SHIPETOWN SQUARE

Transportation Impact Analysis

Rutledge Pike (US 11-W)

Knoxville, TN

A Transportation Impact Analysis for the Shipetown Square

Submitted to

Knoxville – Knox County Planning Commission

Revised February 22, 2021
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FMA Project No. 588.009

Submitted By:

3-D-21-UR
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Executive Summary

Reliance Development, LLC is proposing a commercial development (i.e. Shipetown Square). The full build out of the development will consist of a 4,088 SF convenience market with 10 gas station pump locations and an internal fast food restaurant with a drive-thru window and no indoor seating. The concept plan also shows approximately 3,340 SF of retail shops to be located behind the convenience market. The project is located at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Square in Knox County. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2024.

There are two proposed driveways for the development; a right-in/right-out driveway on Rutledge Pike (US 11W) and a full access driveway on Shipetown Road.

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

Rutledge Pike (US 11W) at Roberts Road/Shipetown Road
After the completion of the TDOT intersection improvements including the addition of a traffic signal and the full buildout of the Shipetown Square development the traffic conditions for the signalized intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road will operate at a LOS C during the AM peak hour and a LOS B during the PM peak hour. The traffic from the Shipetown Square development will only cause a minor increase in delay to the signalized intersection; therefore there are no recommended improvements.

Rutledge Pike at RIRO Driveway
After the completion of the full buildout of the Shipetown Square development the westbound right turn (driveway) will operate at a LOS A during the AM peak hour and a LOS B during the PM peak hour. A northbound right turn lane is not warranted at the intersection of Rutledge Pike (US 11W) at the right-on/right-out driveway connection per TDOT Roadway Design Guidelines.

Shipetown Road at Driveway Connection
After the completion of the Shipetown Square development the intersection of Shipetown Road at the driveway connection will operate at an acceptable LOS B or better; therefore, there are no recommended improvements. Neither an eastbound left turn lane nor a westbound right turn lane are warranted at the proposed driveway connection.

1 Introduction

1.1 Project Description

This report provides a summary of a traffic impact study that was performed for the Shipetown Square development. The project is located at the northeast corner of the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road in Knox County, Tennessee. The location of the site is shown in Figure 1.

The full build out of the development will consist of a 4,088 SF convenience market with 10 gas station pump locations and an internal fast food restaurant with a drive-thru window and no indoor seating. The concept plan also shows approximately 3,340 SF of retail shops to be located behind the convenience market. Construction is proposed to take place this year, and this study assumes full build out for the development will occur in 2024.

There are two proposed driveways for the development; a right-in/right-out driveway on Rutledge Pike (US 11W) and a full access driveway on Shipetown Road. The right-in/right-out driveway is located approximately 150 north of Rutledge Pike (US 11W). The proposed driveway width is 30 feet. The full access driveway is located approximately 180 feet east of the intersection with Rutledge Pike (US 11W) and has a proposed width of 34.72 feet. The convenience market driveway is expected to line up with the existing Dollar General driveway to create a four-way intersection with stop control on the minor approaches. The proposed layout is shown in Figure 2.

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

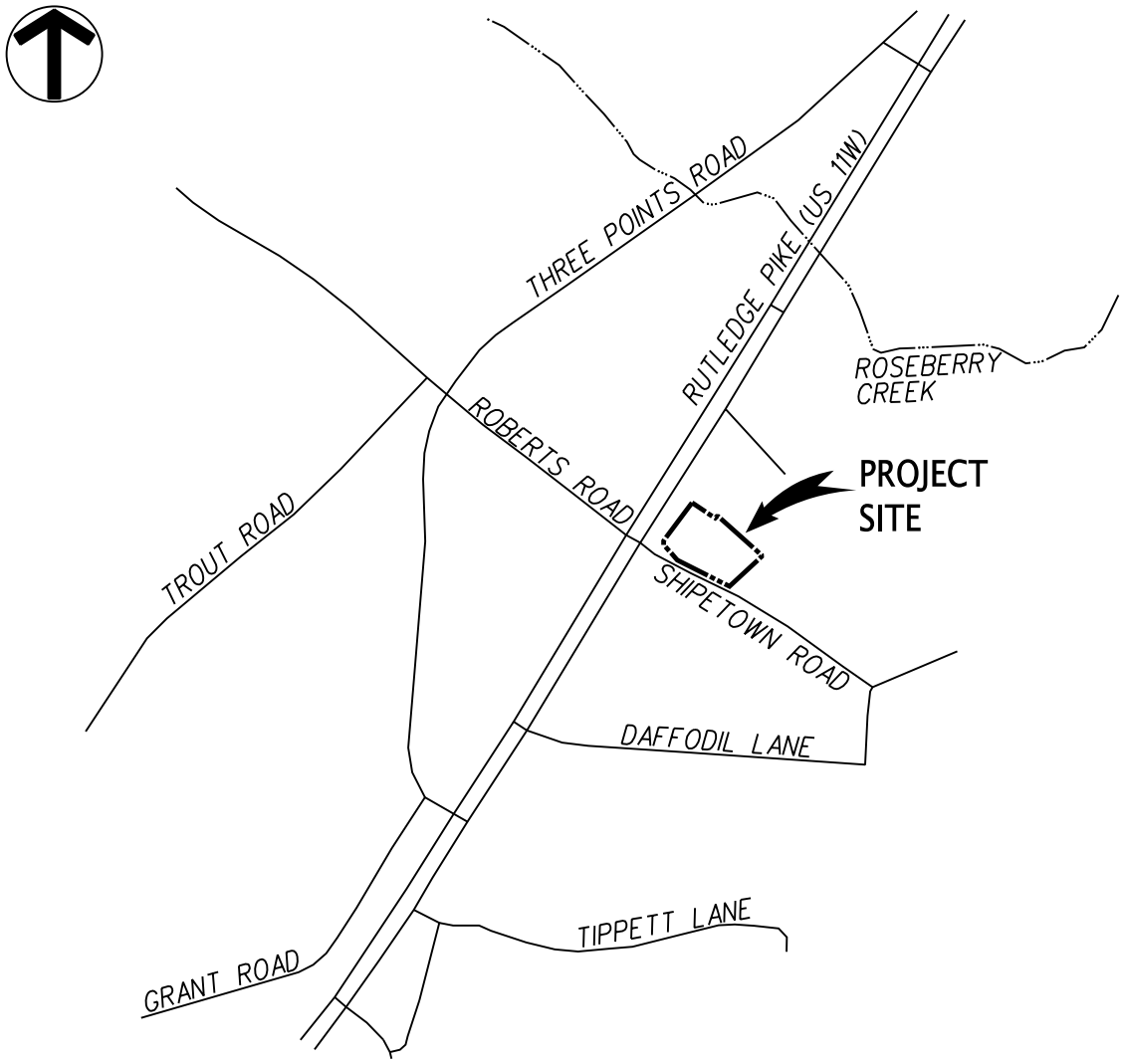


Figure 1: Location Map

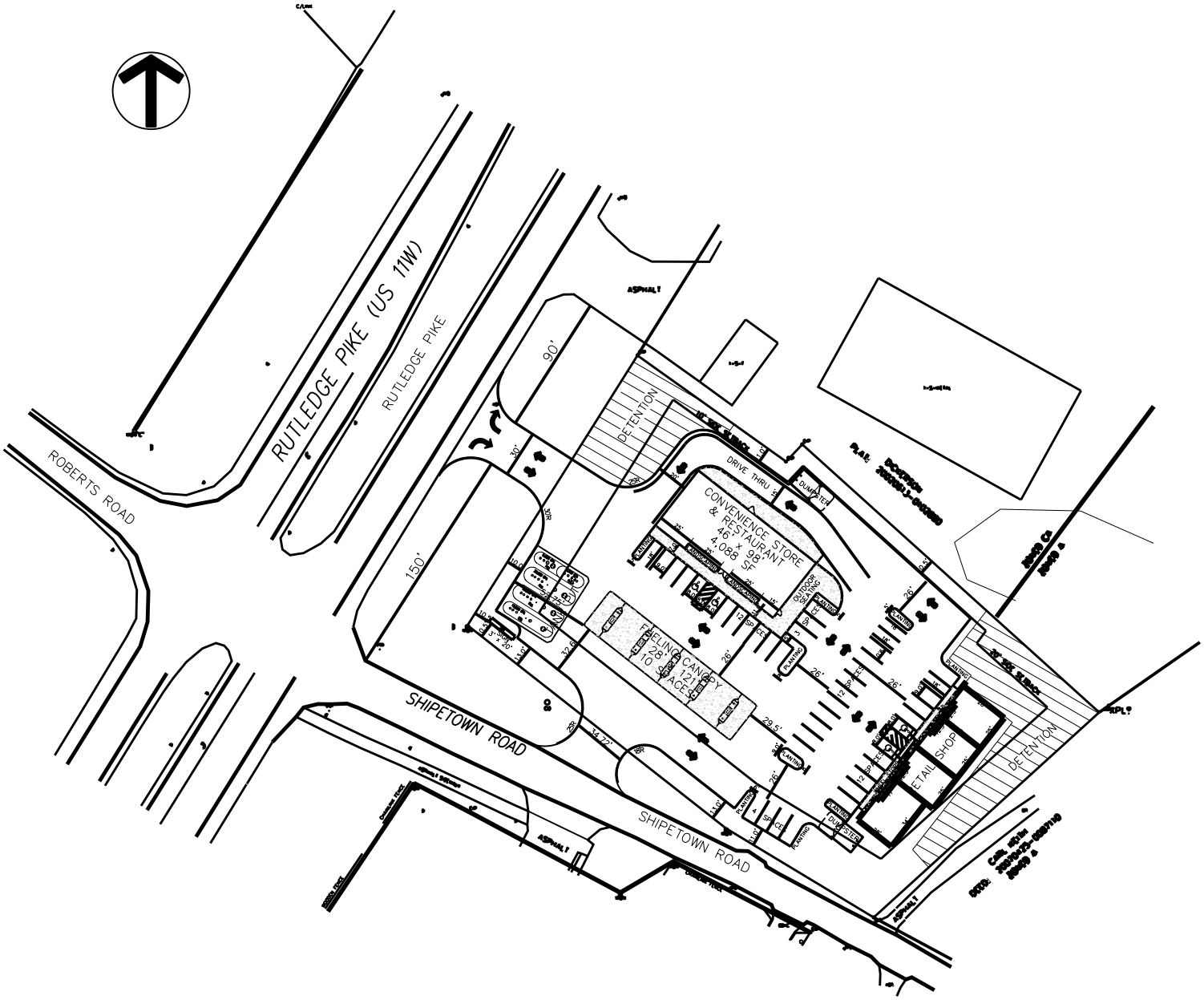


Figure 2: Site Plan

1.2 Existing Site Conditions

Rutledge Pike (US 11W) is a four-lane road. Rutledge Pike (US 11W) at the intersection with Roberts Road/Shipetown Road has an existing 25 foot wide grass median and a 10 foot wide paved shoulder for both northbound and southbound lanes. At the intersection with Roberts Road/Shipetown Road there is an existing northbound left turn lane with an approximate 120 feet storage length and a 235 feet taper length and a southbound left turn lane with an approximate 120 feet storage length and a 200 taper length. The Knoxville-Knox County Planning Commission classifies Rutledge Pike (US 11W) as a Major Arterial with a 112 feet right-of-way per the Major Road Plan. The posted speed limit on Rutledge Pike (US 11W) is 55 mph.

Roberts Road at the intersection with Rutledge Pike (US 11W) is a two-lane road. The Knoxville-Knox County Planning Commission classifies Roberts Road in the vicinity of the proposed development as a Minor Arterial with a 70 feet right-of-way per the Major Road Plan. The posted speed limit on Roberts Road is 40 mph.

Shipetown Road at the intersection with Rutledge Pike (US 11W) is a two-lane road. The Knoxville-Knox County Planning Commission does not classify Shipetown Road; therefore, it is considered a local street per the Major Road Plan. The posted speed limit on Shipetown Road is 25 mph.

There is an existing sidewalk connecting the Dollar General parking lot to Rutledge Pike (US 11W). There are no other sidewalks or designated bike lanes along Rutledge Pike (US 11W) or in the vicinity of the proposed development.

An aerial photo of the existing intersection is included in Attachment 1.

2 Existing Traffic Volumes

Due to the altered traffic patterns from COVID-19 FMA did not collect any new turning movement counts for the Shipetown Square transportation impact analysis.

The Tennessee Department of Transportation Region I Traffic Office conducted a turning movement count at the intersection of Rutledge Pike (US 11W) at Roberts Road/Shipetown Road on Tuesday August 28, 2018 from 7:00 a.m. to 9:00 a.m., 11:00 a.m. to 1:00 p.m. and 2:00 p.m. to 6:00 p.m. The AM peak hour occurred between 7:00 a.m. and 8:00 a.m. with an AM peak volume of 1472 vehicles and an AM peak hour factor of 0.88. The PM peak hour occurred between 4:45 p.m. and 5:45 p.m. with a PM peak hour volume of 1338 vehicles and a PM peak hour factor of 0.94. The TDOT turning movement count is included in Attachment 2.

In order to calculate existing traffic conditions FMA estimated the growth rate from the 2018 turning movement count to the projected existing 2021 traffic conditions. The growth rate was determined by analyzing nearby traffic counts provided by the Tennessee Department of Transportation (TDOT) in the vicinity of the proposed development. Traffic counts located on Rutledge Pike (US 11W) and Roberts Road had an average growth rate of approximately 3%. The ADT trend line growth charts are included in Attachment 3.

2.1 Dollar General Driveway

The existing Dollar General driveway connection is located on Shipetown Road approximately 200 feet east of the existing intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road. The existing retail building size is approximately 9,350 SF and has a driveway width of 37 feet. There are sidewalks that connect the existing Dollar General parking lot to Rutledge Pike (US 11W).

Due to the altered traffic patterns from COVID-19 FMA did not collect any new turning movement counts for the intersection of the Dollar General driveway connection and Shipetown Road. FMA estimated the traffic generated by the Dollar General retail store using the *Trip Generation, 10th Edition,* published by the Institute of Transportation Engineers. Variety Store or Land Use 814 was used to calculate site trips for the Dollar General using the average rates. The land use worksheets are included in Attachment 5 and a trip generation summary is shown in Table 2.1-1.

Table 2.1-1
Trip Generation Summary
Dollar General

Land Use	Density	Daily Trips	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Variety Store (LUC 814)	9350 SF	593	17	13	33	31

FMA assumed the directional distribution of the traffic generated by the Dollar General using the existing traffic volumes at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road. FMA assumed that 90% of traffic would enter/exit from Rutledge Pike (US 11W) and 10% of traffic would enter/exit from Shipetown Road.

Figure 3 shows the projected 2021 traffic volumes including both the AM and PM peak hour traffic volumes at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road and the intersection or Shipetown Road at the Dollar General driveway connection.

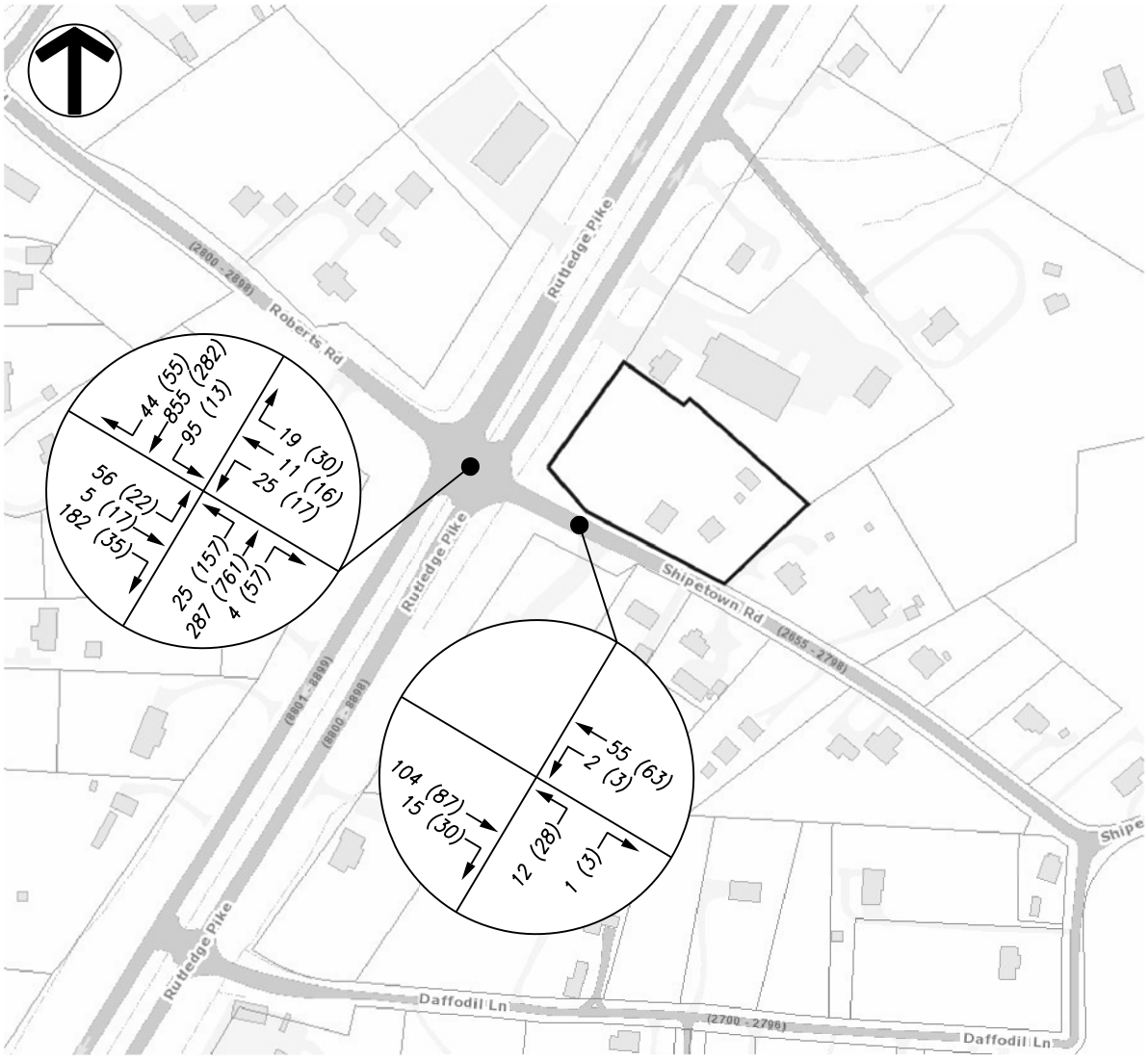


Figure 3: 2021 Existing Peak Hour Traffic

3 Background Growth

The Tennessee Department of Transportation (TDOT) maintains count stations in the vicinity of the proposed development.

TDOT count station ID: 000366 is located on Rutledge Pike (US 11W) south of the intersection with Roberts Road / Shipetown Road. The annual growth rate for this station over the last ten years is approximately 2.53% and the 2018 ADT was 13,249 vehicles per day.

TDOT count station ID: 000302 is located on Roberts Road (Route 01287) west of Rutledge Pike (US 11W) near the Grainger County line. The annual growth rate for this station over the last ten years is approximately 3.40% and the 2018 ADT was 2,482 vehicles per day.

For the purpose of this study, an annual growth rate of 3.0% was assumed for the traffic at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road until full occupancy is reached in 2024. Attachment 3 shows the trend line growth charts for the TDOT count stations.

Figure 4 demonstrates the projected background peak hour volumes at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road after applying the background growth rate to the existing conditions.

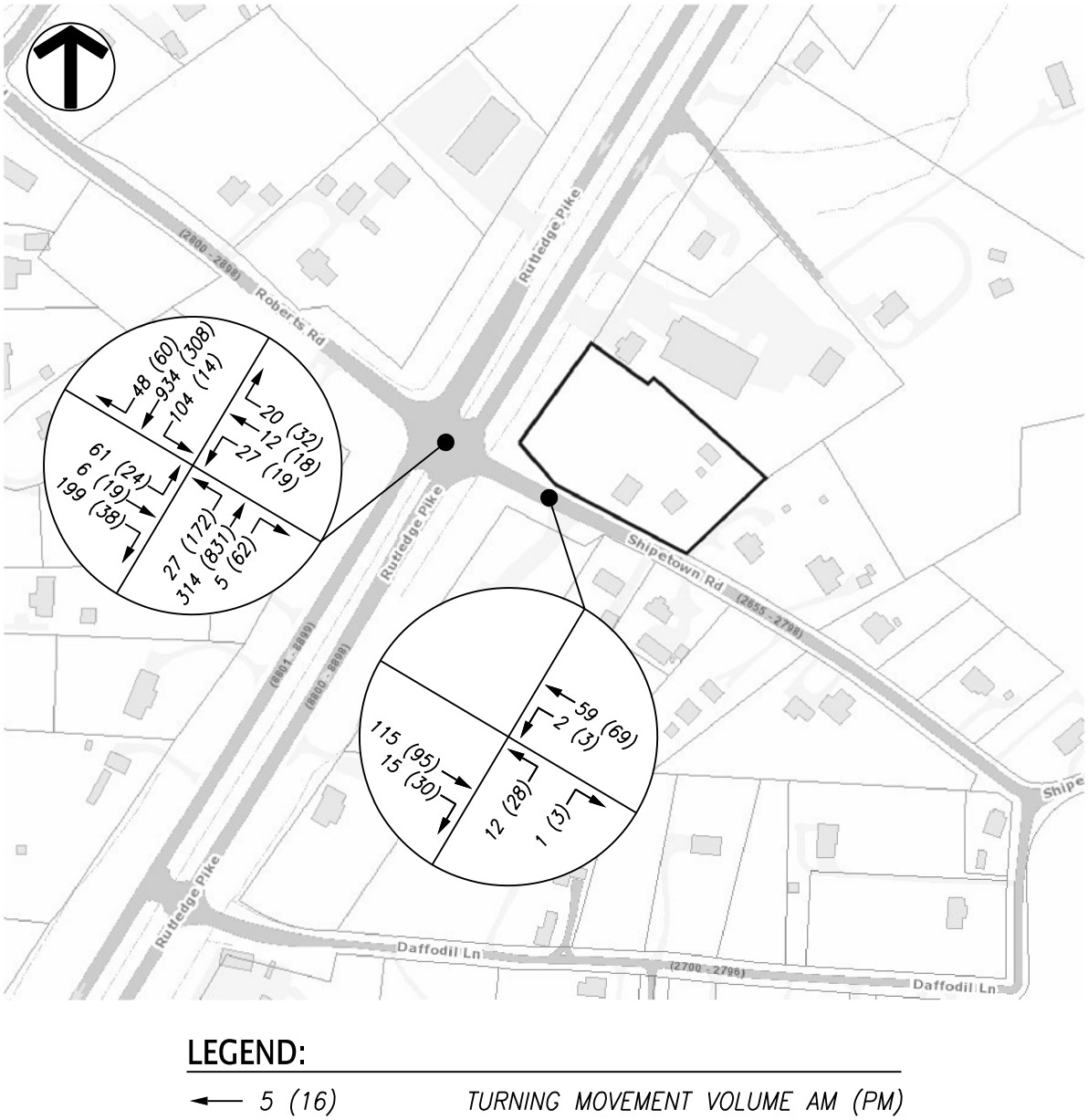


Figure 4: 2024 Background Peak Hour Traffic

3.1 Rutledge Pike (US 11W) Road Improvements

The Tennessee Department of Transportation is planning an improvement project at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road. Construction is expected to be completed prior to the projected full buildout of the Shipetown Square development in 2024.

Cannon & Cannon, Inc. prepared a preliminary concept plan on May 27, 2020 for the TDOT intersection improvements that includes additional turns lanes on both Rutledge Pike (US 11W) and Roberts Road as well as the installation of a traffic signal.

The preliminary concept plan shows revised lane configurations for Rutledge Pike (US 11W) northbound that include a revised left turn lane with a 250 feet storage length and a 180 taper length and a new right turn lane with a 200 feet storage length and a 180 feet taper length. Rutledge Pike (US 11W) southbound includes a revised left turn lane with a 175 feet storage length and a 180 taper length and a new right turn lane with a 100 feet storage length and a 180 feet taper length. The TDOT preliminary concept plan also shows a new right turn lane on Roberts Road with a 200 feet storage length and a 100 feet taper length.

The preliminary concept plans also shows the location of signal poles and detailed pavement markings that will be installed as a part of the intersection improvements.

The Cannon & Cannon preliminary concept plan is included in Attachment 4.

4 Trip Generation and Trip Distribution

The Shipetown Square development proposes a 4,088 SF convenience market with 10 vehicle fueling positions, an internal 500 SF fast food restaurant with a drive-through window and no indoor seating and a 3,340 SF retail building. Super Convenience Market/Gas Station or Land Use 960 was used to calculate site trips for the convenience market/gas station using the fitted curve equations from the *Trip Generation, 10th Edition,* published by the Institute of Transportation Engineers. Copy, Print, and Express Ship Store or Land Use 920 was used to calculate site trips for the 3,340 SF retail building and Fast-Food Restaurant with Drive-Through Window and No Indoor Searing or Land Use 935 was used for the 500 SF fast food restaurant located inside the convenience market. The land use worksheets are included in Attachment 5.

A pass-by trip occurs when a proposed development diverts traffic that is already traveling on a street adjacent to the site. A pass-by rate reduction of 65% was used for convenience market with an ADT between 10,000 – 20,000 and a pass-by rate reduction of 40% was used for the fast food restaurant per the Knoxville-Knox County Planning Commission pass-by rate Memo.

The total new trips generated by the Shipetown Square development was estimated to be 945 daily trips. The estimated trips are 118 trips during the AM peak hour and 118 trips during the PM peak hour. A trip generation summary is shown in Table 4-1.

Table 4-1
Shipetown Square
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Super Convenience Market/Gas Station (Land Use 960)	10 Vehicle Fueling Positions	2305	140	140	115	115
35% New Trips		807	49	49	40	40
65% Pass-By Trips		1498	91	91	75	75
Fast-Food Restaurant With Drive-Through (LUC 935)	500 SF	230	8	9	11	10
60% New Trips		138	5	6	7	6
40% Pass-By Trips		92	3	3	4	4

Copy, Print, and Express Ship Store (LUC 920)	4,000 SF	7	2	11	14
Total New Trips	**945**	**61**	**57**	**58**	**60**
Total Pass-By Trips	**1590**	**94**	**94**	**79**	**79**

The existing peak hour trip distribution on Rutledge Pike (US 11W) at the intersection with the driveway connection is approximately 30% northbound and 70% southbound during the AM peak hour and 70% northbound and 30% southbound during the PM peak hour.

The directional distribution of the traffic generated by the Shipetown Square development was estimated based on existing distribution at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road. The entering trip distribution during the AM peak hour is 20% northbound Rutledge Pike (US 11W), 60% southbound Rutledge Pike (US 11W), 5% Shipetown Road and 15% Roberts Road and the exiting trip distribution during the AM peak hour is 30% northbound Rutledge Pike (US 11W), 60% southbound Rutledge Pike (US 11W), 5% Shipetown Road and 5% Roberts Road. The entering trip distribution during the PM peak hour is 65% northbound Rutledge Pike (US 11W), 25% southbound Rutledge Pike (US 11W), 5% Shipetown Road and 5% Roberts Road and the exiting trip distribution during the PM peak hour is 55% northbound Rutledge Pike (US 11W), 25% southbound Rutledge Pike (US 11W), 10% Shipetown Road and 10% Roberts Road.

Figure 5 and Figure 6 show the AM and PM peak hour new trip distribution and Figure 7 and Figure 8 show the AM and PM peak hour pass-by trip distribution.

Figure 9 shows the new peak hour site trips and Figure 10 shows the pass-by peak hour site trips. Figure 11 shows the combined 2024 full buildout peak hour traffic after the completion of the Shipetown Square development.

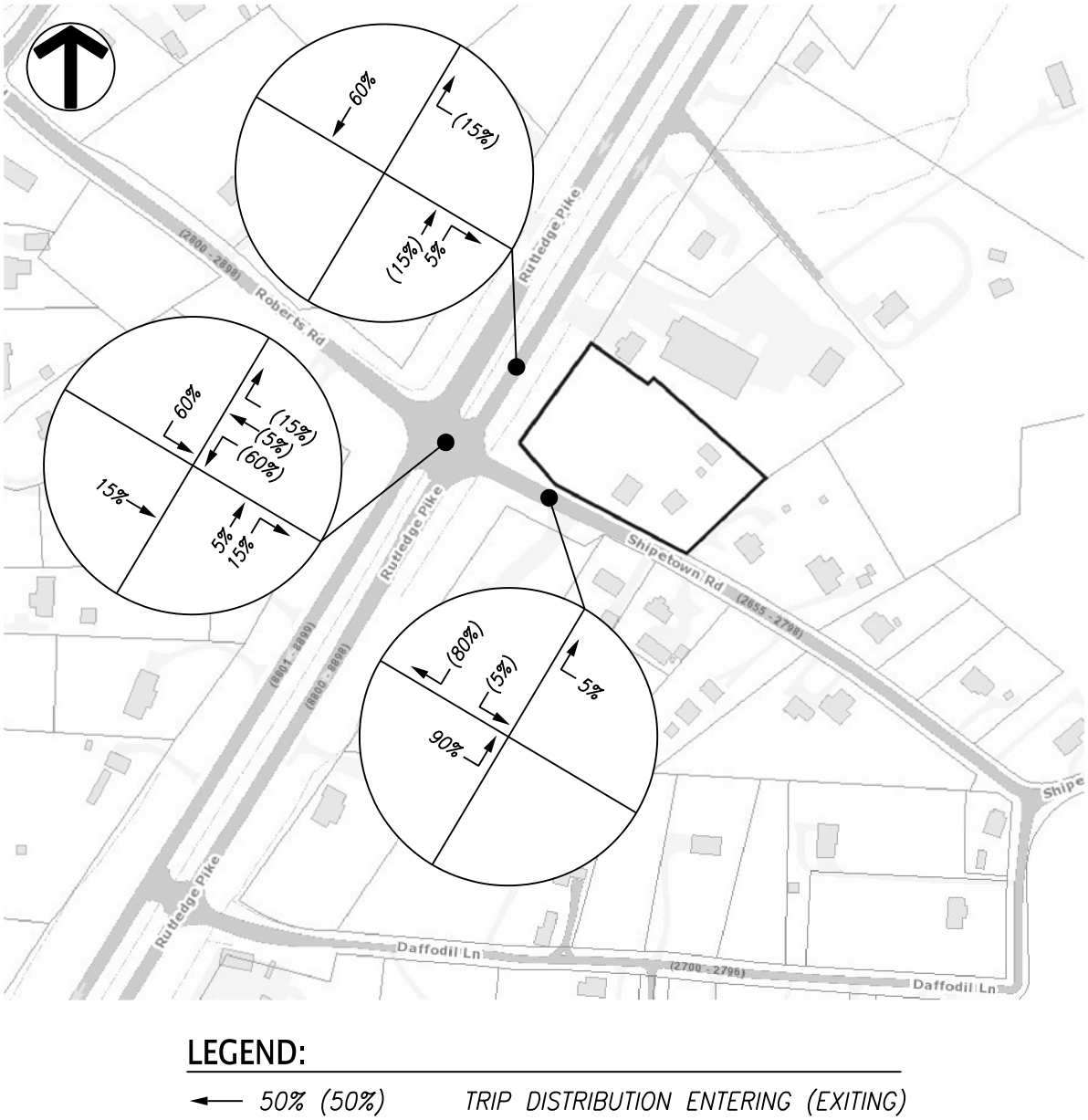


Figure 5: AM Peak Hour New Trip Distribution

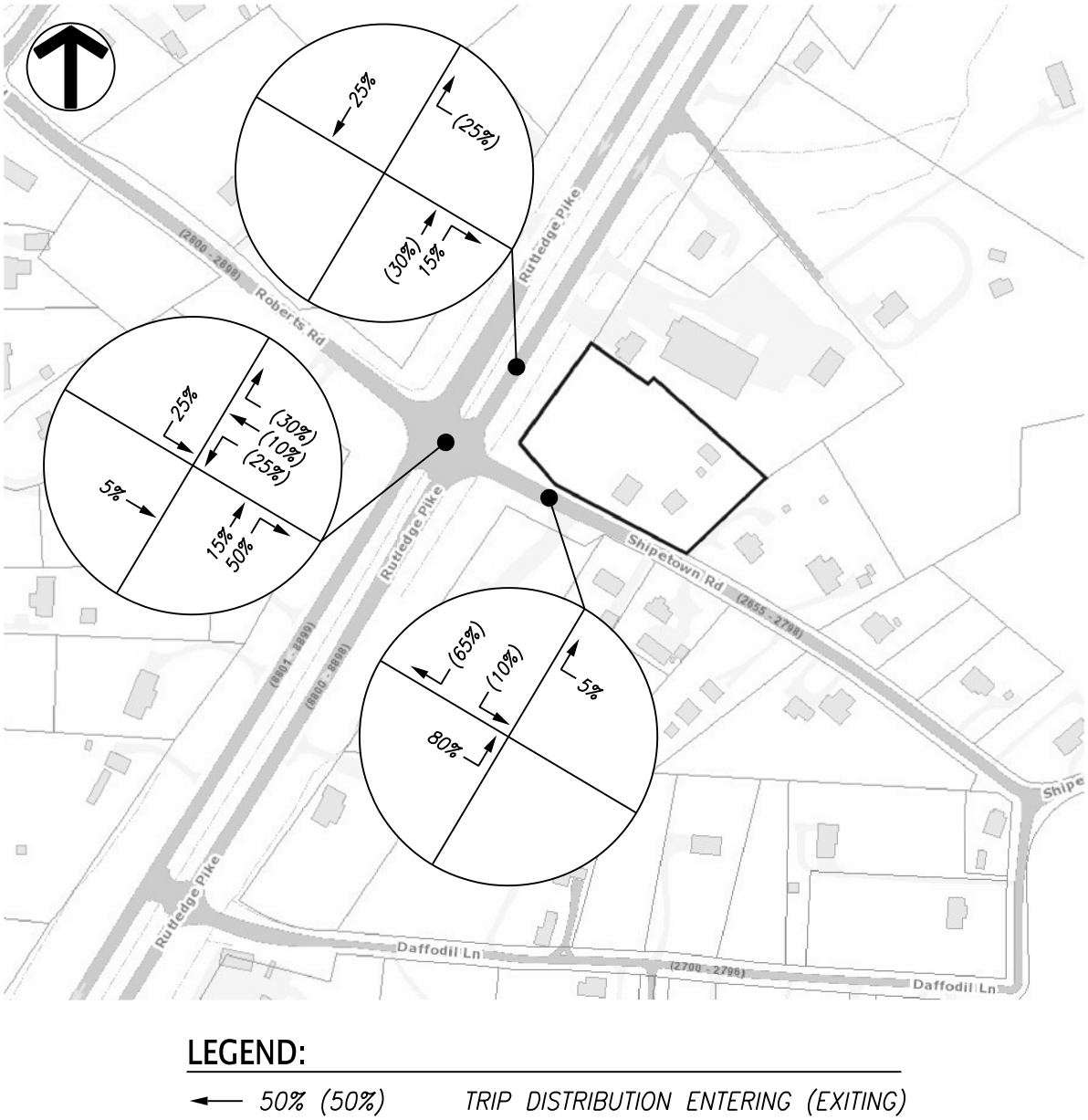


Figure 6: PM Peak Hour New Trip Distribution

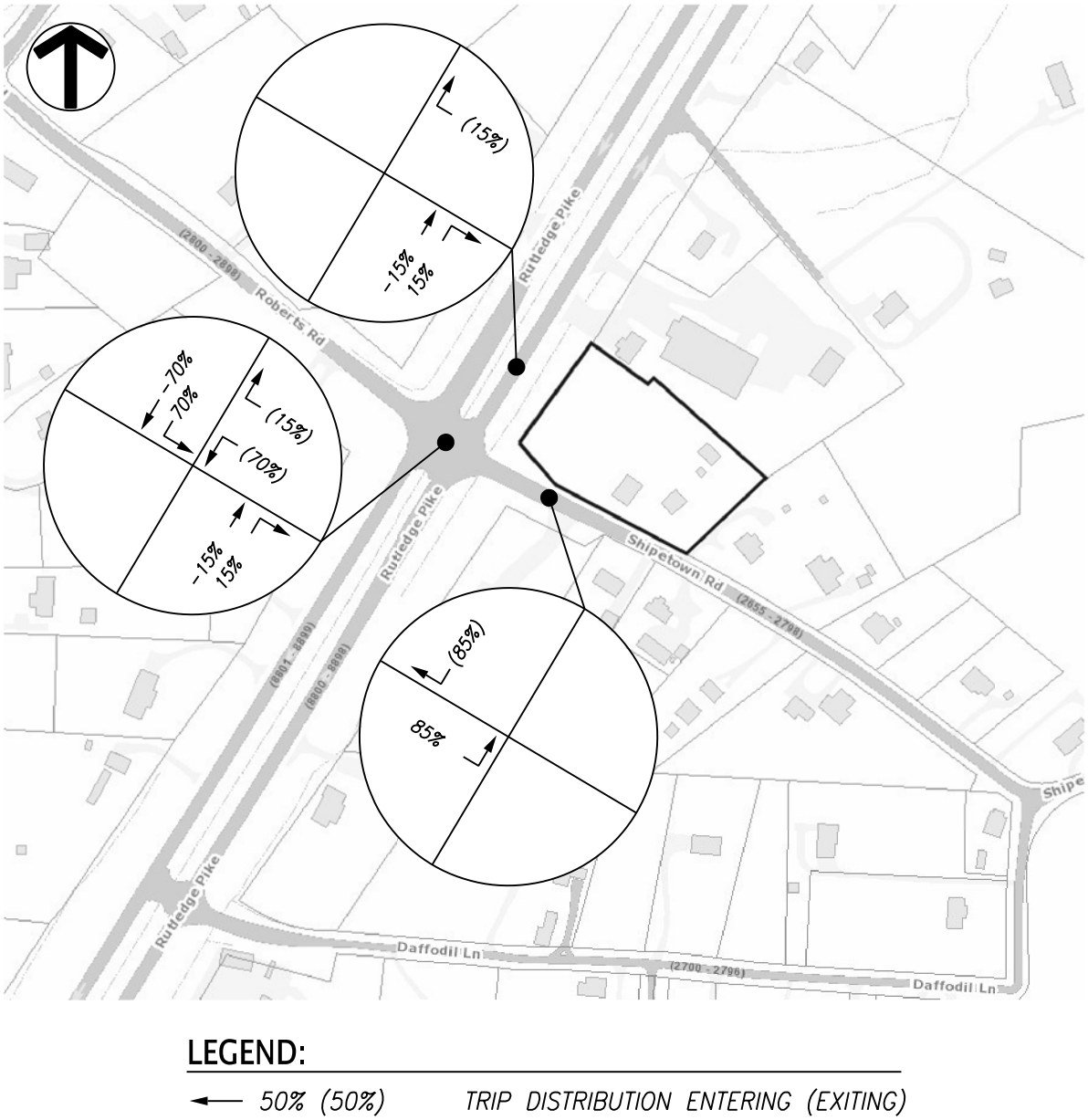


Figure 7: AM Peak Hour Pass-By Trip Distribution

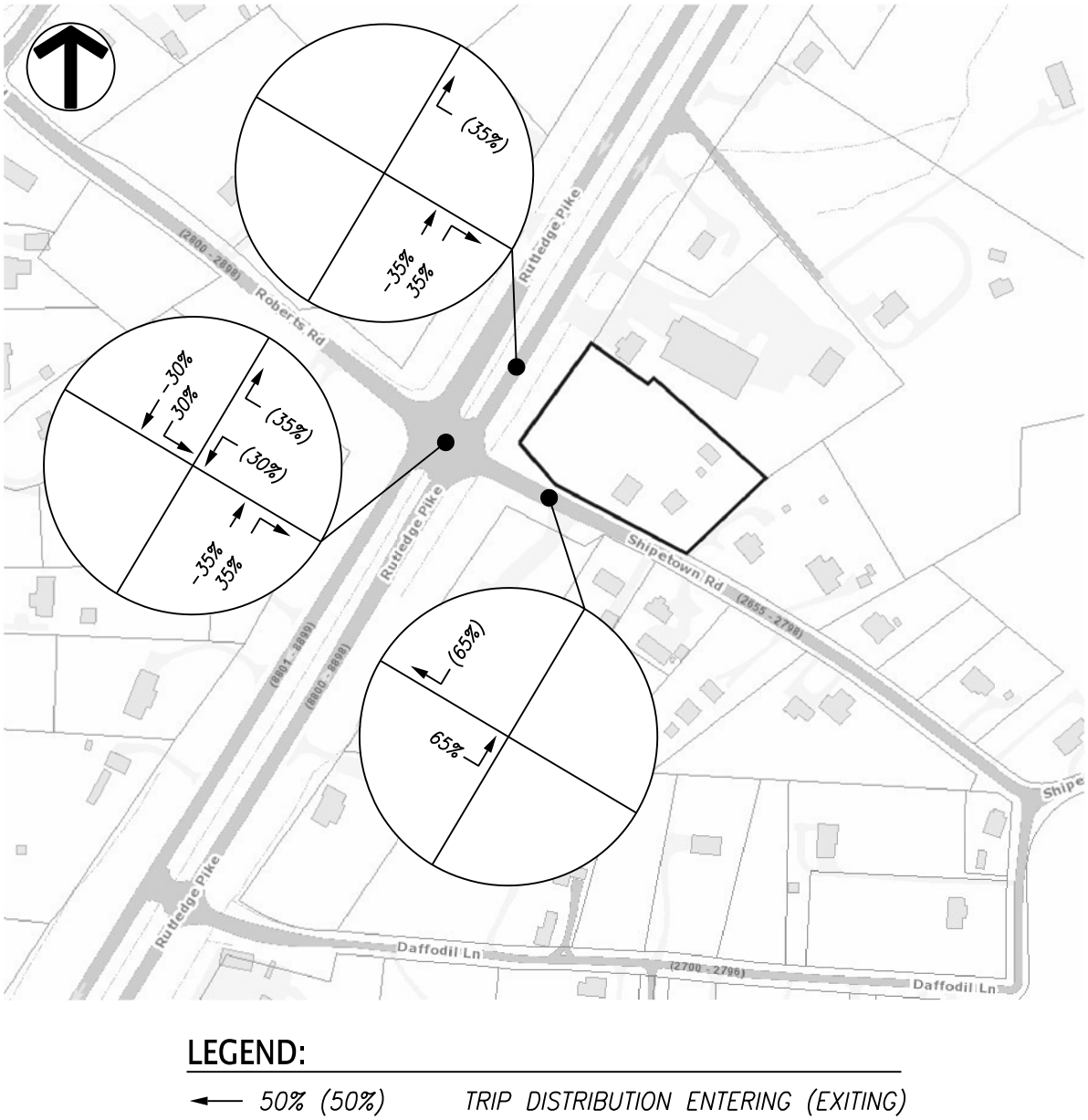


Figure 8: PM Peak Hour Pass-By Trip Distribution

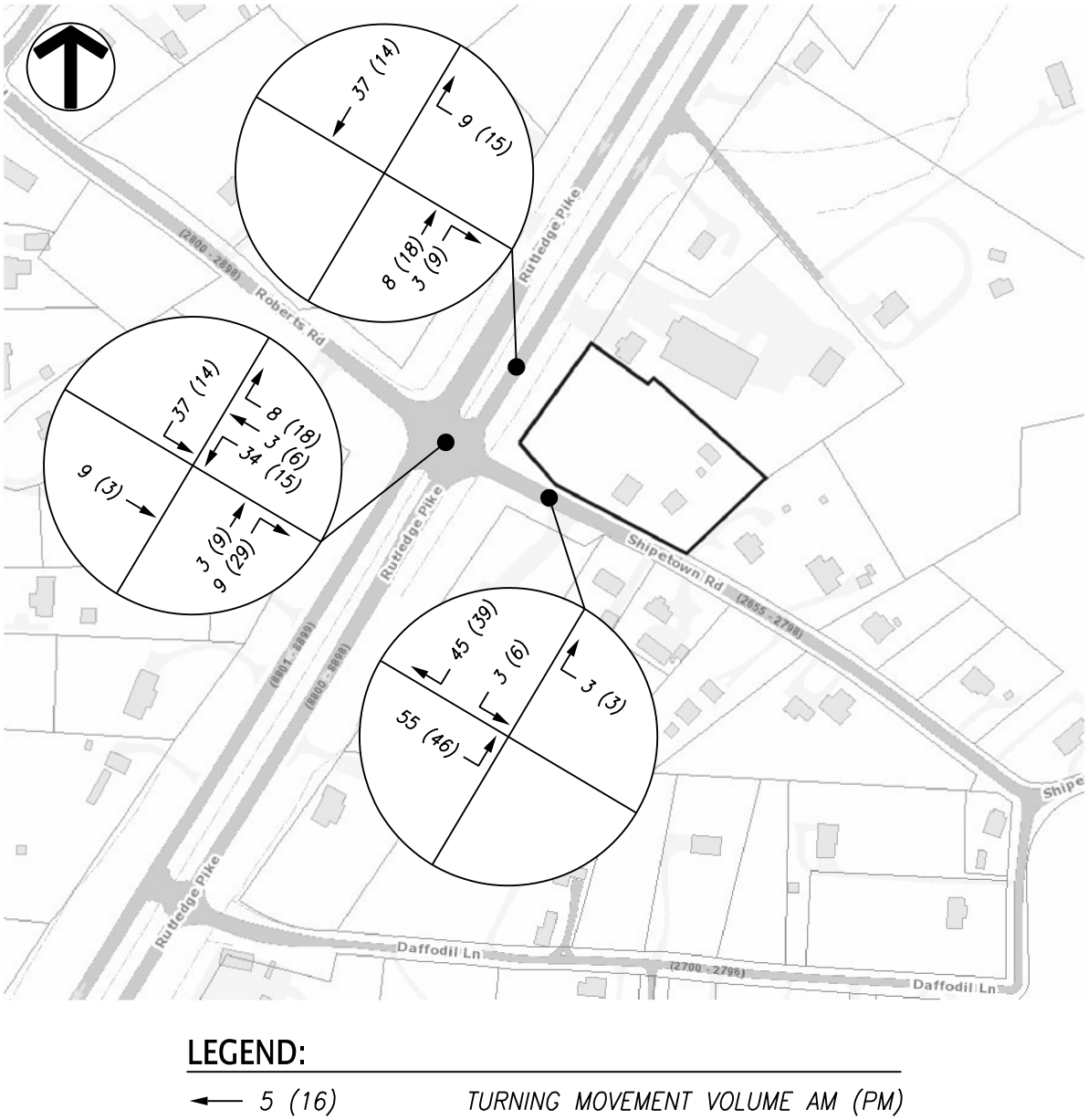


Figure 9: New Peak Hour Site Trips

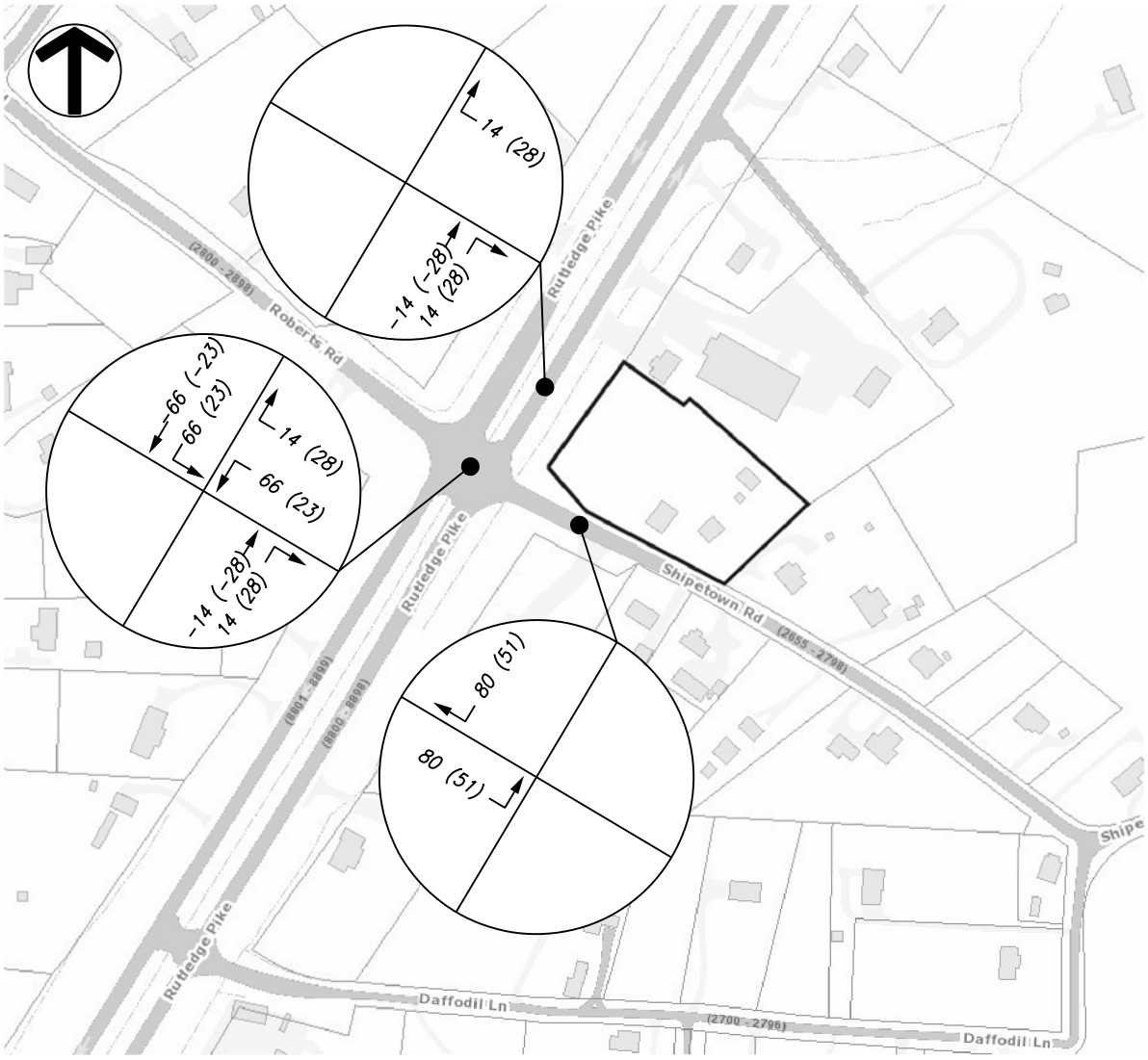


Figure 10: Pass-By Peak Hour Site Trips

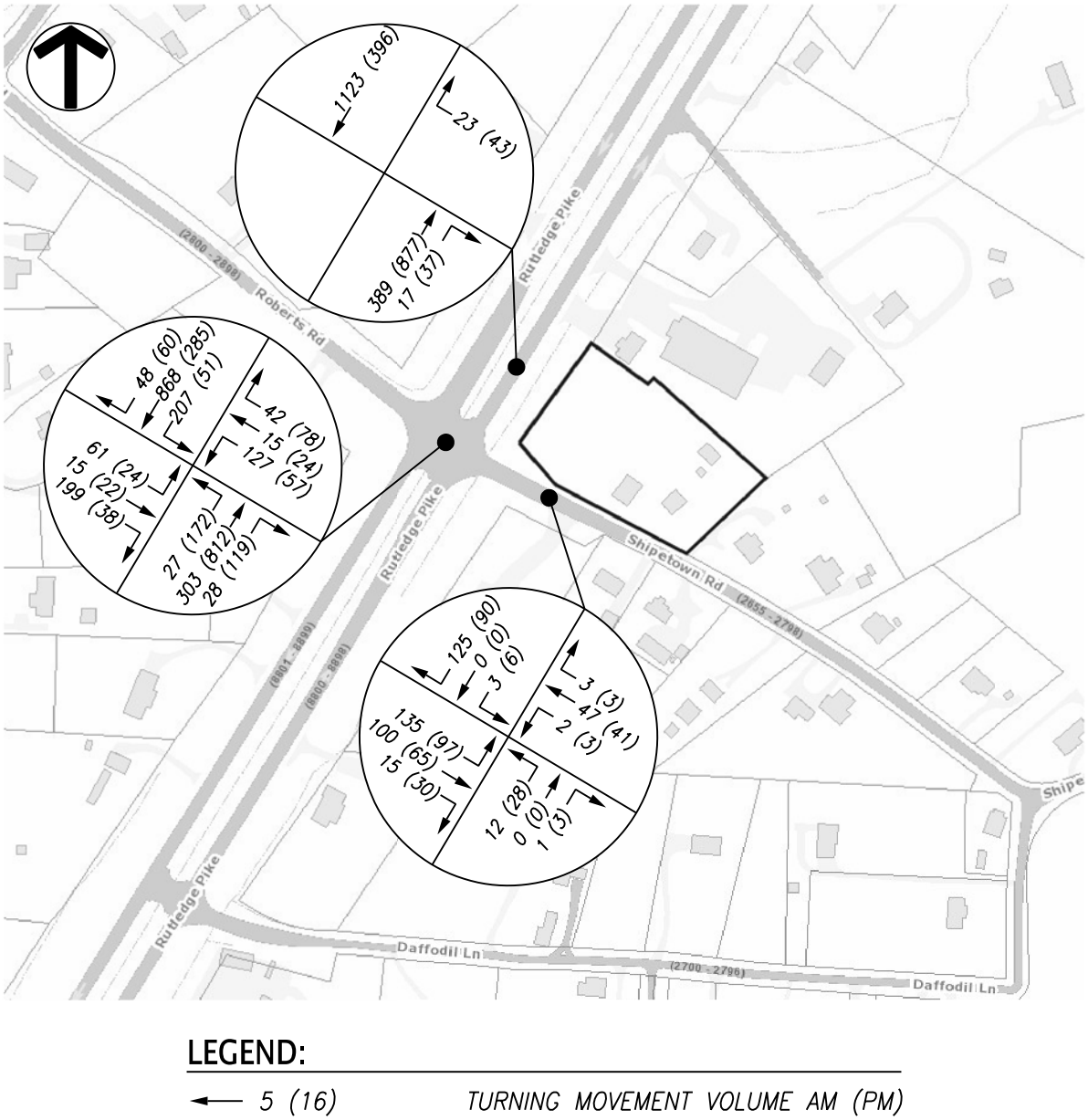


Figure 11: 2024 Full Buildout Peak Hour Traffic

5 Projected Capacity and Level of Service

The existing intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road is a two-way stop controlled intersection; however, the intersection will be signalized after the completion of the TDOT roadway improvements. The driveway connection along Rutledge Pike (US 11W) will be right-in/right-out and the full access driveway connection at Shipetown Road will be stop controlled on the minor approaches.

Unsignalized intersection capacity analyses were performed using the Highway Capacity Software (HCS7) for the AM and PM peak hours to evaluate the existing traffic conditions at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road and the full buildout conditions at the driveway connections.

Signalized intersection capacity analyses were performed using Highway Capacity Software (HCS7) with optimized signal timing for the AM and PM peak hours to evaluate the background and full buildout traffic conditions at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road.

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 existing, background and full buildout HCS7 worksheets are included in Attachment 6, 7 and 8. Table 5-1 shows the results of the capacity analyses.

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

		Delay (sec)/LOS
Rutledge Pike @ Roberts Road/Shipetown Road (Existing 2021)		
AM Peak	EB Approach	84.5 / F
	WB Approach	45.8 / E
	NB Left Turn	10.6 / B
	WB Left Turn	8.2 / A
PM Peak	EB Approach	33.6 / D
	WB Approach	51.2 / F
	NB Left Turn	8.5 / A
	SB Left Turn	9.8 / A

Rutledge Pike @ Roberts Road/Shipetown Road (Background 2024)		
AM Peak	Intersection	16.8 / B
PM Peak	Intersection	11.5 / B
Rutledge Pike @ RIRO Driveway Connection (Full Buildout 2024)		
AM Peak	EB Right Turn	9.7 / A
PM Peak	EB Right Turn	12.6 / B
Rutledge Pike @ Roberts Road/Shipetown Road (Full Buildout 2024)		
AM Peak	Intersection	22.0 / C
PM Peak	Intersection	16.1 / B
Shipetown Road @ Driveway Connection (Full Buildout 2024)		
AM Peak	EB Approach	7.6 / A
	WB Approach	7.5 / A
	NB Approach	14.8 / B
	SB Approach	9.2 / A
PM Peak	EB Approach	7.5 / A
	WB Approach	7.4 / A
	NB Approach	12.7 / B
	SB Approach	9.2 / A

6 Turn Lane Warrant Analysis

The intersection of Shipetown Road at the full access driveway connection 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.

Neither an eastbound left turn nor a westbound right turn lane on Shipetown Road is warranted for the driveway connection. The turn lane warrant worksheets and analysis are included in Attachment 9.

The intersection of Rutledge Pike (US 11W) at the right-in/right-out driveway connection was evaluated to determine if a right turn lane is warranted. Per the TDOT Roadway Design Guidelines revised March 2, 2020 "As suggested in the *2016 Highway Capacity Manual,* TRB, page 19-33, exclusive right turn lanes shall be considered when the right-turn volume exceeds 300 vph and the adjacent thru-lane volume also exceeds 300 vphpl." The proposed right turn volumes are 17 vehicles during the AM peak hour and 37 vehicles during the PM peak hour; therefore, an exclusive right turn lane is not warranted at this intersection.

7 Conclusions and Recommendations

7.1 Rutledge Pike (US 11W) @ Roberts Road/Shipetown Road

The existing traffic conditions at the unsignalized intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road and the background and full buildout conditions at the signalized intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road were analyzed using the Highway Capacity Software (HCS7).

The existing traffic conditions for the eastbound approach (Roberts Road) operate at a LOS F, the westbound approach (Shipetown Road) operates at a LOS E, the northbound left turn lane operates at a LOS B and the southbound left turn lane operates at a LOS A during the AM peak hour. The eastbound approach (Roberts Road) operates at a LOS D, the westbound approach operates at a LOS F (Shipetown Road) and both the northbound and southbound left turn lanes operate at a LOS A during the PM peak hour.

The TDOT roadway improvements are expected to be completed by the year 2024 and are therefore included in the background intersection analysis. The background traffic conditions at the signalized intersection of Rutledge Pike (US 11W) at Roberts

Road / Shipetown Road operate at LOS B during both the AM and PM peak hours using the optimized signal timing per the HCS7 software.

After the completion of the full buildout of the Shipetown Square development the signalized intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road will operate at a LOS C during the AM peak hour and a LOS B during the PM peak hour using the optimized signal timing per the HCS7 software.

The average queue length reflects the capacity of the traffic signals and the 95% queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95% queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage.

The signalized intersection capacity analyses shows a 95% queue length at the full buildout at the intersection of Rutledge Pike (US 11W) at Roberts Road / Shipetown Road of 12 feet for the northbound right turn lane and 97 feet for the southbound left turn lane during the AM peak hour and 38 feet for the northbound right turn lane and 19 feet for the southbound left turn lane during the PM peak hour. The TDOT concept plan shows a storage capacity of 200 feet for the northbound right turn lane and 175 feet for the southbound left turn lane; therefore, the queue from the signalized intersection is not expected to exceed the capacity for the newly designed TDOT intersection improvements.

7.2 Rutledge Pike at RIRO Driveway Connection

The traffic conditions at the unsignalized intersection of Rutledge Pike (US 11W) at the right-in/right-out driveway connection were analyzed using the Highway Capacity Software (HCS7). After the completion of the full buildout of the Shipetown Square development the westbound right turn (driveway) will operate at a LOS A during the AM peak hour and a LOS B during the PM peak hour.

After the completion of the Shipetown Square development a northbound right turn lane is not warranted at the intersection of Rutledge Pike (US 11W) at the right-on/right-out driveway connection.

The minimum required intersection sight distance and stopping sight distance were determined using the AASHTO "Geometric Design of Highways and Streets". The required intersection sight distance for a five lane road with a 55 mph speed limit is 566 feet and the minimum required stopping sight distance is 495 feet. FMA measured the sight distance at the proposed intersection of Rutledge Pike (US 11W) at the right-in/right-out driveway connection. At 15 feet from the edge of pavement the sight distance at the proposed intersection is greater than 600 southbound.

7.3 Shipetown Road at Driveway Connections

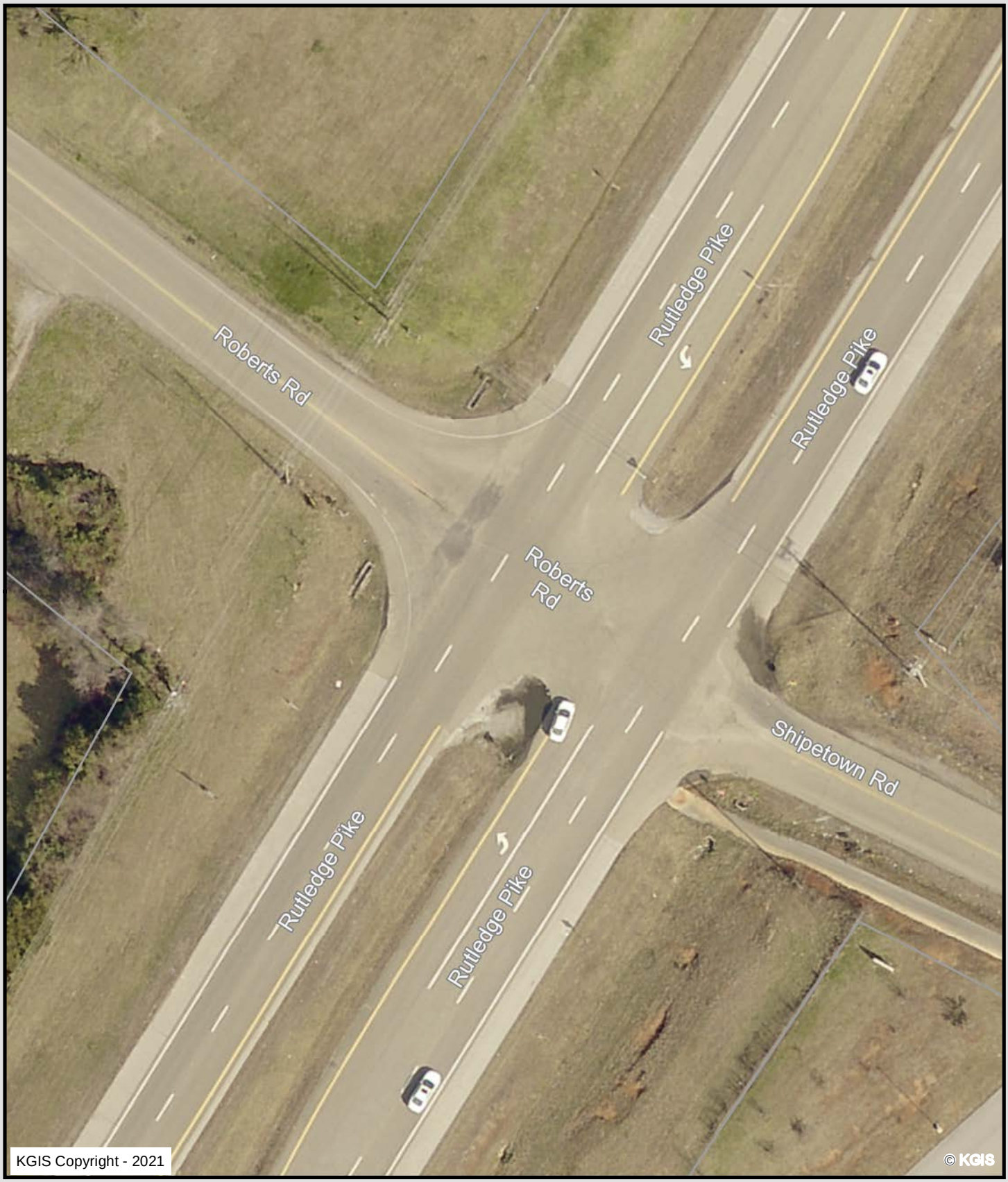
The full buildout traffic conditions at the unsignalized intersection of Shipetown Road at the proposed driveway connection was analyzed using the Highway Capacity Software (HCS7).

The intersection of Shipetown Road at the driveway connection is a four-way intersection with stop signs located at both the Dollar General driveway and the proposed convenience market driveway connection. After the completion of the full buildout of the Shipetown Square development the northbound approach (Dollar General driveway) operates at a LOS B during both the AM and PM peak hours. All other approaches operate at a LOS A during both the AM and PM peak hours.

After the completion of the Shipetown Square development neither an eastbound left turn lane nor a westbound right turn lane are warranted at the intersection of Shipetown Road at the proposed driveway connection.

The minimum required sight distance for a road with a posted speed limit of 25 mph is 250 feet in each direction in accordance with the "Knoxville-Knox County Subdivision Regulations" amended through February 13, 2020. FMA measured the sight distance at the existing intersection of Shipetown Road at the Dollar General driveway connection. At 15 feet from the edge of pavement the sight distance is greater than 250 feet eastbound and 250 feet westbound. FMA recommends any necessary landscaping that may be involved to maintain this sight distance and continue to comply with Knox County Engineering requirements.

Attachment 1
Aerial Photo



Rutledge Pike @ Roberts

Printed: 1/17/2021 at 9:51:48 AM

0 25 50 100

ft

Knoxville - Knox County - KUB Geographic Information System

Attachment 2
Traffic Counts

Tennessee Department of Transportation
Region 1 Traffic Office

Major Road: SR-1, US 11W
Minor Road: Roberts and Shipetown
Counted by: TW

File Name : Counts
Site Code :
Start Date : 8/28/2018
Page No : 1

Groups Printed- Cars + - Trucks

	State Route 1, US 11W Southbound					Roberts Rd Westbound					State Route 1, US 11W Northbound					Shiptown Rd Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	77	128	4	0	209	7	5	4	0	16	5	70	0	0	75	14	0	32	0	46	346
07:15 AM	6	270	15	0	291	4	0	6	0	10	5	56	0	0	61	8	1	46	0	55	417
07:30 AM	2	221	10	0	233	7	2	5	0	14	7	89	2	0	98	17	3	51	0	71	416
07:45 AM	2	163	11	0	176	5	3	2	0	10	6	48	2	0	56	12	1	38	0	51	293
Total	87	782	40	0	909	23	10	17	0	50	23	263	4	0	290	51	5	167	0	223	1472
08:00 AM	2	124	5	0	131	5	2	0	0	7	6	46	2	0	54	13	2	27	0	42	234
08:15 AM	2	121	6	0	129	3	2	0	0	5	3	48	4	0	55	11	3	23	0	37	226
08:30 AM	0	103	2	0	105	3	0	2	0	5	5	40	4	0	49	10	2	21	0	33	192
08:45 AM	4	117	5	0	126	9	1	1	0	11	6	48	3	0	57	8	5	18	0	31	225
Total	8	465	18	0	491	20	5	3	0	28	20	182	13	0	215	42	12	89	0	143	877
11:00 AM	5	62	9	0	76	3	2	2	0	7	7	50	4	0	61	12	1	13	0	26	170
11:15 AM	1	59	9	0	69	3	4	0	0	7	4	67	3	0	74	5	3	7	0	15	165
11:30 AM	2	60	4	0	66	5	4	1	0	10	3	56	2	0	61	5	3	8	0	16	153
11:45 AM	0	53	3	0	56	2	3	0	0	5	4	61	3	0	68	6	3	4	0	13	142
Total	8	234	25	0	267	13	13	3	0	29	18	234	12	0	264	28	10	32	0	70	630
12:00 PM	2	63	5	0	70	3	3	2	0	8	6	53	5	0	64	5	3	4	0	12	154
12:15 PM	6	56	6	0	68	7	0	2	0	9	7	67	1	0	75	6	2	11	0	19	171
12:30 PM	13	60	8	0	81	2	2	3	0	7	5	51	11	0	67	2	1	5	0	8	163
12:45 PM	0	67	6	0	73	6	2	1	0	9	13	75	7	0	95	7	3	4	0	14	191
Total	21	246	25	0	292	18	7	8	0	33	31	246	24	0	301	20	9	24	0	53	679
02:00 PM	2	53	7	0	62	2	2	1	0	5	9	73	6	0	88	6	2	5	0	13	168
02:15 PM	3	82	8	0	93	3	2	3	0	8	9	78	2	0	89	10	4	10	0	24	214
02:30 PM	2	73	6	0	81	2	4	3	0	9	12	96	6	0	114	11	3	6	0	20	224
02:45 PM	19	78	11	0	108	5	6	7	0	18	7	98	6	0	111	9	3	12	0	24	261
Total	26	286	32	0	344	12	14	14	0	40	37	345	20	0	402	36	12	33	0	81	867
03:00 PM	11	86	18	0	115	2	4	2	0	8	10	81	5	0	96	12	1	15	0	28	247
03:15 PM	3	76	7	0	86	3	1	7	0	11	14	101	6	0	121	4	3	14	0	21	239
03:30 PM	1	73	10	0	84	0	8	4	0	12	16	107	15	0	138	5	5	8	0	18	252
03:45 PM	6	72	12	0	90	5	5	3	0	13	30	123	10	0	163	8	1	12	0	21	287
Total	21	307	47	0	375	10	18	16	0	44	70	412	36	0	518	29	10	49	0	88	1025
04:00 PM	4	70	10	0	84	8	5	5	0	18	23	132	9	0	164	7	5	6	0	18	284
04:15 PM	6	67	15	0	88	3	5	4	0	12	26	147	9	0	182	9	2	9	0	20	302
04:30 PM	6	64	14	0	84	4	3	9	0	16	21	145	11	0	177	5	3	12	0	20	297
04:45 PM	6	66	9	0	81	3	4	3	0	10	31	164	15	0	210	4	4	9	0	17	318
Total	22	267	48	0	337	18	17	21	0	56	101	588	44	0	733	25	14	36	0	75	1201
05:00 PM	1	51	12	0	64	3	5	5	0	13	37	172	9	0	218	4	2	6	0	12	307
05:15 PM	4	68	16	0	88	5	3	12	0	20	34	179	13	0	226	8	7	8	0	23	357
05:30 PM	1	73	13	0	87	5	3	7	0	15	42	181	15	0	238	4	3	9	0	16	356
05:45 PM	2	65	12	0	79	3	5	6	0	14	23	144	11	0	178	9	2	14	0	25	296
Total	8	257	53	0	318	16	16	30	0	62	136	676	48	0	860	25	14	37	0	76	1316
06:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Grand Total	201	2844	288	0	3333	130	100	112	0	342	436	2947	201	0	3584	256	86	467	0	809	8068
Apprch %	6	85.3	8.6	0		38	29.2	32.7	0		12.2	82.2	5.6	0		31.6	10.6	57.7	0		
Total %	2.5	35.3	3.6	0	41.3	1.6	1.2	1.4	0	4.2	5.4	36.5	2.5	0	44.4	3.2	1.1	5.8	0	10	
Cars +	198	2621										2689									
% Cars +	98.5	92.2	96.9	0	92.9	96.9	98	99.1	0	98	99.3	91.2	98	0	92.6	96.1	97.7	98.5	0	97.7	93.5

Tennessee Department of Transportation
Region 1 Traffic Office

File Name : Counts
Site Code :
Start Date : 8/28/2018
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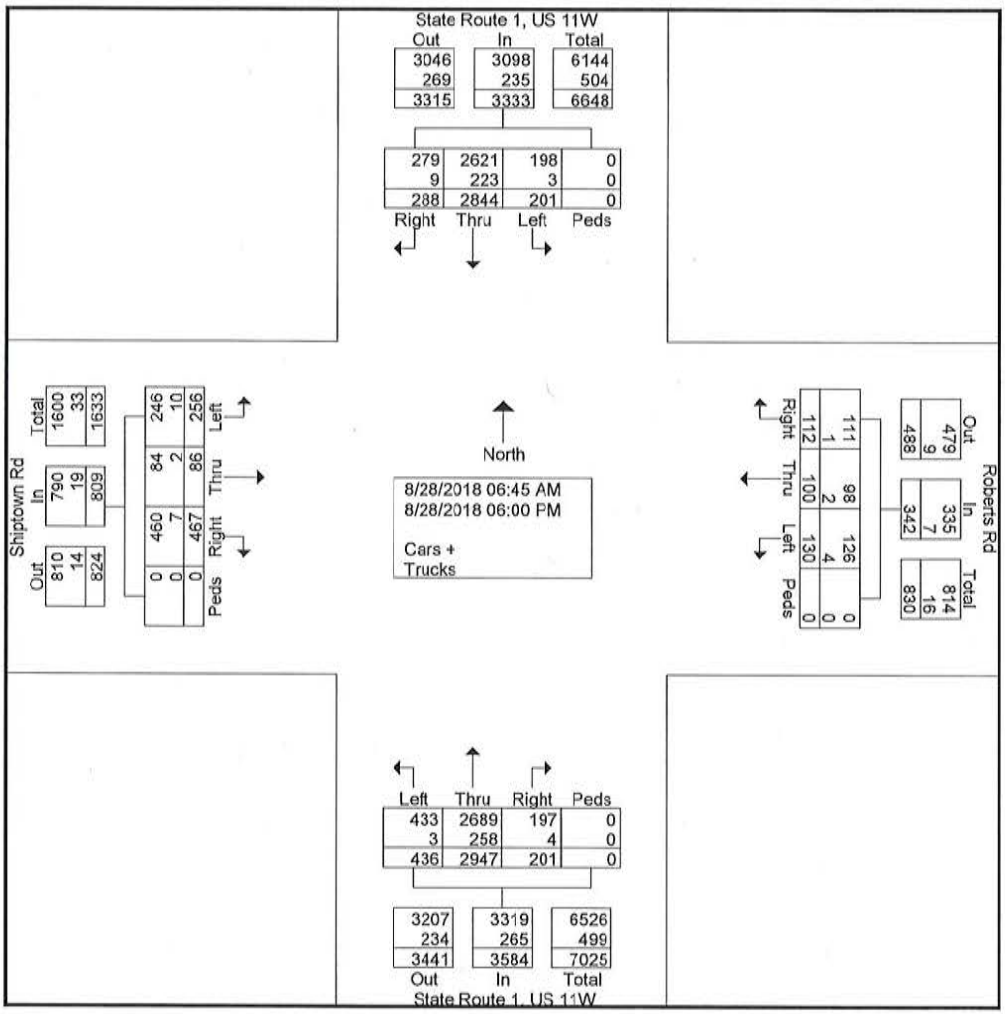
Groups Printed- Cars + - Trucks

	State Route 1, US 11W Southbound					Roberts Rd Westbound					State Route 1, US 11W Northbound					Shiptown Rd Eastbound					
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Trucks	3	223	9	0	235	4	2	1	0	7	3	258	4	0	265	10	2	7	0	19	526
% Trucks	1.5	7.8	3.1	0	7.1	3.1	2	0.9	0	2	0.7	8.8	2	0	7.4	3.9	2.3	1.5	0	2.3	6.5



	State Route 1, US 11W Southbound					Roberts Rd Westbound					State Route 1, US 11W Northbound					Shiptown Rd Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	**77**	128	4	0	209	**7**	**5**	4	0	**16**	5	70	0	0	75	14	0	32	0	46	346
07:15 AM	6	**270**	**15**	0	**291**	4	0	**6**	0	10	5	56	0	0	61	8	1	46	0	55	**417**
07:30 AM	2	221	10	0	233	7	2	5	0	14	**7**	**89**	**2**	0	**98**	**17**	**3**	**51**	0	**71**	416
07:45 AM	2	163	11	0	176	5	3	2	0	10	6	48	2	0	56	12	1	38	0	51	293
Total Volume	87	782	40	0	909	23	10	17	0	50	23	263	4	0	290	51	5	167	0	223	1472
% App. Total	9.6	86	4.4	0		46	20	34	0		7.9	90.7	1.4	0		22.9	2.2	74.9	0		
PHF	.282	.724	.667	.000	.781	.821	.500	.708	.000	.781	.821	.739	.500	.000	.740	.750	.417	.819	.000	.785	.882

Tennessee Department of Transportation
Region 1 Traffic Office

File Name : Counts
Site Code :
Start Date : 8/28/2018
Page No : 3

	State Route 1, US 11W Southbound					Roberts Rd Westbound					State Route 1, US 11W Northbound					Shiptown Rd Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 06:00 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	**6**	66	9	0	81	3	4	3	0	10	31	164	**15**	0	210	4	4	**9**	0	17	318
05:00 PM	1	51	12	0	64	3	**5**	5	0	13	37	172	9	0	218	4	2	6	0	12	307
05:15 PM	4	68	**16**	0	**88**	**5**	3	**12**	0	**20**	34	179	13	0	226	**8**	**7**	8	0	**23**	**357**
05:30 PM	1	**73**	13	0	87	5	3	7	0	15	**42**	**181**	15	0	**238**	4	3	9	0	16	356
Total Volume	12	258	50	0	320	16	15	27	0	58	144	696	52	0	892	20	16	32	0	68	1338
% App. Total	3.8	80.6	15.6	0		27.6	25.9	46.6	0		16.1	78	5.8	0		29.4	23.5	47.1	0		
PHF	.500	.884	.781	.000	.909	.800	.750	.563	.000	.725	.857	.961	.867	.000	.937	.625	.571	.889	.000	.739	.937

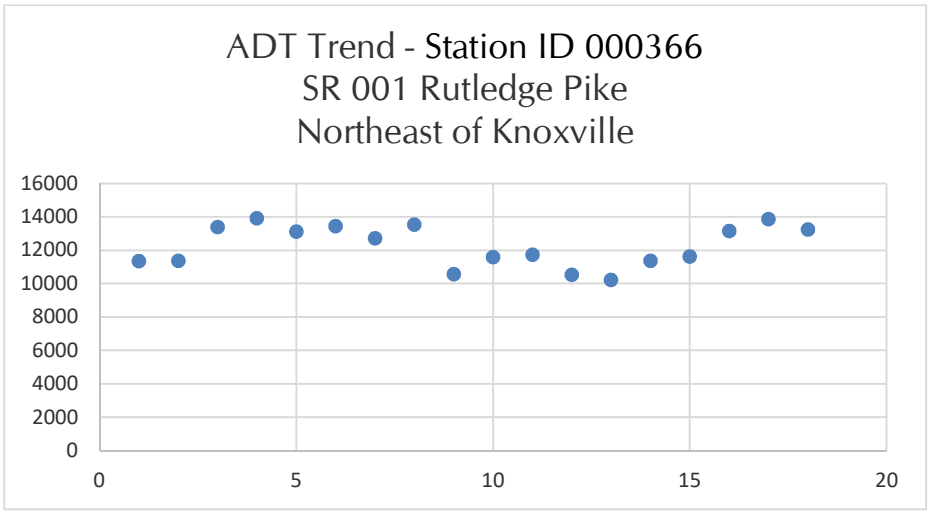
Project: Shipetown Square TIA
Intersection: Rutledge Pike (US 11W) at Roberts Road / Shipetown Road
Date Conducted: August 28, 2018

AM Peak Hour	7:00 AM - 8:00 AM	1472
PM Peak Hour	4:45 PM - 5:45 PM	1338

	Rutledge Pike Northbound				Rutledge Pike Southbound				Roberts Road Eastbound				Shipetown Road Westbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:15 AM																	
7:00 AM	5	70	0	75	**77**	128	4	209	14	0	32	46	**7**	**5**	4	16	346
7:15 AM	5	56	0	61	6	**270**	**15**	291	8	1	46	55	4	0	**6**	10	**417**
7:30 AM	**7**	**89**	**2**	98	2	221	10	233	**17**	**3**	**51**	71	7	2	5	14	416
7:45 AM	6	48	2	56	2	163	11	176	12	1	38	51	5	3	2	10	293
Total Volume	23	263	4	290	87	782	40	909	51	5	167	223	23	10	17	50	1472
2021 (3% over 3 yrs)	25	287	4		95	855	44		56	5	182		25	11	19		1608
2024 (3% over 6 yrs)	27	314	5		104	934	48		61	6	199		27	12	20		1758
PHF	0.82	0.74	0.50		0.28	0.72	0.67		0.75	0.42	0.82		0.82	0.50	0.71		0.88
Peak Hour Analysis from 4:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
4:45 PM	31	164	15	**210**	**6**	66	9	81	4	4	9	17	3	**4**	3	10	318
5:00 PM	37	172	9	218	1	51	12	64	4	2	6	**12**	3	5	5	13	307
5:15 PM	34	179	13	226	4	68	**16**	88	**8**	**7**	8	23	**5**	3	**12**	20	**357**
5:30 PM	**42**	**181**	**15**	238	1	**73**	13	**87**	4	3	**9**	16	5	3	7	15	356
Total Volume	144	696	52	892	12	258	50	320	20	16	32	68	16	15	27	58	1338
2021 (3% over 3 yrs)	157	761	57		13	282	55		22	17	35		17	16	30		1462
2024 (3% over 6 yrs)	172	831	62		14	308	60		24	19	38		19	18	32		1598
PHF	0.86	0.96	0.87		0.50	0.88	0.78		0.63	0.57	0.89		0.80	0.94	0.56		0.94

Attachment 3
ADT Trends

Year	Adjusted Average Daily Traffic
2001	11360
2002	11375
2003	13391
2004	13921
2005	13128
2006	13449
2007	12717
2008	13542
2009	10577
2010	11592
2011	11745
2012	10540
2013	10229
2014	11367
2015	11622
2016	13167
2017	13864
2018	13249

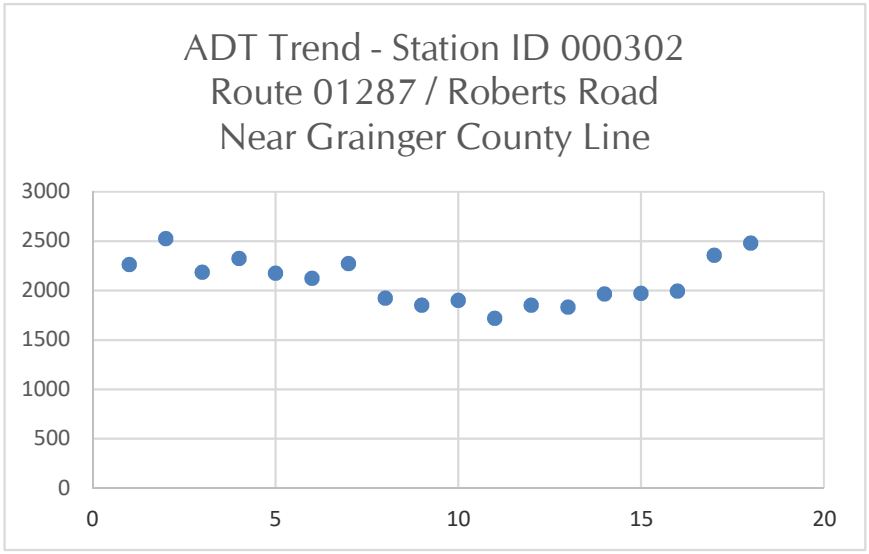


Most Recent Trend Line Growth

Year	ADT
2009	10577
2018	13249

Annual Percent Growth	**2.53%**

Year	Adjusted Average Daily Traffic
2001	2265
2002	2526
2003	2186
2004	2326
2005	2175
2006	2124
2007	2274
2008	1924
2009	1852
2010	1902
2011	1719
2012	1853
2013	1834
2014	1966
2015	1973
2016	1993
2017	2358
2018	2482



Most Recent Trend Line Growth

Year	ADT
2009	1852
2018	2482

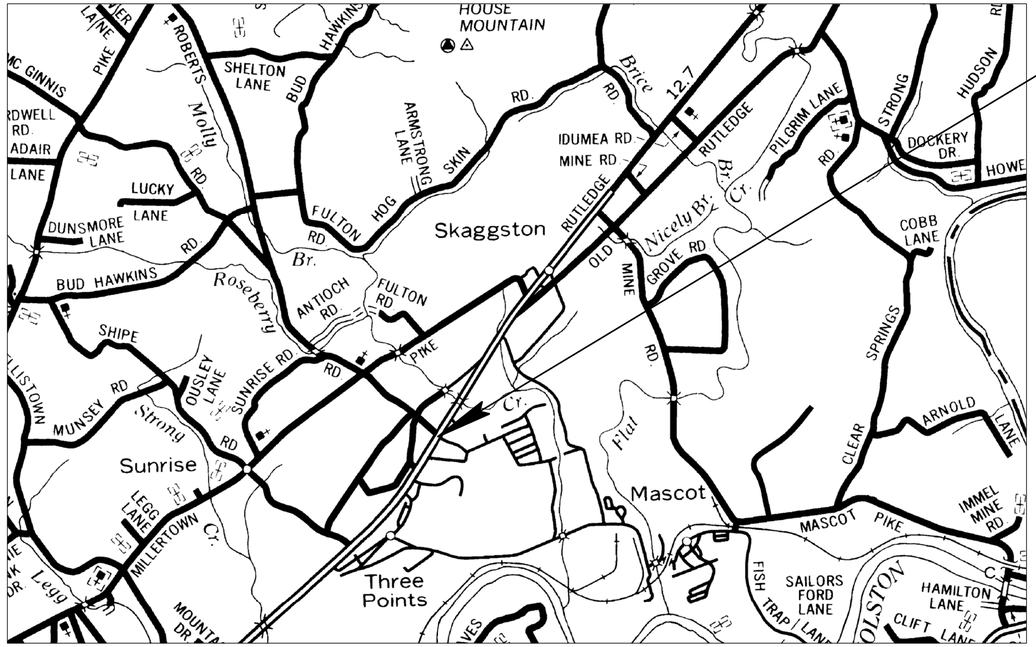
Annual Percent Growth	**3.40%**

Attachment 4
TDOT Concept Plan

INDEX OF SHEETS

KNOX COUNTY COMMISSIONERS
RANDY SMITH
BRAD ANDERS
CHARLES BUSLER
MICHELE CARRINGER
CARSON DAILEY
EVELYN GILL
HUGH NYSTROM
JOHN SCHOONMAKER
JUSTIN BIGGS
LARSEN JAY
RICHIE BEELER

RUTLEDGE PIKE AT ROBERTS ROAD/SHIPETOWN ROAD INTERSECTION CONCEPT PLAN



GLENN JACOBS - MAYOR

JIM SNOWDEN - SENIOR DIRECTOR OF ENGINEERING AND PUBLIC WORKS

KNOX COUNTY ENGINEERING AND PUBLIC WORKS
205 WEST BAXTER AVENUE
KNOXVILLE, TENNESSEE 37917

REVISIONS	DATE

CANNON & CANNON INC
CONSULTING ENGINEERS · FIELD SURVEYORS
TEL 865.670.8555 | WWW.CANNON-CANNON.COM
8550 Kingston Pike
Knoxville, TN 37919

CLIENT:
KNOX COUNTY DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

PROJECT:
RUTLEDGE PIKE AT ROBERTS ROAD/SHIPETOWN ROAD INTERSECTION CONCEPT PLAN

TITLE SHEET

PRELIMINARY

CCI PROJECT NO.	00263-0096
DATE	MAY 27, 2020
P.M.	BJH
DRAWN	TSN
Q.C.	BJH

1

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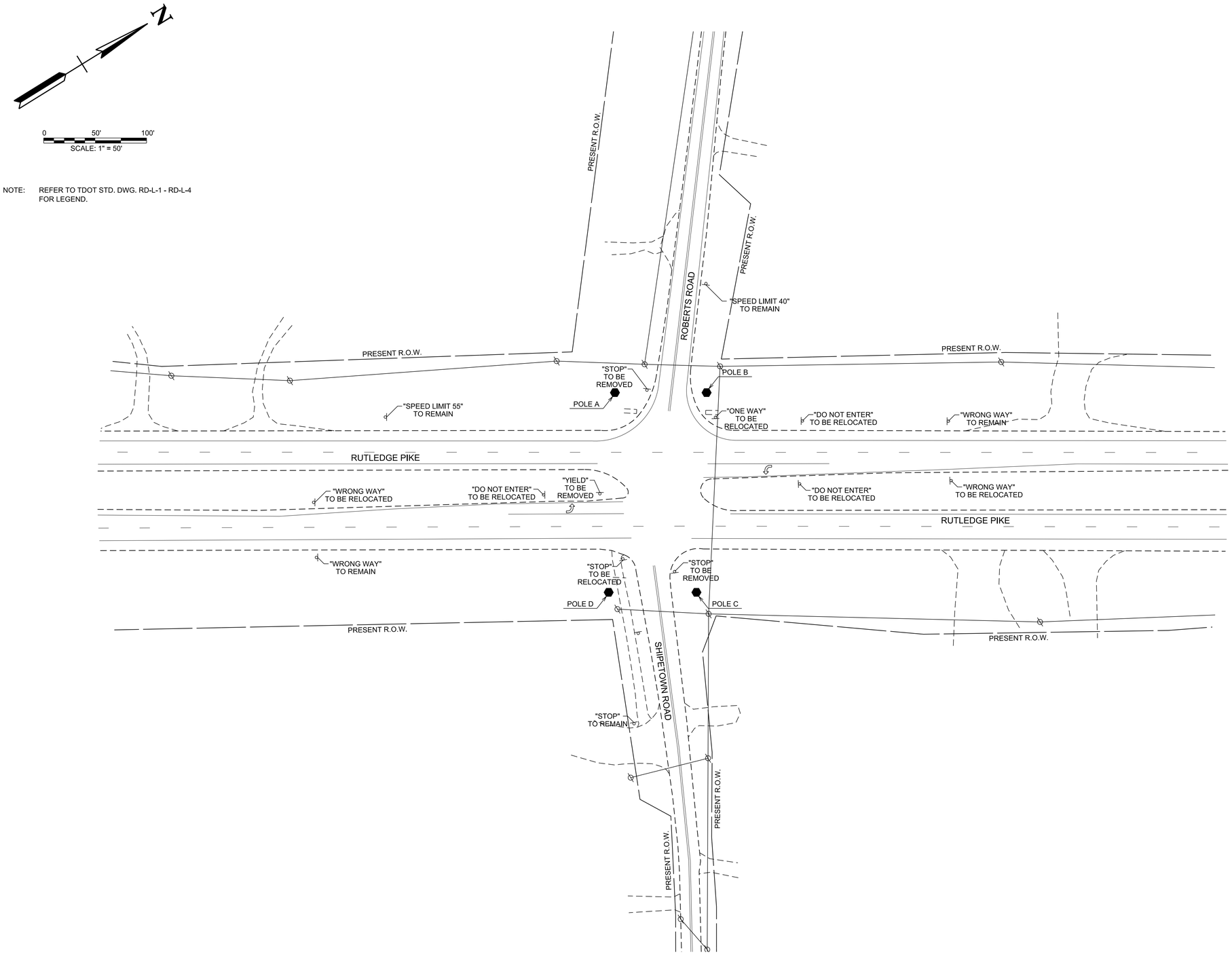

NOTE: REFER TO TDOT STD. DWG. RD-L-1 - RD-L-4 FOR LEGEND.

REVISIONS	DATE

CANNON & CANNON INC
CONSULTING ENGINEERS · FIELD SURVEYORS
TEL: 865.670.8555 | 8550 Kingston Pike
WWW.CANNON-CANNON.COM | Knoxville, TN 37919

CLIENT:
KNOX COUNTY
DEPARTMENT OF ENGINEERING
AND PUBLIC WORKS

PROJECT:
RUTLEDGE PIKE AT
ROBERTS ROAD/SHIPETOWN ROAD
INTERSECTION CONCEPT PLAN

PRESENT LAYOUT

PRELIMINARY

CCI PROJECT NO.	00263-0096
DATE	MAY 27, 2020
P.M.	BJH
DRAWN	TSN
Q.C.	BJH

2

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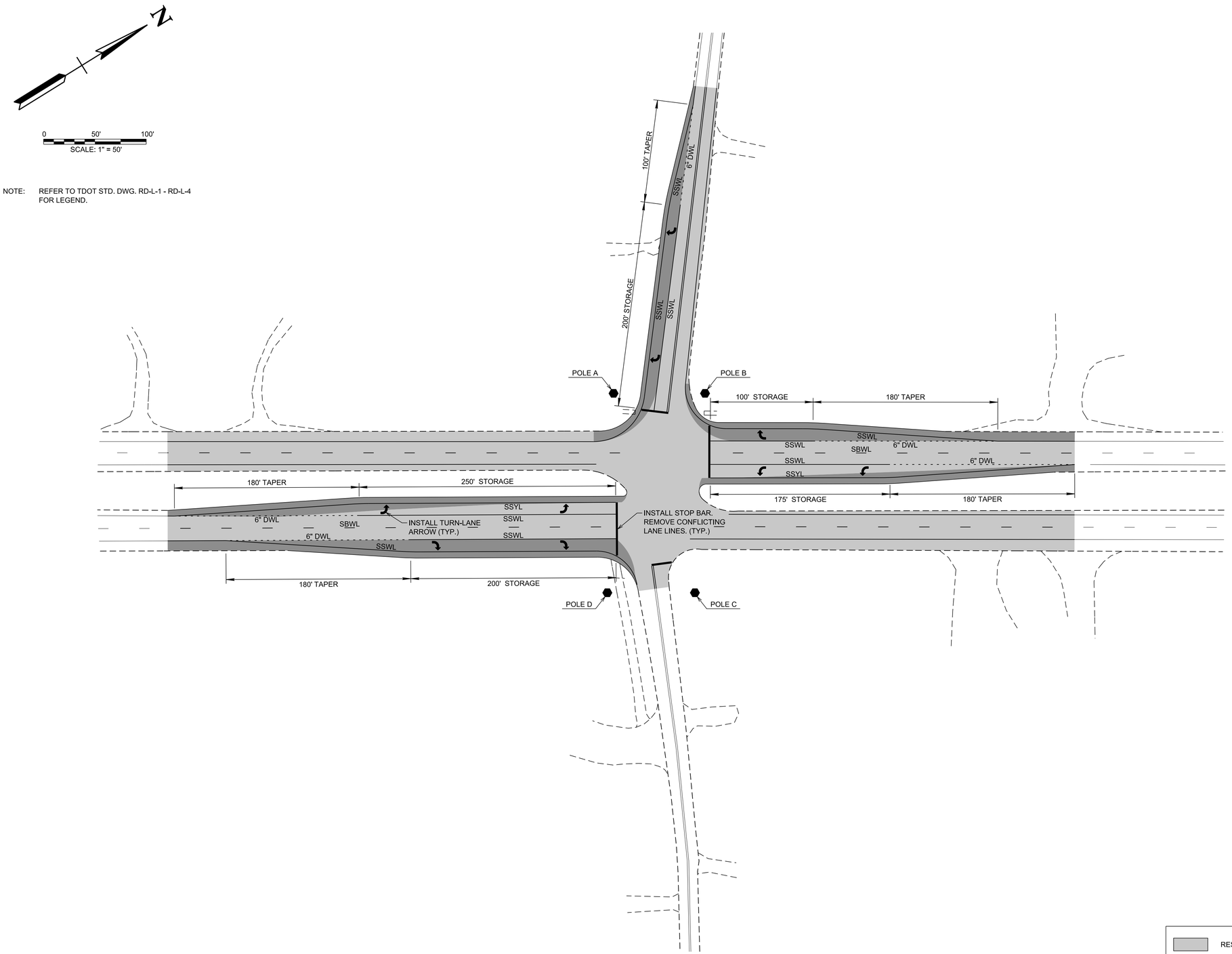

NOTE: REFER TO TDOT STD. DWG. RD-L-1 - RD-L-4 FOR LEGEND.

REVISIONS	DATE

CANNON & CANNON INC
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TEL 865.670.8555
WWW.CANNON-CANNON.COM
8550 Kingston Pike
Knoxville, TN 37919

CLIENT:
KNOX COUNTY DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

PROJECT:
RUTLEDGE PIKE AT ROBERTS ROAD/SHIPETOWN ROAD INTERSECTION CONCEPT PLAN

PROPOSED LAYOUT

PRELIMINARY

CCI PROJECT NO.	00263-0096
DATE	MAY 27, 2020
P.M.	BJH
DRAWN	TSN
Q.C.	BJH

3

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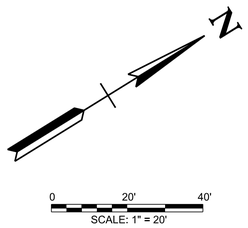
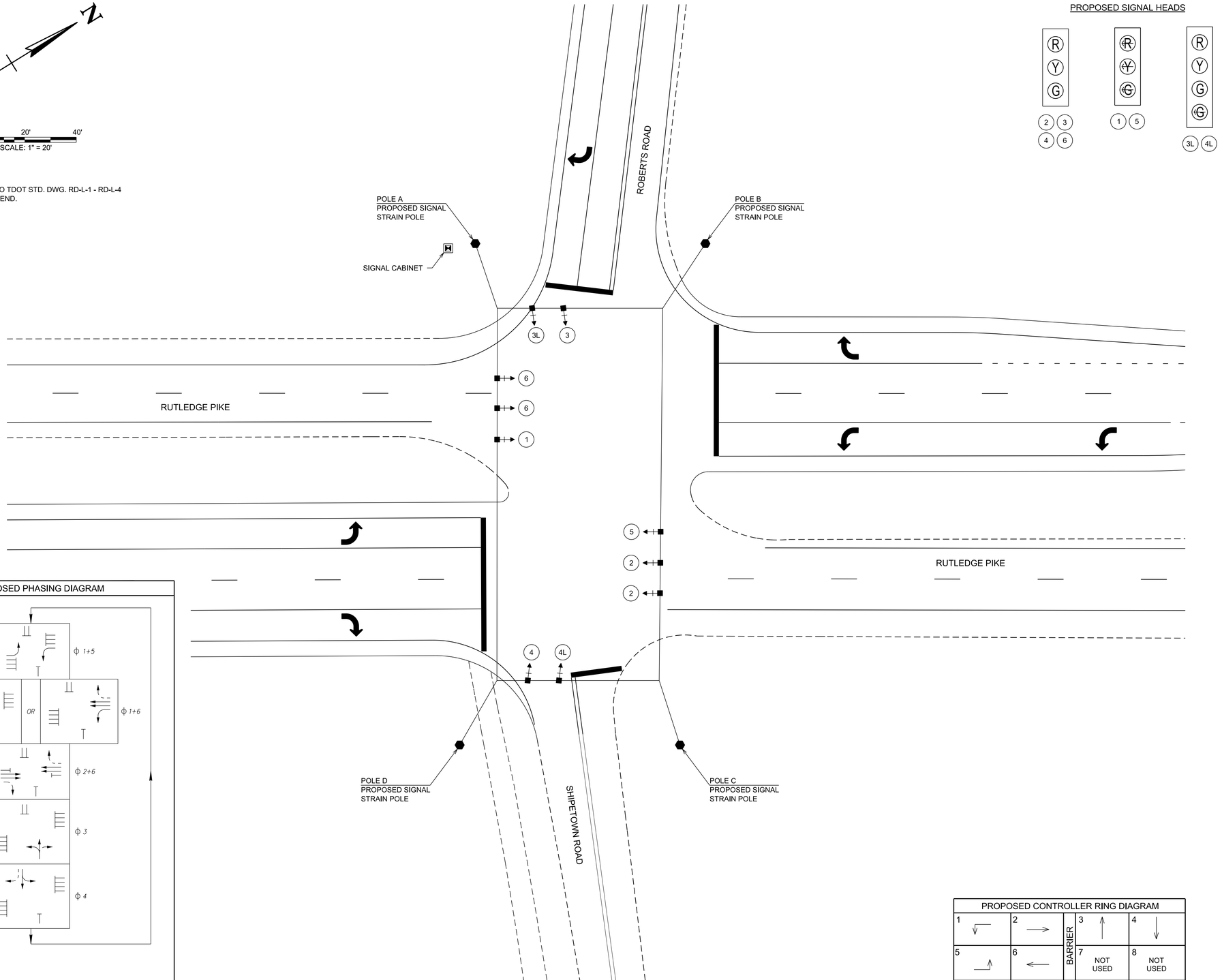
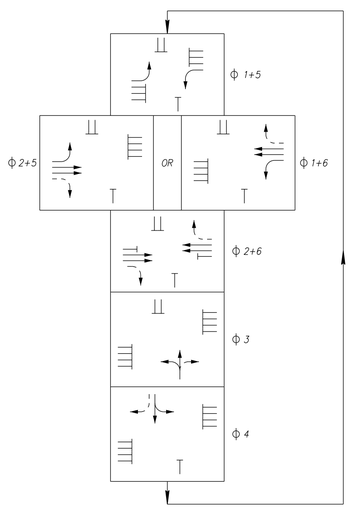


NOTE: REFER TO TDOT STD. DWG. RD-L-1 - RD-L-4 FOR LEGEND.

PROPOSED SIGNAL HEADS



PROPOSED PHASING DIAGRAM



NOTES:

1. PERMITTED, BUT NOT PROTECTED VEHICULAR MOVEMENT.

PROPOSED CONTROLLER RING DIAGRAM

1	2	BARRIER	3	4
5	6		7 NOT USED	8 NOT USED

REVISIONS	DATE

CANNON & CANNON INC
CONSULTING ENGINEERS · FIELD SURVEYORS
TEL 865.670.8555
WWW.CANNON-CANNON.COM
8550 Kingston Pike
Knoxville, TN 37919

CLIENT:
KNOX COUNTY DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

PROJECT:
RUTLEDGE PIKE AT ROBERTS ROAD/SHIPETOWN ROAD INTERSECTION CONCEPT PLAN

PROPOSED SIGNAL LAYOUT

PRELIMINARY

CCI PROJECT NO.	00263-0096
DATE	MAY 27, 2020
P.M.	BJH
DRAWN	TSN
Q.C.	BJH

4

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Attachment 5
Trip Generation

Project: Shipetown Square Retail
Date Conducted: 1/21/2021

Variety Store (LUC 814)
9,350 SF Building

Average Daily Traffic
Average Rate = 63.47
T = 63.47 * (9.350)
T = 593

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 3.18
T = 3.18 * (9.350)
T = 30

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 6.84
T = 6.84 * (9.350)
T = 64

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	593	50%	50%	297	297
AM Peak Hour	30	57%	43%	17	13
PM Peak Hour	64	52%	48%	33	31

Project: Shipetown Square
Date Conducted: 1/13/2021

Super Convenience Market/Gas Station (LUC 960)
10 Vehicle Fueling Positions

Average Daily Traffic
Average Rate = 230.52
T = 230.52 * 10
T = 2305

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 28.08
T = 28.08 * 10
T = 281

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 22.96
T = 22.96 * 10
T = 230

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	2305	50%	50%	1153	1153
AM Peak Hour	281	50%	50%	141	141
PM Peak Hour	230	50%	50%	115	115

New Trips 35%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	807	50%	50%	403	403
AM Peak Hour	98	50%	50%	49	49
PM Peak Hour	81	50%	50%	40	40

Pass-By Trips 65%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1498	50%	50%	749	749
AM Peak Hour	183	50%	50%	91	91
PM Peak Hour	150	50%	50%	75	75

Project: Shipetown Square
Date Conducted: 1/13/2021

Fast-Food Restaurant with Drive-Through Window and
No Indoor Seating (LUC 935)
500 SF

Average Daily Traffic
Average Rate = 459.20
T = 459.20 * 0.5
T = 230

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 33.76
T = 33.76 * 0.5
T = 17

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 42.65
T = 42.65 * 0.5
T = 21

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	230	50%	50%	115	115
AM Peak Hour	17	48%	52%	8	9
PM Peak Hour	21	51%	49%	11	10

New Trips 60%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	138	50%	50%	69	69
AM Peak Hour	10	48%	52%	5	5
PM Peak Hour	13	51%	49%	6	6

Pass-By Trips 40%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	92	50%	50%	46	46
AM Peak Hour	7	48%	52%	3	4
PM Peak Hour	8	51%	49%	4	4

Project: Shipetown Square Retail
Date Conducted: 2/19/2021

Copy, Print, and Express Ship Store (LUC 920)
3,340 SF Building

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 2.78
T = 2.78 * (3.34)
T = 9

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 7.42
T = 7.42 * (3.34)
T = 25

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)		50%	50%	0	0
AM Peak Hour	9	75%	25%	7	2
PM Peak Hour	25	44%	56%	11	14

Variety Store
(814)

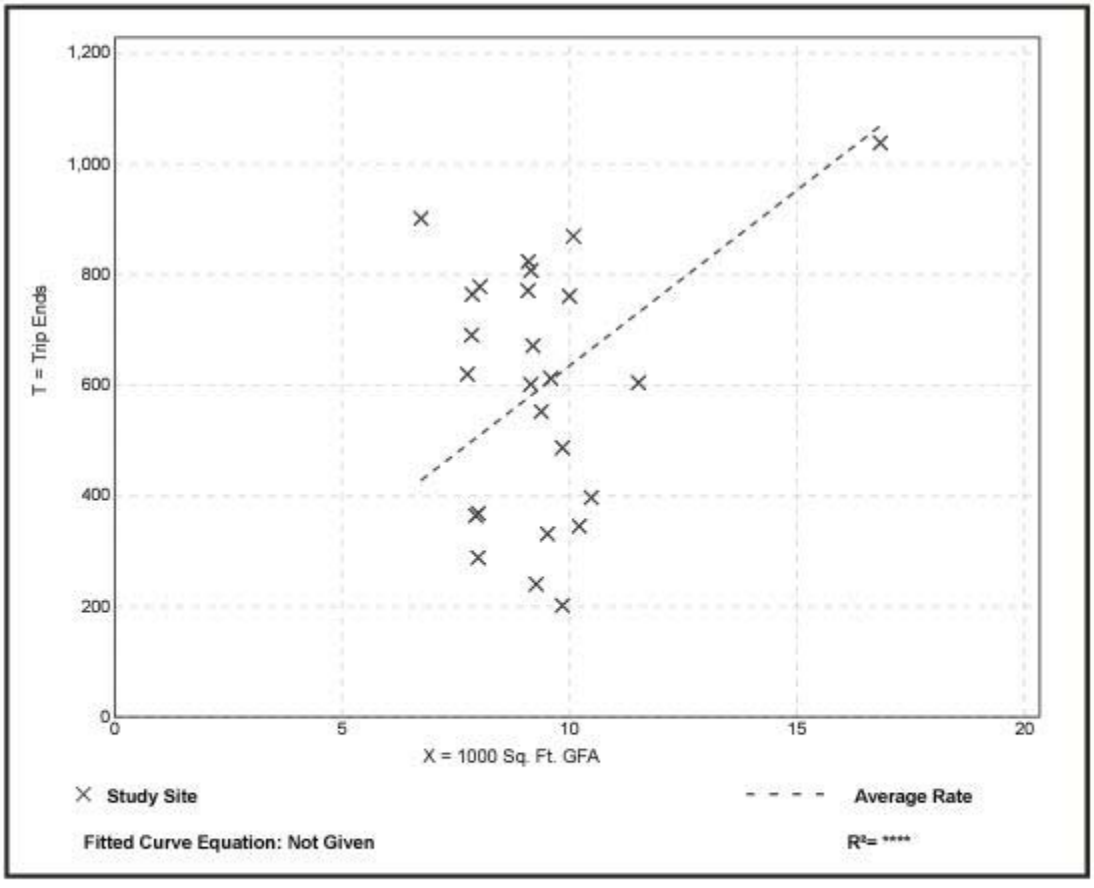
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 25
1000 Sq. Ft. GFA: 9
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
63.47	20.51 - 133.68	25.93

Data Plot and Equation



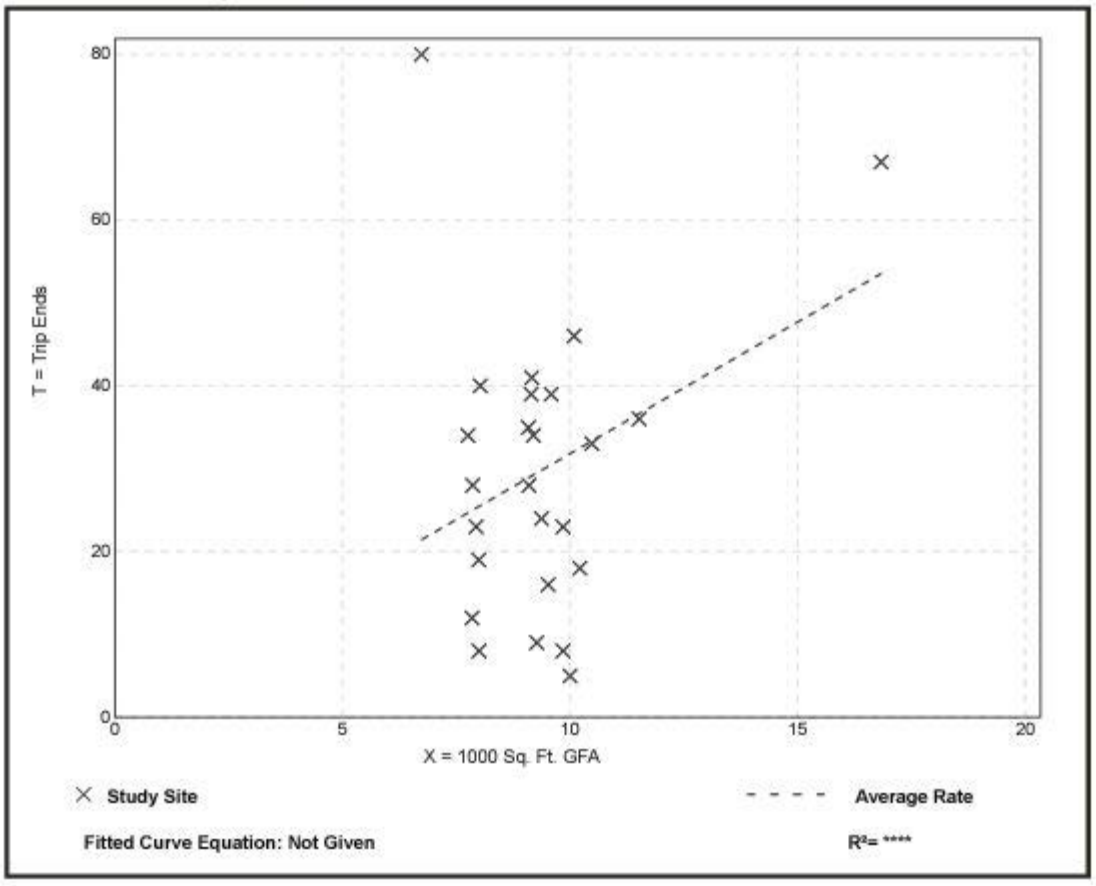
Variety Store
(814)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	25
1000 Sq. Ft. GFA:	9
Directional Distribution:	57% entering, 43% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.18	0.50 - 11.87	2.01

Data Plot and Equation



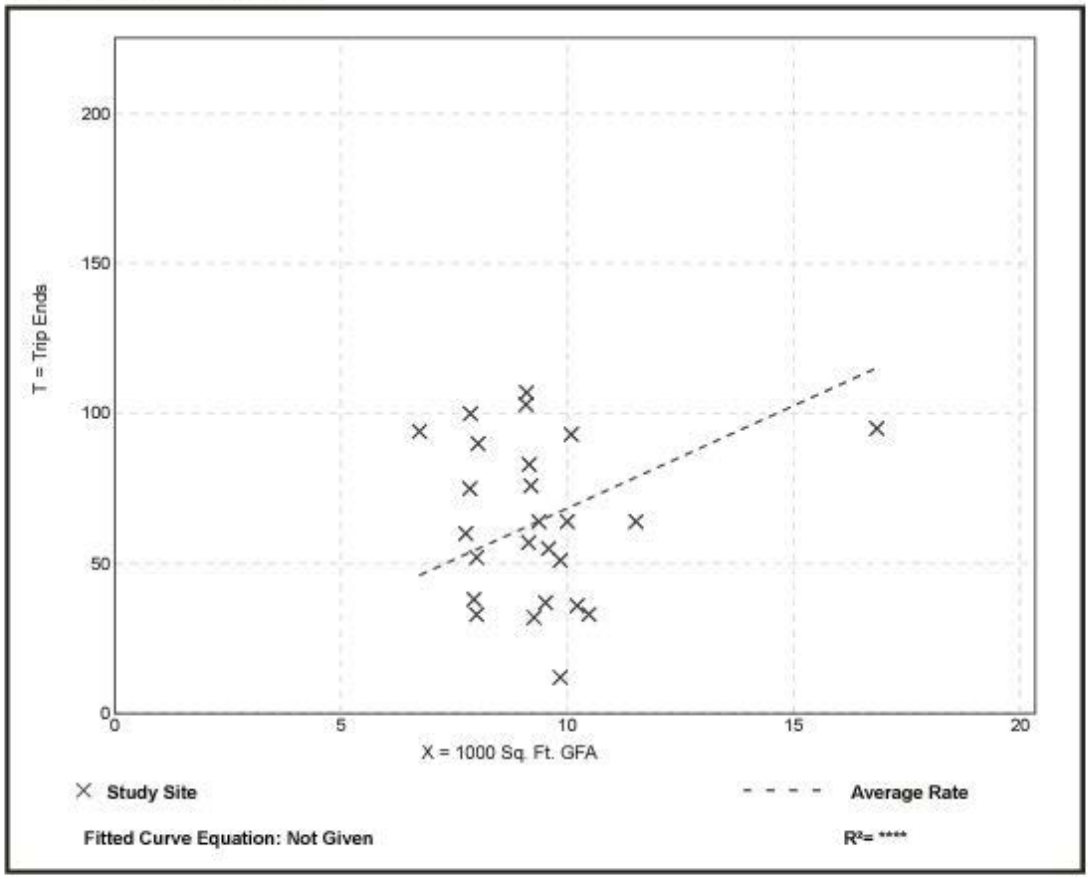
Variety Store
(814)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	25
1000 Sq. Ft. GFA:	9
Directional Distribution:	52% entering, 48% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
6.84	1.22 - 13.95	3.19

Data Plot and Equation



Super Convenience Market/Gas Station
(960)

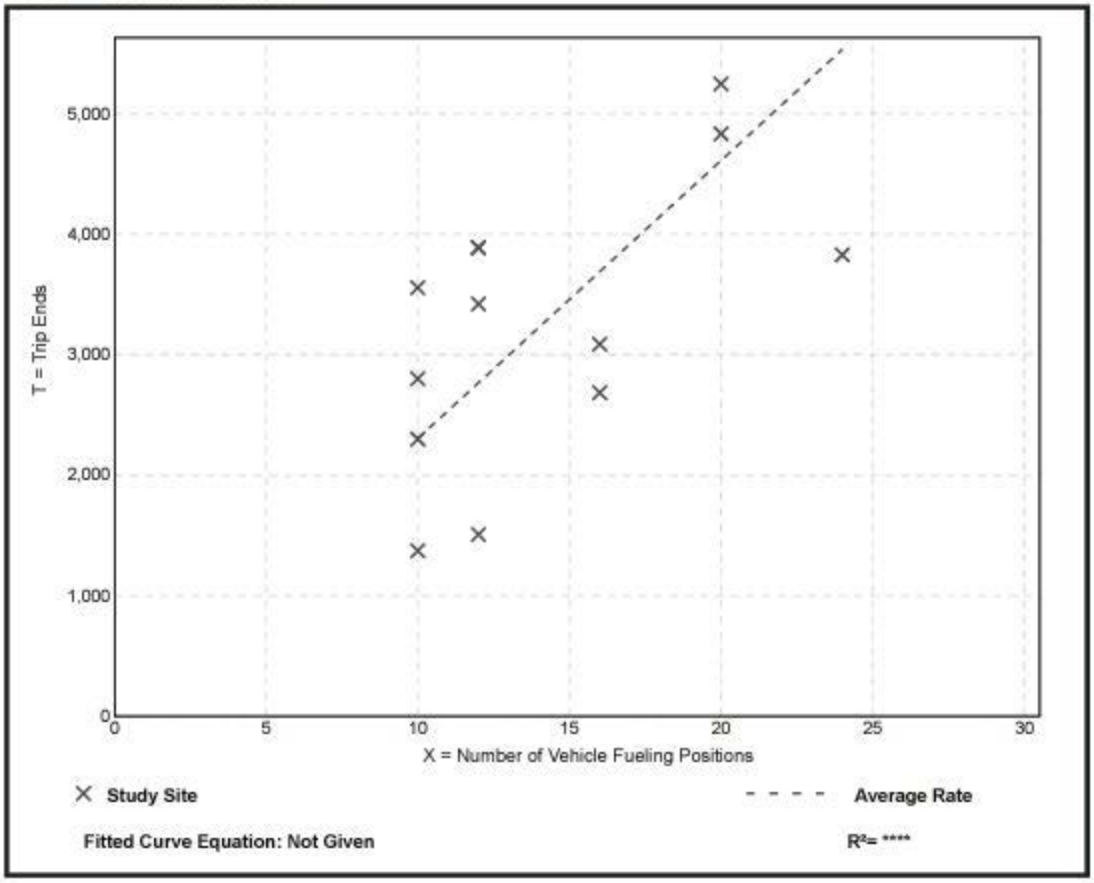
Vehicle Trip Ends vs: **Vehicle Fueling Positions**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 13
Avg. Num. of Vehicle Fueling Positions: 14
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
230.52	125.67 - 355.60	71.75

Data Plot and Equation



Fitted Curve Equation: Not Given

R^2= ****

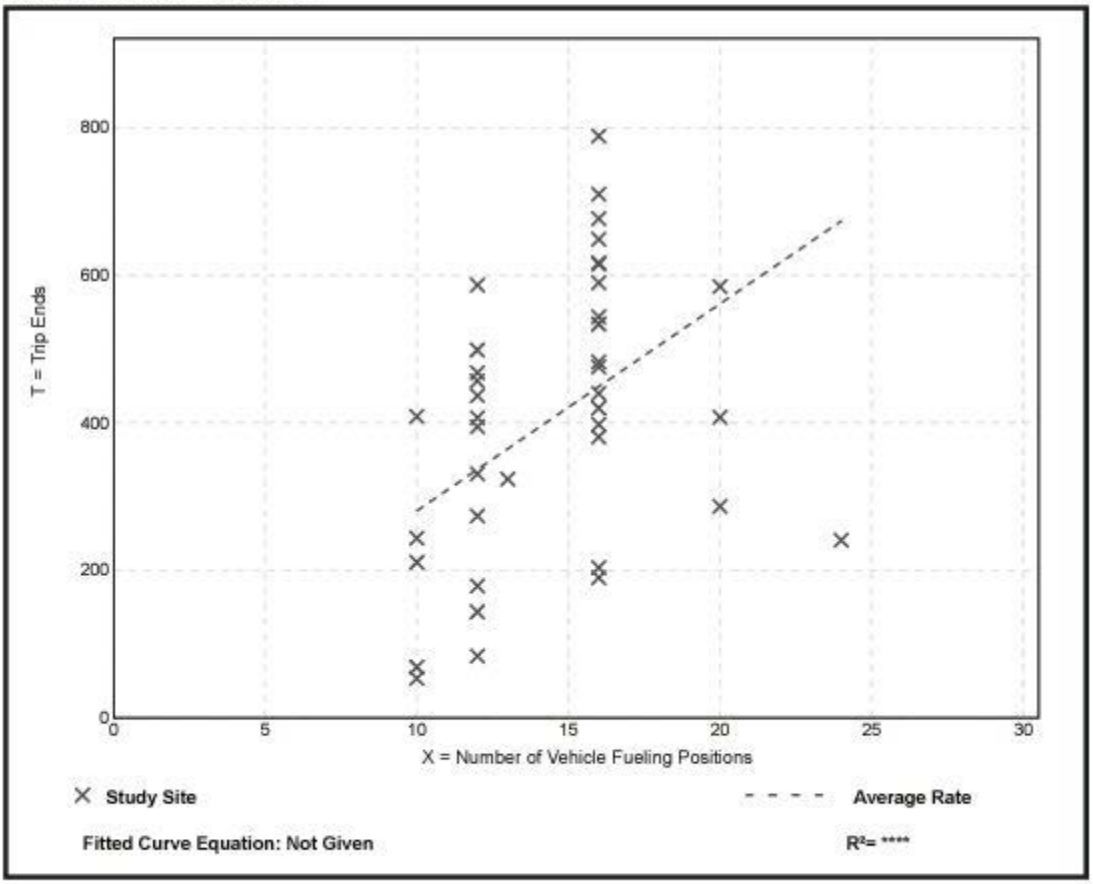
Super Convenience Market/Gas Station
(960)

Vehicle Trip Ends vs:	**Vehicle Fueling Positions**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	39
Avg. Num. of Vehicle Fueling Positions:	14
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
28.08	5.40 - 49.31	11.98

Data Plot and Equation



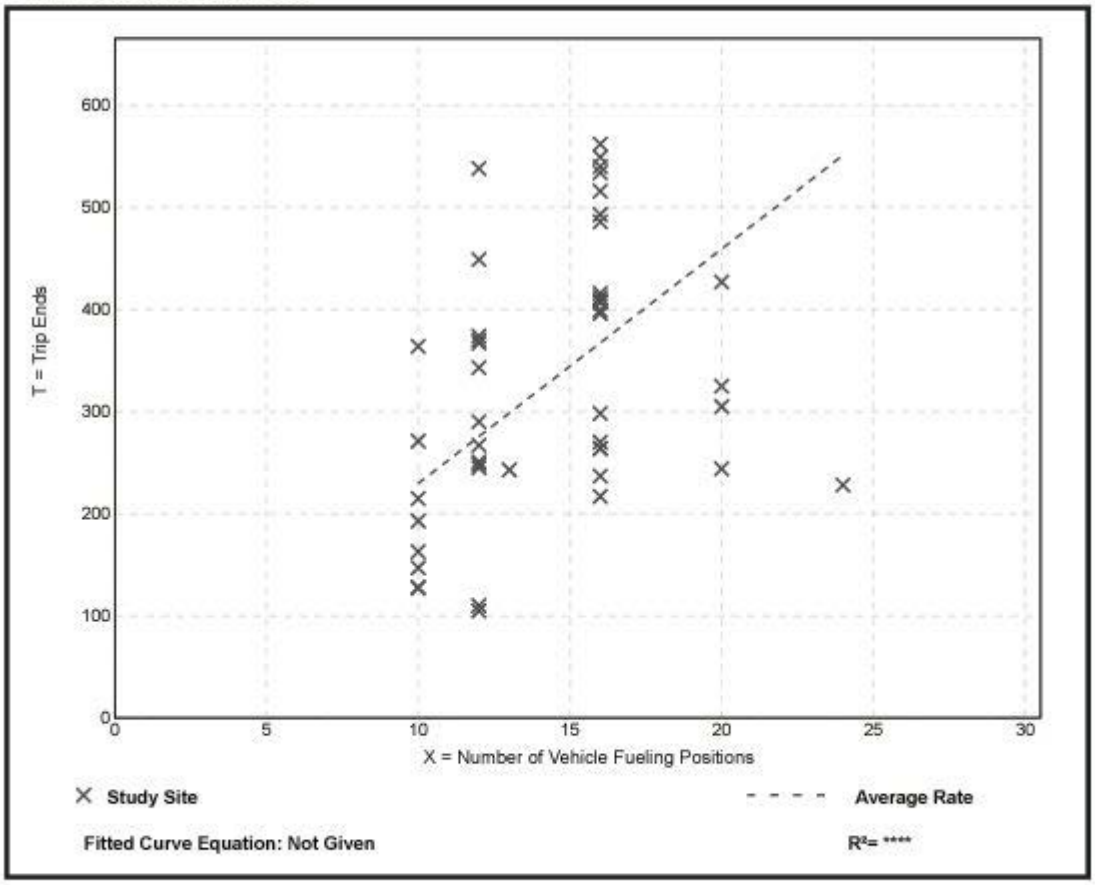
Super Convenience Market/Gas Station
(960)

Vehicle Trip Ends vs:	**Vehicle Fueling Positions**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	48
Avg. Num. of Vehicle Fueling Positions:	14
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
22.96	8.75 - 44.83	8.34

Data Plot and Equation



Fitted Curve Equation: Not Given

R^2= ****

Fast-Food Restaurant with Drive-Through Window and No Indoor Seating (935)

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

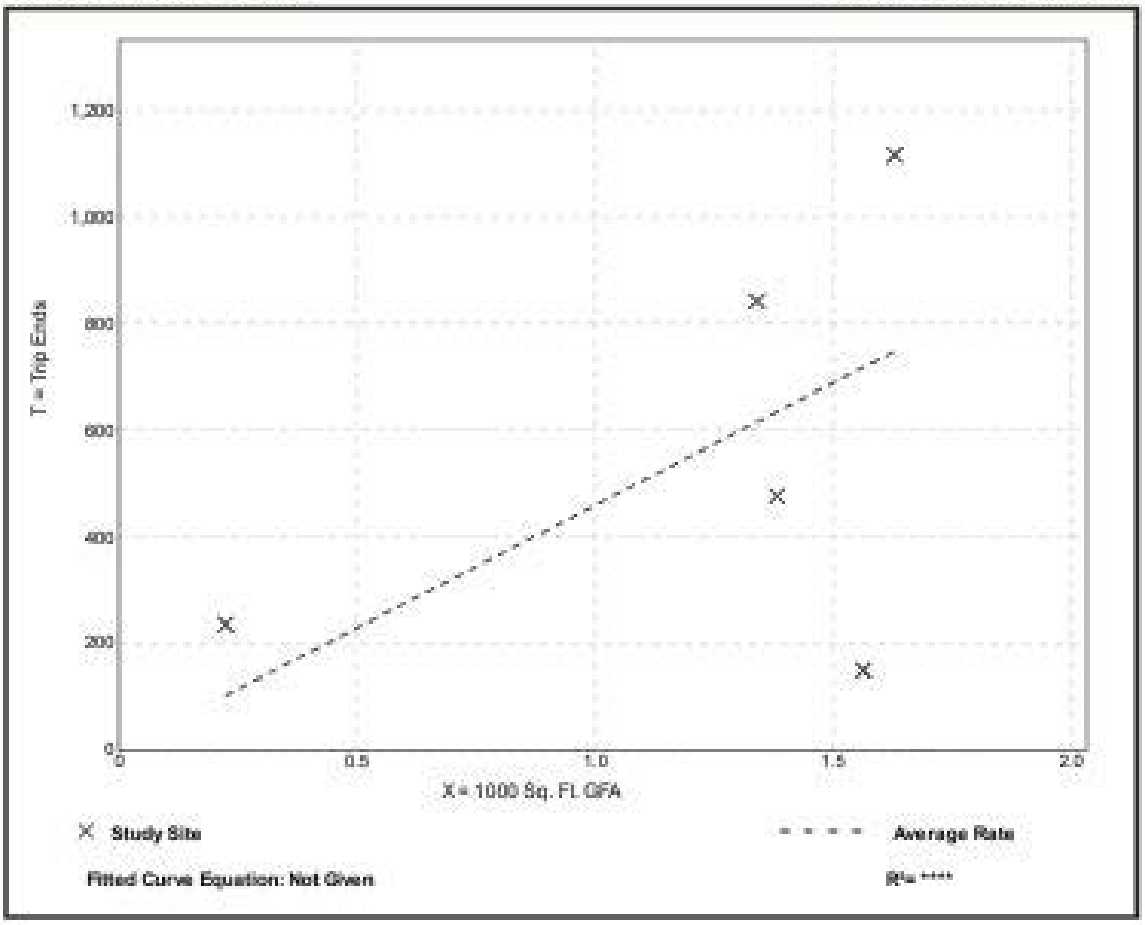
Setting/Location: **General Urban/Suburban**
Number of Studies: 5
1000 Sq. Ft. GFA: 1
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
459.20	95.91 - 1053.57	294.09

Data Plot and Equation

Caution – Small Sample Size



Fast-Food Restaurant with Drive-Through Window and No Indoor Seating (935)

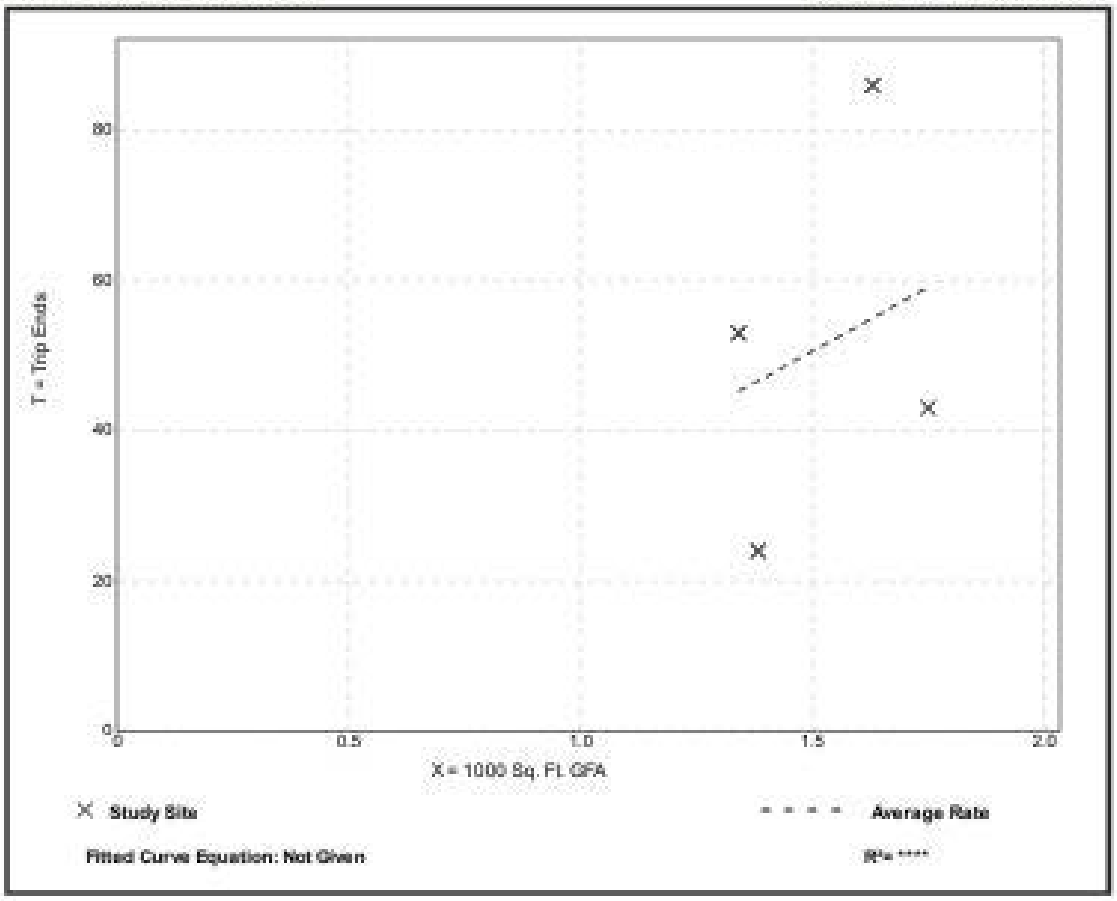
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 4
1000 Sq. Ft. GFA: 2
Directional Distribution: 48% entering, 52% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
33.76	17.37 - 52.79	15.88

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R² = **

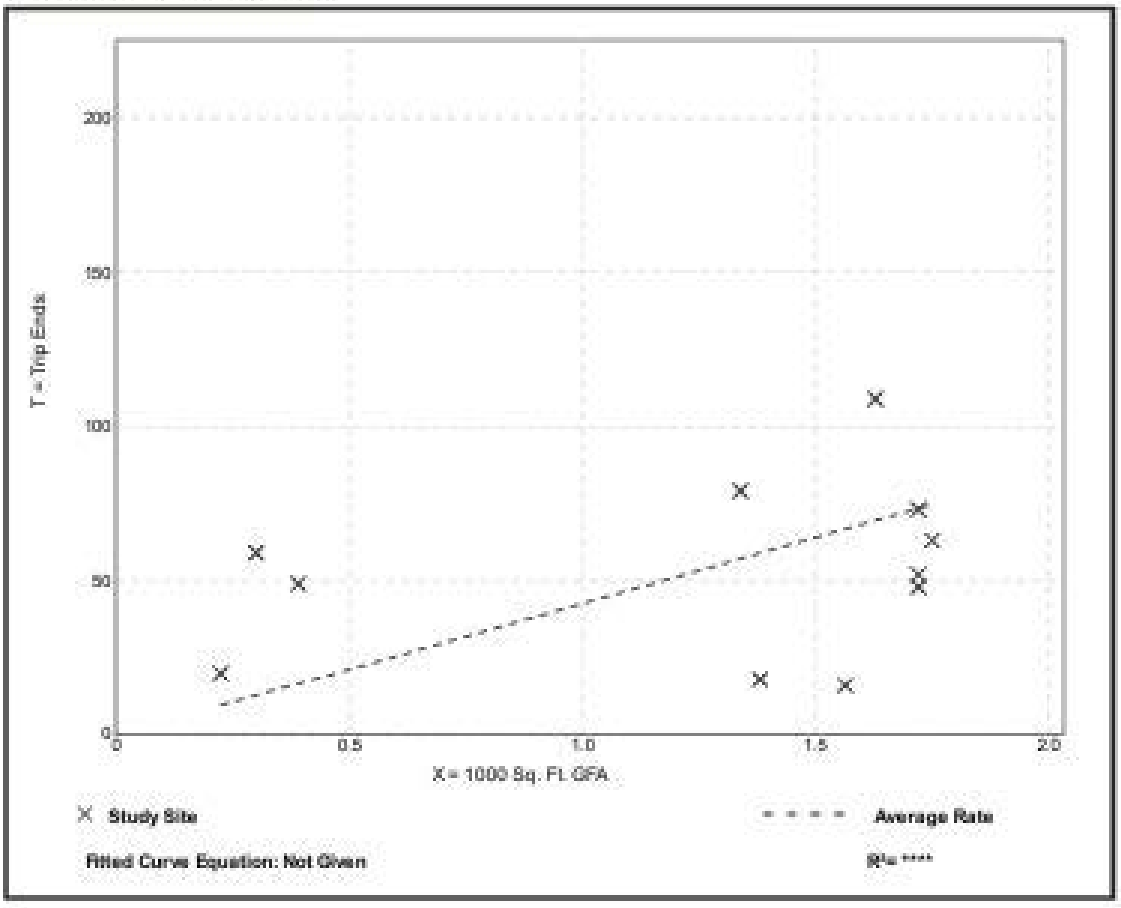
Fast-Food Restaurant with Drive-Through Window and No Indoor Seating (935)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 11
1000 Sq. Ft. GFA: 1
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
42.65	10.23 - 196.67	34.86

Data Plot and Equation



Copy, Print, and Express Ship Store
(920)

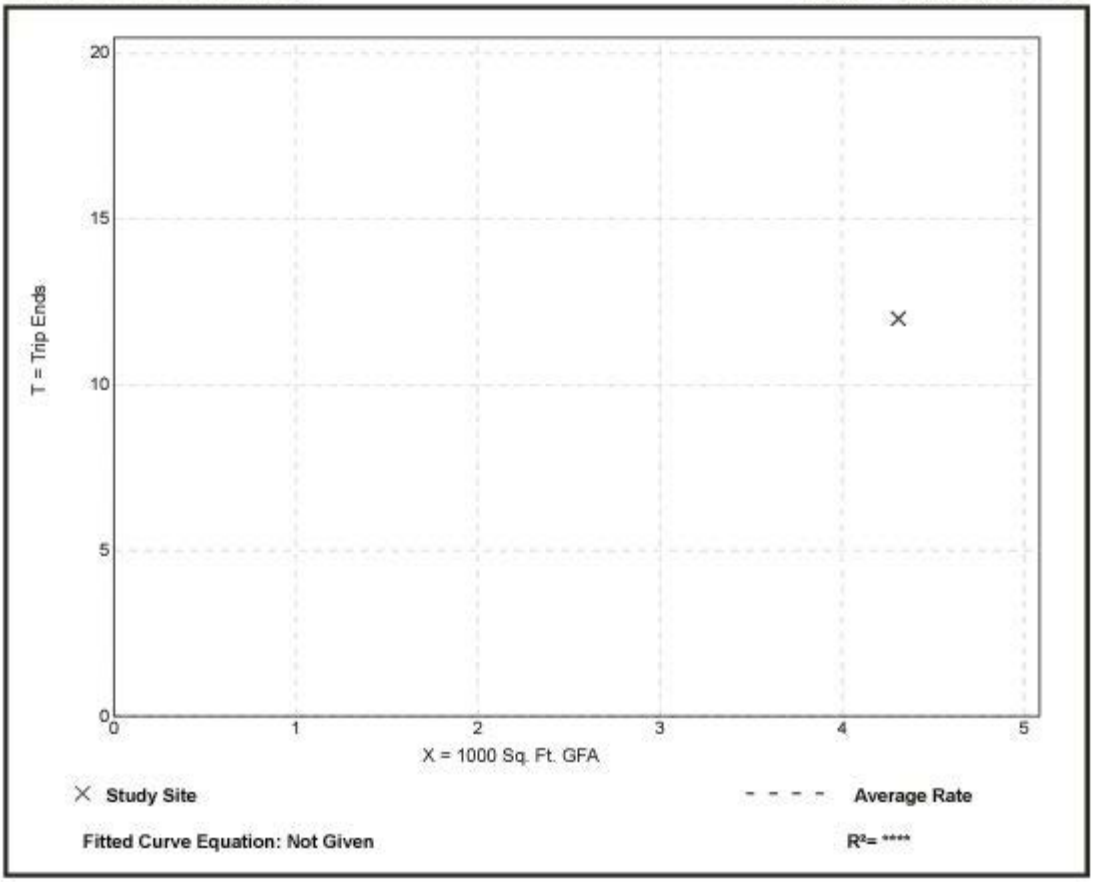
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	1
1000 Sq. Ft. GFA:	4
Directional Distribution:	75% entering, 25% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.78	2.78 - 2.78	*

Data Plot and Equation

Caution – Small Sample Size



Copy, Print, and Express Ship Store
(920)

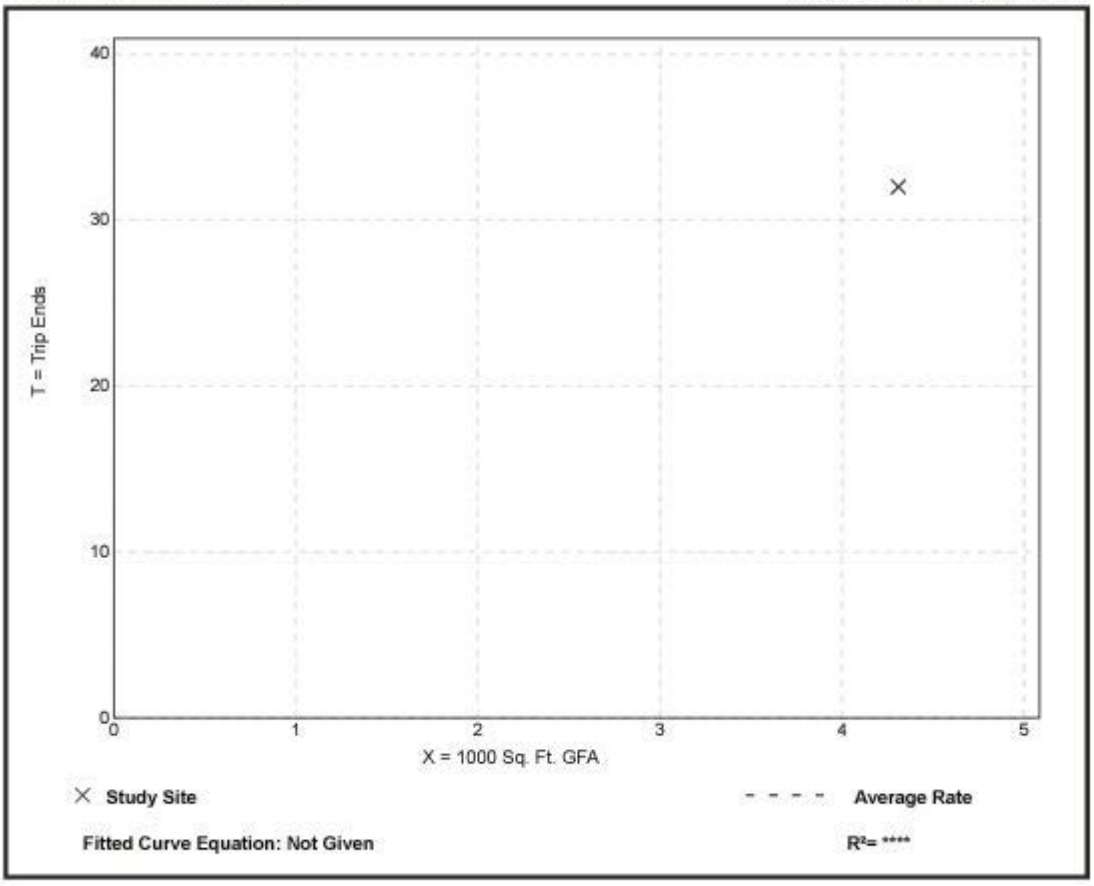
Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	1
1000 Sq. Ft. GFA:	4
Directional Distribution:	44% entering, 56% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
7.42	7.42 - 7.42	*

Data Plot and Equation

Caution – Small Sample Size



Attachment 6
Intersection Worksheets – Existing AM/PM Peaks

HCS7 Two-Way Stop-Control Report

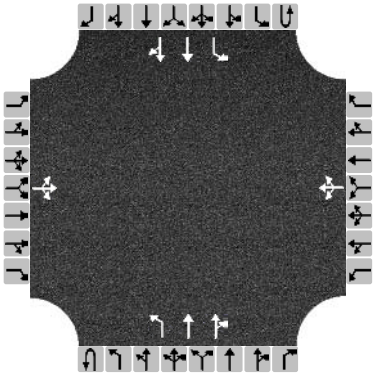
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	1/20/2021
Analysis Year	2021
Time Analyzed	Existing AM Peak
Intersection Orientation	North-South
Project Description	588.009 Shipetown Square

Site Information

Intersection	Rutledge Pike at Roberts
Jurisdiction	Knox County
East/West Street	Roberts/Shipetown
North/South Street	Rutledge Pike
Peak Hour Factor	0.88
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	1	2	0	0	1	2	0
Configuration			LTR				LTR			L	T	TR		L	T	TR
Volume, V (veh/h)		25	11	19		56	5	182		25	287	4		95	855	44
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)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
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)			62				277			28				108		
Capacity, c (veh/h)			102				348			675				1225		
v/c Ratio			0.61				0.80			0.04				0.09		
95% Queue Length, Q_{95} (veh)			2.9				6.7			0.1				0.3		
Control Delay (s/veh)			84.5				45.8			10.6				8.2		
Level of Service, LOS			F				E			B				A		
Approach Delay (s/veh)		84.5				45.8				0.8				0.8		
Approach LOS		F				E										

HCS7 Two-Way Stop-Control Report

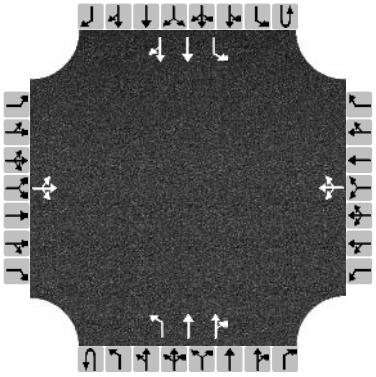
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	1/20/2021
Analysis Year	2021
Time Analyzed	Existing PM Peak
Intersection Orientation	North-South
Project Description	588.009 Shipetown Square

Site Information

Intersection	Rutledge Pike at Roberts
Jurisdiction	Knox County
East/West Street	Roberts/Shipetown
North/South Street	Rutledge Pike
Peak Hour Factor	0.94
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	1	2	0	0	1	2	0
Configuration			LTR				LTR			L	T	TR		L	T	TR
Volume, V (veh/h)		22	17	35		17	16	30		157	761	57		13	282	55
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)		7.5	6.5	6.9		7.5	6.5	6.9		4.1				4.1		
Critical Headway (sec)		7.54	6.54	6.94		7.54	6.54	6.94		4.14				4.14		
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		

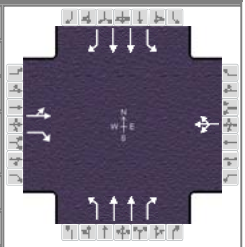
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			78				67			167				14		
Capacity, c (veh/h)			202				142			1196				770		
v/c Ratio			0.39				0.47			0.14				0.02		
95% Queue Length, Q_{95} (veh)			1.7				2.2			0.5				0.1		
Control Delay (s/veh)			33.6				51.2			8.5				9.8		
Level of Service, LOS			D				F			A				A		
Approach Delay (s/veh)		33.6				51.2				1.4				0.4		
Approach LOS		D				F										

Attachment 7
Intersection Worksheets – Background AM/PM Peaks

HCS7 Signalized Intersection Results Summary

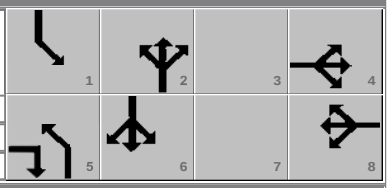
General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	Jan 20, 2021	Area Type	Other
Jurisdiction	Knox County	Time Period	Background AM Peak	PHF	0.88
Urban Street	Rutledge Pike (US 11W)	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Rutledge Pike at Robert…	File Name	Background AM Peak_Rutledge.xus		
Project Description	588.009 Shipetown Square				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	61	6	199	27	12	20	27	314	5	104	934	48

Signal Information			
Cycle, s	90.0	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	3.2	2.5	47.2	10.5	4.7	0.0	
Yellow	4.0	0.0	4.0	4.0	4.0	0.0	
Red	1.5	0.0	1.5	1.5	1.5	0.0	



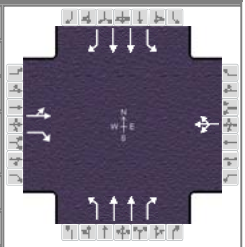
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		11.0		12.0	1.1	3.0	1.1	3.0
Phase Duration, s		16.0		10.2	8.7	52.7	11.2	55.1
Change Period, ($Y+R_c$), s		5.5		5.5	5.5	5.5	5.5	5.5
Max Allow Headway (*MAH*), s		3.2		3.3	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s		10.3		5.1	2.7		4.6	
Green Extension Time (g_e), s		0.2		0.0	0.0	0.0	0.2	0.0
Phase Call Probability		1.00		0.78	0.54		0.95	
Max Out Probability		0.17		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	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		76	158		60		31	357	3	118	1061	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1789	1610		1743		1781	1781	1585	1781	1781	1585
Queue Service Time (g_s), s		3.5	8.3		3.1		0.7	4.8	0.1	2.6	17.1	1.0
Cycle Queue Clearance Time (g_c), s		3.5	8.3		3.1		0.7	4.8	0.1	2.6	17.1	1.0
Green Ratio (*g/C*)		0.12	0.15		0.05		0.56	0.52	0.52	0.59	0.55	0.55
Capacity (*c*), veh/h		208	245		90		324	1866	831	675	1964	874
Volume-to-Capacity Ratio (*X*)		0.365	0.645		0.666		0.095	0.191	0.004	0.175	0.540	0.044
Back of Queue (*Q*), ft/ln (95 th percentile)		69.3	143.8		63.6		10.1	74.1	1.3	36.9	245.3	14.1
Back of Queue (*Q*), veh/ln (95 th percentile)		2.7	5.8		2.5		0.4	2.9	0.1	1.5	9.7	0.6
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.72		0.00		0.04	0.00	0.01	0.15	0.00	0.14
Uniform Delay (d_1), s/veh		36.7	35.9		41.9		10.5	11.3	10.2	8.4	12.9	9.3
Incremental Delay (d_2), s/veh		0.4	1.1		3.1		0.0	0.2	0.0	0.0	1.1	0.1
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		37.1	36.9		45.0		10.6	11.6	10.2	8.4	14.0	9.4
Level of Service (LOS)		D	D		D		B	B	B	A	B	A
Approach Delay, s/veh / LOS	37.0	D		45.0	D		11.5	B		13.3	B	
Intersection Delay, s/veh / LOS	16.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.1	B	2.3	B
Bicycle LOS Score / LOS	0.9	A	0.6	A	0.8	A	1.5	A

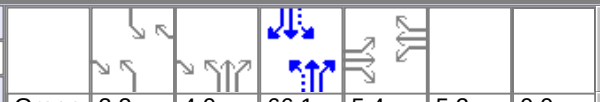
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	Jan 20, 2021	Area Type	Other
Jurisdiction	Knox County	Time Period	Background PM Peak	PHF	0.88
Urban Street	Rutledge Pike (US 11W)	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Rutledge Pike at Robert…	File Name	Background PM Peak_Rutledge.xus		
Project Description	588.009 Shipetown Square				

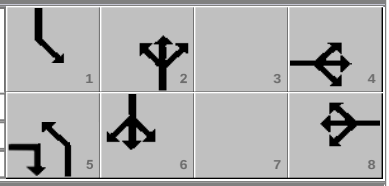


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	24	19	38	19	18	32	172	831	62	14	308	60

Signal Information			
Cycle, s	105.0	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	2.2	4.0	66.1	5.4	5.2	0.0			
Yellow	4.0	0.0	4.0	4.0	4.0	0.0			
Red	1.5	0.0	1.5	1.5	1.5	0.0			



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		11.0		12.0	1.1	3.0	1.1	3.0
Phase Duration, s		10.9		10.7	11.7	75.6	7.7	71.6
Change Period, ($Y+R_c$), s		5.5		5.5	5.5	5.5	5.5	5.5
Max Allow Headway (*MAH*), s		3.3		3.1	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s		4.7		6.0	6.0		2.3	
Green Extension Time (g_e), s		0.0		0.1	0.3	0.0	0.0	0.0
Phase Call Probability		0.90		0.86	1.00		0.37	
Max Out Probability		0.56		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	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		49	31		67		195	944	49	16	350	48
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1820	1610		1727		1781	1781	1585	1781	1781	1585
Queue Service Time (g_s), s		2.7	1.8		4.0		4.0	12.6	1.1	0.3	4.2	1.2
Cycle Queue Clearance Time (g_c), s		2.7	1.8		4.0		4.0	12.6	1.1	0.3	4.2	1.2
Green Ratio (*g/C*)		0.05	0.11		0.05		0.69	0.67	0.67	0.65	0.63	0.63
Capacity (*c*), veh/h		94	179		86		782	2379	1059	420	2243	998
Volume-to-Capacity Ratio (*X*)		0.521	0.172		0.781		0.250	0.397	0.046	0.038	0.156	0.048
Back of Queue (*Q*), ft/ln (95 th percentile)		59.3	33.1		83.9		49.5	174.2	14.1	4.6	62.3	16.4
Back of Queue (*Q*), veh/ln (95 th percentile)		2.3	1.3		3.3		1.9	6.9	0.6	0.2	2.5	0.6
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.17		0.00		0.20	0.00	0.07	0.02	0.00	0.16
Uniform Delay (d_1), s/veh		48.5	42.3		49.3		5.7	7.9	6.0	7.0	8.0	7.4
Incremental Delay (d_2), s/veh		1.7	0.2		5.7		0.1	0.5	0.1	0.0	0.1	0.1
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		50.2	42.5		55.0		5.7	8.4	6.1	7.0	8.1	7.5
Level of Service (LOS)		D	D		D		A	A	A	A	A	A
Approach Delay, s/veh / LOS	47.2	D		55.0	D		7.8	A		8.0	A	
Intersection Delay, s/veh / LOS	11.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.1	B	2.3	B
Bicycle LOS Score / LOS	0.6	A	0.6	A	1.5	A	0.8	A

Attachment 8
Intersection Worksheets – Full Buildout AM/PM Peaks

HCS7 Two-Way Stop-Control Report

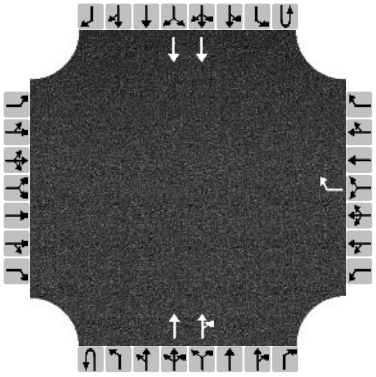
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/20/2021
Analysis Year	2024
Time Analyzed	Full Buildout AM Peak
Intersection Orientation	North-South
Project Description	588.009 Shipetown Square

Site Information

Intersection	Rutledge Pike at RIRO
Jurisdiction	Knox County
East/West Street	RIRO Driveway
North/South Street	Rutledge Pike
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	0	2	0
Configuration								R			T	TR			T	
Volume, V (veh/h)								23			389	17			1123	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

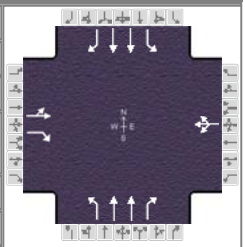
Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.94								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.32								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								25								
Capacity, c (veh/h)								784								
v/c Ratio								0.03								
95% Queue Length, Q_{95} (veh)								0.1								
Control Delay (s/veh)								9.7								
Level of Service, LOS								A								
Approach Delay (s/veh)						9.7										
Approach LOS						A										

HCS7 Signalized Intersection Results Summary

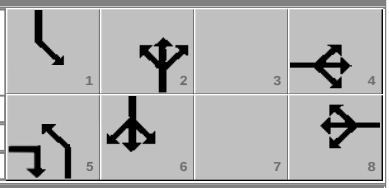
General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	Feb 20, 2021	Area Type	Other
Jurisdiction	Knox County	Time Period	Full Buildout AM Peak	PHF	0.88
Urban Street	Rutledge Pike (US 11W)	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Rutledge Pike at Robert…	File Name	Full Buildout AM Peak_Rutledge.xus		
Project Description	588.009 Shipetown Square				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	61	15	199	127	15	42	27	303	28	207	868	48

Signal Information			
Cycle, s	90.0	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	3.2	0.1	36.8	10.5	11.9	0.0	
Yellow	4.0	4.0	4.0	4.0	4.0	0.0	
Red	1.5	1.5	1.5	1.5	1.5	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		11.0		12.0	1.1	3.0	1.1	3.0
Phase Duration, s		16.0		17.4	8.7	42.3	14.3	47.8
Change Period, ($Y+R_c$), s		5.5		5.5	5.5	5.5	5.5	5.5
Max Allow Headway (*MAH*), s		3.2		3.3	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s		10.3		11.7	2.9		8.5	
Green Extension Time (g_e), s		0.3		0.3	0.0	0.0	0.4	0.0
Phase Call Probability		1.00		0.99	0.54		1.00	
Max Out Probability		0.07		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	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		86	158		194		31	344	22	235	986	39
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1798	1610		1752		1781	1781	1585	1781	1781	1585
Queue Service Time (g_s), s		4.0	8.3		9.7		0.9	5.7	0.7	6.5	18.3	1.2
Cycle Queue Clearance Time (g_c), s		4.0	8.3		9.7		0.9	5.7	0.7	6.5	18.3	1.2
Green Ratio (*g/C*)		0.12	0.15		0.13		0.44	0.41	0.41	0.53	0.47	0.47
Capacity (*c*), veh/h		210	246		232		284	1454	647	612	1675	746
Volume-to-Capacity Ratio (*X*)		0.411	0.643		0.837		0.108	0.237	0.033	0.385	0.589	0.052
Back of Queue (*Q*), ft/ln (95 th percentile)		79	143.7		197.5		14.3	97.6	11.6	97.3	276.6	17.9
Back of Queue (*Q*), veh/ln (95 th percentile)		3.1	5.7		7.8		0.6	3.8	0.5	3.8	10.9	0.7
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.72		0.00		0.06	0.00	0.06	0.39	0.00	0.18
Uniform Delay (d_1), s/veh		36.9	35.8		38.1		15.4	17.4	16.0	12.0	17.5	12.9
Incremental Delay (d_2), s/veh		0.5	1.0		3.1		0.1	0.4	0.1	0.1	1.5	0.1
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		37.3	36.9		41.2		15.5	17.8	16.1	12.1	19.0	13.1
Level of Service (LOS)		D	D		D		B	B	B	B	B	B
Approach Delay, s/veh / LOS	37.0	D		41.2	D		17.5	B		17.5	B	
Intersection Delay, s/veh / LOS	22.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.1	B	2.3	B
Bicycle LOS Score / LOS	0.9	A	0.8	A	0.8	A	1.5	B

HCS7 Two-Way Stop-Control Report

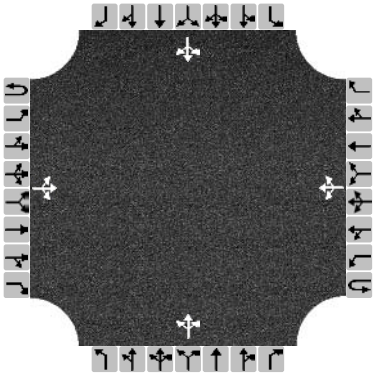
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/20/2021
Analysis Year	2024
Time Analyzed	Full Buildout AM Peak
Intersection Orientation	East-West
Project Description	588.009 Shipetown Square

Site Information

Intersection	Shipetown at DG Driveway
Jurisdiction	Knox County
East/West Street	Shipetown Road
North/South Street	Dollar General Driveway
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	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		135	100	15		2	47	3		12	0	1		3	0	125
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)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.12				4.12				7.12	6.52	6.22		7.12	6.52	6.22
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.22				2.22				3.52	4.02	3.32		3.52	4.02	3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		147				2					14				139	
Capacity, c (veh/h)		1550				1461					380				990	
v/c Ratio		0.09				0.00					0.04				0.14	
95% Queue Length, Q_{95} (veh)		0.3				0.0					0.1				0.5	
Control Delay (s/veh)		7.6				7.5					14.8				9.2	
Level of Service, LOS		A				A					B				A	
Approach Delay (s/veh)		4.4				0.3				14.8				9.2		
Approach LOS										B				A		

HCS7 Two-Way Stop-Control Report

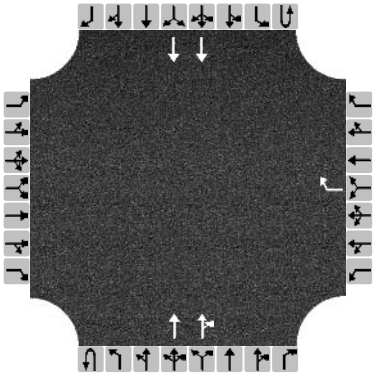
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/20/2021
Analysis Year	2024
Time Analyzed	Full Buildout PM Peak
Intersection Orientation	North-South
Project Description	588.009 Shipetown Square

Site Information

Intersection	Rutledge Pike at RIRO
Jurisdiction	Knox County
East/West Street	RIRO Driveway
North/South Street	Rutledge Pike
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	0	2	0
Configuration								R			T	TR			T	
Volume, V (veh/h)								43			877	37			396	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

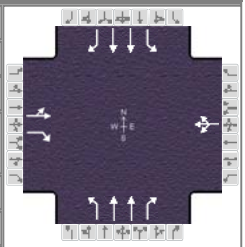
Base Critical Headway (sec)								6.9								
Critical Headway (sec)								6.94								
Base Follow-Up Headway (sec)								3.3								
Follow-Up Headway (sec)								3.32								

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								47								
Capacity, c (veh/h)								519								
v/c Ratio								0.09								
95% Queue Length, Q_{95} (veh)								0.3								
Control Delay (s/veh)								12.6								
Level of Service, LOS								B								
Approach Delay (s/veh)						12.6										
Approach LOS						B										

HCS7 Signalized Intersection Results Summary

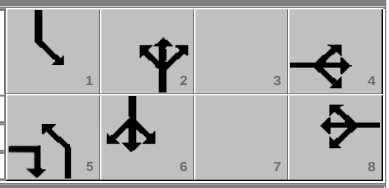
General Information				Intersection Information	
Agency	FMA			Duration, h	0.25
Analyst	Addie Kirkham	Analysis Date	Feb 20, 2021	Area Type	Other
Jurisdiction	Knox County	Time Period	Full Buildout PM Peak	PHF	0.88
Urban Street	Rutledge Pike (US 11W)	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	Rutledge Pike at Robert…	File Name	Full Buildout PM Peak_Rutledge.xus		
Project Description	588.009 Shipetown Square				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	24	22	38	57	24	78	172	812	119	51	285	60

Signal Information			
Cycle, s	90.0	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	4.6	2.2	46.2	5.2	9.8	0.0	
Yellow	4.0	0.0	4.0	4.0	4.0	0.0	
Red	1.5	0.0	1.5	1.5	1.5	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		11.0		12.0	1.1	3.0	1.1	3.0
Phase Duration, s		10.7		15.3	12.3	53.9	10.1	51.7
Change Period, ($Y+R_c$), s		5.5		5.5	5.5	5.5	5.5	5.5
Max Allow Headway (*MAH*), s		3.1		3.3	2.9	0.0	2.9	0.0
Queue Clearance Time (g_s), s		4.5		9.8	6.6		3.3	
Green Extension Time (g_e), s		0.1		0.2	0.3	0.0	0.1	0.0
Phase Call Probability		0.87		0.98	0.99		0.77	
Max Out Probability		0.00		0.01	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	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (*v*), veh/h		52	31		152		195	923	94	58	324	48
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1823	1610		1712		1781	1781	1585	1781	1781	1585
Queue Service Time (g_s), s		2.5	1.5		7.8		4.6	14.6	2.6	1.3	4.4	1.4
Cycle Queue Clearance Time (g_c), s		2.5	1.5		7.8		4.6	14.6	2.6	1.3	4.4	1.4
Green Ratio (*g/C*)		0.06	0.13		0.11		0.59	0.54	0.54	0.56	0.51	0.51
Capacity (*c*), veh/h		106	215		186		705	1914	852	385	1827	813
Volume-to-Capacity Ratio (*X*)		0.492	0.142		0.818		0.277	0.482	0.111	0.151	0.177	0.059
Back of Queue (*Q*), ft/ln (95 th percentile)		51.5	26		158		63.5	218.3	37.5	19.2	68.9	19.8
Back of Queue (*Q*), veh/ln (95 th percentile)		2.0	1.0		6.2		2.5	8.6	1.5	0.8	2.7	0.8
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00	0.13		0.00		0.25	0.00	0.19	0.08	0.00	0.20
Uniform Delay (d_1), s/veh		41.1	34.4		39.2		8.7	13.0	10.2	10.1	11.7	11.0
Incremental Delay (d_2), s/veh		1.3	0.1		3.4		0.1	0.9	0.3	0.1	0.2	0.1
Initial Queue Delay (d_3), s/veh		0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (*d*), s/veh		42.4	34.5		42.6		8.8	13.9	10.5	10.2	11.9	11.1
Level of Service (LOS)		D	C		D		A	B	B	B	B	B
Approach Delay, s/veh / LOS	39.5	D		42.6	D		12.8	B		11.6	B	
Intersection Delay, s/veh / LOS	16.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	3.0	C	2.1	B	2.3	B
Bicycle LOS Score / LOS	0.6	A	0.7	A	1.5	A	0.8	A

HCS7 Two-Way Stop-Control Report

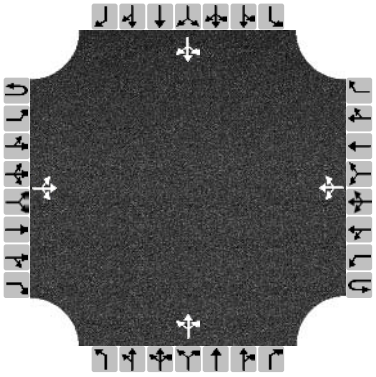
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/20/2021
Analysis Year	2024
Time Analyzed	Full Buildout PM Peak
Intersection Orientation	East-West
Project Description	588.009 Shipetown Square

Site Information

Intersection	Shipetown at DG Driveway
Jurisdiction	Knox County
East/West Street	Shipetown Road
North/South Street	Dollar General Driveway
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	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		97	65	30		3	41	3		28	0	3		6	0	90
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)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.12				4.12				7.12	6.52	6.22		7.12	6.52	6.22
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.22				2.22				3.52	4.02	3.32		3.52	4.02	3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		105				3					33				105	
Capacity, c (veh/h)		1558				1486					502				971	
v/c Ratio		0.07				0.00					0.07				0.11	
95% Queue Length, Q_{95} (veh)		0.2				0.0					0.2				0.4	
Control Delay (s/veh)		7.5				7.4					12.7				9.2	
Level of Service, LOS		A				A					B				A	
Approach Delay (s/veh)		4.0				0.5				12.7				9.2		
Approach LOS										B				A		

Attachment 9
Turn Lane Warrant Analysis

Attachment 9
Turn Lane Warrant Analysis

Project: Shipetown Square

Shipetown Square at Convenience Market Driveway Connection

Shipetown Road VOLUMES
at Convenience Market Driveway Connection

LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	52	115	135	300	NO
PM	47	95	97	300	NO

Shipetown Road VOLUMES
at Convenience Market Driveway Connection

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	49	3	599	NO
PM	44	3	599	NO

Shipetown Road at Convenience Market Driveway

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	300	235	185	145	120	100
150 - 199	245	190	160	130	110	90
200 - 249	205	165	140	115	100	80
250 - 299	175	150	125	105	90	70
300 - 349	155	135	110	95	80	65
350 - 399	135	120	100	85	70	60
400 - 449	120	105	90	75	65	55
450 - 499	105	90	80	70	60	50
500 - 549	95	80	70	65	55	50
550 - 599	85	70	65	60	50	45
600 - 649	75	65	60	55	45	40
650 - 699	70	60	55	50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

AM Peak 135 LT
PM Peak 97 LT

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

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

Shipetown Road at Convenience Market Driveway

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	AM Peak 3 RT PM Peak 3 RT					
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

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

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