COWARD MILL SUBDIVISION

Traffic Impact Study
Coward Mill Road
Knoxville, TN

A Traffic Impact Study for the Proposed Coward Mill Subdivision

Submitted to

Knoxville – Knox County Metropolitan Planning Commission

Revised March 21, 2018
Revised February 26, 2018
January 29, 2018
FMA Project No. 548.004

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

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

Executive Summary

Hardin Valley Land Partners is proposing a residential development with single family homes in Knox County. The project is located between Coward Mill Road and Faith Promise Lane east of Pellissippi Parkway. The development will consist of 118 single family homes. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2021.

This project will be completed in two phases. Phase 1 shows a single temporary connection, Access Road #1 to Coward Mill Road. Phase 1 is expected to start in 2018 and be completed in 2019 and will include the construction of 35 single family lots. Construction of the Cherahala Boulevard extension will start in circa April 2019 and is projected to be substantially complete by April 2020. At this time Access Road #2 will be built as a connection to the proposed Cherahala Boulevard extension. Phase 2 will include the full buildout of the subdivision with an anticipated completion in 2021.

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

Coward Mill Road @ Temporary Access Road #1

At the intersection of Coward Mill Road at Access Road #1, the overall intersection operates at a LOS A during the AM peak hour and a LOS A during the PM peak hour after the completion of both the Phase 1 and Phase 2 of the Coward Mill Subdivision.

Once the Cherahala Boulevard extension is substantially complete, this intersection will be removed.

Coward Mill Road @ Pellissippi Parkway

The TDOT improvements to the intersection of Coward Mill Road at Pellissippi Parkway will restrict the traffic turning from Coward Mill road onto Pellissippi Parkway to right turns only. The background traffic volumes for the westbound approach will operate at a LOS E (48.2 sec) during the AM peak hour and a LOS D (31.5 sec) during the PM peak hour.

After the completion of the Phase 1 of the Coward Mill Subdivision the westbound approach of the intersection of Coward Mill Road at Pellissippi Parkway is expected to operate at a LOS F (56.5 sec) during the AM peak hour and a LOS D (33.6 sec) during the PM peak hour.

Coward Mill Road

The width of Coward Mill Road between the intersection of Pellissippi Parkway and temporary Access Road #1 varies between 17 feet to 22 feet. Knox County policy states that access to new developments need to have a pavement width of at least 20 feet. Roadway improvements on Coward Mill Road will not be required due to the rural road status of Coward Mill Road and the maximum of 35 single family lots that will be built in Phase 1 of the Coward Mill Subdivision.

Cherahala Boulevard Extension @ Access Road #2

At the intersection of Cherahala Boulevard at Access Road #2, the northbound approach operates at a LOS B during both the AM and PM peak hours after the completion of the Phase 2 of the Coward Mill Subdivision including the full build-out of 118 single family lots.

Based on current conditions neither a southbound right turn lane nor a northbound left turn lane is warranted at the intersection of Cherahala Boulevard at Access Road #2.

Cherahala Boulevard @ Hardin Valley Road

After the completion of Phase 2 of the Coward Mill Subdivision including the connection to Cherahala Boulevard the overall intersection will operate at a LOS F during both the AM and PM peak hours.

FMA recommends signal timing at the intersection of Cherahala Boulevard at Hardin Valley Road be updated as a part of the Cherahala Boulevard extension project due to the changing traffic patterns and increase in overall intersection delay.

1 Introduction

1.1 Project Description

This report provides a summary of a traffic impact study that was performed for the proposed Coward Mill Subdivision. The project is located between Coward Mill Road and Faith Promise Lane east of Pellissippi Parkway (SR 162) in Knox County. The location of the site is shown in Figure 1.

This proposed Coward Mill Subdivision will be completed in two phases. Phase 1 shows a single temporary driveway connection to Coward Mill Road. Phase 1 is expected to be completed by 2019 and will include the construction of 35 single family lots.

Construction of the Cherahala Boulevard extension will start in circa April 2019 and is projected to be substantially complete by April 2020. At this time Access Road #2 will be built as a connection to the proposed Cherahala Boulevard extension. Phase 2 will include the full buildout of the subdivision with an anticipated completion in 2021. 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 development of the proposed subdivision.

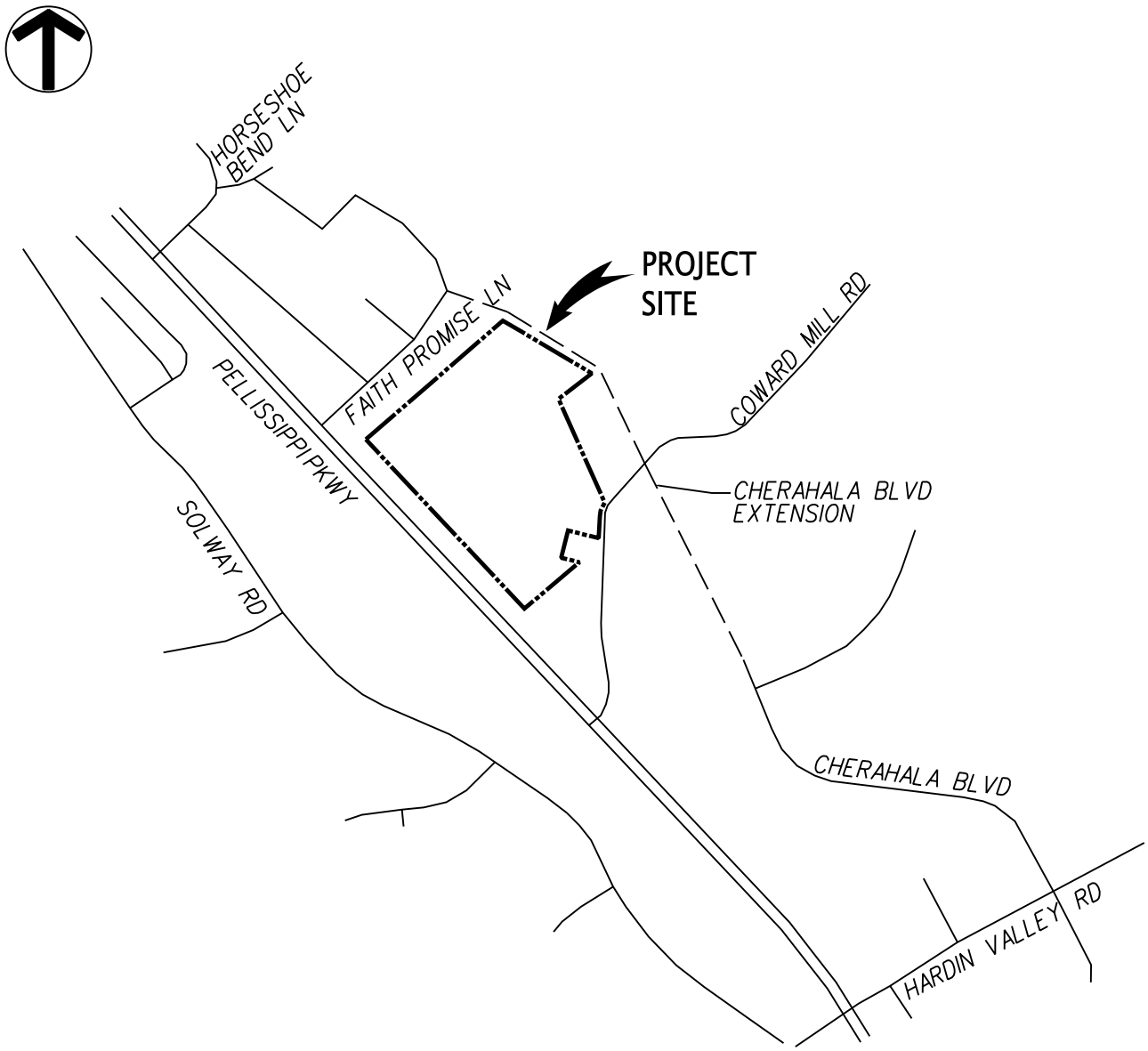


Figure 1: Location Map

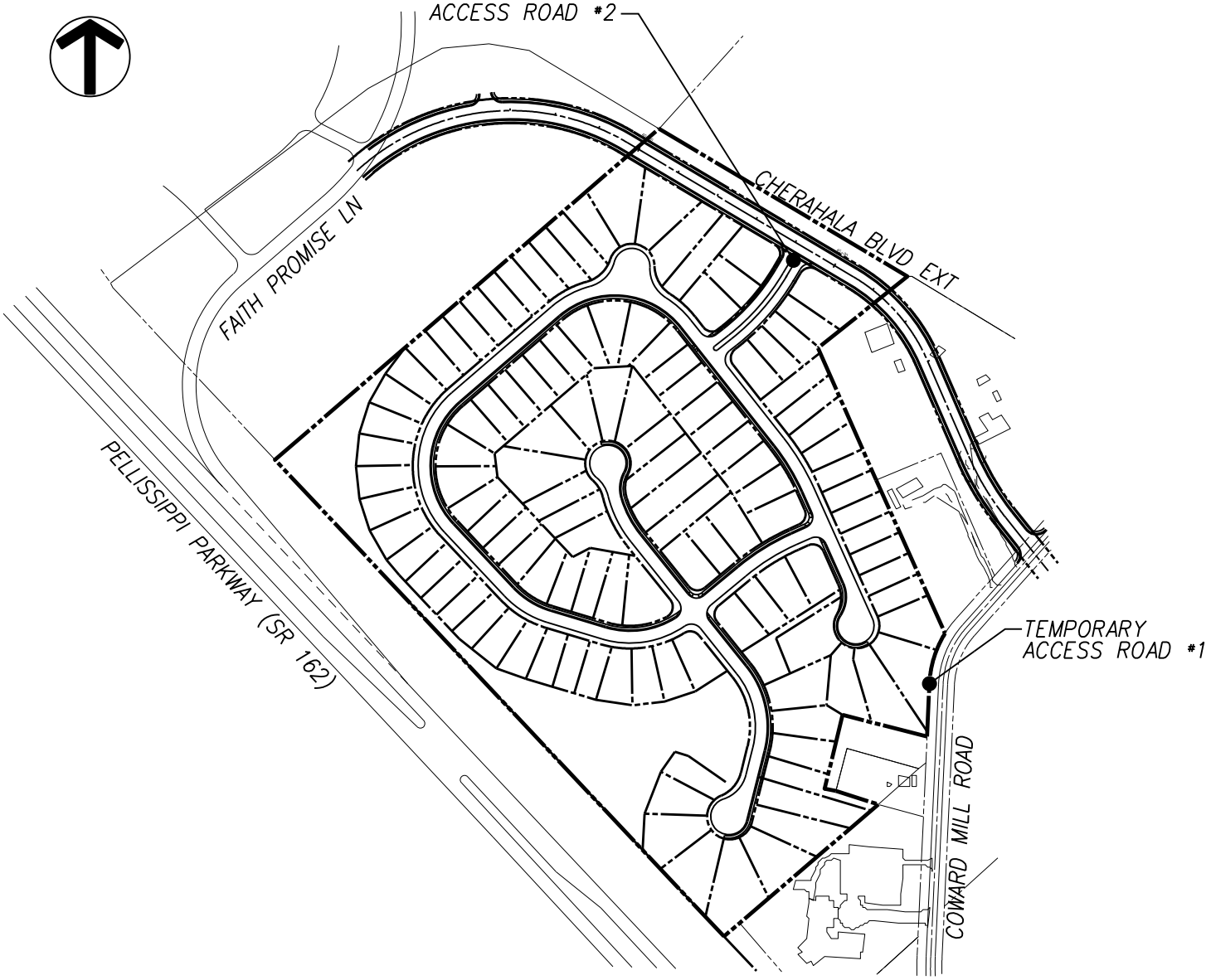


Figure 2: Site Plan

1.2 Existing Site Conditions

The proposed subdivision site access will have one permanent access road. A temporary Access Road #1 will be built during phase 1 and tie into Coward Mill Road. Prior to the start of Phase 2 the temporary Access Road #1 will be removed and Access Road #2 will be built to tie into the proposed Cherahala Boulevard roadway extension that is currently under design.

During a site visit it was determined that Pellissippi Parkway is a four-lane road with a 135 foot left turn lane and a grass median at the intersection with Coward Mill Road. The Knoxville-Knox County Metropolitan Planning Commission classifies Pellissippi Parkway as an expressway per the Major Road Plan. The posted speed limit on Pellissippi Parkway is 55 mph.

Coward Mill Road is a two-lane road and has a posted speed limit of 30 mph. The Knoxville-Knox County Metropolitan Planning Commission classifies Coward Mill Road as a minor collector per the Major Road Plan. The intersection sight distance at the temporary driveway connection to Coward Mill Road was measured at 635 feet east and 790 feet west of the intersection. The pavement width on Coward Mill Road between the temporary Access Road #1 and Pellissippi Parkway varies between 17 feet and 22 feet.

Hardin Valley Road is a four-lane road with a raised median at the intersection of Cherahala Boulevard. The Knoxville-Knox County Metropolitan Planning Commission classifies Hardin Valley Road as a minor arterial per the Major Road Plan. The posted speed limit on Hardin Valley Road is 45 mph.

Cherahala Boulevard at the intersection with Hardin Valley Road is a four-lane road with a 24 foot curbed median. Past the intersection Cherahala Boulevard is a three-lane road with a two-way left turn lane and the Cherahala Boulevard extension is shown as a two-lane road at the proposed intersection with Access Road #2. The Knoxville-Knox County Metropolitan Planning Commission does not currently list a classification for Cherahala Boulevard; therefore it is considered a local street. After the completion of the Cherahala Boulevard extension Cherahala Boulevard will be reclassified as a collector. The posted speed limit on Cherahala Boulevard is 30 mph.

2 Existing Traffic Volumes

FMA conducted a turning movement count at the intersection of Hardin Valley Road at Cherahala Boulevard and at the intersection of Coward Mill Road at Pellissippi Parkway (SR 162) on Wednesday January 24, 2018.

TDOT (Tennessee Department of Transportation) conducted a thru movement count on Pellissippi Parkway on January 26, 2017 at the TDOT count station #000083 North of George Light Road.

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

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 Cherahala Boulevard the AM peak hour occurred between 7:30 am and 8:30 am, and the PM peak hour occurred between 5:00 pm and 6:00 pm. At the intersection of Coward Mill Road at Pellissippi Parkway (SR 162) the AM peak hour occurred between 7:30 am and 8:30 am, and the PM peak hour occurred between 4:45 pm and 5:45 pm.

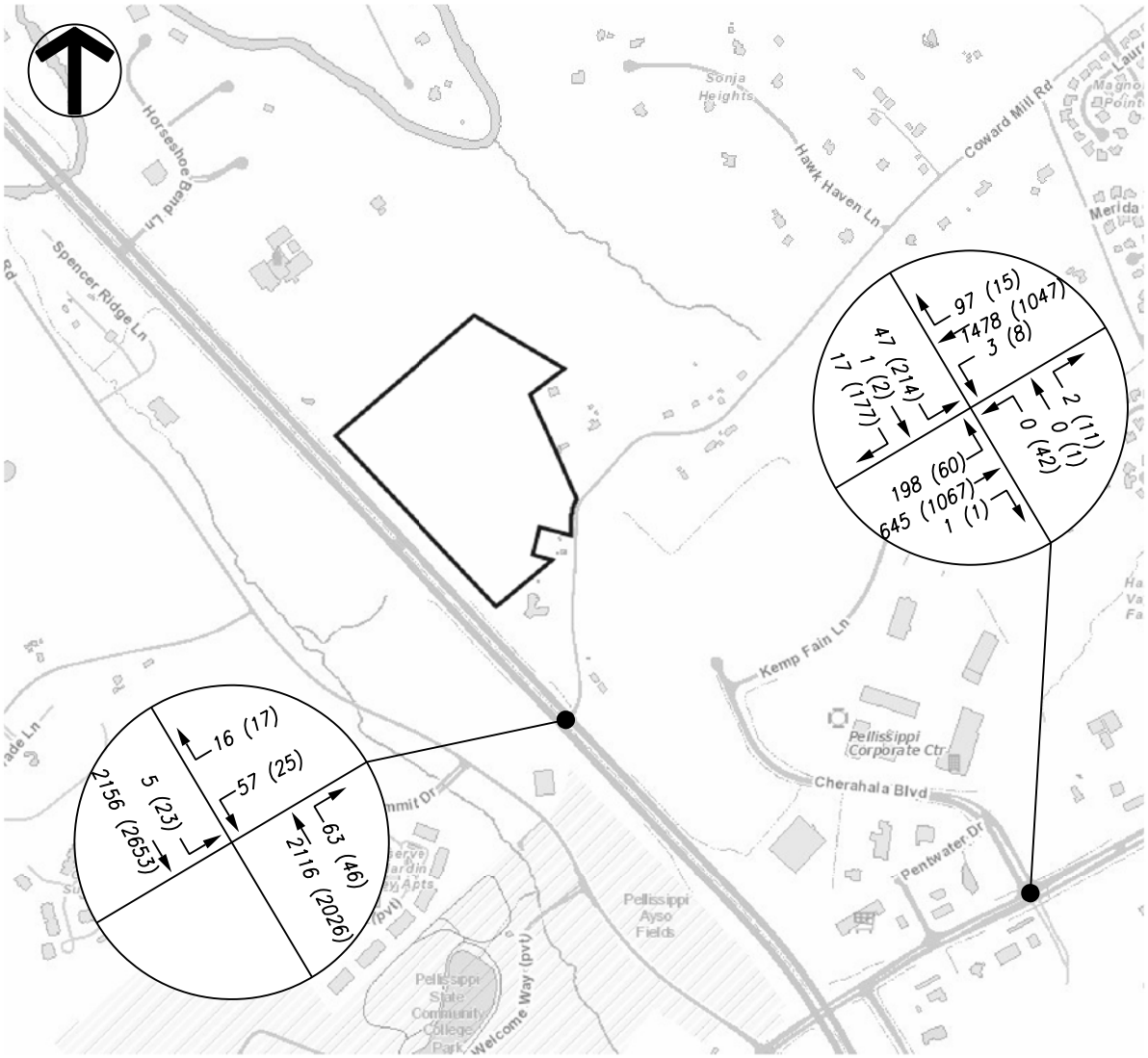
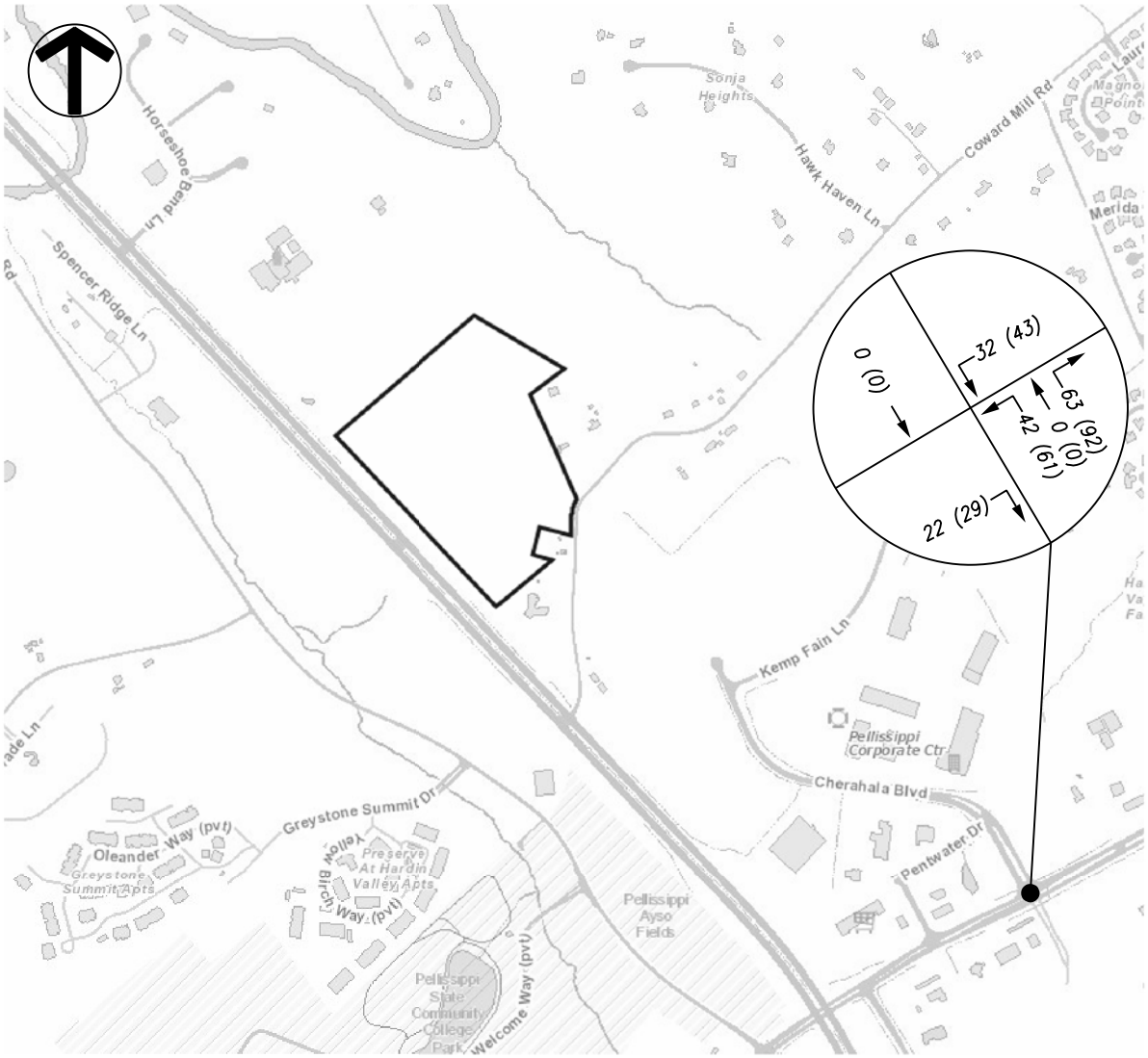


Figure 3: 2018 Existing Peak Hour Traffic

3 Background Growth

After the completion of the construction on Schaeffer Road there is expected to be an increase in the traffic at the intersection of Hardin Valley Road at Cherahala Boulevard. A traffic count on Schaeffer Road was conducted on October 18, 2016 and the results of that study were provided by Knox County Engineering & Public Works and are included in Attachment 3. Assuming a 40% eastbound trip distribution and a 60% westbound trip distribution the projected increase at the intersection of Cherahala Boulevard and Hardin Valley Road is shown in Figure 4. Schaeffer Road is currently under construction with an expected completion date prior to the start of Phase 2 of the Coward Mill Subdivision.



LEGEND:

← 5 (16) TURNING MOVEMENT VOLUME AM (PM)

Figure 4: 2021 Schaeffer Road Peak Hour Traffic

The Tennessee Department of Transportation (TDOT) maintains count station #000084 on Hardin Valley Road near the Anderson County line south of the proposed project. The annual traffic growth rate for this station over the last ten years is approximately 10.21% but over the last five years the annual traffic growth rate is approximately 0.11%.

The Knoxville Regional Transportation Planning Organization (TPO) also maintains count station ID 093M313 on Coward Mill Road east of Pellissippi Parkway north of the proposed project. The annual traffic growth rate for this station between 2001 and 2015 is approximately 10.89%.

For the purpose of this study, an annual growth rate of 1% was assumed for traffic on Pellisippi Parkway and an annual growth rate of 5.0% was assumed for traffic on Coward Mill Road and traffic at the intersection of Hardin Valley Road at Cherahala Boulevard until full occupancy is reached in 2021. Attachment 2 shows the trend line growth charts for the TDOT and TPO count stations.

TDOT is currently working on improvements to Pellissippi Parkway that will include resurfacing and re-striping of several intersections. Coward Mill Road at Pellissippi Parkway is one of the intersections that will be affected. After TDOT has finished the planned improvements at the intersection of Coward Mill Road at Pellissippi Parkway the traffic turning from Coward Mill Road onto Pellissippi Parkway will be restricted to right turns only and is expected to be completed no later than October 2018.

Figure 5 demonstrates the projected background peak hour volumes at the intersection including the Schaeffer Road improvements and after applying the background growth rate to the existing conditions.

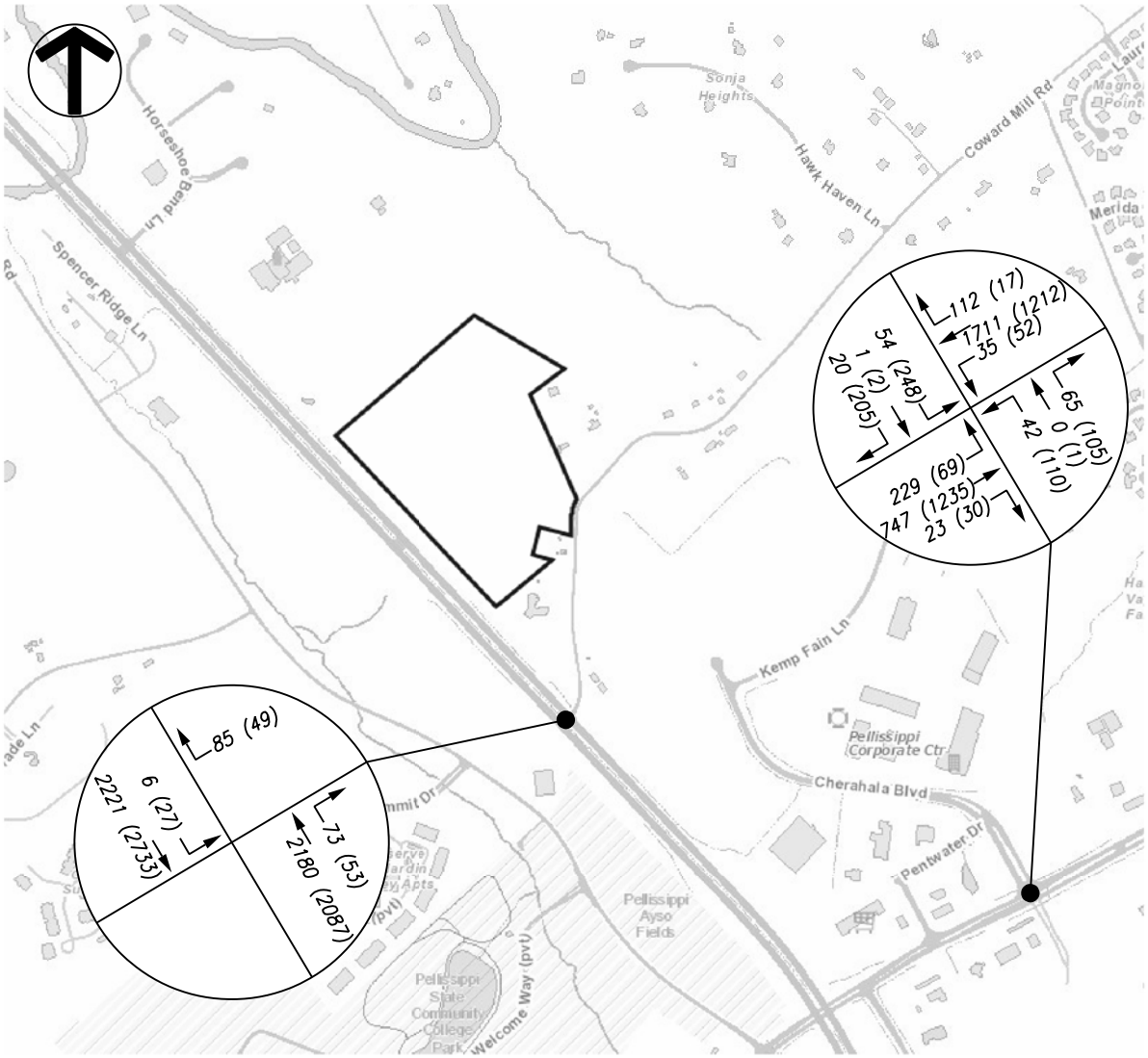


Figure 5: Phase 1 - 2021 Background Peak Hour Traffic

3.1 Phase 2 – Background Growth

Construction of the Cherahala Boulevard extension will start in circa April 2019 and is projected to be substantially complete by April 2020. The Cherahala Boulevard extension will start at the existing cul-de-sac at the end of Cherahala Boulevard and continue on to connect to Horseshoe Bend Lane. It will create new intersections with Cherahala Boulevard at Horseshoe Bend Lane, Cherahala Boulevard at Faith Promise Lane and Cherahala Boulevard at Coward Mill Road. Also the intersection of Coward Mill Road at Pellissippi Parkway will be closed permanently.

Trips for the existing areas were calculated using the *Trip Generation, 9th Edition,* published by the Institute of Transportation Engineers. Business Park or Land Use 770 was used to calculate the site trips for the existing 40 acre business park on Horseshoe Bend Lane and Church or Land Use 560 was used to calculate trips for the 67,000 SF Faith Promise Church campus. A trip generation summary is shown in Table 3-1 and the trip generation worksheets that were provided by Knox County Engineering & Public Works are included in Attachment 3.

Table 3-1
Cherahala Boulevard Extension
Trip Generation Summary

	Business Park (Land Use 770)				
	Total Trips	% Entering	%Exiting	Number Entering	Number Exiting
A.M. Peak	779	85	15	662	117
P.M. Peak	674	20	80	135	539
	Faith Promise Church (Land Use 560)				
	Total Trips	% Entering	%Exiting	Number Entering	Number Exiting
A.M. Peak	48	54	46	26	22
P.M. Peak	44	54	46	24	20
	Total Combined Trips				
A.M. Peak	827			688	139
P.M. Peak	718			159	559

4 Trip Generation and Trip Distribution

Single-Family Detached Housing or Land Use 210 was used to calculate site trips for the proposed single family housing using the fitted curve equations from *Trip Generation, 9th Edition,* published by the Institute of Transportation Engineers. The land use worksheets are included in Attachment 4.

The total number of trips generated by the Coward Mill Subdivision was estimated to be 1,223 daily trips. The estimated trips are 92 trips during the AM peak hour and 122 trips during the PM peak hour. A trip generation summary is shown in Table 4-1.

Table 4-1
Coward Mill Subdivision
Trip Generation Summary

	Single-Family Detached Housing (Land Use 210)				
	Total New Trips	% Entering	%Exiting	Number Entering	Number Exiting
			Phase 1 – 35 Lots		
A.M. Peak	34	25	75	9	26
P.M. Peak	40	63	37	25	15
			Phase 2 – Full Buildout 118 Lots		
Weekday	1223	50	50	612	612
A.M. Peak	92	25	75	23	69
P.M. Peak	122	63	37	77	45

The directional distribution of the traffic generated by the Coward Mill Subdivision was determined using the traffic data collected for the existing conditions. For Phase 1 traffic it was assumed that 50% of traffic would be eastbound and 50% of traffic would be westbound on Coward Mill Road. This assumption was used for both the AM and PM peak hours. The Phase 1 trip distribution for the Coward Mill Subdivision is shown in Figure 6 and Figure 7.

Figure 8 shows the Phase 1 peak hour subdivision traffic and Figure 9 shows the combined Phase 1 background and subdivision peak hour traffic.

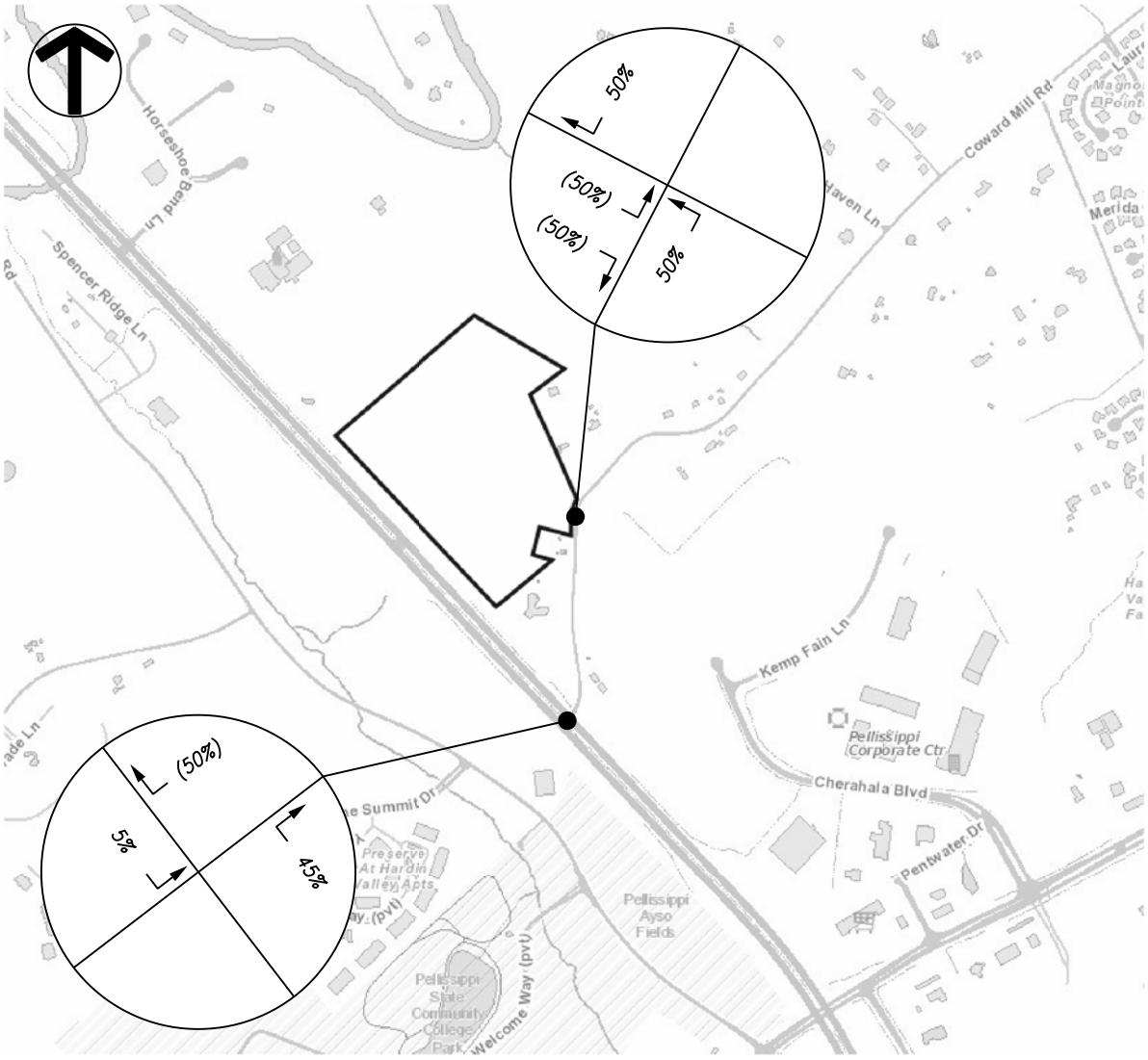


Figure 6: Phase 1 - AM Peak Hour Trip Distribution

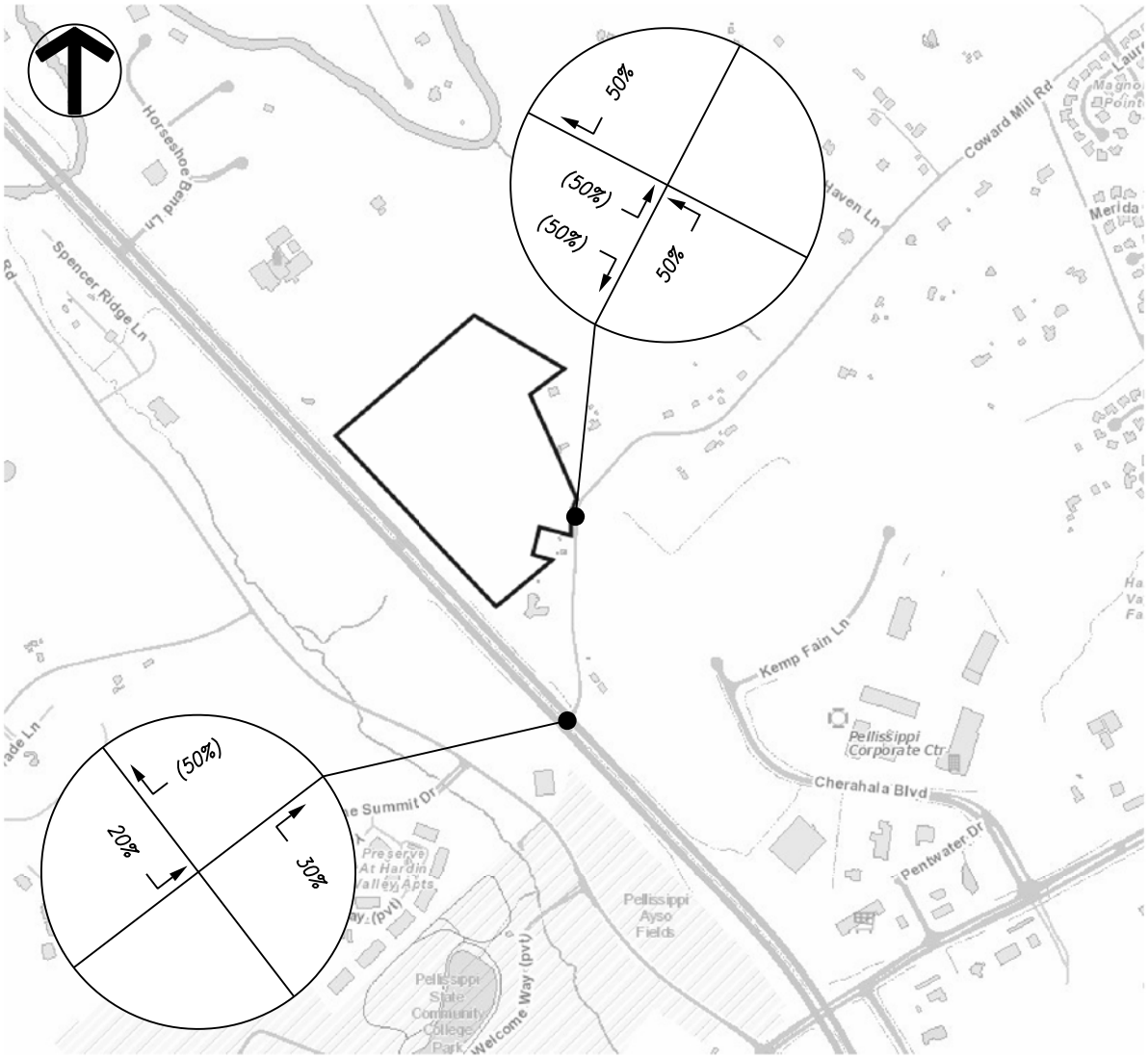


Figure 7: Phase 1 - PM Peak Hour Trip Distribution

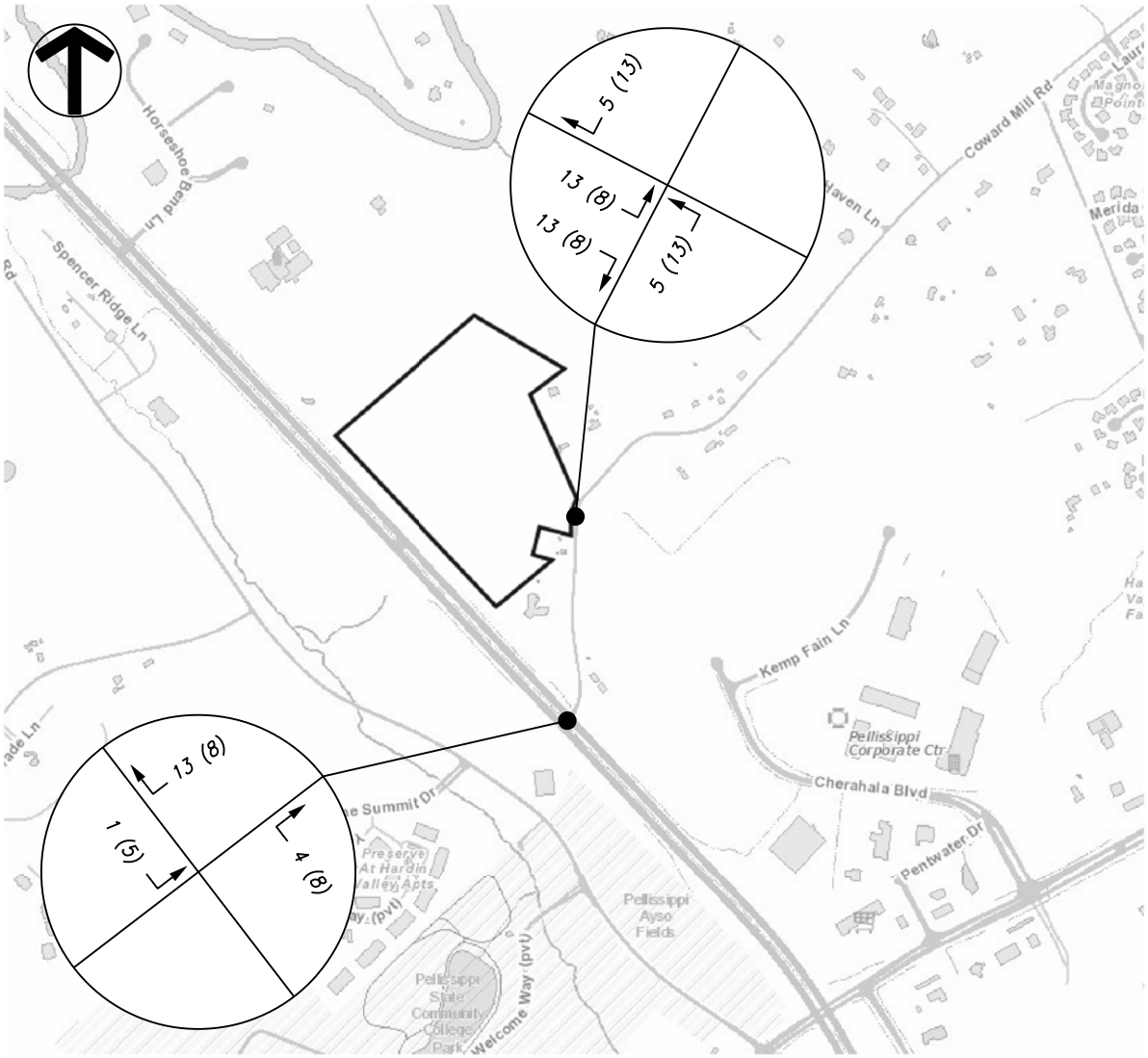


Figure 8: Phase 1 - Peak Hour Subdivision Traffic

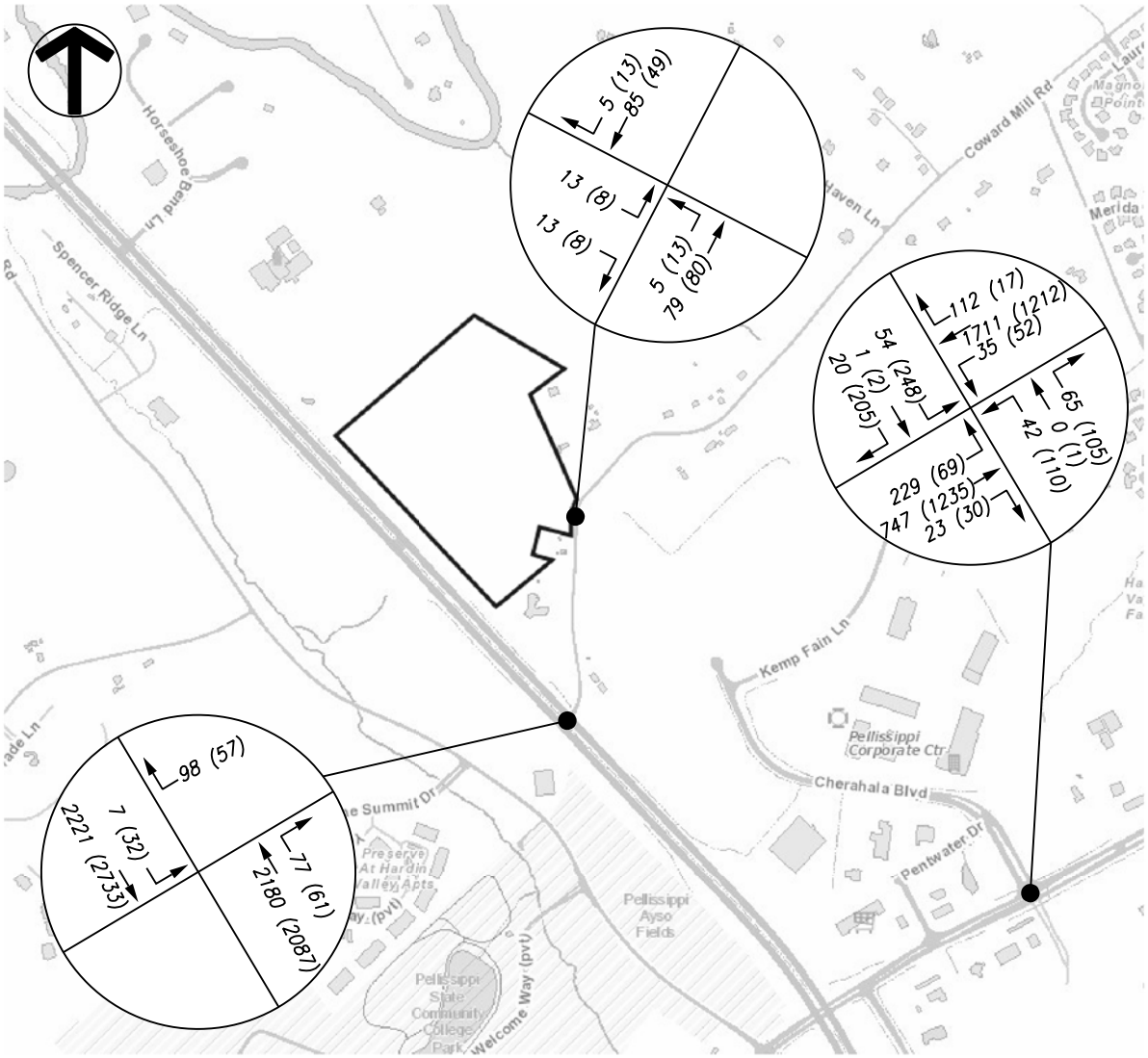


Figure 9: Phase 1 - 2021 Combined Peak Hour Traffic

4.1 Phase 2 Trip Distribution

The directional distribution of the traffic for the Cherahala Boulevard extension was determined using the traffic data collected for the existing conditions. For Phase 2 traffic it was assumed that 30% of traffic would be southbound and 70% of traffic would be northbound on Cherahala Boulevard. This assumption was used for both the AM and PM peak hours. The Phase 2 trip distribution for the Coward Mill Subdivision is shown in Figure 10.

After the intersection of Coward Mill Road at Pellissippi Parkway is permanently closed the traffic will be rerouted either onto Cherahala Boulevard or to the intersection of Horseshoe Bend Lane at Pellissippi Parkway. Figure 11 shows the expected rerouted traffic on Coward Mill Road.

Using the Phase 2 trip distribution Figure 12 shows the trips generated from the existing Faith Promise Church and the Business Park.

Using the Phase 2 trip distribution the trips generated from the Coward Mill Subdivision are shown in Figure 13. Figure 14 shows the combined peak hour traffic from the background growth and the full build out of Phase 2 of the Coward Mill Subdivision.

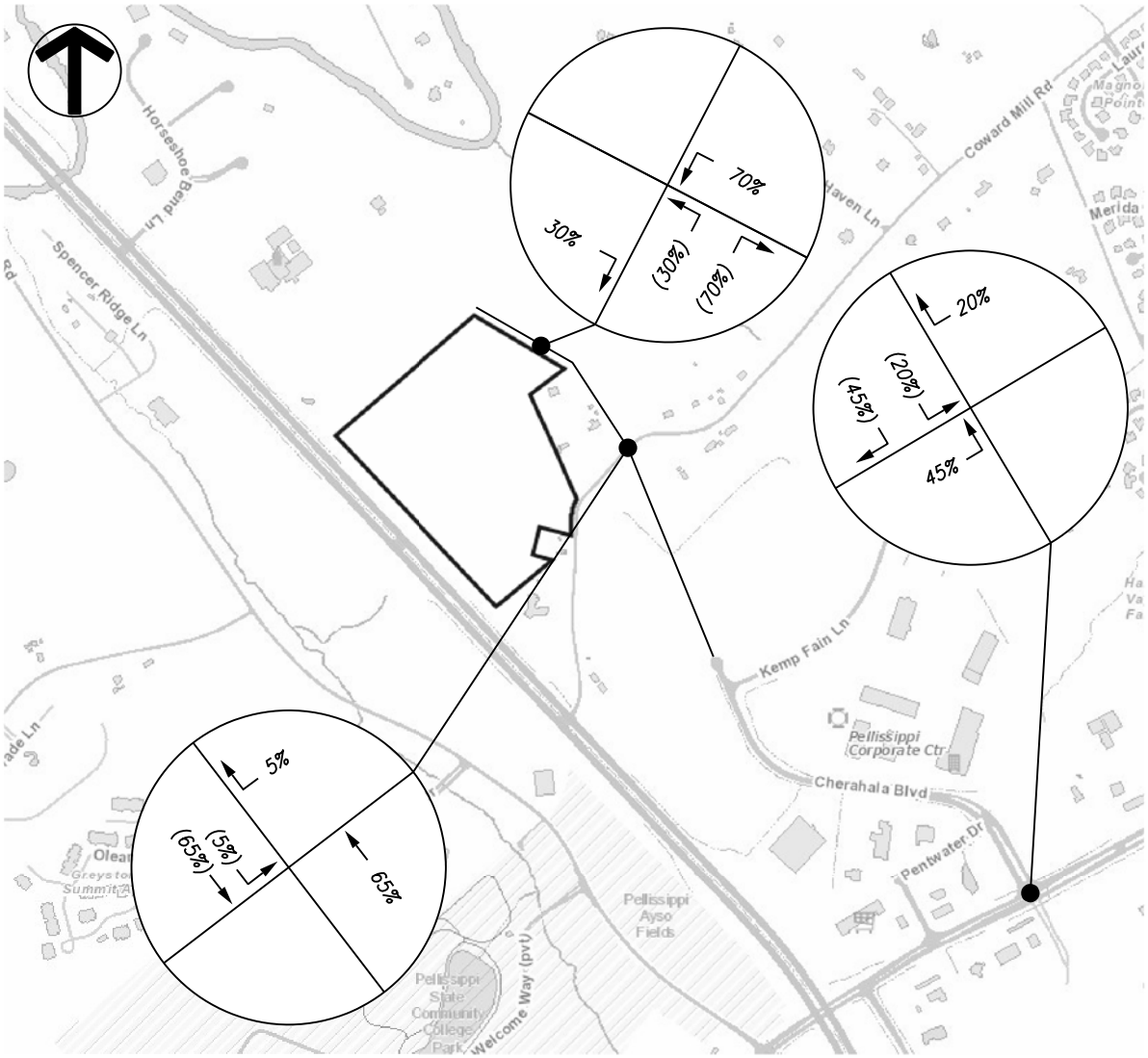


Figure 10: Phase 2 - AM & PM Peak Hour Trip Distribution

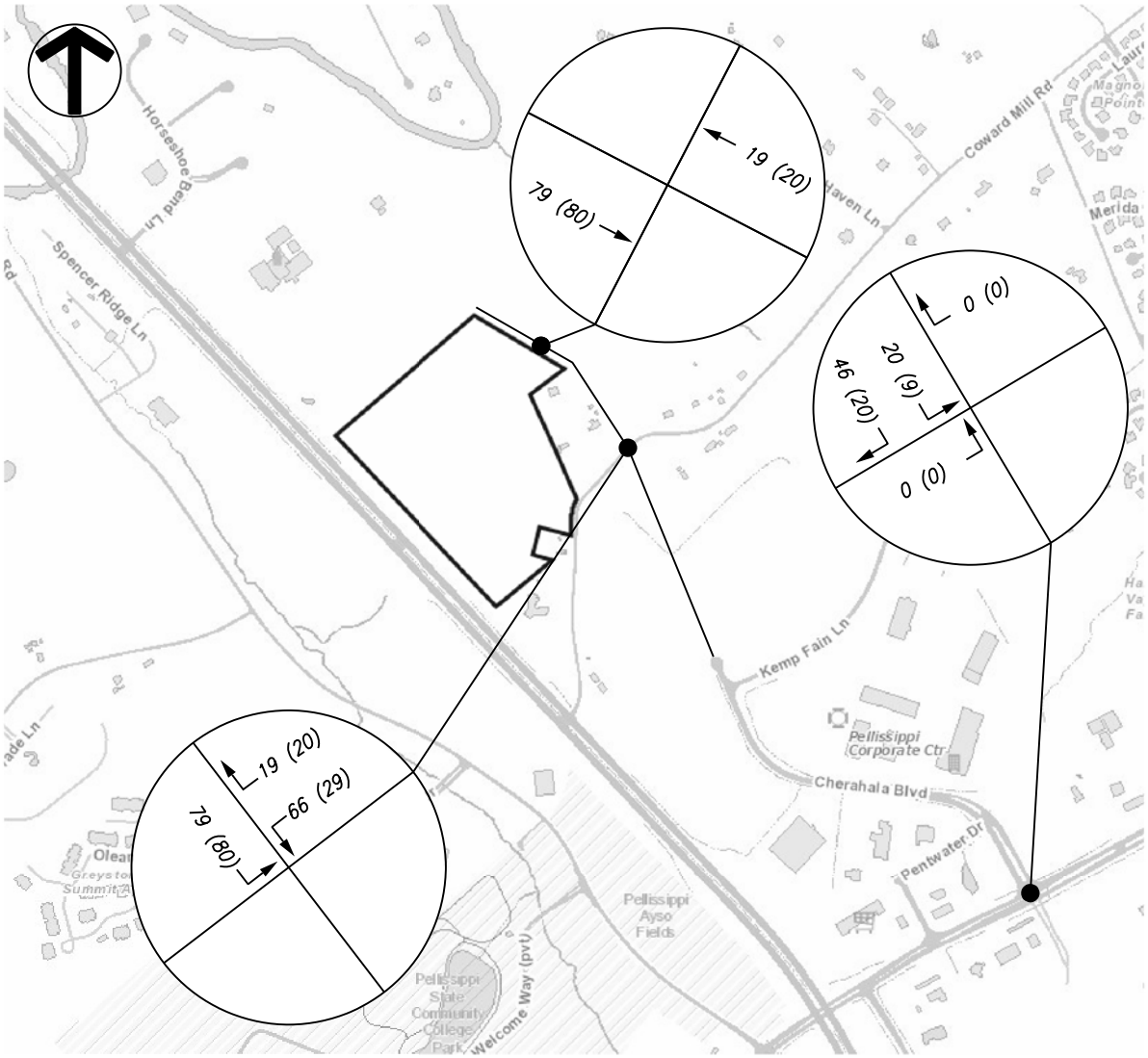


Figure 11: Phase 2 - 2021 Coward Mill Rd Peak Hour Traffic

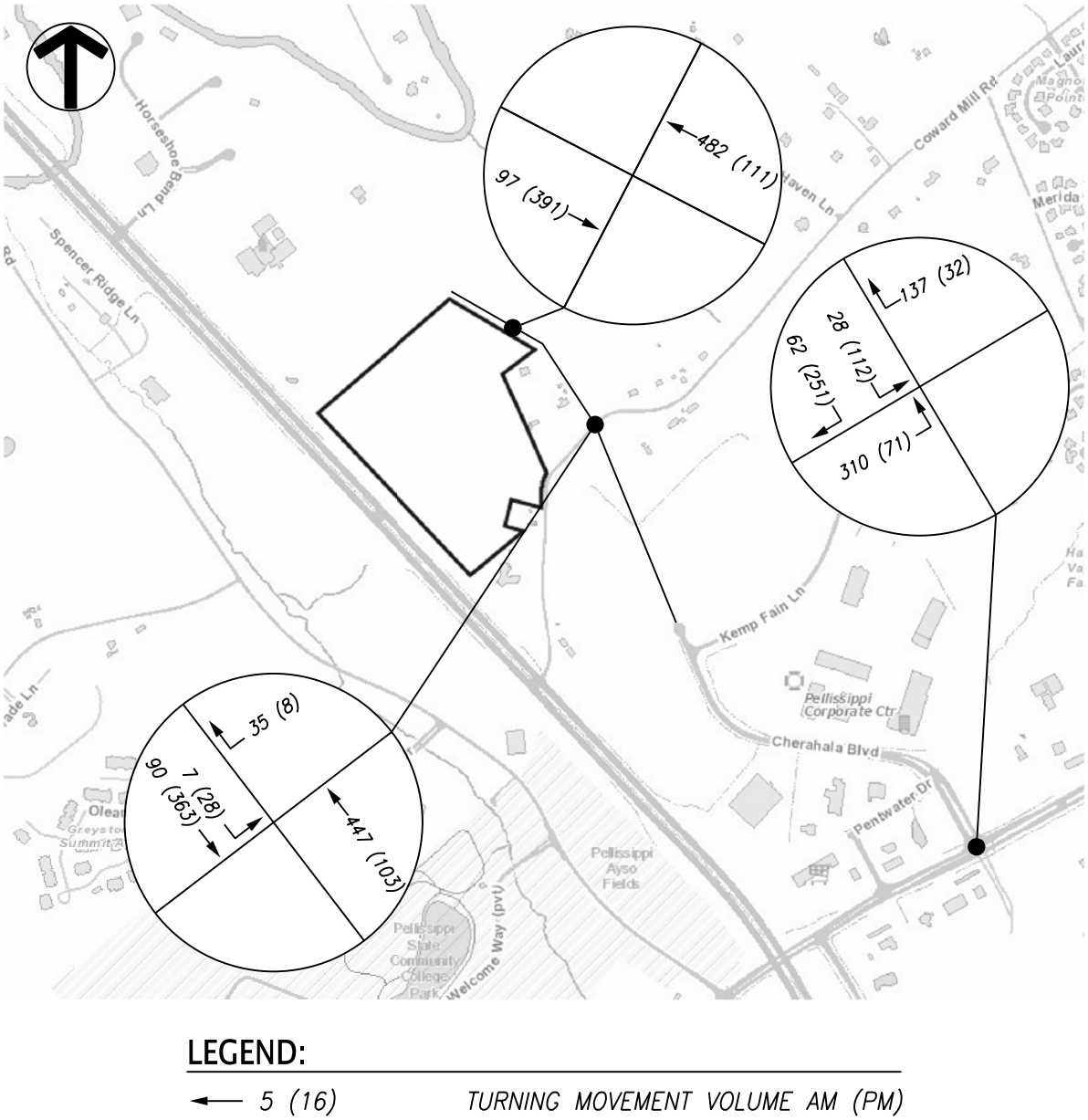


Figure 12: Phase 2 - 2021 Cherahala Blvd Peak Hour Traffic

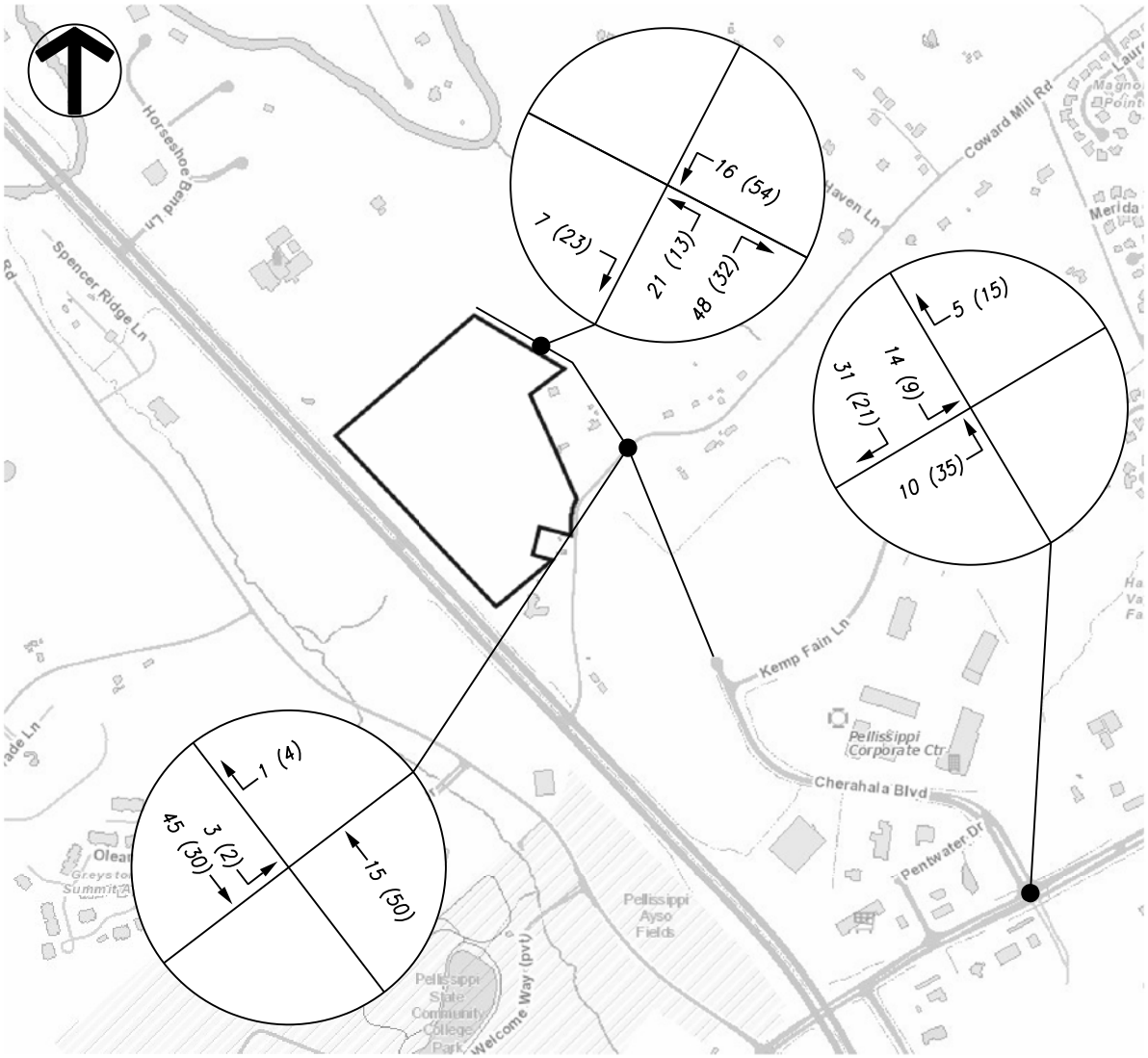


Figure 13: Phase 2 - Peak Hour Subdivision Traffic

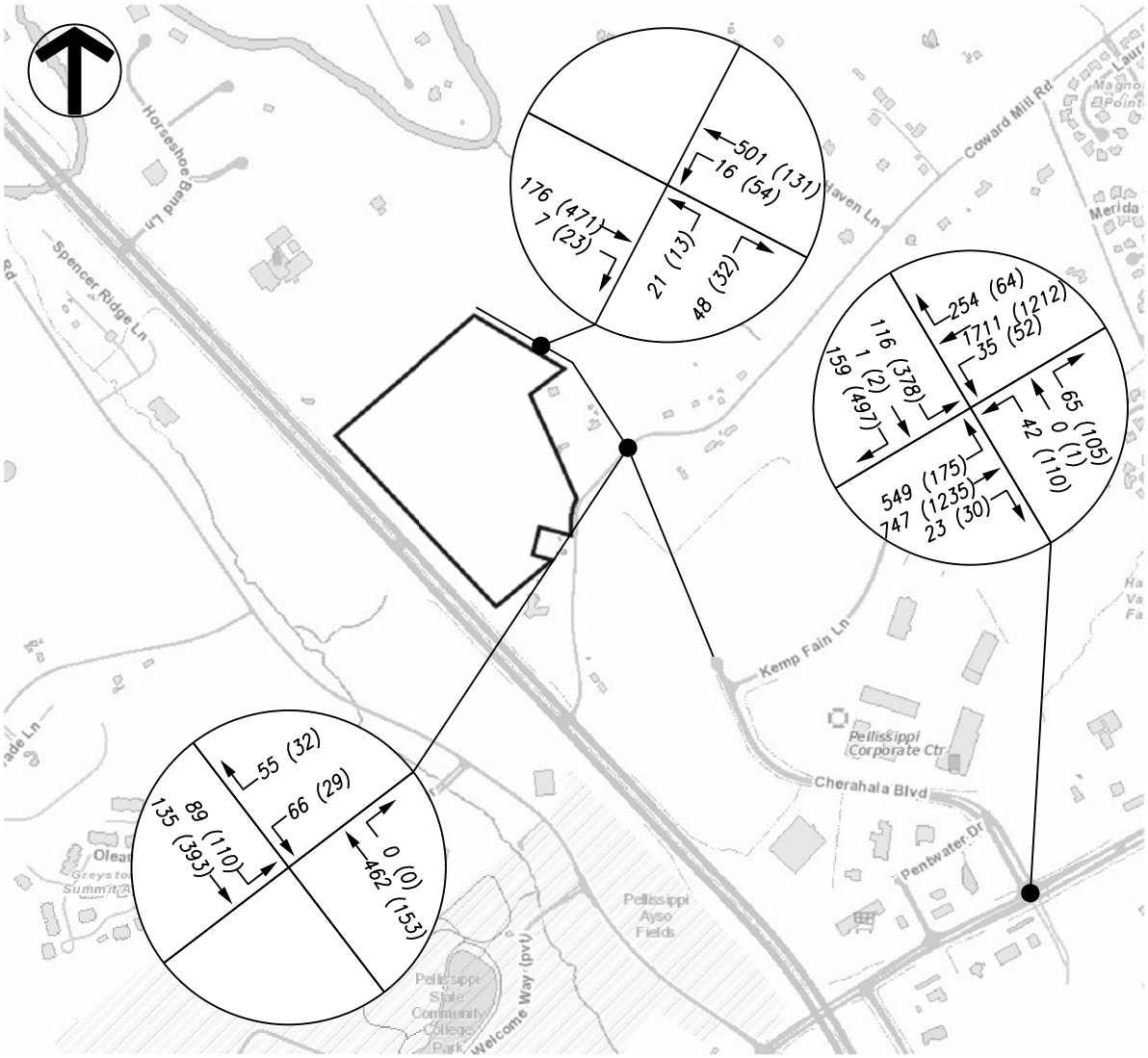


Figure 14: Phase 2 - Peak Hour Traffic Full Buildout

5 Projected Capacity and Level of Service

Unsignalized intersection capacity analyses were performed using the Highway Capacity Software (HCS7) for the AM and PM peak hours to evaluate the traffic conditions at the Phase 1 intersections of Coward Mill Road at Pellissippi Parkway and Coward Mill Road at Temporary Access Road #1 and the Phase 2 intersections of Cherahala Boulevard at Access Road #2 and Cherahala Boulevard at Coward Mill Road.

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 Cherahala Boulevard. The existing signal timing was provided by Knox County and is included in Attachment 5. Optimized signal timing was used for the background and Phase 2 traffic conditions at the intersection of Hardin Valley Road at Cherahala Boulevard.

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 6, 7, 8, and 9. Table 5-1 shows the results of the capacity analyses for Phase 1 and Table 5-2 shows the results of the capacity analyses for Phase 2.

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

		Delay (sec)/LOS
Coward Mill Road @ Pellissippi Parkway (Existing 2018)		
AM Peak	WB Approach	418.4 / F
	SB Left Turn	23.2 / C
PM Peak	WB Approach	143.7 / F
	SB Left Turn	23.0 / C
Cherahala Boulevard @ Hardin Valley Road (Existing 2018)		
AM Peak	Intersection	64.4 / E
PM Peak	Intersection	48.0 / D
Coward Mill Road @ Pellissippi Parkway (Background 2021)		
AM Peak	WB Approach	48.2 / E
	SB Left Turn	24.9 / C
PM Peak	WB Approach	31.5 / D
	SB Left Turn	24.8 / C
Cherahala Boulevard @ Hardin Valley Road (Background 2021)		
AM Peak	Intersection	78.3 / E
PM Peak	Intersection	56.1 / E
Coward Mill Road @ Pellissippi Parkway (Phase 1 - 35 Lots 2021)		
AM Peak	WB Approach	56.5 / F
	SB Left Turn	25.1 / D
PM Peak	WB Approach	33.6 / D
	SB Left Turn	25.7 / D
Coward Mill Road @ Temporary Access Road #1 (Phase 1 – 35 Lots 2021)		
AM Peak	EB Approach	9.3 / A
	NB Approach	7.4 / A
PM Peak	EB Approach	9.1 / A
	NB Approach	7.4 / A

Table 5-2
Phase 2 - Intersection Analysis
Level of Service (LOS) Summary

		Delay (sec)/LOS
Cherahala Boulevard @ Hardin Valley Road (Phase 2 Buildout 2021)		
AM Peak	Intersection	104.5 / F
PM Peak	Intersection	93.9 / F
Cherahala Boulevard @ Coward Mill Road (Phase 2 Buildout 2021)		
AM Peak	WB Approach	19.1 / C
	NB Approach	7.5 / A
	SB Approach	8.7 / A
PM Peak	WB Approach	14.0 / B
	NB Approach	8.2 / A
	SB Approach	7.8 / A
Coward Mill Road @ Access Road #2 (Phase 2 Buildout 2021)		
AM Peak	WB Approach	7.7 / A
	NB Approach	11.9 / B
PM Peak	WB Approach	8.7 / A
	NB Approach	13.6 / B

6 Turn Lane Warrant Analysis

The intersection of Cherahala Boulevard at Access Road #2 was evaluated to determine if a right turn lane or a left turn lane are warranted. The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to analyze the information. No turn lane warrants are met at the intersection of Cherahala Boulevard at Access Road #2 during the AM or PM peak hours. The turn lane warrant worksheets and analysis are included in Attachment 10.

7 Delay Study Analysis

A delay study was performed at the intersection of Coward Mill Road at Pellissippi Parkway on Thursday February 22, 2018 during the AM and PM peak 15 minute periods. The AM peak period was from 8:00 am – 8:15 am with a total volume of 10 vehicles and a calculated delay of 36 seconds per vehicle. The PM peak period was from 5:00 pm – 5:15 pm with a total volume of 15 vehicles and a calculated delay of 153 seconds per vehicle. The delay study worksheets and analysis are included in Attachment 11.

8 Conclusions and Recommendations

8.1 Coward Mill Road @ Temporary Access Road #1

At the intersection of Coward Mill Road at Temporary Access Road #1, the overall intersection operates at a LOS A during both the AM and PM peak hours after the completion of the Phase 1 of the Coward Mill Subdivision.

The minimum required sight distance for a road with a posted speed limit of 30 mph is 300 feet in each direction in accordance with the "Minimum Subdivision Regulations" for Knoxville and Knox County. The proposed intersection of Coward Mill Road at Access Road #1 has a measured sight distance that exceeds 300 feet east and west of the intersection, which meets the requirement. The approximate sight distance is 635 feet east and 790 feet west of the intersection. FMA recommends any landscaping be installed so as to maintain the sight distance and continue to comply with Knox County Engineering & Public Works requirements.

Coward Mill Road is classified as a collector. The minimum intersection spacing required for a collector is 300 feet per the "Minimum Subdivision Regulations" for Knoxville and Knox County. For Phase 1 the nearest road intersection to the proposed Access Road #1 is currently 1,250 feet south at the intersection of Coward Mill Road at Pellissippi Parkway. This intersection exceeds the typical minimum separation of 300 feet between roads on a collector; therefore, no change is necessary.

Once the Cherahala Boulevard extension is substantially complete, this intersection will be removed.

8.2 Coward Mill Road @ Pellissippi Parkway

The existing westbound approach of the intersection of Coward Mill Road at Pellissippi Parkway operates at a LOS F (418.4 sec) during the AM peak hour and a LOS F (143.7 sec) during the PM peak hour using the existing intersection layout which allows for both left and right turns onto Pellissippi Parkway.

The delay study calculated an existing average delay of 36 seconds per vehicle during the AM peak period and an existing average delay of 153 seconds per vehicle during the PM peak period. The discrepancy during the AM peak period is most likely due to the lower traffic volume that was measured on the day that the delay study was performed in comparison to the traffic volume on the day that the turning movement count was performed.

The TDOT improvements to the intersection of Coward Mill Road at Pellissippi Parkway will restrict the traffic turning from Coward Mill road onto Pellissippi Parkway to right turns only. The background traffic volumes for the westbound approach will operate at a LOS E (48.2 sec) during the AM peak hour and a LOS D (31.5 sec) during the PM peak hour.

After the completion of the Phase 1 of the Coward Mill Subdivision the westbound approach of the intersection of Coward Mill Road at Pellissippi Parkway is expected to operate at a LOS F (56.5 sec) during the AM peak hour and a LOS D (33.6 sec) during the PM peak hour.

8.3 Coward Mill Road

The width of Coward Mill Road between the intersection of Pellissippi Parkway and temporary Access Road #1 varies between 17 feet to 22 feet. Knox County policy states that access to new developments need to have a pavement width of at least 20 feet. Roadway improvements on Coward Mill Road will not be required due to the temporary subdivision access and the maximum of 35 single family lots that will be built in Phase 1 of the Coward Mill Subdivision.

8.4 Cherahala Boulevard Extension @ Access Road #2

At the intersection of Cherahala Boulevard at Access Road #2, the northbound approach operates at a LOS B during both the AM and PM peak hours after the completion of the Phase 2 of the Coward Mill Subdivision including the full build-out of 118 single family lots.

The minimum required sight distance for a road with a posted speed limit of 30 mph is 300 feet in each direction in accordance with the "Minimum Subdivision Regulations" for Knoxville and Knox County. The proposed intersection of Cherahala Boulevard at Access Road #2 has a measured sight distance that exceeds 300 feet north and south of the intersection, which meets the requirement. FMA recommends any landscaping be installed so as to maintain the sight distance and continue to comply with Knox County Engineering & Public Works requirements.

Based on current conditions neither a southbound right turn lane nor a northbound left turn lane is warranted at the intersection of Cherahala Boulevard at Access Road #2.

8.5 Cherahala Boulevard @ Coward Mill Road

At the proposed intersection of Cherahala Boulevard at Coward Mill Road the westbound approach (Coward Mill Road) operates at a LOS C during the AM peak hour and a LOS B during the PM peak hour, while all other approaches operate at a LOS A after the completion of the Phase 2 of the Coward Mill Subdivision.

The final design plans for the Cherahala Boulevard extension have not been completed; therefore the exact location of the intersection of Cherahala Boulevard at Coward Mill road is unknown at this time.

8.6 Cherahala Boulevard @ Hardin Valley Road

The existing intersection of Cherahala Boulevard and Hardin Valley Road operates at a LOS E during the AM peak hour and a LOS D during the PM peak hour using the existing signal timing and existing intersection layout.

After the completion of the Schaeffer Road extension the intersection will operate at a LOS E during both the AM and PM peak hours using the updated intersection layout and optimized signal timing.

After the completion of Phase 2 of the Coward Mill Subdivision including the connection to Cherahala Boulevard the overall intersection will operate at a LOS F during both the AM and PM peak hours.

FMA recommends signal timing at the intersection of Cherahala Boulevard at Hardin Valley Road be updated as a part of the Cherahala Boulevard extension project due to the changing traffic patterns and increase in overall intersection delay.

Attachment 1
Traffic Counts

Attachment 1
Traffic Counts

Project: Coward Mill Subdivision
Intersection: Hardin Valley Rd @ Cherahala Blvd
Date Conducted: 01/24/2018

	Hardin Valley Rd Eastbound				Hardin Valley Rd Westbound				Cherahala Blvd Northbound				Cherahala Blvd Southbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
7:00 AM	11	138	0	149	0	203	5	208	1	0	0	1	9	0	1	10	368
7:15 AM	20	169	1	190	0	322	11	333	0	0	0	0	12	0	4	16	539
7:30 AM	45	227	1	273	0	341	15	356	0	0	1	1	15	0	4	19	649
7:45 AM	57	98	0	155	0	375	23	398	0	0	1	1	10	1	5	16	570
Total	133	632	2	767	0	1241	54	1295	1	0	2	3	46	1	14	61	2126
8:00 AM	43	169	0	212	1	413	26	440	0	0	0	0	12	0	3	15	667
8:15 AM	53	151	0	204	2	349	33	384	0	0	0	0	10	0	5	15	603
8:30 AM	35	130	0	165	0	249	19	268	0	0	0	0	11	0	5	16	449
8:45 AM	42	103	0	145	1	253	35	289	0	0	0	0	8	0	3	11	445
Total	173	553	0	726	4	1264	113	1381	0	0	0	0	41	0	16	57	2164
3:00 PM	6	224	2	232	3	168	10	181	9	0	1	10	17	0	21	38	461
3:15 PM	5	205	0	210	2	166	3	171	0	0	0	0	15	0	21	36	417
3:30 PM	5	236	0	241	3	229	5	237	1	0	2	3	19	0	19	38	519
3:45 PM	2	306	3	311	4	251	9	264	4	0	3	7	23	1	15	39	621
Total	18	971	5	994	12	814	27	853	14	0	6	20	74	1	76	151	2018
4:00 PM	35	245	3	283	5	231	5	241	9	0	1	10	31	2	37	70	604
4:15 PM	6	234	0	240	3	171	5	179	13	0	4	17	23	1	23	47	483
4:30 PM	28	260	1	289	10	209	2	221	3	0	2	5	29	2	41	72	587
4:45 PM	10	274	3	287	3	228	1	232	6	0	8	14	29	3	38	70	603
Total	79	1013	7	1099	21	839	13	873	31	0	15	46	112	8	139	259	2277
5:00 PM	17	265	0	282	0	258	6	264	9	1	1	11	52	2	53	107	664
5:15 PM	12	280	0	292	6	284	1	291	18	0	6	24	28	0	33	61	668
5:30 PM	14	264	0	278	1	222	4	227	9	0	1	10	84	0	69	153	668
5:45 PM	17	258	1	276	1	283	4	288	6	0	3	9	50	0	22	72	645
Total	60	1067	1	1128	8	1047	15	1070	42	1	11	54	214	2	177	393	2645
Grand Total	463	4236	15	4714	45	5205	222	5472	88	1	34	123	487	12	422	921	11230
Approach %	9.8	9413.3	0.3		0.8	5914.8	4.1		71.5	0.8	27.6		52.9	0.1	45.8		
Total %	4.1	#DIV/0!	0.1	42.0	0.4	#DIV/0!	2.0	48.7	0.8	0.0	0.3	1.1	4.3	#DIV/0!	3.8	8.2	

Project: Coward Mill Subdivision
Date Conducted: 1/24/2018

AM Peak Hour	7:30 AM - 8:30 AM	2489
PM Peak Hour	5:00 PM - 6:00 PM	2645

	Hardin Valley Road Eastbound				Hardin Valley Road Westbound				Cherahala Blvd Northbound				Cherahala Blvd Southbound				
Start	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 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:30 AM																	
7:30 AM	45	**227**	**1**	273	0	341	15	356	0	0	**1**	1	**15**	0	4	19	649
7:45 AM	**57**	98	0	155	0	375	23	398	0	0	1	1	10	**1**	**5**	16	570
8:00 AM	43	169	0	212	1	**413**	26	440	0	0	0	0	12	0	3	15	**667**
8:15 AM	53	151	0	204	**2**	349	**33**	384	0	0	0	0	10	0	5	15	603
Total Volume	198	645	1	844	3	1478	97	1578	0	0	2	2	47	1	17	65	2489
Future (5% over 3 yrs)	229	747	1		3	1711	112		0	0	2		54	1	20		2881
PHF	0.87	0.71	0.25		0.38	0.89	0.73		-	-	0.50		0.78	0.25	0.85		0.93
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
5:00 PM	**17**	265	0	282	0	258	**6**	264	9	**1**	1	11	52	**2**	53	107	664
5:15 PM	12	**280**	0	292	**6**	**284**	1	291	**18**	0	**6**	24	28	0	33	61	**668**
5:30 PM	14	264	0	278	1	222	4	227	9	0	1	10	84	0	**69**	153	668
5:45 PM	17	258	**1**	276	1	283	4	288	6	0	3	9	50	0	22	72	645
Total Volume	60	1067	1	1128	8	1047	15	1070	42	1	11	54	214	2	177	393	2645
Future (5% over 3 yrs)	69	1235	1		9	1212	17		49	1	13		248	2	205		3062
PHF	0.88	0.95	0.25		0.33	0.92	0.63		0.58	0.25	0.46		0.64	0.25	0.64		0.99

Project: Coward Mill Subdivision
Intersection: Coward Mill Road @ Pellissippi Parkway
Date Conducted: 01/24/2018

	Coward Mill Road Westbound			Pellissippi Parkway Northbound			Pellissippi Parkway Southbound			
Start	Left	Right	Total	Thru	Right	Total	Left	Thru	Total	Int. Total
7:00 AM	5	4	9	0	8	8	0	0	0	17
7:15 AM	13	7	20	0	3	3	0	0	0	23
7:30 AM	11	4	15	0	12	12	0	0	0	27
7:45 AM	18	2	20	0	10	10	1	0	1	31
Total	47	17	64	0	33	33	1	0	1	98
8:00 AM	12	6	18	0	21	21	3	0	3	42
8:15 AM	16	4	20	0	20	20	1	0	1	41
8:30 AM	13	2	15	0	8	8	1	0	1	24
8:45 AM	10	2	12	0	4	4	1	0	1	17
Total	51	14	65	0	53	53	6	0	6	124
3:00 PM	8	2	10	0	6	6	4	0	4	20
3:15 PM	7	2	9	0	7	7	1	0	1	17
3:30 PM	9	2	11	0	2	2	3	0	3	16
3:45 PM	9	3	12	0	3	3	4	0	4	19
Total	33	9	42	0	18	18	12	0	12	72
4:00 PM	5	0	5	0	8	8	3	0	3	16
4:15 PM	7	1	8	0	8	8	4	0	4	20
4:30 PM	1	0	1	0	7	7	3	0	3	11
4:45 PM	4	6	10	0	6	6	9	0	9	25
Total	17	7	24	0	29	29	19	0	19	72
5:00 PM	13	3	16	0	7	7	7	0	7	30
5:15 PM	5	3	8	0	10	10	4	0	4	22
5:30 PM	3	5	8	0	23	23	3	0	3	34
5:45 PM	3	6	9	0	6	6	2	0	2	17
Total	24	17	41	0	46	46	16	0	16	103
Grand Total	172	64	236	0	179	179	54	0	54	469
Approach %	72.9	27.1		0.0	100.0		100.0	0.0		
Total %	36.7	13.6	50.3	#DIV/0!	38.2	38.2	11.5	0.0	11.5	

Project: Coward Mill Subdivision
Date Conducted: 1/24/2018

AM Peak Hour	7:30 AM - 8:30 AM	141
PM Peak Hour	4:45 PM - 5:45 PM	111

	Coward Mill Road Westbound			Pellissippi Parkway Northbound			Pellissippi Parkway Southbound			
Start	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:30 AM										
7:30 AM	11	4	15	0	12	12	0	0	0	27
7:45 AM	**18**	2	20	0	10	10	1	0	1	31
8:00 AM	12	**6**	18	0	**21**	21	**3**	0	3	**42**
8:15 AM	16	4	20	0	20	20	1	0	1	41
Total Volume	57	16	73	0	63	63	5	0	5	141
Future (5% over 3 yrs)	66	19		0	73		6	0		163
PHF	0.79	0.67		-	0.75		0.42	-		0.84
Peak Hour Analysis from 3:00 PM to 6:00 PM										
PM Peak Hour begins at 4:45 PM										
4:45 PM	4	**6**	10	0	6	6	**9**	0	9	25
5:00 PM	**13**	3	16	0	7	7	7	**0**	7	30
5:15 PM	5	3	8	0	10	10	4	0	4	22
5:30 PM	3	5	8	0	**23**	23	3	0	3	**34**
Total Volume	25	17	42	0	46	46	23	0	23	111
Future (5% over 3 yrs)	29	20		0	53		27	0		128
PHF	0.48	0.71		-	0.50		0.64	-		0.82

TDOT Station 83 Knox County - SR 162 (Pellissippi Pkwy) North of George Light Rd

Count on: 1/26/17

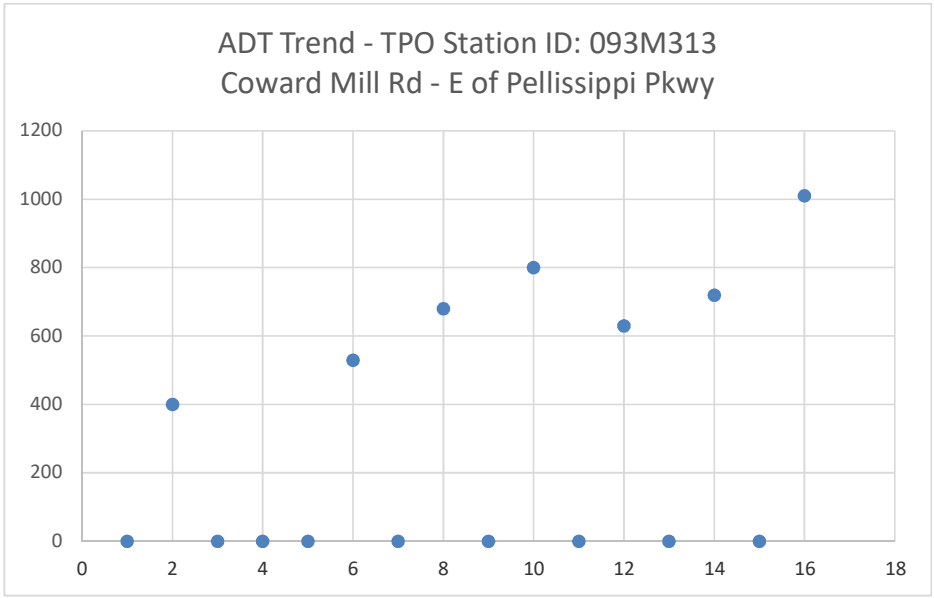
Hour Begin	Southbound	Northbound	Total
10	901	1,020	**1,921**
11	1,092	1,055	**2,147**
12	1,213	1,221	**2,434**
13	1,267	1,141	**2,408**
14	1,332	1,240	**2,572**
15	1,945	1,661	**3,606**
16	2,653	2,026	**4,679**
17	1,852	2,333	**4,185**
18	526	1,463	**1,989**
19	785	1,033	**1,818**
20	442	786	**1,228**
21	349	621	**970**
22	212	392	**604**
23	109	247	**356**
24	60	137	**197**
1	45	91	**136**
2	32	50	**82**
3	60	77	**137**
4	142	169	**311**
5	436	450	**886**
6	1,166	1,140	**2,306**
7	2,156	2,116	**4,272**
8	1,537	1,716	**3,253**
9	1,238	1,187	**2,425**
TOTALS	**21,550**	**23,372**	**44,922**

Peak AM:	7:00 - 8:00 a.m.	50/50
Peak PM:	4:00 - 5:00 p.m.	57/43 SB/NB

Attachment 2
ADT Trends

Attachment 2
ADT Trends

	Year	Adjusted Average Daily Traffic
1	2000	0
2	2001	400
3	2002	0
4	2003	0
5	2004	0
6	2005	529
7	2006	0
8	2007	680
9	2008	0
10	2009	800
11	2010	0
12	2011	630
13	2012	0
14	2013	720
15	2014	0
	2015	1010



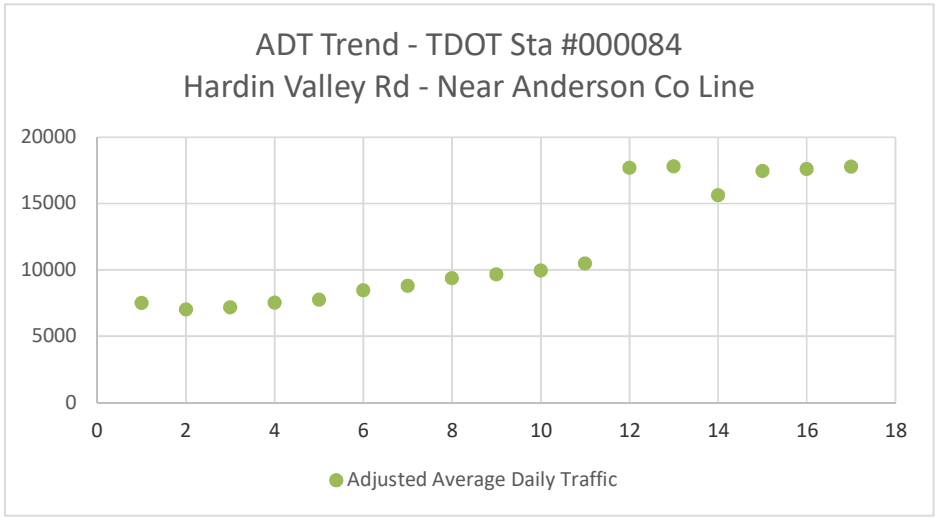
Most Recent Trend Line Growth

Year	ADT
2001	400
2015	1010

Annual Percent Growth	10.89%

Attachment 2
ADT Trends

	Year	Adjusted Average Daily Traffic
1	2000	7520
2	2001	7019
3	2002	7179
4	2003	7533
5	2004	7761
6	2005	8457
7	2006	8804
8	2007	9379
9	2008	9660
10	2009	9950
11	2010	10492
12	2011	17696
13	2012	17809
14	2013	15642
15	2014	17441
16	2015	17615
17	2016	17791



Most Recent Trend Line Growth

Year	ADT
2006	8804
2016	17791

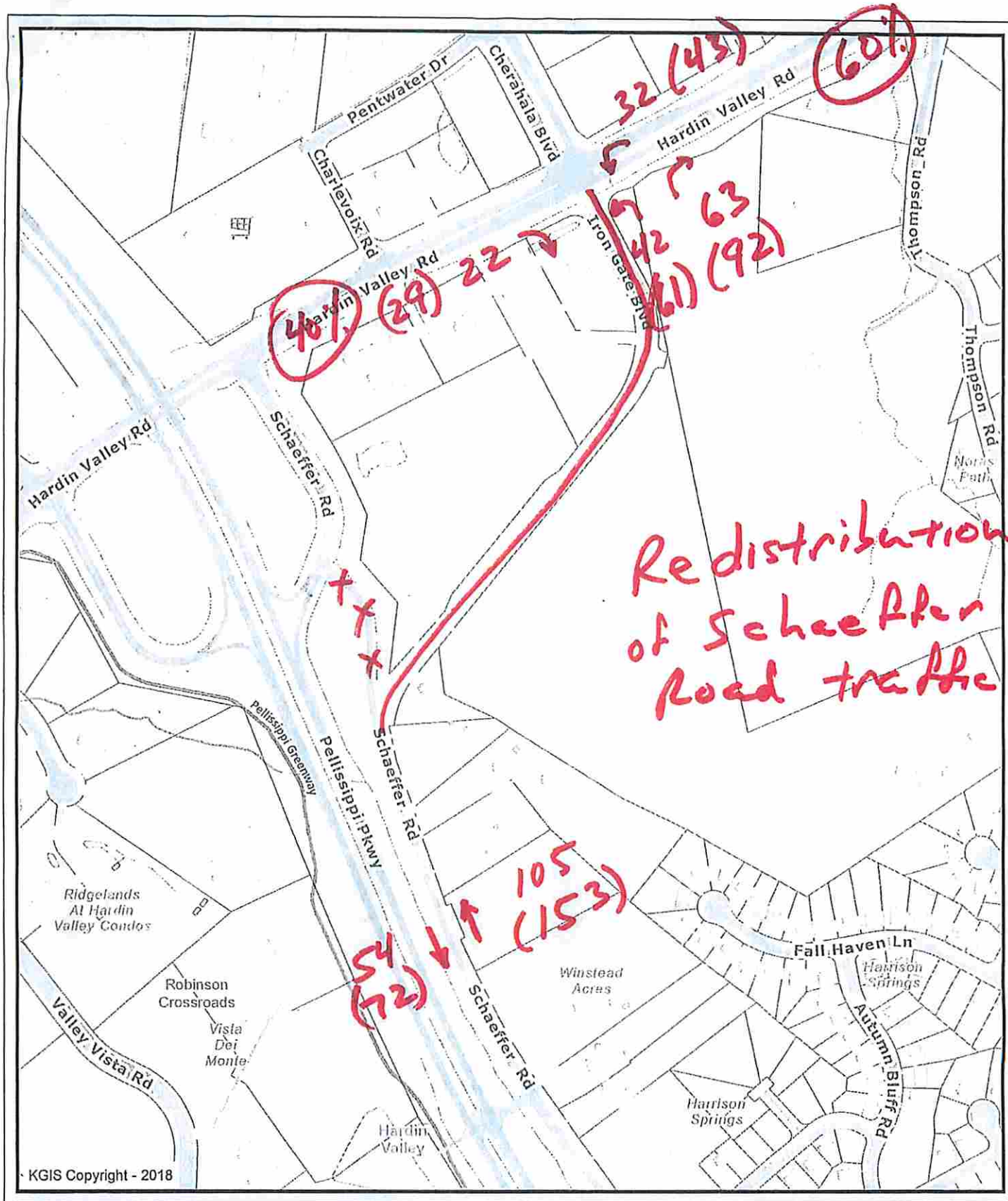
Annual Percent Growth 10.21%

Most Recent Trend Line Growth

Year	ADT
2011	17696
2016	17791

Annual Percent Growth 0.11%

Attachment 3
Cherahala Boulevard / Schaeffer Road Background Traffic
Knox County Engineering & Public Works



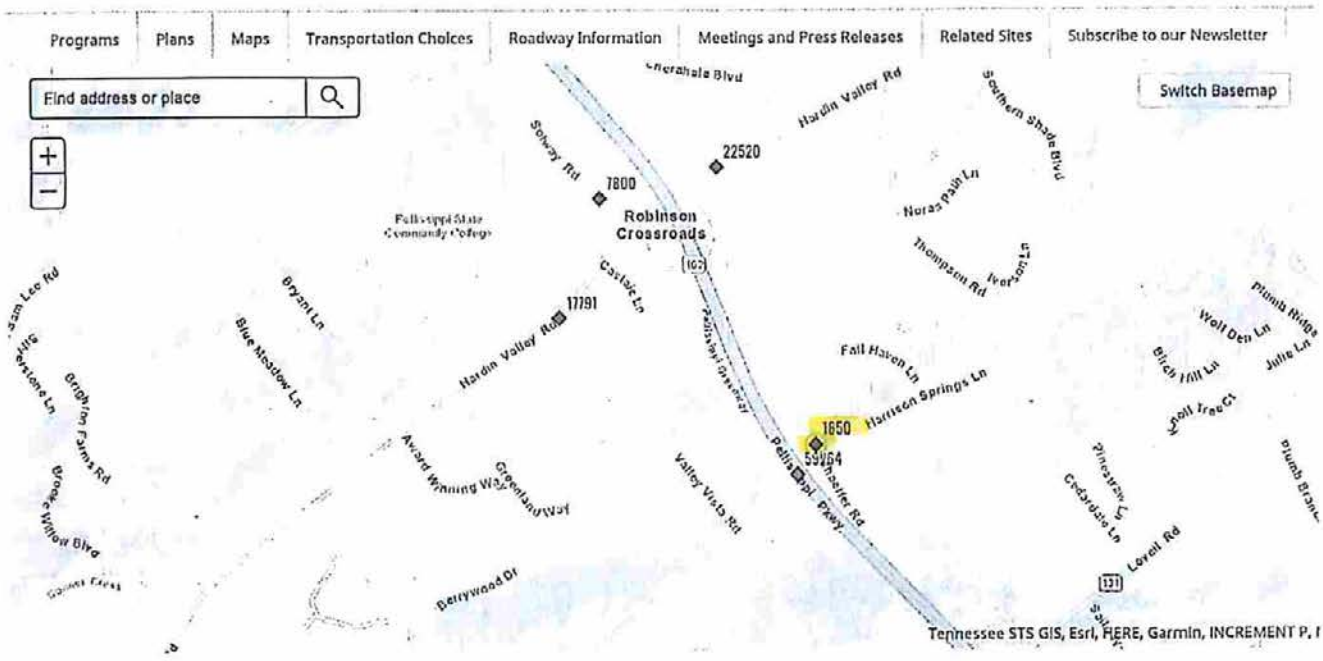
Letter Portrait

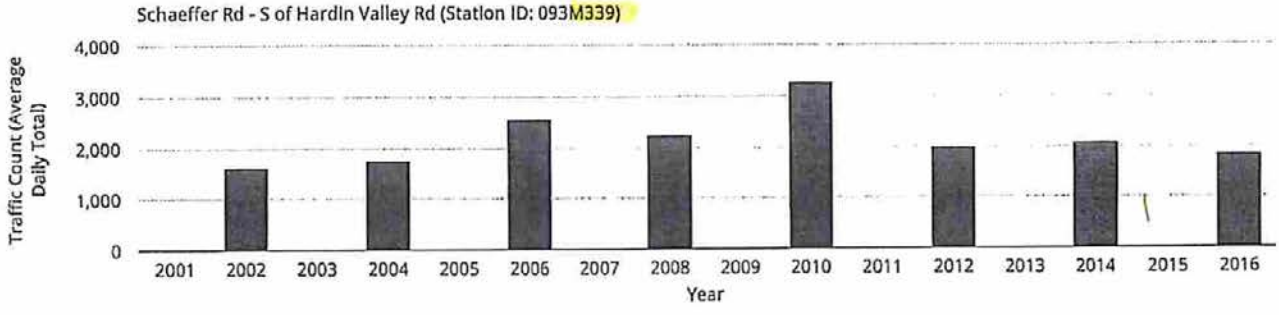
Printed: 2/14/2018 at 9:11:37 AM

0 200 400 800

ft

Knoxville - Knox County - KUB Geographic Information System





Download CSV **Click on a traffic count station above - ◇ (TDOT) or ◇ (TPO) or X (Discontinued)- to view a chart with the historic traffic counts**

Knoxville Region Traffic Count Program

The TPO conducts traffic counts at over 300 locations in Knox and Blount Counties. These annual counts supplement those collected by the Tennessee Department of Transportation at several thousand other locations across the 10-county region.

About the Counts

The traffic count data are given in the standard "Average Daily Traffic" format, which represents the volume of traffic, in both directions, at a particular location on an average day during that particular year. The average traffic is computed by taking the raw traffic count data that is collected usually over a 24-hour period and then adjusting it by factors to account for daily and seasonal variations.

Download Traffic History and Station Location (CSV)

Download Count Station GIS Shapefile with Traffic History (ZIP)

Greater Traffic Company

SCHAEFFER RD S OF HARDIN VALLEY RD

M339

Start Time	10/18/2016 Tue	NB AM	NB PM	Hour Totals AM	Hour Totals PM	SB AM	SB PM	Hour Totals AM	Hour Totals PM
12:00		0	20			0	16		
12:15		0	18			1	13		
12:30		0	22			0	10		
12:45		0	16	0	76	2	14	3	53
01:00		0	13			1	7		
01:15		0	15			0	8		
01:30		0	19			0	13		
01:45		0	18	0	65	0	13	1	41
02:00		1	12			0	14		
02:15		0	18			0	19		
02:30		0	23			0	12		
02:45		0	20	1	73	0	11	0	56
03:00		0	21			0	16		
03:15		0	18			0	9		
03:30		0	22			0	**26**		
03:45		1	20	1	81	0	**19**	0	70
04:00		1	20			0	**19**		
04:15		0	17			0	**13**		
04:30		2	17			3	9		
04:45		0	**20**	3	74	0	11	3	52
05:00		1	**39**			0	22		
05:15		2	**47**			1	22		
05:30		5	**47**			1	14		
05:45		4	20	12	153	3	14	5	72
06:00		4	22			2	23		
06:15		4	17			3	14		
06:30		20	15			6	8		
06:45		**26**	12	54	66	6	14	17	59
07:00		**23**	10			9	6		
07:15		**32**	12			12	9		
07:30		**24**	12			**12**	11		
07:45		21	9	100	43	**19**	10	52	36
08:00		28	11			**11**	7		
08:15		21	4			**13**	7		
08:30		12	11			7	1		
08:45		12	7	73	33	7	6	38	21
09:00		14	8			3	7		
09:15		17	6			9	7		
09:30		10	7			10	0		
09:45		12	3	53	24	7	1	29	15
10:00		15	2			4	3		
10:15		17	2			7	3		
10:30		20	2			9	3		
10:45		13	3	65	9	9	2	29	11
11:00		11	1			7	1		
11:15		14	3			12	1		
11:30		19	3			12	1		
11:45		20	1	64	8	16	1	47	4
Peak	-	06:45	04:45	-	-	07:30	03:30	-	-
Vol.	-	105	153	-	-	55	77	-	-
P.H.F.		0.820	0.814			0.724	0.740		
Lane Total		1131				714			

From M339 Count

		NB	SB	Total	Hourly		
AM	12:00	0	0	0			
	12:15	0	1	1			
	12:30	0	0	0			
	12:45	0	2	2	3		
	01:00	0	1	1	4		
	01:15	0	0	0	3		
	01:30	0	0	0	3		
	01:45	0	0	0	1		
	02:00	1	0	1	1		
	02:15	0	0	0	1		
	02:30	0	0	0	1		
	02:45	0	0	0	1		
	03:00	0	0	0	0		
	03:15	0	0	0	0		
	03:30	0	0	0	0		
	03:45	1	0	1	1		
	04:00	1	0	1	2		
	04:15	0	0	0	2		
	04:30	2	3	5	7		
	04:45	0	0	0	6		
	05:00	1	0	1	6		
	05:15	2	1	3	9		
	05:30	5	1	6	10		
	05:45	4	3	7	17		
	06:00	4	2	6	22		
	06:15	4	3	7	26		
	06:30	20	6	26	46		
	06:45	26	6	32	71		
	07:00	23	9	32	97		
	07:15	32	12	44	134		
	07:30	24	12	36	144		
	07:45	21	19	40	152	NB	SB
	08:00	28	11	39	159	105	54
	08:15	21	13	34	149		
	08:30	12	7	19	132		
	08:45	12	7	19	111		
	09:00	14	3	17	89		
	09:15	17	9	26	81		
	09:30	10	10	20	82		
	09:45	12	7	19	82		
	10:00	15	4	19	84		
	10:15	17	7	24	82		
	10:30	20	9	29	91		
	10:45	13	9	22	94		
	11:00	11	7	18	93		
	11:15	14	12	26	95		
	11:30	19	12	31	97		
	11:45	20	16	36	111		
PM	12:00	20	16	36	129		
	12:15	18	13	31	134		
	12:30	22	10	32	135		
	12:45	16	14	30	129		
	01:00	13	7	20	113		
	01:15	15	8	23	105		
	01:30	19	13	32	105		
	01:45	18	13	31	106		
	02:00	12	14	26	112		
	02:15	18	19	37	126		
	02:30	23	12	35	129		
	02:45	20	11	31	129		
	03:00	21	16	37	140		
	03:15	18	9	27	130		
	03:30	22	26	48	143		
	03:45	20	19	39	151		
	04:00	20	19	39	153		
	04:15	17	13	30	156		
	04:30	17	9	26	134		
	04:45	20	11	31	126		
	05:00	39	22	61	148		
	05:15	47	22	69	187		
	05:30	47	14	61	222	NB	SB
	05:45	20	14	34	225	153	72
	06:00	22	23	45	209		
	06:15	17	14	31	171		
	06:30	15	8	23	133		
	06:45	12	14	26	125		
	07:00	10	6	16	96		
	07:15	12	9	21	86		
	07:30	12	11	23	86		
	07:45	9	10	19	79		
	08:00	11	7	18	81		
	08:15	4	7	11	71		
	08:30	11	1	12	60		
	08:45	7	6	13	54		
	09:00	8	7	15	51		
	09:15	6	7	13	53		
	09:30	7	0	7	48		
	09:45	3	1	4	39		
	10:00	2	3	5	29		
	10:15	2	3	5	21		
	10:30	2	3	5	19		
	10:45	3	2	5	20		
	11:00	1	1	2	17		
	11:15	3	1	4	16		
	11:30	3	1	4	15		
	11:45	1	1	2	12		
		1131	714	1845			

Kimley-Horn 2015 Signal Timing update

ITM Peak Hour Summary

Prepared by:

NDS

National Data & Surveying Services

Schaeffer Rd Pellissippi Pkwy NB Ramps and Hardin Valley Rd , Knoxville

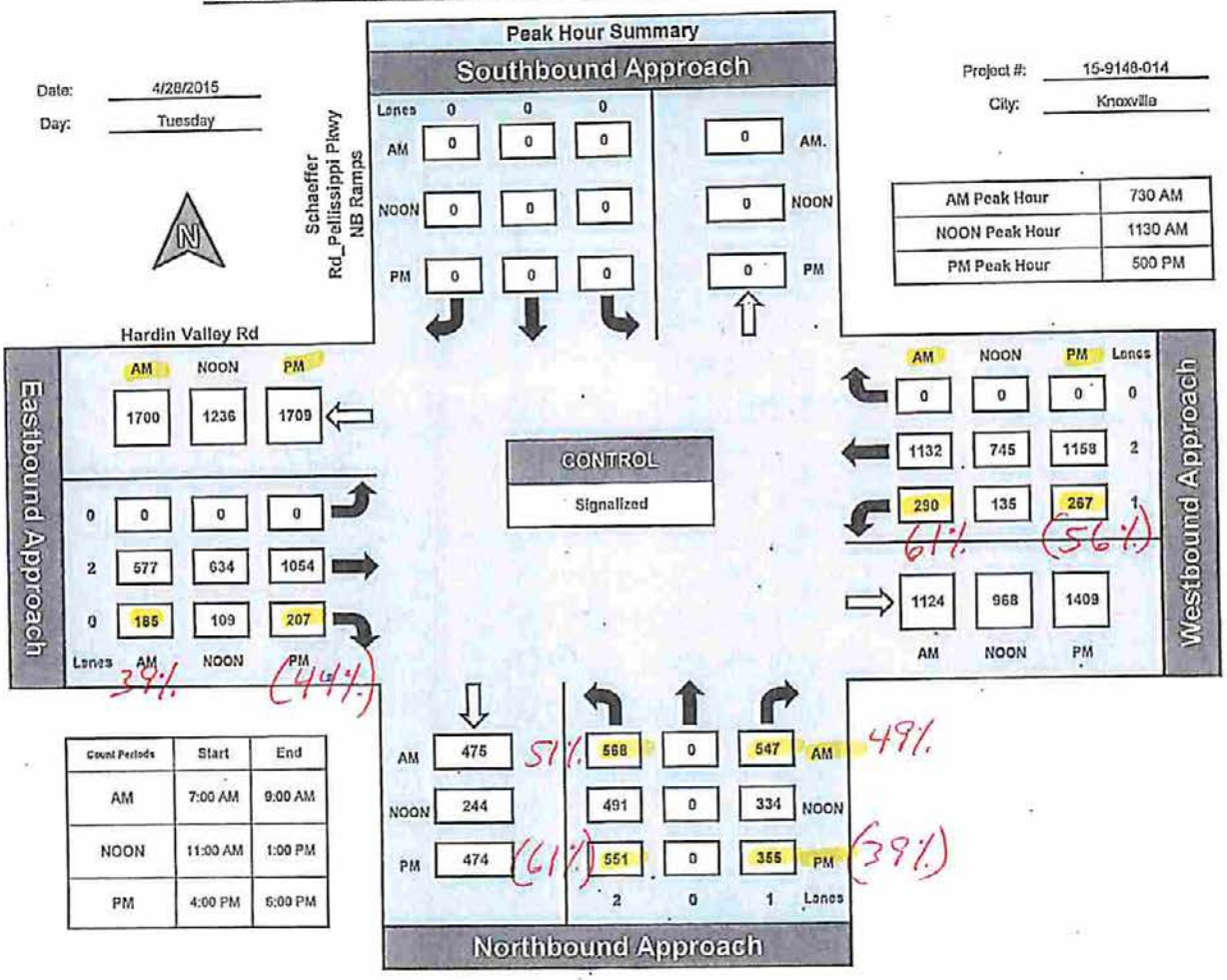
Date: 4/28/2015

Day: Tuesday

Project #: 15-9148-014

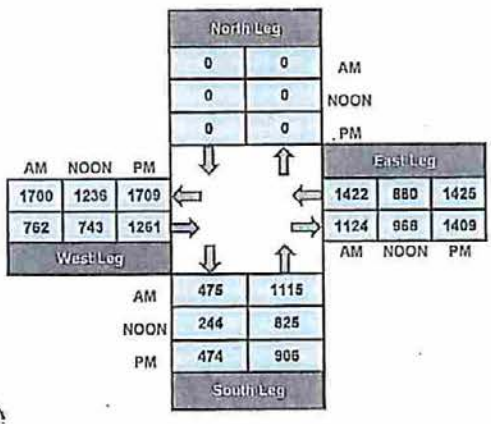
City: Knoxville

AM Peak Hour	730 AM
NOON Peak Hour	1130 AM
PM Peak Hour	500 PM

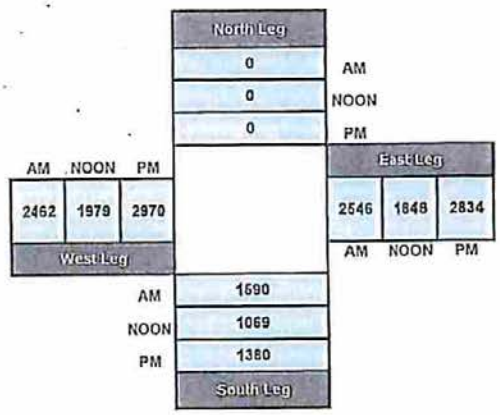


Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	6:00 PM

Total Ins & Outs



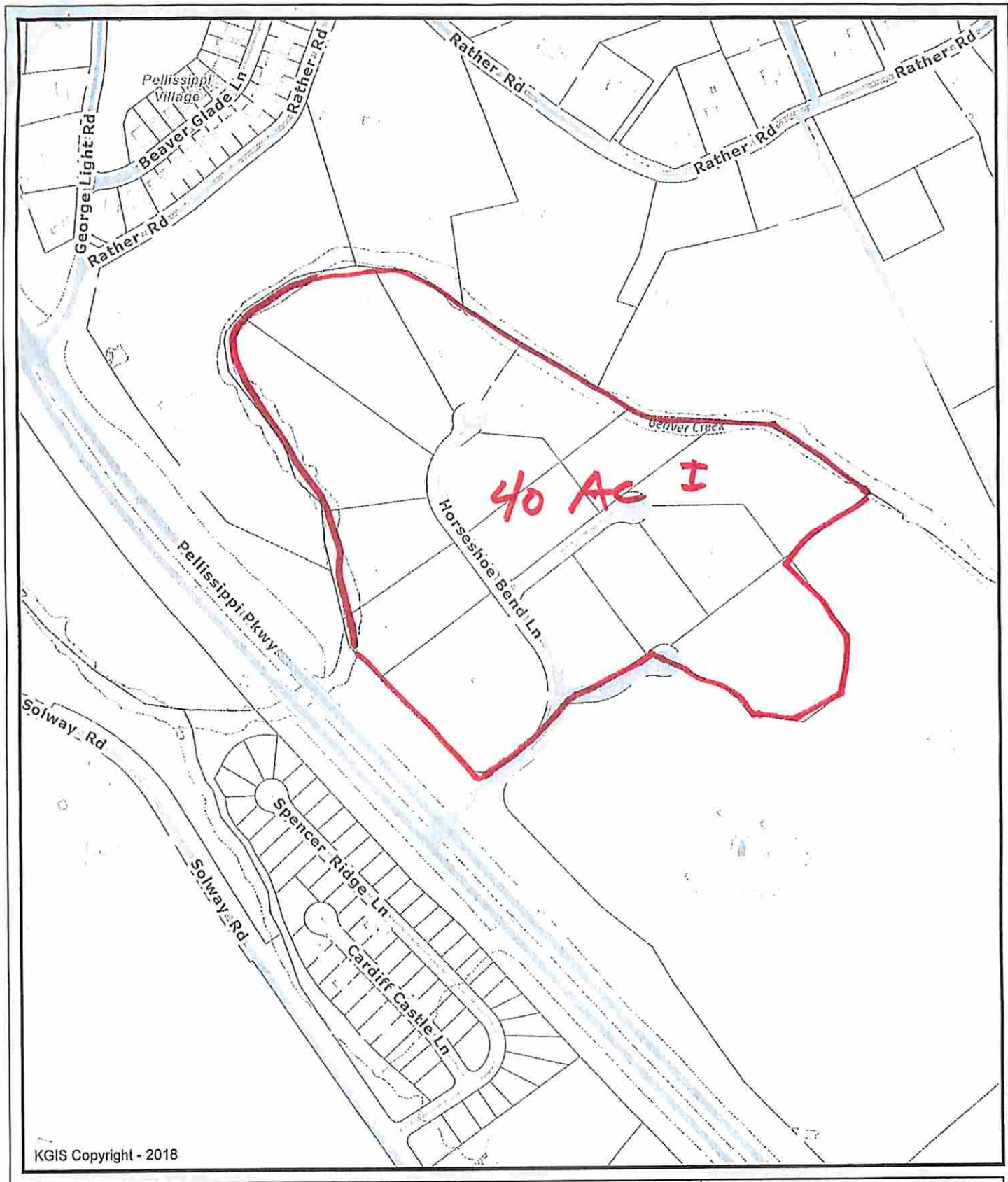
Total Volume Per Leg



JWS
2/14/18

Trip Generation w/ Cherahala Blvd. Extension in place

		Enter	Exit
Horseshoe Bend Bus. Park	AM	662	117
	PM	135	539
Faith Promise church	AM	26	22
	PM	24	20
Total	AM	688	139
	PM	159	559



Letter Portrait

Printed: 2/14/2018 at 8:32:09 AM

0 200 400 800

ft

Knoxville - Knox County - KUB Geographic Information System

Business Park
(770)

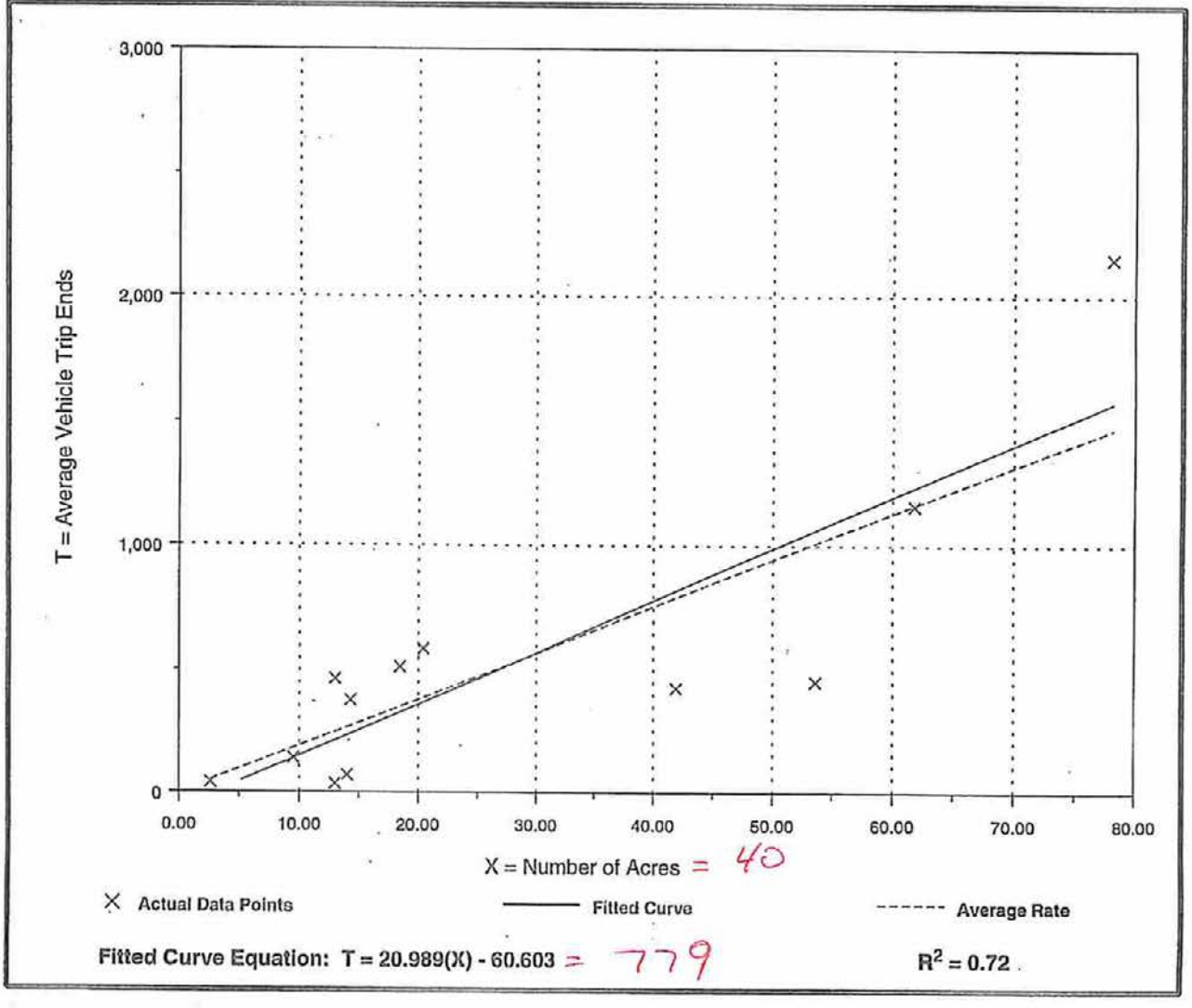
Average Vehicle Trip Ends vs: Acres
On a: Weekday,
A.M. Peak Hour

Number of Studies: 12 — 662
Average Number of Acres: 28 — 117
Directional Distribution: 85% entering, 15% exiting

Trip Generation per Acre

Average Rate	Range of Rates	Standard Deviation
18.86	2.77 - 35.62	10.17

Data Plot and Equation



Fitted Curve Equation: T = 20.989(X) - 60.603 = 779

R^2 = 0.72

Business Park
(770)

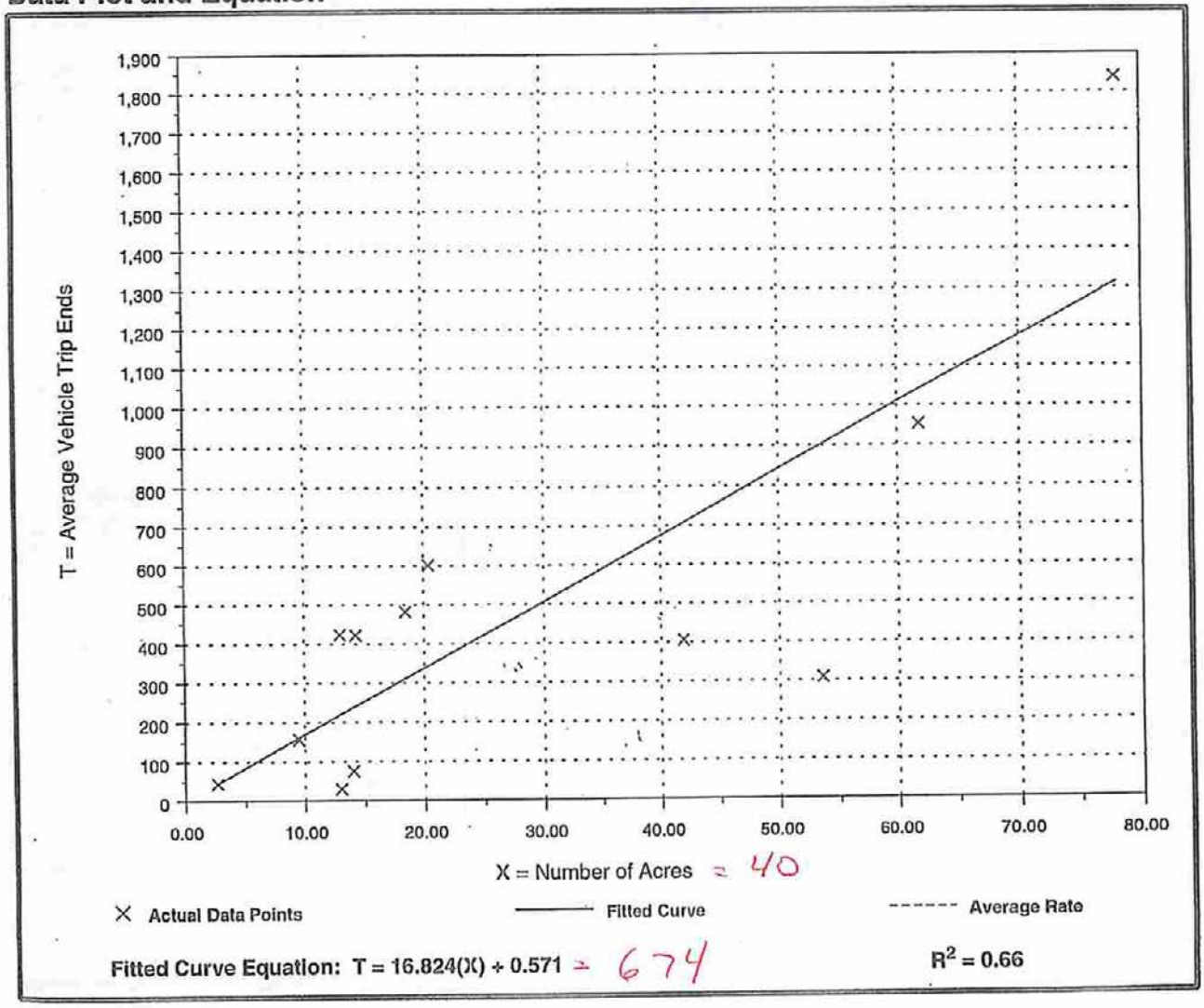
Average Vehicle Trip Ends vs: **Acres**
On a: **Weekday,**
P.M. Peak Hour

Number of Studies: 12 — 135 — 539
Average Number of Acres: 28
Directional Distribution: 20% entering, 80% exiting

Trip Generation per Acre

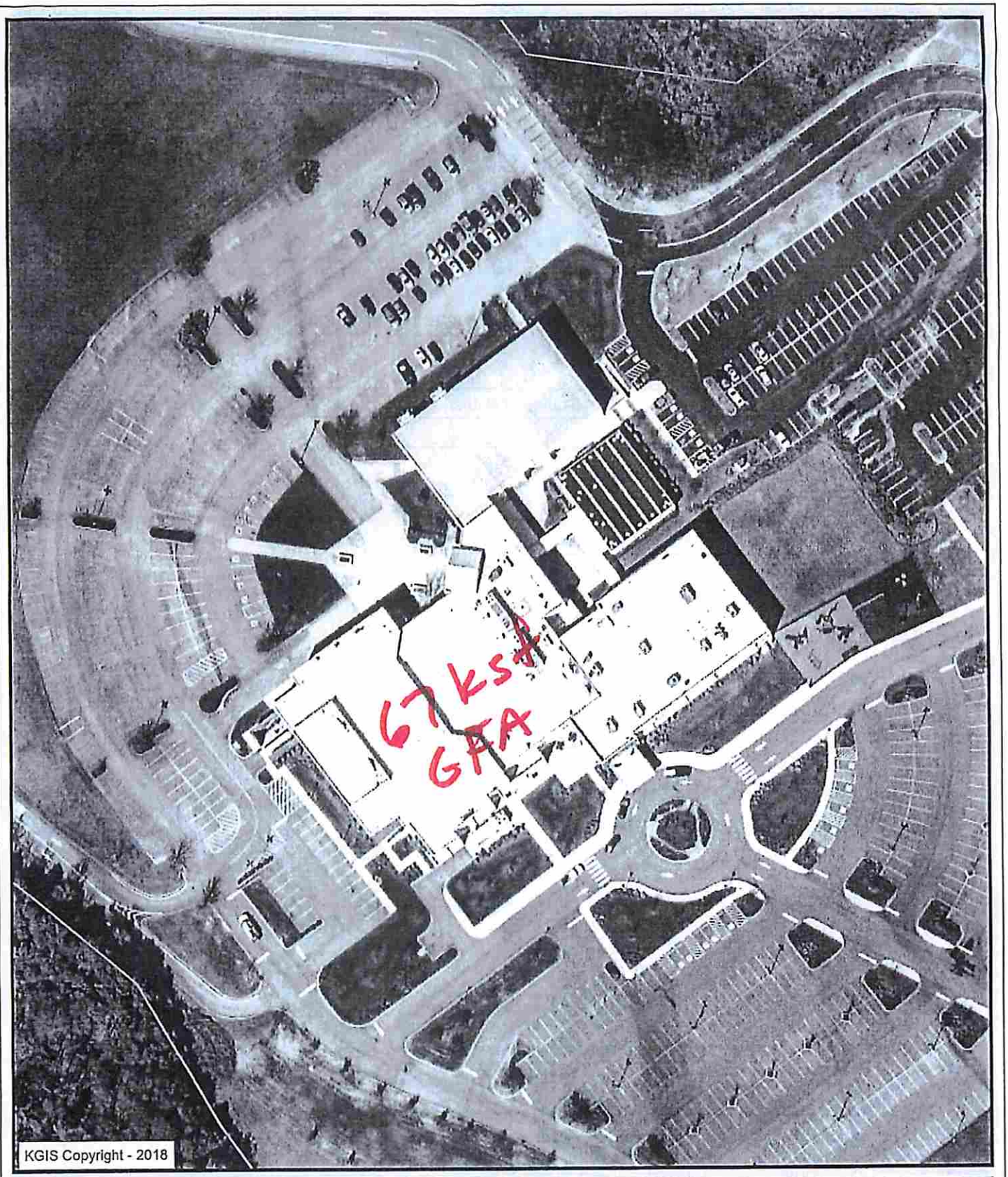
Average Rate	Range of Rates	Standard Deviation
16.84	2.31 - 32.54	9.82

Data Plot and Equation



Fitted Curve Equation: $T = 16.824(X) + 0.571 = 674$

$R^2 = 0.66$



Letter Portrait

Printed: 2/14/2018 at 8:15:34 AM

0 50 100 200

ft

Knoxville - Knox County - KUB Geographic Information System

Church
(560)

Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

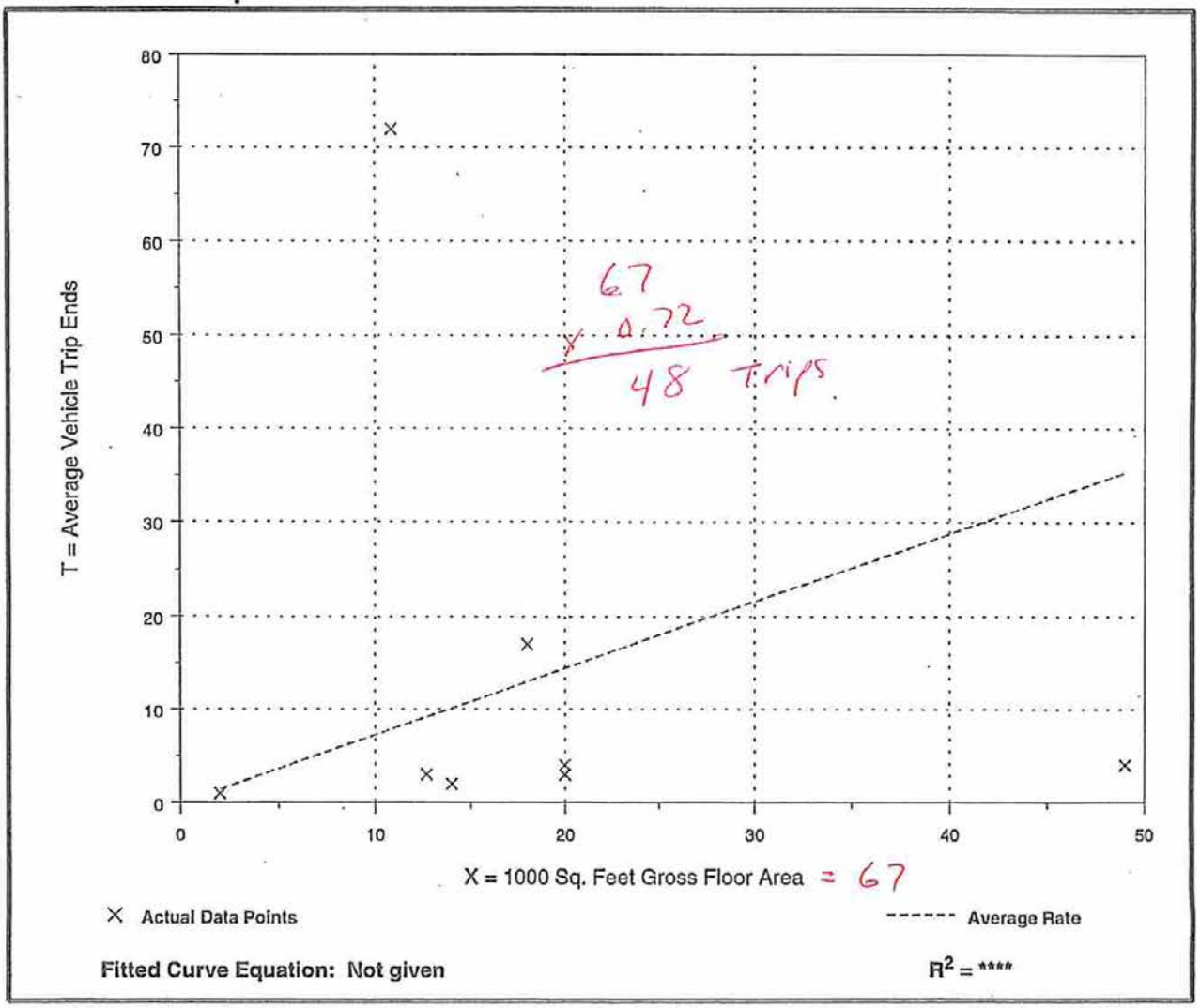
Number of Studies: 8
Average 1000 Sq. Feet GFA: 18
Directional Distribution: 54% entering, 46% exiting

26 22

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
0.72	0.08 - 6.61	1.88

Data Plot and Equation



Church
(560)

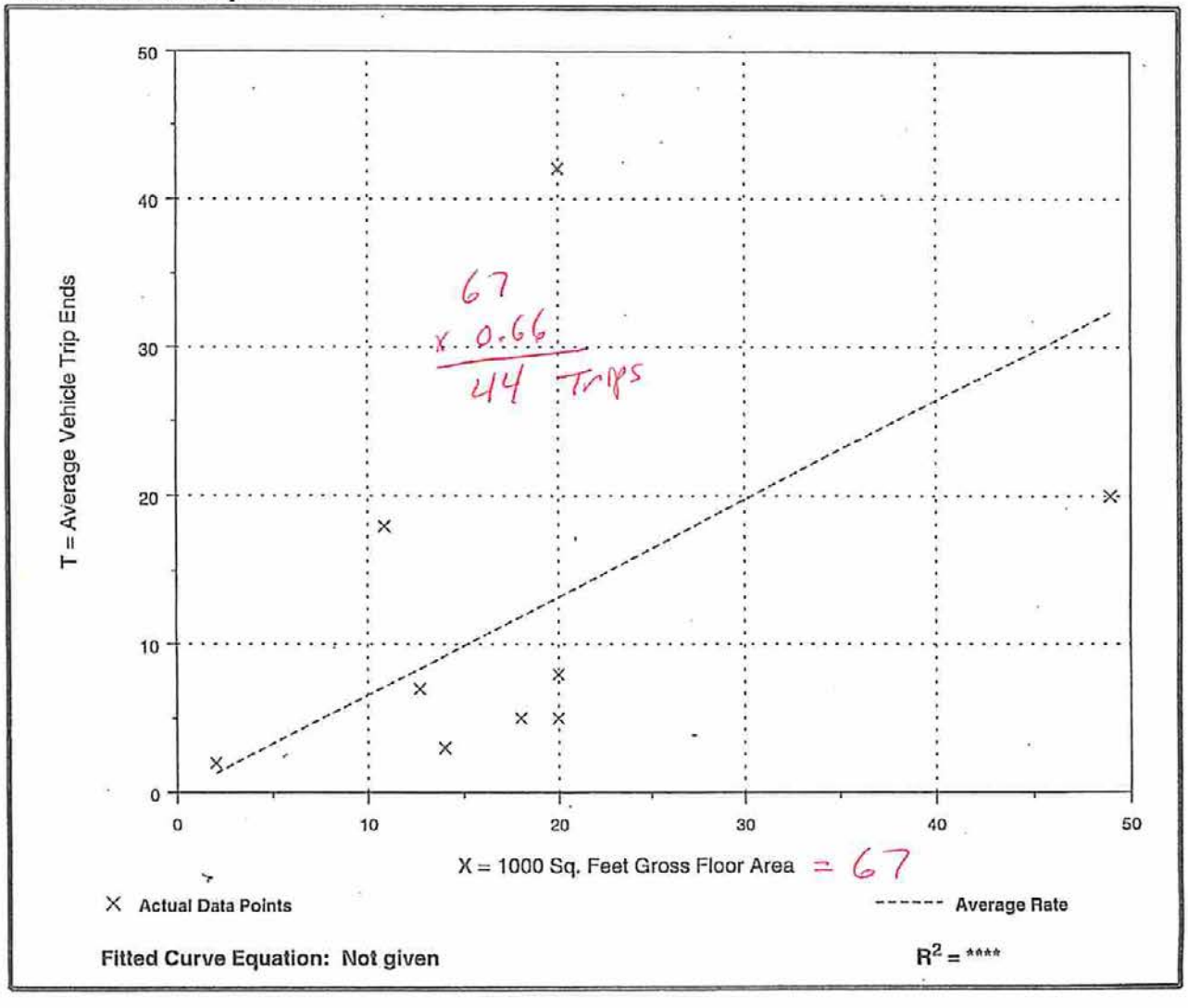
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 9 (24)
Average 1000 Sq. Feet GFA: 19 (20)
Directional Distribution: 54% entering, 46% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
0.66	0.21 - 2.10	1.01

Data Plot and Equation



Attachment 4
Trip Generation

Project: Coward Mill Subdivision **Attachment 4**
Date Conducted: 1/26/2018 **Trip Generation**

Single-Family Detached Housing - 118 Lots
(Land Use 210)

Average Daily Traffic
Ln(T) = 0.92 Ln(X) + 2.72
Ln(T) = 0.92 Ln(118 units) + 2.72
T = 1223

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
T = 0.70(X) + 9.74
T = 0.70(118 units) + 9.74
T = 92

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Ln(T) = 0.90 Ln(X) +0.51
Ln(T) = 0.90 Ln(118 units) +0.51
T = 122

Phase 1 - 35 Lots

		Percent		Number	
Time Period	Total Trips	Enter	Exit	Enter	Exit
Weekday (24 hours)	400	50%	50%	200	200
AM Peak Hour	34	25%	75%	9	26
PM Peak Hour	40	63%	37%	25	15

Phase 2 - 118 Lots

		Percent		Number	
Time Period	Total Trips	Enter	Exit	Enter	Exit
Weekday (24 hours)	1223	50%	50%	612	612
AM Peak Hour	92	25%	75%	23	69
PM Peak Hour	122	63%	37%	77	45

Single-Family Detached Housing
(210)

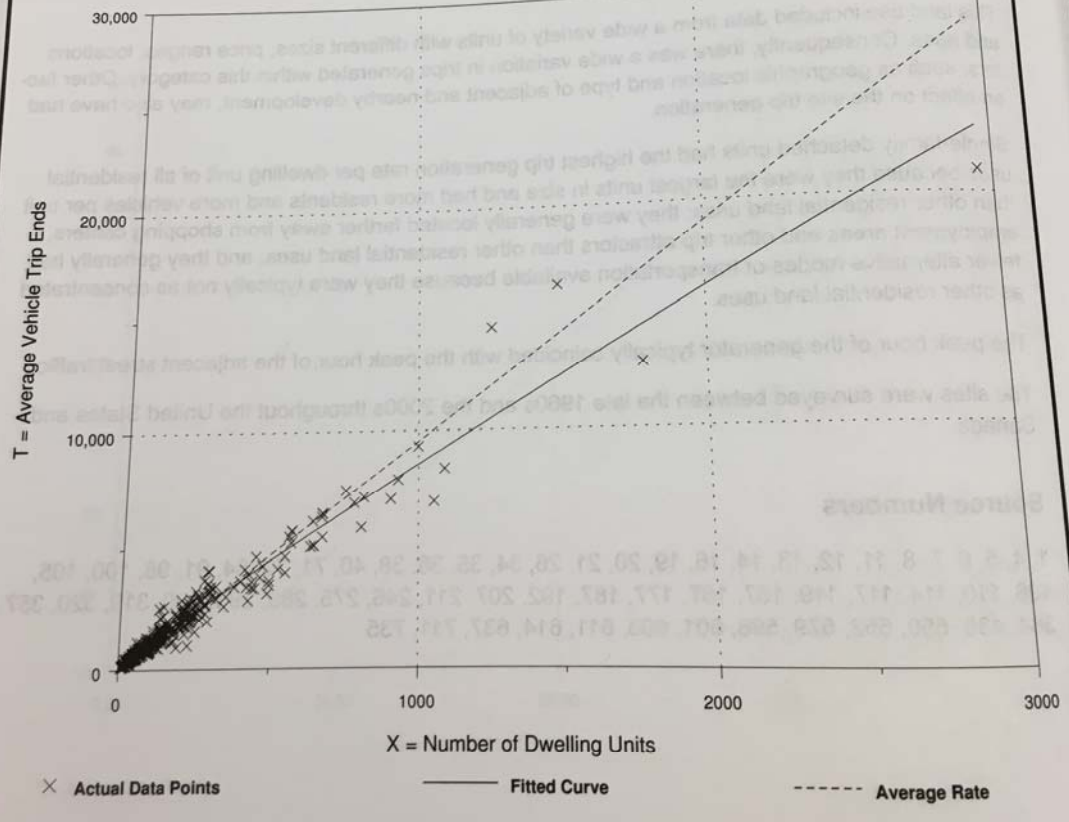
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

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

Trip Generation per Dwelling Unit

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

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.92\ Ln(X) + 2.72$

$R^2 = 0.95$

Single-Family Detached Housing
(210)

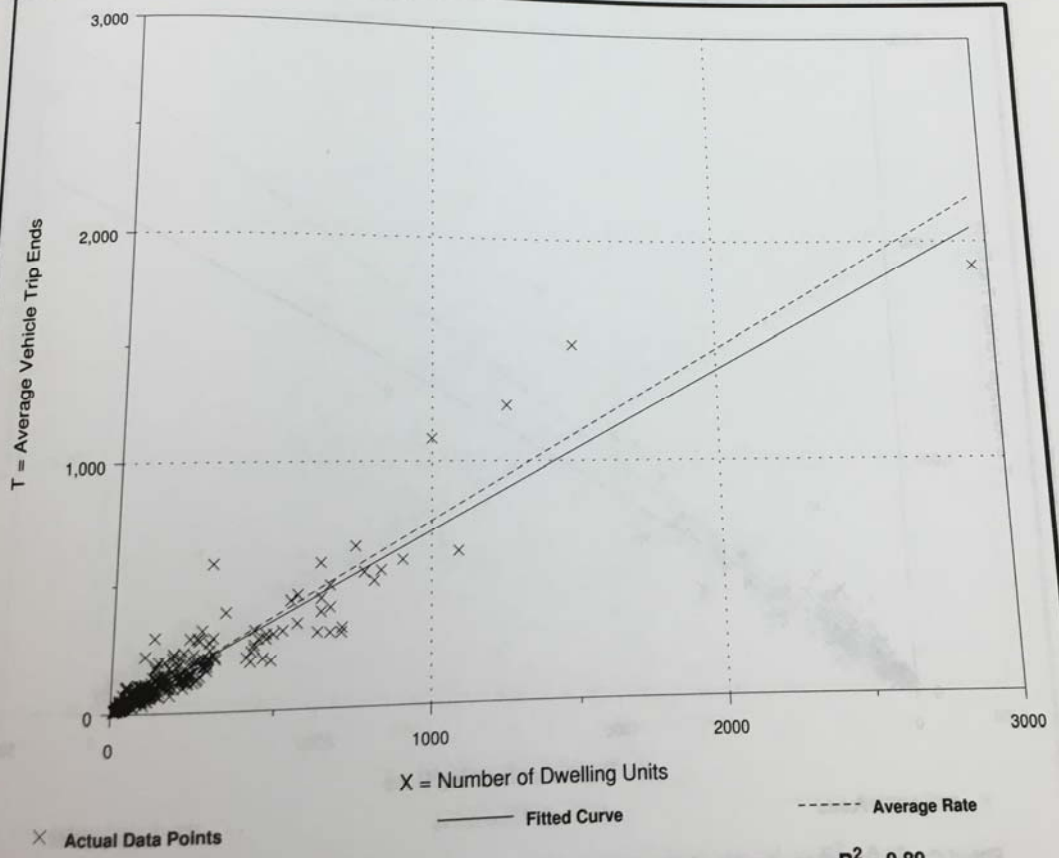
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

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

Trip Generation per Dwelling Unit

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

Data Plot and Equation



$R^2 = 0.89$

Fitted Curve Equation: $T = 0.70(X) + 9.74$

Single-Family Detached Housing
(210)

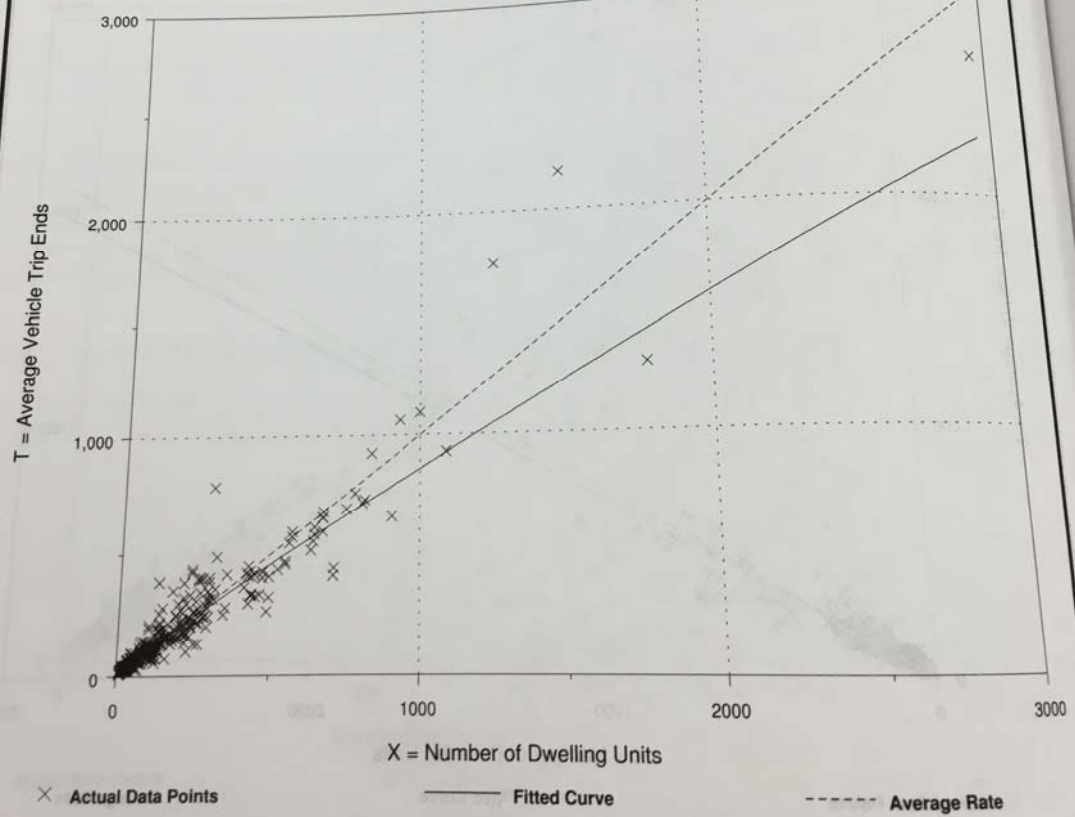
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

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

Trip Generation per Dwelling Unit

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

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.90\ Ln(X) + 0.51$

$R^2 = 0.91$

Attachment 5
Signal Timing

LOCAL CONTROLLER PROGRAMMING

INTERSECTION NUMBER: **15** ZONE: **C**

INTERSECTION: Hardin Valley Road at Cherahala Boulevard / Iron Gate Boulevard

INSTALLATION DATE: _____

PROGRAMMED BY: _____

NOTES: _____

PEEK TRAFFIC
A Kapsch Company

PEEK 3000 SERIES

MASTER TYPE: PEEK 3000

MASTER LOCATION: _____

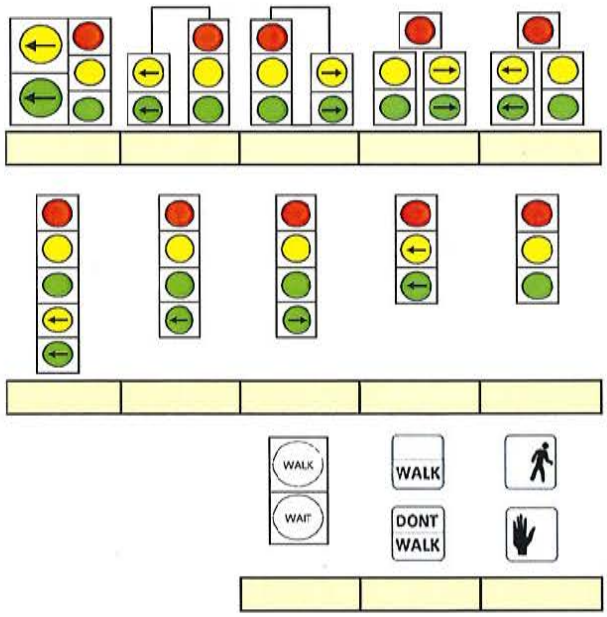
TIME BY PHASE (SEC) & FUNCTIONS

PHASE	1	2	3	4	5	6	7	8
INITIAL	6	10		6	6	10		6
PASSAGE	2.0	4.0		2.0	2.0	4.0		2.0
YELLOW	4.5	4.5		4.0	4.5	4.5		4.0
RED CLEAR	2.5	2.5		4.0	2.0	2.5		4.0
WALK		7		4				
PED CLEAR		47		31				
MAX 1								
MAX 2								
MAX 3 LIMIT								
MAX 3 ADJUST								
CNA 1								
CNA 2								
WALK REST MOD.								
FLASH WALK								
INHIBIT MAX								
PED RECYCLE								
MIN RECALL								
MAX RECALL								
PED RECALL								
SOFT RECALL								
NON-LOCK								
VEHICLE OMIT								
PED OMIT								
MAX OUTS TO ADJ MAX 3								
GAP OUTS TO ADJ MAX 3								

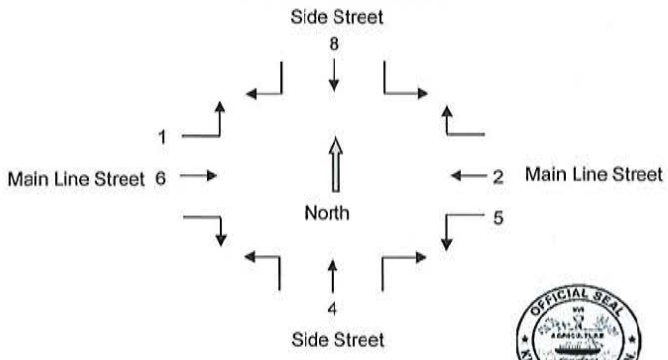
CONTROLLER OPTIONS

PHASE	1	2	3	4	5	6	7	8
START UP								
UCF LAST								
UCF EXIT								
SIM. GAP								
MIN RED REVERT		UCF OVERRIDE HOLD				PRE-EMPT OVERRIDES STOP TIME		
RED REVERT TIME		UCF TEST A OR B						
AUTO PED CLEAR		PASSAGE SEQUENTIAL						
START UP FLASH		ENABLE SIM. GAP						
START UP INTERVAL		ENHANCED PED OPERATION						
START UP ALL RED		EXT. START OVERRIDES						
FLASH								
FREE								
SPECIAL								

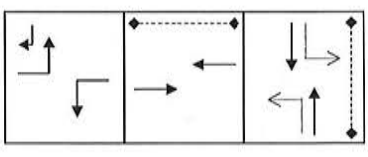
SIGNAL DISPLAYS



PHASING SCHEMATIC



PHASING SEQUENCE



KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

INTERSECTION NUMBER: **15** ZONE: **C**

INTERSECTION: Hardin Valley Road at Cherahala Boulevard / Iron Gate Boulevard

INSTALLATION DATE: _____

PROGRAMMED BY: _____

NOTES: _____

DETECTOR SETTINGS

PEEK TRAFFIC
A Q-Free Company

PEEK 3000 SERIES

DETECTION DATA

PHASE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
LOOPS																
VIDEO																

DETECTOR ASSIGNMENTS

DETECTOR	1	2	3	4	5	6	7	8
DETECTOR 1	X							
DETECTOR 2		X						
DETECTOR 3			X					
DETECTOR 4				X				
DETECTOR 5					X			
DETECTOR 6						X		
DETECTOR 7							X	
DETECTOR 8								X

DETECTOR MODES & TIMING

DETECTOR	DETECTOR MODE	DELAY TIME	STRETCH/ STOP BAR
1			
2			
3			
4			
5			
6			
7			
8			

DELAY INHIBITS

PHASE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DETECTOR 1																
DETECTOR 2																
DETECTOR 3																
DETECTOR 4																
DETECTOR 5																
DETECTOR 6																
DETECTOR 7																
DETECTOR 8																

OFFICIAL SEAL — KNOX COUNTY, TENN.

KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

INTERSECTION NUMBER: **15** ZONE: **C**

COORDINATION AND OPERATION

INTERSECTION: Hardin Valley Road at Cherahala Boulevard / Iron Gate Boulevard

INSTALLATION DATE: _____

PROGRAMMED BY: _____

NOTES: Offset is referenced at beginning of yellow

PEEK TRAFFIC A Gtpata Company

PEEK 3000 SERIES

PHASE ALLOCATIONS (SEC)

PHASE	1	2	3	4	5	6	7	8
CYCLE 1/SPLIT 1	18	79		23	18	79		23
CYCLE 1/SPLIT 2								
CYCLE 2/SPLIT 1	17	77		36	17	77		36
CYCLE 2/SPLIT 2								
CYCLE 3/SPLIT 1	20	50		30	20	50		30
CYCLE 3/SPLIT 2								
CYCLE 4/SPLIT 1								
CYCLE 4/SPLIT 2								

DYNAMIC OMITS

PHASE/OVL	1/A	2/B	3/C	4/D	5/E	6/F	7/G	8/H
OMIT PHASE								
IF PHASE OR OVL ON								
OMIT PHASE								
IF PHASE OR OVL ON								
OMIT PHASE								
IF PHASE OR OVL ON								
OMIT PHASE								
IF PHASE OR OVL ON								

OPERATING MODE

FUNCTION	
AUTO PERM	
END OF MAIN ST	
ENHANCED PERM	
FIXED FORCE OFF	
YELLOW OFFSET	
CENTRAL OVERIDE	
NO PCL OFFSET ADJ	
OFFSET ENTRY IN %	
PERM-PA ENTRY IN %	
INVERT FREE IN	
SPLIT MATRIX	
4 SPLITS / CYCLE	
NO EARLY COORD PED	
CYCLE SOURCE	
SPLIT SOURCE	
OFFSET SOURCE	
FREE SOURCE	
FLASH SOURCE	
INTER. TOD REVERT	
TYPE OF PERM	
OFFSET SEEKING	
PED PERMISSIVE	
YIELD PERCENT	

CYCLE LENGTH / DWELL / OFFSETS

CYCLE	1	2	3	4	5	6
CYCLE LENGTH	120	130	100			
MAX DWELL						
OFFSET 1	42	22	32			
OFFSET 2						
OFFSET 3						
OFFSET 4						
OFFSET 5						

PHASE REVERSAL

PATTERN	MODE	PHASES	
		LEAD	LAG
*1	2	2	1

*2/1/1 and 3/1/1 Plans Only

DUAL ENTRY

PHASE	1	2	3	4	5	6	7	8
PHASE 1								
PHASE 2								
PHASE 3								
PHASE 4								
PHASE 5								
PHASE 6								
PHASE 7								
PHASE 8								

COORD. PHASES

CYCLE	PHASES TO BE COORD	
1	2	6
2		
3		
4		
5		
6		

CYCLE / OFFSET / SPLIT / FREE TO TOD CIRCUITS

PLAN	C / O / S / FREE				CKT	CKT	CKT	CKT
1								
2								

OFFICIAL SEAL KNOX COUNTY, TENN.

KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

TIME OF DAY PROGRAMMING

INTERSECTION NUMBER: **15** ZONE: **C**

INTERSECTION: Hardin Valley Road at Cherahala Boulevard / Iron Gate Boulevard

INSTALLATION DATE: _____

PROGRAMMED BY: _____

NOTES: _____

PEEK TRAFFIC
A Q-Free Company

PEEK 3000 SERIES

WEEKLY PROGRAM PLAN

PLAN	SUN 1	MON 2	TUE 3	WED 4	THU 5	FRI 6	SAT 7
1	2	1	1	1	1	1	2
2							
3							
4							
5							

DAYLIGHT SAVINGS

	MONTH	W-O-M
SPRING	3	2
FALL	11	1

CIRCUIT OVERRIDES

CKT	SYM	ON/OFF/TOD

TIME DEPENDENT SYNC REF

CYCLE	HH:MM
1	
2	
3	
4	
5	
6	
SYNC REF	

DAY PLAN EVENTS

PLAN	HH:MM	CKT PLAN	C/O/S	CKT	ON/OFF
1	00:00	FREE			
1	06:30		1/1/1		
1	09:30		3/1/1		
1	14:30		2/1/1		
1	18:00		3/1/1		
1	21:00	FREE			
2	00:00	FREE			
2	09:00		3/1/1		
2	19:00	FREE			

TOD CIRCUIT PLANS

PLAN	CKT	ON/OFF	CKT	ON/OFF	CKT	ON/OFF	CKT	ON/OFF
1								
2								
3								

OFFICIAL SEAL ★ KNOX COUNTY, TENN. ★

KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

Attachment 6
Intersection Worksheets
Existing AM/PM Peaks

HCS7 Two-Way Stop-Control Report

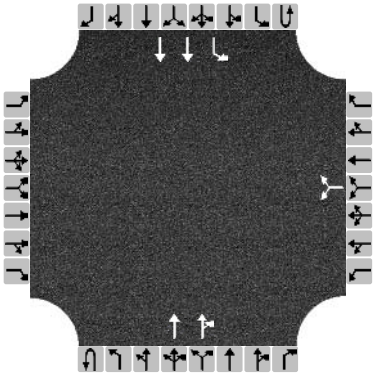
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2018
Time Analyzed	Existing AM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Coward Mill @ Pellissippi
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Pellissippi Parkway
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume, V (veh/h)						57		16			2116	63		5	2156	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							79							5		
Capacity, c (veh/h)							53							203		
v/c Ratio							1.48							0.02		
95% Queue Length, Q_{95} (veh)							7.3							0.1		
Control Delay (s/veh)							418.4							23.2		
Level of Service, LOS							F							C		
Approach Delay (s/veh)						418.4								0.0		
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

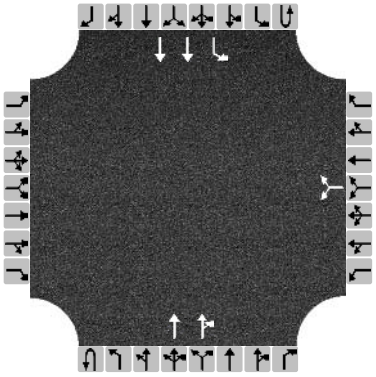
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2018
Time Analyzed	Existing PM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Coward Mill @ Pellissippi
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Pellissippi Parkway
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	2	0	0	1	2	0
Configuration							LR				T	TR		L	T	
Volume, V (veh/h)						25		17			2026	46		23	2653	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

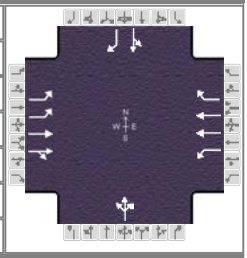
Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						6.84		6.94						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.52		3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							45							25		
Capacity, c (veh/h)							64							225		
v/c Ratio							0.70							0.11		
95% Queue Length, Q_{95} (veh)							3.1							0.4		
Control Delay (s/veh)							143.7							23.0		
Level of Service, LOS							F							C		
Approach Delay (s/veh)						143.7								0.2		
Approach LOS						F										

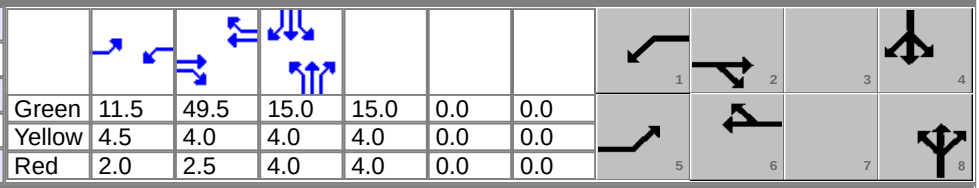
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	ALK	Analysis Date	1/28/2018	Area Type	Other
Jurisdiction	Knox County	Time Period	Existing AM Peak	PHF	0.93
Urban Street	Hardin Valley Road	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	Hardin Valley @ Cherah…	File Name	Existing AM Peak_Hardin Valley.xus		
Project Description	548.004 Coward Mill 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	198	645	1	3	1478	97	0	0	2	47	1	17

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.5	49.5	15.0	15.0	0.0	0.0
Yellow	4.5	4.0	4.0	4.0	0.0	0.0
Red	2.0	2.5	4.0	4.0	0.0	0.0

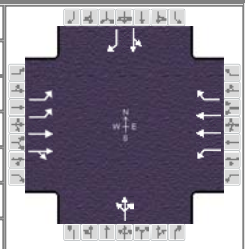
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	4.0	2.0	3.0		12.0		11.0
Phase Duration, s	18.0	56.0	18.0	56.0		23.0		23.0
Change Period, ($Y+R_c$), s	7.0	6.5	6.5	6.5		8.0		8.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.4		3.2
Queue Clearance Time (g_s), s	9.1		2.2			2.1		5.1
Green Extension Time (g_e), s	0.1	0.0	0.0	0.0		0.0		0.1
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		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	213	347	347	3	1589	104		0			52	18
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1870	1869	1781	1781	1585		0			1783	1585
Queue Service Time (g_s), s	7.1	16.1	16.1	0.2	49.5	5.0		0.0			3.1	1.2
Cycle Queue Clearance Time (g_c), s	7.1	16.1	16.1	0.2	49.5	5.0		0.0			3.1	1.2
Green Ratio (*g/C*)	0.09	0.41	0.41	0.10	0.41	0.41					0.12	0.12
Capacity (*c*), veh/h	317	772	771	171	1469	654					223	198
Volume-to-Capacity Ratio (*X*)	0.671	0.450	0.450	0.019	1.082	0.160		0.000			0.232	0.092
Back of Queue (*Q*), ft/ln (50 th percentile)	89	183.6	180.9	2.4	762.9	47.8		0			39.3	13.6
Back of Queue (*Q*), veh/ln (50 th percentile)	3.5	7.2	7.2	0.1	30.0	1.9		0.0			1.5	0.5
Queue Storage Ratio (*RQ*) (50 th percentile)	0.41	0.00	0.00	0.03	0.00	0.25		0.00			0.00	0.00
Uniform Delay (d_1), s/veh	52.8	25.4	25.4	49.1	35.3	22.2					47.3	46.5
Incremental Delay (d_2), s/veh	10.8	1.9	1.9	0.2	49.0	0.5		0.0			2.4	0.9
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
Control Delay (*d*), s/veh	63.6	27.3	27.3	49.3	84.3	22.7					49.7	47.4
Level of Service (LOS)	E	C	C	D	F	C					D	D
Approach Delay, s/veh / LOS	35.8	D		80.4	F		46.1	D		49.1	D	
Intersection Delay, s/veh / LOS	64.4						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.7	C	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.2	A	1.9	B	0.5	A	0.6	A

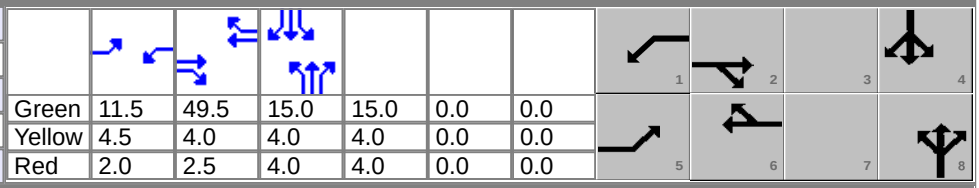
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	ALK	Analysis Date	1/28/2018	Area Type	Other
Jurisdiction	Knox County	Time Period	Existing PM Peak	PHF	0.93
Urban Street	Hardin Valley Road	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	Hardin Valley @ Cherah…	File Name	Existing PM Peak_Hardin Valley.xus		
Project Description	548.004 Coward Mill 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	1067	1	8	1047	15	42	1	11	214	2	177

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	11.5	49.5	15.0	15.0	0.0	0.0
Yellow	4.5	4.0	4.0	4.0	0.0	0.0
Red	2.0	2.5	4.0	4.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	4.0	2.0	3.0		12.0		11.0
Phase Duration, s	18.0	56.0	18.0	56.0		23.0		23.0
Change Period, ($Y+R_c$), s	7.0	6.5	6.5	6.5		8.0		8.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.2		3.3
Queue Clearance Time (g_s), s	4.1		2.5			5.6		17.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.00			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	65	574	574	9	1126	16		58			232	190
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1870	1870	1781	1781	1585		1739			1782	1585
Queue Service Time (g_s), s	2.1	31.2	31.2	0.5	32.6	0.7		3.6			15.0	14.3
Cycle Queue Clearance Time (g_c), s	2.1	31.2	31.2	0.5	32.6	0.7		3.6			15.0	14.3
Green Ratio (*g/C*)	0.09	0.41	0.41	0.10	0.41	0.41		0.12			0.12	0.12
Capacity (*c*), veh/h	317	772	771	171	1469	654		217			223	198
Volume-to-Capacity Ratio (*X*)	0.203	0.744	0.744	0.050	0.766	0.025		0.267			1.043	0.961
Back of Queue (*Q*), ft/ln (50 th percentile)	23.9	372.1	365.8	6.5	354.9	6.9		44.7			282.9	220.4
Back of Queue (*Q*), veh/ln (50 th percentile)	0.9	14.7	14.6	0.3	14.0	0.3		1.8			11.1	8.7
Queue Storage Ratio (*RQ*) (50 th percentile)	0.11	0.00	0.00	0.07	0.00	0.04		0.00			0.00	0.00
Uniform Delay (d_1), s/veh	50.4	29.9	29.9	49.3	30.3	20.9		47.5			52.5	52.2
Incremental Delay (d_2), s/veh	1.4	6.4	6.4	0.6	3.9	0.1		3.0			71.9	54.4
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
Control Delay (*d*), s/veh	51.9	36.3	36.3	49.8	34.2	21.0		50.5			124.4	106.6
Level of Service (LOS)	D	D	D	D	C	C		D			F	F
Approach Delay, s/veh / LOS	37.1	D		34.1	C		50.5	D		116.4	F	
Intersection Delay, s/veh / LOS	48.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.7	C	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.5	A	1.4	A	0.6	A	1.2	A

Attachment 7
Intersection Worksheets
Phase 1 Background AM/PM Peak

HCS7 Two-Way Stop-Control Report

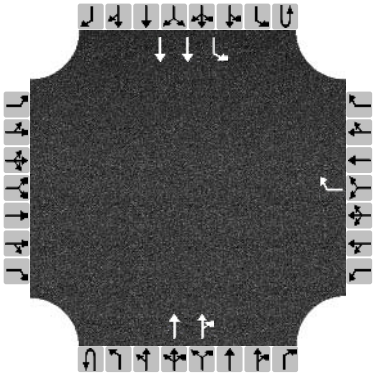
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2021
Time Analyzed	Background AM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Coward Mill @ Pellissippi
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Pellissippi Parkway
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	1	2	0
Configuration								R			T	TR		L	T	
Volume, V (veh/h)								85			2180	73		6	2221	
Percent Heavy Vehicles (%)								2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9						4.1		
Critical Headway (sec)								6.94						4.14		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								92						7		
Capacity, c (veh/h)								171						188		
v/c Ratio								0.54						0.04		
95% Queue Length, Q_{95} (veh)								2.7						0.1		
Control Delay (s/veh)								48.2						24.9		
Level of Service, LOS								E						C		
Approach Delay (s/veh)						48.2								0.1		
Approach LOS						E										

HCS7 Two-Way Stop-Control Report

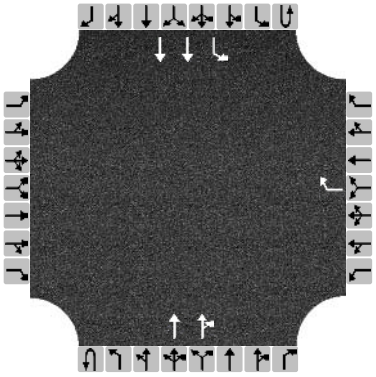
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2021
Time Analyzed	Background PM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Coward Mill @ Pellissippi
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Pellissippi Parkway
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	1	2	0
Configuration								R			T	TR		L	T	
Volume, V (veh/h)								49			2087	53		27	2733	
Percent Heavy Vehicles (%)								2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

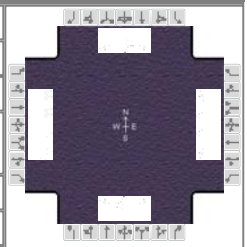
Base Critical Headway (sec)								6.9						4.1		
Critical Headway (sec)								6.94						4.14		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								53						29		
Capacity, c (veh/h)								188						211		
v/c Ratio								0.28						0.14		
95% Queue Length, Q_{95} (veh)								1.1						0.5		
Control Delay (s/veh)								31.5						24.8		
Level of Service, LOS								D						C		
Approach Delay (s/veh)						31.5								0.2		
Approach LOS						D										

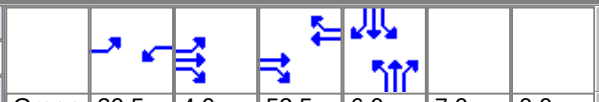
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	ALK	Analysis Date	1/28/2018	Area Type	Other
Jurisdiction	Knox County	Time Period	Background AM Peak	PHF	0.93
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley @ Cherah…	File Name	Background AM Peak_Hardin Valley.xus		
Project Description	548.004 Coward Mill Subdivision				

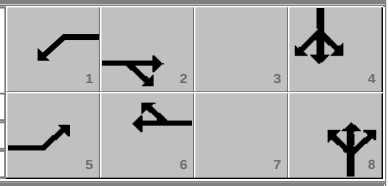


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	229	747	23	35	1711	112	42	0	65	54	1	20

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	20.5	4.0	53.5	6.0	7.0	0.0
Yellow	4.5	0.0	4.0	4.0	4.0	0.0
Red	2.0	0.0	2.5	4.0	4.0	0.0



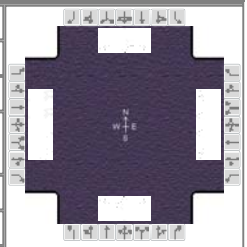
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	4.0	2.0	3.0		9.0		9.0
Phase Duration, s	31.0	64.0	27.0	60.0		15.0		14.0
Change Period, ($Y+R_c$), s	7.0	6.5	6.5	6.5		8.0		8.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.3		3.2
Queue Clearance Time (g_s), s	9.4		4.1			7.1		5.8
Green Extension Time (g_e), s	0.4	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.00		0.00			1.00		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	246	416	412	38	1840	120	45	0	70	58	1	22
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1870	1850	1781	1781	1585	1810	1870	1610	1810	1870	1585
Queue Service Time (g_s), s	7.4	17.9	17.9	2.1	53.5	5.5	2.9	0.0	5.1	3.8	0.1	1.6
Cycle Queue Clearance Time (g_c), s	7.4	17.9	17.9	2.1	53.5	5.5	2.9	0.0	5.1	3.8	0.1	1.6
Green Ratio (*g/C*)	0.20	0.48	0.48	0.17	0.45	0.45	0.06	0.06	0.06	0.05	0.05	0.05
Capacity (*c*), veh/h	692	896	887	304	1588	707	106	109	94	90	94	79
Volume-to-Capacity Ratio (*X*)	0.356	0.464	0.464	0.124	1.159	0.170	0.428	0.000	0.744	0.642	0.011	0.271
Back of Queue (*Q*), ft/ln (50 th percentile)	81.2	198.3	193.5	25.3	984.3	51.9	41.9	0	78.8	62	0.9	20.5
Back of Queue (*Q*), veh/ln (50 th percentile)	3.2	7.8	7.7	1.0	38.8	2.0	1.7	0.0	3.2	2.5	0.0	0.8
Queue Storage Ratio (*RQ*) (50 th percentile)	0.38	0.00	0.00	0.28	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	41.3	20.9	20.9	42.1	33.3	19.9	54.6	0.0	55.6	55.9	54.2	54.9
Incremental Delay (d_2), s/veh	1.4	1.7	1.7	0.8	78.9	0.5	12.2	0.0	41.1	30.0	0.2	8.3
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	0.0
Control Delay (*d*), s/veh	42.8	22.7	22.7	43.0	112.2	20.5	66.7	0.0	96.7	86.0	54.4	63.1
Level of Service (LOS)	D	C	C	D	F	C	E		F	F	D	E
Approach Delay, s/veh / LOS	27.3	C		105.4	F		84.9	F		79.5	E	
Intersection Delay, s/veh / LOS	78.3						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.8	C	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.4	A	2.1	B	0.7	A	0.6	A

HCS7 Signalized Intersection Results Summary

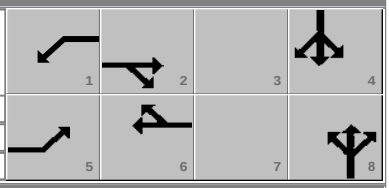
General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	ALK	Analysis Date	1/28/2018	Area Type	Other
Jurisdiction	Knox County	Time Period	Background PM Peak	PHF	0.93
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley @ Cherah…	File Name	Background PM Peak_Hardin Valley.xus		
Project Description	548.004 Coward Mill 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	69	1235	30	52	1212	17	110	1	105	248	2	205

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	6.5	1.0	52.5	15.0	16.0	0.0	
Yellow	4.5	0.0	4.0	4.0	4.0	0.0	
Red	2.0	0.0	2.5	4.0	4.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	4.0	2.0	3.0		9.0		9.0
Phase Duration, s	14.0	60.0	13.0	59.0		24.0		23.0
Change Period, ($Y+R_c$), s	7.0	6.5	6.5	6.5		8.0		8.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.3		3.3
Queue Clearance Time (g_s), s	4.5		5.7			9.8		17.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.2		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		1.00			0.08		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	74	683	678	56	1303	18	118	1	113	267	2	220
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1870	1854	1781	1781	1585	1810	1870	1610	1810	1870	1585
Queue Service Time (g_s), s	2.5	38.2	38.3	3.7	39.0	0.8	7.3	0.1	7.8	15.0	0.1	15.0
Cycle Queue Clearance Time (g_c), s	2.5	38.2	38.3	3.7	39.0	0.8	7.3	0.1	7.8	15.0	0.1	15.0
Green Ratio (*g/C*)	0.06	0.45	0.45	0.05	0.44	0.44	0.13	0.13	0.13	0.12	0.12	0.12
Capacity (*c*), veh/h	202	834	827	96	1558	693	241	249	215	226	234	198
Volume-to-Capacity Ratio (*X*)	0.368	0.819	0.820	0.579	0.836	0.026	0.490	0.004	0.526	1.179	0.009	1.113
Back of Queue (*Q*), ft/ln (50 th percentile)	30.4	458.2	448.8	56.6	426.1	7.5	93.9	0.8	92.2	353.1	1.6	287.2
Back of Queue (*Q*), veh/ln (50 th percentile)	1.2	18.0	18.0	2.2	16.8	0.3	3.8	0.0	3.7	14.1	0.1	11.3
Queue Storage Ratio (*RQ*) (50 th percentile)	0.14	0.00	0.00	0.63	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	54.4	29.0	29.0	55.4	29.9	19.2	48.2	45.1	48.5	52.5	46.0	52.5
Incremental Delay (d_2), s/veh	5.1	8.8	8.9	22.9	5.5	0.1	7.0	0.0	8.9	116.7	0.1	97.4
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	0.0
Control Delay (*d*), s/veh	59.5	37.8	38.0	78.3	35.4	19.3	55.2	45.1	57.4	169.2	46.1	149.9
Level of Service (LOS)	E	D	D	E	D	B	E	D	E	F	D	F
Approach Delay, s/veh / LOS	39.0	D		37.0	D		56.2	E		159.9	F	
Intersection Delay, s/veh / LOS	56.1						E					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.8	C	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.7	B	1.6	B	0.9	A	1.3	A

Attachment 8
Intersection Worksheets
Phase 1 Full Buildout AM/PM Peaks

HCS7 Two-Way Stop-Control Report

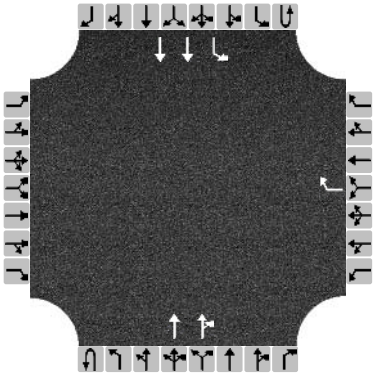
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2021
Time Analyzed	Phase 1 AM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Coward Mill @ Pellissippi
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Pellissippi Parkway
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	1	2	0
Configuration								R			T	TR		L	T	
Volume, V (veh/h)								98			2180	77		7	2221	
Percent Heavy Vehicles (%)								2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9						4.1		
Critical Headway (sec)								6.94						4.14		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								107						8		
Capacity, c (veh/h)								170						187		
v/c Ratio								0.63						0.04		
95% Queue Length, Q_{95} (veh)								3.5						0.1		
Control Delay (s/veh)								56.5						25.1		
Level of Service, LOS								F						D		
Approach Delay (s/veh)						56.5								0.1		
Approach LOS						F										

HCS7 Two-Way Stop-Control Report

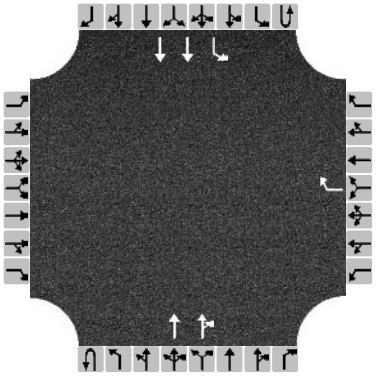
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2021
Time Analyzed	Phase 1 PM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Coward Mill @ Pellissippi
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Pellissippi Parkway
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	0	0	1	2	0
Configuration								R			T	TR		L	T	
Volume, V (veh/h)								57			2087	61		32	2733	
Percent Heavy Vehicles (%)								2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)								6.9						4.1		
Critical Headway (sec)								6.94						4.14		
Base Follow-Up Headway (sec)								3.3						2.2		
Follow-Up Headway (sec)								3.32						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								62						35		
Capacity, c (veh/h)								187						209		
v/c Ratio								0.33						0.17		
95% Queue Length, Q_{95} (veh)								1.4						0.6		
Control Delay (s/veh)								33.6						25.7		
Level of Service, LOS								D						D		
Approach Delay (s/veh)						33.6								0.3		
Approach LOS						D										

HCS7 Two-Way Stop-Control Report

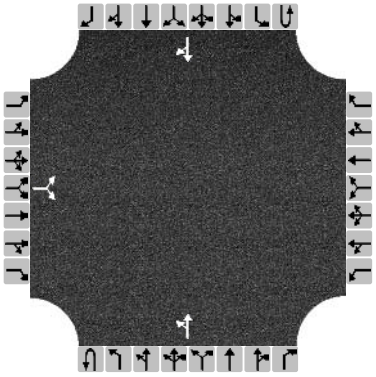
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2021
Time Analyzed	Phase 1 AM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Access #1 @ Coward Mill
Jurisdiction	Knox County
East/West Street	Access #1
North/South Street	Coward Mill Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		13		13						5	79				85	5
Percent Heavy Vehicles (%)		2		2						2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.42		6.22						4.12						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			28							5						
Capacity, c (veh/h)			871							1495						
v/c Ratio			0.03							0.00						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			9.3							7.4						
Level of Service, LOS			A							A						
Approach Delay (s/veh)		9.3								0.4						
Approach LOS		A														

HCS7 Two-Way Stop-Control Report

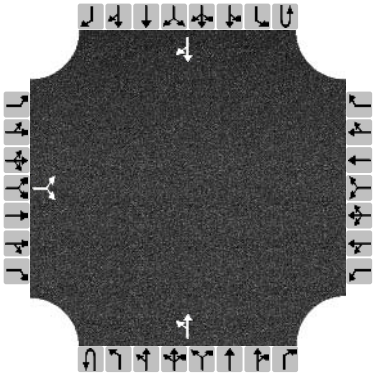
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/16/2018
Analysis Year	2021
Time Analyzed	Phase 1 PM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Access #1 @ Coward Mill
Jurisdiction	Knox County
East/West Street	Access Road #1
North/South Street	Coward Mill Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		8		8						13	80				49	13
Percent Heavy Vehicles (%)		2		2						2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.42		6.22						4.12						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.52		3.32						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			18							14						
Capacity, c (veh/h)			895							1533						
v/c Ratio			0.02							0.01						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			9.1							7.4						
Level of Service, LOS			A							A						
Approach Delay (s/veh)		9.1								1.1						
Approach LOS		A														

Attachment 9
Intersection Worksheets
Phase 2 Full Buildout AM/PM Peaks

HCS7 Two-Way Stop-Control Report

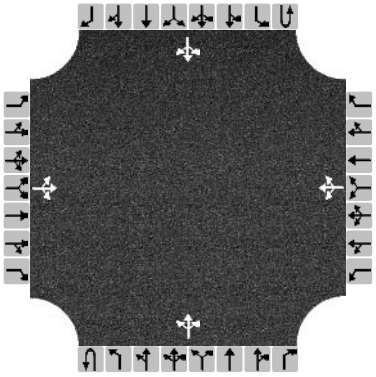
General Information

Analyst	ALK
Agency/Co.	FMA
Date Performed	3/18/2018
Analysis Year	2021
Time Analyzed	Phase 2 AM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Cherahala @ Coward Mill
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Cherahala Boulevard
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		0	0	0		66	0	55		0	462	0		89	135	0
Percent Heavy Vehicles (%)		2	2	2		2	2	2		2				2		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.12	6.52	6.22		6.42	6.52	6.22		4.12				4.12		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			0				132			0				97		
Capacity, c (veh/h)			0				385			1434				1062		
v/c Ratio							0.34			0.00				0.09		
95% Queue Length, Q_{95} (veh)							1.5			0.0				0.3		
Control Delay (s/veh)			5.0				19.1			7.5				8.7		
Level of Service, LOS			A				C			A				A		
Approach Delay (s/veh)		5.0				19.1				0.0				4.0		
Approach LOS		A				C										

HCS7 Two-Way Stop-Control Report

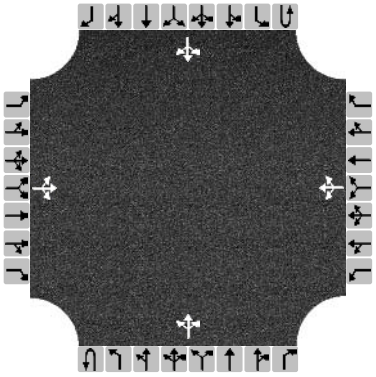
General Information

Analyst	ALK
Agency/Co.	FMA
Date Performed	3/18/2018
Analysis Year	2021
Time Analyzed	Phase 2 PM Peak
Intersection Orientation	North-South
Project Description	548.004 Coward Mill Subdivision

Site Information

Intersection	Cherahala @ Coward Mill
Jurisdiction	Knox County
East/West Street	Coward Mill Road
North/South Street	Cherahala Boulevard
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		0	0	0		29	0	32		0	153	0		110	393	0
Percent Heavy Vehicles (%)		2	2	2		2	2	2		2				2		
Proportion Time Blocked																
Percent Grade (%)		0				0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

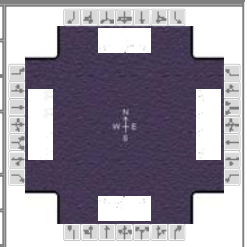
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.12	6.52	6.22		6.42	6.52	6.22		4.12				4.12		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			0				67			0				120		
Capacity, c (veh/h)			0				468			1132				1411		
v/c Ratio							0.14			0.00				0.09		
95% Queue Length, Q_{95} (veh)							0.5			0.0				0.3		
Control Delay (s/veh)			5.0				14.0			8.2				7.8		
Level of Service, LOS			A				B			A				A		
Approach Delay (s/veh)		5.0				14.0				0.0				2.4		
Approach LOS		A				B										

HCS7 Signalized Intersection Results Summary

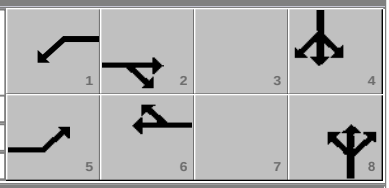
General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	ALK	Analysis Date	1/28/2018	Area Type	Other
Jurisdiction	Knox County	Time Period	Full Buildout AM Peak	PHF	0.93
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley @ Cherah…	File Name	Full Buildout AM Peak_Hardin Valley.xus		
Project Description	548.004 Coward Mill 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	549	747	23	35	1711	254	42	0	65	116	1	159

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	16.5	2.0	53.5	6.0	6.0	0.0						
Yellow	4.5	4.5	4.0	4.0	4.0	0.0						
Red	2.0	2.5	2.5	4.0	4.0	0.0						



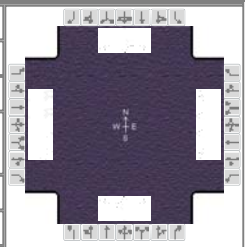
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	4.0	2.0	3.0		9.0		9.0
Phase Duration, s	32.0	69.0	23.0	60.0		14.0		14.0
Change Period, ($Y+R_c$), s	7.0	6.5	6.5	6.5		8.0		8.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.3		3.3
Queue Clearance Time (g_s), s	21.5		4.2			7.2		8.0
Green Extension Time (g_e), s	0.6	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	0.76		0.00			1.00		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	590	416	412	38	1840	273	45	0	70	125	1	171
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1870	1850	1781	1781	1585	1810	1870	1610	1810	1870	1585
Queue Service Time (g_s), s	19.5	16.5	16.5	2.2	53.5	13.8	2.9	0.0	5.2	6.0	0.1	6.0
Cycle Queue Clearance Time (g_c), s	19.5	16.5	16.5	2.2	53.5	13.8	2.9	0.0	5.2	6.0	0.1	6.0
Green Ratio (*g/C*)	0.21	0.52	0.52	0.14	0.45	0.45	0.05	0.05	0.05	0.05	0.05	0.05
Capacity (*c*), veh/h	721	974	964	245	1588	707	90	94	81	90	94	79
Volume-to-Capacity Ratio (*X*)	0.819	0.427	0.427	0.154	1.159	0.386	0.499	0.000	0.868	1.379	0.011	2.157
Back of Queue (*Q*), ft/ln (50 th percentile)	231.8	177.7	173.4	26.9	984.3	132.6	44.8	0	90.8	210	0.9	374.2
Back of Queue (*Q*), veh/ln (50 th percentile)	9.1	7.0	6.9	1.1	38.8	5.2	1.8	0.0	3.6	8.4	0.0	14.7
Queue Storage Ratio (*RQ*) (50 th percentile)	1.08	0.00	0.00	0.30	0.00	0.70	0.00	0.00	0.00	0.00	0.00	1.36
Uniform Delay (d_1), s/veh	45.3	17.7	17.7	45.6	33.3	22.3	55.5	0.0	56.6	57.0	54.2	57.0
Incremental Delay (d_2), s/veh	10.1	1.4	1.4	1.3	78.9	1.6	18.3	0.0	68.4	225.2	0.2	560.1
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	0.0	0.0
Control Delay (*d*), s/veh	55.4	19.1	19.1	46.9	112.2	23.9	73.9	0.0	125.0	282.2	54.4	617.1
Level of Service (LOS)	E	B	B	D	F	C	E		F	F	D	F
Approach Delay, s/veh / LOS	34.2	C		99.8	F		104.9	F		474.3	F	
Intersection Delay, s/veh / LOS	104.5						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.8	C	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.7	B	2.3	B	0.7	A	1.0	A

HCS7 Signalized Intersection Results Summary

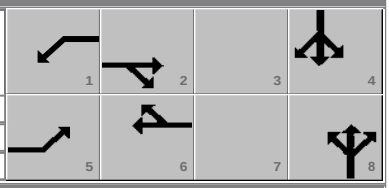
General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	ALK	Analysis Date	1/28/2018	Area Type	Other
Jurisdiction	Knox County	Time Period	Full Buildout PM Peak	PHF	0.93
Urban Street	Hardin Valley Road	Analysis Year	2021	Analysis Period	1> 7:00
Intersection	Hardin Valley @ Cherah…	File Name	Full Buildout PM Peak_Hardin Valley.xus		
Project Description	548.004 Coward Mill 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	175	1235	30	52	1212	64	110	1	105	378	2	497

Signal Information			
Cycle, s	120.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.0	4.0	42.5	30.0	7.0	0.0
Yellow	4.5	0.0	4.0	4.0	4.0	0.0
Red	2.5	0.0	2.5	4.0	4.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2	1	6		8		4
Case Number	2.0	4.0	2.0	3.0		9.0		9.0
Phase Duration, s	14.0	49.0	18.0	53.0		15.0		38.0
Change Period, ($Y+R_c$), s	7.0	6.5	6.5	6.5		8.0		8.0
Max Allow Headway (*MAH*), s	3.0	0.0	3.0	0.0		3.3		3.3
Queue Clearance Time (g_s), s	8.5		5.5			9.0		32.0
Green Extension Time (g_e), s	0.0	0.0	0.0	0.0		0.0		0.0
Phase Call Probability	1.00		1.00			1.00		1.00
Max Out Probability	1.00		0.01			1.00		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	188	683	678	56	1303	69	118	1	113	406	2	534
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730	1870	1854	1781	1781	1585	1810	1870	1610	1810	1870	1585
Queue Service Time (g_s), s	6.5	42.5	42.5	3.5	42.4	3.3	7.0	0.1	7.0	26.1	0.1	30.0
Cycle Queue Clearance Time (g_c), s	6.5	42.5	42.5	3.5	42.4	3.3	7.0	0.1	7.0	26.1	0.1	30.0
Green Ratio (*g/C*)	0.06	0.35	0.35	0.10	0.39	0.39	0.06	0.06	0.06	0.25	0.25	0.25
Capacity (*c*), veh/h	202	662	657	171	1380	614	106	109	94	452	468	396
Volume-to-Capacity Ratio (*X*)	0.933	1.030	1.032	0.328	0.944	0.112	1.121	0.010	1.202	0.898	0.005	1.349
Back of Queue (*Q*), ft/ln (50 th percentile)	104.4	668.7	655.1	45.1	508.4	32.3	170.5	0.9	173.4	362.8	1.3	779.8
Back of Queue (*Q*), veh/ln (50 th percentile)	4.1	26.3	26.2	1.8	20.0	1.3	6.8	0.0	6.9	14.5	0.0	30.7
Queue Storage Ratio (*RQ*) (50 th percentile)	0.49	0.00	0.00	0.50	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d_1), s/veh	56.3	38.8	38.8	50.6	35.5	23.5	56.5	53.2	56.5	43.5	33.8	45.0
Incremental Delay (d_2), s/veh	47.9	43.0	43.5	5.1	14.2	0.4	123.7	0.2	157.0	23.3	0.0	172.8
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	0.0	0.0
Control Delay (*d*), s/veh	104.1	81.7	82.3	55.7	49.7	23.9	180.2	53.4	213.5	66.8	33.8	217.8
Level of Service (LOS)	F	F	F	E	D	C	F	D	F	E	C	F
Approach Delay, s/veh / LOS	84.7	F		48.6	D		195.8	F		152.3	F	
Intersection Delay, s/veh / LOS	93.9						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.4	B	2.8	C	3.0	C	3.0	C
Bicycle LOS Score / LOS	1.8	B	1.7	B	0.9	A	2.0	B

HCS7 Two-Way Stop-Control Report

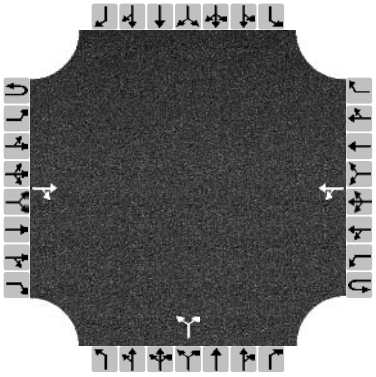
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/18/2018
Analysis Year	2018
Time Analyzed	Phase 2 AM Peak
Intersection Orientation	East-West
Project Description	548.001 Coward Mill Subdivision

Site Information

Intersection	Access #2 @ Cherahala
Jurisdiction	Knox County
East/West Street	Cherahala Boulevard
North/South Street	Access Road #2
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			176	7		16	501			21		48				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.12				6.42		6.22				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						17					75					
Capacity, c (veh/h)						1372					600					
v/c Ratio						0.01					0.12					
95% Queue Length, Q_{95} (veh)						0.0					0.4					
Control Delay (s/veh)						7.7					11.9					
Level of Service, LOS						A					B					
Approach Delay (s/veh)						0.4				11.9						
Approach LOS										B						

HCS7 Two-Way Stop-Control Report

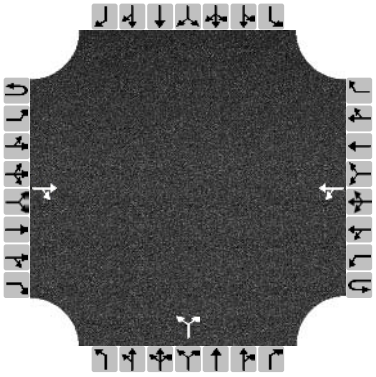
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/18/2018
Analysis Year	2018
Time Analyzed	Phase 2 PM Peak
Intersection Orientation	East-West
Project Description	548.001 Coward Mill Subdivision

Site Information

Intersection	Access #2 @ Cherahala
Jurisdiction	Knox County
East/West Street	Cherahala Boulevard
North/South Street	Access Road #2
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			471	23		54	131			13		32				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.12				6.42		6.22				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						59					49					
Capacity, c (veh/h)						1030					470					
v/c Ratio						0.06					0.10					
95% Queue Length, Q_{95} (veh)						0.2					0.3					
Control Delay (s/veh)						8.7					13.6					
Level of Service, LOS						A					B					
Approach Delay (s/veh)						2.9					13.6					
Approach LOS											B					

Attachment 10
Turn Lane Warrant Analysis

Attachment 10
Turn Lane Warrant Analysis

Project: Coward Mill Subdivision

Cherahala Blvd at Access Road #2	VOLUMES				
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	183	501	16	55	NO
PM	494	131	54	105	NO

Cherahala Blvd at Access Road #2	VOLUMES			
RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	176	7	499	NO
PM	471	23	149	NO

Cherahala Blvd at Access Road #2

TABLE 4A

LEFT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	235 200	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	170 150	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	135 120	110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105	105 90	90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85	54 LT PM Peak 70	70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	65 60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149 150 - 199	100 90	80 75	70 65	60 55	55 50	50 45
200 - 249 250 - 299	80 70	72 65	460 55	55 50	16 LT AM Peak 45	45 40
300 - 349 350 - 399	65 60	60 55	50 50	50 45	45 40	40 40
400 - 449 450 - 499	55 50	50 45	45 45	45 40	40 35	35 35
500 - 549 550 - 599	50 45	45 40	40 40	40 35	35 35	35 35
600 - 649 650 - 699	40 35	35 35	35 35	35 30	35 30	30 30
700 - 749 750 or More	30 30	30 30	30 30	30 30	30 30	30 30

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

Cherahala Blvd at Access Road #2

TABLE 4B

RIGHT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

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
300 - 349 350 - 399				Yes	Yes Yes	Yes Yes
400 - 449 450 - 499			Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599		Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

7 RT AM Peak

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
200 - 249 250 - 299	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

23 RT PM Peak

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

Attachment 11
Delay Study Worksheets

Project: Coward Mill Subdivision
Intersection: Coward Mill Rd @ Pellissippi Parkway
Date Conducted: 02/22/2018
Time Conducted: AM Peak (8:00am - 8:15am)

	Number of Stopped Vehicles; Vs			
Min/Sec	0	15	30	45
0	0	0	0	0
1	0	0	2	1
2	1	1	1	0
3	1	1	1	1
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	1	1
10	1	0	0	1
11	0	0	0	1
12	1	1	0	0
13	1	1	1	0
14	0	0	2	2

Totals	5	4	8	7

Volume, V =	10 veh

Stopped Delay =	36 sec

Project: Coward Mill Subdivision
Intersection: Coward Mill Rd @ Pellissippi Parkway
Date Conducted: 02/22/2018
Time Conducted: PM Peak (5:00pm - 5:15pm)

	Number of Stopped Vehicles; Vs			
Min/Sec	0	15	30	45
0	2	2	3	4
1	2	1	1	1
2	1	1	1	2
3	1	1	2	3
4	3	2	3	3
5	3	4	4	4
6	4	4	5	4
7	4	4	4	4
8	4	4	3	3
9	4	4	4	1
10	1	1	1	1
11	1	2	3	3
12	3	3	3	3
13	3	2	2	3
14	3	1	0	0
Totals	39	36	39	39

Volume, V =	15 veh

Stopped Delay =	153 sec