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TIPTON STATION SUBDIVISION

Transportation Impact Analysis

Tipton Station Road

Knoxville, TN

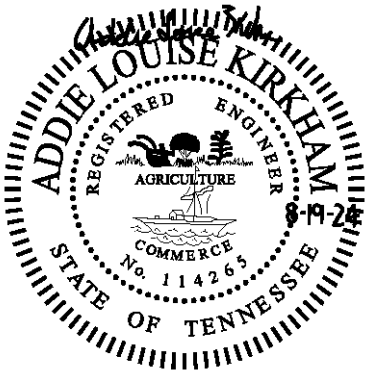
A Transportation Impact Analysis for the Tipton Station Subdivision

Submitted to

Knoxville-Knox County Planning

August 19, 2024
Ardurra Project No. 787.001

Submitted By:



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Executive Summary

D.R. Horton - Knoxville is proposing a residential development. The project is located east of the two-way stop-controlled intersection of W Martin Mill Pike at Tipton Station Road in Knox County, Tennessee. The full buildout of the Tipton Station Subdivision proposes 343 single-family residential lots. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2027.

The Tipton Station Subdivision has a proposed single roadway connection to Tipton Station Road with a boulevard entrance.

Based on the results of the traffic analysis conducted to determine the impacts caused by the Tipton Station Subdivision on the studied intersections, the following observations have been made:

W Martin Mill Pike at Tipton Station Road
After the completion of the Tipton Station Road Subdivision the traffic conditions for the two-way stop-controlled intersection of W Martin Mill Pike at Tipton Station Road operates as follows: the northbound approach (W Martin Mill Pike) operate at a LOS A during both the AM and PM peak hours and the eastbound approach (Tipton Station Road) operates at a LOS C during both the AM and PM peak hours.

A northbound left turn lane is warranted during the AM peak hour per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

Maryville Pike (SR 33) at Tipton Station Road
After the completion of the Tipton Station Road Subdivision the overall traffic conditions for the two-way stop-controlled intersection of Maryville Pike (SR 33) at Tipton Station Road will operate as follows: the westbound approach (Tipton Station Road) will operate at a LOS F during the PM peak hour; however, the overall intersection delay will continue to operate at an acceptable LOS.

A southbound left turn lane is warranted during the existing, background and full buildout conditions. The warrant for a southbound left turn lane is an existing condition and not a result of the Tipton Station Subdivision.

Tipton Station Road at Roadway Connection
After the completion of the full buildout of the Tipton Station Subdivision the intersection of Tipton Station Road at Subdivision Roadway will operate as follows. The northbound approach (Subdivision Roadway) will operate at a LOS B during both

the AM and PM peak hours and the westbound approach (Tipton Station Road) will operate at a LOS A during both the AM and PM peak hours.

Recommendations

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

- Recommended mitigation at W Martin Mill Pike at Tipton Station Road
  - Install a northbound left turn lane with a minimum storage length of 50 feet.
- Recommended mitigation at Maryville Pike (SR 33) at Tipton Station Road
  - There are no recommended improvements as a result of the Tipton Station Subdivision.
- Recommended mitigation at Tipton Station Road at Subdivision Connection
  - Install a boulevard entrance between Tipton Station Road and the first internal intersection.
- Ardurra recommends that the intersection sight distance be certified by a land surveyor prior to construction in order to verify that Tipton Station Road has adequate intersection sight distance at the proposed subdivision roadway connection.
- Ardurra recommends that the signs and pavement markings be installed in accordance with the standards provided in the *Manual on Uniform Traffic Control Devices* (MUTCD).
- Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by Knox County Engineering and Public Works.

1 Introduction

1.1 Project Description

This report provides a summary of a transportation impact analysis that was performed for the Tipton Station Subdivision residential development. The Tipton Station Subdivision proposes 343 single-family residential lots. The project is located east of the two-way stop-controlled intersection of W Martin Mill Pike at Tipton Station Road in Knox County, Tennessee. The location of the site is shown in Figure 1.

Construction is proposed to take place this year and this study assumes full build out for the subdivision and the future development area will occur in 2027.

The Tipton Station Subdivision has a proposed single roadway connection to Tipton Station Road with a boulevard entrance.

The standard practice for a residential development with 150 or more lots/units is to require at least two access points to provide alternative access opportunities in the event that one access is blocked by a fallen tree, crash, or other. For the Tipton Station Subdivision the roadway connection proposes a boulevard entrance with a single lane for entering and exiting traffic. The boulevard entrance extends from Tipton Station Road to the first internal intersection in order to provide an alternate access.

The proposed site layout is shown in Figure 2.

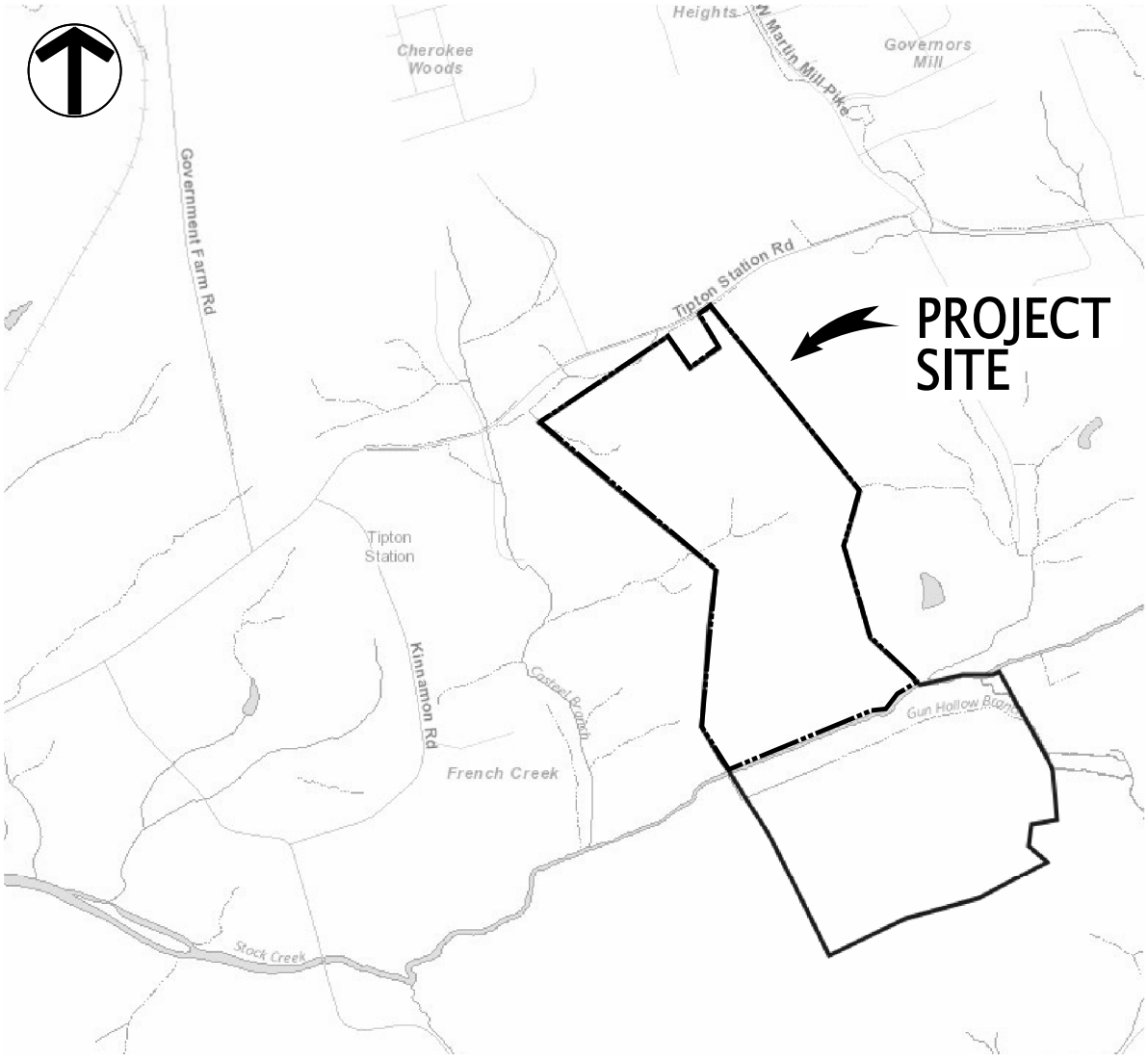


Figure 1: Location Map

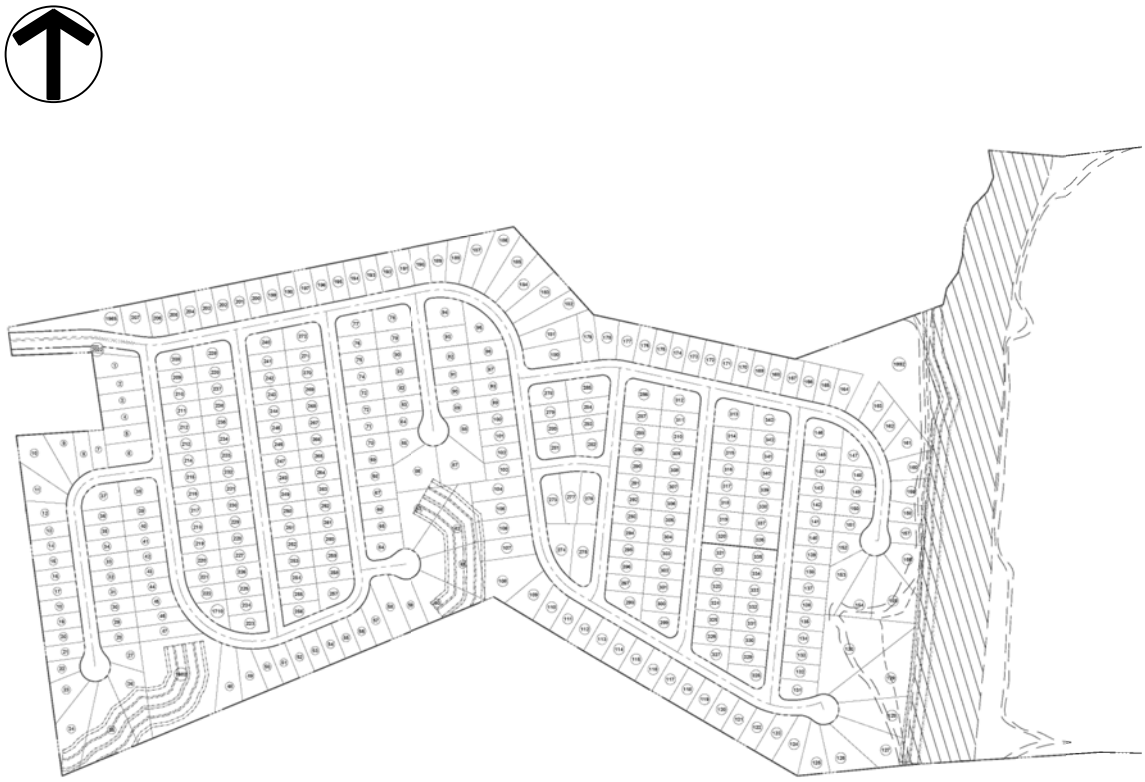


Figure 2: Site Plan

1.2 Study Area

The purpose of this study is to evaluate the impacts to the traffic conditions caused by the proposed development. Maryville Pike (SR 33) and Martin Mill Pike are considered north-south orientated roadways and Tipton Station Road is considered an east-west oriented roadway. The existing intersections and existing traffic control are summarized in Table 1.2-1 Study Area.

Table 1.2-1
Tipton Station Subdivision
Study Area

Intersection	Existing Traffic Control
Maryville Pike (SR 33) at Tipton Station Road	TWSC
W Martin Mill Pike at Tipton Station Road	TWSC

1.3 Existing Site Conditions

Roadway geometry and posted speed limits were obtained by field observations. The Knoxville-Knox County Planning "2018 Major Road Plan" was used to determine road classification. This information is summarized in Table 1.3-1 Existing Site Conditions.

Table 1.3-1
Tipton Station Subdivision
Existing Site Conditions

Roadway	Speed Limit	Lanes	Road Width	Major Road Plan	
Maryville Pike (SR 33)	45 mph	2	~22 feet	Minor Arterial	88′ ROW
W Martin Mill Pike	40 mph	2	~20 feet	Minor Arterial	60′ ROW
Tipton Station Road	40 mph	2	~19.5 feet	Major Collector	60′ ROW
S Lake Blvd	25 mph	2	~26 feet	Local Street	

The intersection of Maryville Pike (SR 33) at Tipton Station Road / S Lake Blvd is a two-way stop-controlled intersection. S Lake Boulevard is the roadway connection to a residential subdivision with a boulevard entrance between Maryville Pike and S Creek Road. Tipton Station Road has a skewed intersection angle of approximately 60 degrees.

Tipton Station Road is classified as Major Collector per the Major Road Plan. The minimum intersection spacing required on a collector road is 300 feet per the "Knoxville-Knox County Subdivision Regulations" amended through October 6, 2022. Goddard Road is located approximately 70 feet west of W Martin Mill Pike; therefore, the minimum separation on a collector is not met between the Goddard Road and W Martin Mill Pike.

There are no sidewalks or bike infrastructure in the vicinity of the proposed development.

An aerial photo of the intersection of Maryville Pike (SR 33) at Tipton Station Road / S Lake Boulevard and W Martin Mill Pike at Tipton Station Road are included in Attachment 1.

2 Existing Traffic Volumes

Ardurra conducted a turning movement count at the two-way stop-controlled intersection of Tipton Station Road at W Martin Mill Pike on Thursday May 16, 2024. The AM peak hour occurred between 7:15 a.m. and 8:15 a.m. with an AM PHF of 0.87 and an AM peak hour volume of 612 vph. The PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a PM PHF of 0.98 and a PM peak hour volume of 610 vph.

Ardurra conducted a turning movement count at the two-way stop-controlled intersection of Maryville Pike (SR 33) at Tipton Station Road / S Lake Boulevard on Thursday May 16, 2024. The AM peak hour occurred between 7:30 a.m. and 8:30 a.m. with an AM PHF of 0.89 and an AM peak hour volume of 763 vph. The PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a PM PHF of 0.88 and a PM peak hour volume of 1,029 vph.

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 2.

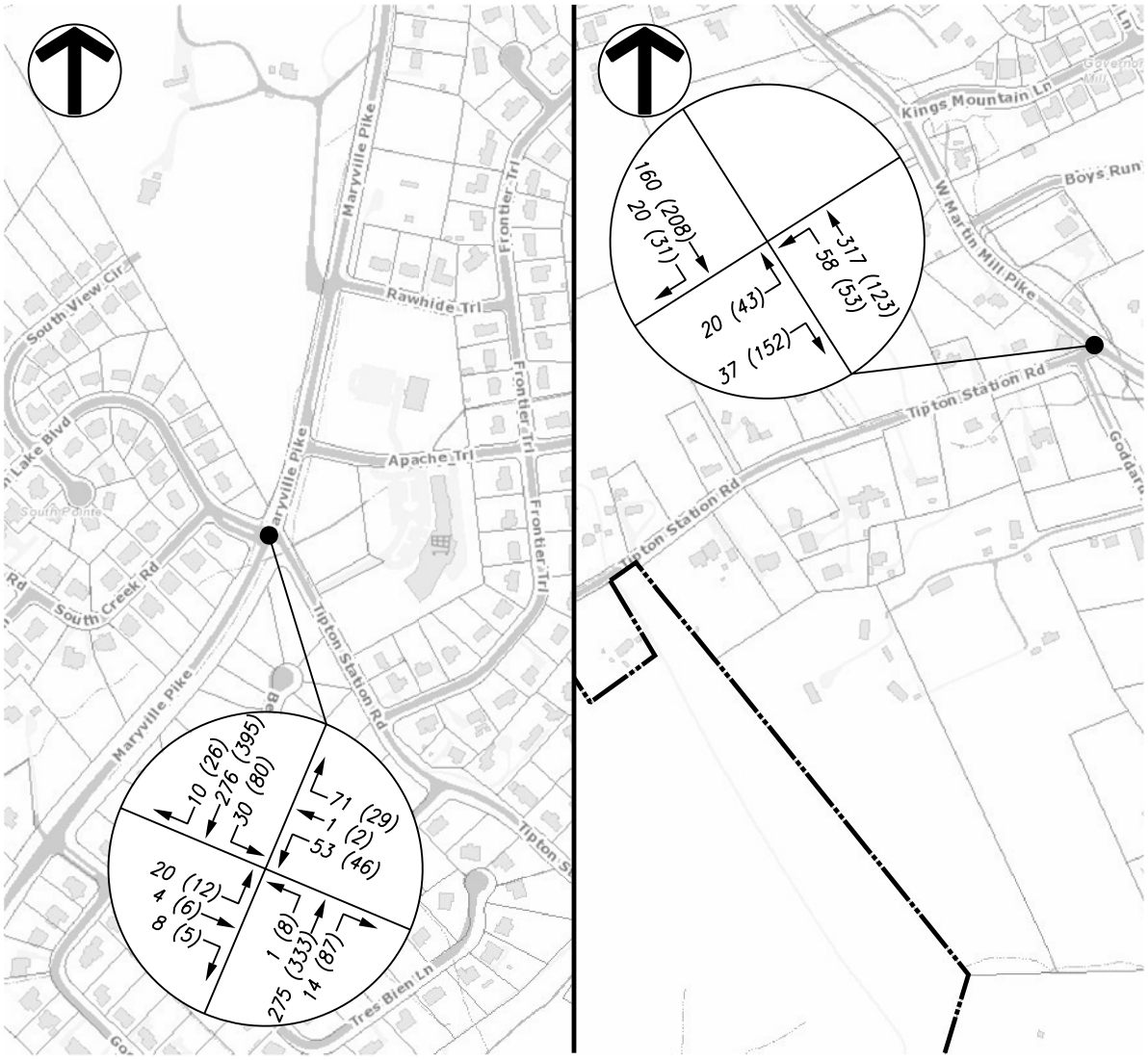


Figure 3: 2024 Existing Peak Hour Traffic

3 Background Growth

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

TDOT count station ID 47000516 is located on Tipton Station Road east of Maryville Pike (SR 33) in Knoxville, TN. This count location was established in 2015 so the annual growth rate over the last eight years is approximately 0.30%. The 2023 ADT was 3,075 vehicles per day.

TDOT count station ID 47000117 is located on Maryville Pike (SR 33) near the Blount County Line and south of the intersection with Tipton Station Road. The annual growth rate for this station over the last ten years is approximately 0.95%. The 2023 ADT was 6,368 vehicles per day.

TDOT count station ID 47000496 is located on Martin Mill Pike south of W Governor John Sevier Highway (SR 168) and north of the intersection with Tipton Station Road. This count location was established in 2010 so the annual growth rate for this station over the last twelve years is approximately 0.52%. The 2022 ADT was 4,240 vehicles per day.

For the purpose of this study, an annual growth rate of 1.0% was assumed for traffic at the studied intersections until full occupancy is reached in 2027. Attachment 3 shows the trend line growth charts for the TDOT count stations.

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

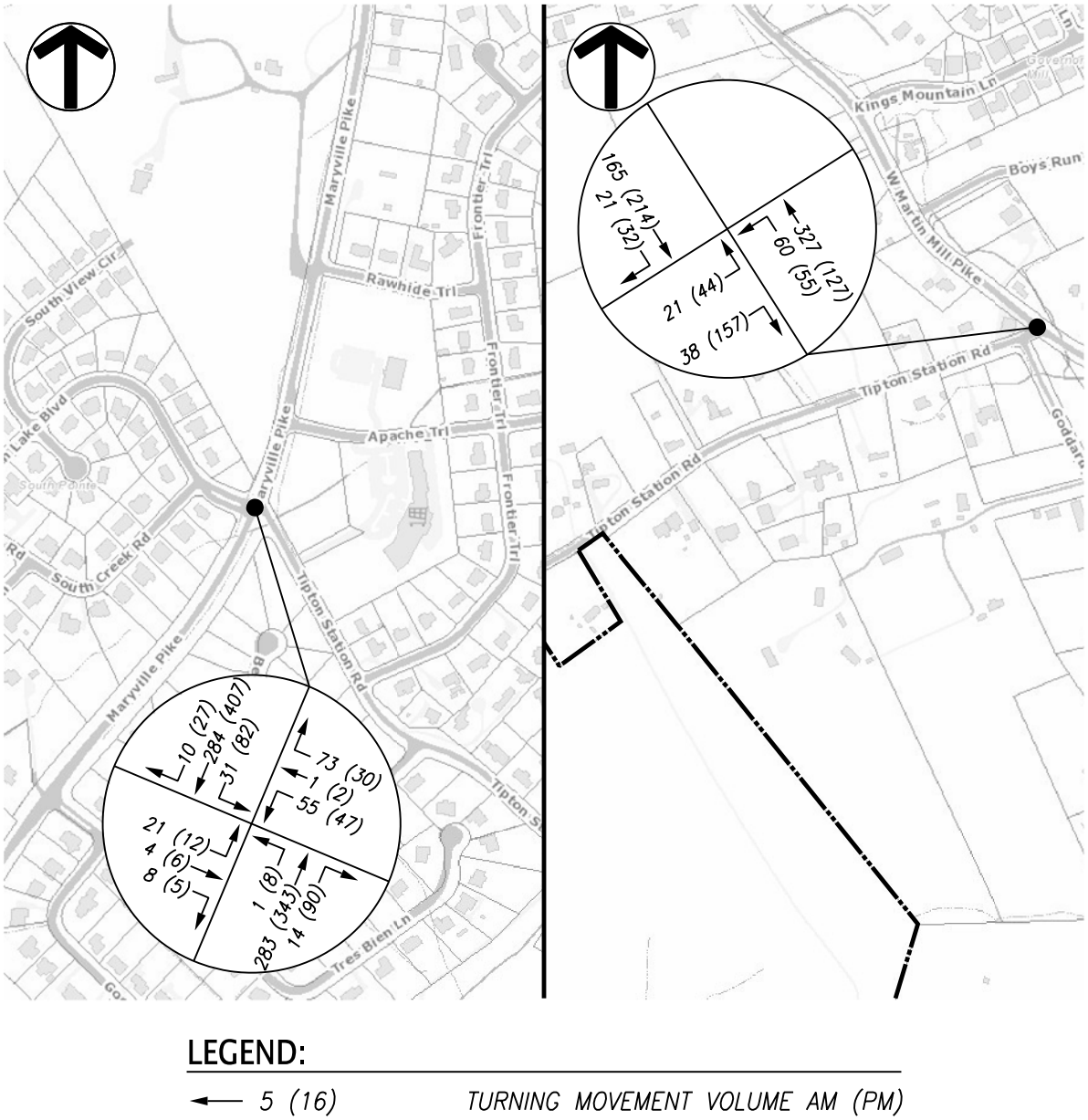


Figure 4: 2027 Background Peak Hour Traffic

4 Trip Generation and Trip Distribution

The Tipton Station Subdivision proposes 343 single-family residential lots. Single-Family Detached Housing or Land Use 210 was used to calculate site trips for the development using the fitted curve equations from the Trip Generation, 11th Edition, published by the Institute of Transportation Engineers.

The land use worksheets are included in Attachment 4. A trip generation summary is shown in Table 4-1.

Table 4-1
Tipton Station Subdivision
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Single Family Detached Housing (LUC	343 Lots	3,136	57	172	200	117

The total combined new trips generated by the Tipton Station Subdivision were estimated to be 3,136 daily trips. The estimated trips are 229 trips during the AM peak hour and 317 trips during the PM peak hour.

Tipton Station Road at the proposed roadway connection has an existing trip distribution of 40% eastbound and 60% westbound during the AM peak hour and 70% eastbound and 30% westbound during the PM peak hour.

The directional distribution of the traffic generated by the Tipton Station Subdivision was determined using the existing traffic volumes in combination with the site plan layout. The entering/exiting traffic was assumed to be 60% eastbound Tipton Station Road to/from W Martin Mill Pike, 30% westbound Tipton Station Road to/from Maryville Pike (SR 33) and 10% westbound Tipton Station Road via Government Farm Road.

Figures 5 and 6 show the subdivision peak hour trip distribution and site trips. Figure 7 shows the 2027 full buildout peak hour traffic including the background growth and the peak hour site trips from both the future development area and the Tipton Station Road Subdivision.

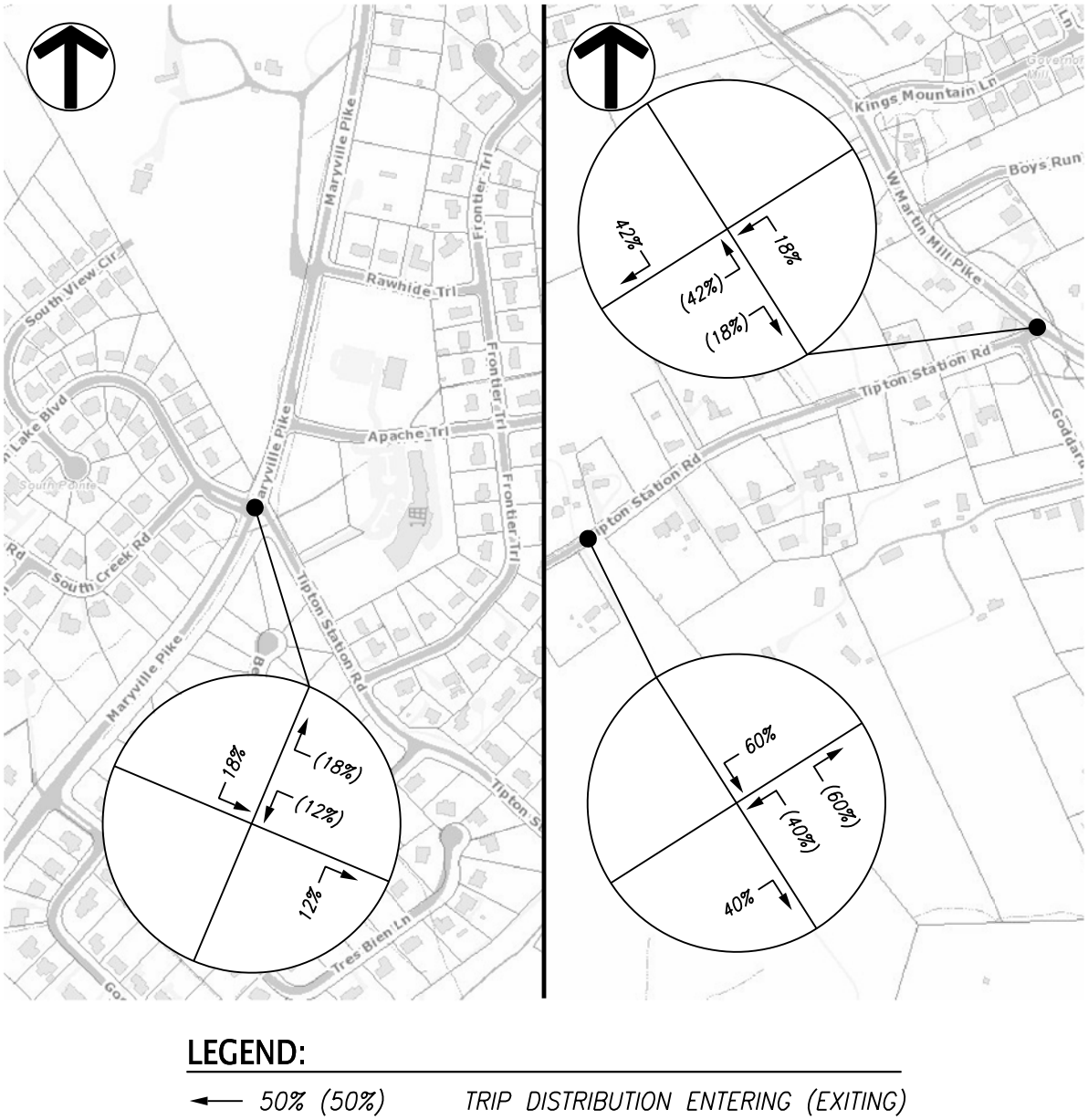


Figure 5: Subdivision Peak Hour Trip Distribution

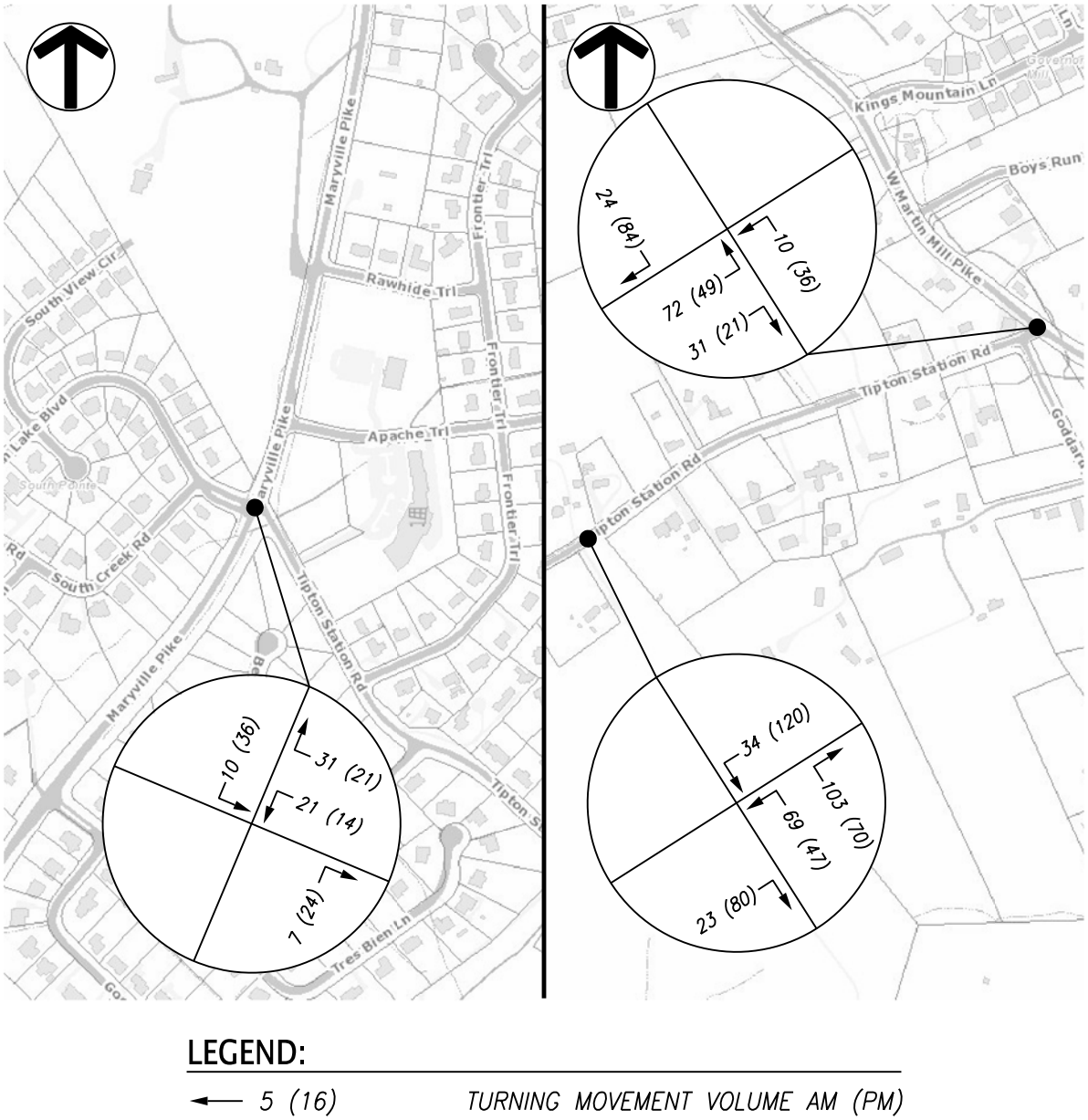


Figure 6: Subdivision Peak Hour Site Trips

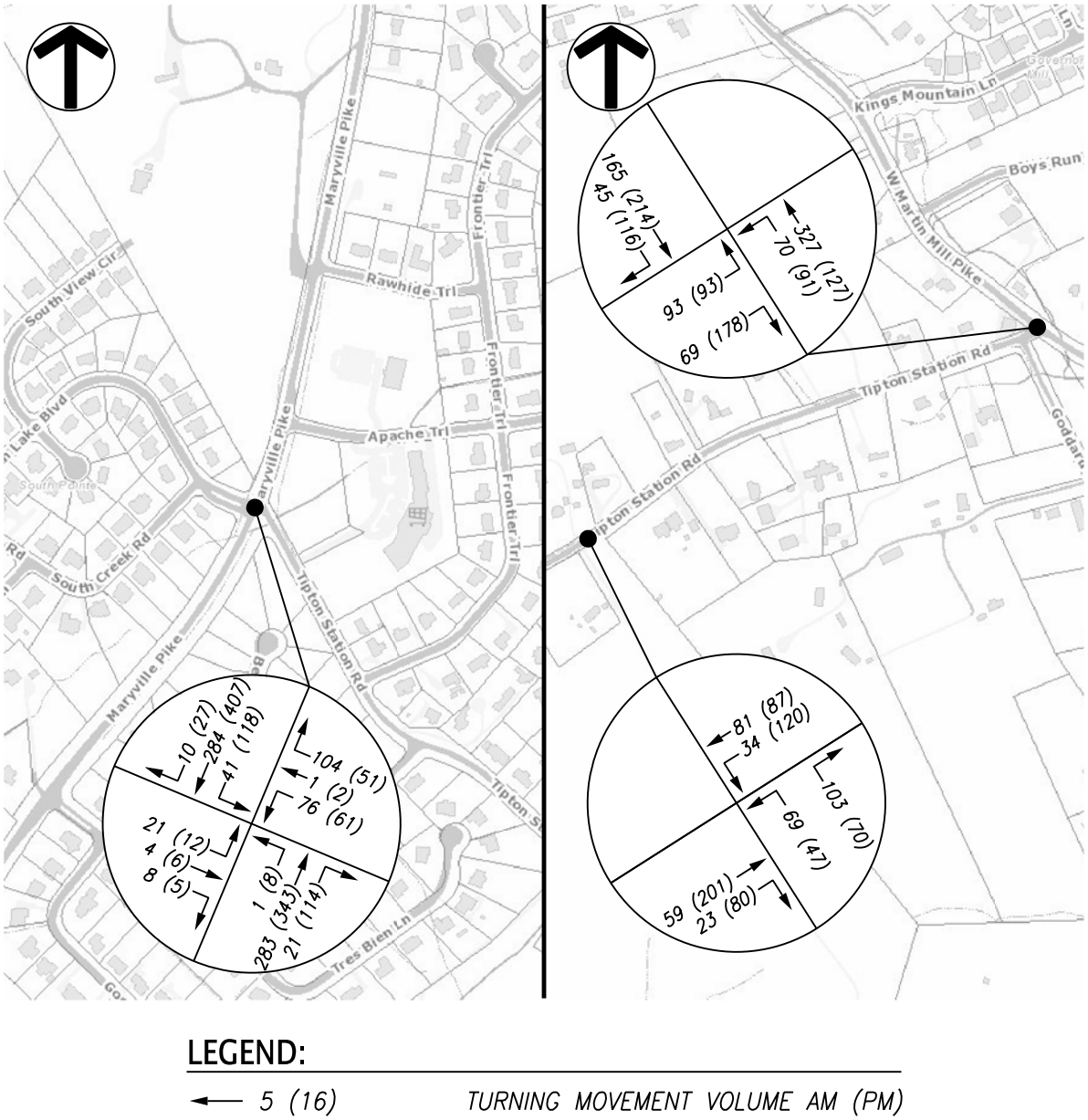


Figure 7: 2027 Full Buildout Peak Hour Traffic

5 Projected Capacity and Level of Service

Intersection capacity analyses were performed using the Synchro 11 at the two-way stop-controlled intersections in order to evaluate the AM and PM peak hours for existing, background and full buildout conditions.

Level of Service

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. Table 5-1 shows the LOS index range for signalized and unsignalized intersections as defined by the Highway Capacity Manual (HCM).

Table 5-1
Level of Service (LOS) Index

Level of Service	Signalized Intersection	Unsignalized Intersection
LOS A	≤ 10 sec	≤ 10 sec
LOS B	10 – 20 sec	10 – 15 sec
LOS C	20 – 35 sec	15 – 25 sec
LOS D	35 – 55 sec	25 – 35 sec
LOS E	55 – 80 sec	35 – 50 sec
LOS F	> 80 sec	> 50 sec

The Synchro 11 worksheets are included in Attachments 5, 6, and 7. Table 5-2 shows the results of the capacity analyses.

Table 5-2
Level of Service (LOS) Summary

Intersection	Time Period	Year 2024 Existing (Delay/LOS)	Year 2027 Background (Delay/LOS)	Year 2027 Full Buildout (Delay/LOS)
W Martin Mill Pike @ Tipton Station Road	**AM Peak**			
	EB Approach	11.8 / B	12.0 / B	17.9 / C
	NW Approach	7.8 / A	7.8 / A	7.9 / A
	PM Peak			
	EB Approach	11.8 / B	12.0 / B	16.0 / C
	NW Approach	7.8 / A	7.9 / A	8.2 / A
Maryville Pike (SR 33) @ Tipton Station Road	**AM Peak**			
	NB Approach	7.9 / A	7.9 / A	7.9 / A
	EB Approach	16.6 / C	17.2 / C	18.8 / C
	WB Approach	15.6 / C	16.1 / C	19.2 / C
	SB Approach	8.0 / A	8.0 / A	8.1 / A
	PM Peak			
	NB Approach	8.4 / A	8.4 / A	8.4 / A
	EB Approach	26.3 / D	27.8 / D	35.0 / E
	WB Approach	30.1 / D	32.4 / D	53.3 / F
	SB Approach	8.6 / A	8.7 / A	8.9 / A
Tipton Station Road @ Driveway	**AM Peak**			
	NB Approach			10.3 / B
	WB Approach			7.5 / A
	PM Peak			
	NB Approach			13.2 / B
	WB Approach			8.2 / A

Notes:
1.Whole intersection weighted average control delay expressed in second per vehicle for signalized intersections and all-way stop controlled intersections.

6 Turn Lane Warrant Analysis

Knox County Turn Lane Warrants

The intersection of W Martin Mill Pike at Tipton Station Road and Tipton Station Road at the proposed subdivision roadway connection were 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.

At the intersection of Tipton Station Road at the proposed roadway connection to the subdivision neither an eastbound right turn lane nor a westbound left turn lane are warranted during the AM or PM peak hours after the completion of the Tipton Station Subdivision.

At the intersection of Tipton Station Road at W Martin Mill Pike a southbound right turn lane is not warranted during either the AM or PM peak hours and a northbound left turn lane is warranted during the AM peak hour after the completion of the Tipton Station Subdivision.

TDOT Turn Lane Warrants

The intersection of Maryville Pike (SR 33) at Tipton Station Road was evaluated to determine if a northbound right turn lane and southbound left turn lane on Maryville Pike (SR 33) are warranted. The TDOT Highway System Access Manual (HSAM) Volume 3: Geometric Design Criteria dated April 2021 was used to analyze the information. TDOT recommends that a turn lane be installed at an intersection when the turn lane warrants are met during both the AM and PM peak hours.

In order to evaluate a right turn lane warrant, the Major-Road Volume, (one direction), veh/h and Right-Turn Volume, veh/h were reference from Figure 7: 2027 Full Buildout Peak Hour Traffic. Per Figure 3-18: Right-Turn Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control) the full buildout conditions at the intersection of Maryville Pike (SR 33) at Tipton Station Road will only warrant a right turn lane during the PM peak hour; therefore, a northbound right turn lane on Maryville Pike (SR 33) is not recommended.

In order to evaluate a left turn lane warrant, the Major Highway Volume (veh/h/ln) and the Left-Turn Volume (veh/h) were referenced from Figure 7: 2027 Full Buildout Peak Hour Traffic. Per Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized) the full buildout conditions at the intersection of Maryville Pike (SR 33) at Tipton Station Road will warrant a southbound left turn lane during both the AM and PM peak hours.

A southbound left turn lane is warranted during the existing, background and full buildout conditions. Per the TDOT HSAM "The volume-based warrants indicate situations where a left-turn would help mitigate traffic conflicts, not necessarily situations where a left-turn lane is required or must be constructed."

Per the TDOT HSAM Table 3-11: Lane Change and Deceleration Distance the recommended lane change and deceleration distance for a roadway with a speed limit of 45 mph is 340 feet and the minimum queue storage length for a turn lane is 50 feet. Therefore, the total recommended turn lane length is 390 feet.

The turn lane worksheets and TDOT Highway System Access Manual Figures are included in Attachment 8.

7 Conclusions and Recommendations

7.1 W Martin Mill Pike at Tipton Station Road

The existing, background and full buildout conditions at the two-way stop-controlled intersection of W Martin Mill Pike at Tipton Station Road were analyzed using the Synchro 11 software. The existing intersection is a three-legged stop-controlled intersection.

The existing and background traffic conditions for the two-way stop-controlled intersection of W Martin Mill Pike at Tipton Station Road operates as follows: the northbound approach (W Martin Mill Pike) operate at a LOS A during both the AM and PM peak hours and the eastbound approach (Tipton Station Road) operates at a LOS B during both the AM and PM peak hours.

After the completion of the Tipton Station Road Subdivision the traffic conditions for the two-way stop-controlled intersection of W Martin Mill Pike at Tipton Station Road operates as follows: the northbound approach (W Martin Mill Pike) operate at a LOS A during both the AM and PM peak hours and the eastbound approach (Tipton Station Road) operates at a LOS C during both the AM and PM peak hours.

A northbound left turn lane is warranted during the AM peak hour and a southbound right turn lane is not warranted at the intersection of W Martin Mill Pike at Tipton Station Road per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

The northbound left turn lane has a recommended minimum storage length of 50 feet per the AASHTO Greenbook "A Policy on Geometric Design of Highways and Streets."

Ardurra recommends that any future intersection improvements be reviewed, coordinated and approved by Knox County Engineering and Public Works.

7.2 Maryville Pike (SR 33) at Tipton Station Road

The existing, background and full buildout conditions at the two-way stop-controlled intersection of Maryville Pike (SR 33) at Tipton Station Road were analyzed using the Synchro 11 software. The existing intersection is a four-legged stop-controlled intersection.

The existing and background traffic conditions for the two-way stop-controlled intersection of Maryville Pike (SR 33) at Tipton Station Road operates as follows: the northbound and southbound approaches (Maryville Pike) operate at a LOS A during both the AM and PM peak hours and the eastbound approach (S Lake Boulevard) operates at a LOS C during the AM peak hour and LOS D during the PM peak hour and the westbound approach (Tipton Station Road) operates at a LOS C during the AM peak hour and a LOS D during the PM peak hour.

After the completion of the Tipton Station Road Subdivision the traffic conditions for the two-way stop-controlled intersection of Maryville Pike (SR 33) at Tipton Station Road operates as follows: the northbound and southbound approaches (Maryville Pike) operate at a LOS A during both the AM and PM peak hours and the eastbound approach (S Lake Boulevard) operates at a LOS C during the AM peak hour and LOS E during the PM peak hour and the westbound approach (Tipton Station Road) operates at a LOS C during the AM peak hour and a LOS F during the PM peak hour.

The westbound approach (Tipton Station Road) will operate at a LOS F during the PM peak hour after the completion of the Tipton Station Road Subdivision; however, the overall intersection delay will continue to operate at an acceptable LOS.

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 westbound approach (Tipton Station Road) has an existing storage length of 200 feet before the queue from the intersection would block the driveway to the retail strip center. The unsignalized intersection capacity analysis shows the full buildout 95% queue length for the westbound approach (Tipton Station Road) of approximately 2.3 vehicles (58 feet) during the AM peak hour and 4 vehicles (100 feet) during the PM peak hour; therefore, the queue is not expected to block the nearest driveway intersection.

A southbound left turn lane is warranted during the existing, background and full buildout conditions. The warrant for a southbound left turn lane is an existing condition and not a result of the Tipton Station Subdivision.

Per the TDOT Highway System Access Manual (HSAM) Volume 3: Geometric Design Criteria dated April 2021. "The volume-based warrants indicate situations where a left-turn would help mitigate traffic conflicts, not necessarily situations where a left-turn lane is required or must be constructed."

Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by both Tennessee Department of Transportation and Knox County Engineering and Public Works.

7.3 Tipton Station Road at Roadway Connection

The proposed full buildout conditions at the two-way stop-controlled intersection of Tipton Station Road at the Subdivision Roadway were analyzed using the Synchro 11 Software.

After the completion of the full buildout of the Tipton Station Subdivision the intersection of Tipton Station Road at Subdivision Roadway will operate as follows. The northbound approach (Subdivision Roadway) will operate at a LOS B during both the AM and PM peak hours and the westbound approach (Tipton Station Road) will operate at a LOS A during both the AM and PM peak hours.

The standard practice for a residential development with 150 or more lots/units is to require at least two access points to provide alternative access opportunities in the event that one access is blocked by a fallen tree, crash, or other. For the Tipton Station Subdivision the roadway connection proposes a boulevard entrance with a single lane for entering and exiting traffic. The boulevard entrance extends from Tipton Station Road to the first internal intersection in order to provide an alternate access.

Neither an eastbound right turn lane nor a westbound left turn lane is warranted at the intersection of Tipton Station Road at Subdivision Roadway per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

Tipton Station Road is classified as Major Collector per the Major Road Plan. The minimum intersection spacing required on a collector road is 300 feet per the "Knoxville-Knox County Subdivision Regulations" amended through October 6, 2022. The Subdivision Roadway is located approximately 890 feet east of Galyon

Lane and 1,635 feet west of Goddard Road; therefore, the minimum separation on a collector is met and no change is necessary.

The minimum required sight distance for a road with a posted speed limit of 40 mph is 400 feet in each direction in accordance with the "Knoxville-Knox County Subdivision Regulations" amended through October 6, 2022.

At 15 feet from the edge of pavement the intersection sight distance is approximately 800 feet looking left (westbound) and 625 feet looking right (eastbound). Attachment 9 includes pictures of the intersection sight distance at the intersection of Tipton Station Road at Subdivision Roadway.

Ardurra recommends that the intersection sight distance be certified by a land surveyor prior to construction in order to verify that Tipton Station Road has adequate intersection sight distance at the proposed subdivision roadway connection to comply with Knox County Engineering and Public Works guidelines.

Ardurra recommends that the signs and pavement markings be installed in accordance with the standards provided in the *Manual on Uniform Traffic Control Devices* (MUTCD).

Any future improvements to the intersection or the various traffic management infrastructure, would need to be reviewed, coordinated, and approved by Knox County Engineering and Public Works.

Attachment 1
Aerial Photos

W Martin Mill Pike at Tipton Station Road – TWSC

Maryville Pike (SR 33) at Tipton Station Road – TWSC

Attachment 2
Traffic Counts

Project: 787.001 Tipton Station Subdivision
Intersection: Tipton Station Road at W Martin Mill Pike
Date Conducted: Thursday May 16, 2024

	W Martin Mill Pike Southbound					Westbound			Tipton Station Road Northbound				Tipton Station Road Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
7:00 AM	0	26	6	32	0	0	0	0	8	48	0	56	6	0	4	10	98
7:15 AM	0	35	4	39	0	0	0	0	15	82	0	97	3	0	13	16	152
7:30 AM	0	39	6	45	0	0	0	0	23	93	0	116	6	0	8	14	175
7:45 AM	0	29	5	34	0	0	0	0	13	93	0	106	5	0	10	15	155
Total	0	129	21	150	0	0	0	0	59	316	0	375	20	0	35	55	580
8:00 AM	0	57	5	62	0	0	0	0	7	49	0	56	6	0	6	12	130
8:15 AM	0	37	2	39	0	0	0	0	14	53	0	67	5	0	12	17	123
8:30 AM	0	17	5	22	0	0	0	0	6	40	0	46	7	0	4	11	79
8:45 AM	0	19	5	24	0	0	0	0	3	23	0	26	6	0	3	9	59
Total	0	130	17	147	0	0	0	0	30	165	0	195	24	0	25	49	391
9:00 AM	0	14	3	17	0	0	0	0	4	31	0	35	2	0	3	5	57
9:15 AM	0	16	2	18	0	0	0	0	1	19	0	20	3	0	1	4	42
9:30 AM	0	17	4	21	0	0	0	0	4	27	0	31	4	0	5	9	61
9:45 AM	0	18	4	22	0	0	0	0	7	25	0	32	8	0	5	13	67
Total	0	65	13	78	0	0	0	0	16	102	0	118	17	0	14	31	227
10:00 AM	0	14	8	22	0	0	0	0	3	15	0	18	2	0	2	4	44
10:15 AM	0	16	6	22	0	0	0	0	7	32	0	39	8	0	12	20	81
10:30 AM	0	14	3	17	0	0	0	0	4	27	0	31	5	0	5	10	58
10:45 AM	0	10	5	15	0	0	0	0	3	28	0	31	2	0	3	5	51
Total	0	54	22	76	0	0	0	0	17	102	0	119	17	0	22	39	234
11:00 AM	0	20	5	25	0	0	0	0	5	16	0	21	7	0	7	14	60
11:15 AM	0	16	5	21	0	0	0	0	3	21	0	24	6	0	3	9	54
11:30 AM	0	15	6	21	0	0	0	0	6	20	0	26	7	0	8	15	62
11:45 AM	0	15	2	17	0	0	0	0	4	21	0	25	4	0	8	12	54
Total	0	66	18	84	0	0	0	0	18	78	0	96	24	0	26	50	230
12:00 PM	0	16	8	24	0	0	0	0	5	28	0	33	4	0	6	10	67
12:15 PM	0	20	7	27	0	0	0	0	3	17	0	20	10	0	6	16	63
12:30 PM	0	27	6	33	0	0	0	0	5	26	0	31	2	0	10	12	76
12:45 PM	0	17	3	20	0	0	0	0	3	27	0	30	5	0	6	11	61
Total	0	80	24	104	0	0	0	0	16	98	0	114	21	0	28	49	267
1:00 PM	0	17	4	21	0	0	0	0	3	16	0	19	3	0	7	10	50
1:15 PM	0	27	2	29	0	0	0	0	6	18	0	24	1	0	5	6	59
1:30 PM	0	22	5	27	0	0	0	0	9	23	0	32	6	0	11	17	76
1:45 PM	0	27	4	31	0	0	0	0	4	17	0	21	8	0	7	15	67
Total	0	93	15	108	0	0	0	0	22	74	0	96	18	0	30	48	252
2:00 PM	0	18	6	24	0	0	0	0	2	29	0	31	3	0	10	13	68
2:15 PM	0	23	6	29	0	0	0	0	5	24	0	29	5	0	9	14	72
2:30 PM	0	21	5	26	0	0	0	0	2	15	0	17	7	0	7	14	57
2:45 PM	0	38	6	44	0	0	0	0	15	37	0	52	6	0	13	19	115
Total	0	100	23	123	0	0	0	0	24	105	0	129	21	0	39	60	312
3:00 PM	0	34	4	38	0	0	0	0	9	43	0	52	14	0	13	27	117
3:15 PM	0	38	9	47	0	0	0	0	8	17	0	25	5	0	15	20	92
3:30 PM	0	33	1	34	0	0	0	0	33	77	0	110	11	0	18	29	173
3:45 PM	0	37	11	48	0	0	0	0	7	22	0	29	6	0	11	17	94
Total	0	142	25	167	0	0	0	0	57	159	0	216	36	0	57	93	476
4:00 PM	0	35	9	44	0	0	0	0	10	30	0	40	13	0	22	35	119
4:15 PM	0	44	10	54	0	0	0	0	10	30	0	40	13	0	22	35	129
4:30 PM	0	39	10	49	0	0	0	0	8	25	0	33	8	0	32	40	122
4:45 PM	0	52	11	63	0	0	0	0	10	33	0	43	9	0	28	37	143
Total	0	170	40	210	0	0	0	0	38	118	0	156	43	0	104	147	513
5:00 PM	0	54	8	62	0	0	0	0	11	31	0	42	9	0	40	49	153
5:15 PM	0	50	8	58	0	0	0	0	15	32	0	47	9	0	40	49	154
5:30 PM	0	53	5	58	0	0	0	0	14	36	0	50	10	0	30	40	148
5:45 PM	0	51	10	61	0	0	0	0	13	24	0	37	15	0	42	57	155
Total	0	208	31	239	0	0	0	0	53	123	0	176	43	0	152	195	610
Grand Total	0	1237	249	1486	0	0	0	0	350	1440	0	1790	284	0	532	816	4092
Approach %	0.0	83.2	16.8		#####	#####	#####		19.6	80.4	0.0		34.8	0.0	65.2		
Total %	0.0	30.2	6.1	36.3	0.0	0.0	0.0	0.0	8.6	35.2	0.0	43.7	6.9	0.0	13.0	19.9	

Project: 787.001 Tipton Station Subdivision
Intersection: Tipton Station Road at W Martin Mill Pike
Date Conducted: Thursday May 16, 2024

AM Peak Hour	7:15 AM - 8:15 AM	612
PM Peak Hour	5:00 PM - 6:00 PM	610

	W Martin Mill Pike Southbound				Westbound				Tipton Station Road Northbound				Tipton Station Road Eastbound				
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																	
7:15 AM	0	35	4	39	0	0	0	0	15	82	0	97	3	0	**13**	16	152
7:30 AM	0	39	**6**	45	0	0	0	0	**23**	**93**	0	116	**6**	0	8	14	**175**
7:45 AM	0	29	5	34	0	0	0	0	13	93	0	106	5	0	10	15	155
8:00 AM	0	**57**	5	62	0	0	0	0	7	49	0	56	6	0	6	12	130
Total Volume	0	160	20	180	0	0	0	0	58	317	0	375	20	0	37	57	612
Future (1.0% over 3 yrs)	0	165	21		0	0	0		60	327	0		21	0	38		631
PHF	-	0.70	0.83		-	-	-		0.63	0.85	-		0.83	-	0.71		0.87
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
5:00 PM	0	**54**	8	62	0	0	0	0	11	31	**0**	42	9	0	**40**	49	153
5:15 PM	0	50	8	58	0	0	0	0	**15**	32	0	47	9	0	40	49	154
5:30 PM	0	53	5	58	0	0	0	0	14	**36**	0	50	10	0	30	40	148
5:45 PM	0	51	**10**	61	0	0	0	0	13	24	0	37	**15**	0	42	57	**155**
Total Volume	0	208	31	239	0	0	0	0	53	123	0	176	43	0	152	195	610
Future (1.0% over 3 yrs)	0	214	32		0	0	0		55	127	0		44	0	157		628
PHF	-	0.96	0.78		-	-	-		0.88	0.85	-		0.72	-	0.95		0.98

Project: 787.001 Tipton Station Subdivision
Intersection: Marvyille Pike at Tipton Station Rd/S Lake Blvd
Date Conducted: Thursday May 16, 2024

	Maryville Pike Southbound				Tipton Station Road Westbound				Maryville Pike Northbound				S Lake Boulevard Eastbound				
Start	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Int. Total
7:00 AM	2	57	0	59	16	1	19	36	0	50	2	52	5	2	4	11	158
7:15 AM	7	52	0	59	11	0	10	21	1	78	5	84	10	0	1	11	175
7:30 AM	3	70	2	75	18	0	29	47	0	80	5	85	7	0	1	8	215
7:45 AM	8	77	3	88	20	0	10	30	1	66	4	71	5	0	2	7	196
Total	20	256	5	281	65	1	68	134	2	274	16	292	27	2	8	37	744
8:00 AM	9	65	3	77	10	0	13	23	0	56	3	59	7	3	4	14	173
8:15 AM	10	64	2	76	5	1	19	25	0	73	2	75	1	1	1	3	179
8:30 AM	6	53	0	59	8	1	12	21	0	32	0	32	3	1	0	4	116
8:45 AM	4	53	5	62	2	0	9	11	0	41	1	42	3	1	0	4	119
Total	29	235	10	274	25	2	53	80	0	202	6	208	14	6	5	25	587
9:00 AM	4	37	1	42	5	0	13	18	0	37	3	40	8	1	0	9	109
9:15 AM	5	44	5	54	0	0	6	6	1	34	1	36	2	0	1	3	99
9:30 AM	4	44	4	52	5	2	5	12	1	33	3	37	6	0	2	8	109
9:45 AM	6	35	2	43	5	1	6	12	0	31	3	34	4	1	2	7	96
Total	19	160	12	191	15	3	30	48	2	135	10	147	20	2	5	27	413
10:00 AM	7	47	5	59	9	0	5	14	2	38	2	42	1	0	0	1	116
10:15 AM	11	48	5	64	8	0	8	16	1	38	4	43	2	1	1	4	127
10:30 AM	8	44	5	57	5	0	8	13	1	45	1	47	4	1	1	6	123
10:45 AM	7	40	4	51	2	0	8	10	0	50	9	59	1	0	1	2	122
Total	33	179	19	231	24	0	29	53	4	171	16	191	8	2	3	13	488
11:00 AM	9	34	2	45	3	0	3	6	0	64	6	70	4	1	0	5	126
11:15 AM	8	54	0	62	4	1	7	12	1	49	4	54	2	0	0	2	130
11:30 AM	5	43	5	53	3	0	8	11	0	40	6	46	2	0	0	2	112
11:45 AM	9	57	3	69	1	0	5	6	0	51	5	56	1	0	0	1	132
Total	31	188	10	229	11	1	23	35	1	204	21	226	9	1	0	10	500
12:00 PM	10	68	3	81	5	1	8	14	1	64	8	73	7	1	2	10	178
12:15 PM	9	51	4	64	5	1	8	14	1	52	5	58	2	1	2	5	141
12:30 PM	6	47	2	55	4	1	6	11	0	47	4	51	3	0	1	4	121
12:45 PM	8	54	3	65	4	0	7	11	0	41	6	47	1	0	2	3	126
Total	33	220	12	265	18	3	29	50	2	204	23	229	13	2	7	22	566
1:00 PM	6	54	3	63	6	0	2	8	0	47	5	52	7	0	3	10	133
1:15 PM	10	64	1	75	6	0	4	10	0	50	2	52	2	1	1	4	141
1:30 PM	10	58	0	68	3	0	12	15	2	56	2	60	2	1	1	4	147
1:45 PM	11	51	2	64	7	0	8	15	1	39	5	45	1	0	1	2	126
Total	37	227	6	270	22	0	26	48	3	192	14	209	12	2	6	20	547
2:00 PM	18	48	4	70	5	0	4	9	2	66	6	74	2	0	0	2	155
2:15 PM	10	55	2	67	4	0	8	12	2	59	8	69	2	1	0	3	151
2:30 PM	12	59	2	73	6	0	7	13	0	78	9	87	3	0	1	4	177
2:45 PM	14	63	3	80	6	0	8	14	1	64	13	78	1	0	0	1	173
Total	54	225	11	290	21	0	27	48	5	267	36	308	8	1	1	10	656
3:00 PM	10	54	5	69	7	0	5	12	2	65	9	76	5	0	0	5	162
3:15 PM	8	55	1	64	4	0	8	12	1	62	12	75	1	1	0	2	153
3:30 PM	10	72	5	87	4	4	13	21	0	82	13	95	2	1	0	3	206
3:45 PM	8	84	7	99	9	1	13	23	2	72	14	88	3	2	1	6	216
Total	36	265	18	319	24	5	39	68	5	281	48	334	11	4	1	16	737
4:00 PM	17	60	5	82	10	2	5	17	0	82	16	98	3	2	1	6	203
4:15 PM	19	69	5	93	11	0	6	17	1	63	14	78	7	0	1	8	196
4:30 PM	14	84	3	101	6	1	3	10	3	78	12	93	7	0	5	12	216
4:45 PM	24	86	4	114	7	0	10	17	1	65	24	90	0	0	0	0	221
Total	74	299	17	390	34	3	24	61	5	288	66	359	17	2	7	26	836
5:00 PM	18	94	5	117	10	1	5	16	3	118	29	150	4	3	2	9	292
5:15 PM	25	121	5	151	13	0	9	22	3	89	14	106	0	2	2	4	283
5:30 PM	16	86	11	113	12	1	8	21	1	70	16	87	4	0	1	5	226
5:45 PM	21	94	5	120	11	0	7	18	1	56	28	85	4	1	0	5	228
Total	80	395	26	501	46	2	29	77	8	333	87	428	12	6	5	23	1029
Grand Total	446	2649	146	3241	305	20	377	702	37	2551	343	2931	151	30	48	229	7103
Approach %	13.8	81.7	4.5		43.4	2.8	53.7		1.3	87.0	11.7		65.9	13.1	21.0		
Total %	6.3	37.3	2.1	45.6	4.3	0.3	5.3	9.9	0.5	35.9	4.8	41.3	2.1	0.4	0.7	3.2	

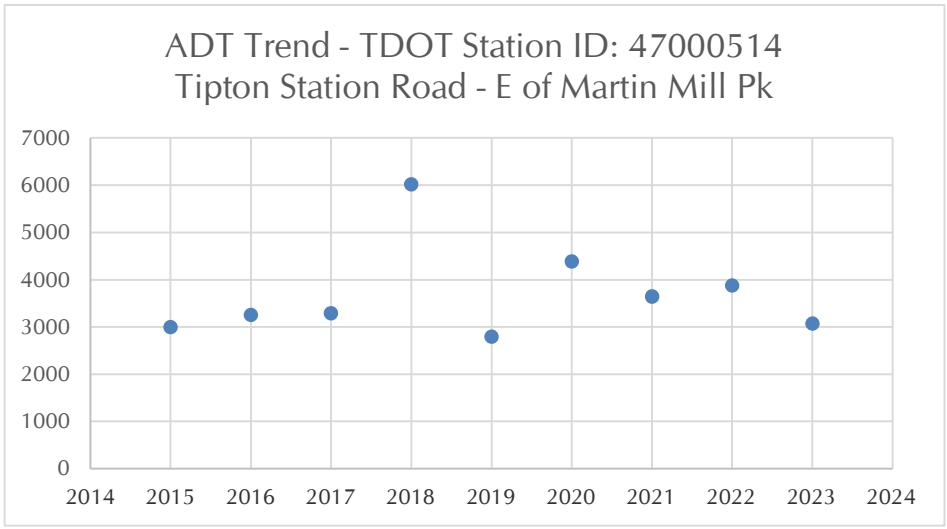
Project: 787.001 Tipton Station Subdivision
Intersection: Marvyille Pike at Tipton Station Rd/S Lake Blvd
Date Conducted: Thursday May 16, 2024

AM Peak Hour	7:30 AM - 8:30 AM	763
PM Peak Hour	5:00 PM - 6:00 PM	1029

	Maryville Pike Southbound				Tipton Station Road Westbound				Maryville Pike Northbound				S Lake Boulevard Eastbound				
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 7:30 AM																	
7:30 AM	3	70	2	75	18	0	**29**	47	0	**80**	**5**	85	**7**	0	1	8	**215**
7:45 AM	8	**77**	**3**	88	**20**	0	10	30	**1**	66	4	71	5	0	2	7	196
8:00 AM	9	65	3	77	10	0	13	23	0	56	3	59	7	**3**	**4**	14	173
8:15 AM	**10**	64	2	76	5	**1**	19	25	0	73	2	75	1	1	1	3	179
Total Volume	30	276	10	316	53	1	71	125	1	275	14	290	20	4	8	32	763
Future (1.0% over 3 yrs)	31	284	10		55	1	73		1	283	14		21	4	8		786
PHF	0.75	0.90	0.83		0.66	0.25	0.61		0.25	0.86	0.70		0.71	0.33	0.50		0.89
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
5:00 PM	18	94	5	117	10	**1**	5	16	**3**	**118**	**29**	150	**4**	**3**	**2**	9	**292**
5:15 PM	**25**	**121**	5	151	**13**	0	**9**	22	3	89	14	106	0	2	2	4	283
5:30 PM	16	86	**11**	113	12	1	8	21	1	70	16	87	4	0	1	5	226
5:45 PM	21	94	5	120	11	0	7	18	1	56	28	85	4	1	0	5	228
Total Volume	80	395	26	501	46	2	29	77	8	333	87	428	12	6	5	23	1029
Future (1.0% over 3 yrs)	82	407	27		47	2	30		8	343	90		12	6	5		1060
PHF	0.80	0.82	0.59		0.88	0.50	0.81		0.67	0.71	0.75		0.75	0.50	0.63		0.88

Attachment 3
ADT Trends

Year	Adjusted Average Daily Traffic
2015	3000
2016	3258
2017	3291
2018	6017
2019	2798
2020	4389
2021	3647
2022	3881
2023	3075

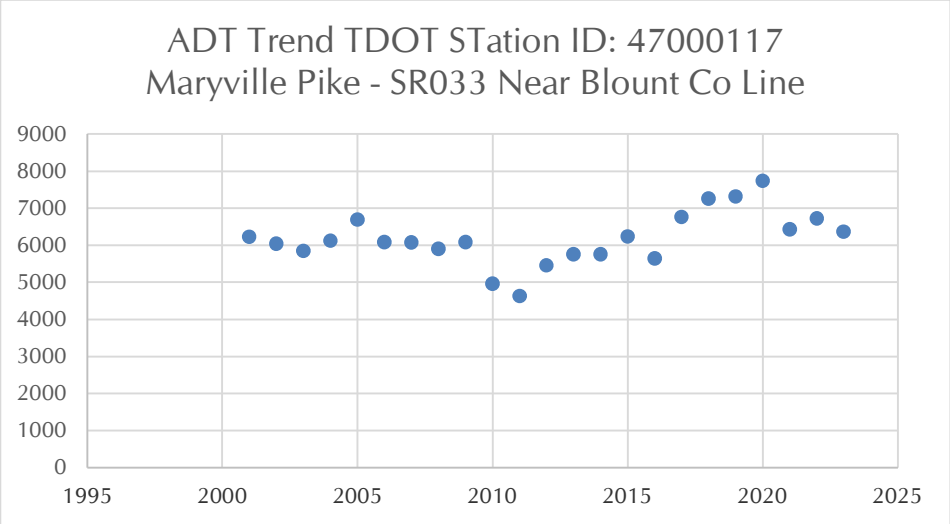


Most Recent Trend Line Growth

Year	ADT
2015	3000
2023	3075

Annual Percent Growth **0.30%**

Year	Adjusted Average Daily Traffic
2001	6227
2002	6040
2003	5850
2004	6120
2005	6689
2006	6081
2007	6074
2008	5906
2009	6083
2010	4964
2011	4626
2012	5459
2013	5760
2014	5754
2015	6238
2016	5645
2017	6763
2018	7262
2019	7314
2020	7736
2021	6431
2022	6723
2023	6368

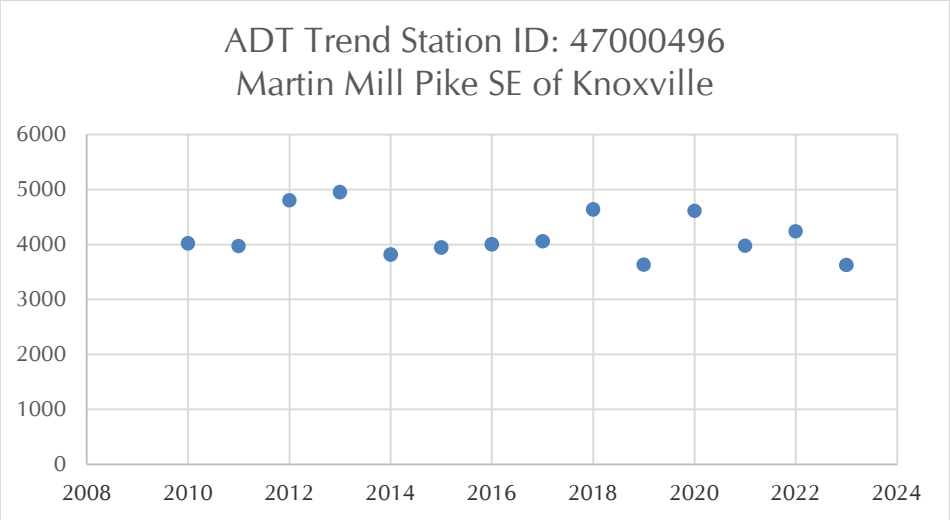


Most Recent Trend Line Growth

Year	ADT
2013	5760
2023	6368

Annual Percent Growth **0.95%**

Year	Adjusted Average Daily Traffic
2010	4018
2011	3970
2012	4806
2013	4950
2014	3816
2015	3942
2016	4003
2017	4059
2018	4637
2019	3631
2020	4614
2021	3976
2022	4240
2023	3625



Most Recent Trend Line Growth

Year	ADT
2010	4018
2022	4240

Annual Percent Growth **0.52%**

Attachment 4
Trip Generation

Project: Tipton Station Subdivision
Date Conducted: 7/9/2024

Single-Family Detached Housing (LUC 210)
343 Lots

Average Daily Traffic
Ln(T) = 0.92 Ln(X) + 2.68
Ln(T) = 0.92 Ln(343) + 2.68
T = 3136

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Ln(T) = 0.91 Ln(X) + 0.12
Ln(T) = 0.91 Ln(343) + 0.12
T = 229

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Ln(T) = 0.94 Ln(X) + 0.27
Ln(T) = 0.94 Ln(343) + 0.27
T = 317

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	3136	50%	50%	1568	1568
AM Peak Hour	229	25%	75%	57	172
PM Peak Hour	317	63%	37%	200	117

Single-Family Detached Housing
(210)

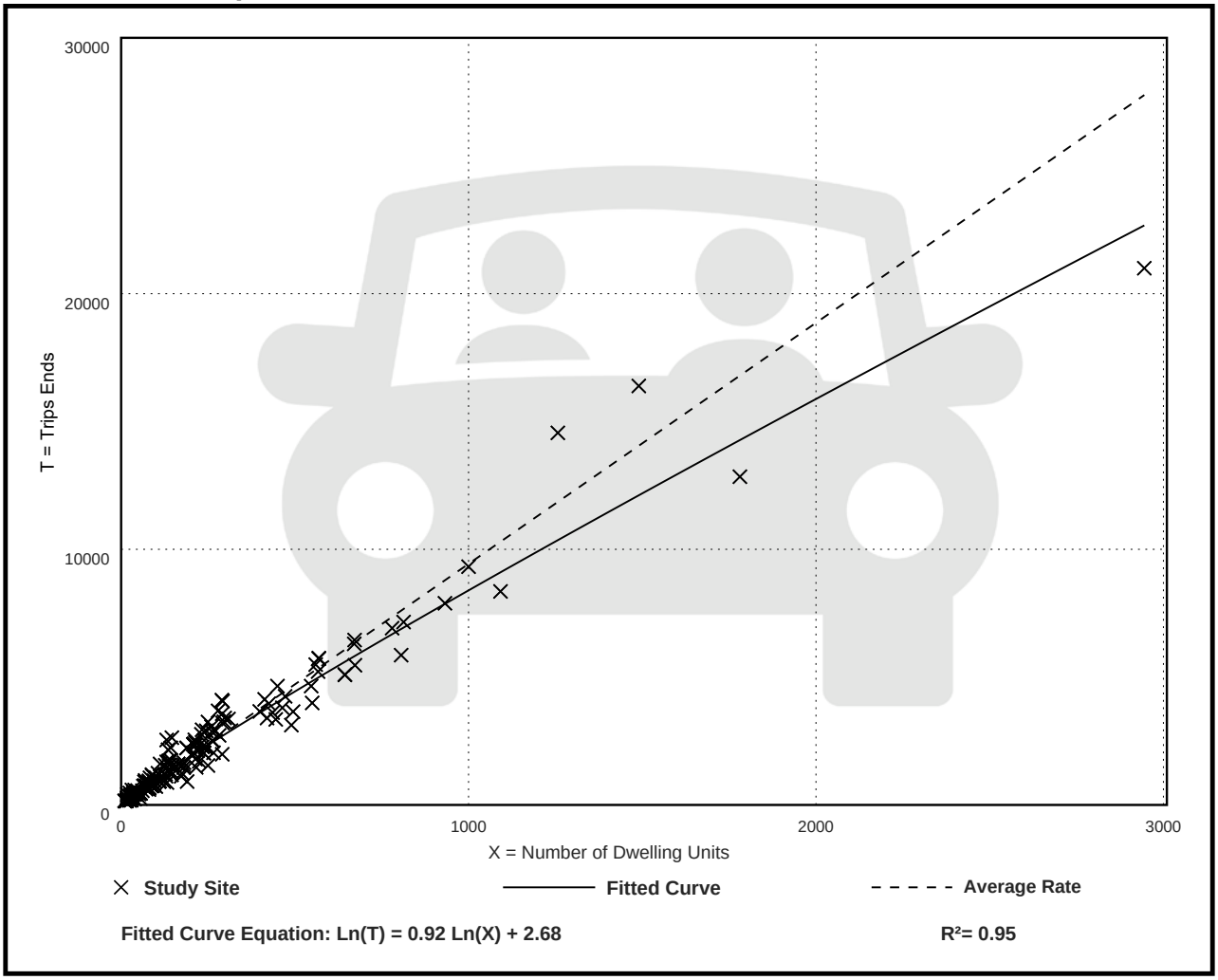
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 174
Avg. Num. of Dwelling Units: 246
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.43	4.45 - 22.61	2.13

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.92 Ln(X) + 2.68

R^2= 0.95

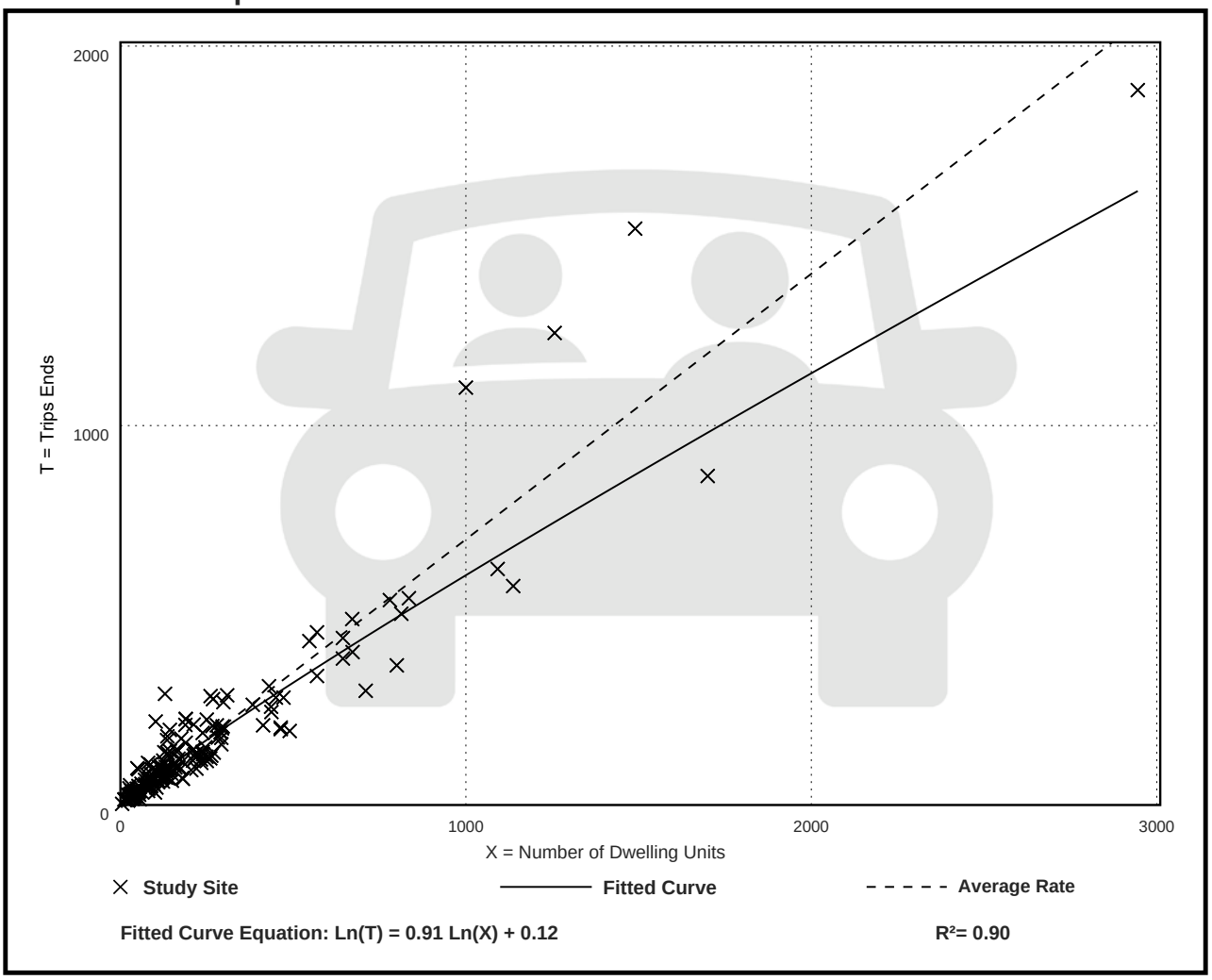
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: Dwelling Units
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: 192
Avg. Num. of Dwelling Units: 226
Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

Data Plot and Equation



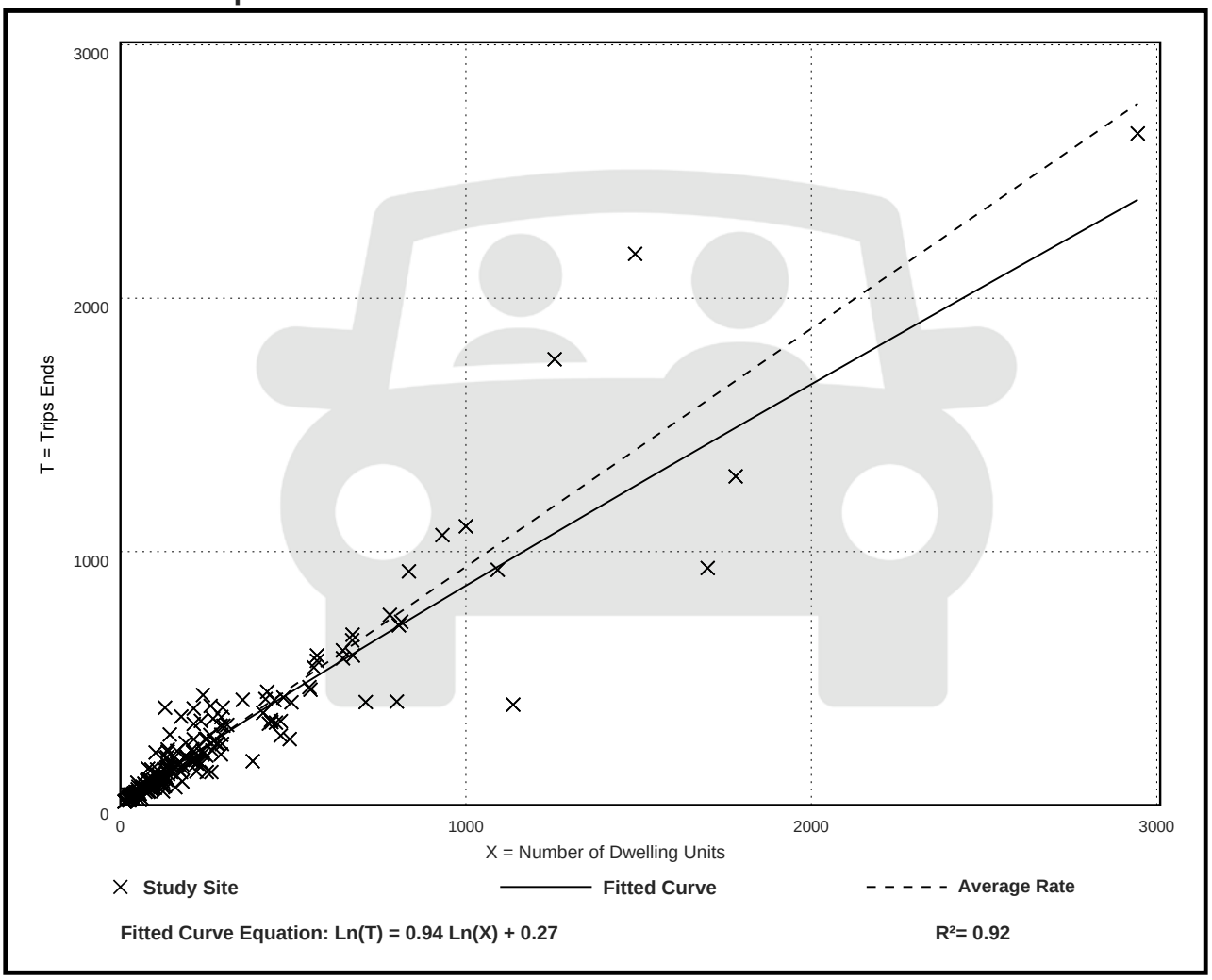
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: Dwelling Units
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: 208
Avg. Num. of Dwelling Units: 248
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

Data Plot and Equation



Attachment 5
Intersection Worksheets – Existing AM/PM Peaks

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	20	37	160	20	58	317
Future Vol, veh/h	20	37	160	20	58	317
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	43	184	23	67	364

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	694	196	0	0	207	0
Stage 1	196	-	-	-	-	-
Stage 2	498	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	409	845	-	-	1364	-
Stage 1	837	-	-	-	-	-
Stage 2	611	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	384	845	-	-	1364	-
Mov Cap-2 Maneuver	384	-	-	-	-	-
Stage 1	837	-	-	-	-	-
Stage 2	573	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	11.8	0	1.2
HCM LOS	B		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	1364	-	595	-	-
HCM Lane V/C Ratio	0.049	-	0.11	-	-
HCM Control Delay (s)	7.8	0	11.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.4	-	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	20	4	8	53	1	71	1	275	14	30	276	10
Future Vol, veh/h	20	4	8	53	1	71	1	275	14	30	276	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	4	9	60	1	80	1	309	16	34	310	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	744	711	316	709	708	317	321	0	0	325	0	0
Stage 1	384	384	-	319	319	-	-	-	-	-	-	-
Stage 2	360	327	-	390	389	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	331	358	724	349	360	724	1239	-	-	1235	-	-
Stage 1	639	611	-	693	653	-	-	-	-	-	-	-
Stage 2	658	648	-	634	608	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	286	345	724	332	347	724	1239	-	-	1235	-	-
Mov Cap-2 Maneuver	286	345	-	332	347	-	-	-	-	-	-	-
Stage 1	638	590	-	692	652	-	-	-	-	-	-	-
Stage 2	584	647	-	600	587	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	16.6	15.6	0	0.8
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1239	-	-	346	480	1235	-	-
HCM Lane V/C Ratio	0.001	-	-	0.104	0.293	0.027	-	-
HCM Control Delay (s)	7.9	0	-	16.6	15.6	8	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	1.2	0.1	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	43	152	208	31	53	123
Future Vol, veh/h	43	152	208	31	53	123
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	44	155	212	32	54	126

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	462	228	0	0	244	0
Stage 1	228	-	-	-	-	-
Stage 2	234	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	558	811	-	-	1322	-
Stage 1	810	-	-	-	-	-
Stage 2	805	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	533	811	-	-	1322	-
Mov Cap-2 Maneuver	533	-	-	-	-	-
Stage 1	810	-	-	-	-	-
Stage 2	770	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	11.8	0	2.4
HCM LOS	B		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	1322	-	727	-	-
HCM Lane V/C Ratio	0.041	-	0.274	-	-
HCM Control Delay (s)	7.8	0	11.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.1	-	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	6	5	46	2	29	8	333	87	80	395	26
Future Vol, veh/h	12	6	5	46	2	29	8	333	87	80	395	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	7	6	52	2	33	9	378	99	91	449	30

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1109	1141	464	1099	1107	428	479	0	0	477	0	0
Stage 1	646	646	-	446	446	-	-	-	-	-	-	-
Stage 2	463	495	-	653	661	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	187	201	598	190	210	627	1083	-	-	1085	-	-
Stage 1	460	467	-	591	574	-	-	-	-	-	-	-
Stage 2	579	546	-	456	460	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	159	176	598	165	184	627	1083	-	-	1085	-	-
Mov Cap-2 Maneuver	159	176	-	165	184	-	-	-	-	-	-	-
Stage 1	455	413	-	584	568	-	-	-	-	-	-	-
Stage 2	540	540	-	393	407	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	26.3	30.1	0.2	1.4
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1083	-	-	195	229	1085	-	-
HCM Lane V/C Ratio	0.008	-	-	0.134	0.382	0.084	-	-
HCM Control Delay (s)	8.4	0	-	26.3	30.1	8.6	0	-
HCM Lane LOS	A	A	-	D	D	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.5	1.7	0.3	-	-

Attachment 6
Intersection Worksheets – Background AM/PM Peaks

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	21	38	165	21	60	327
Future Vol, veh/h	21	38	165	21	60	327
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	44	190	24	69	376

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	716	202	0	0	214	0
Stage 1	202	-	-	-	-	-
Stage 2	514	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	397	839	-	-	1356	-
Stage 1	832	-	-	-	-	-
Stage 2	600	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	372	839	-	-	1356	-
Mov Cap-2 Maneuver	372	-	-	-	-	-
Stage 1	832	-	-	-	-	-
Stage 2	562	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	12	0	1.2
HCM LOS	B		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	1356	-	580	-	-
HCM Lane V/C Ratio	0.051	-	0.117	-	-
HCM Control Delay (s)	7.8	0	12	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.4	-	-

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	21	4	8	55	1	73	1	283	14	31	284	10
Future Vol, veh/h	21	4	8	55	1	73	1	283	14	31	284	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	24	4	9	62	1	82	1	318	16	35	319	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	765	731	325	729	728	326	330	0	0	334	0	0
Stage 1	395	395	-	328	328	-	-	-	-	-	-	-
Stage 2	370	336	-	401	400	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	320	349	716	338	350	715	1229	-	-	1225	-	-
Stage 1	630	605	-	685	647	-	-	-	-	-	-	-
Stage 2	650	642	-	626	602	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	275	336	716	321	337	715	1229	-	-	1225	-	-
Mov Cap-2 Maneuver	275	336	-	321	337	-	-	-	-	-	-	-
Stage 1	629	584	-	684	646	-	-	-	-	-	-	-
Stage 2	574	641	-	592	581	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	17.2	16.1	0	0.8
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1229	-	-	332	467	1225	-	-
HCM Lane V/C Ratio	0.001	-	-	0.112	0.31	0.028	-	-
HCM Control Delay (s)	7.9	0	-	17.2	16.1	8	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.4	1.3	0.1	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	44	157	214	32	55	127
Future Vol, veh/h	44	157	214	32	55	127
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	45	160	218	33	56	130

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	477	235	0	0	251	0
Stage 1	235	-	-	-	-	-
Stage 2	242	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	547	804	-	-	1314	-
Stage 1	804	-	-	-	-	-
Stage 2	798	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	522	804	-	-	1314	-
Mov Cap-2 Maneuver	522	-	-	-	-	-
Stage 1	804	-	-	-	-	-
Stage 2	761	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	12	0	2.4
HCM LOS	B		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	1314	-	719	-	-
HCM Lane V/C Ratio	0.043	-	0.285	-	-
HCM Control Delay (s)	7.9	0	12	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	-	-

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	6	5	47	2	30	8	343	90	82	407	27
Future Vol, veh/h	12	6	5	47	2	30	8	343	90	82	407	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	7	6	53	2	34	9	390	102	93	463	31

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1142	1175	479	1130	1139	441	494	0	0	492	0	0
Stage 1	665	665	-	459	459	-	-	-	-	-	-	-
Stage 2	477	510	-	671	680	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	177	192	587	181	201	616	1070	-	-	1071	-	-
Stage 1	449	458	-	582	566	-	-	-	-	-	-	-
Stage 2	569	538	-	446	451	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	149	167	587	156	175	616	1070	-	-	1071	-	-
Mov Cap-2 Maneuver	149	167	-	156	175	-	-	-	-	-	-	-
Stage 1	444	403	-	575	559	-	-	-	-	-	-	-
Stage 2	529	532	-	382	397	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	27.8	32.4	0.2	1.4
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1070	-	-	184	219	1071	-	-
HCM Lane V/C Ratio	0.008	-	-	0.142	0.41	0.087	-	-
HCM Control Delay (s)	8.4	0	-	27.8	32.4	8.7	0	-
HCM Lane LOS	A	A	-	D	D	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.5	1.9	0.3	-	-

Attachment 7
Intersection Worksheets – Full Buildout AM/PM Peaks

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	93	69	165	45	70	327
Future Vol, veh/h	93	69	165	45	70	327
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	107	79	190	52	80	376

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	752	216	0	0	242	0
Stage 1	216	-	-	-	-	-
Stage 2	536	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	378	824	-	-	1324	-
Stage 1	820	-	-	-	-	-
Stage 2	587	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	349	824	-	-	1324	-
Mov Cap-2 Maneuver	349	-	-	-	-	-
Stage 1	820	-	-	-	-	-
Stage 2	542	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	17.9	0	1.4
HCM LOS	C		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	1324	-	463	-	-
HCM Lane V/C Ratio	0.061	-	0.402	-	-
HCM Control Delay (s)	7.9	0	17.9	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.2	-	1.9	-	-

Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	21	4	8	76	1	104	1	283	21	41	284	10
Future Vol, veh/h	21	4	8	76	1	104	1	283	21	41	284	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	24	4	9	85	1	117	1	318	24	46	319	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	808	761	325	755	754	330	330	0	0	342	0	0
Stage 1	417	417	-	332	332	-	-	-	-	-	-	-
Stage 2	391	344	-	423	422	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	299	335	716	325	338	712	1229	-	-	1217	-	-
Stage 1	613	591	-	681	644	-	-	-	-	-	-	-
Stage 2	633	637	-	609	588	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	240	319	716	306	322	712	1229	-	-	1217	-	-
Mov Cap-2 Maneuver	240	319	-	306	322	-	-	-	-	-	-	-
Stage 1	612	564	-	680	643	-	-	-	-	-	-	-
Stage 2	528	636	-	569	561	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	18.8	19.2	0	1
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1229	-	-	297	455	1217	-	-
HCM Lane V/C Ratio	0.001	-	-	0.125	0.447	0.038	-	-
HCM Control Delay (s)	7.9	0	-	18.8	19.2	8.1	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.4	2.3	0.1	-	-

Intersection	
Int Delay, s/veh	5.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	59	23	34	81	69	103
Future Vol, veh/h	59	23	34	81	69	103
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	64	25	37	88	75	112

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	89	0	239	77
Stage 1	-	-	-	-	77	-
Stage 2	-	-	-	-	162	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1506	-	749	984
Stage 1	-	-	-	-	946	-
Stage 2	-	-	-	-	867	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1506	-	730	984
Mov Cap-2 Maneuver	-	-	-	-	730	-
Stage 1	-	-	-	-	946	-
Stage 2	-	-	-	-	844	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.2	10.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	863	-	-	1506	-
HCM Lane V/C Ratio	0.217	-	-	0.025	-
HCM Control Delay (s)	10.3	-	-	7.5	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

Intersection	
Int Delay, s/veh	6.2

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	93	178	214	116	91	127
Future Vol, veh/h	93	178	214	116	91	127
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	95	182	218	118	93	130

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	593	277	0	0	336	0
Stage 1	277	-	-	-	-	-
Stage 2	316	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	468	762	-	-	1223	-
Stage 1	770	-	-	-	-	-
Stage 2	739	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	430	762	-	-	1223	-
Mov Cap-2 Maneuver	430	-	-	-	-	-
Stage 1	770	-	-	-	-	-
Stage 2	678	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	16	0	3.4
HCM LOS	C		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	1223	-	602	-	-
HCM Lane V/C Ratio	0.076	-	0.459	-	-
HCM Control Delay (s)	8.2	0	16	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.2	-	2.4	-	-

Intersection	
Int Delay, s/veh	6.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	6	5	61	2	51	8	343	114	118	407	27
Future Vol, veh/h	12	6	5	61	2	51	8	343	114	118	407	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	7	6	69	2	58	9	390	130	134	463	31

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1250	1285	479	1226	1235	455	494	0	0	520	0	0
Stage 1	747	747	-	473	473	-	-	-	-	-	-	-
Stage 2	503	538	-	753	762	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	150	165	587	155	176	605	1070	-	-	1046	-	-
Stage 1	405	420	-	572	558	-	-	-	-	-	-	-
Stage 2	551	522	-	402	414	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	115	134	587	126	143	605	1070	-	-	1046	-	-
Mov Cap-2 Maneuver	115	134	-	126	143	-	-	-	-	-	-	-
Stage 1	400	346	-	565	551	-	-	-	-	-	-	-
Stage 2	490	516	-	321	341	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	35	53.3	0.1	1.9
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1070	-	-	146	196	1046	-	-
HCM Lane V/C Ratio	0.008	-	-	0.179	0.661	0.128	-	-
HCM Control Delay (s)	8.4	0	-	35	53.3	8.9	0	-
HCM Lane LOS	A	A	-	E	F	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.6	4	0.4	-	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	201	80	120	87	47	70
Future Vol, veh/h	201	80	120	87	47	70
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	218	87	130	95	51	76

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	305	0	617	262
Stage 1	-	-	-	-	262	-
Stage 2	-	-	-	-	355	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1256	-	453	777
Stage 1	-	-	-	-	782	-
Stage 2	-	-	-	-	710	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1256	-	404	777
Mov Cap-2 Maneuver	-	-	-	-	404	-
Stage 1	-	-	-	-	782	-
Stage 2	-	-	-	-	633	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.8	13.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	567	-	-	1256	-
HCM Lane V/C Ratio	0.224	-	-	0.104	-
HCM Control Delay (s)	13.2	-	-	8.2	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.3	-

Attachment 8
Turn Lane Warrants

Project: Tipton Station Subdivision

Tipton Station Road at Subdivision Roadway

Tipton Station Road VOLUMES
at Subdivision Roadway

LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	82	81	34	250	NO
PM	281	87	120	130	NO

Tipton Station Road VOLUMES
at Subdivision Roadway

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	59	23	549	NO
PM	201	80	349	NO

Tipton Station Road at W Martin Mill Pike

Tipton Station Road VOLUMES
at W Martin Mill Pike

LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	210	327	70	65	YES
PM	330	127	91	110	NO

Tipton Station Road VOLUMES
at W Martin Mill Pike

RIGHT TURN	Thru	RT	RT MAX	Warrant Met
AM	165	45	449	NO
PM	214	116	349	NO

TABLE 5A

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

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

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

AM Peak 70 LT

PM Peak 91 LT

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

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

TABLE 5B

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

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	< 100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99	AM Peak 45 RT					
100 - 149 150 - 199		PM Peak 116 RT				
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99				Yes	Yes Yes	Yes Yes
100 - 149 150 - 199		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

TABLE 5A

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

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	250 200	AM Peak 34 LT 140	140 105	110 90	80 70	70 60
200 - 249 250 - 299	160 130	115 PM Peak 120 LT	85 75	75 65	65 60	55 50
300 - 349 350 - 399	110 100	90 80	70 65	60 55	55 50	45 40
400 - 449 450 - 499	90 80	70 65	60 55	50 45	45 40	35 30
500 - 549 550 - 599	70 65	60 55	45 40	35 35	35 30	25 25
600 - 649 650 - 699	60 55	45 35	35 35	30 30	25 25	25 20
700 - 749 750 or More	50 45	35 35	30 25	25 25	20 20	20 20

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

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

TABLE 5B

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

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	< 100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99	AM Peak 23 RT		PM Peak 80 RT			
100 - 149 150 - 199						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99				Yes	Yes Yes	Yes Yes
100 - 149 150 - 199		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

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

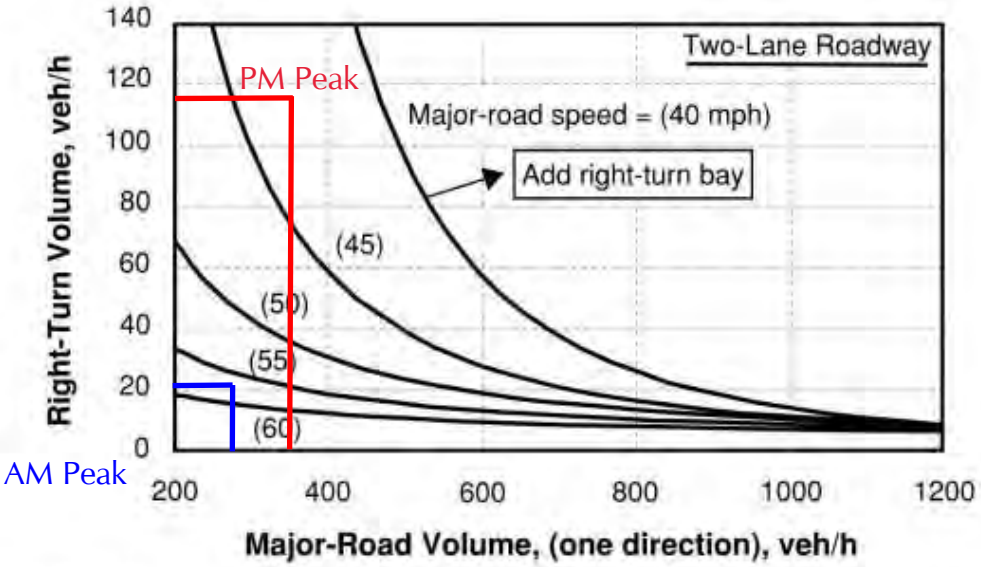


Figure 3-18: Right-Turn Lane Warrant along Two-Lane Roadway (Unsignalized Intersection with Two-Way Stop-Control)[24]

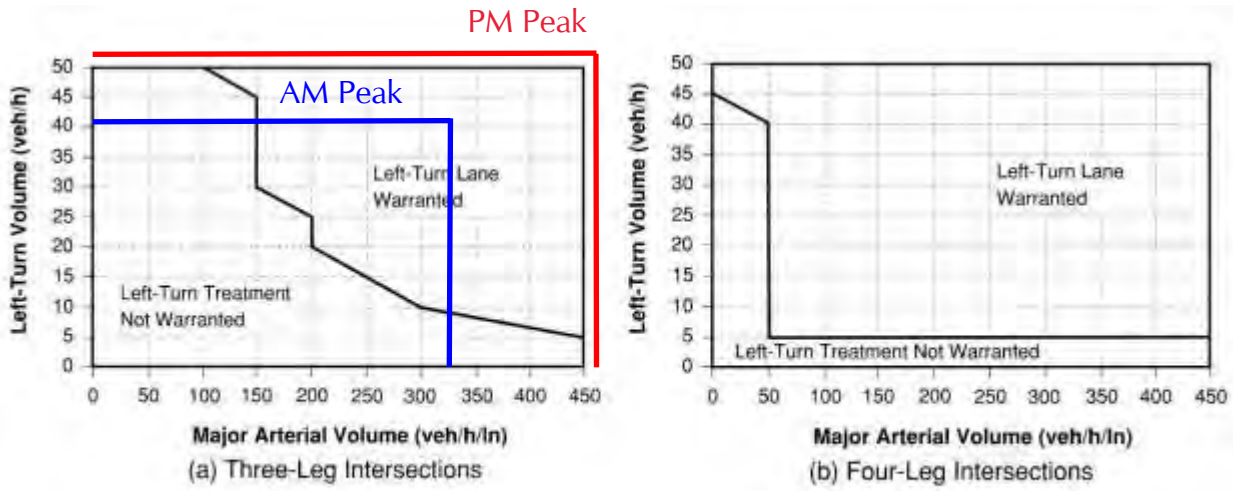


Figure 3-15: Left-Turn Lane Warrant for Urban and Suburban Arterials (Unsignalized)[20, 21]

Attachment 9
Sight Distance

Tipton Station Road at Subdivision Roadway – Looking Left (Westbound)

Tipton Station Road at Subdivision Roadway – Looking Right (Eastbound)