

BABELAY SUBDIVISION
Transportation Impact Analysis
Babelay Road
Knoxville, TN

A Transportation Impact Analysis for the Babelay Subdivision

Submitted to

Knoxville - Knox County Planning

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FMA Project No. 330.020

Submitted By:



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Executive Summary

S & E Properties, LLC is proposing a residential development located in Knox County, TN. The project is located east of the intersection of Babelay Road at Harris Road and southeast of Washington Pike. The full build out of the residential development will include 262 single family lots. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2024.

The concept plan shows a driveway connection at the intersection of Babelay Road at Road "A" and a second driveway connection at the intersection of Harris Road at Road "F". Both driveway connections will include a boulevard entrance with a 10 foot raised median and 18 feet wide lanes.

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

Babelay Road @ Harris Road

The northbound and southbound approaches of Harris Road are separated by a distance of 100 feet but the intersection was analyzed as a four-way intersection that is stop controlled on the minor approaches (Harris Road).

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the intersection of Babelay Road at Harris Road will operate at an acceptable LOS B or better for all approaches during both the AM and PM peak hours.

Washington Pike @ Harris Road

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the intersection of Washington Pike at Harris Road will operate as follows. The westbound approach (Washington Pike) will operate at a LOS A during both the AM and PM peak hours. The northbound approach (Harris Road) will operate at a LOS D during the AM peak hour and a LOS C during the PM peak hour.

The result of the queue analysis and the turn lane warrant analysis is that the existing intersection is adequate and there are no recommended improvements to the intersection of Washington Pike at Harris Road to accommodate the traffic from the Babelay Subdivision.

Babelay Road at Driveway Connection (Road "A")

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the intersection of Babelay Road at driveway connection (Road "A") will operate at an acceptable LOS A for all approaches during both the AM and PM peak hours.

An eastbound left turn lane and a westbound right turn lane on Babelay Road are not warranted per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

Harris Road at Driveway Connection (Road "F")

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the intersection of Harris Road at driveway connection (Road "F") will operate at an acceptable LOS A for all approaches during both the AM and PM peak hours.

A southbound left turn lane and a northbound right turn lane on Harris Road are not warranted per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

Roadway Network

FMA conducted field measurements of the width of Harris Road between Babelay Road and Washington Pike at approximate 500 foot intervals. The result was a width that varies between 17 feet and 19 feet with an overall average width of 18 feet.

FMA recommends any improvements on Harris Road between Babelay Road and Washington Pike including road widening, resurfacing, striping plan, etc. be coordinated with Knox County Engineering and Public Works.

Road "A", Road "B", Road "C", Road "D", Road "E", Road "F", Road "G", Road "H" and Road "I" will have a width of 26 feet in accordance with the "Knoxville-Knox County Subdivision Regulations" amended through February 13, 2020.

Any required sight distance easements for the internal subdivision intersections of Road "A", Road "B", Road "C", Road "D", Road "E", Road "F", Road "G", Road "H" and Road "I" should be coordinated with Knox County Engineering and Public Works and included on the final design drawings prior to construction of the subdivision.

1 Introduction

1.1 Project Description

This report provides a summary of a traffic impact study that was performed for the Babelay Subdivision. The project is located east of the intersection of Babelay Road at Harris Road and southeast of Washington Pike in Knox County, Tennessee. The location of the site is shown in Figure 1.

The full build out of the residential development will include 262 single family lot. Construction is proposed to take place this year, and this study assumes full build out for the development will occur in 2026.

The concept plan shows a driveway connection at the intersection of Babelay Road at Road "A" and a second driveway connection at the intersection of Harris Road at Road "F". Both driveway connections will include a boulevard entrance with a 10 foot raised median and 18 feet wide lanes.

The proposed driveway connection at the intersection of Babelay Road at Road "A" is located approximately 2,565 feet east of Harris Road and approximately 1,215 feet west of Link Road. And the proposed driveway connection at the intersection of Harris Road at Road "F" is located approximately 1,960 feet north of Milroy Lane and approximately 2,590 feet south of Washington Pike. Babelay Road and Harris Road are both two-lane two-way roads with no additional turn lanes for storage. The proposed site layout is shown in Figure 2.

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

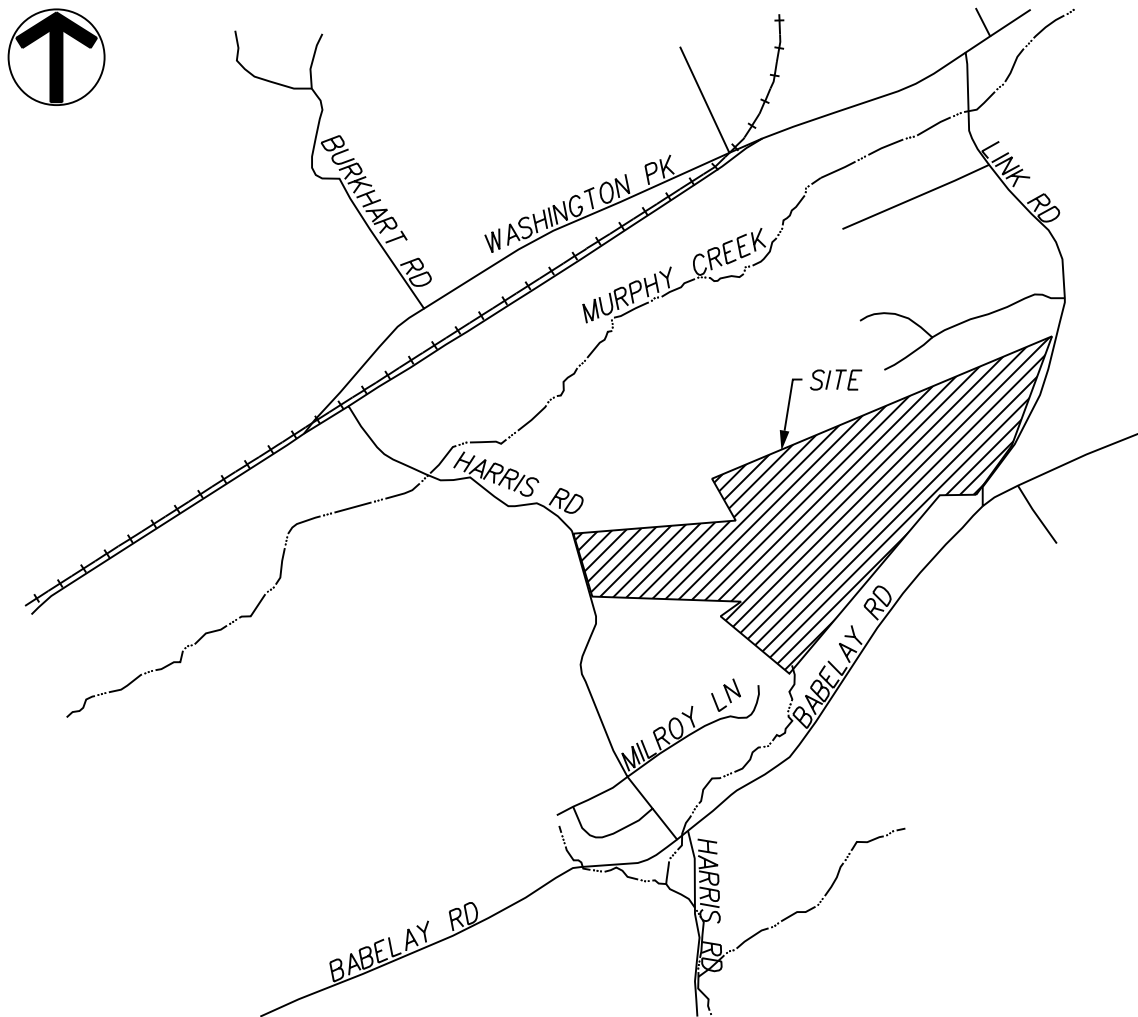


Figure 1: Location Map

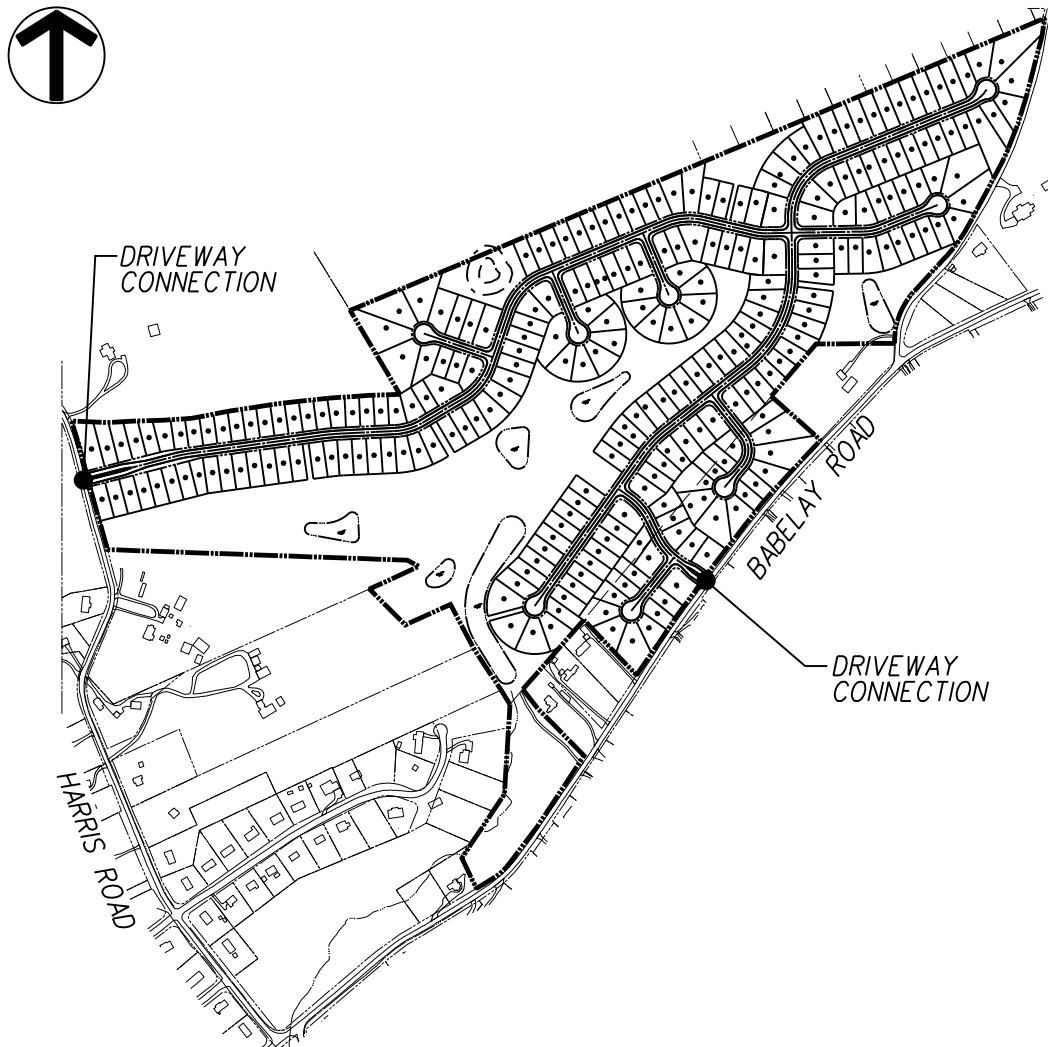


Figure 2: Site Plan

1.2 Existing Site Conditions

Babelay Road is a two-lane road with an approximate width of 18 feet at the proposed driveway connection. Knoxville-Knox County Planning classifies Babelay Road as a Minor Collector between Bud McMillan Road and Washington Pike with a 60 foot right-of-way per the Major Road Plan. The posted speed limit on Babelay Road is 30 mph.

Harris Road is a two-lane road with an approximate width that varies between 17 feet and 19 feet between Babelay Road and Washington Pike. Knoxville-Knox County Planning classifies Harris Road as a Minor Arterial between Washington Pike and Millertown Pike with a 60 foot right-of-way per the Major Road Plan. The posted speed limit on Harris Road is 30 mph.

Washington Pike is a two-lane road at the intersection with Harris Road. Knoxville-Knox County Planning classifies Washington Pike as a Minor Arterial between Millertown Pike and E Emory Road with an 88 foot right-of-way per the Major Road Plan. The posted speed limit on Washington Pike is 45 mph.

There are no existing sidewalks or designated bike lanes along Babelay Road, Harris Road or in the vicinity of the proposed development.

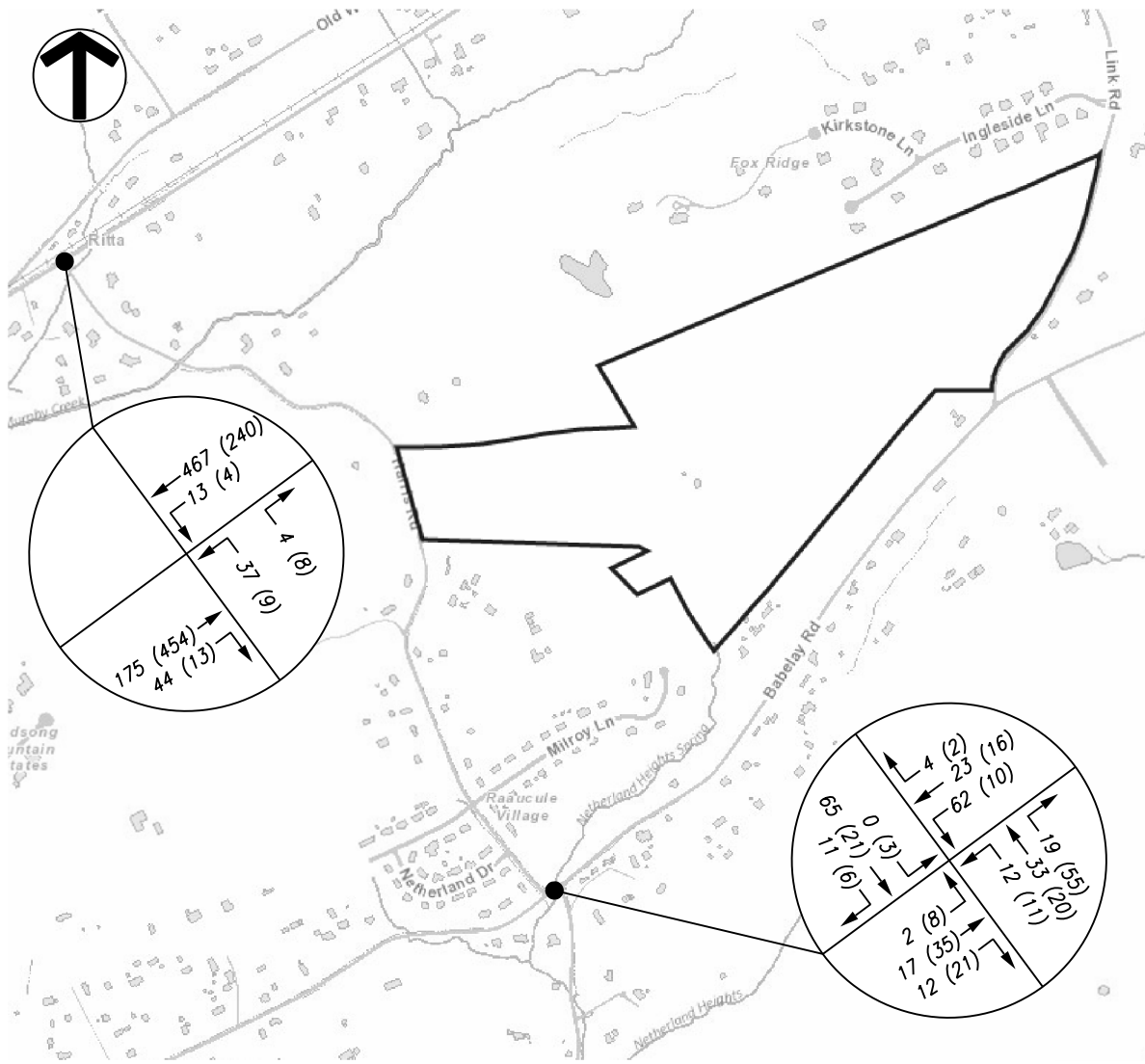
An aerial photo of the existing intersections are included in Attachment 1.

2 Existing Traffic Volumes

FMA conducted a peak hour turning movement count at the unsignalized intersection of Babelay Road at Harris Road on Wednesday November 3, 2021. The AM peak hour occurred between 7:00 a.m. and 8:00 a.m. with an AM PHF (peak hour factor) of 0.75. The PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a PM PHF of 0.84.

FMA conducted a peak hour turning movement count at the unsignalized intersection of Washington Pike at Harris Road on Thursday November 4, 2021. The AM peak hour occurred between 7:00 a.m. and 8:00 a.m. with an AM PHF of 0.75. The PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a PM PHF of 0.92.

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.



LEGEND:

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

Figure 3: 2021 Existing Peak Hour Traffic

3 Background Growth

The Tennessee Department of Transportation (TDOT) and Knoxville Regional Transportation Planning Organization (TPO) maintain count stations in the vicinity of the proposed development.

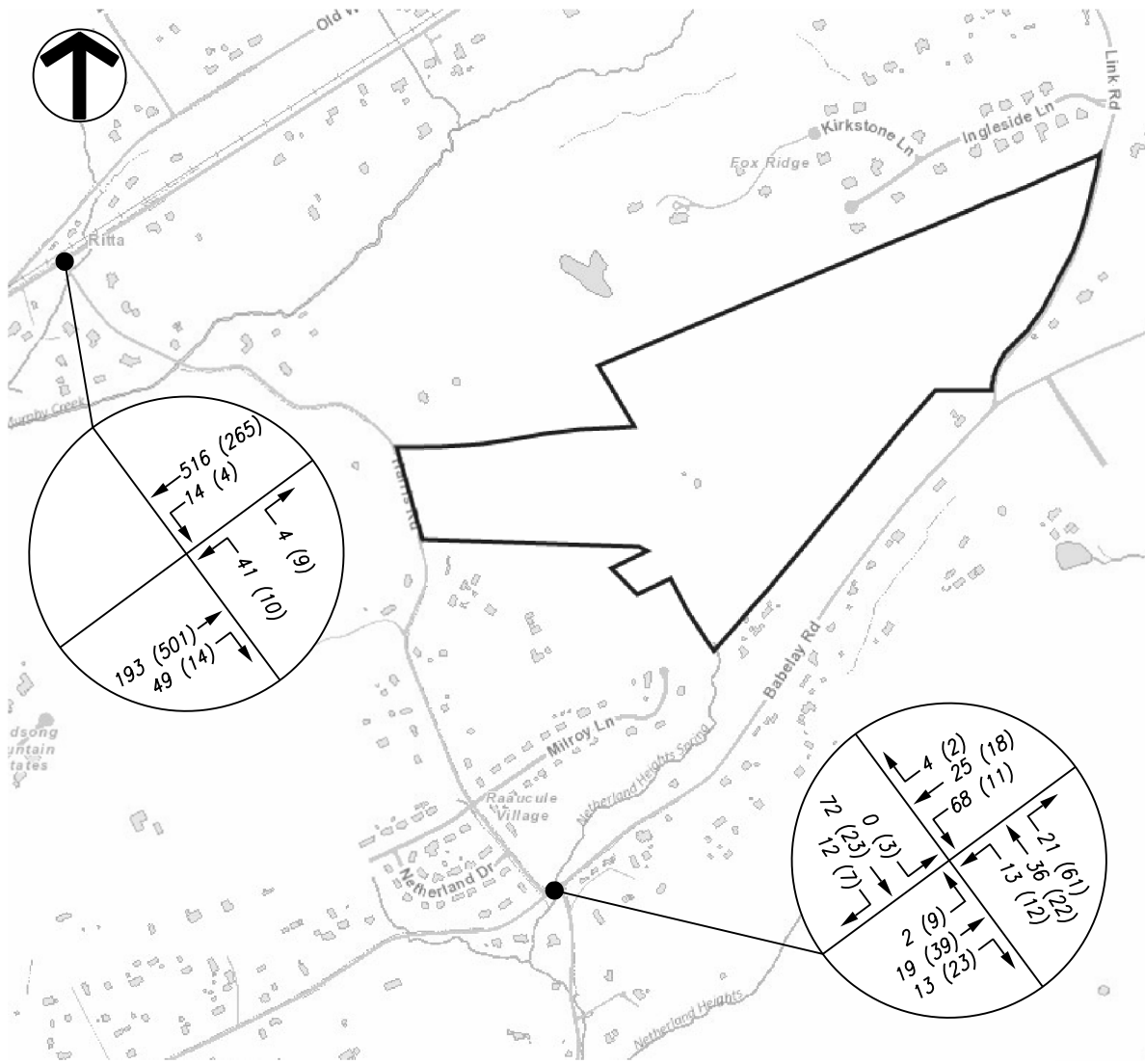
TDOT count station # 000307 is located on Harris Road south of the intersection of Babelay Road and north of Rutledge Pike. The annual growth rate for this station over the last ten years is approximately 2.24% and the 2018 ADT was 1,409 vehicles per day.

TPO count station ID: 093M225 is located on Babelay Road east of Washington Pike. The annual growth rate for this station over the last ten years is approximately 1.80% and the 2020 ADT was 1,780 vehicles per day.

TDOT count station #000033 is located on Washington Pike east of the intersection with Murphy Road. The annual growth rate for this station over the last twenty years is approximately 0.98% and the 2022 ADT was 8,246.

For the purpose of this study, an annual growth rate of 2.0% was assumed for the traffic at the intersection of Babelay Road at Harris Road and Washington Pike at Harris Road until full occupancy is reached in 2026. 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.



LEGEND:

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

Figure 4: 2026 Background Peak Hour Traffic

4 Trip Generation and Trip Distribution

The Babelay Subdivision proposes a total of 262 single-family 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.

The total trips generated by the full buildout of the Babelay Subdivision were estimated to be 2,448 daily trips. The estimated trips are 179 trips during the AM peak hour and 246 trips during the PM peak hour. A trip generation summary is shown in Table 4-1.

Table 4-1
Babelay Subdivision
Trip Generation Summary

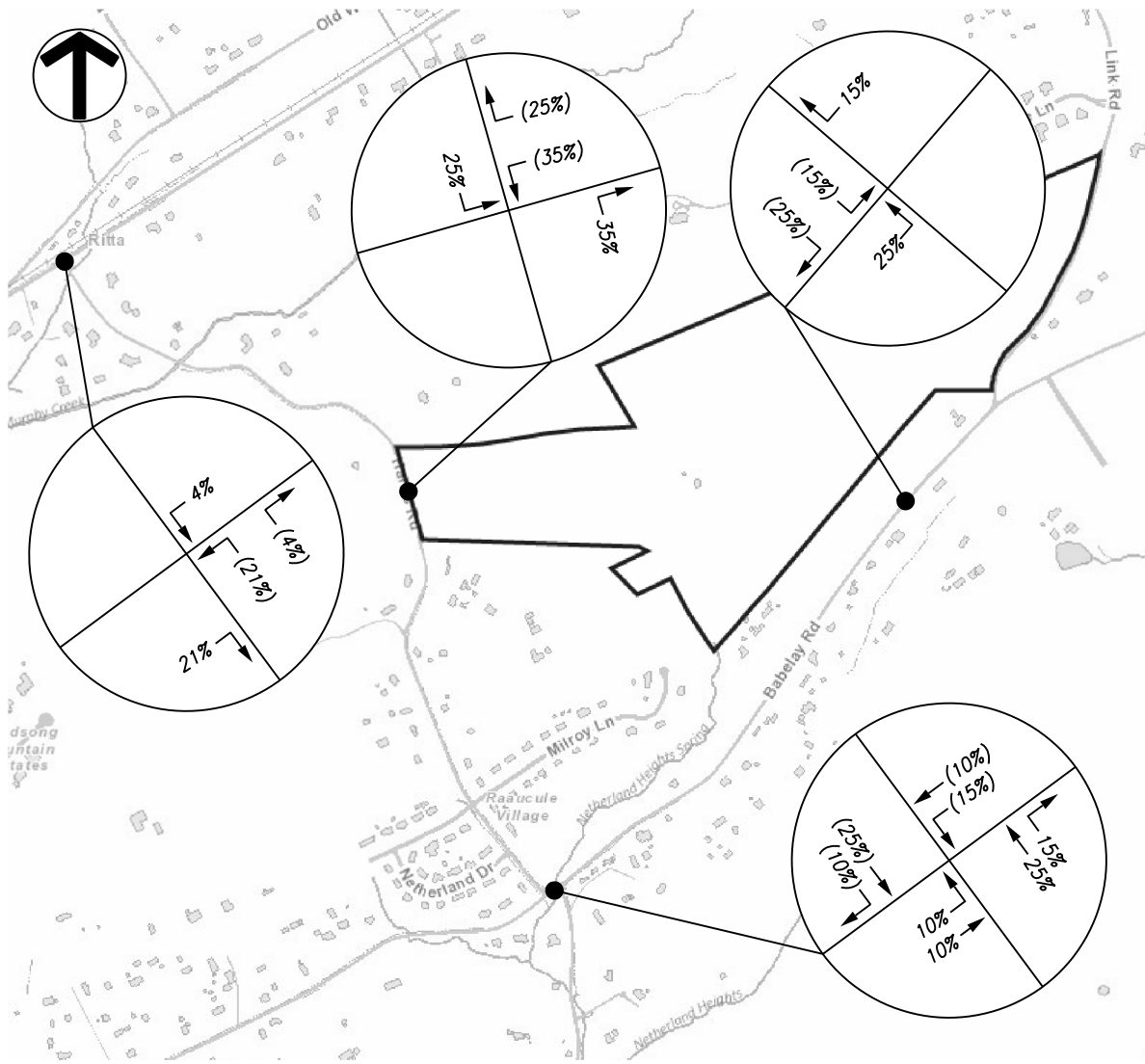
Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Single-Family Detached Housing (Land Use 210)	262 lots	2,448	47	132	155	91

The existing distribution of traffic on Babelay Road at the intersection with Harris Road is approximately 30% eastbound and 70% westbound during the AM peak hour and 70% eastbound and 30% westbound during the PM peak hour. The existing distribution of traffic on Washington Pike at the intersection with Harris Road is approximately 25% eastbound and 75% westbound during the AM peak hour and 65% eastbound and 35% westbound during the PM peak hour.

The directional distribution of the traffic generated by the Babelay Subdivision was determined using the existing traffic volumes along Babelay Road, Harris Road and Washington Pike in combination with the concept plan layout. The approximate distribution of traffic on the existing roadway network during both the AM and PM peak hours is 15% Babelay Road eastbound, 20% Babelay Road westbound, 25% Harris Road northbound and 40% Harris Road southbound.

FMA assumed that 40% of traffic would enter/exit the development to/from the driveway connection of Babelay Road at Road "A" and that 60% of traffic would enter/exit the development to/from the driveway connection of Harris Road at Road "F".

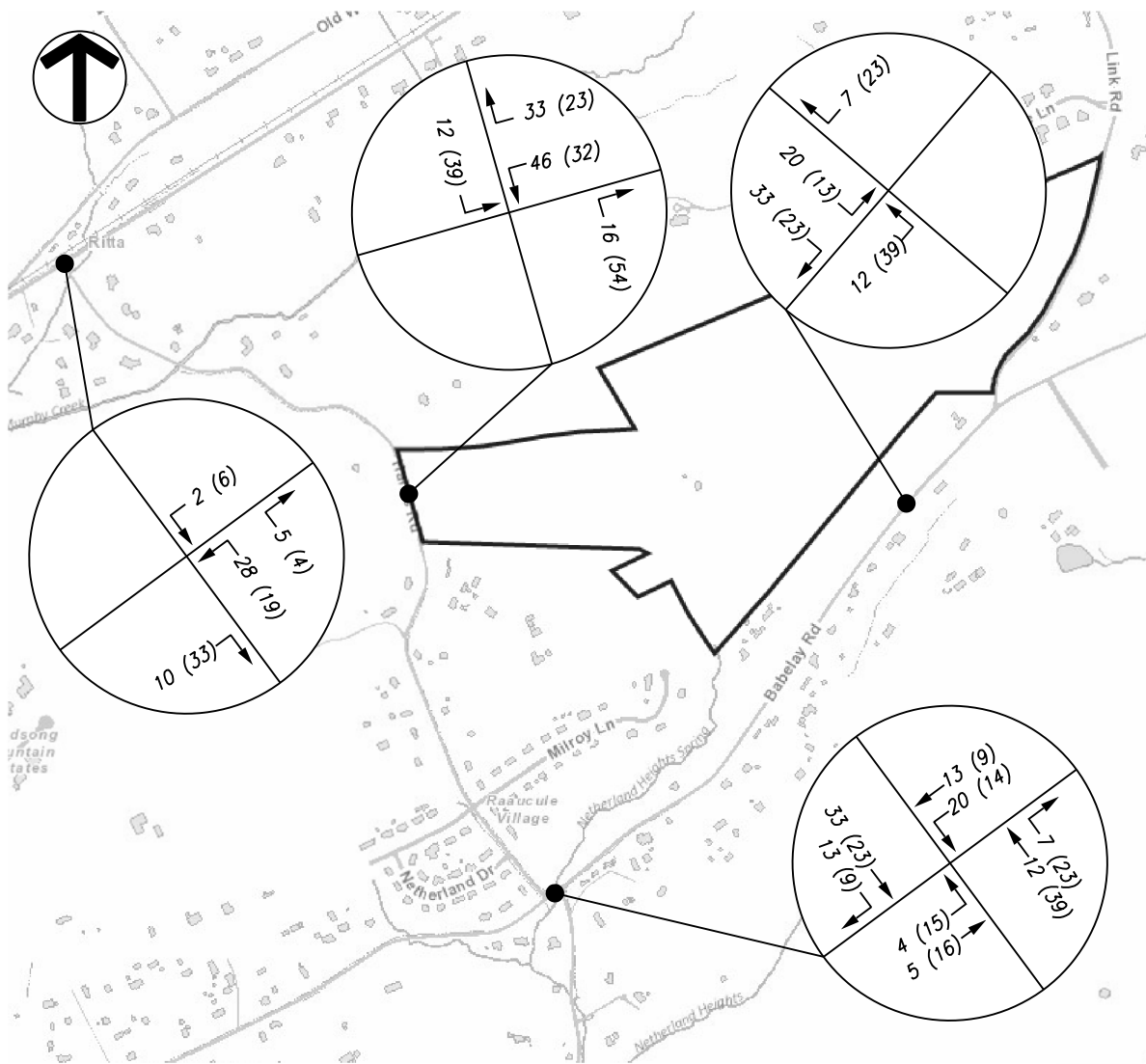
Figure 5 shows the peak hour trip distribution, Figure 6 shows the peak hour site trips for the Babelay Subdivision and Figure 7 shows the 2026 peak hour traffic including the background traffic data and the peak hour site trips for the full buildout of the Babelay Subdivision.



LEGEND:

← 50% (50%) TRIP DISTRIBUTION ENTERING (EXITING)

Figure 5: Peak Hour Trip Distribution



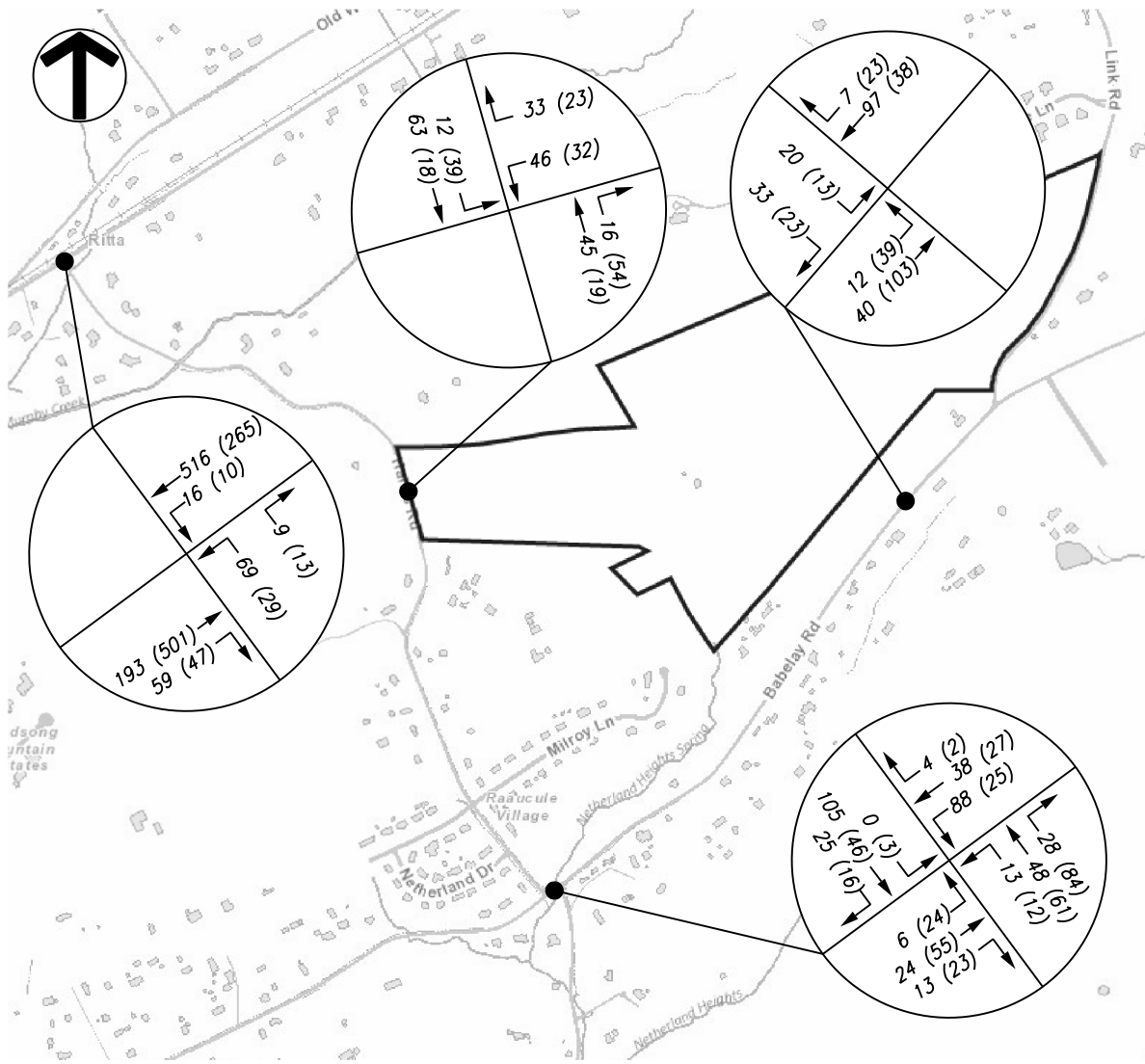
LEGEND:

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

Figure 6: Babelay Subdivision - Peak Hour Site Trips

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LEGEND:

← 5 (16)

TURNING MOVEMENT VOLUME AM (PM)

Figure 7: Babelay Subdivision Full Buildout - Peak Hour Traffic

5 Projected Capacity and Level of Service

The existing intersection of Harris Road at Babelay Road is stop-controlled for the minor approaches (Harris Road). Harris Road northbound and Harris Road southbound are separated by 100 feet of roadway. The existing intersection of Washington Pike at Harris Road is stop-controlled for the minor approach (Harris Road).

Unsignalized intersection capacity analyses were performed using the Highway Capacity Software (HCS7) for the AM and PM peak hours to evaluate the existing, background and full buildout conditions at the intersections of Babelay Road at Harris Road and Washington Pike at Harris Road as well as the proposed driveway connections to both Babelay Road and Harris 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 HCS7 worksheets are included in Attachments 5, 6, and 7.

Table 5-1 shows the results of the capacity analyses.

Table 5-1

Babelay Subdivision
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Intersection Analysis
Level of Service (LOS) Summary

Delay (sec)/LOS		
Babelay Road @ Harris Road (Existing 2021)		
AM Peak	EB Approach	7.3 / A
	WB Approach	7.4 / A
	NB Approach	10.9 / B
	SB Approach	11.4 / B
PM Peak	EB Approach	7.3 / A
	WB Approach	7.4 / A
	NB Approach	9.5 / A
	SB Approach	9.8 / A
Washington Pike @ Harris Road (Existing 2021)		
AM Peak	WB Approach	7.9 / A
	NB Approach	18.8 / C
PM Peak	WB Approach	8.4 / A
	NB Approach	13.5 / B
Babelay Road @ Harris Road (Background 2024)		
AM Peak	EB Approach	7.3 / A
	WB Approach	7.4 / A
	NB Approach	11.2 / B
	SB Approach	11.8 / B
PM Peak	EB Approach	7.3 / A
	WB Approach	7.4 / A
	NB Approach	9.6 / A
	SB Approach	9.9 / A
Washington Pike @ Harris Road (Background 2024)		
AM Peak	WB Approach	8.0 / A
	NB Approach	21.7 / C
PM Peak	WB Approach	8.6 / A
	NB Approach	14.4 / B

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Babelay Road @ Harris Road (Full Buildout 2024)		
AM Peak	EB Approach	7.3 / A
	WB Approach	7.5 / A
	NB Approach	12.7 / B
	SB Approach	13.9 / B
PM Peak	EB Approach	7.3 / A
	WB Approach	7.4 / A
	NB Approach	11.0 / B
	SB Approach	10.9 / B
Washington Pike @ Harris Road (Full Buildout 2024)		
AM Peak	WB Approach	8.0 / A
	NB Approach	25.7 / D
PM Peak	WB Approach	8.7 / A
	NB Approach	16.6 / C
Babelay Road @ Driveway Connection (Full Buildout 2024)		
AM Peak	EB Approach	7.5 / A
	SB Approach	9.3 / A
PM Peak	EB Approach	7.4 / A
	SB Approach	9.3 / A
Harris Road @ Driveway Connection (Full Buildout 2024)		
AM Peak	WB Approach	9.4 / A
	SB Approach	7.4 / A
PM Peak	WB Approach	9.3 / A
	SB Approach	7.4 / A

6 Turn Lane Warrant Analysis

The intersections of Babelay Road at Harris Road, Harris Road at Washington Pike, Babelay Road at driveway connection (Road "A") and Harris Road at driveway connection (Road "F") were evaluated to determine if right or left turn lanes are warranted. The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to analyze the information.

There are no turn lanes warranted on Babelay Road, Harris Road or Washington Pike after the full buildout of the Babelay Subdivision.

The turn lane warrant worksheets and analysis are included in Attachment 8.

7 Conclusions and Recommendations

7.1 Babelay Road @ Harris Road

The existing, background and full buildout conditions at the unsignalized intersection of Babelay Road at Harris Road were analyzed using the Highway Capacity Software (HCS7). The northbound and southbound approaches of Harris Road are separated by a distance of 100 feet but the intersection was analyzed as a four-way intersection that is stop controlled on the minor approaches (Harris Road).

The existing and background traffic conditions for the eastbound and westbound approaches (Babelay Road) operate at a LOS A during both the AM and PM peak hours and the northbound and southbound approaches (Harris Road) operate at a LOS B during the AM peak hour and LOS A during the PM peak hour.

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the intersection of Babelay Road at Harris Road will operate as follows. The eastbound and westbound approaches (Babelay Road) will operate at a LOS A during both the AM and PM peak hours. The northbound and southbound approaches (Harris Road) will operate at a LOS B during both the AM and PM peak hours.

There are no turn lanes warranted on either Babelay Road eastbound or Babelay Road westbound per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

The minimum required sight distance for a road with a posted speed limit of 30 mph is 300 feet in each direction in accordance with the "Knoxville-Knox County Subdivision Regulations" amended through February 13, 2020. FMA measured the sight distance at the existing intersections of Babeley Road at Harris Road (northbound) and Babelay Road at Harris Road (southbound) in November 2021.

At 15 feet from the edge of pavement the existing sight distance at the intersection of Babelay Road at Harris Road (northbound) is approximately 300 feet looking east and greater than 350 feet looking to the west. The sight distance looking to the east is partially blocked due to the existing trees and vegetation located within the right-of-way.

At 15 feet from the edge of pavement the existing sight distance at the intersection of Babelay Road at Harris Road (southbound) is greater than 350 looking to the east and greater than 350 feet looking to the west.

Attachment 9 shows pictures of the existing intersection sight distance at both intersections of Babelay Road at Harris Road.

7.2 Washington Pike @ Harris Road

The existing, background and full buildout conditions at the unsignalized intersection of Washington Pike at Harris Road were analyzed using the Highway Capacity Software (HCS7).

The existing and background traffic conditions for the westbound approach (Washington Pike) operates at a LOS A during both the AM and PM peak hours and the northbound approach (Harris Road) operates at a LOS C during the AM peak hour and LOS B during the PM peak hour.

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the intersection of Washington Pike at Harris Road will operate as follows. The westbound approach (Washington Pike) will operate at a LOS A during both the AM and PM peak hours. The northbound approach (Harris Road) will operate at a LOS D during the AM peak hour and a LOS C during the PM peak hour.

An eastbound right turn lane and a westbound left turn lane on Washington Pike are not warranted per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

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 unsignalized intersection capacity analysis shows the full buildout 95% queue length for the northbound approach (Harris Road) of 1.7 car lengths during the AM peak hour and less than one length during the PM peak hour; therefore, the existing storage at the intersection is adequate and no improvements are necessary in order to accommodate the Babelay Subdivision residential development.

The minimum required sight distance for a road with a posted speed limit of 45 mph is 450 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 Washington Pike at Harris Road in November 2021. At 15 feet from the edge of pavement the sight distance at the existing intersection is greater than 500 feet both looking to the east and looking to the west.

7.3 Babelay Road at Driveway Connection (Road "A")

The full buildout conditions at the unsignalized intersection of Babelay Road at the driveway connection (Road "A") were analyzed using the Highway Capacity Software (HCS7).

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the eastbound approach (Babelay Road) operate at a LOS A during both the AM and PM peak hours and the traffic conditions for the southbound approach (Road "A") operate at a LOS A during both the AM and PM peak hours.

An eastbound left turn lane and a westbound right turn lane on Babelay Road are not warranted per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

Babelay Road is classified as a Minor Collector by the Major Road Plan. The minimum intersection spacing required on a collector street is 300 feet per the "Knoxville-Knox County Subdivision Regulations" amended through February 13, 2020. The driveway connection (Road "A") is located approximately 1,215 feet west of Link Road and exceeds the typical minimum separation on a collector; therefore, no change is necessary.

The minimum required sight distance for a road with a posted speed limit of 45 mph is 450 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 proposed intersection of Babelay Road at the driveway connection (Road "A") in November 2021. At 15 feet from the edge of pavement the proposed sight distance is greater than 500 feet both looking to the east and looking to the west.

7.4 Harris Road at Driveway Connection (Road “F”)

The full buildout conditions at the unsignalized intersection of Harris Road at the driveway connection (Road “F”) were analyzed using the Highway Capacity Software (HCS7).

After the completion of the full buildout of the Babelay Subdivision the traffic conditions for the southbound approach (Harris Road) operate at a LOS A during both the AM and PM peak hours and the traffic conditions for the westbound approach (Road “F”) operate at a LOS A during both the AM and PM peak hours.

A southbound left turn lane and a northbound right turn lane on Harris Road are not warranted per the Knox County Department of Engineering and Public Works handbook, “Access Control and Driveway Design Policy.”

Harris Road is classified as a Minor Arterial by the Major Road Plan. The minimum intersection spacing required on an arterial is 400 feet per the “Knoxville-Knox County Subdivision Regulations” amended through February 13, 2020. The driveway connection (Road “F”) is located approximately 1,960 feet north of Milroy Lane and exceeds the typical minimum separation on an arterial; therefore, no change is necessary.

The minimum required sight distance for a road with a posted speed limit of 30 mph is 300 feet in each direction in accordance with the “Knoxville-Knox County Subdivision Regulations” amended through February 13, 2020. FMA measured the sight distance at the proposed intersection of Harris Road at the driveway connection (Road “F”) in November 2021. At 15 feet from the edge of pavement the proposed sight distance is approximately 330 feet looking to the north and 380 feet looking to the south.

7.5 Roadway Network

FMA conducted field measurements of the width of Harris Road between Babelay Road and Washington Pike at approximate 500 foot intervals. The result was a width that varies between 17 feet and 19 feet with an overall average width of 18 feet. Attachment 10 includes the Harris Road width measurements.

FMA recommends any improvements on Harris Road between Babelay Road and Washington Pike including road widening, resurfacing, striping plan, etc. be coordinated with Knox County Engineering and Public Works.

Road “A”, Road “B”, Road “C”, Road “D”, Road “E”, Road “F”, Road “G”, Road “H” and Road “I” will have a width of 26 feet in accordance with the “Knoxville-Knox County Subdivision Regulations” amended through February 13, 2020.

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Any required sight distance easements for the internal subdivision intersections of Road "A", Road "B", Road "C" Road "D", Road "E", Road "F", Road "G", Road "H" and Road "I" should be coordinated with Knox County Engineering and Public Works and included on the final design drawings prior to construction of the subdivision.

Attachment 1
Aerial Photos

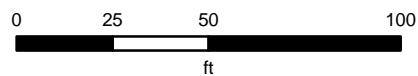


Babelay Rd at Harris Rd

Knoxville - Knox County - KUB Geographic Information System



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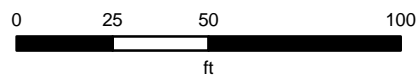


Washington Pike at Harris Rd

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Attachment 2

Traffic Counts

Project: Babelay Subdivision
Intersection: Harris Road at Babelay Road
Date Conducted: Wednesday 11/3/2021

	Harris Road Southbound				Babelay Road Westbound				Harris Road Northbound				Babelay 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	2	2	4	14	5	1	20	2	7	3	12	0	2	5	7	43
7:15 AM	0	20	0	20	14	4	1	19	2	12	5	19	1	5	1	7	65
7:30 AM	0	25	6	31	18	10	1	29	4	12	2	18	0	5	4	9	87
7:45 AM	0	18	3	21	16	4	1	21	4	2	9	15	1	5	2	8	65
Total	0	65	11	76	62	23	4	89	12	33	19	64	2	17	12	31	260
8:00 AM	0	5	1	6	6	8	0	14	3	1	5	9	1	2	3	6	35
8:15 AM	0	4	2	6	3	3	0	6	2	3	2	7	1	2	1	4	23
8:30 AM	0	3	4	7	8	4	0	12	1	0	0	1	2	1	1	4	24
8:45 AM	0	3	2	5	4	0	0	4	1	4	1	6	2	0	0	2	17
Total	0	15	9	24	21	15	0	36	7	8	8	23	6	5	5	16	99
2:00 PM	0	0	1	1	3	4	0	7	2	3	3	8	0	6	0	6	22
2:15 PM	0	2	0	2	4	1	0	5	0	12	7	19	1	2	3	6	32
2:30 PM	1	1	1	3	3	5	0	8	0	1	6	7	2	3	3	8	26
2:45 PM	0	15	0	15	2	2	1	5	1	3	2	6	4	3	2	9	35
Total	1	18	2	21	12	12	1	25	3	19	18	40	7	14	8	29	115
3:00 PM	0	7	5	12	3	2	3	8	1	2	4	7	0	2	3	5	32
3:15 PM	0	3	2	5	1	5	0	6	2	2	6	10	5	9	4	18	39
3:30 PM	0	4	1	5	7	6	0	13	9	1	7	17	3	5	3	11	46
3:45 PM	0	3	2	5	5	2	2	9	2	8	6	16	2	9	3	14	44
Total	0	17	10	27	16	15	5	36	14	13	23	50	10	25	13	48	161
4:00 PM	1	1	0	2	6	1	0	7	2	3	10	15	1	6	2	9	33
4:15 PM	0	2	2	4	6	4	1	11	3	4	12	19	2	4	6	12	46
4:30 PM	0	2	0	2	6	1	1	8	5	7	14	26	3	7	8	18	54
4:45 PM	0	2	0	2	4	2	1	7	4	5	14	23	5	6	5	16	48
Total	1	7	2	10	22	8	3	33	14	19	50	83	11	23	21	55	181
5:00 PM	1	3	1	5	1	7	1	9	4	6	14	24	3	12	8	23	61
5:15 PM	1	4	2	7	2	3	0	5	1	4	15	20	1	6	4	11	43
5:30 PM	1	5	2	8	2	1	0	3	4	4	13	21	1	8	1	10	42
5:45 PM	0	9	1	10	5	5	1	11	2	6	13	21	3	9	8	20	62
Total	3	21	6	30	10	16	2	28	11	20	55	86	8	35	21	64	208
Grand Total	5	143	40	188	143	89	15	247	61	112	173	346	44	119	80	243	1024
Approach %	2.7	76.1	21.3		57.9	36.0	6.1		17.6	32.4	50.0		18.1	49.0	32.9		
Total %	0.5	14.0	3.9	18.4	14.0	8.7	1.5	24.1	6.0	10.9	16.9	33.8	4.3	11.6	7.8	23.7	

Project: Babelay Subdivision

Intersection: Harris Road at Babelay Road

Date Conducted: Wednesday 11/3/2021

AM Peak Hour	7:00 AM - 8:00 AM	260
PM Peak Hour	5:00 PM - 6:00 PM	208

	Harris Road Southbound				Babelay Road Westbound				Harris Road Northbound				Babelay 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 7:00 AM																	
7:00 AM	0	2	2	4	14	5	1	20	2	7	3	12	0	2	5	7	43
7:15 AM	0	20	0	20	14	4	1	19	2	12	5	19	1	5	1	7	65
7:30 AM	0	25	6	31	18	10	1	29	4	12	2	18	0	5	4	9	87
7:45 AM	0	18	3	21	16	4	1	21	4	2	9	15	1	5	2	8	65
Total Volume	0	65	11	76	62	23	4	89	12	33	19	64	2	17	12	31	260
Future (2% over 5 yrs)	0	72	12		68	25	4		13	36	21		2	19	13		287
PHF	-	0.65	0.46		0.86	0.58	1.00		0.75	0.69	0.53		0.50	0.85	0.60		0.75
Peak Hour Analysis from 2:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
5:00 PM	1	3	1	5	1	7	1	9	4	6	14	24	3	12	8	23	61
5:15 PM	1	4	2	7	2	3	0	5	1	4	15	20	1	6	4	11	43
5:30 PM	1	5	2	8	2	1	0	3	4	4	13	21	1	8	1	10	42
5:45 PM	0	9	1	10	5	5	1	11	2	6	13	21	3	9	8	20	62
Total Volume	3	21	6	30	10	16	2	28	11	20	55	86	8	35	21	64	208
Future (2% over 5 yrs)	3	23	7		11	18	2		12	22	61		9	39	23		230
PHF	0.75	0.58	0.75		0.50	0.57	0.50		0.69	0.83	0.92		0.67	0.73	0.66		0.84

Project: Babelay Subdivision**Intersection: Washington Pike at Harris Road****Date Conducted: Thursday 11/4/2021**

	Washington Pike Westbound			Harris Road Northbound			Washington Pike Eastbound			
Start	Left	Thru	Total	Left	Right	Total	Thru	Right	Total	Int. Total
7:00 AM	1	133	134	7	0	7	23	2	25	166
7:15 AM	3	147	150	18	2	20	61	15	76	246
7:30 AM	7	99	106	10	0	10	44	25	69	185
7:45 AM	2	88	90	2	2	4	47	2	49	143
Total	13	467	480	37	4	41	175	44	219	740
8:00 AM	0	79	79	3	2	5	48	3	51	135
8:15 AM	1	72	73	1	0	1	45	0	45	119
8:30 AM	0	79	79	0	0	0	41	0	41	120
8:45 AM	0	69	69	2	2	4	34	2	36	109
Total	1	299	300	6	4	10	168	5	173	483
2:00 PM	1	72	73	4	0	4	54	1	55	132
2:15 PM	0	70	70	3	1	4	59	3	62	136
2:30 PM	0	63	63	5	1	6	51	4	55	124
2:45 PM	0	72	72	4	4	8	91	16	107	187
Total	1	277	278	16	6	22	255	24	279	579
3:00 PM	3	57	60	4	0	4	82	3	85	149
3:15 PM	0	50	50	1	2	3	86	0	86	139
3:30 PM	2	47	49	1	0	1	90	2	92	142
3:45 PM	1	72	73	0	0	0	83	2	85	158
Total	6	226	232	6	2	8	341	7	348	588
4:00 PM	1	74	75	2	1	3	108	7	115	193
4:15 PM	1	45	46	5	3	8	107	3	110	164
4:30 PM	0	50	50	3	2	5	103	3	106	161
4:45 PM	0	57	57	3	1	4	99	2	101	162
Total	2	226	228	13	7	20	417	15	432	680
5:00 PM	0	54	54	3	1	4	136	3	139	197
5:15 PM	1	58	59	3	3	6	110	5	115	180
5:30 PM	2	67	69	1	0	1	111	3	114	184
5:45 PM	1	61	62	2	4	6	97	2	99	167
Total	4	240	244	9	8	17	454	13	467	728
Grand Total	27	1735	1762	87	31	118	1810	108	1918	3798
Approach %	1.5	98.5		73.7	26.3		94.4	5.6		
Total %	0.7	45.7	46.4	2.3	0.8	3.1	47.7	2.8	50.5	

Project: Babelay Subdivision

Intersection: Washington Pike at Harris Road

Date Conducted: Thursday 11/4/2021

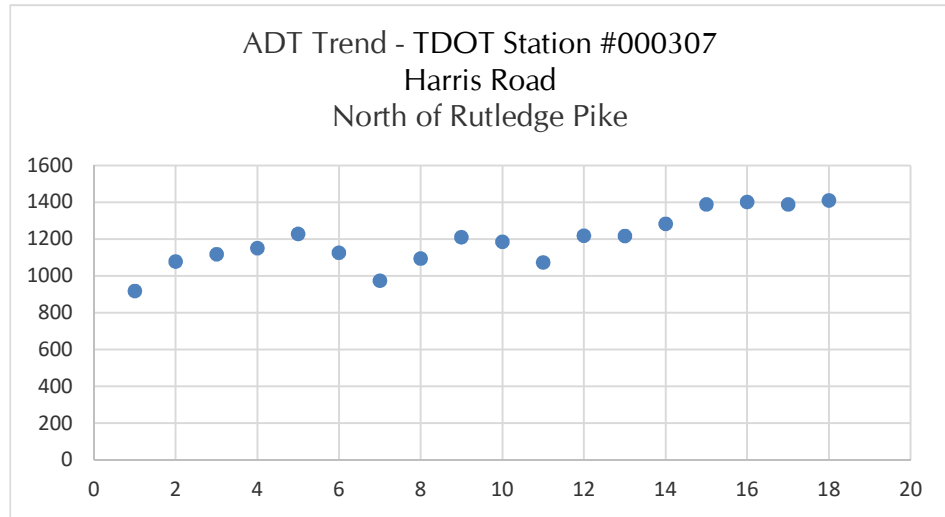
AM Peak Hour	7:00 AM - 8:00 AM	740
PM Peak Hour	5:00 PM - 6:00 PM	728

	Washington Pike Westbound			Harris Road Northbound			Washington Pike Eastbound			
Start	Left	Thru	Total	Left	Right	Total	Thru	Right	Total	Int. Total
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:00 AM										
7:00 AM	1	133	134	7	0	7	23	2	25	166
7:15 AM	3	147	150	18	2	20	61	15	76	246
7:30 AM	7	99	106	10	0	10	44	25	69	185
7:45 AM	2	88	90	2	2	4	47	2	49	143
Total Volume	13	467	480	37	4	41	175	44	219	740
Future (2% over 5 yrs)	14	516		41	4		193	49		817
PHF	0.46	0.79		0.51	0.50		0.72	0.44		0.75
Peak Hour Analysis from 2:00 PM to 6:00 PM										
PM Peak Hour begins at 5:00 PM										
5:00 PM	0	54	54	3	1	4	136	3	139	197
5:15 PM	1	58	59	3	3	6	110	5	115	180
5:30 PM	2	67	69	1	0	1	111	3	114	184
5:45 PM	1	61	62	2	4	6	97	2	99	167
Total Volume	4	240	244	9	8	17	454	13	467	728
Future (2% over 5 yrs)	4	265		10	9		501	14		804
PHF	0.50	0.90		0.75	0.50		0.83	0.65		0.92

Attachment 3

ADT Trends

Year	Adjusted Average Daily Traffic
2001	918
2002	1078
2003	1117
2004	1151
2005	1228
2006	1125
2007	974
2008	1094
2009	1210
2010	1185
2011	1073
2012	1218
2013	1217
2014	1282
2015	1388
2016	1402
2017	1389
2018	1409

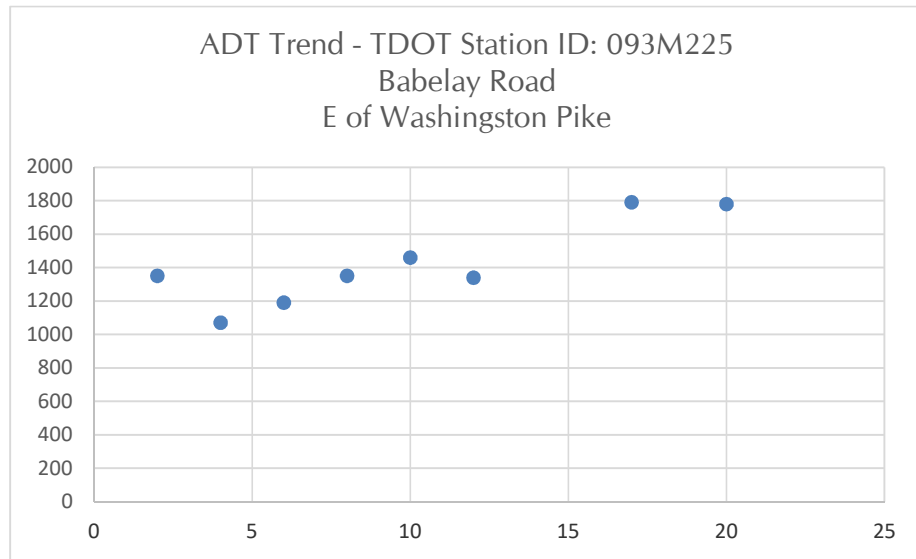


Most Recent Trend Line Growth

Year	ADT
2008	1094
2018	1409

Annual Percent Growth	2.24%
-----------------------	-------

Year	Adjusted Average Daily Traffic
2001	
2002	1350
2003	
2004	1070
2005	
2006	1190
2007	
2008	1350
2009	
2010	1460
2011	
2012	1340
2013	
2014	
2015	
2016	
2017	1790
2018	
2019	
2020	1780



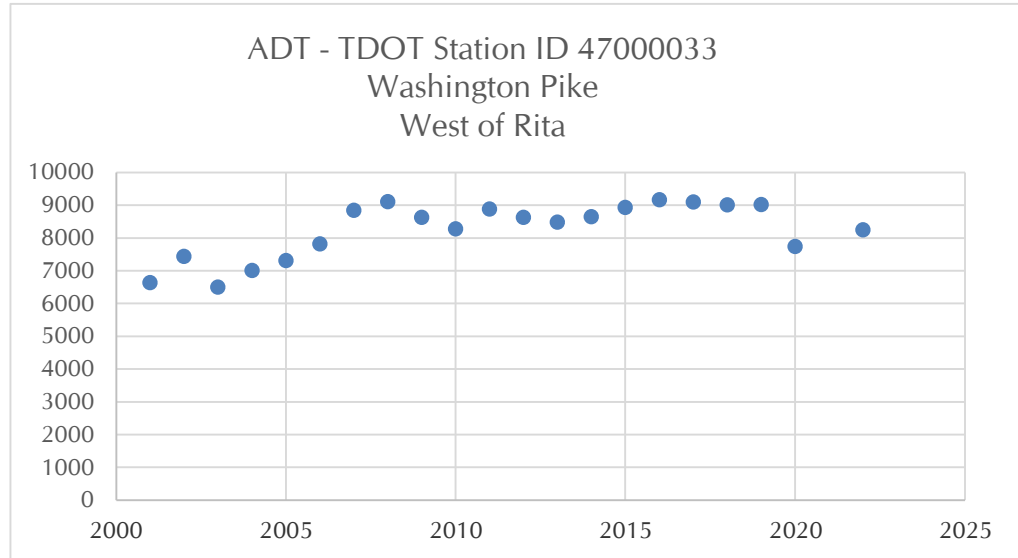
Most Recent Trend Line Growth

Year	ADT
2010	1460
2020	1780

Annual Percent Growth	1.80%
------------------------------	--------------

E of Tazewell Pike

Year	Adjusted Average Daily Traffic
2001	6642
2002	7437
2003	6499
2004	7009
2005	7317
2006	7824
2007	8845
2008	9110
2009	8635
2010	8277
2011	8887
2012	8626
2013	8480
2014	8649
2015	8933
2016	9166
2017	9095
2018	9013
2019	9021
2020	7746
2022	8246



Most Recent Trend Line Growth

Year	ADT
2002	7437
2022	8246

Annual Percent Growth	0.98%
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Attachment 4

Trip Generation

Project: Babelay Subdivision - Full Buildout

Date Conducted: 11/5/2021

Single-Family Detached Housing (LUC 210)

262 Single Family Lots

Average Daily Traffic

$$\ln(T) = 0.92\ln(X) + 2.68$$

$$\ln(T) = 0.92\ln(262) + 2.68$$

$$T = 2448$$

Peak Hour of Adjacent Street Traffic

One Hour Between 7 and 9 a.m.

$$\ln(T) = 0.91\ln(X) + 0.12$$

$$\ln(T) = 0.91\ln(262) + 0.12$$

$$T = 179$$

Peak Hour of Adjacent Street Traffic

One Hour Between 4 and 6 p.m.

$$\ln(T) = 0.94\ln(X) + 0.27$$

$$\ln(T) = 0.94\ln(262) + 0.27$$

$$T = 246$$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	2448	50%	50%	1224	1224
AM Peak Hour	179	26%	74%	47	132
PM Peak Hour	246	63%	37%	155	91

Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 174

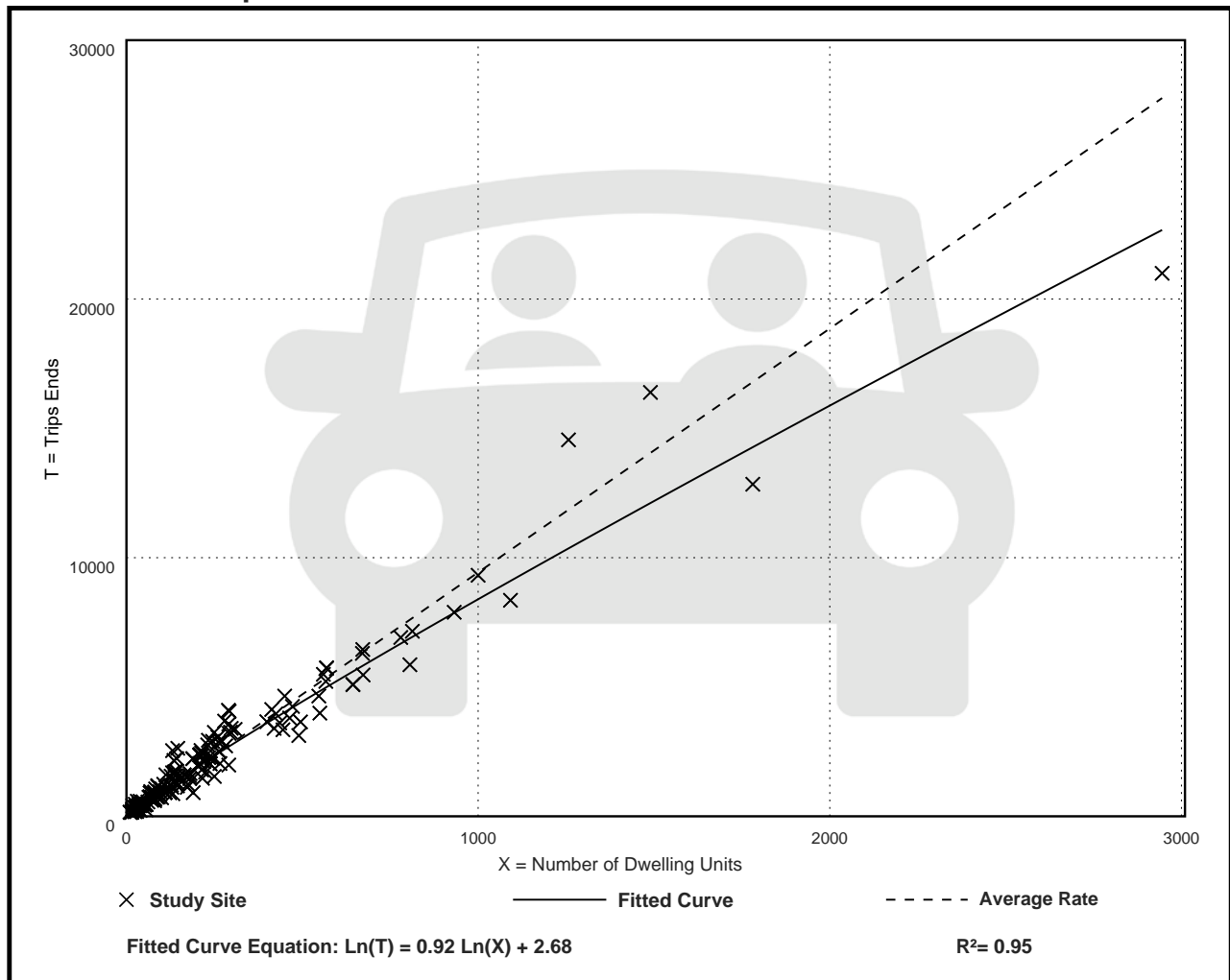
Avg. Num. of Dwelling Units: 246

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



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

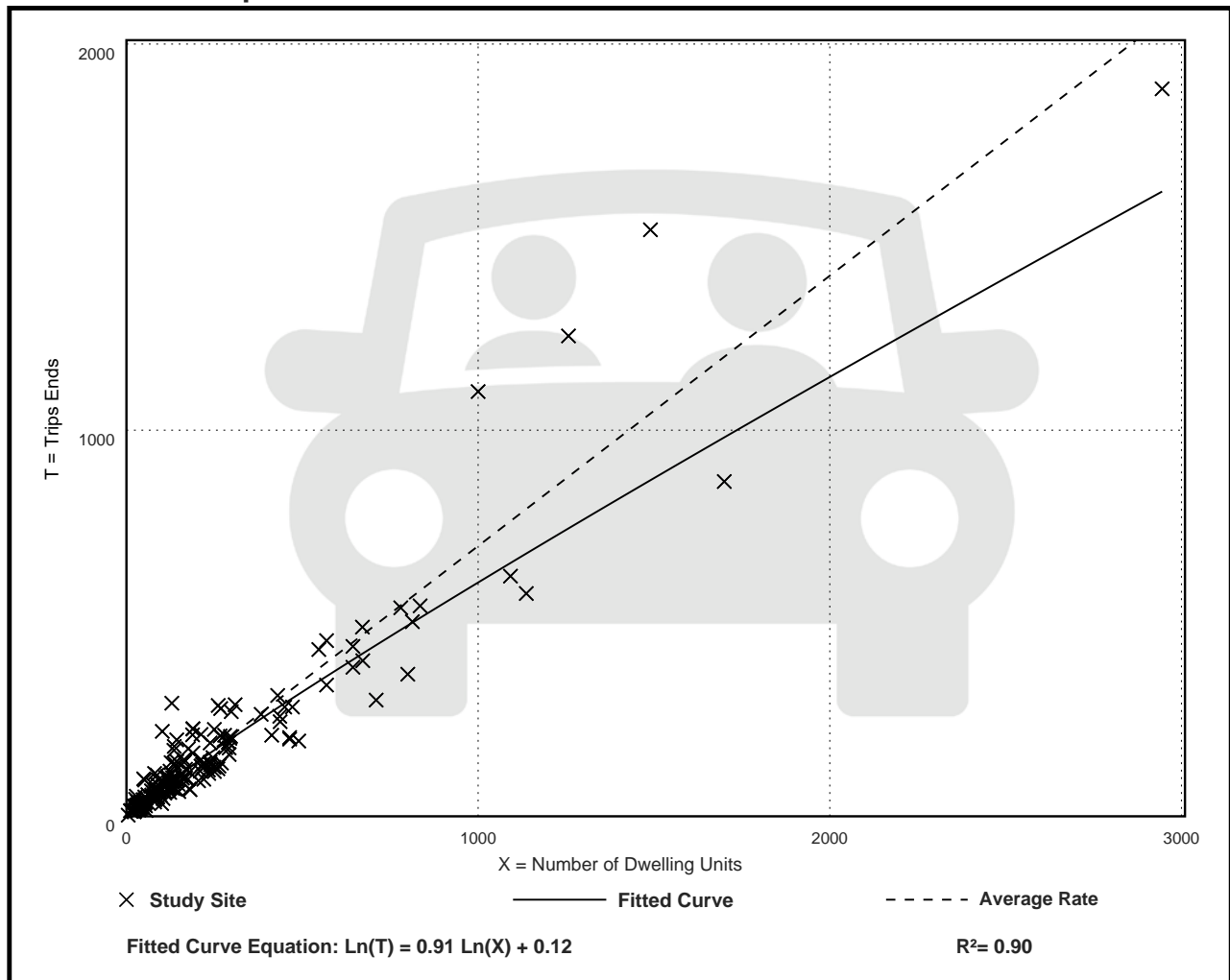
Avg. Num. of Dwelling Units: 226

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

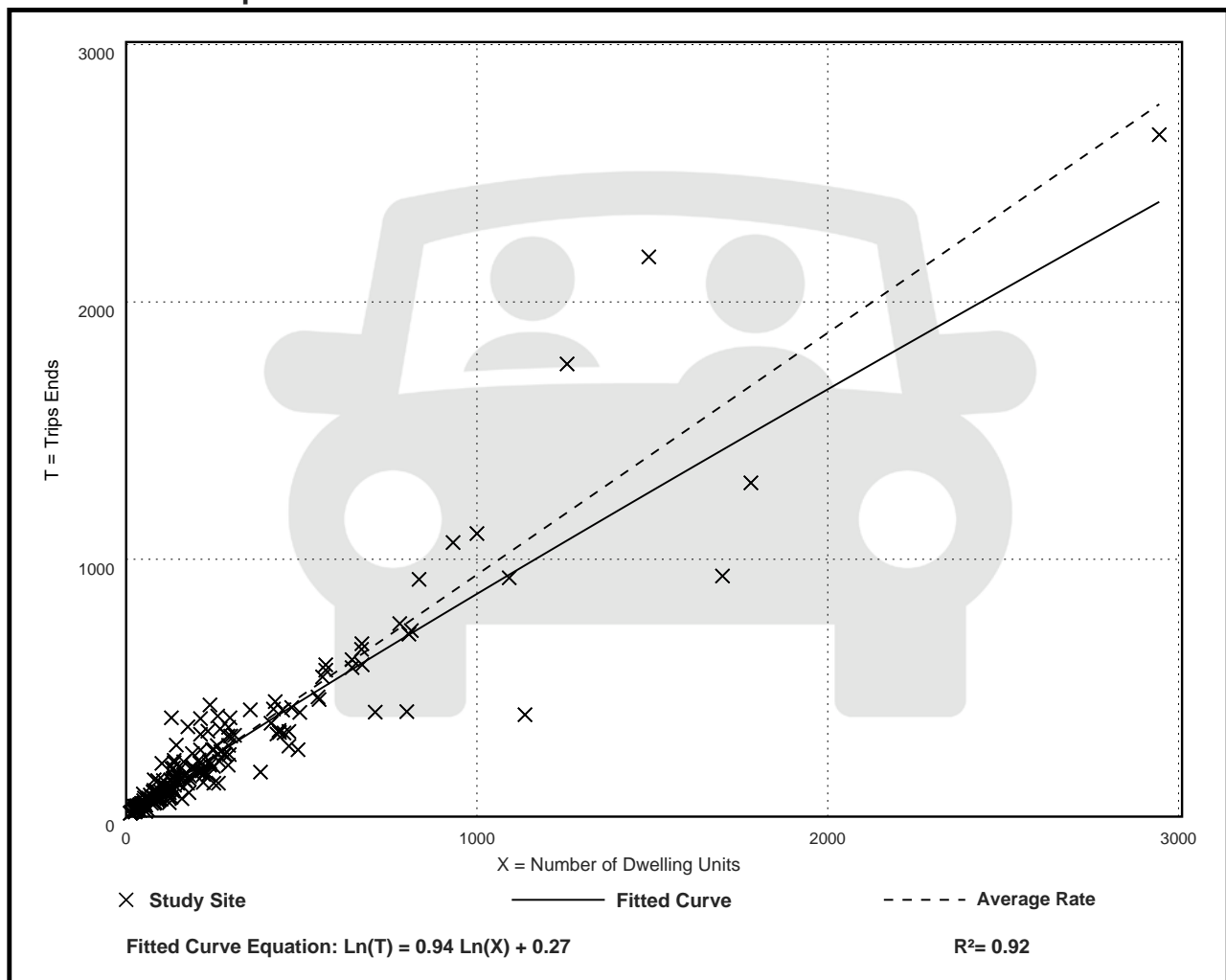
Avg. Num. of Dwelling Units: 248

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

HCS7 Two-Way Stop-Control Report

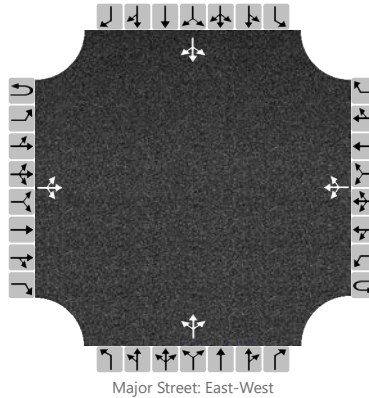
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	11/10/2021
Analysis Year	2021
Time Analyzed	Existing AM Peak
Intersection Orientation	East-West
Project Description	330.020 - Babelay Subdivision

Site Information

Intersection	Babelay Rd @ Harris Rd
Jurisdiction	Knox County
East/West Street	Babelay Road
North/South Street	Harris Road
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



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)		2	17	12		62	23	4		12	33	19		0	65	11
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

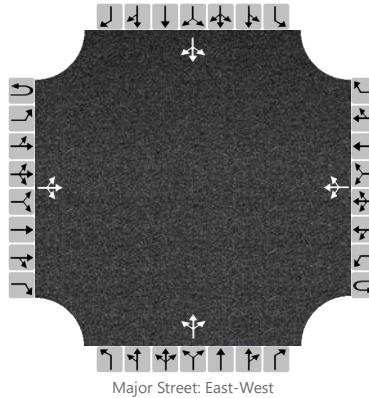
Flow Rate, v (veh/h)		3				83					85				102	
Capacity, c (veh/h)		1574				1570					691				660	
v/c Ratio		0.00				0.05					0.12				0.15	
95% Queue Length, Q ₉₅ (veh)		0.0				0.2					0.4				0.5	
Control Delay (s/veh)		7.3				7.4					10.9				11.4	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)	0.5				5.3				10.9				11.4			
Approach LOS									B				B			

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Babelay Rd @ Harris Rd
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	11/10/2021	East/West Street	Babelay Road
Analysis Year	2021	North/South Street	Harris Road
Time Analyzed	Existing PM Peak	Peak Hour Factor	0.84
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



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)		8	35	21		10	16	2		11	20	55		3	21	6
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)		10				12					102				36	
Capacity, c (veh/h)		1594				1533					910				790	
v/c Ratio		0.01				0.01					0.11				0.05	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0					0.4				0.1	
Control Delay (s/veh)		7.3				7.4					9.5				9.8	
Level of Service, LOS		A				A					A				A	
Approach Delay (s/veh)	1.0				2.7				9.5				9.8			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

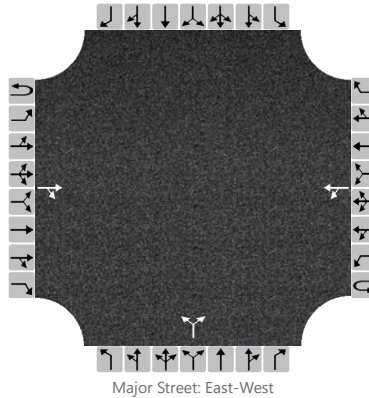
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	11/10/2021
Analysis Year	2021
Time Analyzed	Existing AM Peak
Intersection Orientation	East-West
Project Description	330.020 - Babelay Subdivision

Site Information

Intersection	Washington Pk @ Harris Rd
Jurisdiction	Knox County
East/West Street	Washington Pike
North/South Street	Harris Road
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			175	44		13	467			37		4				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

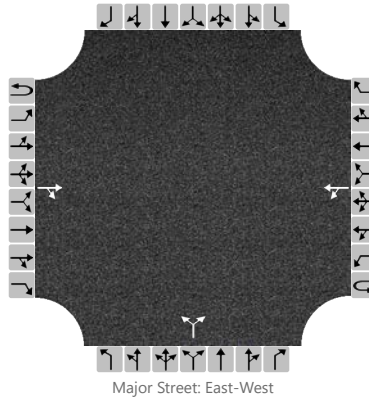
Flow Rate, v (veh/h)						17					54					
Capacity, c (veh/h)						1269					315					
v/c Ratio						0.01					0.17					
95% Queue Length, Q ₉₅ (veh)						0.0					0.6					
Control Delay (s/veh)						7.9					18.8					
Level of Service, LOS						A					C					
Approach Delay (s/veh)					0.4				18.8							
Approach LOS									C							

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Washington Pk @ Harris Rd
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	11/10/2021	East/West Street	Washington Pike
Analysis Year	2021	North/South Street	Harris Road
Time Analyzed	Existing PM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			454	13		4	240			9		8				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						4					19					
Capacity, c (veh/h)						1057					442					
v/c Ratio						0.00					0.04					
95% Queue Length, Q ₉₅ (veh)						0.0					0.1					
Control Delay (s/veh)						8.4					13.5					
Level of Service, LOS						A					B					
Approach Delay (s/veh)					0.2				13.5							
Approach LOS									B							

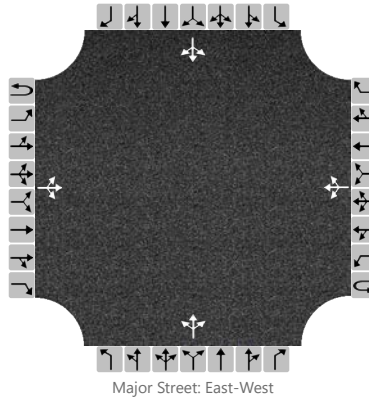
Attachment 6
Intersection Worksheets – Background AM/PM Peaks

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Babelay Rd @ Harris Rd
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Babelay Road
Analysis Year	2026	North/South Street	Harris Road
Time Analyzed	Background AM Peak	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



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)		2	19	13		68	25	4		13	36	21		0	72	12
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

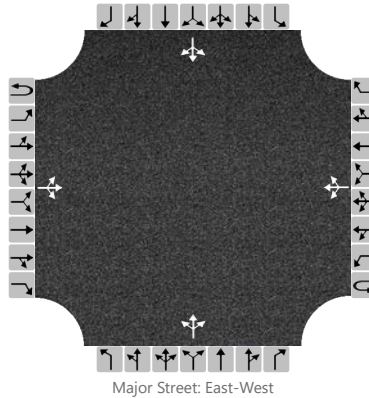
Flow Rate, v (veh/h)		3				91					93				112	
Capacity, c (veh/h)		1571				1566					671				639	
v/c Ratio		0.00				0.06					0.14				0.18	
95% Queue Length, Q ₉₅ (veh)		0.0				0.2					0.5				0.6	
Control Delay (s/veh)		7.3				7.4					11.2				11.8	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)	0.5				5.4				11.2				11.8			
Approach LOS									B				B			

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Babelay Rd @ Harris Rd
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Babelay Road
Analysis Year	2026	North/South Street	Harris Road
Time Analyzed	Background PM Peak	Peak Hour Factor	0.84
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



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)		9	39	23		11	18	2		12	22	61		3	23	7
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

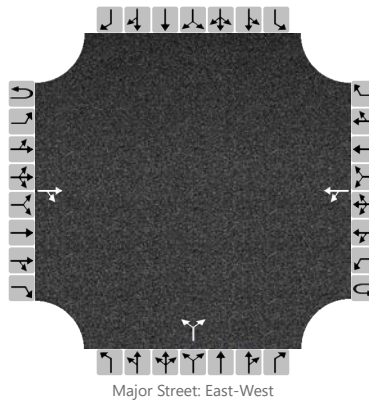
Flow Rate, v (veh/h)		11				13					113				39	
Capacity, c (veh/h)		1591				1526					902				780	
v/c Ratio		0.01				0.01					0.13				0.05	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0					0.4				0.2	
Control Delay (s/veh)		7.3				7.4					9.6				9.9	
Level of Service, LOS		A				A					A				A	
Approach Delay (s/veh)	1.0				2.7				9.6				9.9			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Washington Pk @ Harris Rd
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Washington Pike
Analysis Year	2026	North/South Street	Harris Road
Time Analyzed	Background AM Peak	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			193	49		14	516			41		4				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						19					60					
Capacity, c (veh/h)						1237					275					
v/c Ratio						0.02					0.22					
95% Queue Length, Q ₉₅ (veh)						0.0					0.8					
Control Delay (s/veh)						8.0					21.7					
Level of Service, LOS						A					C					
Approach Delay (s/veh)					0.4				21.7							
Approach LOS									C							

HCS7 Two-Way Stop-Control Report

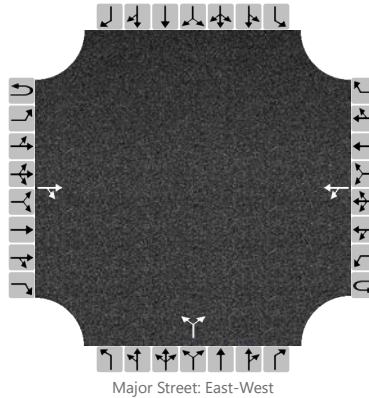
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/18/2022
Analysis Year	2026
Time Analyzed	Background PM Peak
Intersection Orientation	East-West
Project Description	330.020 - Babelay Subdivision

Site Information

Intersection	Washington Pk @ Harris Rd
Jurisdiction	Knox County
East/West Street	Washington Pike
North/South Street	Harris Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			501	14		4	265			10		9				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						4					21					
Capacity, c (veh/h)						1010					403					
v/c Ratio						0.00					0.05					
95% Queue Length, Q ₉₅ (veh)						0.0					0.2					
Control Delay (s/veh)						8.6					14.4					
Level of Service, LOS						A					B					
Approach Delay (s/veh)					0.2				14.4							
Approach LOS									B							

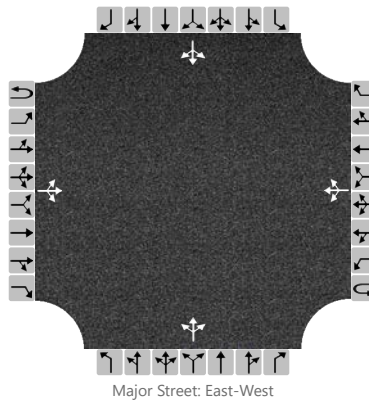
Attachment 7
Intersection Worksheets – Full Buildout AM/PM Peaks

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Babelay Rd @ Harris Rd
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Babelay Road
Analysis Year	2026	North/South Street	Harris Road
Time Analyzed	Full Buildout AM Peak	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



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)		6	24	13		88	38	4		13	48	28		0	105	25
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)		8				117					118				173	
Capacity, c (veh/h)		1548				1557					588				578	
v/c Ratio		0.01				0.08					0.20				0.30	
95% Queue Length, Q ₉₅ (veh)		0.0				0.2					0.7				1.2	
Control Delay (s/veh)		7.3				7.5					12.7				13.9	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)	1.1				5.3				12.7				13.9			
Approach LOS									B				B			

HCS7 Two-Way Stop-Control Report

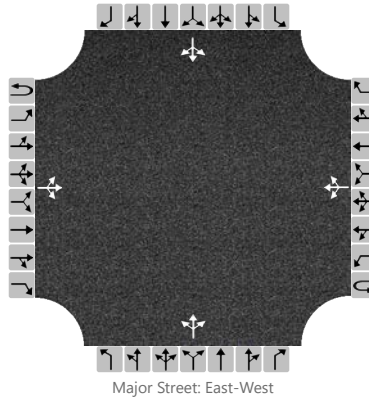
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/18/2022
Analysis Year	2026
Time Analyzed	Full Buildout PM Peak
Intersection Orientation	East-West
Project Description	330.020 - Babelay Subdivision

Site Information

Intersection	Babelay Rd @ Harris Rd
Jurisdiction	Knox County
East/West Street	Babelay Road
North/South Street	Harris Road
Peak Hour Factor	0.84
Analysis Time Period (hrs)	0.25

Lanes



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)		24	55	23		25	27	2		12	61	84		3	46	16
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

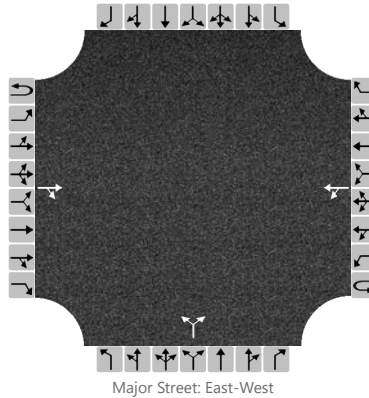
Flow Rate, v (veh/h)		29				30					187				78	
Capacity, c (veh/h)		1576				1502					785				690	
v/c Ratio		0.02				0.02					0.24				0.11	
95% Queue Length, Q ₉₅ (veh)		0.1				0.1					0.9				0.4	
Control Delay (s/veh)		7.3				7.4					11.0				10.9	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)	1.9				3.6				11.0				10.9			
Approach LOS									B				B			

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Washington Pk @ Harris Rd
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Washington Pike
Analysis Year	2026	North/South Street	Harris Road
Time Analyzed	Full Buildout AM Peak	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			193	59		16	516			69		9				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						21					104					
Capacity, c (veh/h)						1222					276					
v/c Ratio						0.02					0.38					
95% Queue Length, Q ₉₅ (veh)						0.1					1.7					
Control Delay (s/veh)						8.0					25.7					
Level of Service, LOS						A					D					
Approach Delay (s/veh)					0.5				25.7							
Approach LOS									D							

HCS7 Two-Way Stop-Control Report

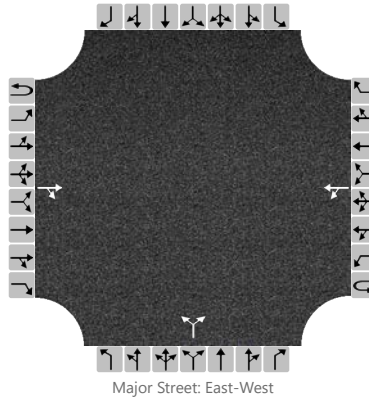
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/18/2022
Analysis Year	2026
Time Analyzed	Full Buildout PM Peak
Intersection Orientation	East-West
Project Description	330.020 - Babelay Subdivision

Site Information

Intersection	Washington Pk @ Harris Rd
Jurisdiction	Knox County
East/West Street	Washington Pike
North/South Street	Harris Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume, V (veh/h)			501	47		10	265			29		13				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

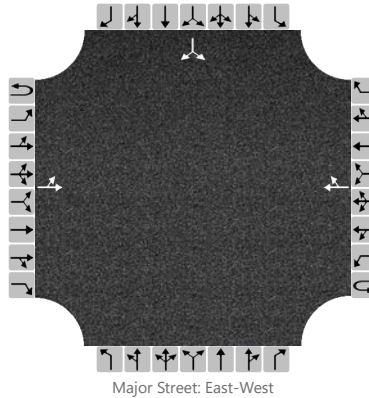
Flow Rate, v (veh/h)						11					46					
Capacity, c (veh/h)						980					357					
v/c Ratio						0.01					0.13					
95% Queue Length, Q ₉₅ (veh)						0.0					0.4					
Control Delay (s/veh)						8.7					16.6					
Level of Service, LOS						A					C					
Approach Delay (s/veh)					0.4				16.6							
Approach LOS									C							

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Babelay @ Driveway
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Babelay Road
Analysis Year	2026	North/South Street	Driveway Connection
Time Analyzed	Full Buildout AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



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	0	0		0	1	0
Configuration		LT						TR							LR	
Volume, V (veh/h)		12	40				97	7						20		33
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

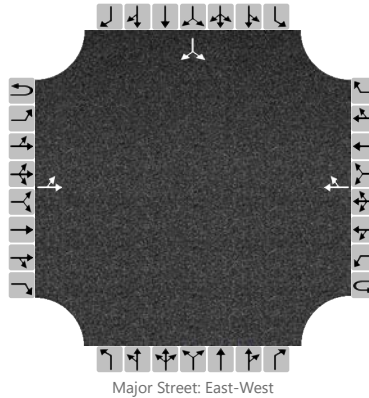
Flow Rate, v (veh/h)		13													58	
Capacity, c (veh/h)		1475													886	
v/c Ratio		0.01													0.07	
95% Queue Length, Q ₉₅ (veh)		0.0													0.2	
Control Delay (s/veh)		7.5													9.3	
Level of Service, LOS		A													A	
Approach Delay (s/veh)	1.8												9.3			
Approach LOS													A			

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Babelay @ Driveway
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Babelay Road
Analysis Year	2026	North/South Street	Driveway Connection
Time Analyzed	Full Buildout PM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



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	0	0		0	1	0
Configuration		LT						TR							LR	
Volume, V (veh/h)		39	103				38	23						13		23
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

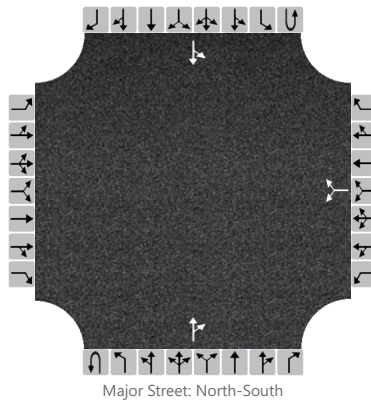
Flow Rate, v (veh/h)		42													39	
Capacity, c (veh/h)		1535													883	
v/c Ratio		0.03													0.04	
95% Queue Length, Q ₉₅ (veh)		0.1													0.1	
Control Delay (s/veh)		7.4													9.3	
Level of Service, LOS		A													A	
Approach Delay (s/veh)	2.2												9.3			
Approach LOS													A			

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Harris @ Driveway
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	2/18/2022	East/West Street	Driveway Connection
Analysis Year	2026	North/South Street	Harris Road
Time Analyzed	Full Buildout AM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	330.020 - Babelay Subdivision		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						46		33			45	16		12	63	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						86								13		
Capacity, c (veh/h)						898								1535		
v/c Ratio						0.10								0.01		
95% Queue Length, Q ₉₅ (veh)						0.3								0.0		
Control Delay (s/veh)						9.4								7.4		
Level of Service, LOS						A								A		
Approach Delay (s/veh)					9.4								1.2			
Approach LOS					A											

HCS7 Two-Way Stop-Control Report

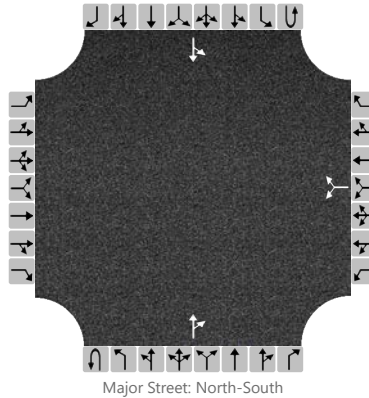
General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	2/18/2022
Analysis Year	2026
Time Analyzed	Full Buildout PM Peak
Intersection Orientation	North-South
Project Description	330.020 - Babelay Subdivision

Site Information

Intersection	Harris @ Driveway
Jurisdiction	Knox County
East/West Street	Driveway Connection
North/South Street	Harris Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						32		23			19	54		39	18	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						60								42		
Capacity, c (veh/h)						888								1517		
v/c Ratio						0.07								0.03		
95% Queue Length, Q ₉₅ (veh)						0.2								0.1		
Control Delay (s/veh)						9.3								7.4		
Level of Service, LOS						A								A		
Approach Delay (s/veh)					9.3								5.1			
Approach LOS					A											

Attachment 8
Turn Lane Warrant Analysis

Project: Babelay Subdivision

Date Conducted: 2/18/2022

Babelay Road at Harris Road - Full Buildout					
Babelay Road Eastbound at Harris Road		VOLUMES			
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	130	37	6	300	NO
PM	54	78	24	300	NO
Babelay Road Eastbound at Harris Road		VOLUMES			
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		30	13	599	NO
PM		79	23	599	NO
Babelay Road at Harris Road - Full Buildout					
Babelay Road Westbound at Harris Road		VOLUMES			
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	43	42	88	300	NO
PM	102	29	25	300	NO
Babelay Road Westbound at Harris Road		VOLUMES			
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		126	4	499	NO
PM		52	2	599	NO
Harris Road at Washington Pike - Full Buildout					
Harris Road at Washington Pike		VOLUMES			
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	252	516	16	30	NO
PM	548	265	10	35	NO
Harris Road at Washington Pike		VOLUMES			
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		193	59	449	NO
PM		501	47	49	NO
Babelay Road at Driveway Connection - Full Buildout					
Babelay Road at Driveway Connection		VOLUMES			
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	104	40	12	300	NO
PM	61	103	39	300	NO
Babelay Road at Driveway Connection		VOLUMES			
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		97	7	599	NO
PM		38	23	599	NO
Harris Road at Driveway Connection - Full Buildout					
Harris Road at Driveway Connection		VOLUMES			
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	61	63	12	300	NO
PM	73	18	39	300	NO
Harris Road at Driveway Connection		VOLUMES			
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		45	16	599	NO
PM		19	54	599	NO

TABLE 4A

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

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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	AM Peak 6 LT PM Peak 24	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	150	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	135 120	110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105	105 90	90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85	80 70	70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	65 60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

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

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

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 13 RT PM Peak 23 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.

TABLE 4A

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



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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	AM Peak 88 LT PM Peak 25 LT	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175		140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	135 120	110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105	105 90	90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85	80 70	70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	65 60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

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

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

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	 PM Peak 2 RT	 AM Peak 4 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.

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	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	65	55	45	40	30
500 - 549	70	60	45	35	PM Peak 10 LT	
550 - 599	65	55	40	35		
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20


OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	70	60	50	45	40	35
150 - 199	60	55	45	40	35	30
200 - 249	55	50	40	35	30	30
250 - 299	50	45	35	30	30	30
300 - 349	45	40	35	30	AM Peak 16 LT	
350 - 399	40	35	30	25		
400 - 449	35	30	30	25	20	20
450 - 499	30	25	25	20	20	20
500 - 549	25	25	20	20	20	15
550 - 599	25	20	20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	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 59 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			PM Peak 47 RT	 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 4A

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


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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	AM Peak 12 LT PM Peak 39 LT	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	150	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	135 120	110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105	105 90	90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85	80 70	70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	65 60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

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

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

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 7 RT PM Peak 23RT				
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.

TABLE 4A

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



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

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	AM Peak 12 LT PM Peak 39 LT	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175		140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	135 120	110 100	95 85	80 70	65 60
400 - 449 450 - 499	120 105	105 90	90 80	75 70	65 60	55 50
500 - 549 550 - 599	95 85	80 70	70 65	65 60	55 50	50 45
600 - 649 650 - 699	75 70	65 60	60 55	55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

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

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

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 16 RT PM Peak 54 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.

Attachment 9
Sight Distance



Babelay Road at Harris Road
(northbound) looking east



Babelay Road at Harris Road
(northbound) looking west



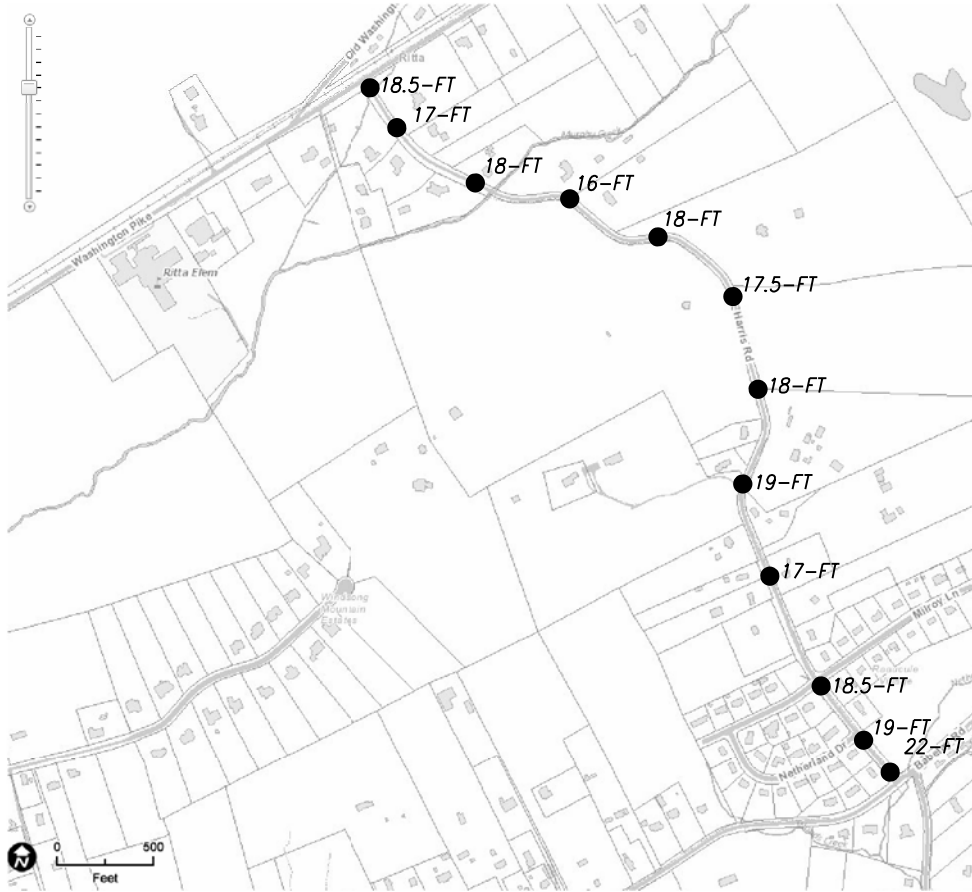
Babelay Road at Harris Road
(southbound) looking east



Babelay Road at Harris Road
(southbound) looking west

Attachment 10
Harris Roadway Width Measurements

Babelay Subdivision
Transportation Impact Analysis
February 21, 2022



Harris Roadway Width Measurements



Date: February 21, 2022

Project Name: Babelay Subdivision

To: Knoxville-Knox County Planning

Subject: TIA Review for Babelay Subdivision (3-SC-22-C / 3-D-22-UR)

Dear Knoxville-Knox County Planning staff,

The following comment response document is submitted to address comments dated February 11, 2022:

- 1. Reviewer Comment:** The TIS notes that there will be two phases, but does not specify the unit count, their locations on the overall parcel or timeframe. Along with that, we believe that a 2024 buildout and full occupancy of this entire 262-unit is extremely optimistic such that we would prefer to see the analyses reflect two independent phases with phase 1 potentially complete by 2024 and phase 2 at least as far out as 2026.

Response: The Babelay Subdivision will not be built in phases, but I did revise the background year to 2026 for the full buildout of the development.

- 2. Reviewer Comment:** Please compute a background growth rate based on Washington Pk traffic count trends and if higher than the proposed 2% then this should be used for a growth rate at the Harris Rd/Washington Pk intersection.

Response: Added a background growth rate graph to the appendix based on the TDOT count station on Washington Pike. The growth rate was less than 2% so no change was necessary.

- 3. Reviewer Comment:** The trip generation worksheets provided in the appendix show a different total unit count (279) than the 262 units discussed in the main body of the report, please correct as necessary.

Response: Updated the appendix to show the correct 262 units.

- 4. Reviewer Comment:** Please provide additional information regarding the road width of Harris Rd, which was documented as 17' wide at the proposed subdivision entrance in the Existing Conditions section. Knox County typically requires some level of improvement if a roadway being tied into by a major new subdivision is less than 18' wide. Please denote the road widths at other intervals of Harris Rd for its

entire length between Washington Pk and Babelay Rd and provide any recommendations that may be needed to address width deficiencies.

Response: Added a figure to the Attachments showing the roadway width of Harris Road at intervals between Washington Pike and Babelay Road. The result was a width that varies between 17 and 19 feet with an overall average width of 18 feet.

5. Reviewer Comment: The reviewing agencies are not in agreement with the trip distribution percentages that were assumed and request that these be changed based on the following factors:

- a. The assignment of 30% of the trips to the northeast from the proposed Babelay Rd access point does not appear to be supported by existing splits and the major destinations (schools, shopping, employment) in the overall region which are predominantly to the south and west.

Response: Updated the trip distribution to/from Babelay Road eastbound to 15% from the intersection of Babelay Road at the driveway connection (Road "A").

- b. With pending major widening improvements to Washington Pk by the City of Knoxville between I-640 and Murphy Rd within the next 5 years we believe that there is potential to draw substantially more traffic than the 15% that was assumed to head towards Washington Pk.

Response: Updated the trip distribution to/from Washington Pike to 25% from the intersection of Harris Road at the driveway connection (Road "F").

- c. The internal lot layout of the subdivision appears to be oriented with a greater number of lots with a more direct route to the Harris Rd access such that the 50/50 split between access points that was assumed is also questionable.

Response: Updated the driveway split to 60/40 where 60% of traffic will enter/exit the intersection of Harris Road at the driveway connection (Road "F") and 40% of traffic will enter/exit the intersection of Babelay Road at the driveway connection (Road "A").

- d. Please revise the trip distribution percentages or provide additional justification for the current ones that were assumed for our review and approval.

Response: Revised Figure 5: Peak Hour Trip Distribution and updated the report to reflect the changes.

- 6. Reviewer Comment:** Please provide additional information regarding the sight distances for all intersections including graphics and/or pictures to illustrate the existing conditions. It is not entirely clear which directions are being discussed for the intersection of Babelay Rd at Harris Rd especially and it is noted that the sight distance is blocked by vegetation in one direction but it's not clear if this results in less than adequate sight distance or not. Additionally, it would be more clear to use terminology such as "looking to the east" rather than saying "eastbound sight distance".

Response: Included pictures at the intersections of Babelay Road at Harris Road in Attachment 9 and updated the verbiage of the sight distance in the report. The intersection of Babelay Road at Harris (northbound) does have adequate sight distance but it could be improved if the vegetation in the right-of-way were cleared.

- 7. Reviewer Comment:** The turning movement count included in the appendix for Washington Pk at Harris Rd was mis-labeled as "Harris Rd at Babelay Rd".

Response: Revised the turning movement with the correct label.

Sincerely,



Addie Kirkham, P.E.