the former Powell Airport site. A summary of the capacity analysis results for the Year 2014 Existing Conditions, Year 2020 Background Conditions (with and without the Kroger development) and Year 2020 Combined Conditions (with and without the Kroger development) is shown in TABLE 2.

TABLE 3
CAPACITY ANALYSIS SUMMARY

			W/OUT KROGER		*WITH KROGER*	
INTERSECTION	TIME PERIOD	YEAR 2014 EXISTING (LOS/DELAY)	YEAR 2020 BACKGROUND[3] (LOS/DELAY)	YEAR 2020 PROJECTED[3] (LOS/DELAY)	YEAR 2020 BACKGROUND[4] (LOS/DELAY)	YEAR 2020 PROJECTED[4] (LOS/DELAY)
W. Emory Road at Central Ave Pike / Heiskell Road. (SIGNALIZED)[1,]	A.M. P.M.	C 25.3 C 27.2	C 28.9 C 31.8	C 30.1 C 33.3	D 36.6 E 66.8	D 39.4 E 77.0
W. Emory Road at Site Access (SIDE-STREET STOP)[2]	A.M. P.M.	- -	- -	B 12.4 B 13.2	- -	B 13.2 B 14.9

[1]SIGNALIZED CONTROL – Level-of-Service and Average Vehicular Delay (seconds) for full intersection utilizing HCM methodology. Timing Optimized.
[2]SIDE STREET STOP CONTROL – Level-of-Service and Average Vehicular Delay (seconds) for side street approach utilizing HCM methodology.
[3]Includes 2020 background volumes without Kroger development trips and with existing roadway geometry.
[4]Includes 2020 background volumes, proposed Kroger development trips, and existing roadway geometry.
See APPENDIX for detailed computer print-out summaries and discussion of Capacity and Level-of-Service concepts.

As shown in TABLE 3, the proposed site driveway onto W. Emory Road is anticipated to operate at a good LOS of "B". This intersection is assumed to have one entering and two exiting travel lanes.

The intersection of W. Emory Road and Central Avenue Pike / Heiskell Road was found to operate at acceptable levels-of-service under existing, background, and combined conditions (without Kroger traffic) with existing traffic control and geometry. The only exception would be the northbound Central Avenue Pike approach during the P.M. peak hour when the northbound shared through / right lane is anticipated to experience long queues with 2020 background volumes, especially with the Kroger development. Estimates of 95% queue lengths are provided in TABLE 4 for all analysis periods.

TABLE 4
VEHICLE QUEUE EVALUATION

INTERSECTION APPROACH	YEAR 2014 EXISTING		W/OUT KROGER YEAR 2020 BACKGROUND		W/OUT KROGER YEAR 2020 PROJECTED		WITH KROGER YEAR 2020 BACKGROUND		WITH KROGER YEAR 2020 PROJECTED	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
W. Emory Road										
EB Left	20'	41'	26'	48'	29'	52'	27'	89'	28'	97'
EB Thru/Right	164'	134'	240'	164'	282'	189'	302'	345'	342'	381'
WB Left	76'	65'	126'	87'	140'	104'	201'	332'	200'	332'
WB Thru Right	137'	161'	181'	196'	192'	224'	223'	406'	225'	439'
Central Avenue Pike										
NB Left	41'	61'	48'	78'	53'	97'	56'	105'	60'	122'
NB Thru / Right	53'	268'	63'	353'	73'	363'	116'	667'	117'	667'
Heiskell Road										
SB Left	161'	78'	189'	123'	202'	138'	275'	278'	288'	278'
SB Thru / Right	128'	80'	160'	103'	167'	117'	181'	133'	183'	142'

Note: Values represent 95% queue length estimate from capacity analysis with existing traffic control and existing geometry.

The addition of the Kroger development related trips to the above analysis results in reduced levels-of-service and increased delays and queue lengths under background and combined conditions. The evaluation assumed existing traffic control and geometry and optimized signal timing for the background and combined analyses.

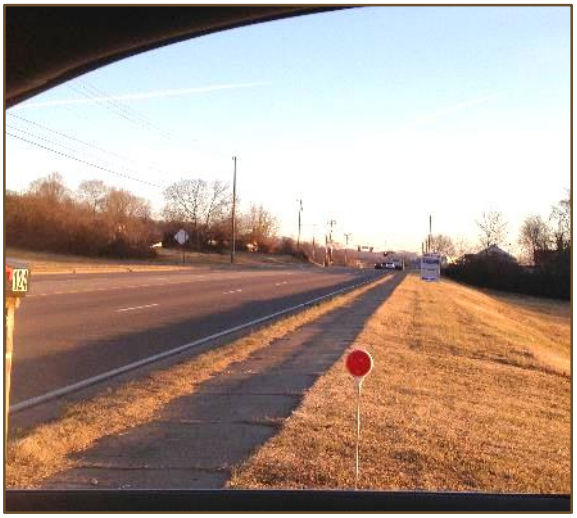
TURN LANE ASSESSMENT

A center two-way left-turn lane currently exists on W. Emory Road at the proposed site driveway location. Therefore, only right-turn lane warrants were conducted for the proposed site driveway under proposed development conditions (with and without the Kroger development). These analyses employed Table 5B from the Knox County Access Control and Driveway Design Policy, which is based on turn lane warrants developed by Harmelink. The results were that an eastbound right-turn lane is not warranted at the proposed site driveway locations under either analysis scenario (with and without the Kroger development). Copies of the turn lane warrant worksheets are located in the APPENDIX.

SIGHT DISTANCE ASSESSMENT

Intersection sight distance was assessed looking both directions along W. Emory Road from the proposed site driveway intersection. The speed limit along W. Emory Road is 40 mph, so the minimum required sight distance to oncoming traffic is 400 feet. The sight distance field assessment found a sight distance in excess of 1,500 feet looking to the west and in excess of 800 feet looking to the east. Photographs of existing sight distance are shown in FIGURE 11. Care should be taken during the site development to ensure that site landscaping and signage does not restrict intersection sight distance views.

Sight distance looking west along W. Emory Road



Sight distance looking east along W. Emory Road

FIGURE 11
SIGHT DISTANCE ASSESSMENT

7.0 CONCLUSIONS & RECOMMENDATIONS

The primary conclusion of this study is that the traffic generated from the proposed multi-family residential development will not have a significant impact on the study intersections. Intersection sight distance at the proposed site driveway location on W. Emory Road is more than adequate for the posted speed limit. Under existing and projected conditions, the intersection of W. Emory Road and Central Avenue Pike / Heiskell Road is anticipated to operate at acceptable levels-of-service, except for the northbound Central Avenue Pike approach during the P.M. peak traffic hour. Long northbound queues during the P.M. peak are anticipated to increase under background conditions and approach 350' without consideration of additional traffic from the nearby Kroger development and 660' with the inclusion of Kroger related trips. The results from the existing and background analyses support recommendations presented within the traffic impact study conducted for the proposed Kroger development which include the addition of an exclusive northbound right-turn lane on Central Avenue Pike at W. Emory Road. The addition of this turn lane would provide relief for existing and anticipated background northbound P.M. peak hour traffic.

The following listing is a summary of the improvements that are recommended in order to address the above issues and appropriately serve the traffic generated by the proposed development:

Site Related

1. Install a STOP sign on the site entrance roadway approach to W. Emory Road.
2. Maintain intersection corner sight distance at the proposed site entrance roadway by ensuring any site landscaping or site signage is properly placed such that sight distance is not restricted.

W. Emory Road at Central Avenue Pike / Heiskell Road

1. Consider installation of an exclusive northbound right-turn lane to address existing and projected northbound vehicle queueing. Design of the right-turn lane should be as recommended by the proposed Kroger development traffic impact study so that site related traffic anticipated to be generated by the development of the former Powell Airport site will be adequately accommodated.

8.0 APPENDIX

APPENDIX A | TRAFFIC DATA

APPENDIX B | TRIP GENERATION

APPENDIX C | ANALYSES

APPENDIX A | TRAFFIC DATA

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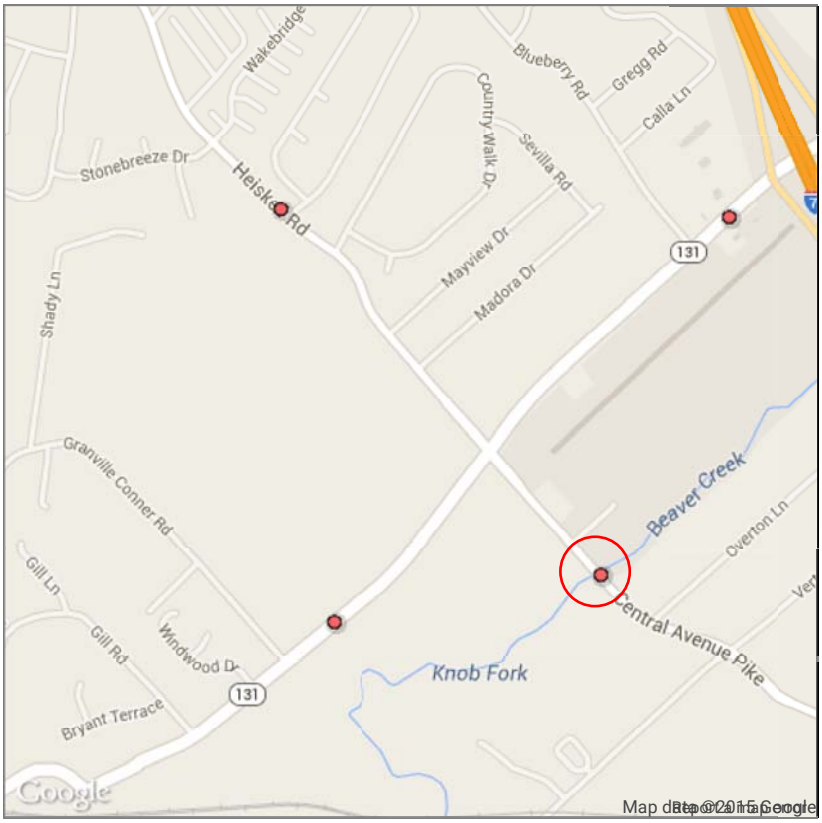

Station Information

Station	000043
Route	01256
Location	SOUTH OF EMORY RD
County	Knox
2013	7786
2012	8199
2011	7870
2010	7619
2009	7323
2008	6682
2007	6487
2006	6437
2005	6096
2004	7105
2003	6935
2002	7528
2001	6958
2000	7099
1999	5930
1998	5068
1997	5412
1996	4464
1995	5267
1994	4120
1993	3877

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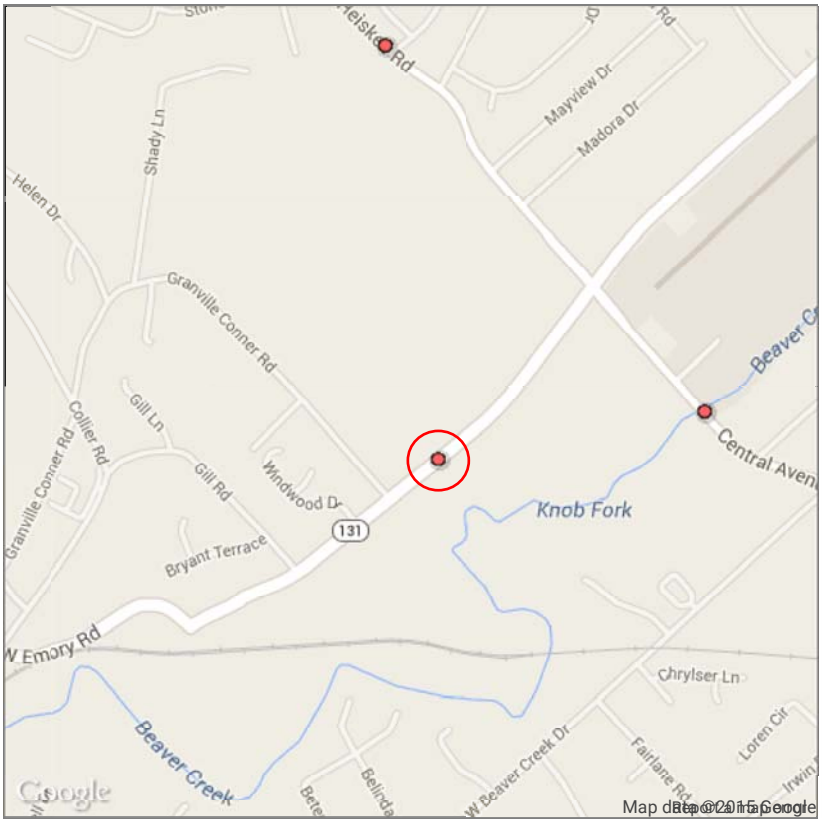

Station Information

Station	000046
Route	SR131
Location	NW KNOXVILLE
County	Knox
2013	14581
2012	15042
2011	13821
2010	13914
2009	14139
2008	14366
2007	14185
2006	13679
2005	12893
2004	14041
2003	13666
2002	13733
2001	13022
2000	12720
1999	12592
1998	11071
1997	11465
1996	10630
1995	10223
1994	11150
1993	10085

Download File:
Open With:

KML	ESRI Geodatabase | ESRI Shapefile	Database Table
Google Earth	ArcGIS Explorer	MS Access or Excel

Department of Transportation
James K. Polk Building, Suite 700
Nashville, TN 37243-0349
615.741.2848

CDM SMITH Inc.
1100 Marion Street, Suite 300
Knoxville, TN 37921
(865) 963-4300

Counted by: Allyson Foster

File Name : Emory at Central
Site Code : 00000000
Start Date : 12/4/2014
Page No : 1

Northbound Eastbound **Groups Printed- Unshifted** Southbound Westbound

	CENTRAL ~~Southbound~~				EMORY ~~Westbound~~				CENTRAL ~~Northbound~~				EMORY ~~Eastbound~~				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	10	9	18	37	3	102	4	109	88	26	22	136	27	89	12	128	410
07:15 AM	36	9	22	67	5	122	12	139	114	37	19	170	38	113	18	169	545
07:30 AM	21	11	25	57	7	135	16	158	81	31	21	133	41	108	21	170	518
07:45 AM	17	13	33	63	10	113	22	145	73	33	27	133	39	124	14	177	518
Total	84	42	98	224	25	472	54	551	356	127	89	572	145	434	65	644	1991
08:00 AM	12	8	27	47	10	129	31	170	60	30	21	111	35	93	15	143	471
08:15 AM	3	9	29	41	11	108	22	141	47	24	16	87	26	79	25	130	399
08:30 AM	11	8	37	56	7	140	11	158	73	37	13	123	40	101	16	157	494
08:45 AM	16	25	33	74	18	88	12	118	32	15	20	67	39	110	32	181	440
Total	42	50	126	218	46	465	76	587	212	106	70	388	140	383	88	611	1804
*** BREAK ***																	
03:00 PM	17	38	21	76	19	107	24	150	33	27	16	76	35	116	40	191	493
03:15 PM	22	52	64	138	38	139	36	213	55	17	12	84	40	84	51	175	610
03:30 PM	7	25	25	57	22	69	11	102	27	12	7	46	27	63	30	120	325
03:45 PM	13	32	48	93	21	100	12	133	43	16	5	64	26	77	46	149	439
Total	59	147	158	364	100	415	83	598	158	72	40	270	128	340	167	635	1867
04:00 PM	20	24	30	74	11	89	8	108	31	10	11	52	30	74	19	123	357
04:15 PM	26	28	34	88	20	108	19	147	32	28	8	68	40	98	43	181	484
04:30 PM	24	44	29	97	8	99	13	120	29	20	10	59	33	111	46	190	466
04:45 PM	25	48	42	115	20	143	19	182	34	17	8	59	27	108	38	173	529
Total	95	144	135	374	59	439	59	557	126	75	37	238	130	391	146	667	1836
05:00 PM	24	39	25	88	15	67	14	96	18	14	7	39	28	74	51	153	376
05:15 PM	33	48	41	122	22	107	11	140	45	23	16	84	33	93	62	188	534
05:30 PM	25	56	44	125	16	104	13	133	39	26	15	80	36	122	43	201	539
05:45 PM	32	57	27	116	25	163	19	207	45	32	15	92	30	151	34	215	630
Total	114	200	137	451	78	441	57	576	147	95	53	295	127	440	190	757	2079
Grand Total	394	583	654	1631	308	2232	329	2869	999	475	289	1763	670	1988	656	3314	9577
Apprch %	24.2	35.7	40.1		10.7	77.8	11.5		56.7	26.9	16.4		20.2	60	19.8		
Total %	4.1	6.1	6.8	17	3.2	23.3	3.4	30	10.4	5	3	18.4	7	20.8	6.8	34.6	

CDM SMITH Inc.
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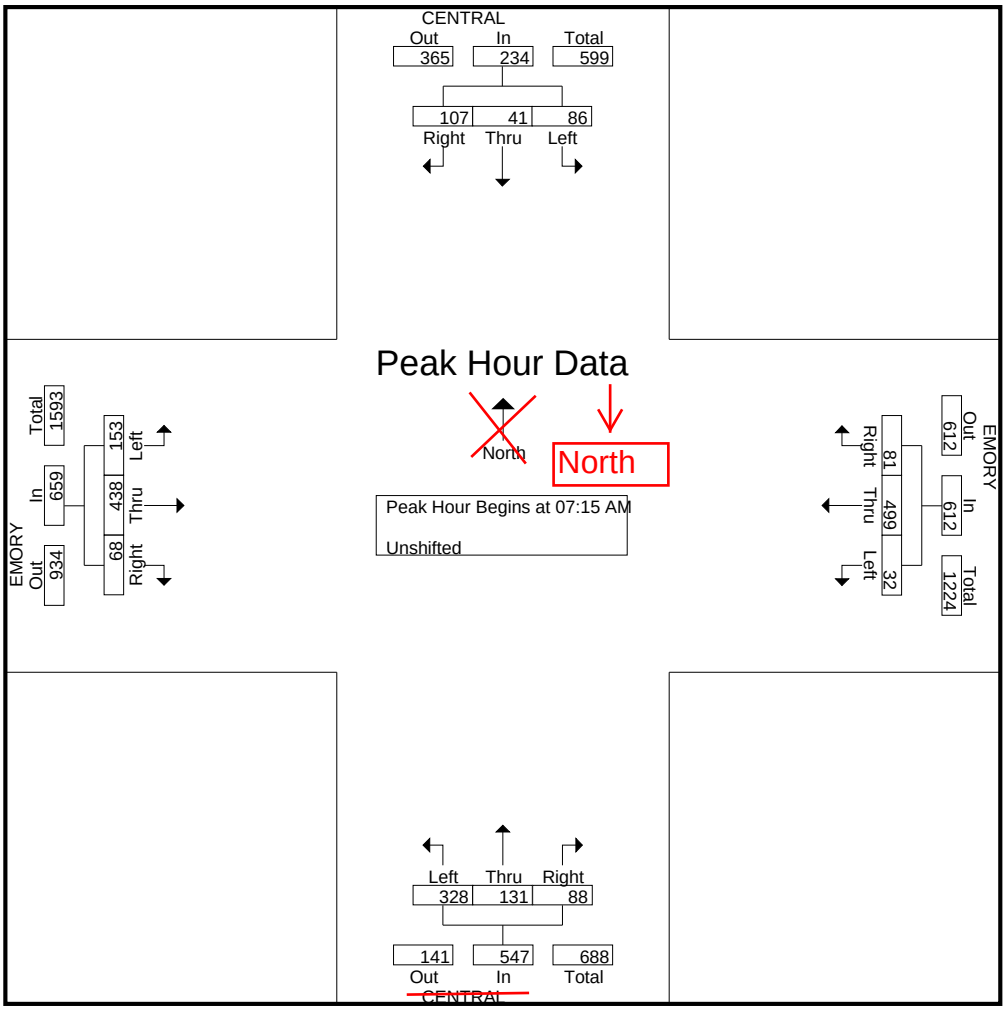
Counted by: Allyson Foster

File Name : Emory at Central
Site Code : 00000000
Start Date : 12/4/2014
Page No : 2

	Northbound				Eastbound				Southbound				Westbound				
	CENTRAL Southbound				EMORY Westbound				CENTRAL Northbound				EMORY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	**36**	9	22	**67**	5	122	12	139	**114**	**37**	19	**170**	38	113	18	169	**545**
07:30 AM	21	11	25	57	7	**135**	16	158	81	31	21	133	**41**	108	**21**	170	518
07:45 AM	17	**13**	**33**	63	**10**	113	22	145	73	33	**27**	133	39	**124**	14	**177**	518
08:00 AM	12	8	27	47	10	129	**31**	**170**	60	30	21	111	35	93	15	143	471
Total Volume	86	41	107	234	32	499	81	612	328	131	88	547	153	438	68	659	2052
% App. Total	36.8	17.5	45.7		5.2	81.5	13.2		60	23.9	16.1		23.2	66.5	10.3		
PHF	.597	.788	.811	.873	.800	.924	.653	.900	.719	.885	.815	.804	.933	.883	.810	.931	.941



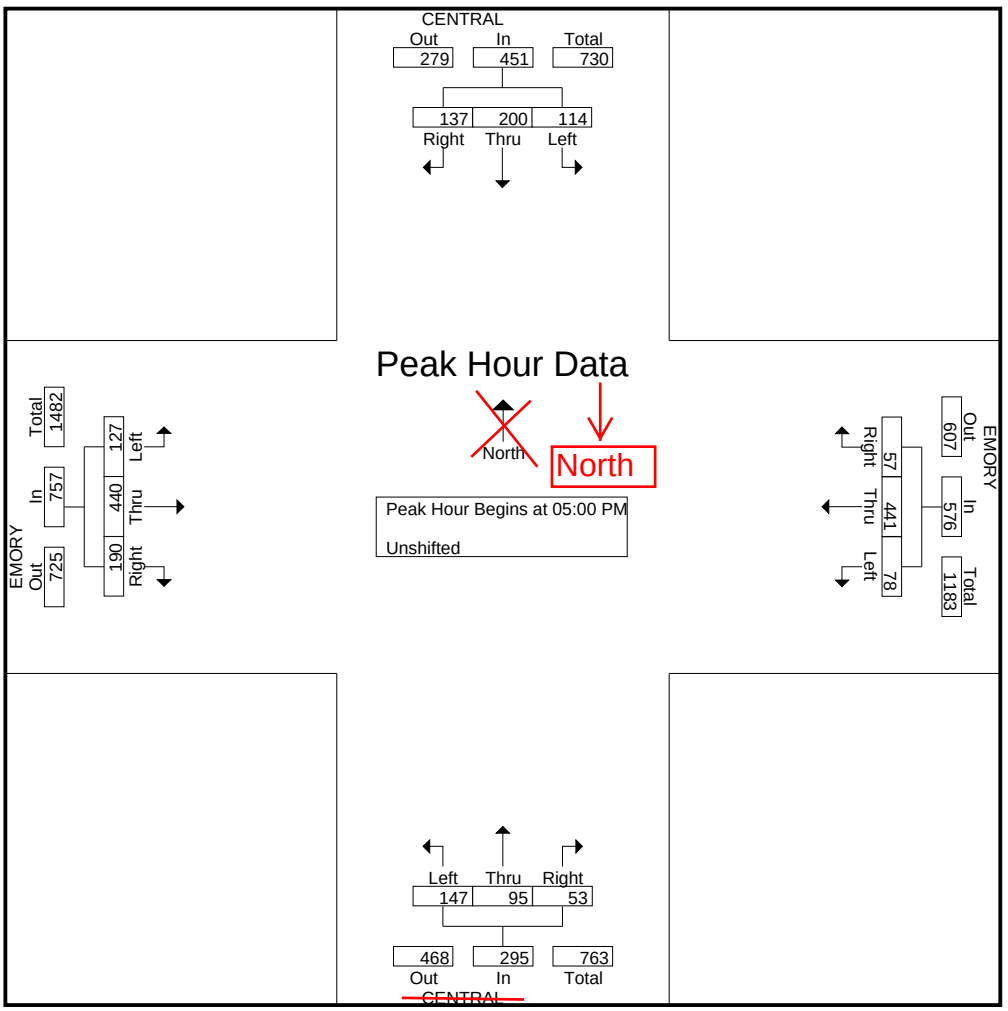
Heiskell Rd

CDM SMITH Inc.
1100 Marion Street, Suite 300
Knoxville, TN 37921
(865) 963-4300

Counted by: Allyson Foster

File Name : Emory at Central
Site Code : 00000000
Start Date : 12/4/2014
Page No : 3

	Northbound				Eastbound				Southbound				Westbound				
	CENTRAL Southbound				EMORY Westbound				CENTRAL Northbound				EMORY Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	24	39	25	88	15	67	14	96	18	14	7	39	28	74	51	153	376
05:15 PM	**33**	48	41	122	22	107	11	140	**45**	23	**16**	84	33	93	**62**	188	534
05:30 PM	25	56	**44**	**125**	16	104	13	133	39	26	15	80	**36**	122	43	201	539
05:45 PM	32	**57**	27	116	**25**	**163**	**19**	**207**	45	**32**	15	**92**	30	**151**	34	**215**	**630**
Total Volume	114	200	137	451	78	441	57	576	147	95	53	295	127	440	190	757	2079
% App. Total	25.3	44.3	30.4		13.5	76.6	9.9		49.8	32.2	18		16.8	58.1	25.1		
PHF	.864	.877	.778	.902	.780	.676	.750	.696	.817	.742	.828	.802	.882	.728	.766	.880	.825



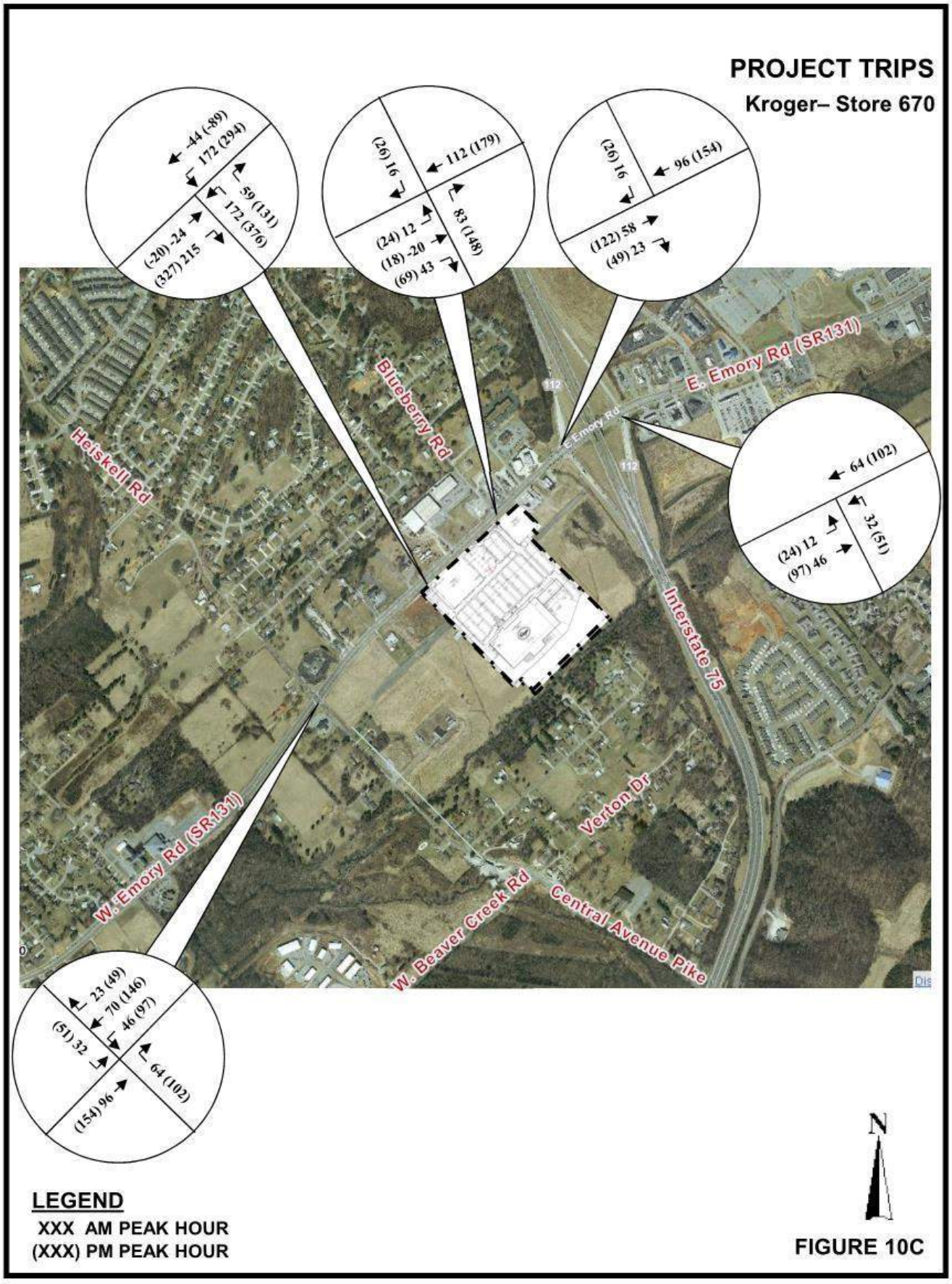

PROJECT TRIPS
Kroger– Store 670
-44 (-89)
172 (294)
59 (131)
172 (376)
(-20) -24
(327) 215
(26) 16
112 (179)
(24) 12
(18) -20
(69) 43
83 (148)
(26) 16
96 (154)
(122) 58
(49) 23
64 (102)
(24) 12
(97) 46
32 (51)
23 (49)
70 (146)
46 (97)
(51) 32
64 (102)
(154) 96
Heiskell Rd
Blueberry Rd
E. Emory Rd (SR131)
E Emory Rd
112
Interstate 75
W. Emory Rd (SR131)
Verton Dr
W. Beaver Creek Rd
Central Avenue Pike
N
LEGEND
XXX AM PEAK HOUR
(XXX) PM PEAK HOUR

FIGURE 10C

APPENDIX B | TRIP GENERATION

Local Apartment
Trip Generation Study

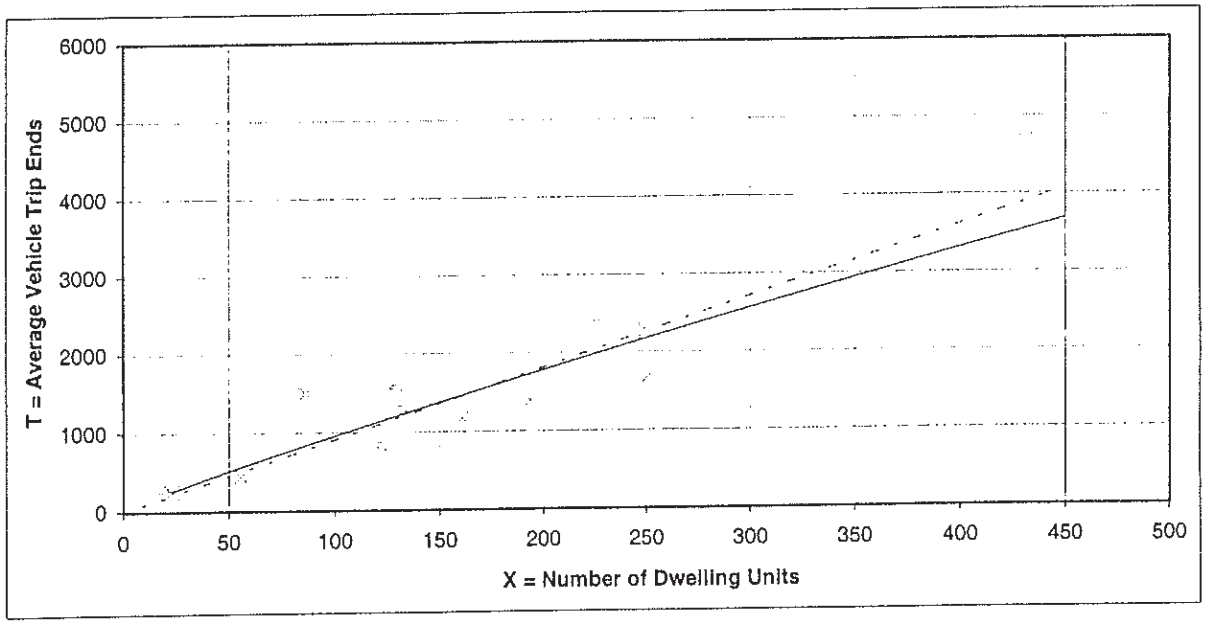
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

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



X Actual Data Points ——— Fitted Curve ····· Average Rate

Fitted Curve Equation: $T = 15.193(X)^{0.899}$ $R^2 = 0.88$

Local Apartment
Trip Generation Study

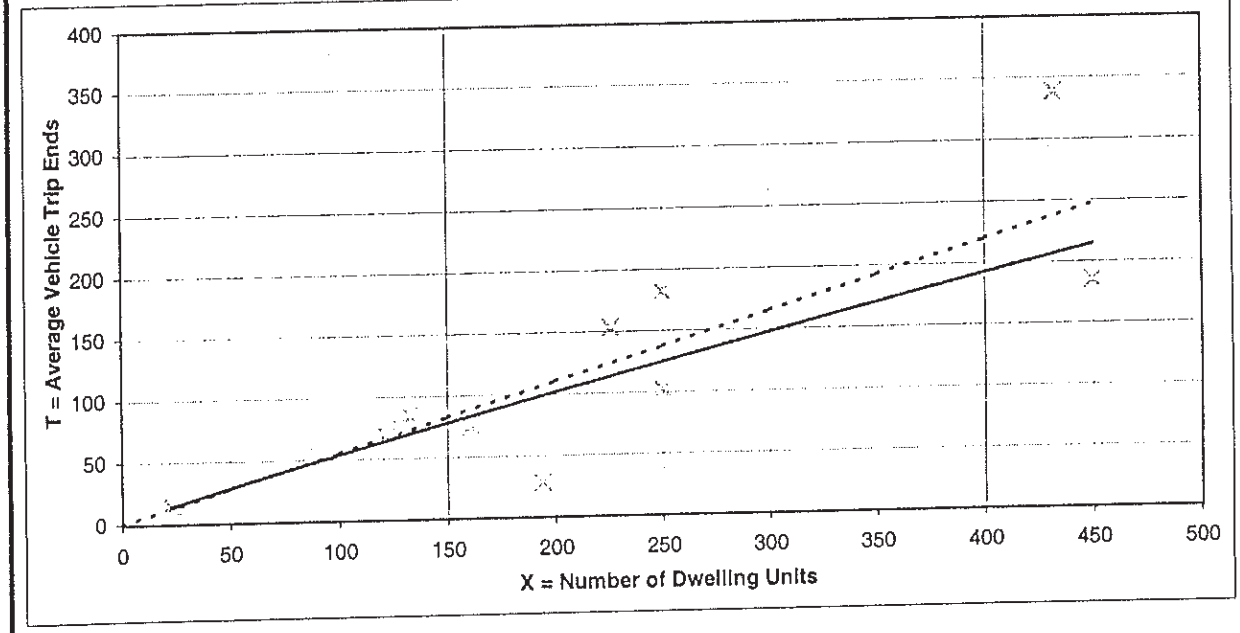
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

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



X Actual Data Points ——— Fitted Curve ····· Average Rate

Fitted Curve Equation: $T = 0.758(X)^{0.924}$ $R^2 = 0.75$

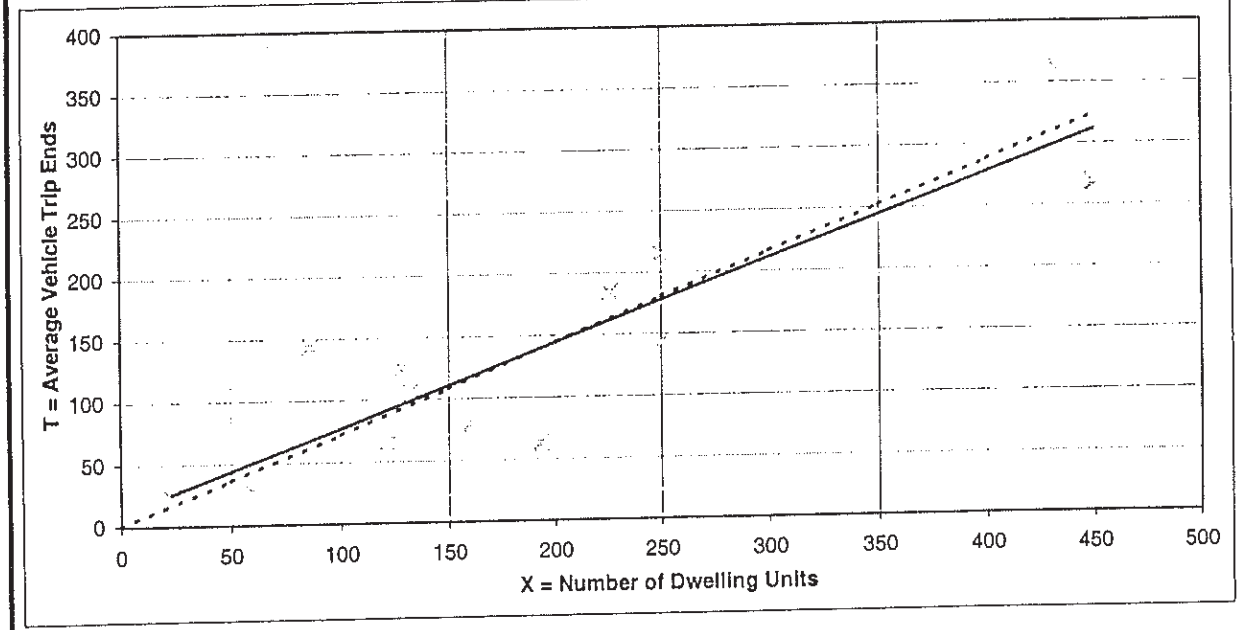
Local Apartment
Trip Generation Study

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



X Actual Data Points ——— Fitted Curve ····· Average Rate

Fitted Curve Equation: $T = 0.669(X) + 10.069$ $R^2 = 0.79$

CANNON & CANNON INC
CONSULTING ENGINEERS · FIELD SURVEYORS

TRIP GENERATION

THE VINTAGE AT EMORY ROAD
Proj. No. 01109-003

Land Use: Land Use: Multi-family Apartments
Land Use Code: Land Use Code: Knox Co. Local Apartment Trip Gen. Study

250 DWELLING UNITS

WEEKDAY

$T = 15.193(X)^{0.899}$
$T = 2174.66$

50%	ENTERING =	1087 trips
50%	EXITING =	1087 trips
	TOTAL =	2175 trips

AM PEAK HOUR

$T = 0.758(X)^{0.924}$
$T = 124.56$

22%	ENTERING =	28 trips
78%	EXITING =	97 trips
	TOTAL =	125 trips

PM PEAK HOUR

$T = 0.669(X)+10.069$
$T = 177.32$

55%	ENTERING =	97 trips
45%	EXITING =	80 trips
	TOTAL =	177 trips

APPENDIX C | ANALYSES

2020 Combined (w/out Krogers)

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					(X) PM	(X) AM
25 - 49						
50 - 99						
100 - 149						
150 - 199						
200 - 249					Yes	Yes
250 - 299						
300 - 349				Yes	Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			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

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25					Yes	Yes
25 - 49				Yes	Yes	Yes
50 - 99						
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.

689/2 = 345
649/2 = (325)

6
(19)

Right Turn Lane not warranted

2020 Combined (w/Kroger)

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						(X) AM
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

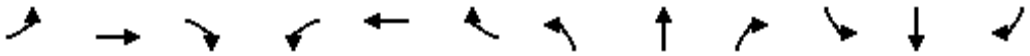
RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99		(X) PM		Yes	Yes Yes	Yes Yes
100 - 149 150 - 199		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes 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.

785/2 = 393 →
803/2 = (402)

6
(19) ↘

Right Turn Lane not warranted



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	499	81	153	438	68	86	41	107	328	131	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.89		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3440		1770	3463		1770	1662		1770	1744	
Flt Permitted	0.40	1.00		0.23	1.00		0.60	1.00		0.38	1.00	
Satd. Flow (perm)	737	3440		423	3463		1119	1662		699	1744	
Peak-hour factor, PHF	0.80	0.92	0.65	0.93	0.88	0.81	0.60	0.79	0.81	0.72	0.89	0.81
Adj. Flow (vph)	40	542	125	165	498	84	143	52	132	456	147	109
RTOR Reduction (vph)	0	33	0	0	21	0	0	112	0	0	43	0
Lane Group Flow (vph)	40	634	0	165	561	0	143	72	0	456	213	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	17.6	15.2		22.4	17.6		13.8	9.0		25.0	15.2	
Effective Green, g (s)	17.6	15.2		22.4	17.6		13.8	9.0		25.0	15.2	
Actuated g/C Ratio	0.29	0.25		0.37	0.29		0.23	0.15		0.42	0.25	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	258	871		266	1016		309	249		488	442	
v/s Ratio Prot	0.01	c0.18		c0.05	0.16		0.04	0.04		c0.17	0.12	
v/s Ratio Perm	0.04			0.18			0.07			c0.22		
v/c Ratio	0.16	0.73		0.62	0.55		0.46	0.29		0.93	0.48	
Uniform Delay, d1	15.3	20.5		13.7	17.9		19.4	22.7		14.7	19.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	5.3		4.4	2.2		1.1	0.6		25.2	0.8	
Delay (s)	15.6	25.8		18.1	20.0		20.4	23.3		39.9	19.9	
Level of Service	B	C		B	C		C	C		D	B	
Approach Delay (s)		25.2			19.6			22.1			32.7	
Approach LOS		C			B			C			C	

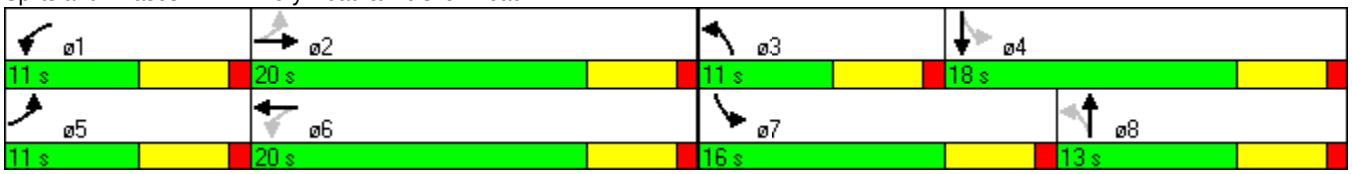
Intersection Summary			
HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

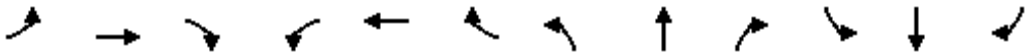
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	32	499	153	438	86	41	328	131
Lane Group Flow (vph)	40	667	165	582	143	184	456	256
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	16.0	18.0
Total Split (%)	18.3%	33.3%	18.3%	33.3%	18.3%	21.7%	26.7%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.11	0.66	0.54	0.46	0.44	0.55	0.96	0.53
Control Delay	10.9	22.4	18.9	16.9	17.5	15.6	51.7	20.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.9	22.4	18.9	16.9	17.5	15.6	51.7	20.8
Queue Length 50th (ft)	8	108	35	67	32	17	128	64
Queue Length 95th (ft)	20	#164	#76	137	41	53	#161	128
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	374	1018	304	1265	326	336	476	485
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.66	0.54	0.46	0.44	0.55	0.96	0.53

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 60
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Emory Road & Heiskell Road





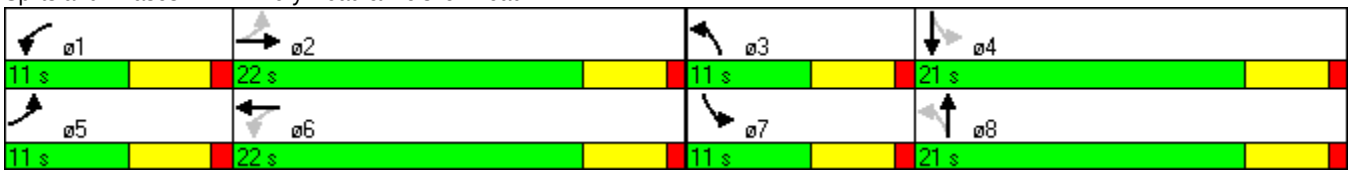
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	78	441	57	127	440	190	114	200	137	147	95	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.93		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3484		1770	3385		1770	1741		1770	1770	
Flt Permitted	0.22	1.00		0.22	1.00		0.64	1.00		0.23	1.00	
Satd. Flow (perm)	419	3484		419	3385		1186	1741		423	1770	
Peak-hour factor, PHF	0.78	0.68	0.75	0.88	0.73	0.77	0.86	0.88	0.78	0.82	0.74	0.83
Adj. Flow (vph)	100	649	76	144	603	247	133	227	176	179	128	64
RTOR Reduction (vph)	0	14	0	0	68	0	0	43	0	0	27	0
Lane Group Flow (vph)	100	711	0	144	782	0	133	360	0	179	165	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	22.6	17.8		22.6	17.8		21.2	16.4		23.6	17.6	
Effective Green, g (s)	22.6	17.8		22.6	17.8		21.2	16.4		23.6	17.6	
Actuated g/C Ratio	0.35	0.27		0.35	0.27		0.33	0.25		0.36	0.27	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	245	954		245	927		430	439		278	479	
v/s Ratio Prot	0.03	0.20		c0.04	c0.23		0.02	c0.21		c0.06	0.09	
v/s Ratio Perm	0.11			0.16			0.08			0.17		
v/c Ratio	0.41	0.75		0.59	0.84		0.31	0.82		0.64	0.34	
Uniform Delay, d1	15.6	21.5		15.6	22.3		16.0	22.9		15.6	19.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	5.3		3.6	9.3		0.4	11.7		5.0	0.4	
Delay (s)	16.7	26.8		19.2	31.6		16.4	34.6		20.7	19.5	
Level of Service	B	C		B	C		B	C		C	B	
Approach Delay (s)		25.6			29.8			30.1			20.1	
Approach LOS		C			C			C			C	

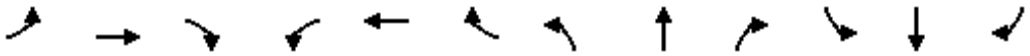
Intersection Summary			
HCM Average Control Delay	27.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	78	441	127	440	114	200	147	95
Lane Group Flow (vph)	100	725	144	850	133	403	179	192
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	22.0	11.0	22.0	11.0	21.0	11.0	21.0
Total Split (%)	16.9%	33.8%	16.9%	33.8%	16.9%	32.3%	16.9%	32.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.35	0.67	0.51	0.78	0.30	0.89	0.66	0.38
Control Delay	15.2	24.6	18.6	26.3	14.4	44.3	27.6	19.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	24.6	18.6	26.3	14.4	44.3	27.6	19.0
Queue Length 50th (ft)	23	136	34	152	32	131	44	51
Queue Length 95th (ft)	41	134	65	161	61	#268	#78	80
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	283	1075	283	1096	445	471	270	506
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.67	0.51	0.78	0.30	0.86	0.66	0.38

Intersection Summary
Cycle Length: 65
Actuated Cycle Length: 65
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 65
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Emory Road & Heiskell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	562	91	172	493	77	97	46	120	369	148	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.89		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3440		1770	3462		1770	1662		1770	1744	
Flt Permitted	0.31	1.00		0.20	1.00		0.58	1.00		0.31	1.00	
Satd. Flow (perm)	569	3440		365	3462		1087	1662		573	1744	
Peak-hour factor, PHF	0.80	0.92	0.65	0.93	0.88	0.81	0.60	0.79	0.81	0.72	0.89	0.81
Adj. Flow (vph)	45	611	140	185	560	95	162	58	148	512	166	122
RTOR Reduction (vph)	0	28	0	0	18	0	0	131	0	0	38	0
Lane Group Flow (vph)	45	723	0	185	637	0	162	75	0	512	250	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	21.6	18.0		26.4	20.4		15.7	8.0		31.0	18.3	
Effective Green, g (s)	21.6	18.0		26.4	20.4		15.7	8.0		31.0	18.3	
Actuated g/C Ratio	0.31	0.26		0.38	0.29		0.22	0.11		0.44	0.26	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	237	885		258	1009		319	190		562	456	
v/s Ratio Prot	0.01	c0.21		c0.06	0.18		0.06	0.05		c0.23	0.14	
v/s Ratio Perm	0.05			0.21			0.06			c0.17		
v/c Ratio	0.19	0.82		0.72	0.63		0.51	0.39		0.91	0.55	
Uniform Delay, d1	17.3	24.4		16.5	21.5		23.2	28.8		16.0	22.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	8.2		9.1	3.0		1.3	1.4		19.0	1.4	
Delay (s)	17.7	32.7		25.6	24.5		24.5	30.1		35.0	23.6	
Level of Service	B	C		C	C		C	C		D	C	
Approach Delay (s)		31.8			24.8			27.6			30.9	
Approach LOS		C			C			C			C	

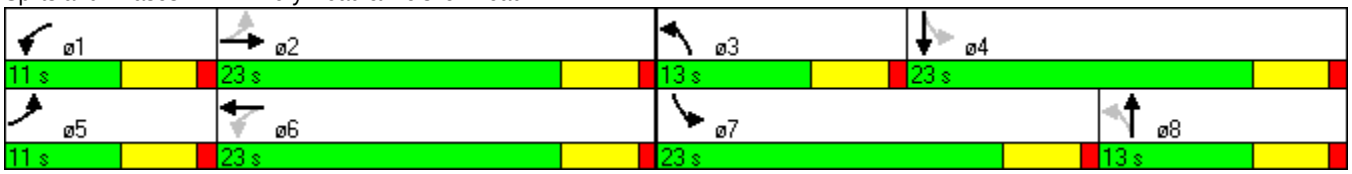
Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

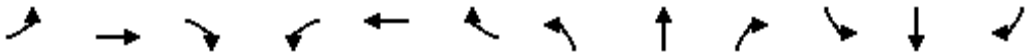
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	36	562	172	493	97	46	369	148
Lane Group Flow (vph)	45	751	185	655	162	206	512	288
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	23.0	11.0	23.0	13.0	13.0	23.0	23.0
Total Split (%)	15.7%	32.9%	15.7%	32.9%	18.6%	18.6%	32.9%	32.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.15	0.82	0.72	0.58	0.51	0.64	0.91	0.58
Control Delay	13.8	32.5	33.6	22.9	20.0	20.6	39.9	24.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.8	32.5	33.6	22.9	20.0	20.6	39.9	24.1
Queue Length 50th (ft)	11	152	50	129	41	23	165	88
Queue Length 95th (ft)	26	#240	#126	181	48	63	189	160
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	298	913	256	1125	326	321	562	493
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.82	0.72	0.58	0.50	0.64	0.91	0.58

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 70
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 70
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Emory Road & Heiskell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	497	64	143	495	214	128	225	154	166	107	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.93		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3484		1770	3385		1770	1741		1770	1770	
Flt Permitted	0.17	1.00		0.16	1.00		0.53	1.00		0.21	1.00	
Satd. Flow (perm)	323	3484		301	3385		996	1741		392	1770	
Peak-hour factor, PHF	0.78	0.68	0.75	0.88	0.73	0.77	0.86	0.88	0.78	0.82	0.74	0.83
Adj. Flow (vph)	113	731	85	162	678	278	149	256	197	202	145	72
RTOR Reduction (vph)	0	12	0	0	58	0	0	37	0	0	24	0
Lane Group Flow (vph)	113	804	0	162	898	0	149	416	0	202	193	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	27.9	23.1		32.1	25.2		25.0	19.0		25.0	19.0	
Effective Green, g (s)	27.9	23.1		32.1	25.2		25.0	19.0		25.0	19.0	
Actuated g/C Ratio	0.37	0.31		0.43	0.34		0.33	0.25		0.33	0.25	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	213	1073		264	1137		394	441		241	448	
v/s Ratio Prot	0.03	0.23		c0.06	c0.27		0.03	c0.24		c0.07	0.11	
v/s Ratio Perm	0.16			0.21			0.10			0.21		
v/c Ratio	0.53	0.75		0.61	0.79		0.38	0.94		0.84	0.43	
Uniform Delay, d1	17.0	23.3		15.1	22.5		18.3	27.5		21.0	23.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.5	4.8		4.2	5.6		0.6	29.0		21.7	0.7	
Delay (s)	19.5	28.2		19.3	28.1		18.9	56.5		42.7	24.1	
Level of Service	B	C		B	C		B	E		D	C	
Approach Delay (s)		27.1			26.8			47.2			33.1	
Approach LOS		C			C			D			C	

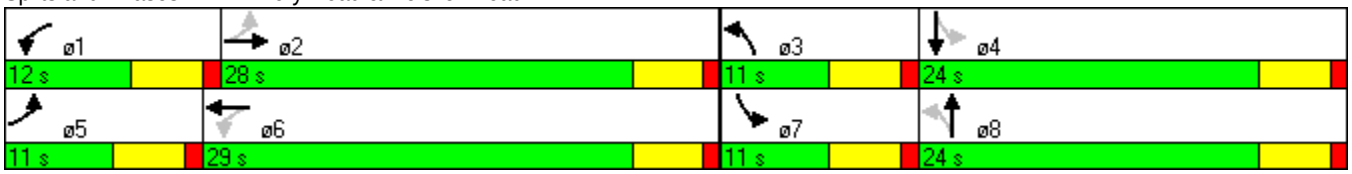
Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

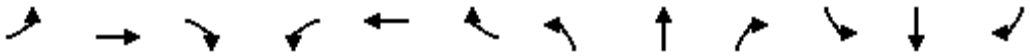
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	88	497	143	495	128	225	166	107
Lane Group Flow (vph)	113	816	162	956	149	453	202	217
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	28.0	12.0	29.0	11.0	24.0	11.0	24.0
Total Split (%)	14.7%	37.3%	16.0%	38.7%	14.7%	32.0%	14.7%	32.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.47	0.75	0.61	0.77	0.38	0.95	0.84	0.46
Control Delay	18.6	28.1	23.4	25.9	18.4	57.7	48.9	23.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.6	28.1	23.4	25.9	18.4	57.7	48.9	23.8
Queue Length 50th (ft)	29	174	42	196	44	187	62	72
Queue Length 95th (ft)	48	164	#87	196	78	#353	#123	103
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	240	1085	265	1240	394	478	241	472
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.75	0.61	0.77	0.38	0.95	0.84	0.46

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Emory Road & Heiskell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	41	616	110	172	510	77	101	46	120	369	148	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.89		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3432		1770	3464		1770	1662		1770	1743	
Flt Permitted	0.30	1.00		0.17	1.00		0.58	1.00		0.31	1.00	
Satd. Flow (perm)	551	3432		318	3464		1084	1662		573	1743	
Peak-hour factor, PHF	0.80	0.92	0.65	0.93	0.88	0.81	0.60	0.79	0.81	0.72	0.89	0.81
Adj. Flow (vph)	51	670	169	185	580	95	168	58	148	512	166	125
RTOR Reduction (vph)	0	30	0	0	17	0	0	122	0	0	36	0
Lane Group Flow (vph)	51	809	0	185	658	0	168	84	0	512	255	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	24.6	21.0		29.4	23.4		15.0	8.0		33.0	21.0	
Effective Green, g (s)	24.6	21.0		29.4	23.4		15.0	8.0		33.0	21.0	
Actuated g/C Ratio	0.33	0.28		0.39	0.31		0.20	0.11		0.44	0.28	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	239	961		241	1081		281	177		571	488	
v/s Ratio Prot	0.01	0.24		c0.06	0.19		0.06	0.05		c0.24	0.15	
v/s Ratio Perm	0.06			c0.24			0.06			c0.16		
v/c Ratio	0.21	0.84		0.77	0.61		0.60	0.47		0.90	0.52	
Uniform Delay, d1	17.6	25.4		17.4	21.9		26.5	31.5		17.3	22.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	8.9		13.6	2.6		3.4	2.0		16.6	1.0	
Delay (s)	18.1	34.3		31.0	24.5		29.9	33.5		33.9	23.8	
Level of Service	B	C		C	C		C	C		C	C	
Approach Delay (s)		33.4			25.9			31.9			30.2	
Approach LOS		C			C			C			C	

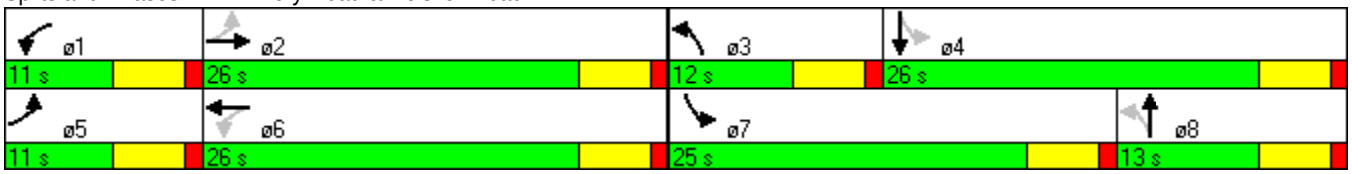
Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

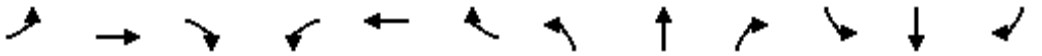
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	41	616	172	510	101	46	369	148
Lane Group Flow (vph)	51	839	185	675	168	206	512	291
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	26.0	11.0	26.0	12.0	13.0	25.0	26.0
Total Split (%)	14.7%	34.7%	14.7%	34.7%	16.0%	17.3%	33.3%	34.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.17	0.85	0.77	0.57	0.60	0.69	0.90	0.56
Control Delay	14.4	34.0	39.5	23.1	25.8	25.7	38.7	23.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	34.0	39.5	23.1	25.8	25.7	38.7	23.6
Queue Length 50th (ft)	14	184	53	141	46	31	180	94
Queue Length 95th (ft)	29	#282	#140	192	53	73	202	167
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	296	991	240	1190	281	300	571	524
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.85	0.77	0.57	0.60	0.69	0.90	0.56

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Emory Road & Heiskell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	92	541	80	143	544	214	152	225	154	166	107	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.93		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3476		1770	3395		1770	1741		1770	1765	
Flt Permitted	0.15	1.00		0.14	1.00		0.42	1.00		0.22	1.00	
Satd. Flow (perm)	282	3476		261	3395		790	1741		416	1765	
Peak-hour factor, PHF	0.78	0.68	0.75	0.88	0.73	0.77	0.86	0.88	0.78	0.82	0.74	0.83
Adj. Flow (vph)	118	796	107	162	745	278	177	256	197	202	145	78
RTOR Reduction (vph)	0	13	0	0	47	0	0	35	0	0	24	0
Lane Group Flow (vph)	118	890	0	162	976	0	177	418	0	202	199	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	31.2	26.4		35.6	28.6		29.3	20.6		23.9	17.9	
Effective Green, g (s)	31.2	26.4		35.6	28.6		29.3	20.6		23.9	17.9	
Actuated g/C Ratio	0.39	0.33		0.45	0.36		0.37	0.26		0.30	0.22	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	199	1147		248	1214		396	448		226	395	
v/s Ratio Prot	0.04	0.26		c0.06	c0.29		0.05	c0.24		c0.07	0.11	
v/s Ratio Perm	0.20			0.23			0.12			0.20		
v/c Ratio	0.59	0.78		0.65	0.80		0.45	0.93		0.89	0.50	
Uniform Delay, d1	17.6	24.1		15.9	23.2		18.2	29.0		25.1	27.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.7	5.2		6.1	5.7		0.8	26.5		32.8	1.0	
Delay (s)	22.3	29.3		21.9	28.9		19.0	55.5		57.8	28.2	
Level of Service	C	C		C	C		B	E		E	C	
Approach Delay (s)		28.5			27.9			45.3			42.3	
Approach LOS		C			C			D			D	

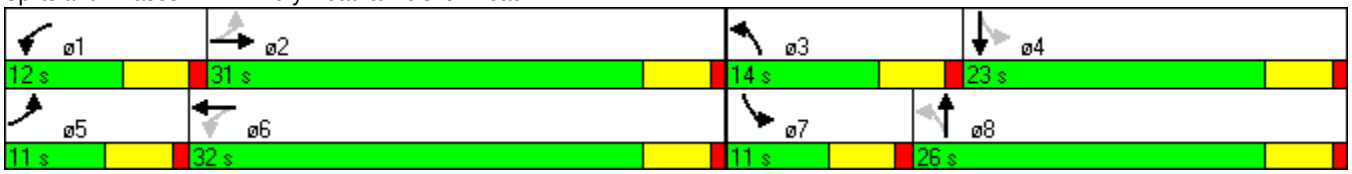
Intersection Summary			
HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	92	541	143	544	152	225	166	107
Lane Group Flow (vph)	118	903	162	1023	177	453	202	223
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	31.0	12.0	32.0	14.0	26.0	11.0	23.0
Total Split (%)	13.8%	38.8%	15.0%	40.0%	17.5%	32.5%	13.8%	28.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.52	0.78	0.66	0.79	0.45	0.94	0.89	0.53
Control Delay	20.9	29.4	27.6	27.3	20.2	55.9	60.9	28.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.9	29.4	27.6	27.3	20.2	55.9	60.9	28.7
Queue Length 50th (ft)	32	208	45	231	57	199	67	84
Queue Length 95th (ft)	52	189	#104	224	97	#363	#138	117
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	226	1160	247	1302	403	492	226	421
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.78	0.66	0.79	0.44	0.92	0.89	0.53

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Emory Road & Heiskell Road



TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*BJH*	Intersection	*Emory at Site Entrance*
Agency/Co.	*Cannon & Cannon, Inc.*	Jurisdiction	*Knox County*
Date Performed	*1/28/2015*	Analysis Year	*Combined 2020*
Analysis Time Period	*AM Peak*		

Project Description

East/West Street: *Emory Road*	North/South Street: *Site Entrance*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*689*	*6*	*22*	*689*	
Peak-Hour Factor, PHF	*1.00*	*0.94*	*0.94*	*0.94*	*0.94*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*732*	*6*	*23*	*732*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*1*	*2*	*0*
Configuration		*T*	*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*19*		*78*			
Peak-Hour Factor, PHF	*0.94*	*1.00*	*0.94*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*20*	*0*	*82*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*23*		*102*				
C (m) (veh/h)		*877*		*588*				
v/c		*0.03*		*0.17*				
95% queue length		*0.08*		*0.62*				
Control Delay (s/veh)		*9.2*		*12.4*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*12.4*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*BJH*	Intersection	*Emory at Site Entrance*
Agency/Co.	*Cannon & Cannon, Inc.*	Jurisdiction	*Knox County*
Date Performed	*1/28/2015*	Analysis Year	*Combined 2020*
Analysis Time Period	*PM Peak*		

Project Description

East/West Street: *Emory Road*	North/South Street: *Site Entrance*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*649*	*19*	*78*	*683*	
Peak-Hour Factor, PHF	*1.00*	*0.83*	*0.83*	*0.83*	*0.83*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*781*	*22*	*93*	*822*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*1*	*2*	*0*
Configuration		*T*	*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*16*		*64*			
Peak-Hour Factor, PHF	*0.83*	*1.00*	*0.83*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*19*	*0*	*77*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*93*		*96*				
C (m) (veh/h)		*830*		*537*				
v/c		*0.11*		*0.18*				
95% queue length		*0.38*		*0.65*				
Control Delay (s/veh)		*9.9*		*13.2*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*13.2*					
Approach LOS	--	--	*B*					

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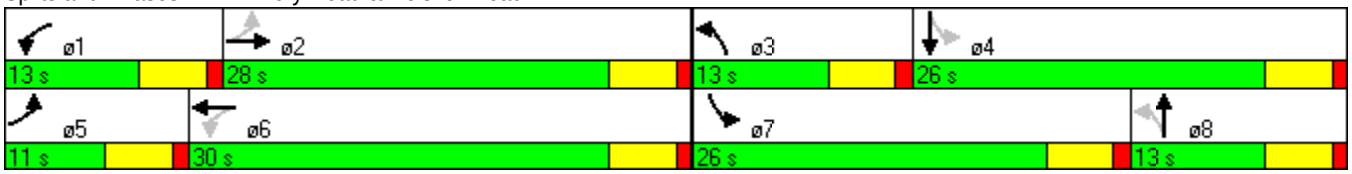
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	658	91	218	563	100	97	46	184	401	148	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	0.88		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3452		1770	3454		1770	1640		1770	1744	
Flt Permitted	0.27	1.00		0.15	1.00		0.58	1.00		0.31	1.00	
Satd. Flow (perm)	508	3452		272	3454		1087	1640		573	1744	
Peak-hour factor, PHF	0.80	0.92	0.65	0.93	0.88	0.81	0.60	0.79	0.81	0.72	0.89	0.81
Adj. Flow (vph)	45	715	140	234	640	123	162	58	227	557	166	122
RTOR Reduction (vph)	0	21	0	0	19	0	0	176	0	0	33	0
Lane Group Flow (vph)	45	834	0	234	744	0	162	109	0	557	255	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	26.6	23.0		35.4	27.4		15.8	8.0		34.0	21.2	
Effective Green, g (s)	26.6	23.0		35.4	27.4		15.8	8.0		34.0	21.2	
Actuated g/C Ratio	0.33	0.29		0.44	0.34		0.20	0.10		0.42	0.26	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	226	992		270	1183		281	164		558	462	
v/s Ratio Prot	0.01	0.24		c0.09	0.22		0.06	0.07		c0.26	0.15	
v/s Ratio Perm	0.06			c0.30			0.06			c0.16		
v/c Ratio	0.20	0.84		0.87	0.63		0.58	0.66		1.00	0.55	
Uniform Delay, d1	18.5	26.8		17.3	22.0		28.4	34.7		20.1	25.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	8.6		24.0	2.5		2.9	9.6		37.4	1.4	
Delay (s)	18.9	35.4		41.3	24.6		31.2	44.3		57.4	26.7	
Level of Service	B	D		D	C		C	D		E	C	
Approach Delay (s)		34.5			28.5			39.6			47.0	
Approach LOS		C			C			D			D	

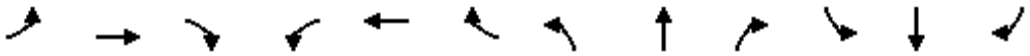
Intersection Summary			
HCM Average Control Delay	36.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	36	658	218	563	97	46	401	148
Lane Group Flow (vph)	45	855	234	763	162	285	557	288
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	28.0	13.0	30.0	13.0	13.0	26.0	26.0
Total Split (%)	13.8%	35.0%	16.3%	37.5%	16.3%	16.3%	32.5%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.16	0.84	0.88	0.59	0.58	0.84	1.00	0.58
Control Delay	14.2	35.3	51.4	23.1	25.9	35.0	60.6	27.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.2	35.3	51.4	23.1	25.9	35.0	60.6	27.0
Queue Length 50th (ft)	12	203	71	167	50	43	226	105
Queue Length 95th (ft)	27	#302	#201	223	56	#116	#275	181
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	279	1013	266	1287	286	341	558	496
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.84	0.88	0.59	0.57	0.84	1.00	0.58

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

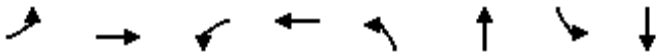
Splits and Phases: 1: Emory Road & Heiskell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	651	64	240	641	263	128	225	256	217	107	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.96		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3496		1770	3390		1770	1706		1770	1770	
Flt Permitted	0.11	1.00		0.10	1.00		0.62	1.00		0.10	1.00	
Satd. Flow (perm)	207	3496		182	3390		1160	1706		182	1770	
Peak-hour factor, PHF	0.78	0.68	0.75	0.88	0.73	0.77	0.86	0.88	0.78	0.82	0.74	0.83
Adj. Flow (vph)	113	957	85	273	878	342	149	256	328	265	145	72
RTOR Reduction (vph)	0	6	0	0	34	0	0	39	0	0	15	0
Lane Group Flow (vph)	113	1036	0	273	1186	0	149	546	0	265	202	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	42.0	36.0		55.0	44.0		42.0	36.0		55.0	44.0	
Effective Green, g (s)	42.0	36.0		55.0	44.0		42.0	36.0		55.0	44.0	
Actuated g/C Ratio	0.35	0.30		0.46	0.37		0.35	0.30		0.46	0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	151	1049		269	1243		437	512		269	649	
v/s Ratio Prot	0.04	0.30		c0.12	0.35		0.02	c0.32		c0.12	0.11	
v/s Ratio Perm	0.23			c0.35			0.10			0.34		
v/c Ratio	0.75	0.99		1.01	0.95		0.34	1.07		0.99	0.31	
Uniform Delay, d1	31.0	41.8		35.9	37.0		27.7	42.0		35.6	27.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.2	25.0		58.7	16.6		0.5	58.3		50.3	0.3	
Delay (s)	49.2	66.8		94.6	53.7		28.2	100.3		85.9	27.4	
Level of Service	D	E		F	D		C	F		F	C	
Approach Delay (s)		65.1			61.2			85.7			59.6	
Approach LOS		E			E			F			E	

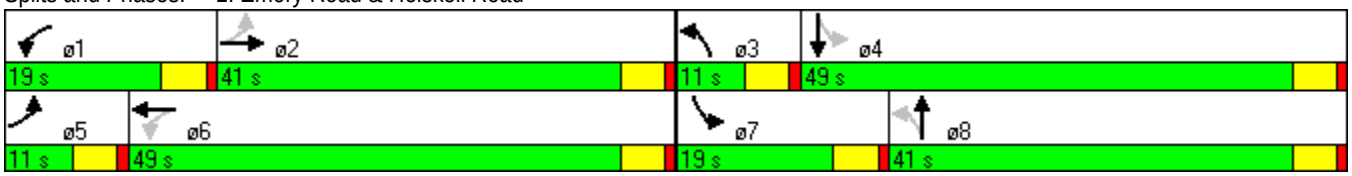
Intersection Summary			
HCM Average Control Delay	66.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

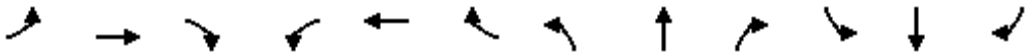


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	88	651	240	641	128	225	217	107
Lane Group Flow (vph)	113	1042	273	1220	149	584	265	217
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	41.0	19.0	49.0	11.0	41.0	19.0	49.0
Total Split (%)	9.2%	34.2%	15.8%	40.8%	9.2%	34.2%	15.8%	40.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.75	0.99	1.01	0.95	0.34	1.06	0.99	0.33
Control Delay	51.8	66.6	91.1	52.2	24.1	92.9	83.5	25.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.8	66.6	91.1	52.2	24.1	92.9	83.5	25.8
Queue Length 50th (ft)	50	419	~167	464	67	~467	155	106
Queue Length 95th (ft)	#89	345	#332	406	105	#667	#278	133
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	151	1055	269	1278	436	550	269	664
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.99	1.01	0.95	0.34	1.06	0.99	0.33

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 120
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

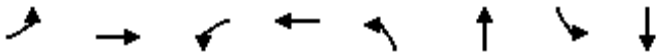
Splits and Phases: 1: Emory Road & Heiskell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	41	712	110	218	580	100	101	46	184	401	148	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.98		1.00	0.88		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3444		1770	3456		1770	1640		1770	1743	
Flt Permitted	0.27	1.00		0.14	1.00		0.58	1.00		0.31	1.00	
Satd. Flow (perm)	500	3444		262	3456		1084	1640		573	1743	
Peak-hour factor, PHF	0.80	0.92	0.65	0.93	0.88	0.81	0.60	0.79	0.81	0.72	0.89	0.81
Adj. Flow (vph)	51	774	169	234	659	123	168	58	227	557	166	125
RTOR Reduction (vph)	0	23	0	0	18	0	0	176	0	0	34	0
Lane Group Flow (vph)	51	920	0	234	764	0	168	110	0	557	257	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	27.6	24.0		36.4	28.4		15.0	8.0		33.0	21.0	
Effective Green, g (s)	27.6	24.0		36.4	28.4		15.0	8.0		33.0	21.0	
Actuated g/C Ratio	0.35	0.30		0.45	0.35		0.19	0.10		0.41	0.26	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	230	1033		270	1227		263	164		536	458	
v/s Ratio Prot	0.01	0.27		c0.09	0.22		0.06	0.07		c0.26	0.15	
v/s Ratio Perm	0.07			c0.31			0.06			c0.17		
v/c Ratio	0.22	0.89		0.87	0.62		0.64	0.67		1.04	0.56	
Uniform Delay, d1	17.9	26.7		17.2	21.4		29.2	34.7		20.7	25.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	11.5		24.0	2.4		5.0	9.8		49.4	1.6	
Delay (s)	18.4	38.2		41.2	23.7		34.2	44.6		70.1	27.1	
Level of Service	B	D		D	C		C	D		E	C	
Approach Delay (s)		37.2			27.8			40.7			55.3	
Approach LOS		D			C			D			E	

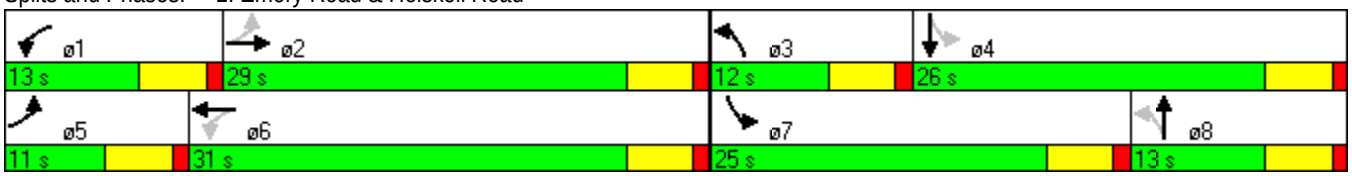
Intersection Summary			
HCM Average Control Delay	39.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

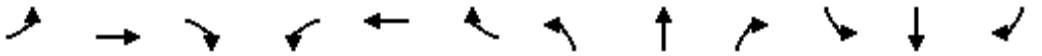


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	41	712	218	580	101	46	401	148
Lane Group Flow (vph)	51	943	234	782	168	285	557	291
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	29.0	13.0	31.0	12.0	13.0	25.0	26.0
Total Split (%)	13.8%	36.3%	16.3%	38.8%	15.0%	16.3%	31.3%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.18	0.89	0.88	0.59	0.64	0.84	1.04	0.59
Control Delay	13.9	38.3	51.2	22.4	30.8	35.4	72.9	27.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.9	38.3	51.2	22.4	30.8	35.4	72.9	27.3
Queue Length 50th (ft)	14	227	69	170	53	44	~254	106
Queue Length 95th (ft)	28	#342	#200	225	60	#117	#288	183
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	282	1056	266	1330	263	340	536	492
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.89	0.88	0.59	0.64	0.84	1.04	0.59

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

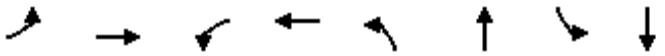
Splits and Phases: 1: Emory Road & Heiskell Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	92	695	80	240	690	263	152	225	256	217	107	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.96		1.00	0.92		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3489		1770	3398		1770	1706		1770	1765	
Flt Permitted	0.11	1.00		0.10	1.00		0.60	1.00		0.10	1.00	
Satd. Flow (perm)	207	3489		182	3398		1119	1706		182	1765	
Peak-hour factor, PHF	0.78	0.68	0.75	0.88	0.73	0.77	0.86	0.88	0.78	0.82	0.74	0.83
Adj. Flow (vph)	118	1022	107	273	945	342	177	256	328	265	145	78
RTOR Reduction (vph)	0	6	0	0	30	0	0	39	0	0	16	0
Lane Group Flow (vph)	118	1123	0	273	1257	0	177	546	0	265	207	0
Turn Type	pm+pt			pm+pt			pm+pt			pm+pt		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	42.0	36.0		55.0	44.0		44.9	36.0		55.0	41.1	
Effective Green, g (s)	42.0	36.0		55.0	44.0		44.9	36.0		55.0	41.1	
Actuated g/C Ratio	0.35	0.30		0.46	0.37		0.37	0.30		0.46	0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	151	1047		269	1246		467	512		269	605	
v/s Ratio Prot	0.04	0.32		c0.12	0.37		0.03	c0.32		c0.12	0.12	
v/s Ratio Perm	0.24			c0.35			0.11			0.34		
v/c Ratio	0.78	1.07		1.01	1.01		0.38	1.07		0.99	0.34	
Uniform Delay, d1	31.7	42.0		35.9	38.0		26.1	42.0		35.6	29.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	22.6	49.3		58.7	27.6		0.5	58.3		50.3	0.3	
Delay (s)	54.3	91.3		94.7	65.6		26.6	100.3		85.9	29.7	
Level of Service	D	F		F	E		C	F		F	C	
Approach Delay (s)		87.8			70.7			83.2			60.2	
Approach LOS		F			E			F			E	

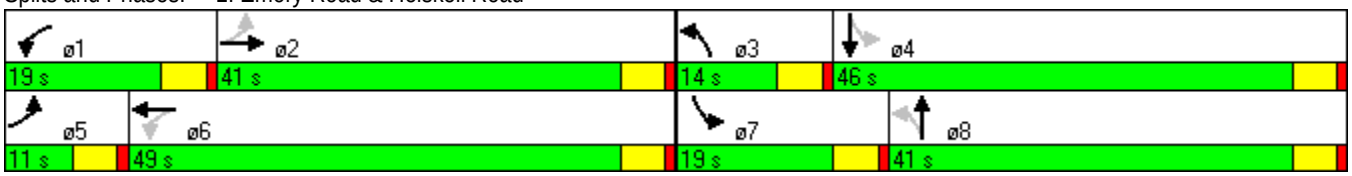
Intersection Summary			
HCM Average Control Delay	77.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	92	695	240	690	152	225	217	107
Lane Group Flow (vph)	118	1129	273	1287	177	584	265	223
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt	
Protected Phases	5	2	1	6	3	8	7	4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	7	4
Switch Phase								
Minimum Initial (s)	6.0	15.0	6.0	15.0	6.0	8.0	6.0	8.0
Minimum Split (s)	11.0	20.0	11.0	20.0	11.0	13.0	11.0	13.0
Total Split (s)	11.0	41.0	19.0	49.0	14.0	41.0	19.0	46.0
Total Split (%)	9.2%	34.2%	15.8%	40.8%	11.7%	34.2%	15.8%	38.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
v/c Ratio	0.78	1.07	1.01	1.01	0.38	1.06	0.99	0.36
Control Delay	56.0	89.3	91.1	64.0	23.2	92.9	83.5	28.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.0	89.3	91.1	64.0	23.2	92.9	83.5	28.1
Queue Length 50th (ft)	52	~509	~167	~516	81	~467	155	114
Queue Length 95th (ft)	#97	381	#332	439	122	#667	#278	142
Internal Link Dist (ft)		850		960		609		473
Turn Bay Length (ft)	100		100		75		150	
Base Capacity (vph)	151	1053	269	1276	469	550	269	621
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	1.07	1.01	1.01	0.38	1.06	0.99	0.36

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Yellow
Natural Cycle: 100
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Emory Road & Heiskell Road



TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*BJH*
Agency/Co.	*Cannon & Cannon, Inc.*
Date Performed	*1/28/2015*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*Emory at Site Entrance*
Jurisdiction	*Knox County*
Analysis Year	*Combined 2020*

Project Description *1109 Vintage TIS, Proposed Geometry*

East/West Street: *Emory Road* | North/South Street: *Site Entrance*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*785*	*6*	*22*	*759*	
Peak-Hour Factor, PHF	*1.00*	*0.94*	*0.94*	*0.94*	*0.94*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*835*	*6*	*23*	*807*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*1*	*2*	*0*
Configuration		*T*	*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*19*		*78*			
Peak-Hour Factor, PHF	*0.94*	*1.00*	*0.94*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*20*	*0*	*82*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*23*		*102*				
C (m) (veh/h)		*803*		*542*				
v/c		*0.03*		*0.19*				
95% queue length		*0.09*		*0.69*				
Control Delay (s/veh)		*9.6*		*13.2*				
LOS		*A*		*B*				
Approach Delay (s/veh)	--	--	*13.2*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*BJH*
Agency/Co.	*Cannon & Cannon, Inc.*
Date Performed	*1/28/2015*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*Emory at Site Entrance*
Jurisdiction	*Knox County*
Analysis Year	*Combined 2020*

Project Description *1109 Vintage TIS, Proposed Geometry*

East/West Street: *Emory Road* | North/South Street: *Site Entrance*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*803*	*19*	*78*	*829*	
Peak-Hour Factor, PHF	*1.00*	*0.83*	*0.83*	*0.83*	*0.83*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*967*	*22*	*93*	*998*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*1*	*2*	*0*
Configuration		*T*	*TR*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*16*		*64*			
Peak-Hour Factor, PHF	*0.83*	*1.00*	*0.83*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*19*	*0*	*77*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*		*LR*				
v (veh/h)		*93*		*96*				
C (m) (veh/h)		*707*		*461*				
v/c		*0.13*		*0.21*				
95% queue length		*0.45*		*0.78*				
Control Delay (s/veh)		*10.9*		*14.9*				
LOS		*B*		*B*				
Approach Delay (s/veh)	--	--	*14.9*					
Approach LOS	--	--	*B*					

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