STEELE LANDING SUBDIVISION

Traffic Impact Study
Hardin Valley Road
Knoxville, TN

A Traffic Impact Study for the Proposed Steele Landing Subdivision

Submitted to

Knoxville – Knox County Planning Commission

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FMA Project No. 548.001

Submitted By:

FULGHUM MACINDOE & ASSOCIATES, INC.

10330 HARDIN VALLEY ROAD SUITE 201 KNOXVILLE, TN 37932 T 865.690.6419 F 865.690.6448 www.fulghummacindoe.com

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Executive Summary

Hardin Valley Land Partners, Inc. is proposing a residential development (i.e. Steele Landing Subdivision) with attached housing lots in Knox County. The project is located south of the intersection of Hardin Valley Road at Steele Road. The development will consist of 91 townhomes. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2021.

The proposed site access will connect to the existing signalized intersection of Hardin Valley Road at Steele Road.

The parcels of land along Hardin Valley Road will have future access to the signalized intersection of Hardin Valley Road at Steele Road. FMA assumed a 28,500 SF office building and a 7,000 SF dentist office for this future commercial development. The commercial development will not be built as a part of the Steele Landing Subdivision, but is included in the traffic impact study.

In order to maintain or provide an acceptable level-of-service for each of the intersections studied, some recommendations are presented.

Hardin Valley Road @ Steele Road
After the completion of the Steele Landing Subdivision the signalized intersection of Hardin Valley Road at Steele Road will operate at a LOS D during AM peak hour and a LOS C during the PM peak hour using the existing signal timing provided by Knox County.

An eastbound right turn lane is not warranted after the full buildout of the Steele Landing Subdivision.

The proposed Steele Landing Subdivision will be within the Parent Responsibility Zone (PRZ) of Hardin Valley Elementary School, Hardin Valley Middle School and Hardin Valley Academy. The PRZ is defined as those who live within one (1) mile from an elementary school or within (1.5) miles for a middle/high school by the shortest route, and are not eligible for transportation service. There are existing sidewalks and crosswalk locations on both Hardin Valley Road and Steele Road near Hardin Valley Elementary School that also extend to Hardin Valley Middle School and Hardin Valley Academy. The Steele Landing Subdivision plans to connect to the existing sidewalk network along Hardin Valley Road.

1 Introduction

1.1 Project Description

This report provides a summary of a traffic impact study that was performed for the proposed Steele Landing Subdivision. The project is located south of the intersection of Hardin Valley Road at Steele Road in Knox County. The location of the site is shown in Figure 1.

The proposed Steele Landing Subdivision will be within the Parent Responsibility Zone (PRZ) of Hardin Valley Elementary School, Hardin Valley Middle School and Hardin Valley Academy. The PRZ is defined as those who live within one (1) mile from an elementary school or within (1.5) miles for a middle/high school by the shortest route, and are not eligible for transportation service.

The Steele Landing Subdivision will consist of 91 townhomes. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2021.

The development will connect to the existing signalized intersection of Hardin Valley Road at Steele Road. The traffic from the Steele Landing Subdivision will enter and exit the site at the signalized intersection. The proposed site layout is shown in Figure 2.

The purpose of this study is to evaluate the impacts to the traffic conditions caused by the proposed development.

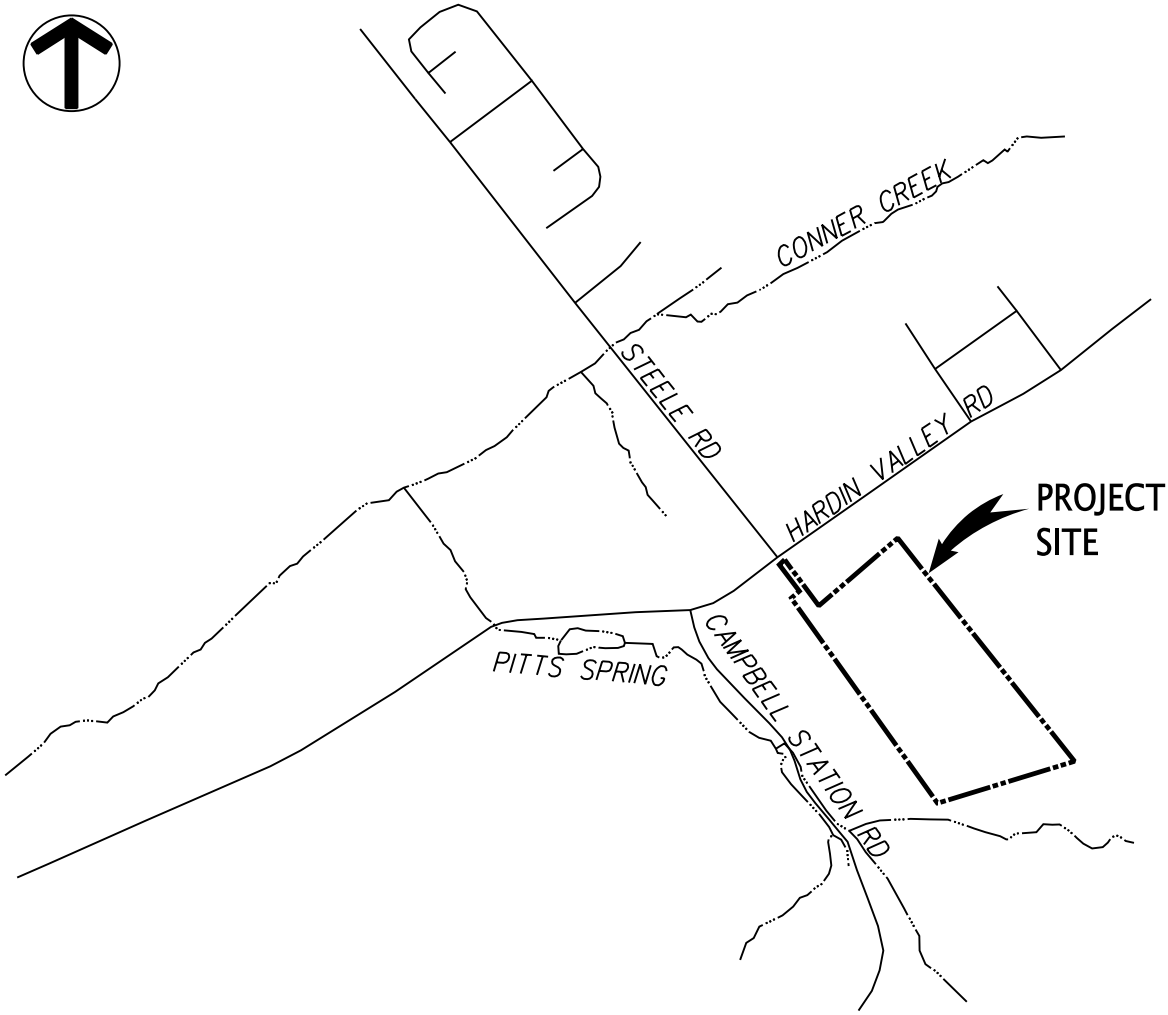


Figure 1: Location Map

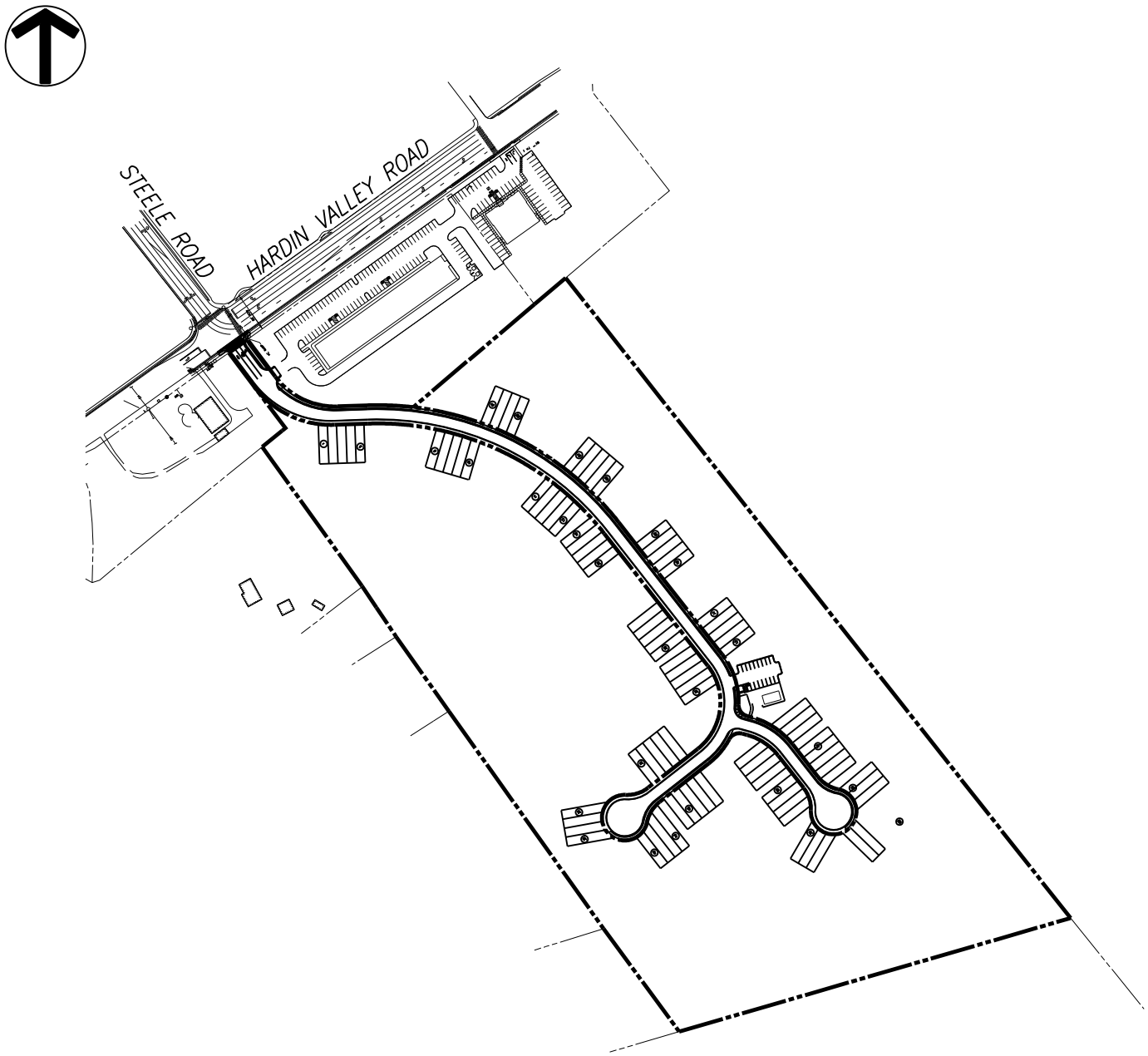


Figure 2: Site Plan

1.2 Existing Site Conditions

The proposed site access will connect to the existing signalized intersection of Hardin Valley Road at Steele Road. An existing westbound left turn lane on Hardin Valley Road has an approximate 215 foot storage length and a 135 foot taper length.

The signalized intersection of Hardin Valley Road at Steele Road is located approximately 640 feet east of the intersection with Campbell Station Road and approximately 750 feet west of the intersection with the Hardin Valley Elementary School Driveway. The existing sight distance at the intersection exceeds 600 feet east and west.

The Knoxville-Knox County Planning Commission classifies Hardin Valley Road at the intersection with Steele Road as a minor arterial per the Major Road Plan with a right-of-way of 88 feet east of the intersection and a 60 feet right-of-way west of Steele Road. The posted speed limit on Hardin Valley Road is 40 mph.

The Knoxville-Knox County Planning Commission classifies Steele Road from Hardin Valley Road to Sam Lee Road as a minor collector per the Major Road Plan with a right-of-way of 60 feet. The posted speed limit on Steele Road is 30 mph.

Hardin Valley Road has existing sidewalks both eastbound and westbound at the intersection with Steele Road. Steele Road has an existing northbound sidewalk that continues past Hardin Valley Elementary School and Hardin Valley Middle School entrances.

There are two crosswalks located at the signalized intersection of Hardin Valley Road at Steele Road. Parents and students will be able to utilize the existing sidewalks and crosswalks to walk to Hardin Valley Elementary School, Hardin Valley Middle School and Hardin Valley Academy from the proposed subdivision.

2 Existing Traffic Volumes

FMA conducted a turning movement count at the intersection of Hardin Valley Road at Steele Road on Thursday October 18, 2018.

The current AM peak hour and PM peak hour were determined using the turning movement count that FMA conducted. At the intersection of Hardin Valley Road at Steele Road the AM peak hour occurred between 7:15 am and 8:15 am, and the PM peak hour occurred between 4:45 pm and 5:45 pm.

The existing volumes including the AM and PM peak hour traffic volumes at the count location is shown in Figure 3, and the count data collected is included in Attachment 1.

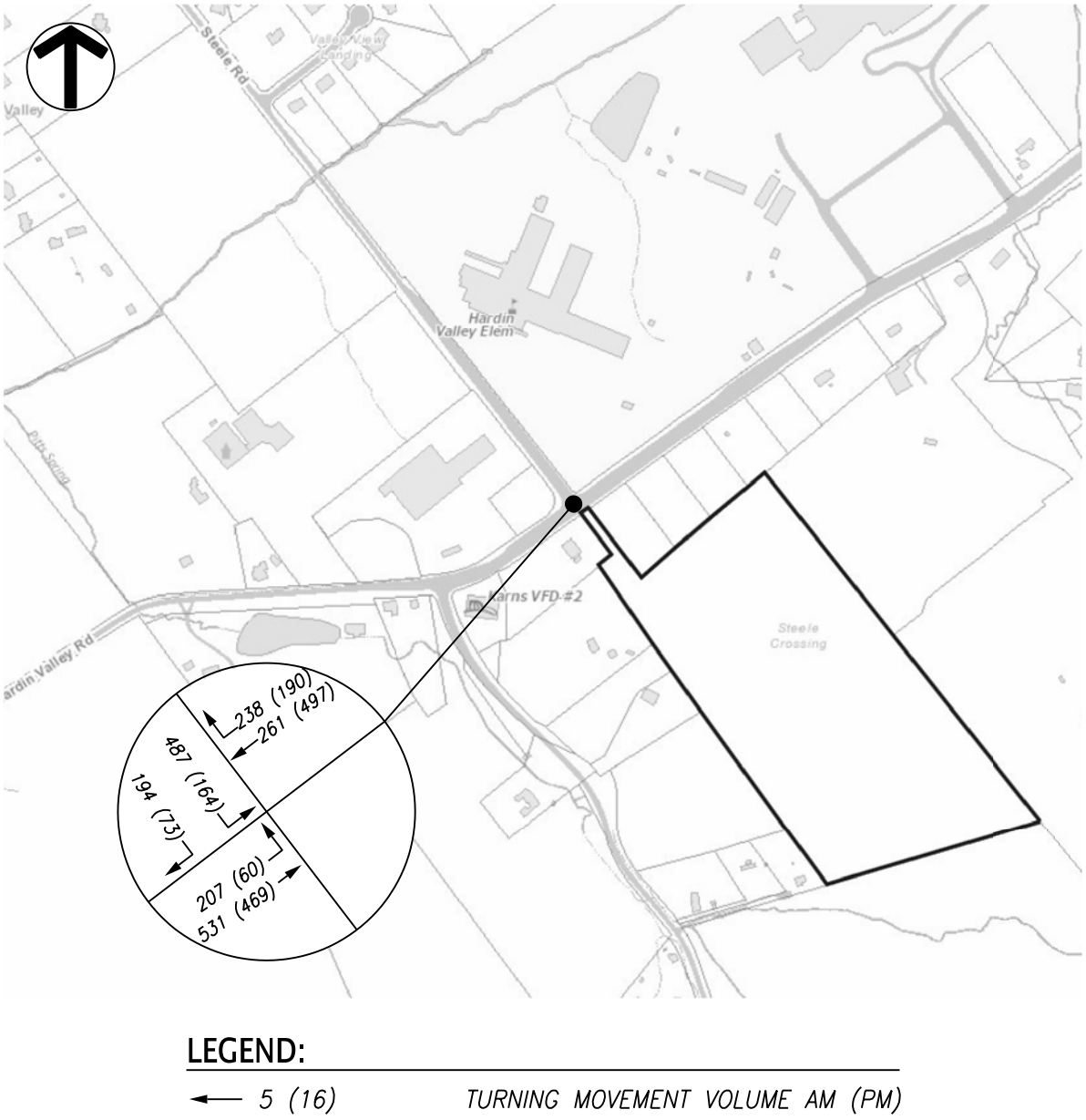


Figure 3: 2018 Existing Peak Hour Traffic

3 Background Growth

The Knoxville Regional Transportation Planning Organization (TPO) maintains count stations on both Steele Road and Hardin Valley Road.

Count station #093M277 is located on Steele Road north of Hardin Valley Road. The annual traffic growth rate for this station over the last ten years is approximately 2.00%.

Count station #093M353 is located on Hardin Valley Road east of Marietta Church Road. The annual growth rate for this station over the last thirteen years is approximately 5.91%.

For the purpose of this study, an annual growth rate of 4.0% was assumed for traffic at the intersection of Hardin Valley Road at Steele Road until full occupancy is reached in 2021. Attachment 2 shows the trend line growth charts for the TDOT count stations.

Figure 4 demonstrates the projected background peak hour volumes at the intersections after applying the background growth rate to the existing conditions.

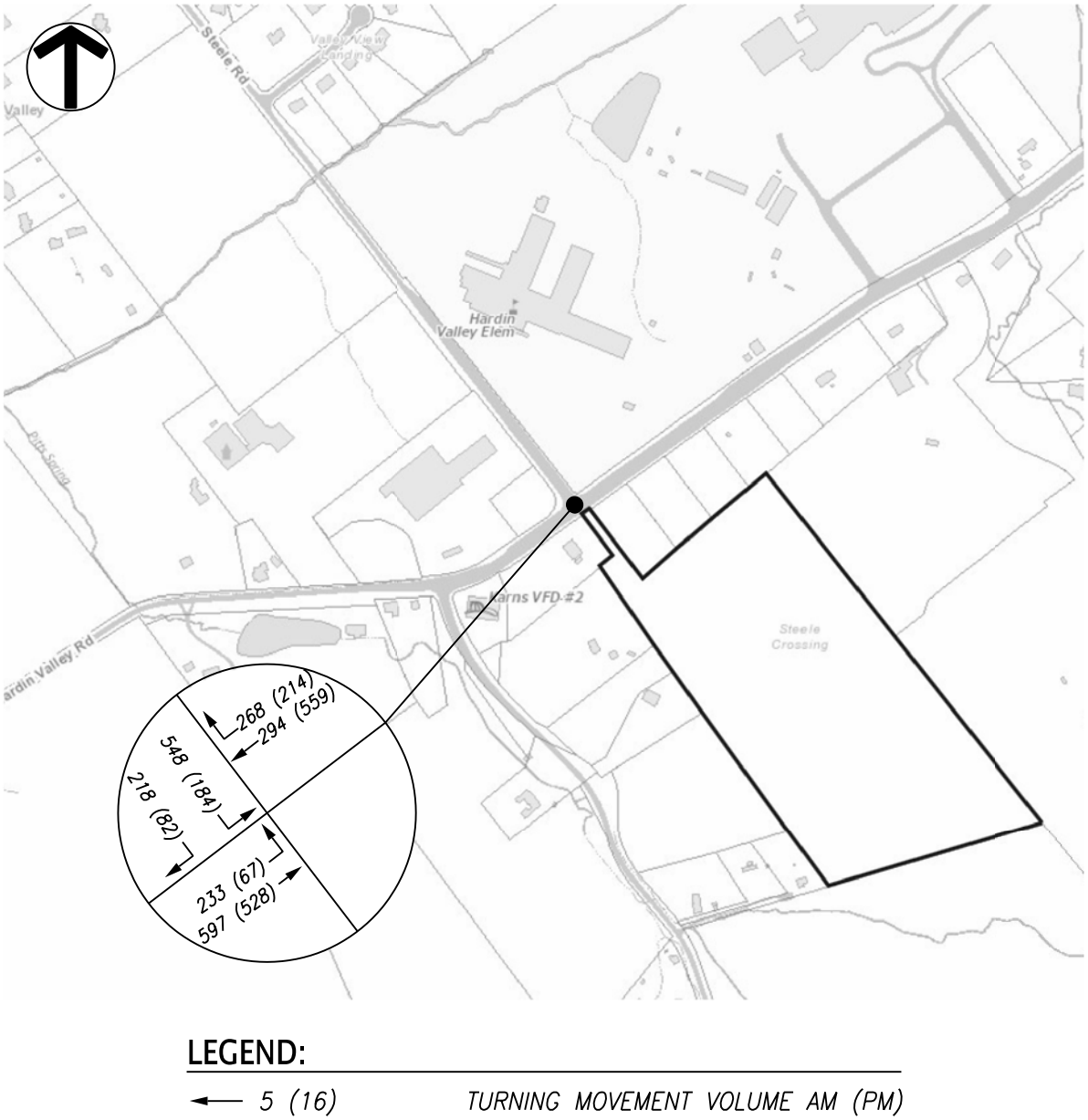


Figure 4: 2021 Background Peak Hour Traffic

4 Trip Generation and Trip Distribution

The Knoxville-Knox County Planning Commission published a memorandum ("Local Trip Generation Rates for Multi-Family Residential Uses", August 14, 2000) for the purpose of providing locally collected data for all multi-family residential developments. The Steele Landing Subdivision will consist of 91 townhomes. The fitted curve equations from the local study were used to calculate site trips for the Steele Landing Subdivision.

For the future commercial development FMA assumed a 28,500 SF office building and a 7,000 SF dentist office. The equations provided in the *Trip Generation, 10th Edition,* published by the Institute of Transportation Engineers were used to calculate the expected site trips using both the General Office Building (Land Use 710) and Medical-Dental Office Building (Land Use 720). The land use worksheets are included in Attachment 3.

The total trips generated by the Steele Landing Subdivision was estimated to be 877 daily trips. The estimated trips are 49 trips during the AM peak hour and 71 trips during the PM peak hour. A trip generation summary is shown in Table 4-1.

Table 4-1
Steele Landing Subdivision
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Steele Landing Subdivision (Local Apartment Study)						
Townhomes	91 Units	877	11	38	39	32
Future Commercial Development						
Office Building (LUC 710)	28,500 SF	314	46	7	6	29
Dentist Office (LUC 720)	7,000 SF	181	16	5	7	19
Commercial Total		495	62	12	13	48
Combined Total		1,372	73	50	52	80

Hardin Valley Road at the intersection of Steele Road has a trip distribution 60% eastbound and 40% westbound during the AM peak hour and 45% eastbound and 55% westbound during the PM peak hour.

The directional distribution of the traffic generated by the Steele Landing Subdivision was determined using the existing traffic volumes in combination with the concept plan layout. It was assumed that during the AM peak hour 50% of exiting traffic would turn right, 40% of exiting traffic would turn left and that the remaining 10% of traffic would go straight onto Steele Road. During the PM peak hour it was assumed that 65% of exiting traffic would turn right, 25% of exiting traffic would turn left and the remaining 10% of traffic would go straight onto Steele Road.

Figure 5 shows the AM peak hour trip distribution and Figure 6 shows the PM peak hour trip distribution.

Figure 7 shows the peak hour site traffic from the Steele Landing Subdivision and Figure 8 shows the full buildout peak hour traffic.

Figure 9 shows the peak hour commercial traffic and Figure 10 shows the combined peak hour traffic from the Steele Landing Subdivision and the future commercial development.

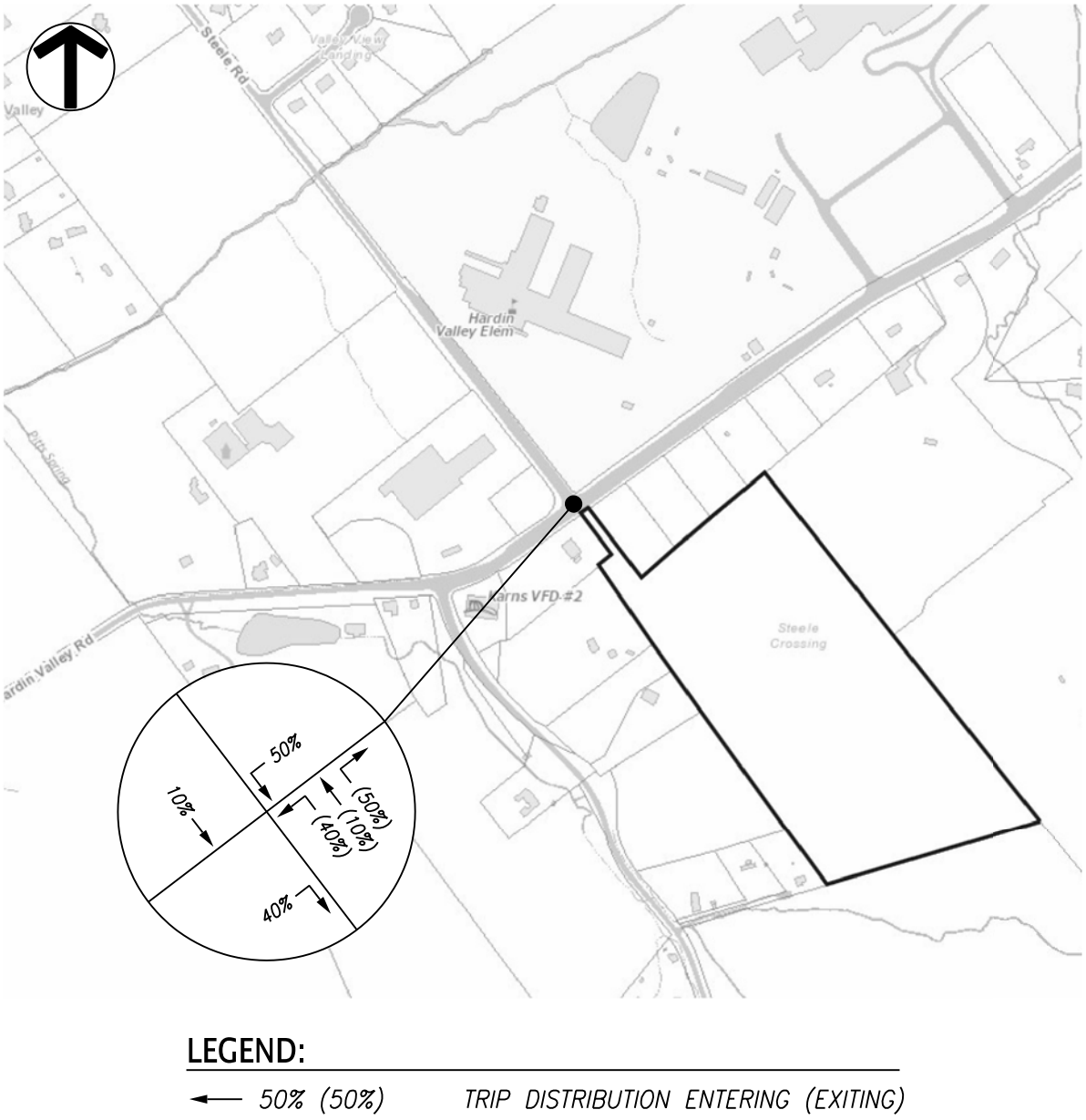


Figure 5: AM Peak Hour Trip Distribution

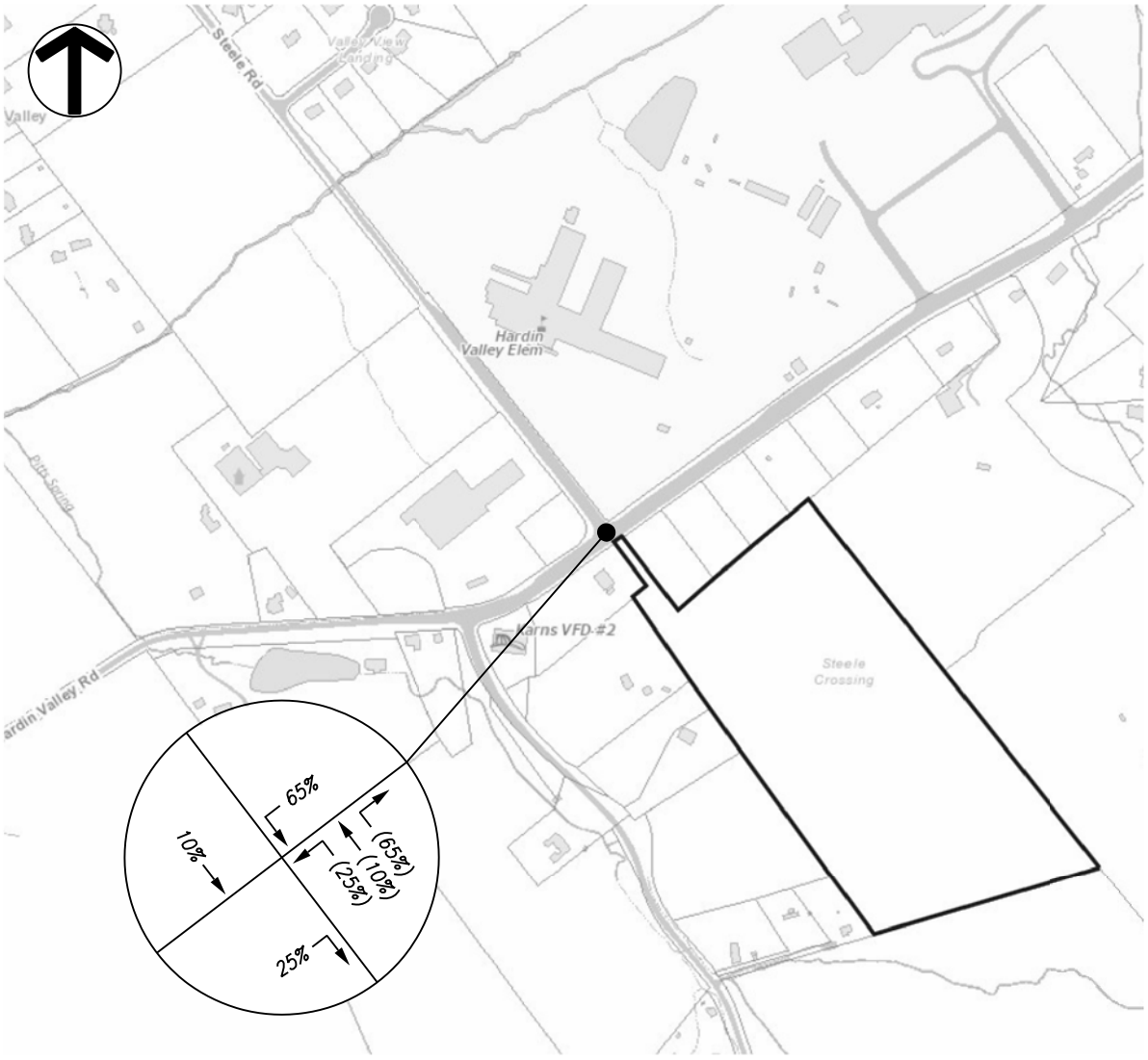


Figure 6: PM Peak Hour Trip Distribution

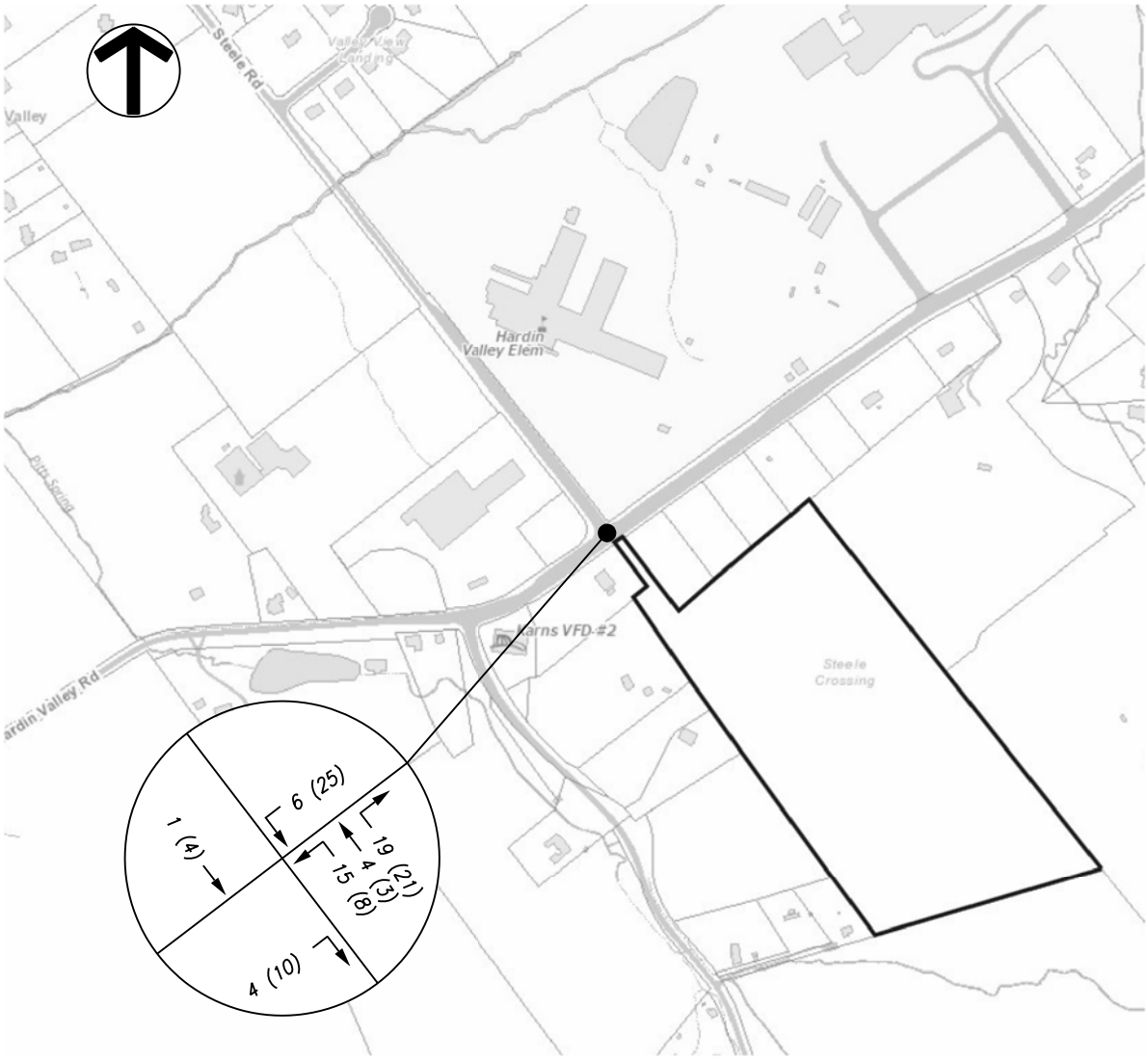


Figure 7: Peak Hour Subdivision Traffic

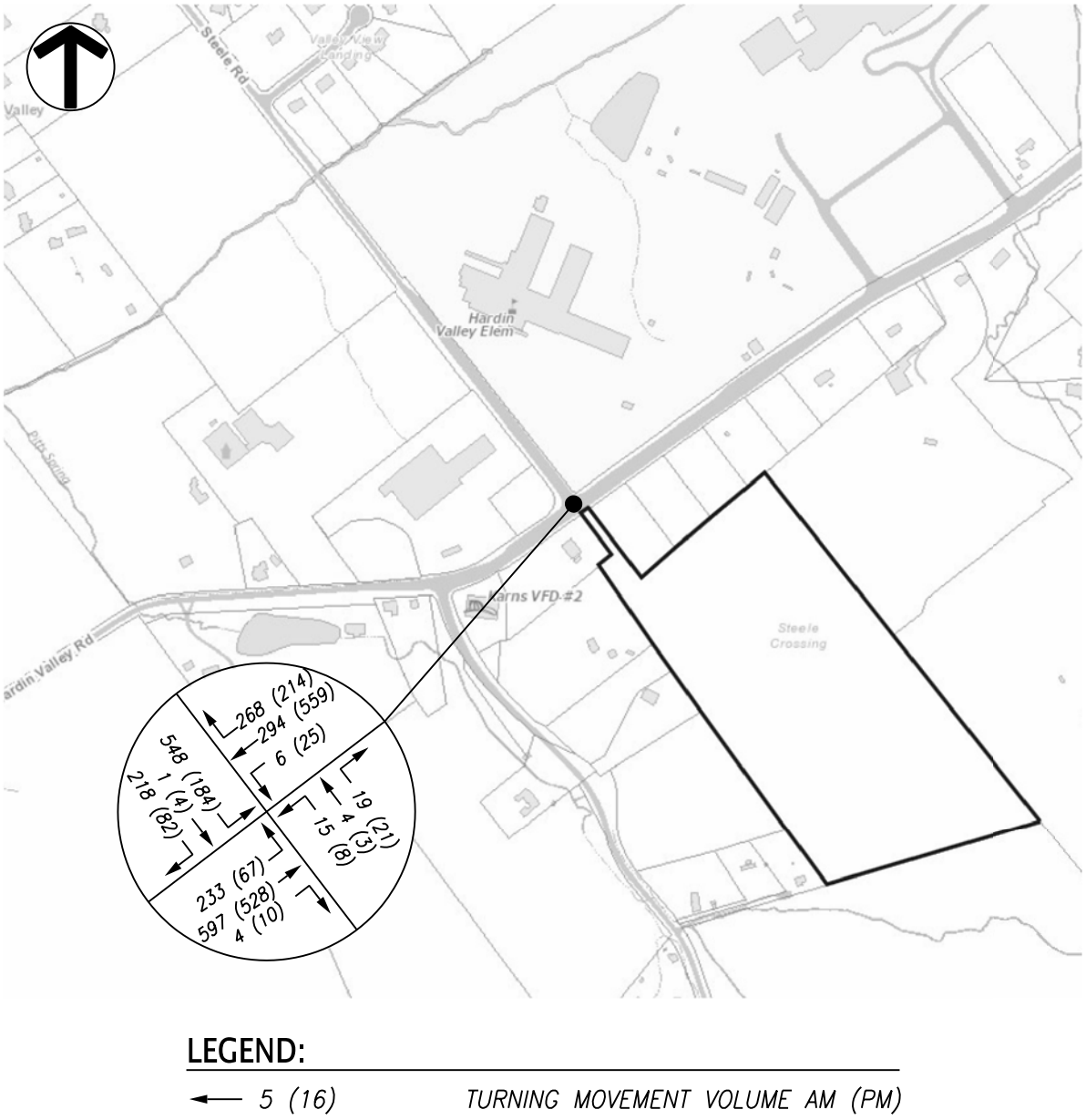


Figure 8: Peak Hour Full Buildout Traffic

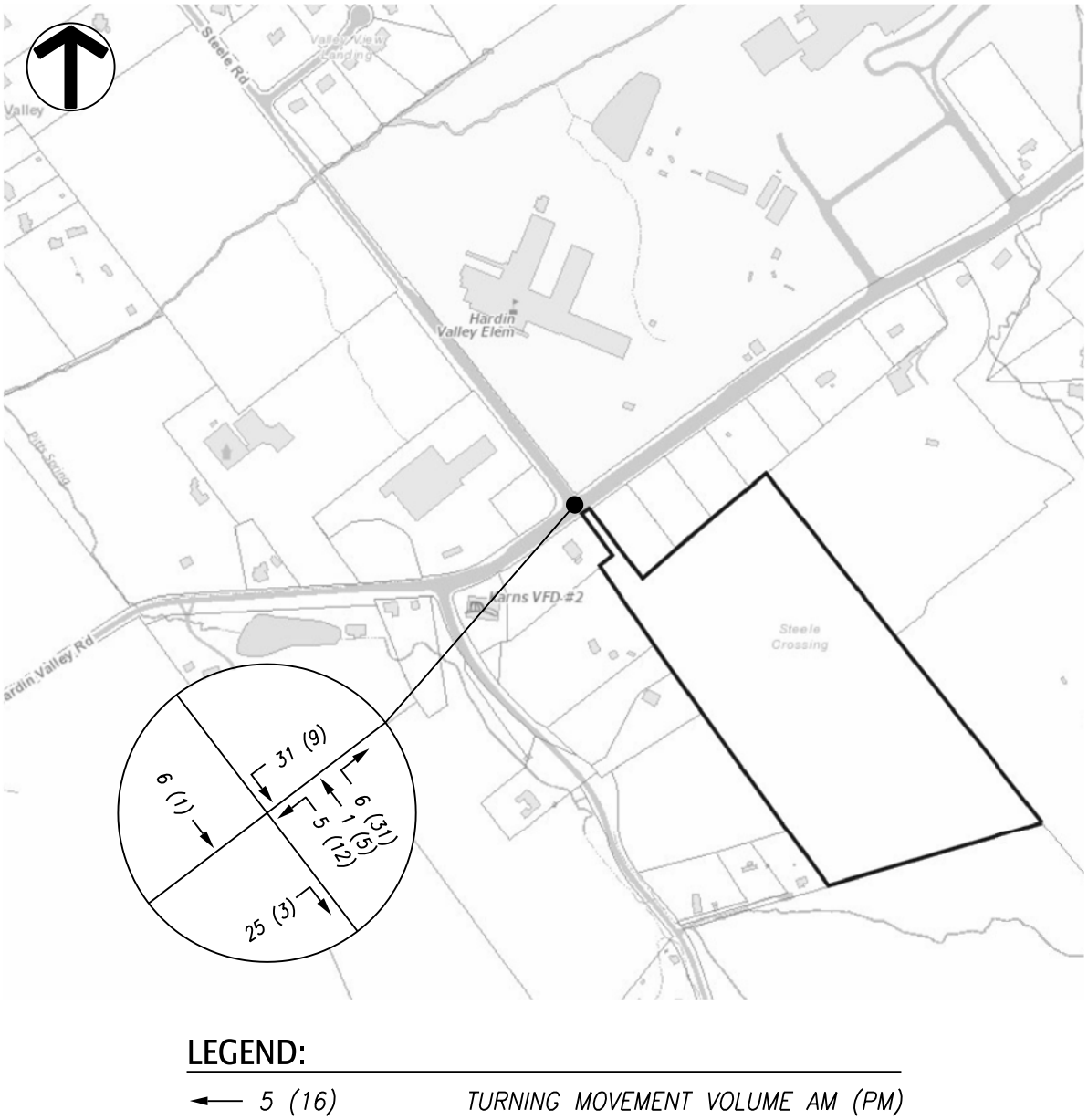


Figure 9: Peak Hour Commercial Traffic

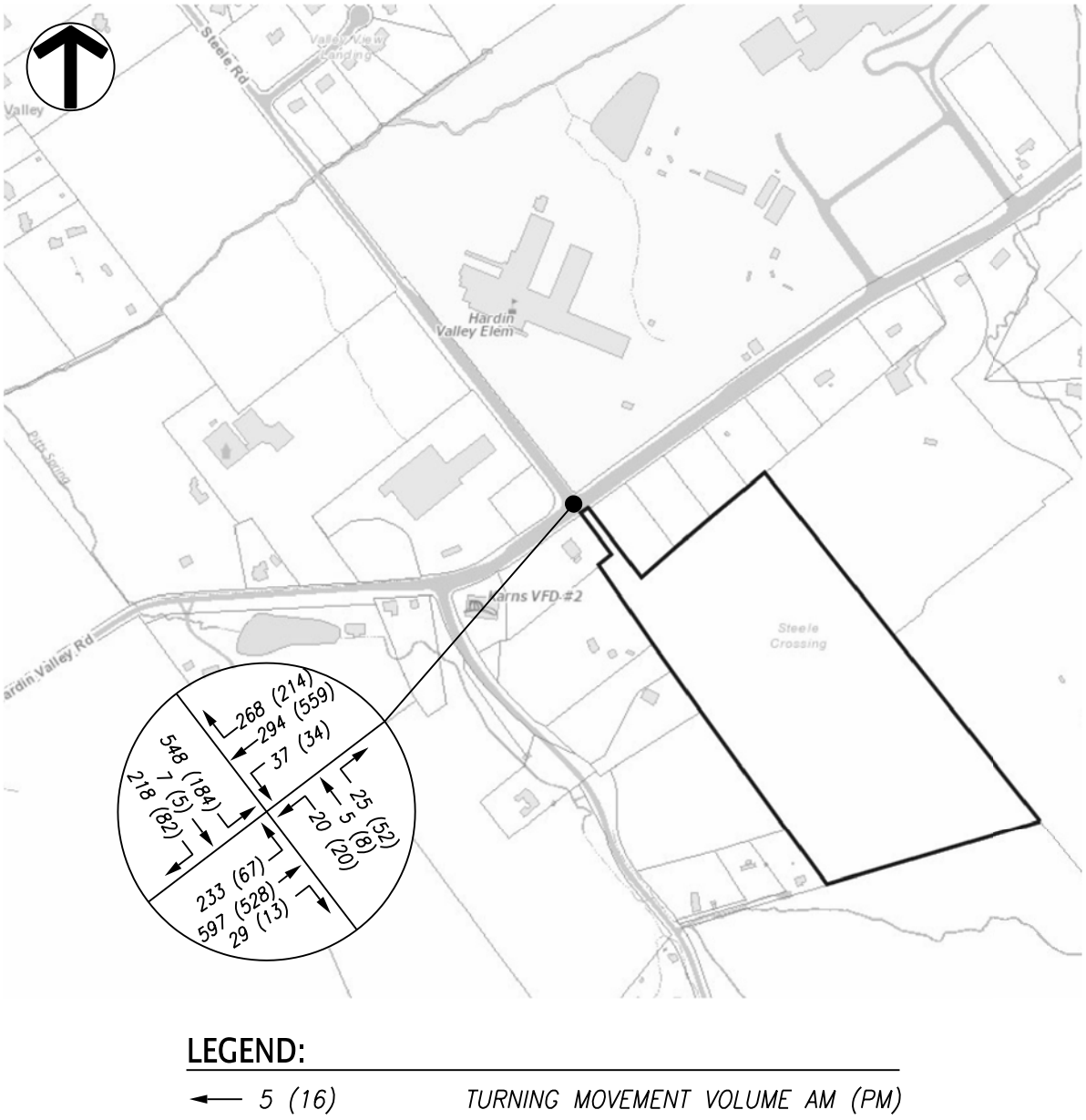


Figure 10: Peak Hour Full Buildout & Commercial Traffic

5 Projected Capacity and Level of Service

Signalized intersection capacity analyses were performed using Highway Capacity Software (HCS7) with the existing signal timing for the AM and PM peak hours to evaluate the traffic conditions at the intersection of Hardin Valley Road at Steele Road. The existing signal timing was provided by Knox County and is included in Attachment 4.

The existing signal for the intersection of Hardin Valley Road at Steele Road will be modified to accommodate the addition of the northbound movement from the Steele Landing Subdivision.

The results from the analyses are expressed with a term "level of service" (LOS), which is based on the amount of delay experienced at the intersection. The LOS index ranges from LOS A, indicating excellent traffic conditions with minimal delay, to LOS F indicating very congested conditions with excessive delay. LOS D generally is considered the minimum acceptable condition in urban areas. The HCS7 worksheets are included in Attachments 5, 6, and 7. Table 5-1 shows the results of the capacity analyses.

Table 5-1
Phase 1 - Intersection Analysis
Level of Service (LOS) Summary

		Delay (sec)/LOS
Hardin Valley Road @ Steele Road (Existing 2018)		
AM Peak	Intersection	21.1 / C
PM Peak	Intersection	14.7 / B
Hardin Valley Road @ Steele Road (Background 2021)		
AM Peak	Intersection	24.9 / C
PM Peak	Intersection	15.5 / B
Hardin Valley Road @ Steele Road (Full Buildout 2021)		
AM Peak	Intersection	45.1 / D
PM Peak	Intersection	23.0 / C
Hardin Valley Road @ Steele Road (Full Buildout & Commercial 2021)		
AM Peak	Intersection	47.8 / D
PM Peak	Intersection	25.4 / C

6 Turn Lane Warrant Analysis

The intersection of Hardin Valley Road at the proposed driveway location was evaluated to determine if a right turn lane is warranted. The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to analyze the information. A right turn lane on Hardin Valley Road is not warranted after the full buildout of the Steele Landing Subdivision. The turn lane warrant worksheets and analysis are included in Attachment 8.

There is an existing westbound left turn lane at the intersection of Hardin Valley Road at Steele Road; therefore a left turn lane warrant was not analyzed.

7 Conclusions and Recommendations

7.1 Hardin Valley Road @ Steele Road

The existing traffic conditions at the signalized intersection of Hardin Valley Road at Steele Road operate at a LOS C during the AM peak hour and a LOS B during the PM peak hour using the existing signal timing provided by Knox County.

The background traffic conditions at the signalized intersection of Hardin Valley Road at Steele Road operate at a LOS C during the AM peak hour and a LOS B during the PM peak hour using the existing signal timing provided by Knox County.

After the completion of the Steele Landing Subdivision the signalized intersection of Hardin Valley Road at Steele Road will operate at a LOS D during AM peak hour and a LOS C during the PM peak hour using the existing signal timing provided by Knox County.

The existing eastbound left turn lane on Hardin Valley Road at the intersection with Steele Road has a storage length of 125 feet (approximately 5 vehicles). The volume to capacity ratio exceeds 1.0 for this turn lane during both the background AM peak hour and the full buildout AM peak hour. The capacity analyses shows a 95% queue length of 5.1 vehicles during the background AM peak hour and a queue length of 9.0 vehicles during the full buildout AM peak hour after the completion of the Steele Landing Subdivision.

The eastbound left turn queue of 9.0 vehicles during the AM peak hour and 1.1 vehicles during the PM peak hour is not expected to block the existing Food City driveway entrance, which is located 225 feet from the intersection of Hardin Valley Road at Steele Road.

The existing westbound left turn lane on Hardin Valley Road at the intersection with Steele Road has a storage length of 215 feet (approximately 8 vehicles) and a taper length of 135 feet. The capacity analysis shows a 95% queue length of less than one car length during both the AM and PM peak hours; therefore the existing storage at the intersection is adequate and no change is necessary.

An eastbound right turn lane is not warranted after the full buildout of the Steele Landing Subdivision.

The proposed Steele Landing Subdivision will be within the Parent Responsibility Zone (PRZ) of Hardin Valley Elementary School, Hardin Valley Middle School and Hardin Valley Academy. The PRZ is defined as those who live within one (1) mile

from an elementary school or within (1.5) miles for a middle/high school by the shortest route, and are not eligible for transportation service. There are existing sidewalks and crosswalk locations on both Hardin Valley Road and Steele Road near Hardin Valley Elementary School that also extend to Hardin Valley Middle School and Hardin Valley Academy. The Steele Landing Subdivision plans to connect to the existing sidewalk network along Hardin Valley Road.

The minimum required sight distance for a road with a posted speed limit of 40 mph is 400 feet in each direction in accordance with the "Subdivision Regulations" for Knoxville and Knox County. FMA measured the sight distance at the proposed intersection of Hardin Valley Road at Driveway Connection. At 15 feet from the edge of pavement the sight distance at the proposed intersection is greater than 600 feet eastbound and 600 feet westbound.

7.2 Future Commercial Development

After the completion of the Future Commercial Development the signalized intersection of Hardin Valley Road at Steele Road will operate at a LOS D during AM peak hour and a LOS C during the PM peak hour using the existing signal timing provided by Knox County.

An eastbound right turn lane is warranted during the AM peak hour after the combined full buildout of the Steele Landing Subdivision and the Future Commercial Development. The need for a turn lane will be mitigated with the design (by others) for the commercial property also being served by this access.

The future commercial development will have a second access on Hardin Valley Road approximately 745 feet east of the intersection with Steele Road and across from the entrance to Hardin Valley Elementary School. This access was not analyzed as a part of the Steele Landing Subdivision traffic impact study.

Attachment 1
Traffic Counts

Project: Steele Landing Subdivision
Intersection: Steele Road / Hardin Valley Road
Date Conducted: 10/18/2018

	Hardin Valley Eastbound			Hardin Valley Westbound			Steele Road Southbound			
Start	Left	Thru	Total	Thru	Right	Total	Left	Right	Total	Int. Total
7:00 AM	36	110	146	32	45	77	99	27	126	349
7:15 AM	76	127	203	51	86	137	153	37	190	530
7:30 AM	62	113	175	62	67	129	135	64	199	503
7:45 AM	33	144	177	77	46	123	110	52	162	462
Total	207	494	701	222	244	466	497	180	677	1844
8:00 AM	36	147	183	71	39	110	89	41	130	423
8:15 AM	16	119	135	76	37	113	53	20	73	321
8:30 AM	5	85	90	36	7	43	29	9	38	171
8:45 AM	6	136	142	49	16	65	17	5	22	229
Total	63	487	550	232	99	331	188	75	263	1144
2:00 PM	9	70	79	135	40	175	31	7	38	292
2:15 PM	21	76	97	92	40	132	27	6	33	262
2:30 PM	14	88	102	77	47	124	23	9	32	258
2:45 PM	20	84	104	64	40	104	70	46	116	324
Total	64	318	382	368	167	535	151	68	219	1136
3:00 PM	20	62	82	81	32	113	60	33	93	288
3:15 PM	14	83	97	78	30	108	34	11	45	250
3:30 PM	26	80	106	136	47	183	74	39	113	402
3:45 PM	7	58	65	146	48	194	64	54	118	377
Total	67	283	350	441	157	598	232	137	369	1317
4:00 PM	10	76	86	94	35	129	68	35	103	318
4:15 PM	7	67	74	117	36	153	41	11	52	279
4:30 PM	15	101	116	123	29	152	37	14	51	319
4:45 PM	21	97	118	114	56	170	32	17	49	337
Total	53	341	394	448	156	604	178	77	255	1253
5:00 PM	14	111	125	130	48	178	54	22	76	379
5:15 PM	15	147	162	133	33	166	41	13	54	382
5:30 PM	10	114	124	120	53	173	37	21	58	355
5:45 PM	14	125	139	106	36	142	38	9	47	328
Total	53	497	550	489	170	659	170	65	235	1444
Grand Total	507	2420	2927	2200	993	3193	1416	602	2018	8138
Approach %	17.3	82.7		68.9	31.1		70.2	29.8		
Total %			36.0			39.2			24.8	

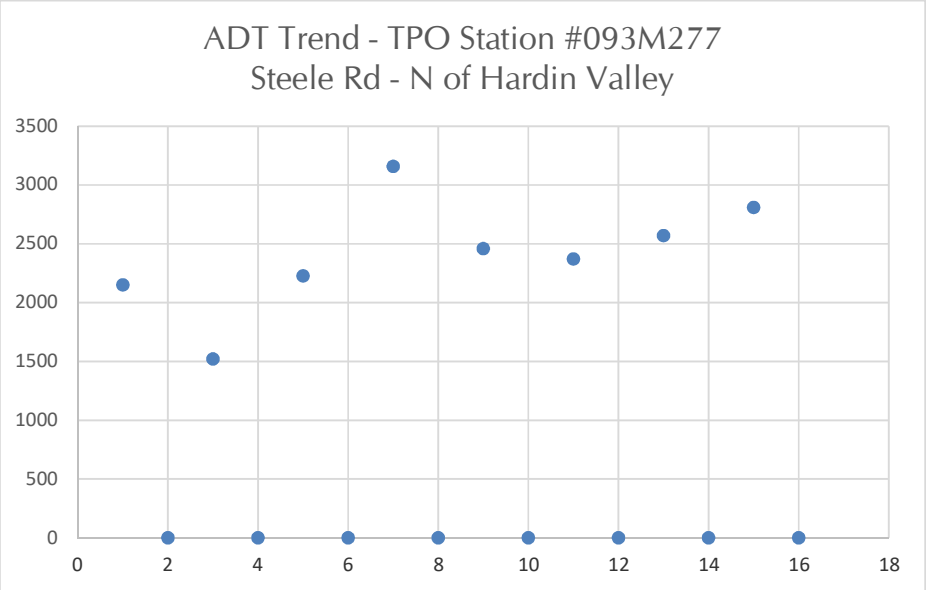
Project: Steele Landing Subdivision
Date Conducted: 10/16/2018

AM Peak Hour	7:15 AM - 8:15 AM	1918
PM Peak Hour	4:45 PM - 5:45 PM	1453

	Hardin Valley Eastbound			Hardin Valley Westbound			Steele Road Southbound			
Start	Left	Thru	App. Total	Thru	Right	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:15 AM										
7:15 AM	**76**	127	203	51	**86**	137	**153**	37	190	**530**
7:30 AM	62	113	175	62	67	129	135	**64**	199	503
7:45 AM	33	144	177	**77**	46	123	110	52	162	462
8:00 AM	36	**147**	183	71	39	110	89	41	130	423
Total Volume	207	531	738	261	238	499	487	194	681	1918
Future (4% over 3	233	597		294	268		548	218		2157
PHF	0.68	0.90		0.85	0.69		0.80	0.76		0.90
Peak Hour Analysis from 3:00 PM to 6:00 PM										
PM Peak Hour begins at 5:00 PM										
4:45 PM	**21**	97	118	114	**56**	170	32	17	49	337
5:00 PM	14	111	125	130	48	178	**54**	**22**	76	**379**
5:15 PM	15	**147**	162	**133**	33	166	41	13	54	382
5:30 PM	10	114	124	120	53	173	37	21	58	355
Total Volume	60	469	529	497	190	687	164	73	237	1453
Future (4% over 3	67	528		559	214		184	82		1634
PHF	0.71	0.80		0.93	0.85		0.76	0.83		0.96

Attachment 2
ADT Trends

	Year	Adjusted Average Daily Traffic
0	2000	N/A
1	2001	2150
2	2002	N/A
3	2003	1520
4	2004	N/A
5	2005	2228
6	2006	N/A
7	2007	3160
8	2008	N/A
9	2009	2460
10	2010	N/A
11	2011	2370
12	2012	N/A
13	2013	2570
14	2014	N/A
15	2015	2810
16	2016	N/A

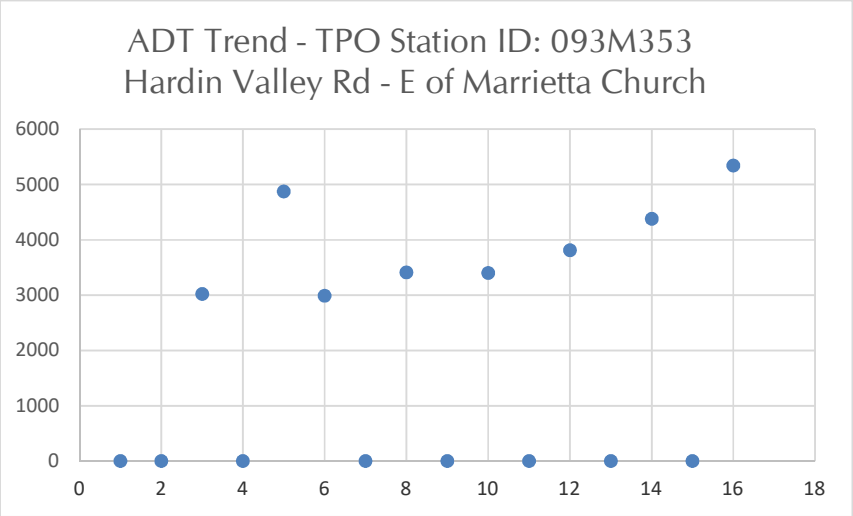


Most Recent Trend Line Growth

Year	ADT
2005	2228
2015	2810

Annual Percent Growth **2.61%**

	Year	Adjusted Average Daily Traffic
1	2001	N/A
2	2002	N/A
3	2003	3020
4	2004	N/A
5	2005	4871
6	2006	2990
7	2007	N/A
8	2008	3410
9	2009	N/A
10	2010	3400
11	2011	N/A
12	2012	3810
13	2013	N/A
14	2014	4380
15	2015	N/A
16	2016	5340



Most Recent Trend Line Growth

Year	ADT
2003	3020
2016	5340

Annual Percent Growth **5.91%**

Attachment 3
Trip Generation

Project: Steele Landing Subdivision
Date Conducted: 4/17/2019

Local Apartment Trip Generation Study
Phase 1 - 91 Units

Average Daily Traffic
T = 15.193 (X)^0.899
T = 15.193 (91) ^0.899
T = 877

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
T = 0.758 (X) ^0.924
T = 0.758 (91) ^0.924
T = 49

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
T = 0.669 (X) + 10.069
T = 0.669 (91) + 10.069
T = 71

		Percent		Number	
Time Period	Total Trips	Enter	Exit	Enter	Exit
Weekday (24 hours)	877	50%	50%	439	439
AM Peak Hour	49	22%	78%	11	38
PM Peak Hour	71	55%	45%	39	32

Project: Steele Landing Subdivision
Date Conducted: 4/17/2019

General Office Building - LUC 710
28,500 SF

Average Daily Traffic
Ln(T) = 0.97*Ln(X)+2.50
Ln(T) = 0.97*Ln(28.5)+2.50
T = 314

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
T = 0.94 (X) + 26.49
T = 0.94 (28.5) + 26.49
T = 53

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Ln(T) = 0.95*Ln(X)+0.36
Ln(T) = 0.95*Ln(28.5)+0.36
T = 35

		Percent		Number	
Time Period	Total Trips	Enter	Exit	Enter	Exit
Weekday (24 hours)	314	50%	50%	157	157
AM Peak Hour	53	86%	14%	46	7
PM Peak Hour	35	16%	84%	6	29

Project: Steele Landing Subdivision
Date Conducted: 4/29/2019

Medical-Dental Office Building - LUC 720
7,000 SF

Average Daily Traffic
T = 38.42(X) - 87.62
T = 38.42(7.0) - 87.62
T = 181

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Ln(T) = 0.89 Ln(X) +1.31
Ln(T) = 0.89 Ln(7.0) +1.31
T = 21

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
T = 3.39(X) + 2.02
T = 3.39(7.0) + 2.02
T = 26

		Percent		Number	
Time Period	Total Trips	Enter	Exit	Enter	Exit
Weekday (24 hours)	181	50%	50%	91	91
AM Peak Hour	21	78%	22%	16	5
PM Peak Hour	26	28%	72%	7	19

General Office Building
(710)

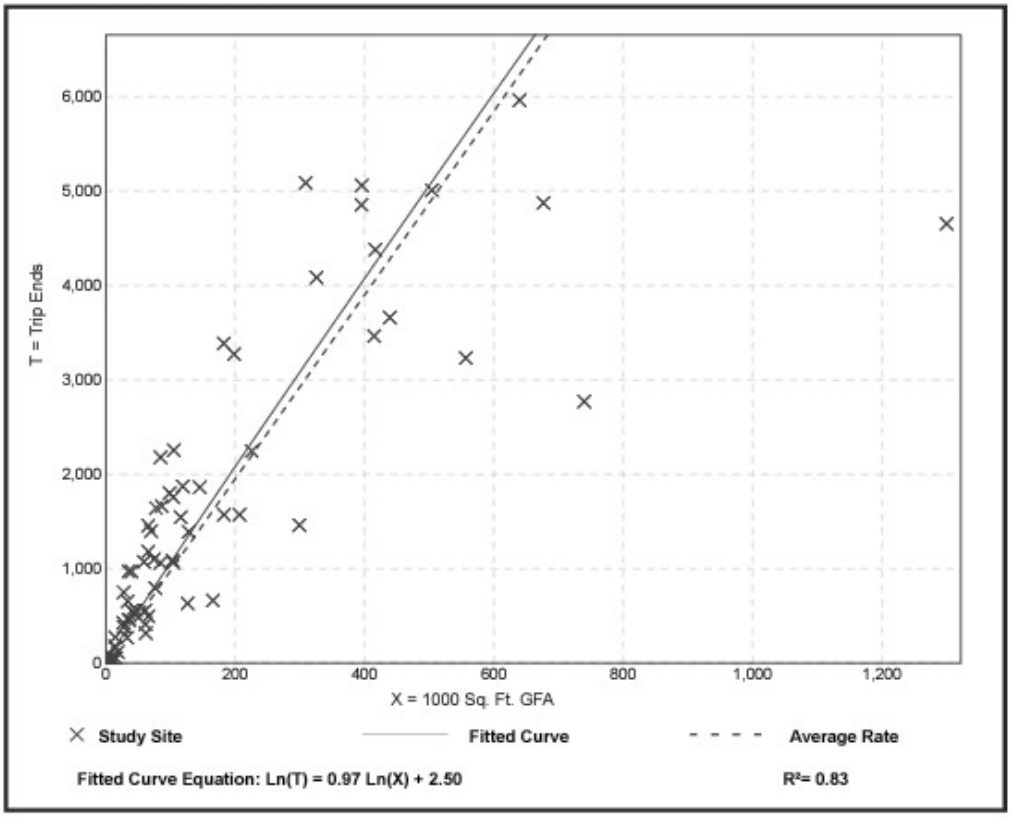
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 66
1000 Sq. Ft. GFA: 171
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.74	2.71 - 27.56	5.15

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.97 Ln(X) + 2.50 **R^2= 0.83**

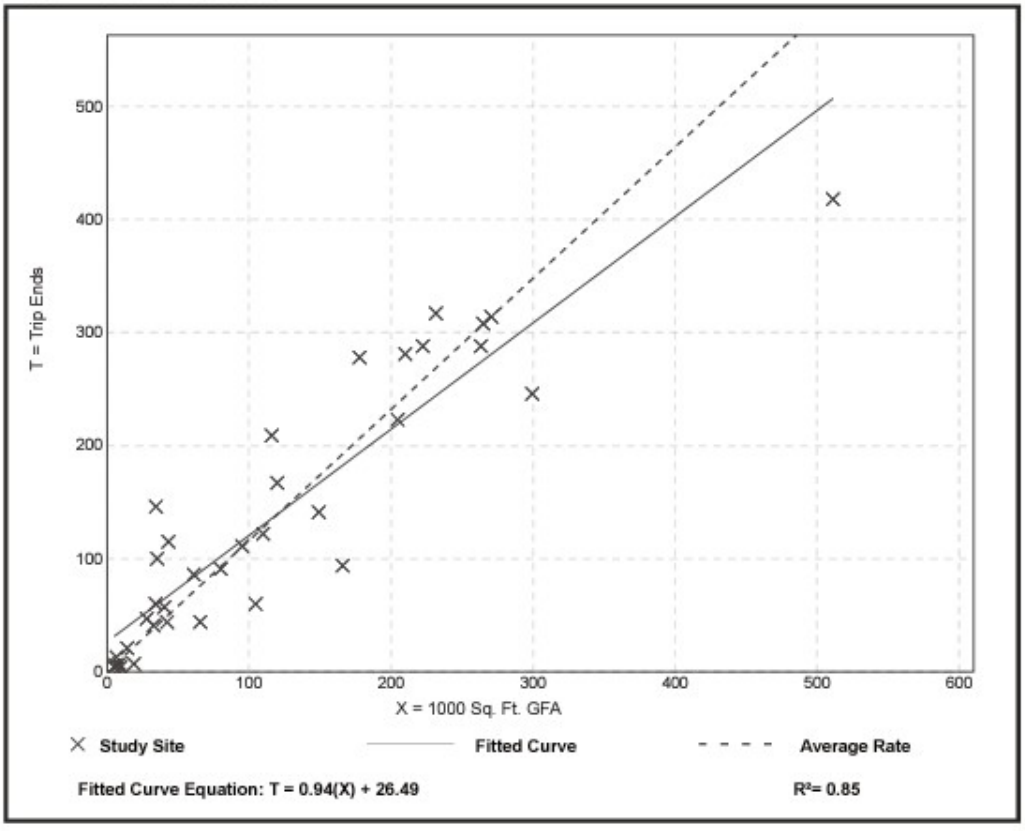
General Office Building
(710)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	35
1000 Sq. Ft. GFA:	117
Directional Distribution:	86% entering, 14% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.16	0.37 - 4.23	0.47

Data Plot and Equation



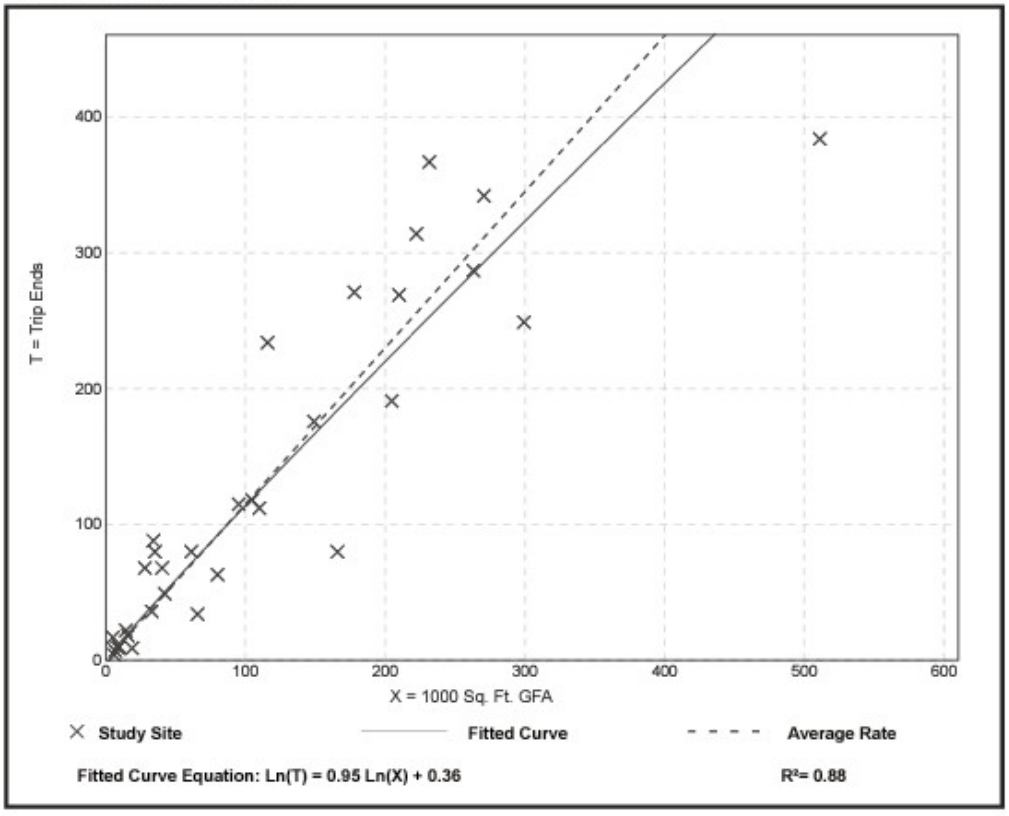
General Office Building
(710)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 32
1000 Sq. Ft. GFA: 114
Directional Distribution: 16% entering, 84% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.15	0.47 - 3.23	0.42

Data Plot and Equation



Medical-Dental Office Building
(720)

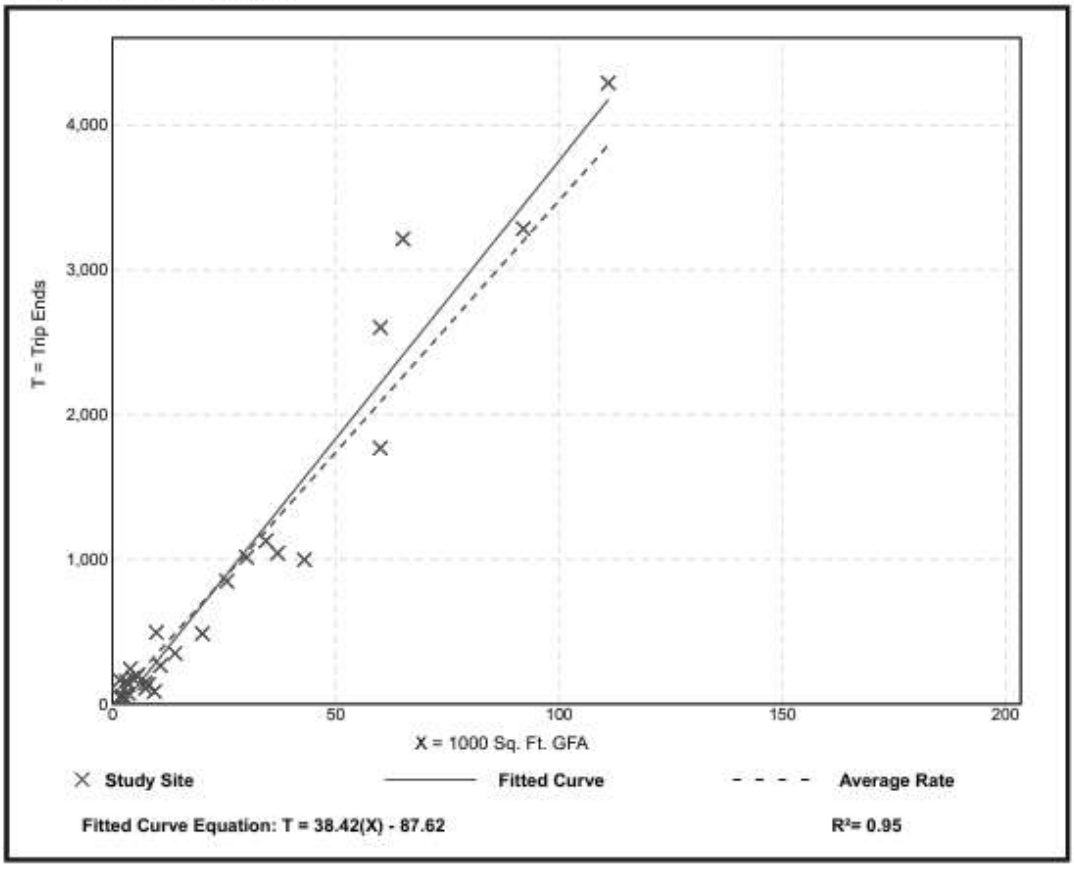
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 28
1000 Sq. Ft. GFA: 24
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
34.80	9.14 - 100.75	9.79

Data Plot and Equation



Fitted Curve Equation: T = 38.42(X) - 87.62

R^2= 0.95

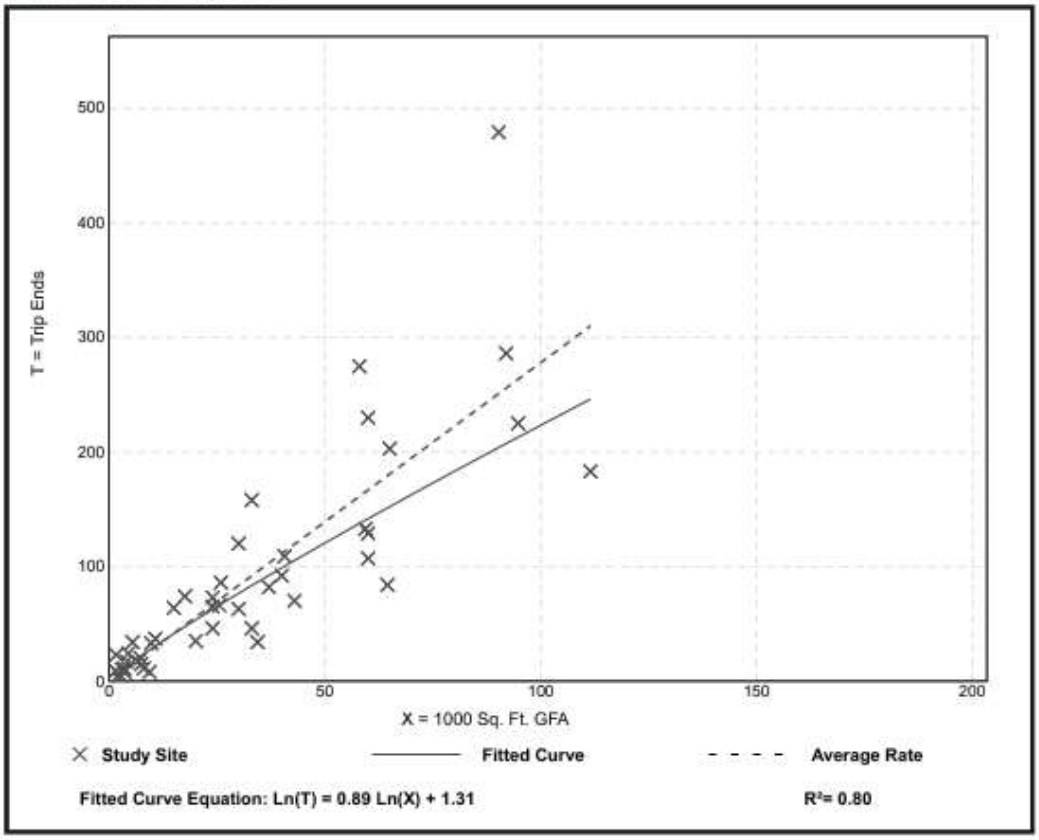
Medical-Dental Office Building
(720)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 44
1000 Sq. Ft. GFA: 32
Directional Distribution: 78% entering, 22% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.78	0.85 - 14.30	1.28

Data Plot and Equation



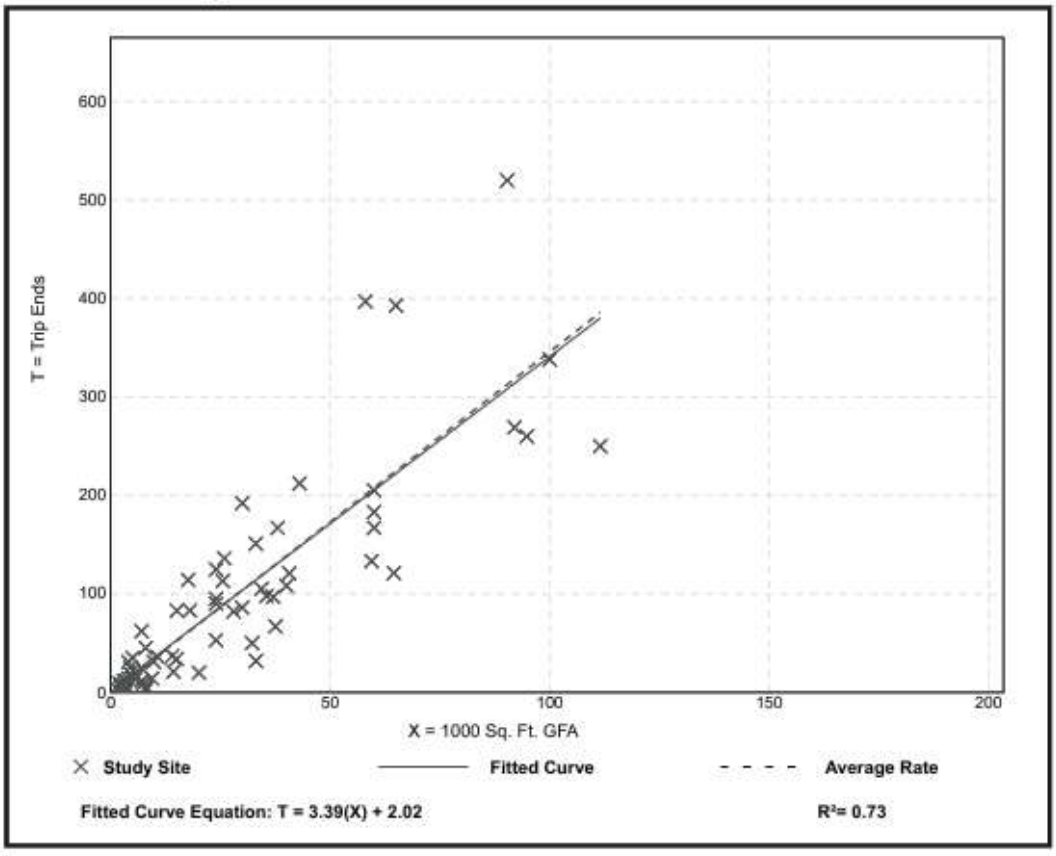
Medical-Dental Office Building
(720)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 65
1000 Sq. Ft. GFA: 28
Directional Distribution: 28% entering, 72% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.46	0.25 - 8.86	1.58

Data Plot and Equation



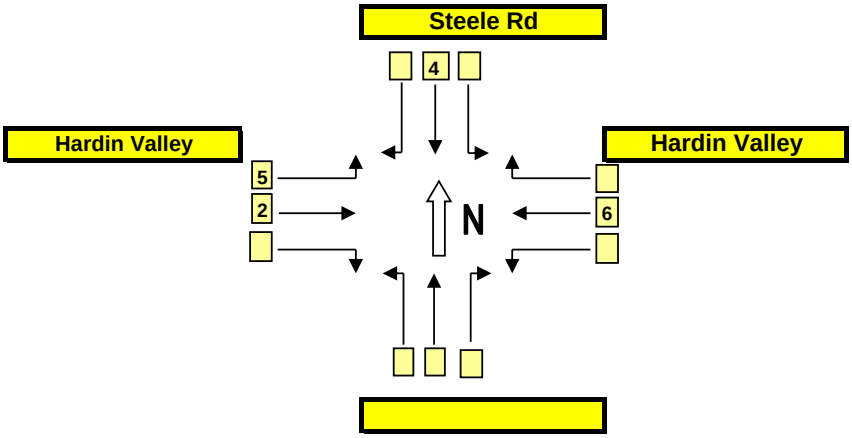
Attachment 4
Signal Timing

LOCAL CONTROLLER PROGRAMMING

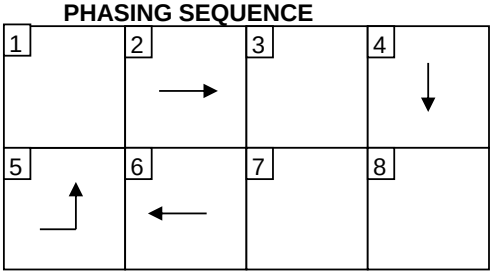
Intersection: Hardin Valley Rd at Steele Rd
Timing changed:
Controller type: Peek 3000

TIME BY PHASE (SEC) & FUNCTIONS

PHASE	1	2	3	4	5	6	7	8
MOVEMENTS	WBLT	EBT	NBLT	SBT	EBLT	WBT	SBLT	NBT
INITIAL		20		10	8	20		
PASSAGE		6		6	2	6		
YELLOW		4.5		4	4.5	4.5		
RED CLEAR		1.5		2.5	1.5	1.5		
WALK				7		7		
PED CLEAR				18		20		
MAX 1		45		45	25	45		
MAX 2		45		45	15	45		
RECALL								



PHASING SEQUENCE

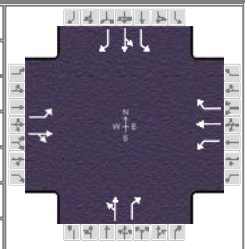


Date:	Initial:	Comment:
4/10/2015	JWS	Increase passage from 4 to 6 seconds for phases 2 and 6, Increased delay for phase 4 from 0 to 6 seconds.
2/11/2016	JWS	Increased MAX for Phases 2 & 6 from 45 to 60 seconds
Fall 2016	Prog	Returned phase times to original (WBRT lane completed)
1/12/2017	JWS	Increased phase 4 (SB) MAX from 25 to 45 seconds

Attachment 5
Intersection Worksheets – Existing AM/PM Peaks

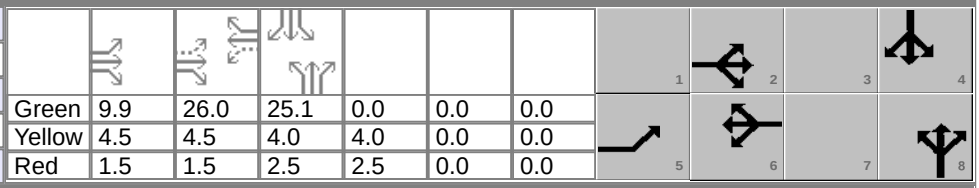
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	3/24/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Existing AM Peak	PHF	0.92
Urban Street	Hardin Valley Road	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	Hardin Valley at Steele…	File Name	Existing AM Peak.xus		
Project Description	548.001 - Steele Road Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	207	531	0	0	261	238	0	0	0	487	0	194

Signal Information			
Cycle, s	79.5	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	9.9	26.0	25.1	0.0	0.0	0.0
Yellow	4.5	4.5	4.0	4.0	0.0	0.0
Red	1.5	1.5	2.5	2.5	0.0	0.0

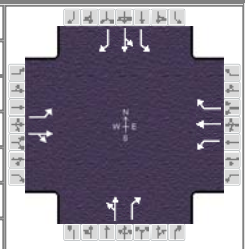
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		11.0		9.0
Phase Duration, s	15.9	47.9		32.0		0.0		31.6
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	1.1	1.0		1.0		0.0		1.1
Queue Clearance Time (g_s), s	8.0	18.8		12.4				25.0
Green Extension Time (g_e), s	0.0	0.1		0.1		0.0		0.1
Phase Call Probability	0.99	1.00		1.00				1.00
Max Out Probability	0.00	0.00		0.00				0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	225	0		0	284	259		0	0	529	0	211
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	0		836	1870	1585		0	1585	1781	1870	1585
Queue Service Time (g_s), s	6.0	0.0		0.0	9.6	10.4		0.0	0.0	23.0	0.0	8.4
Cycle Queue Clearance Time (g_c), s	6.0	0.0		0.0	9.6	10.4		0.0	0.0	23.0	0.0	8.4
Green Ratio (*g/C*)	0.48			0.33	0.33	0.33			0.00	0.32	0.32	0.32
Capacity (*c*), veh/h	538			91	611	518			2	562	590	500
Volume-to-Capacity Ratio (*X*)	0.418	0.000		0.000	0.464	0.499		0.000	0.000	0.941	0.000	0.421
Back of Queue (*Q*), ft/ln (95 th percentile)	97.9	0		0	177.8	164.8		0	0	376.5	0	132.3
Back of Queue (*Q*), veh/ln (95 th percentile)	3.9	0.0		0.0	7.0	6.5		0.0	0.0	14.8	0.0	5.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.78	0.00		0.00	0.00	0.25		0.00	0.00	0.00	0.00	0.53
Uniform Delay (d_1), s/veh	13.5			0.0	21.2	21.5			0.0	26.5	0.0	21.5
Incremental Delay (d_2), s/veh	0.2	0.0		0.0	0.2	0.3		0.0	0.0	5.4	0.0	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	13.7			0.0	21.5	21.8			0.0	31.9	0.0	21.7
Level of Service (LOS)	B				C	C				C		C
Approach Delay, s/veh / LOS	13.4	B		21.6	C		0.0			29.0	C	
Intersection Delay, s/veh / LOS	21.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.4	B	2.5	B	2.3	B
Bicycle LOS Score / LOS	1.8	B	1.4	A	0.5	A	1.7	B

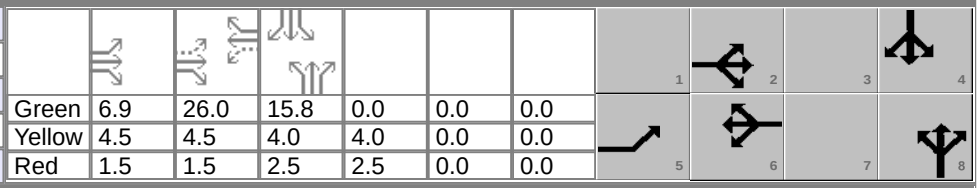
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	3/24/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Existing PM Peak	PHF	0.96
Urban Street	Hardin Valley Road	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	Hardin Valley at Steele…	File Name	Existing PM Peak.xus		
Project Description	548.001 - Steele Road Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	60	469	0	0	497	190	0	0	0	164	0	73

Signal Information			
Cycle, s	67.2	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.9	26.0	15.8	0.0	0.0	0.0						
Yellow	4.5	4.5	4.0	4.0	0.0	0.0						
Red	1.5	1.5	2.5	2.5	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		11.0		9.0
Phase Duration, s	12.9	44.9		32.0		0.0		22.3
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	1.1	1.0		1.0		0.0		1.1
Queue Clearance Time (g_s), s	3.2	12.0		17.8				7.5
Green Extension Time (g_e), s	0.0	0.0		0.0		0.0		0.0
Phase Call Probability	0.69	1.00		1.00				0.99
Max Out Probability	0.00	0.00		0.00				0.00

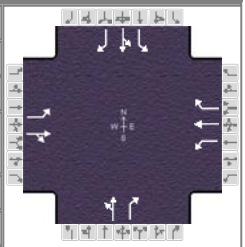
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	63	0		0	518	198		0	0	171	0	76
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	0		908	1870	1585		0	1585	1781	1870	1585
Queue Service Time (g_s), s	1.2	0.0		0.0	15.8	5.9		0.0	0.0	5.5	0.0	2.6
Cycle Queue Clearance Time (g_c), s	1.2	0.0		0.0	15.8	5.9		0.0	0.0	5.5	0.0	2.6
Green Ratio (*g/C*)	0.52			0.39	0.39	0.39			0.00	0.24	0.24	0.24
Capacity (*c*), veh/h	424			107	723	613			2	420	441	373
Volume-to-Capacity Ratio (*X*)	0.148	0.000		0.000	0.716	0.323		0.000	0.000	0.407	0.000	0.204
Back of Queue (*Q*), ft/ln (95 th percentile)	16.9	0		0	251.4	84.6		0	0	95.6	0	40.3
Back of Queue (*Q*), veh/ln (95 th percentile)	0.7	0.0		0.0	9.9	3.3		0.0	0.0	3.8	0.0	1.6
Queue Storage Ratio (*RQ*) (95 th percentile)	0.14	0.00		0.00	0.00	0.13		0.00	0.00	0.00	0.00	0.16
Uniform Delay (d_1), s/veh	10.6			0.0	17.5	14.5			0.0	21.7	0.0	20.6
Incremental Delay (d_2), s/veh	0.1	0.0		0.0	0.5	0.1		0.0	0.0	0.2	0.0	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	10.7			0.0	18.0	14.6			0.0	22.0	0.0	20.7
Level of Service (LOS)	B				B	B				C		C
Approach Delay, s/veh / LOS	8.5	A		17.0	B		0.0			21.6	C	
Intersection Delay, s/veh / LOS	14.7						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.4	B	2.5	B	2.3	B
Bicycle LOS Score / LOS	1.4	A	1.7	B	0.5	A	0.9	A

Attachment 6
Intersection Worksheets – Background AM/PM Peaks

HCS7 Signalized Intersection Results Summary

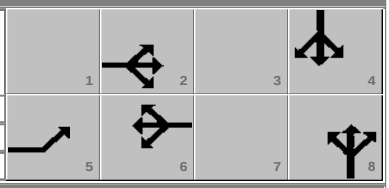
General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	3/24/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Background AM Peak	PHF	0.92
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley at Steele…	File Name	Background AM Peak.xus		
Project Description	548.001 - Steele Road Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	233	597	0	0	294	268	0	0	0	548	0	218

Signal Information			
Cycle, s	84.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	10.0	26.0	29.5	0.0	0.0	0.0
Yellow	4.5	4.5	4.0	4.0	0.0	0.0
Red	1.5	1.5	2.5	2.5	0.0	0.0



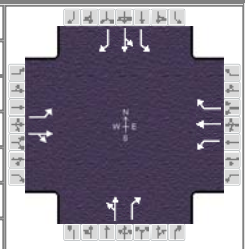
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		11.0		9.0
Phase Duration, s	16.0	48.0		32.0		0.0		36.0
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	1.1	1.0		1.0		0.0		1.1
Queue Clearance Time (g_s), s	9.6	24.3		15.1				29.4
Green Extension Time (g_e), s	0.0	0.1		0.1		0.0		0.1
Phase Call Probability	1.00	1.00		1.00				1.00
Max Out Probability	0.00	0.00		0.00				0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	253	0		0	320	291		0	0	596	0	237
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	0		782	1870	1585		0	1585	1781	1870	1585
Queue Service Time (g_s), s	7.6	0.0		0.0	12.0	13.1		0.0	0.0	27.4	0.0	9.6
Cycle Queue Clearance Time (g_c), s	7.6	0.0		0.0	12.0	13.1		0.0	0.0	27.4	0.0	9.6
Green Ratio (*g/C*)	0.45			0.31	0.31	0.31			0.00	0.35	0.35	0.35
Capacity (*c*), veh/h	473			86	579	490			2	626	657	557
Volume-to-Capacity Ratio (*X*)	0.535	0.000		0.000	0.552	0.594		0.000	0.000	0.951	0.000	0.425
Back of Queue (*Q*), ft/ln (95 th percentile)	129.5	0		0	219	206.7		0	0	465.6	0	151.4
Back of Queue (*Q*), veh/ln (95 th percentile)	5.1	0.0		0.0	8.6	8.1		0.0	0.0	18.3	0.0	6.0
Queue Storage Ratio (*RQ*) (95 th percentile)	1.04	0.00		0.00	0.00	0.32		0.00	0.00	0.00	0.00	0.61
Uniform Delay (d_1), s/veh	16.3			0.0	24.2	24.5			0.0	26.6	0.0	20.8
Incremental Delay (d_2), s/veh	0.4	0.0		0.0	0.3	0.4		0.0	0.0	11.4	0.0	0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	16.6			0.0	24.5	25.0			0.0	38.0	0.0	21.0
Level of Service (LOS)	B				C	C				D		C
Approach Delay, s/veh / LOS	17.3	B		24.7	C		0.0			33.1	C	
Intersection Delay, s/veh / LOS	24.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.4	B	2.5	B	2.3	B
Bicycle LOS Score / LOS	2.0	B	1.5	A	0.5	A	1.9	B

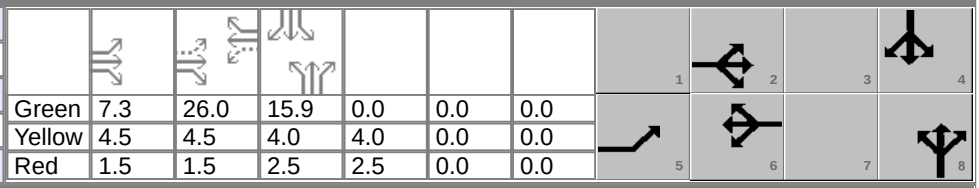
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	3/24/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Existing PM Peak	PHF	0.96
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley at Steele…	File Name	Background PM Peak.xus		
Project Description	548.001 - Steele Road Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	67	528	0	0	559	214	0	0	0	184	0	82

Signal Information			
Cycle, s	67.7	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.3	26.0	15.9	0.0	0.0	0.0
Yellow	4.5	4.5	4.0	4.0	0.0	0.0
Red	1.5	1.5	2.5	2.5	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		11.0		9.0
Phase Duration, s	13.3	45.3		32.0		0.0		22.4
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	1.1	1.0		1.0		0.0		1.1
Queue Clearance Time (g_s), s	3.3	13.8		20.9				8.2
Green Extension Time (g_e), s	0.0	0.1		0.1		0.0		0.0
Phase Call Probability	0.73	1.00		1.00				0.99
Max Out Probability	0.00	0.00		0.00				0.00

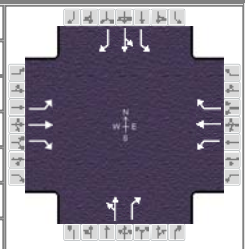
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	70	0		0	582	223		0	0	192	0	85
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	0		858	1870	1585		0	1585	1781	1870	1585
Queue Service Time (g_s), s	1.3	0.0		0.0	18.9	6.8		0.0	0.0	6.2	0.0	3.0
Cycle Queue Clearance Time (g_c), s	1.3	0.0		0.0	18.9	6.8		0.0	0.0	6.2	0.0	3.0
Green Ratio (*g/C*)	0.52			0.38	0.38	0.38			0.00	0.23	0.23	0.23
Capacity (*c*), veh/h	386			106	718	608			2	418	439	372
Volume-to-Capacity Ratio (*X*)	0.181	0.000		0.000	0.811	0.366		0.000	0.000	0.458	0.000	0.229
Back of Queue (*Q*), ft/ln (95 th percentile)	19.1	0		0	292.7	98.7		0	0	110.1	0	46
Back of Queue (*Q*), veh/ln (95 th percentile)	0.8	0.0		0.0	11.5	3.9		0.0	0.0	4.3	0.0	1.8
Queue Storage Ratio (*RQ*) (95 th percentile)	0.15	0.00		0.00	0.00	0.15		0.00	0.00	0.00	0.00	0.18
Uniform Delay (d_1), s/veh	11.6			0.0	18.7	15.0			0.0	22.2	0.0	21.0
Incremental Delay (d_2), s/veh	0.1	0.0		0.0	0.9	0.1		0.0	0.0	0.3	0.0	0.1
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	11.7			0.0	19.5	15.1			0.0	22.5	0.0	21.1
Level of Service (LOS)	B				B	B				C		C
Approach Delay, s/veh / LOS	8.9	A		18.3	B		0.0			22.1	C	
Intersection Delay, s/veh / LOS	15.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.4	B	2.5	B	2.3	B
Bicycle LOS Score / LOS	1.5	B	1.8	B	0.5	A	0.9	A

Attachment 7
Intersection Worksheets – Full Buildout AM/PM Peaks

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	4/29/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Buildout AM Peak	PHF	0.90
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley Road at St…	File Name	Buildout AM Peak_split.xus		
Project Description	548.001 Steele Landing Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	233	597	4	6	294	268	15	4	19	548	1	218

Signal Information			
Cycle, s	120.1	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

							1	2	3	4	
Green	14.8	30.3	43.9	6.0	0.0	0.0	5	6	7	8	
Yellow	4.5	4.5	4.0	4.0	0.0	0.0					
Red	1.5	1.5	2.5	2.5	0.0	0.0					

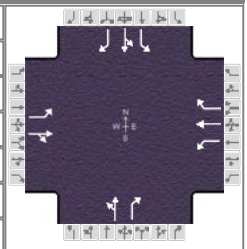
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	3.0		5.3		11.0		9.0
Phase Duration, s	20.8	57.1		36.3		12.5		50.4
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	3.1	7.1		7.1		7.2		7.2
Queue Clearance Time (g_s), s	14.4	39.9		22.8		3.5		41.6
Green Extension Time (g_e), s	0.4	4.2		7.0		0.2		2.4
Phase Call Probability	1.00	1.00		1.00		0.76		1.00
Max Out Probability	0.00	1.00		0.65		0.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	259	663	4	7	327	298		21	21	609	1	242
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1870	1585	772	1870	1585		1799	1585	1781	1870	1585
Queue Service Time (g_s), s	12.4	37.9	0.2	0.9	19.0	20.8		1.4	1.5	39.6	0.0	13.7
Cycle Queue Clearance Time (g_c), s	12.4	37.9	0.2	18.1	19.0	20.8		1.4	1.5	39.6	0.0	13.7
Green Ratio (*g/C*)	0.39	0.43	0.43	0.25	0.25	0.25		0.05	0.05	0.37	0.37	0.37
Capacity (*c*), veh/h	378	796	675	145	472	400		91	80	652	684	580
Volume-to-Capacity Ratio (*X*)	0.684	0.833	0.007	0.046	0.692	0.744		0.233	0.264	0.934	0.002	0.418
Back of Queue (*Q*), ft/ln (95 th percentile)	229.5	651.8	3.4	9	369.1	355.3		33.3	34.3	713.4	0.9	235.3
Back of Queue (*Q*), veh/ln (95 th percentile)	9.0	25.7	0.1	0.4	14.5	14.0		1.3	1.3	28.1	0.0	9.3
Queue Storage Ratio (*RQ*) (95 th percentile)	1.84	0.00	0.00	0.00	0.00	0.55		0.00	0.41	0.00	0.00	0.94
Uniform Delay (d_1), s/veh	28.4	30.7	19.9	48.0	40.7	41.3		54.8	54.9	36.7	24.2	28.5
Incremental Delay (d_2), s/veh	0.8	9.3	0.0	0.5	6.4	9.5		4.7	6.3	21.8	0.0	1.7
Initial Queue Delay (d_3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	29.2	40.0	19.9	48.5	47.1	50.8		59.5	61.2	58.5	24.2	30.3
Level of Service (LOS)	C	D	B	D	D	D		E	E	E	C	C
Approach Delay, s/veh / LOS	36.9	D		48.9	D		60.3	E		50.4	D	
Intersection Delay, s/veh / LOS	45.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.5	B	2.5	B	2.5	B
Bicycle LOS Score / LOS	2.0	B	1.5	B	0.6	A	1.9	B

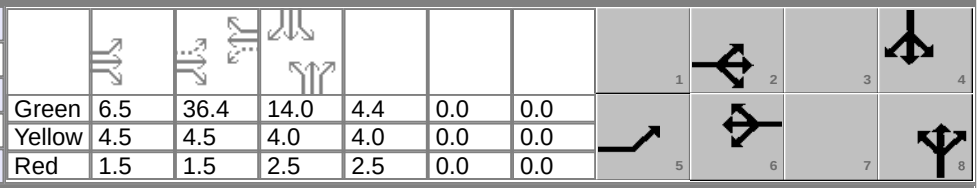
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	3/24/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Buildout PM Peak	PHF	0.96
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley at Steele…	File Name	Buildout PM Peak_split.xus		
Project Description	548.001 - Steele Road Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	67	528	10	25	559	214	8	3	21	184	4	82

Signal Information			
Cycle, s	86.2	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.5	36.4	14.0	4.4	0.0	0.0
Yellow	4.5	4.5	4.0	4.0	0.0	0.0
Red	1.5	1.5	2.5	2.5	0.0	0.0

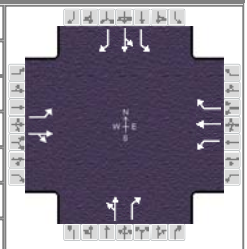
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		11.0		9.0
Phase Duration, s	12.5	54.9		42.4		10.9		20.5
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	3.1	7.1		7.1		7.2		7.1
Queue Clearance Time (g_s), s	3.7	18.1		24.6		3.1		10.7
Green Extension Time (g_e), s	0.1	17.7		11.4		0.2		3.3
Phase Call Probability	0.81	1.00		1.00		0.55		1.00
Max Out Probability	0.00	0.62		0.72		0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	70	560		26	582	223		11	22	192	4	85
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1864		849	1870	1585		1805	1585	1781	1870	1585
Queue Service Time (g_s), s	1.7	16.1		1.7	22.6	8.2		0.5	1.1	8.7	0.2	4.1
Cycle Queue Clearance Time (g_c), s	1.7	16.1		5.3	22.6	8.2		0.5	1.1	8.7	0.2	4.1
Green Ratio (*g/C*)	0.52	0.57		0.42	0.42	0.42		0.05	0.05	0.16	0.16	0.16
Capacity (*c*), veh/h	351	1056		406	788	668		92	81	289	303	257
Volume-to-Capacity Ratio (*X*)	0.199	0.531		0.064	0.739	0.334		0.124	0.270	0.664	0.014	0.332
Back of Queue (*Q*), ft/ln (95 th percentile)	27.4	257.6		15.4	386.6	134		12.8	26.2	196.4	3.4	78
Back of Queue (*Q*), veh/ln (95 th percentile)	1.1	10.1		0.6	15.2	5.3		0.5	1.0	7.7	0.1	3.1
Queue Storage Ratio (*RQ*) (95 th percentile)	0.22	0.00		0.00	0.00	0.21		0.00	0.31	0.00	0.00	0.31
Uniform Delay (d_1), s/veh	14.2	11.6		17.1	21.0	16.8		39.1	39.4	33.9	30.3	32.0
Incremental Delay (d_2), s/veh	0.1	1.5		0.2	5.1	1.1		2.2	6.3	9.1	0.1	2.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	14.3	13.1		17.3	26.1	17.9		41.2	45.7	43.1	30.4	34.7
Level of Service (LOS)	B	B		B	C	B		D	D	D	C	C
Approach Delay, s/veh / LOS	13.2	B		23.6	C		44.2	D		40.3	D	
Intersection Delay, s/veh / LOS	23.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.4	B	2.5	B	2.3	B
Bicycle LOS Score / LOS	1.5	B	1.9	B	0.5	A	1.0	A

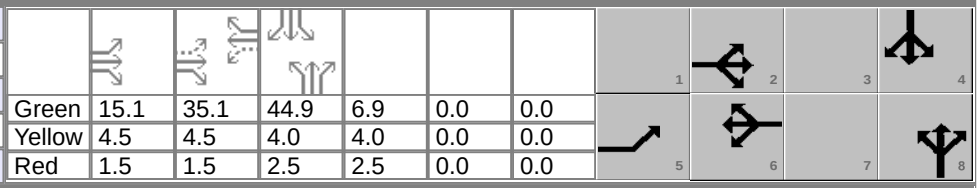
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	3/24/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Buildout AM Peak	PHF	0.90
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley at Steele…	File Name	Commercial AM Peak.xus		
Project Description	548.001 - Steele Road Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	233	597	29	37	294	268	20	5	25	548	7	218

Signal Information			
Cycle, s	127.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	15.1	35.1	44.9	6.9	0.0	0.0		
Yellow	4.5	4.5	4.0	4.0	0.0	0.0		
Red	1.5	1.5	2.5	2.5	0.0	0.0		

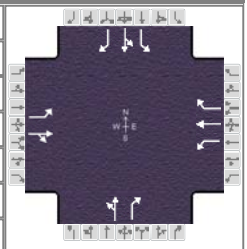
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		11.0		9.0
Phase Duration, s	21.1	62.2		41.1		13.4		51.4
Change Period, (*Y+R c*), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	3.1	7.1		7.1		7.2		7.1
Queue Clearance Time (*g s*), s	14.7	44.5		29.9		4.1		44.6
Green Extension Time (*g e*), s	0.3	0.5		5.2		0.4		0.3
Phase Call Probability	1.00	1.00		1.00		0.86		1.00
Max Out Probability	0.00	1.00		0.82		0.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	259	696		41	327	298		28	28	609	8	242
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1855		749	1870	1585		1798	1585	1781	1870	1585
Queue Service Time (*g s*), s	12.7	42.5		6.6	19.4	21.3		1.9	2.1	42.6	0.3	14.8
Cycle Queue Clearance Time (*g c*), s	12.7	42.5		27.9	19.4	21.3		1.9	2.1	42.6	0.3	14.8
Green Ratio (*g/C*)	0.41	0.44		0.28	0.28	0.28		0.05	0.05	0.35	0.35	0.35
Capacity (*c*), veh/h	398	821		138	517	438		97	86	630	662	561
Volume-to-Capacity Ratio (*X*)	0.650	0.848		0.299	0.632	0.680		0.285	0.323	0.966	0.012	0.432
Back of Queue (*Q*), ft/ln (95 th percentile)	232.1	707.1		63.4	367.7	351.6		45.7	47.2	782.2	7.2	249.6
Back of Queue (*Q*), veh/ln (95 th percentile)	9.1	27.8		2.5	14.5	13.8		1.8	1.9	30.8	0.3	9.8
Queue Storage Ratio (*RQ*) (95 th percentile)	1.86	0.00		0.00	0.00	0.54		0.00	0.56	0.00	0.00	1.00
Uniform Delay (*d 1*), s/veh	28.2	31.6		53.4	40.3	40.9		57.7	57.8	40.3	26.6	31.3
Incremental Delay (*d 2*), s/veh	0.7	10.0		4.3	4.6	6.7		5.7	7.7	28.2	0.0	1.9
Initial Queue Delay (*d 3*), s/veh	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	28.8	41.5		57.7	44.8	47.6		63.4	65.5	68.5	26.6	33.2
Level of Service (LOS)	C	D		E	D	D		E	E	E	C	C
Approach Delay, s/veh / LOS	38.1	D		46.9	D		64.4	E		58.1	E	
Intersection Delay, s/veh / LOS	47.8						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.5	B	2.5	B	2.3	B
Bicycle LOS Score / LOS	2.1	B	1.6	B	0.6	A	1.9	B

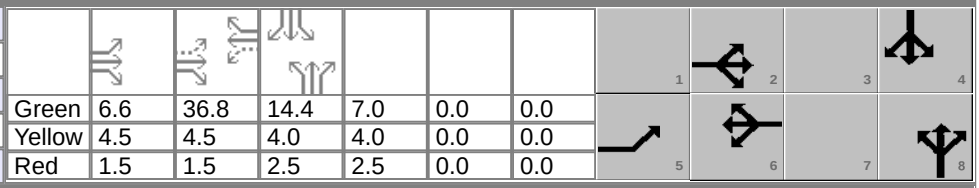
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	3/24/2019	Area Type	Other
Jurisdiction	Knox County	Time Period	Buildout PM Peak	PHF	0.96
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley at Steele…	File Name	Commercial PM Peak.xus		
Project Description	548.001 - Steele Road Subdivision				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	67	528	13	34	559	214	20	8	52	184	5	82

Signal Information			
Cycle, s	89.7	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	Yes	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	6.6	36.8	14.4	7.0	0.0	0.0
Yellow	4.5	4.5	4.0	4.0	0.0	0.0
Red	1.5	1.5	2.5	2.5	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		5.3		11.0		9.0
Phase Duration, s	12.6	55.4		42.8		13.5		20.9
Change Period, ($Y+R_c$), s	6.0	6.0		6.0		6.5		6.5
Max Allow Headway (*MAH*), s	3.1	7.1		7.1		7.2		7.1
Queue Clearance Time (g_s), s	3.8	19.5		25.9		4.9		11.1
Green Extension Time (g_e), s	0.1	17.1		10.4		0.6		3.3
Phase Call Probability	0.82	1.00		1.00		0.87		1.00
Max Out Probability	0.00	0.65		0.75		0.00		0.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	70	564		35	582	223		29	54	192	5	85
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1781	1862		847	1870	1585		1806	1585	1781	1870	1585
Queue Service Time (g_s), s	1.8	17.5		2.5	23.9	8.7		1.4	2.9	9.1	0.2	4.3
Cycle Queue Clearance Time (g_c), s	1.8	17.5		7.5	23.9	8.7		1.4	2.9	9.1	0.2	4.3
Green Ratio (*g/C*)	0.51	0.55		0.41	0.41	0.41		0.08	0.08	0.16	0.16	0.16
Capacity (*c*), veh/h	330	1025		381	766	649		141	124	285	299	254
Volume-to-Capacity Ratio (*X*)	0.212	0.550		0.093	0.760	0.343		0.207	0.438	0.672	0.017	0.337
Back of Queue (*Q*), ft/ln (95 th percentile)	30.3	282.9		23.4	413.3	144.1		31.3	63.9	203.8	4.5	81.6
Back of Queue (*Q*), veh/ln (95 th percentile)	1.2	11.1		0.9	16.3	5.7		1.2	2.5	8.0	0.2	3.2
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24	0.00		0.00	0.00	0.22		0.00	0.76	0.00	0.00	0.33
Uniform Delay (d_1), s/veh	15.5	13.0		19.5	22.7	18.2		38.8	39.5	35.5	31.7	33.5
Incremental Delay (d_2), s/veh	0.1	1.7		0.4	5.9	1.1		2.6	8.6	9.6	0.1	2.8
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh	15.6	14.7		19.9	28.6	19.3		41.4	48.1	45.0	31.8	36.3
Level of Service (LOS)	B	B		B	C	B		D	D	D	C	D
Approach Delay, s/veh / LOS	14.8	B		25.8	C		45.7	D		42.1	D	
Intersection Delay, s/veh / LOS	25.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.2	B	2.4	B	2.5	B	2.3	B
Bicycle LOS Score / LOS	1.5	B	1.9	B	0.6	A	1.0	A

Attachment 8
Turn Lane Warrant Analysis

Project: Steele Landing Subdivision

Intersection: Hardin Valley Road at Steele Road

Steel Landing Subdivision

Hardin Valley Road VOLUMES
at Steele Road

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	597	4	25	NO
PM	528	10	50	NO

Commercial Development

Hardin Valley Road VOLUMES
at Steele Road

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	597	29	25	YES
PM	528	13	50	NO

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						
100 - 149 150 - 199						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

PM Peak 10 RT

AM Peak 4 RT

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

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						
100 - 149 150 - 199						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

PM Peak 13 RT

AM Peak 29 RT

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

Date: May 1, 2019

Project Name: Steele Landing Subdivision

To: Knox County Engineering and Knoxville-Knox County Planning

Subject: TIS Comment Response Document for the Steele Landing Subdivision Comments Dated April 17, 2019.

Dear City of Knoxville Staff,

The following comment response document is submitted to address comments dated April 17, 2019:

1. **Reviewer Comment:** On page 1, correct the name of Table 4-1 in the Table of Contents to "… Trip Generation Summary," not "…Trip Generation Study."

   Response: Revised wording to "Trip Generation Summary"

2. **Reviewer Comment:** Throughout the document, please change "Knoxville Regional Metropolitan Planning Commission" & "Knoxville-Knox County Metropolitan Planning Commission" to "Knoxville-Knox County Planning Commission." This is our new organization name as of December 2018.

   Response: Changed to "Knoxville-Knox County Planning Commission"

3. **Reviewer Comment:** On page 3 first paragraph, mention the current number of proposed houses, not the previous number. Please remove all indications of the previous approval since this is not relevant with the new proposal. Also, modify this reference on page 4.

   Response: Removed the previous approval numbers and replaced with the proposed 91 Townhome Units.

   a. **Reviewer Comment:** The Executive Summary probably only needs one internal heading, Hardin Valley Road @ Steele Road. The "Proposed Driveway Connection" does not need to be a heading, since this is being looked at as an overall development and not a driveway connection. Also, modify this on page 19.

      Response: Removed "Proposed Driveway Connection" from the report.

b. **Reviewer Comment:** In the last paragraph, please mention that the PRZ varies by grade-level. Elementary schools have a requirement of one (1) mile from a school, but Middle/Intermediate/High Schools have a requirement of one and a half (1.5) miles from a school. This development meets the one (1) and one and a half (1.5) mile requirement. Also, modify this reference on page 4 and 19.

Response: Revised PRZ to include middle/high school requirement.

4. **Reviewer Comment:** On page 7, please mention the sidewalk infrastructure on Steele Road in paragraph 5 and how this assists parents and students with walking to school.

   Response: Revised Paragraph 5 to include Steele Road sidewalk and added the following statement to page 7. "Parents and students will be able to utilize the existing sidewalks and crosswalks to walk to Hardin Valley Elementary School, Hardin Valley Middle School and Hardin Valley Academy from the proposed subdivision."

5. **Reviewer Comment:** On page 8 last paragraph, please change "count locations are" to "count location is." There is only one count location that was performed.

   Response: Revised to "count location is".

6. **Reviewer Comment:** On page 10 last paragraph, please add what buildout year the background growth rate is for.

   Response: Revised to "For the purpose of this study, an annual growth rate of 4.0% was assumed for traffic at the intersection of Hardin Valley Road at Steele Road until full occupancy is reached in 2021."

7. **Reviewer Comment:** In Table 4-1, add all commercial development that is attached or connected to the main road into the development. In talking with Knox County Engineering one of the proposed commercial developments has come to them for review. With that commercial development looking for a permit and this residential subdivision looking for approval from Planning Commission, we are needing an idea of what (if any) improvements will be needed as the commercial pieces come in for permits. Recommendations for any access improvements due to the commercial buildings can be made separately in the Conclusions and Recommendations of this study.

   Response: I assumed a 28,500 SF office building and a 7,000 SF restaurant for the Future Commercial development and included those in to the trip generation summary.

a. **Reviewer Comment:** Update the table using the Local Apartment Rate for this residential use.

Response: Revised the trip generation summary using the Local Apartment Rate.

8. **Reviewer Comment:** For each of the Peak Hour Trip Distribution Figures 5 & 6 (AM & PM), we would like to recommend using the same percentages exiting and entering the development. For example, in Figure 5 the NB right-turn and WB left-turn can be the same percentage. Since the traffic distribution for this subdivision is not based upon a particular near-by subdivision, we would advise to use the same percentage in this regard.

   Response: Updated Figures 5 & 6 so that the entering/exiting percentages would be the same.

9. **Reviewer Comment:** Under Projected Capacity and Level of Service (pg 17), please add a paragraph discussing any required signal modifications needed.

   Response: Added "The existing signal for the intersection of Hardin Valley Road at Steele Road will be modified to accommodate the addition of the northbound movement from the Steele Landing Subdivision."

   a. **Reviewer Comment:** In Table 5-1, correct the Background year to 2021.

      Response: Corrected year to 2021.

   b. **Reviewer Comment:** Ensure that the analysis for the intersection of Hardin Valley Road @ Steele Road (Full Buildout 2021) reflects a split phase due to the lane modifications for the north and southbound movements.

      Response: Split phasing was used for the northbound and southbound approaches for the Full Buildout AM/PM peak hours and the Commercial AM/PM peak hours. Table 5-1 and Attachment 7 were updated to reflect the changes.

10. **Reviewer Comment:** Under Turn Lane Warrant Analysis (pg 18), please make a statement that the westbound left-turn lane is existing, and therefore, there is no need to analyze this turn lane warrant.

    Response: Added the following to page 18. "There is an existing westbound left turn lane at the intersection of Hardin Valley Road at Steele Road; therefore a left turn lane warrant was not analyzed."

11. **Reviewer Comment:** In the Conclusions and Recommendations (pg 18) fourth paragraph, the study mentioned a 95% queue length for the eastbound left-turn lane

in the full buildout AM peak hour as being 9 vehicles. That same paragraph mentioned the storage capability for that movement being 125 ft (approximately 5 vehicles). What is the mitigation proposed for this movement since this development analysis shows a need for more storage?

Response: "The eastbound left turn queue of 9.0 vehicles during the AM peak hour and 1.1 vehicles during the PM peak hour is not expected to block the existing Food City driveway entrance, which is located 225 feet from the intersection of Hardin Valley Road at Steele Road."

Additional Comments dated April 29, 2019:

1. **Reviewer Comment:** On Attachment 2 the horizontal access needs to correlate with the year.

   Response: Revised Attachment 2.

2. **Reviewer Comment:** On Attachment 5 for the Existing AM Peak hour traffic the westbound thru and westbound right numbers were reversed.

   Response: Revised Attachment 5. There was no change in the overall delay of the intersection.

3. **Reviewer Comment:** The engineer should add a statement that the need for a turn lane will be mitigated with the design (by others) for the commercial property also being served by this access.

   Response: Added this statement to page 23.

Sincerely,

Addie Kirkham, P.E.