

EBENEZER ROAD SUBDIVISION
Transportation Impact Analysis
Ebenezer Road
Knoxville, TN

**A Transportation Impact Analysis for the Ebenezer Road
Subdivision**

Submitted to

Knoxville-Knox County Planning

April 26, 2024
Ardurra Project No. 330.029

Submitted By:



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Executive Summary

S&E Properties, LLC is proposing a residential development. The project is located south of the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road in Knox County, Tennessee. The full buildout of the Ebenezer Road Subdivision proposes 113 single-family residential lots and a future development area by others. The current plan for the Future Development Area is a proposed apartment complex with 278 garden style apartment units. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2027.

The Ebenezer Road Subdivision has a proposed single roadway connection to Ebenezer Road and the proposed future development area has a separate proposed single roadway connection to Ebenezer Road. A roadway connection between the two developments is under consideration for the purpose of emergency access. The exact location will need to be coordinated between the property owners as well as Knox County Engineering and Public Works.

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

Kingston Pike (SR 70) at Ebenezer Road

After the completion of the Ebenezer Road Subdivision including the future development area the traffic conditions for the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road will operate at an acceptable LOS C during the AM peak hour and a LOS D during the PM peak hour.

The northbound right turn lane (Ebenezer Road) will exceed capacity after the completion of the Ebenezer Road Subdivision and Future Development Area. There are several existing constraints including the location of guard rails and power poles and the proximity to Ten Mile Creek that would make extending the storage length of the right turn lane difficult to construct. Ardurra recommends that any future intersection improvements be reviewed, coordinated and approved by both the City of Knoxville Department of Engineering and Knox County Engineering and Public Works.

Ebenezer Road at Future Development Area

A southbound left turn lane is warranted at the intersection of Ebenezer Road at Future Development Area Roadway per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy." The southbound left turn lane has a recommended minimum storage length

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of 50 feet per the AASHTO Greenbook "A Policy on Geometric Design of Highways and Streets."

After the completion of the full buildout of the Ebenezer Road Subdivision including the proposed roadway improvements the intersection of Ebenezer Road at Future Development Area Roadway will operate at an acceptable LOS B or better for each approach during both the AM and PM peak hours.

Ebenezer Road at Subdivision

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

After the completion of the full buildout of the Ebenezer Road Subdivision the intersection of Ebenezer Road at Subdivision Roadway will operate at an acceptable LOS B or better for each approach during both the AM and PM peak hours.

1 Introduction

1.1 Project Description

This report provides a summary of a transportation impact analysis that was performed for the Ebenezer Road Subdivision residential development. The Ebenezer Road Subdivision proposes 113 single-family residential lots and a future development area by others. The current plan for the Future Development Area is a proposed apartment complex with 278 garden style apartment units. The project is located south of the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer 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 Ebenezer Road Subdivision has a proposed single roadway connection to Ebenezer Road and the proposed future development area has a separate proposed single roadway connection to Ebenezer Road. A roadway connection between the two developments is under consideration for the purpose of emergency access. The exact location will need to be coordinated between the property owners as well as Knox County Engineering and Public Works.

The proposed site layout is shown in Figure 2.

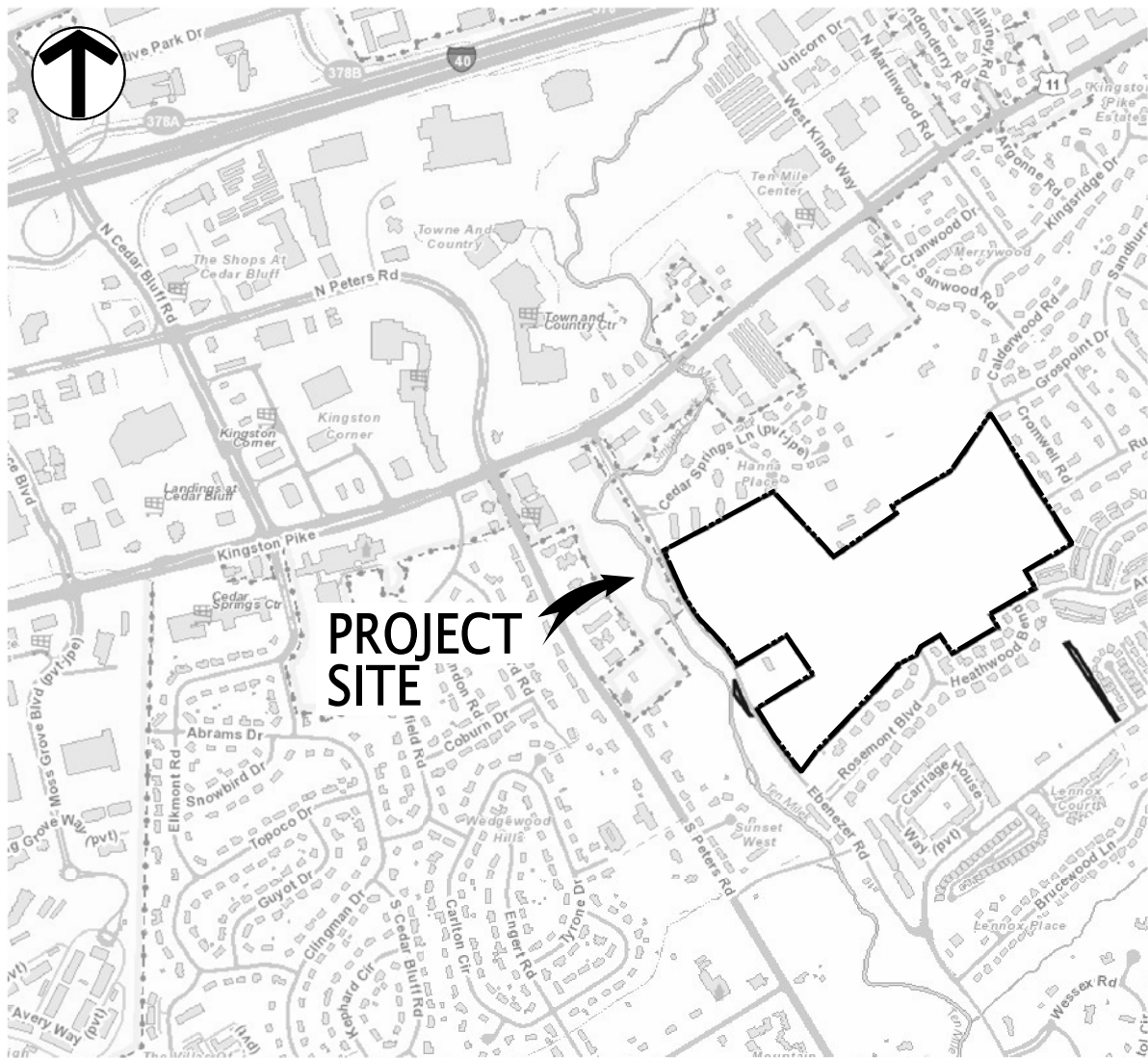


Figure 1: Location Map

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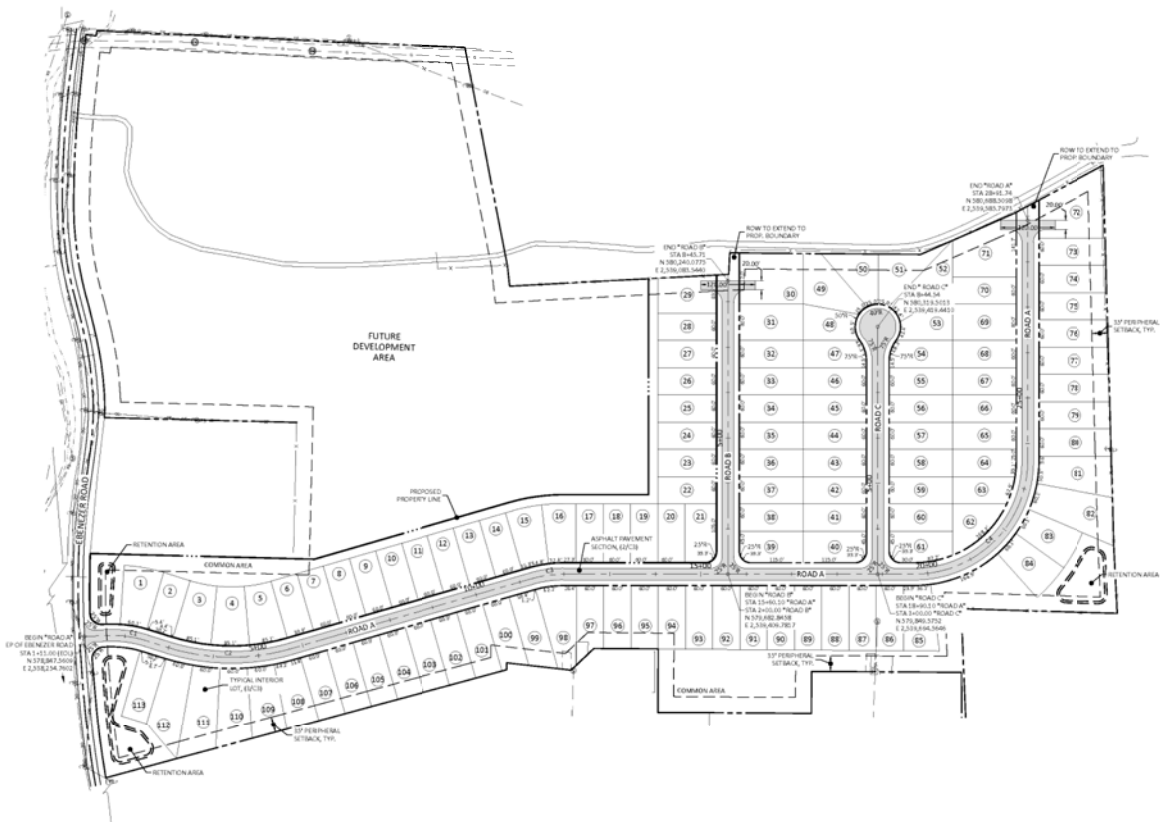


Figure 2: Site Plan

1.2 Study Area

The purpose of this study is to evaluate the impacts to the traffic conditions caused by the proposed development. Ebenezer Road is considered a north-south orientate roadway and Kingston Pike (US 11/US 70) 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
Ebenezer Road Subdivision
Study Area**

Intersection	Existing Traffic Control
Kingston Pike (US 11/US 70) at Ebenezer Road	Signalized

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
Ebenezer Road Subdivision
Existing Site Conditions**

Roadway	Speed Limit	Lanes	Road Width	Major Road Plan
Kingston Pike (US 11/US 70)	45 mph	5	~ 58 feet	Major Arterial
Ebenezer Road	30 mph	2	~ 21 feet	Minor Collector

The intersection of Kingston Pike (US 11/US 70) at Ebenezer Road is located within the City of Knoxville limits and the signal is maintained by the City of Knoxville Department of Engineering.

At the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road the eastbound approach (Kingston Pike) has a left turn lane with an approximate storage length of 140 feet and a right turn lane with an approximate storage length of 140 feet. The westbound approach (Kingston Pike) has a left turn lane with an approximate storage length of 90 feet and a right turn lane with an approximate

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storage length of 100 feet. The southbound approach (Driveway) has a separate right turn lane with an approximate storage length of 50 feet. The northbound approach (Ebenezer Road) has a separate right turn lane with an approximate storage length of 50 feet.

The measured width of Ebenezer Road south of the signalized intersection is 30 feet and tapers to 24 feet past the commercial driveway connections.

An aerial photo of the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road is included in Attachment 1.

Guardrails are located on both sides of Ebenezer Road south of Kingston Pike (US 11/US 70) at the Ten Mile Creek crossing. Pictures of the existing conditions of the guardrails are included in Attachment 1.

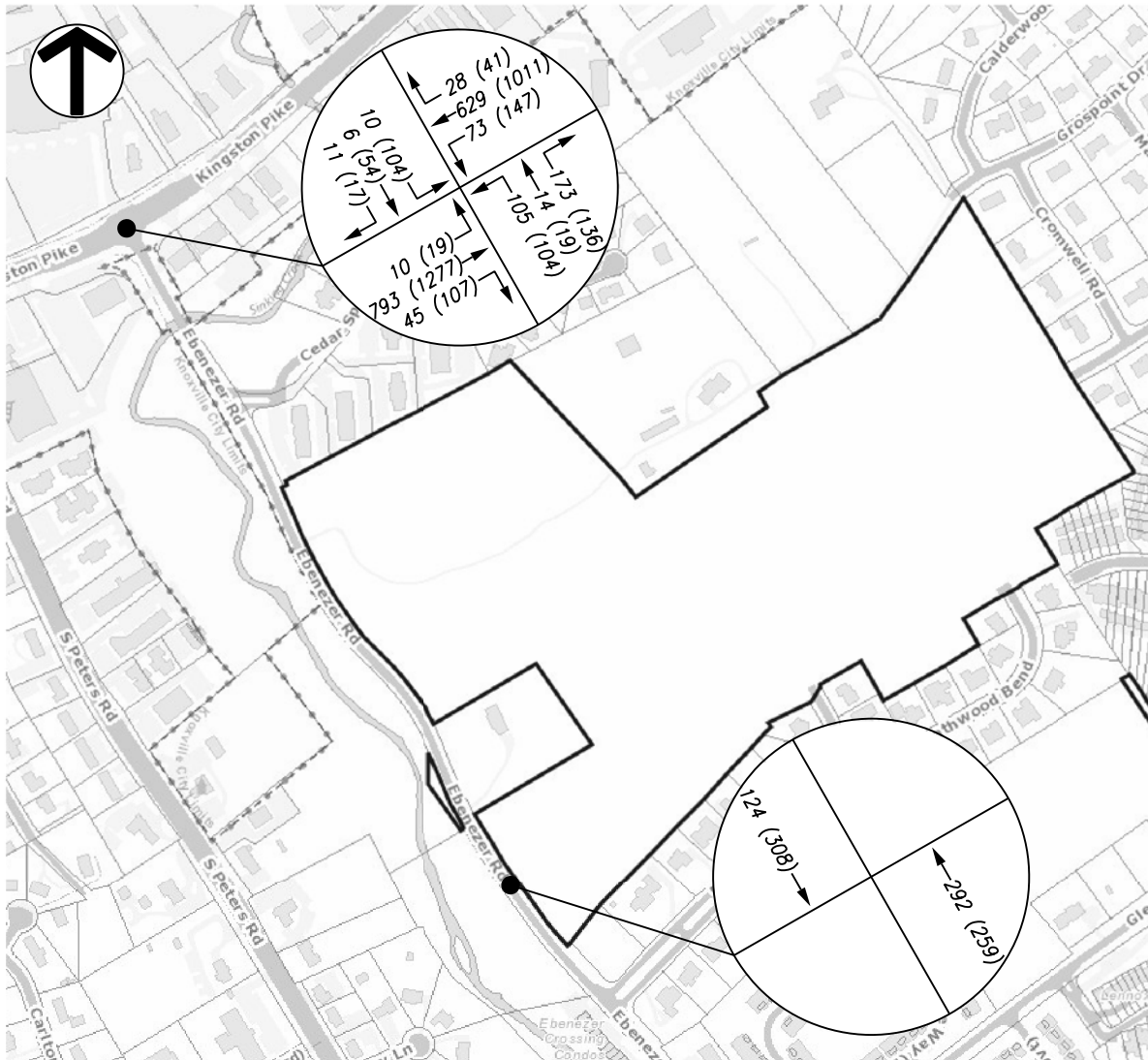
There are no sidewalks or bike infrastructure in the vicinity of the proposed development.

The Knoxville Area Transit (KAT) operates in the vicinity of the proposed development. Route 16 (Cedar Bluff Connector) stops include Parkwest Hospital, Cedar Bluff at Fox Lonas and Walmart Walbrook Drive. The nearest KAT stop to the development along Route 16 is currently located on Cedar Bluff Road near the Kroger Development which is approximately 1.1 miles walk to the Ebenezer Road Subdivision.

2 Existing Traffic Volumes

Ardurra conducted a peak hour turning movement count at the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road on Tuesday March 19, 2024. The AM peak hour occurred between 7:45 a.m. and 8:45 a.m. with an AM PHF of 0.97. The PM peak hour occurred between 5:00 p.m. and 6:00 p.m. with a PM PHF of 0.94.

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: 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 47000466 is located on Ebenezer Road between Kingston Pike (US 11/US 70) and George Williams Road in Knoxville, TN. The annual growth rate for this station over the last ten years is approximately -3.80%. The 2023 ADT was 4,581 vehicles per day.

TDOT count station ID 47000128 is located on Kingston Pike (US 11/US 70) west of the signalized intersection with Cedar Bluff Road. The annual growth rate for this station over the last ten years is approximately 0.59%. The 2022 ADT was 27,645 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.



LEGEND:

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

Figure 4: 2027 Background Peak Hour Traffic

3.1 Future Development Area

In addition to the background growth, the trips from the Future Development Area were calculated and included in the projected background peak hour traffic. The future development area is expected to be a proposed apartment complex with 275 garden style apartment units. A roadway connection between the two developments is under consideration for the purpose of emergency access.

The Knoxville-Knox County Planning Commission published a memorandum (“Local Trip Generation Rates for Multi-Family Residential Uses”, August 14, 2000) for the purpose of providing locally collected data for all multi-family residential developments. The fitted curve equations from the local study were used to calculate site trips for the future development area.

The land use worksheets are included in the attachments and a trip generation summary is shown in Table 3.1.

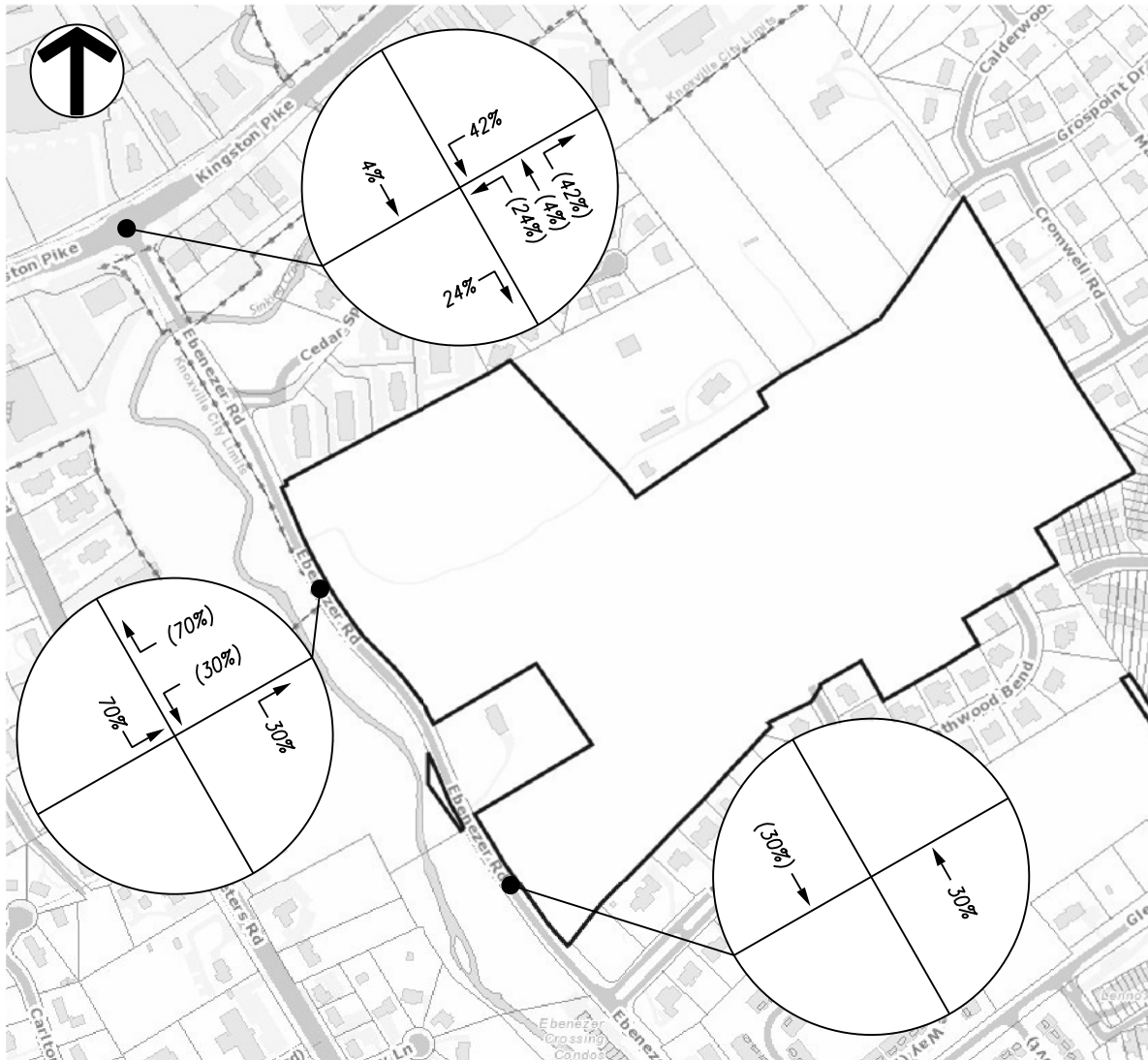
**Table 3.1-1
Future Development Area
Trip Generation Summary**

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Apartments (Local Trip Gen Study)	278 Units	2,392	30	107	108	88

The total combined new trips generated by the Future Development Area were estimated to be 2,392 daily trips. The estimated trips are 137 trips during the AM peak hour and 196 trips during the PM peak hour.

The directional distribution of the traffic generated by the Ebenezer Road Subdivision was determined using the existing traffic volumes in combination with the site plan layout. The entering/exiting traffic was assumed to be 70% Ebenezer Road northbound to/from Kingston Pike (US 11/US 70) and 30% Ebenezer Road southbound to/from Gleason Drive/Westland Drive.

Figures 5 and 6 show the Future Development Area – apartment peak hour trip distribution and site trips.



LEGEND:

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

Figure 5: Apartment Peak Hour Trip Distribution



LEGEND:

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

Figure 6: Apartment Peak Hour Site Trips

4 Trip Generation and Trip Distribution

The Ebenezer Road Subdivision proposes 113 single-family residential lots. A roadway connection between the two developments is under consideration for the purpose of emergency access. 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
Ebenezer Road Subdivision
Trip Generation Summary**

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Single Family Detached Housing (LUC)	113 Lots	1,129	21	62	71	41

The total combined new trips generated by the Ebenezer Road Subdivision were estimated to be 1,129 daily trips. The estimated trips are 83 trips during the AM peak hour and 112 trips during the PM peak hour.

Ebenezer Road at the intersection with Kingston Pike (US 11 / US 70) has an existing trip distribution of 70% northbound and 30% southbound during the AM peak hour and 45% northbound and 55% southbound during the PM peak hour.

The directional distribution of the traffic generated by the Ebenezer Road Subdivision was determined using the existing traffic volumes in combination with the site plan layout. The entering/exiting traffic was assumed to be 70% Ebenezer Road northbound to/from Kingston Pike (US 11 / US 70) and 30% Ebenezer Road southbound to/from Gleason Drive/Westland Drive.

Figures 7 and 8 show the subdivision peak hour trip distribution and site trips. Figure 9 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 Ebenezer Road Subdivision.



LEGEND:

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

Figure 7: Subdivision Peak Hour Trip Distribution



LEGEND:

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

Figure 8: Subdivision Peak Hour Site Trips



LEGEND:

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

Figure 9: 2027 Full Buildout Peak Hour Traffic

5 Projected Capacity and Level of Service

Intersection capacity analyses were performed using the Synchro 11 Software at signalized intersection and the Highway Capacity Software 2023 at the two-way stop-controlled intersections in order to evaluate the AM and PM peak hours for existing, background and full buildout conditions. The existing signal timing at the signalized intersection was provided by City of Knoxville Department of Engineering and is included in Attachment 5.

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

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**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)
Kingston Pike (US 11/US 70) @ Ebenezer Road	AM Peak Intersection	20.8 / C	21.0 / C	22.4 / C
	PM Peak Intersection	29.3 / C	30.7 / C	37.5 / D
Ebenezer Road @ Apartment Driveway	AM Peak WB Approach			12.5 / B
	SB Approach			1.2 / A
	PM Peak WB Approach			14.1 / B
	SB Approach			1.7 / A
Ebenezer Road @ Driveway	AM Peak WB Approach			11.5 / B
	SB Approach			0.8 / A
	PM Peak WB Approach			12.5 / B
	SB Approach			1.4 / A

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

6 Queue Analysis

Table 6-1 presents the Synchro traffic queueing summary for the 95th percentile queue at the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road for both the AM and PM peak hour.

**Table 6-1
Synchro Queue Summary**

Intersection	Movement	Storage Capacity (ft)	Existing Conditions		Background Conditions		Full Buildout Conditions	
			AM	PM	AM	PM	AM	PM
Kingston Pk (US 70/US 11) @ Ebenezer Rd	EBL	140	16	27	16	28	16	29
	EBT	585	292	#622	303	#691	310	#731
	EBR	140	0	22	0	24	0	54
	WBL	90	46	128	48	139	59	215
	WBT	1,000+	164	277	171	288	171	288
	WBR	100	0	1	0	1	0	1
	NBT	1,000+	118	#169	120	#180	163	#259
	NBR	50	54	61	55	65	101	127
	SBT	240	31	#257	31	#268	33	#281
SBR	50	0	0	0	0	0	0	

Notes:

The # footnote indicates that the volume for the 95th percentile cycle exceeds capacity.

Bold indicates queue length exceeds available storage capacity.

Bold cells indicate that the queue lengths are more than the available storage. The 95th percentile queue length is defined as the queue length that has only a 5-percent probability of being exceeded during the analysis time period. The 95th percentile queue length is typically used to determine the length of turning lanes in order to minimize the risk of blockage. Synchro assumes a vehicle length of 25 feet.

The northbound right turn lane has an existing storage length of 50 feet and an additional 30 feet of taper length before the queue from the signalized intersection would block the driveway to the retail strip center. The signalized intersection capacity analysis shows the full buildout 95% queue length for the northbound right turn lane of approximately 101 feet (4 vehicles) during the AM peak hour and 127 feet (5 vehicles) during the PM peak hour and the full buildout 50% queue length for the northbound right turn lane of approximately 28 feet (2 vehicles) during the AM peak hour and 44 feet (2 vehicles) during the PM peak hour.

Therefore; the existing northbound right turn lane storage will exceed capacity and cause spillback into the thru lane less than 50% of time after the completion of the Ebenezer Road Subdivision.

7 Turn Lane Warrant Analysis

The intersection of Ebenezer Road at the proposed apartment roadway connection and the proposed subdivision roadway connection was evaluated to determine if a northbound right turn lane or a southbound 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 Ebenezer Road at the proposed roadway connection to the Future Development Area a southbound left turn is warranted during the PM peak hour and a northbound right turn lane is not warranted during either the AM and or PM peak hours after the full buildout of the Ebenezer Road Subdivision and Future Development Area.

At the intersection of Ebenezer Road at the proposed roadway connection to the Ebenezer Road Subdivision neither a southbound left turn lane nor a northbound right turn lane are warranted during the AM or PM peak hours.

The turn lane warrant worksheets and analysis are included in Attachment 9.

8 Conclusions and Recommendations

8.1 Kingston Pike (US 11/US 70) at Ebenezer Road

The existing intersection of Kingston Pike (US 11/US 70) at Ebenezer Road is a signalized four-legged intersection. The southbound approach is an existing shopping center driveway connection. The existing signal timing was provided by the City of Knoxville.

Under the existing and 2027 background conditions the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road operates at an acceptable LOS C during both the AM and PM peak hours.

After the completion of the Ebenezer Road Subdivision including the future development area the traffic conditions for the signalized intersection of Kingston Pike (US 11/US 70) at Ebenezer Road will operate at an acceptable LOS C during the AM peak hour and a LOS D during the PM peak hour.

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 northbound right turn lane has an existing storage length of 50 feet and an additional 30 feet of taper length before the queue from the signalized intersection would block the driveway to the retail strip center. The signalized intersection capacity analysis shows the full buildout 95% queue length for the northbound right turn lane of approximately 101 feet (4 vehicles) during the AM peak hour and 127 feet (5 vehicles) during the PM peak hour and the full buildout 50% queue length for the northbound right turn lane of approximately 28 feet (2 vehicles) during the AM peak hour and 44 feet (2 vehicles) during the PM peak hour.

The northbound right turn lane (Ebenezer Road) will exceed capacity after the completion of the Ebenezer Road Subdivision and Future Development Area. There are several existing constraints including the location of guard rails and power poles and the proximity to Ten Mile Creek that would make extending the storage length of the right turn lane difficult to construct. Ardurra recommends that any future intersection improvements be reviewed, coordinated and approved by both the City of Knoxville Department of Engineering and Knox County Engineering and Public Works.

8.2 Ebenezer Road at Future Development Area

The proposed full buildout conditions at the unsignalized intersection of Ebenezer Road at the Future Development Area Roadway were analyzed using the Highway Capacity Software (HCS2023).

A southbound left turn lane is warranted during the PM peak hour and a northbound right turn lane is not warranted at the intersection of Ebenezer Road at Future Development Area Roadway per the Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy."

The southbound 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."

After the completion of the full buildout of the Ebenezer Road Subdivision including the proposed roadway improvements the intersection of Ebenezer Road at Future Development Area Roadway will operate as follows. The westbound approach (Apartment Roadway) will operate at a LOS B during both the AM and PM peak

hours and the southbound approach (Ebenezer Road) will operate at a LOS A during both the AM and PM peak hours.

Ebenezer Road is classified as Minor 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 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 October 6, 2022.

The location of the proposed apartment roadway for the Future Development Area is still under consideration.

Ardurra recommends that the intersection sight distance be certified by a land surveyor prior to construction in order to verify that Ebenezer Road has adequate intersection sight distance at the proposed apartment 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.

8.3 Ebenezer Road at Ebenezer Subdivision

The proposed full buildout conditions at the unsignalized intersection of Ebenezer Road at the Ebenezer Subdivision Roadway were analyzed using the Highway Capacity Software (HCS2023).

Neither a southbound left turn lane nor a northbound right turn lane is warranted at the intersection of Ebenezer Road at Ebenezer Subdivision Roadway per the Knox County Department of Engineering and Public Works handbook, “Access Control and Driveway Design Policy.”

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

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AM and PM peak hours and the southbound approach (Ebenezer Road) will operate at a LOS A during both the AM and PM peak hours.

Ebenezer Road is classified as Minor 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 Ebenezer Subdivision Roadway is located approximately 535 feet north of Rosemont Boulevard; 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 30 mph is 300 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 greater than 300 feet looking both northbound and southbound. Attachment 10 includes pictures of the intersection sight distance at the intersection of Ebenezer Road at Ebenezer Subdivision Roadway.

Ardurra recommends that the intersection sight distance be certified by a land surveyor prior to construction in order to verify that Ebenezer Road has adequate intersection sight distance at the proposed apartment 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



Kingston Pike (SR 70) at Ebenezer Road - Signalized



Ebenezer Road Guardrail - Northbound



Ebenezer Road Guardrail – Southbound

Attachment 2 Traffic Counts

Project: 330.029 Ebenezer Rd Subdivision
Intersection: Kingston Pike at Ebenezer Road
Date Conducted: Tuesday March 19, 2024

Start	Driveway Southbound				Kingston Pike Westbound				Ebenezer Road Northbound				Kingston Pike Eastbound				Int. Total
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	
7:00 AM	0	0	0	0	7	81	3	91	13	0	18	31	0	65	3	68	190
7:15 AM	0	0	2	2	6	104	1	111	17	1	32	50	0	130	8	138	301
7:30 AM	2	4	2	8	14	98	4	116	27	1	45	73	0	154	9	163	360
7:45 AM	1	0	2	3	17	158	4	179	31	4	48	83	4	209	13	226	491
Total	3	4	6	13	44	441	12	497	88	6	143	237	4	558	33	595	1342
8:00 AM	4	3	3	10	15	141	3	159	29	2	49	80	3	217	15	235	484
8:15 AM	1	3	1	5	21	160	8	189	20	2	46	68	1	213	10	224	486
8:30 AM	4	0	5	9	20	170	13	203	25	6	30	61	2	154	7	163	436
8:45 AM	5	7	2	14	14	150	4	168	22	3	36	61	3	182	12	197	440
Total	14	13	11	38	70	621	28	719	96	13	161	270	9	766	44	819	1846
9:00 AM	4	3	0	7	15	115	9	139	20	2	26	48	0	139	14	153	347
9:15 AM	7	4	1	12	6	171	6	183	20	2	21	43	2	158	19	179	417
9:30 AM	4	1	0	5	13	129	8	150	22	0	26	48	1	142	11	154	357
9:45 AM	3	0	0	3	21	173	9	203	15	0	28	43	3	163	11	177	426
Total	18	8	1	27	55	588	32	675	77	4	101	182	6	602	55	663	1547
10:00 AM	9	6	2	17	11	158	10	179	18	5	10	33	1	133	8	142	371
10:15 AM	4	6	3	13	7	175	11	193	13	4	17	34	3	196	10	209	449
10:30 AM	9	4	3	16	13	193	13	219	16	6	22	44	2	147	8	157	436
10:45 AM	6	4	3	13	13	194	15	222	17	3	16	36	1	191	12	204	475
Total	28	20	11	59	44	720	49	813	64	18	65	147	7	667	38	712	1731
11:00 AM	14	6	4	24	14	199	14	227	21	8	15	44	6	189	14	209	504
11:15 AM	5	4	8	17	14	220	12	246	26	4	16	46	2	207	11	220	529
11:30 AM	12	6	4	22	21	191	14	226	23	6	15	44	6	185	22	213	505
11:45 AM	7	7	6	20	19	259	12	290	17	5	25	47	5	265	18	288	645
Total	38	23	22	83	68	869	52	989	87	23	71	181	19	846	65	930	2183
12:00 PM	11	3	7	21	25	226	12	263	24	7	22	53	6	231	9	246	583
12:15 PM	15	1	7	23	20	259	16	295	20	2	27	49	4	255	17	276	643
12:30 PM	14	10	3	27	13	264	12	289	23	3	28	54	3	231	28	262	632
12:45 PM	6	5	4	15	24	269	10	303	19	7	19	45	7	256	15	278	641
Total	46	19	21	86	82	1018	50	1150	86	19	96	201	20	973	69	1062	2499
1:00 PM	19	4	6	29	16	197	14	227	26	1	18	45	6	207	15	228	529
1:15 PM	12	3	5	20	15	268	18	301	24	5	18	47	2	262	25	289	657
1:30 PM	12	7	4	23	14	261	15	290	29	2	16	47	5	221	23	249	609
1:45 PM	8	2	4	14	19	307	19	345	29	4	17	50	5	246	18	269	678
Total	51	16	19	86	64	1033	66	1163	108	12	69	189	18	936	81	1035	2473
2:00 PM	17	6	8	31	17	243	18	278	16	4	22	42	3	213	29	245	596
2:15 PM	13	7	6	26	23	261	14	298	19	3	16	38	2	251	22	275	637
2:30 PM	4	7	3	14	16	269	11	296	20	5	15	40	4	217	20	241	591
2:45 PM	9	4	3	16	19	251	19	289	28	4	22	54	3	244	13	260	619
Total	43	24	20	87	75	1024	62	1161	83	16	75	174	12	925	84	1021	2443
3:00 PM	9	8	6	23	22	231	12	265	32	2	23	57	3	237	22	262	607
3:15 PM	9	8	1	18	21	270	15	306	20	4	17	41	5	269	29	303	668
3:30 PM	11	7	4	22	26	257	15	298	33	8	30	71	1	221	20	242	633
3:45 PM	11	8	5	24	37	304	14	355	26	2	18	46	5	266	20	291	716
Total	40	31	16	87	106	1062	56	1224	111	16	88	215	14	993	91	1098	2624
4:00 PM	12	7	5	24	26	218	11	255	32	1	29	62	10	264	27	301	642
4:15 PM	6	7	2	15	27	251	11	289	28	3	23	54	4	320	27	351	709
4:30 PM	21	9	1	31	32	226	12	270	28	7	29	64	3	303	23	329	694
4:45 PM	12	11	2	25	28	261	14	303	18	4	28	50	4	328	25	357	735
Total	51	34	10	95	113	956	48	1117	106	15	109	230	21	1215	102	1338	2780
5:00 PM	28	15	2	45	44	247	7	298	35	3	41	79	5	309	25	339	761
5:15 PM	30	13	4	47	38	253	8	299	29	6	40	75	6	313	28	347	768
5:30 PM	27	11	6	44	33	231	13	277	18	5	24	47	1	299	33	333	701
5:45 PM	19	15	5	39	32	280	13	325	22	5	31	58	7	356	21	384	806
Total	104	54	17	175	147	1011	41	1199	104	19	136	259	19	1277	107	1403	3036
Grand Total	436	246	154	836	868	9343	496	10707	1010	161	1114	2285	149	9758	769	10676	24504
Approach %	52.2	29.4	18.4		8.1	87.3	4.6		44.2	7.0	48.8		1.4	91.4	7.2		
Total %	1.8	1.0	0.6	3.4	3.5	38.1	2.0	43.7	4.1	0.7	4.5	9.3	0.6	39.8	3.1	43.6	

Project: 330.029 Ebenezer Rd Subdivision
 Intersection: Kingston Pike at Ebenezer Road
 Date Conducted: Tuesday March 19,2024

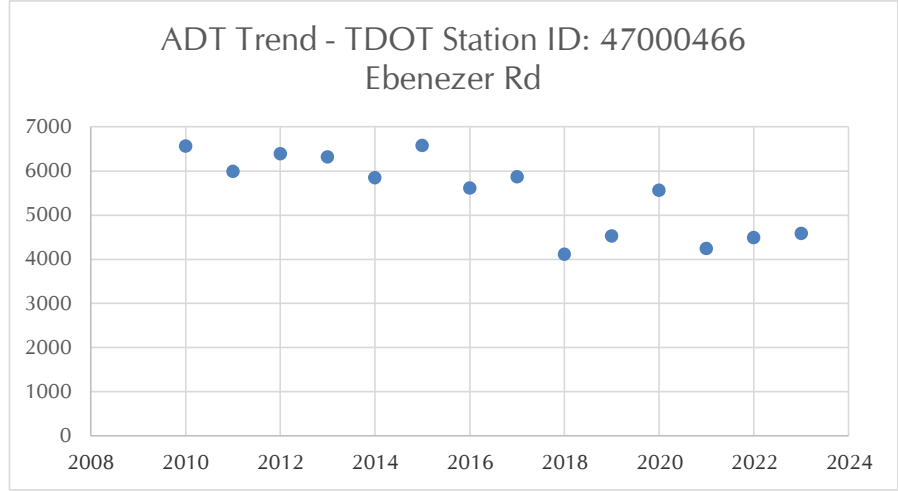
AM Peak Hour	7:45 AM - 8:45 AM	1897
PM Peak Hour	5:00 PM - 6:00 PM	3036

Start	Driveway Southbound				Kingston Pike Westbound				Ebenezer Road Northbound				Kingston Pike Eastbound				Int. Total
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:45 AM																	
7:45 AM	1	0	2	3	17	158	4	179	31	4	48	83	4	209	13	226	491
8:00 AM	4	3	3	10	15	141	3	159	29	2	49	80	3	217	15	235	484
8:15 AM	1	3	1	5	21	160	8	189	20	2	46	68	1	213	10	224	486
8:30 AM	4	0	5	9	20	170	13	203	25	6	30	61	2	154	7	163	436
Total Volume	10	6	11	27	73	629	28	730	105	14	173	292	10	793	45	848	1897
Future (1.0% over 3 yrs)	10	6	11	27	75	648	29	730	108	14	178	292	10	817	46	848	1954
PHF	0.63	0.50	0.55		0.87	0.93	0.54		0.85	0.58	0.88		0.63	0.91	0.75		0.97
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
5:00 PM	28	15	2	45	44	247	7	298	35	3	41	79	5	309	25	339	761
5:15 PM	30	13	4	47	38	253	8	299	29	6	40	75	6	313	28	347	768
5:30 PM	27	11	6	44	33	231	13	277	18	5	24	47	1	299	33	333	701
5:45 PM	19	15	5	39	32	280	13	325	22	5	31	58	7	356	21	384	806
Total Volume	104	54	17	175	147	1011	41	1199	104	19	136	259	19	1277	107	1403	3036
Future (1.0% over 3 yrs)	107	56	18	175	151	1042	42	1199	107	20	140	259	20	1316	110	1403	3128
PHF	0.87	0.90	0.71		0.84	0.90	0.79		0.74	0.79	0.83		0.68	0.90	0.81		0.94

Attachment 3
ADT Trends

Adjusted Average
Daily Traffic

	Year	Adjusted Average Daily Traffic
10	2010	6563
11	2011	5988
12	2012	6391
13	2013	6321
14	2014	5845
15	2015	6576
16	2016	5609
17	2017	5866
18	2018	4111
19	2019	4526
20	2020	5562
21	2021	4240
22	2022	4491
23	2023	4581



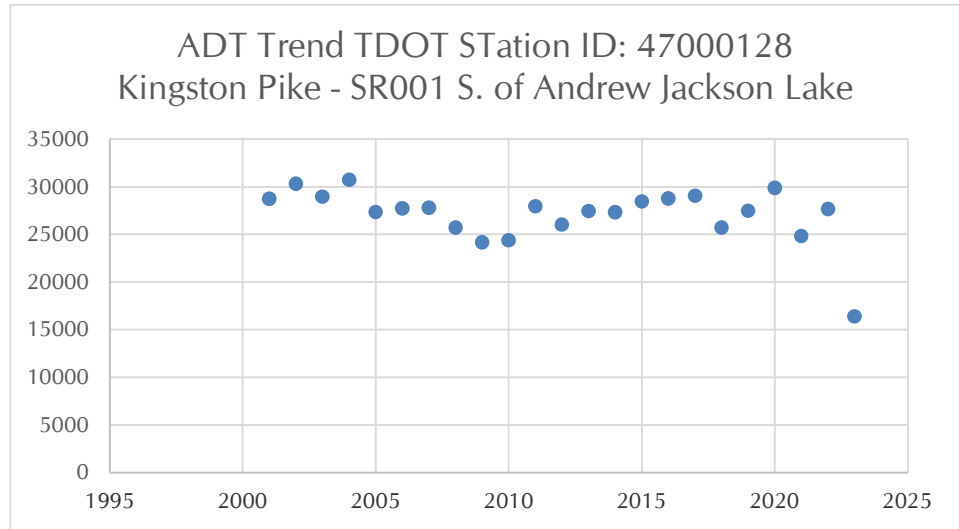
Most Recent Trend Line Growth

Year	ADT
2013	6321
2023	4581

Annual Percent Growth

-3.80%

Year	Adjusted Average Daily Traffic
2001	28732
2002	30319
2003	28953
2004	30734
2005	27340
2006	27738
2007	27777
2008	25714
2009	24173
2010	24388
2011	27957
2012	26019
2013	27441
2014	27306
2015	28450
2016	28758
2017	29058
2018	25708
2019	27477
2020	29865
2021	24832
2022	27645
2023	16397



Most Recent Trend Line Growth

Year	ADT
2012	26019
2022	27645

Annual Percent Growth

0.59%

Attachment 4
Trip Generation

Project: Ebenezer Subdivision - Future Development Area
Date Conducted: 4/12/2024

Local Apartment Trip Generation Study
278 Units

Average Daily Traffic

$$T = 15.193(X)^{0.899}$$
$$T = 15.193(278)^{0.899}$$
$$T = 2392$$

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.

$$T = 0.758(X)^{0.924}$$
$$T = 0.758(278)^{0.924}$$
$$T = 137$$

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

$$T = 0.669(X) + 10.069$$
$$T = 0.669(278) + 10.069$$
$$T = 196$$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	2392	50%	50%	1196	1196
AM Peak Hour	137	22%	78%	30	107
PM Peak Hour	196	55%	45%	108	88

Project: Ebenezer Road Subdivision

Date Conducted: 4/12/2024

Single-Family Detached Housing (LUC 210)

113 Lots

Average Daily Traffic

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

$$\ln(T) = 0.92 \ln(113) + 2.68$$

$$T = 1129$$

Peak Hour of Adjacent Street Traffic

One Hour Between 7 and 9 a.m.

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

$$\ln(T) = 0.91 \ln(113) + 0.12$$

$$T = 83$$

Peak Hour of Adjacent Street Traffic

One Hour Between 4 and 6 p.m.

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

$$\ln(T) = 0.94 \ln(113) + 0.27$$

$$T = 112$$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1129	50%	50%	565	565
AM Peak Hour	83	25%	75%	21	62
PM Peak Hour	112	63%	37%	71	41



MEMORANDUM

To: Traffic Impact Study Reviewers and Preparers (see attached list)

From: Mike Conger *ADC*

Date: August 14, 2000

Subject: Local Trip Generation Rates for Multi-Family Residential Uses

Attached please find a summary of the final report with data plots for the Knox County Local Apartment Trip Generation Study. As you will recall, this report was discussed when the traffic impact study group last convened this past February. A consensus was reached at that meeting that the trip generation rates developed in the local study should be used for new apartment complexes and any other "multi-family" residential uses that are being proposed.

The MPC voted at its July 2000 meeting to officially amend the Traffic Impact Study Guidelines with language which reads that "trip generation rates for proposed uses shall be calculated using the latest edition of the ITE Trip Generation Manual, or using local data when it is available". This amendment allows the full implementation of the new rates, and they should be used for future proposed multi-family developments unless it can be demonstrated otherwise.

Thanks for your assistance and cooperation in this matter, if there are any questions or comments, please let me know.

TRAFFIC IMPACT STUDY REVIEWER & PREPARER GROUP

Name	Organization	Phone Number
Daniel Armstrong	Wilbur Smith	584-8584
Rusty Baksa	Land Dev. Solutions	671-2281
Kim Henry Begg	SITE, inc.	693-5010
Mark Best	TDOT	594-9170
Alan Childers	Cannon & Cannon	988-4818
Steve Drummer	Barge Waggoner	637-2810
Mark Geldmeier	City of Knoxville	215-6100
John Gould	Wilbur Smith	584-8584
Barbara Hatcher	SITE, inc.	693-5010
John Heid	AR/TEC	681-8848
Bill Kervin	Allen Hoshall	694-1834
Hollis Loveday	Wilbur Smith	584-8584
David McGinley	City of Knoxville	215-2148
David Moore	TDOT	594-9170
Linda Mosch	Consultant	777-2025
Amanda Rule	TDOT	594-9170
Cindy Pionke	Knox County	215-5800
Pam Porter	TDOT	594-9170
John Sexton	Allen Hoshall	694-1834
Jim Snowden	Knox County	215-5800
Darcy Sullivan	SITE, inc.	693-5010
Jeff Welch	MPC	215-2500

KNOX COUNTY
LOCAL APARTMENT TRIP GENERATION STUDY

PURPOSE

A Traffic Impact Study (TIS) is currently required in Knox County when a proposed development is projected to generate in excess of 750 trips per day. The determinations of when the threshold is met as well as all subsequent analyses in the TIS are performed using the rates and equations given in the Institute of Transportation Engineers (ITE) Trip Generation Manual. Local governmental agencies rely heavily on the accuracy of these trip generation rates in order to correctly predict the impacts of a proposed development on the transportation system. Therefore, in certain instances, it is logical to verify whether the “national” rates and equations given in the ITE Trip Generation Manual are appropriate for use in a specific local area or region.

The decision was made to study the local trip-making characteristics of apartments because of the discrepancy between the trip generation rates for apartments and single family residential land uses as given in the ITE Trip Generation Manual. While these two land uses are similar in nature, the Trip Generation Manual predicts about three less trips per dwelling unit generated by apartments for the average weekday. Additionally the Trip Generation Manual points out that due to the age of their database, which dates back to the 1960’s, “the rates for apartments probably had changed over time”. It is also assumed that some of the ITE data had come from larger metropolitan areas with denser development and greater transit use than Knox County, which would contribute to lower trip generation rates. Therefore, this study will be used to either verify the rates given in the Trip Generation Manual or generate new ones that can be applied to locally proposed apartment developments.

PROCEDURE

The procedures recommended by ITE in conducting local trip generation studies were generally followed for this study, along with some important assumptions that have made. ITE has published a proposed recommended practice entitled “Trip Generation Handbook” which specifically outlines procedures for conducting local trip generation studies and establishing new rates and equations.

The first step in the study was to define the number and location of the sites to be studied, as well as the counting methodology. Initially 14 sites were selected, although one apartment complex – the College Park Apartments – was later omitted due to uncharacteristically high traffic generation numbers. The number of sites used in this study far exceeds the recommended minimum amount suggested by ITE, which is five sites. Traffic counts were taken for week-long periods at 15-minute intervals between July 22, 1996 and August 9, 1996 at the access points to the apartment complexes. A Technical Appendix to this report contains the traffic count data collected at each apartment complex.

RESULTS

The traffic count data was analyzed using spreadsheets in order to determine the weighted average rates and regression equations. In order to be considered valid, the local rates and equations for each time period of analysis that were generated must meet certain statistical criteria. First, the standard deviation of the independent variable (dwelling units) should be no more than 110 percent of the weighted average rate; and secondly, the regression equations require a computed coefficient of determination (R^2) value of at least 0.75 before good data fit is indicated. This statistical criteria is met by the local data results, and in fact it often exceeds the level of data fit given by their counterparts in the ITE Trip Generation Manual. Finally, in order to simplify the use of the local data, plots were generated that appear identical to the actual ones in the ITE Trip Generation Manual.

The resulting rates and equations calculated from the local data indicate that the average weekday trip generation of apartments in this area is well above the national rates reported in the ITE manual. For example, the locally computed average rate for number of trips generated during a weekday is 35% higher than the rate given by ITE (increase from 6.63 trips per dwelling unit to 9.03 trips per dwelling unit). The trip generation rates do not increase as much for the AM and PM peak hours however. The local rate is roughly 8% higher for the AM peak, and 16% higher for the PM peak. The plots from the ITE Trip Generation Manual are included in the Technical Appendix for comparison purposes.

ASSUMPTIONS MADE

Some important assumptions have been made which may affect the results of the local data that was collected:

- It is important to note that the local trip generation rates were computed for the *total* number of dwelling units in the apartment complex, and not necessarily for the number of *occupied* dwelling units. There are several reasons why this was done, chiefly because of the need for comparability with the rates given in ITE Trip Generation Manual, as it does not specify whether the dwelling units are occupied. According to ITE procedures the selected sites must only be of “reasonably full occupancy (i.e. at least 85%)”. The Apartment Association of Greater Knoxville (AAGK) publishes quarterly reports on occupancy levels of apartment complexes, and the report covering the period of the data collection was reviewed to determine occupancy levels. According to the AAGK report from July 1, 1996 – September 30, 1996 all of the apartment complexes surveyed in this study met the minimum 85% occupancy level, with an average occupancy rate for all sites studied of 94%.
- The count data that was collected at each apartment complex was used “raw” meaning that it was not factored for possible daily or seasonal variations. Once again, according to an ITE representative it is not known whether the data used in the Trip Generation Manual was factored or not, so therefore in order to be able to compare

local rates to those in the manual you must assume that count data should not be factored. Additionally, it was felt that apartment complexes would generally not be as susceptible to major seasonal fluctuations as other land uses might be. The local rates were also developed using count data that was collected and averaged over an entire week, which should limit some of the daily variations. Finally, reliable local daily and seasonal variation factors do not truly exist.

CONCLUSION

The local apartment study methodology and results were distributed for comment to a group of local transportation professionals who are directly responsible for either preparing or reviewing traffic impact studies. A meeting was held between this group on February 16, 2000 in order to gather comments and discuss the study in greater detail. The following conclusions are based on the discussion and consensus reached at this meeting:

1. The trip generation rates and equations meet statistical requirements and resulted from a study that followed accepted procedures; therefore they should be adopted for future use. Furthermore, the rates and equations are recommended for use in reviewing the traffic impact of any development termed as “multi-family”, such as townhouse and condominium developments due to their similarity to apartment complexes.
2. The Traffic Access and Impact Study Guidelines and Procedures adopted by MPC should be amended with the language that local data should be used when available, which will allow the implementation of these new multi-family trip generation rates.
3. The following suggestions were made for future consideration:
 - This study should be updated with data collected from local townhouse and condominium developments in order to further justify the use of the new trip generation rates.
 - A statistical comparison should be made between any newly developed rates and the ITE single family trip generation rates to determine if there is a significant difference. If there is no difference then perhaps ITE single-family rates could be used for any residential development proposed in Knox County.

Local Apartment Trip Generation Study

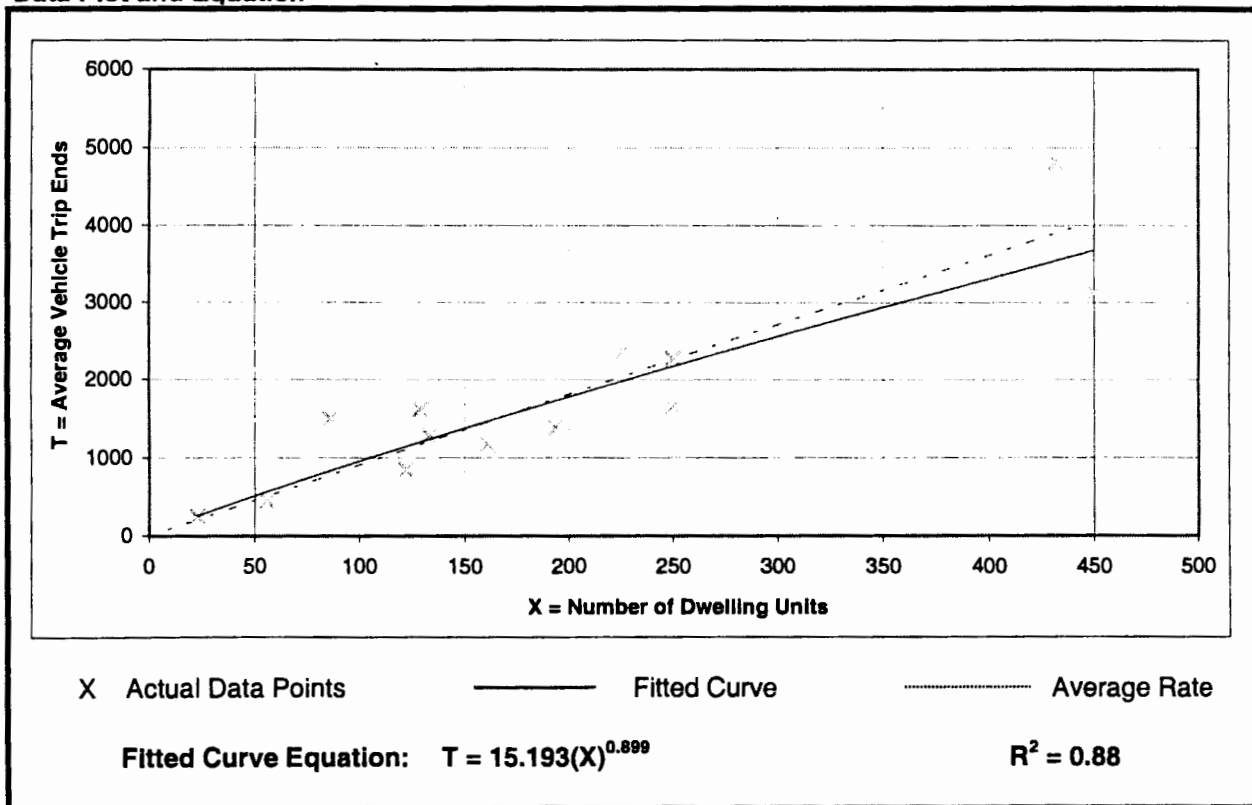
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 13
Average Number of Dwelling Units: 193
Directional Distribution: 50% entering, 50% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
9.03	6.59 - 17.41	2.47

Data Plot and Equation



Local Apartment Trip Generation Study

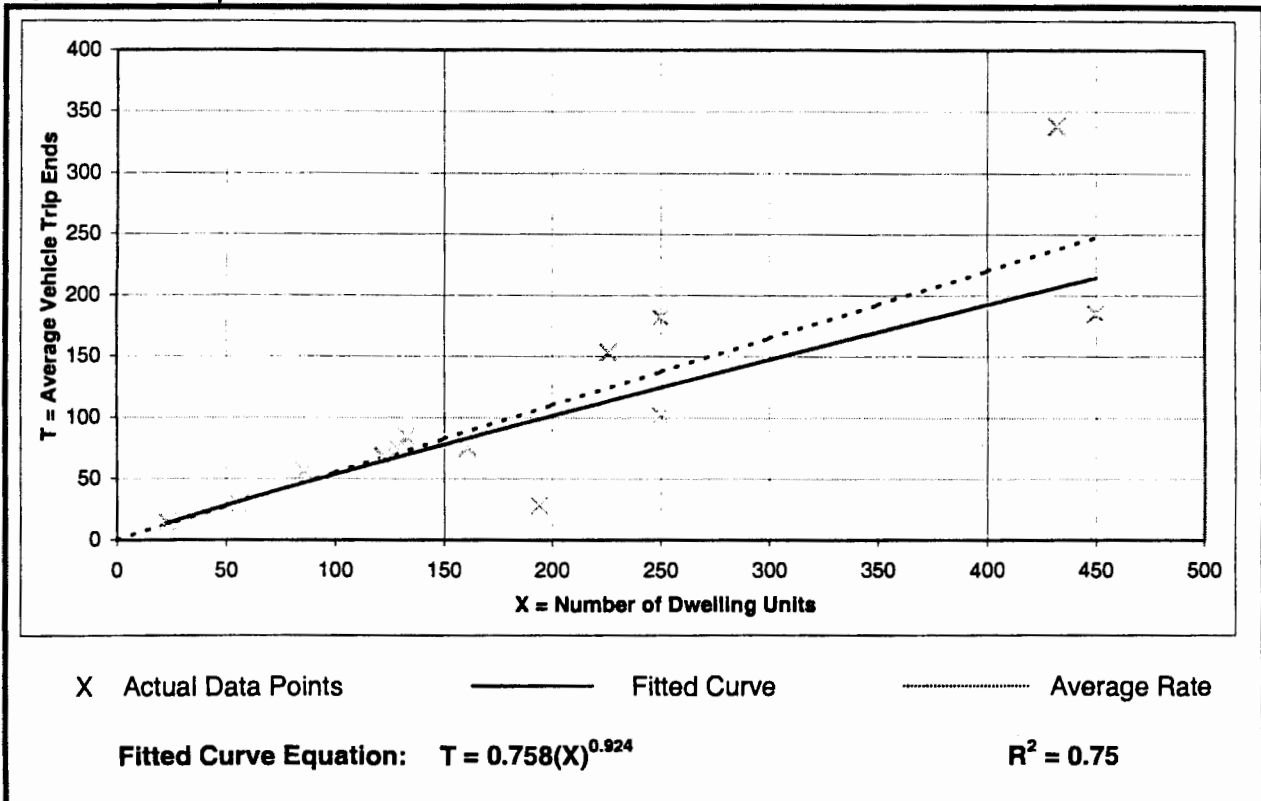
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 22% entering, 78% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.55	0.14 - 0.78	0.18

Data Plot and Equation



Local Apartment Trip Generation Study

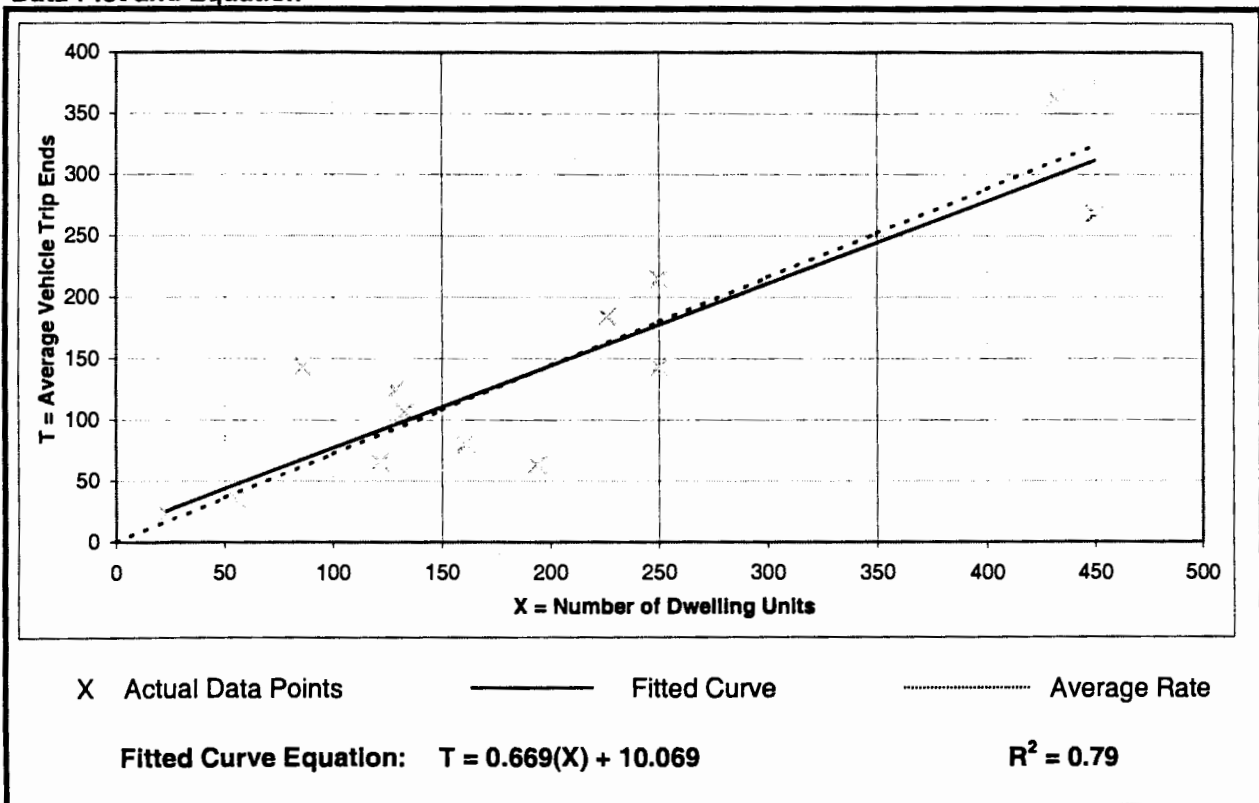
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 55% entering, 45% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.72	0.32 - 1.66	0.25

Data Plot and Equation



Single-Family Detached Housing (210)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 174

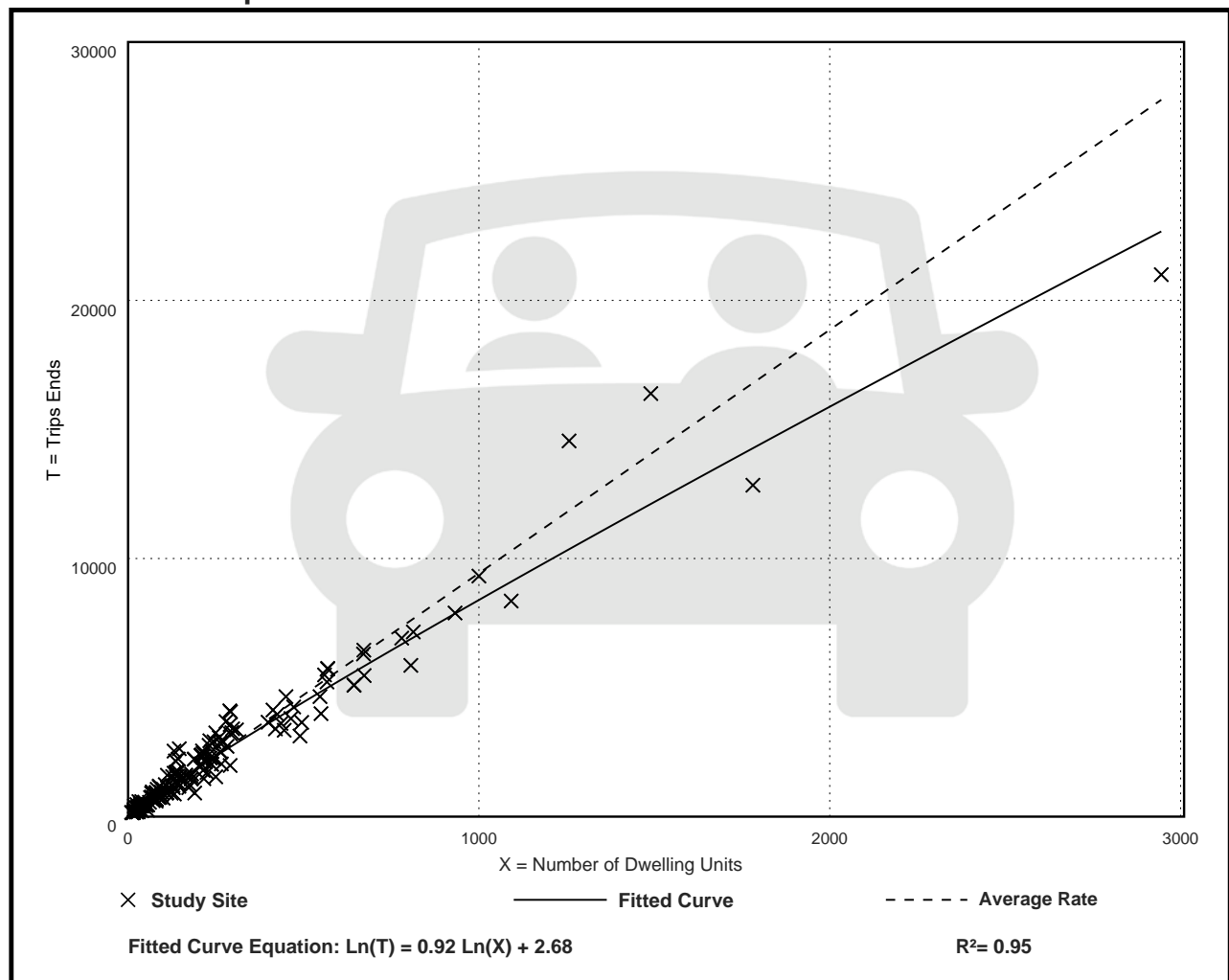
Avg. Num. of Dwelling Units: 246

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

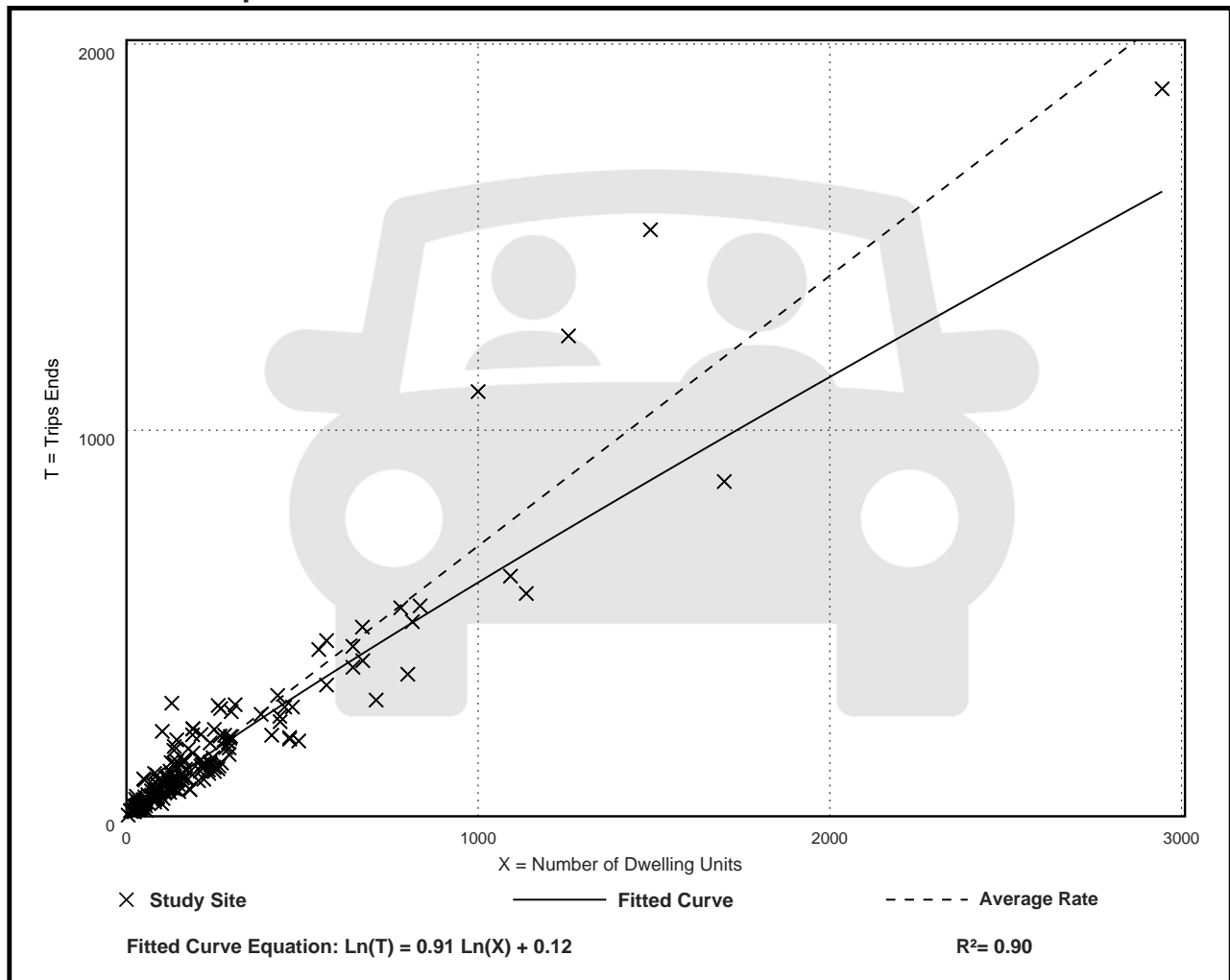
Avg. Num. of Dwelling Units: 226

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

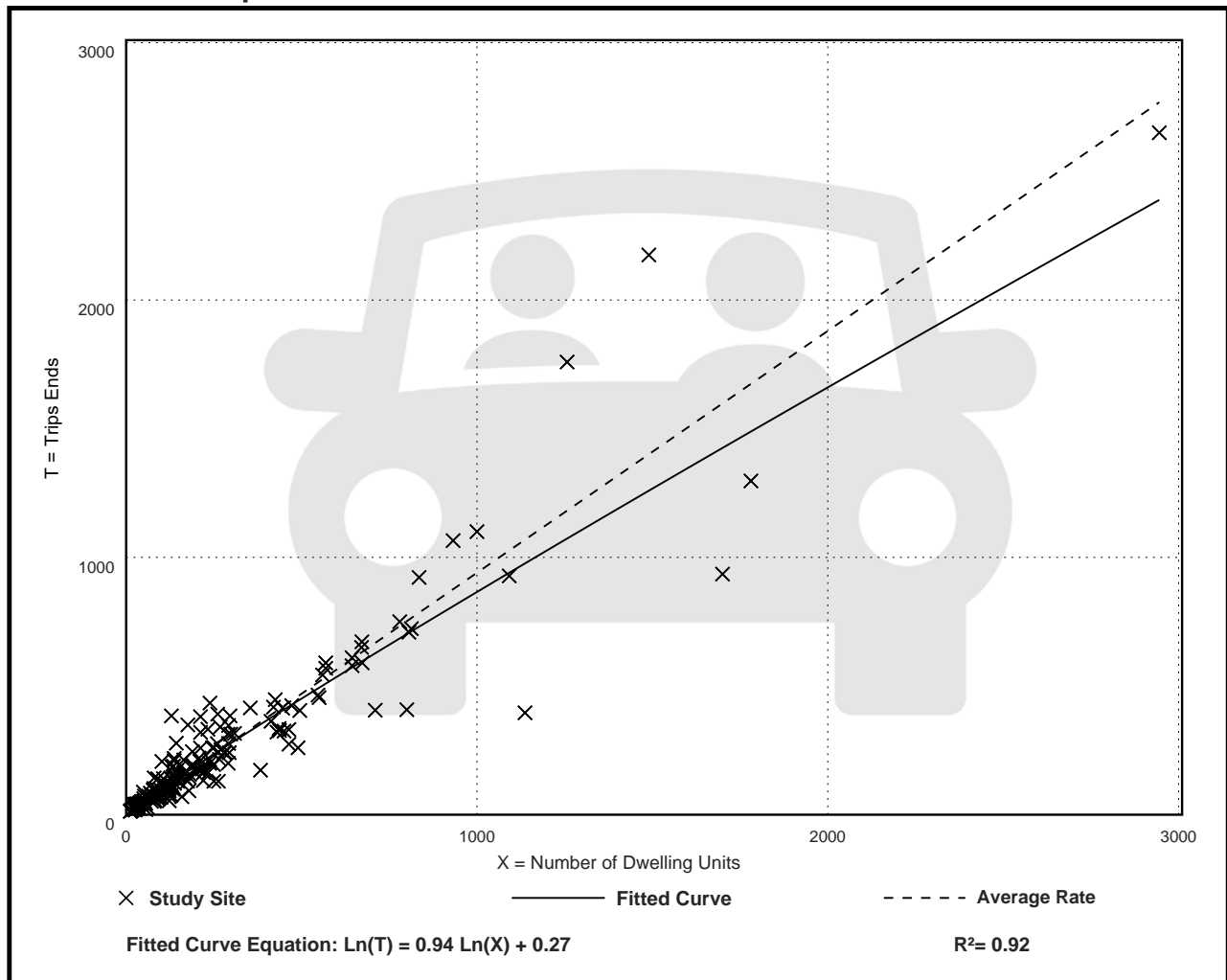
Avg. Num. of Dwelling Units: 248

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

Signal Timing

Intersection Name : Kingston Pike and Ebenezer Rd

Last Updated: 4/8/24

Basic Timing (seconds)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Min Green	6	18	8	8		18		
Gap / Extension	2	3	3	2		3		
Max 1	20	50	30	15		50		
Max 2	25	55	25	30		55		
Yellow Clearance	4	4.5	4	4		4.5		
Red Clearance	1.5	1.5	2	3		1.5		
Walk	N/A	N/A	N/A	N/A		N/A		
Pedestrian Clearance	N/A	N/A	N/A	N/A		N/A		
Max Recall		X				X		
Active (Enable) Phases	X	X	X	X		X		
Flashing Yellow Arrow								
Overlaps (1-4)								

Coordination Timing/(seconds)									
Split #	Coord. Phase	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
Split 1	2	17	36	21	21		53		
Split 2	2	16	38	28	18		54		
Split 3	2	18	60	21	21		78		
Split 4	2	26	54	20	20		80		
Split 5	2	18	63	19	25		81		
Split 6	2	28	63	22	22		91		

Pattern Table					Lead / Lag		Fixed / Floating		Fixed
Pattern#	Cycle	Offset	Split	Seq. #	Phase #		Beginning of (Green/Yellow)		Yellow
1	95	22	1	1	1		Intersection ID#		252
2	100	76	2	1	1		I/P Address		N/A
3	120	18	3	1	1		Hub Address		N/A
4	120	24	4	1	1		Radio Address		
5	125	24	5	1	1		Comm. Type		N/A
6	135	13	6	1	1		Detection		Inductive Loops

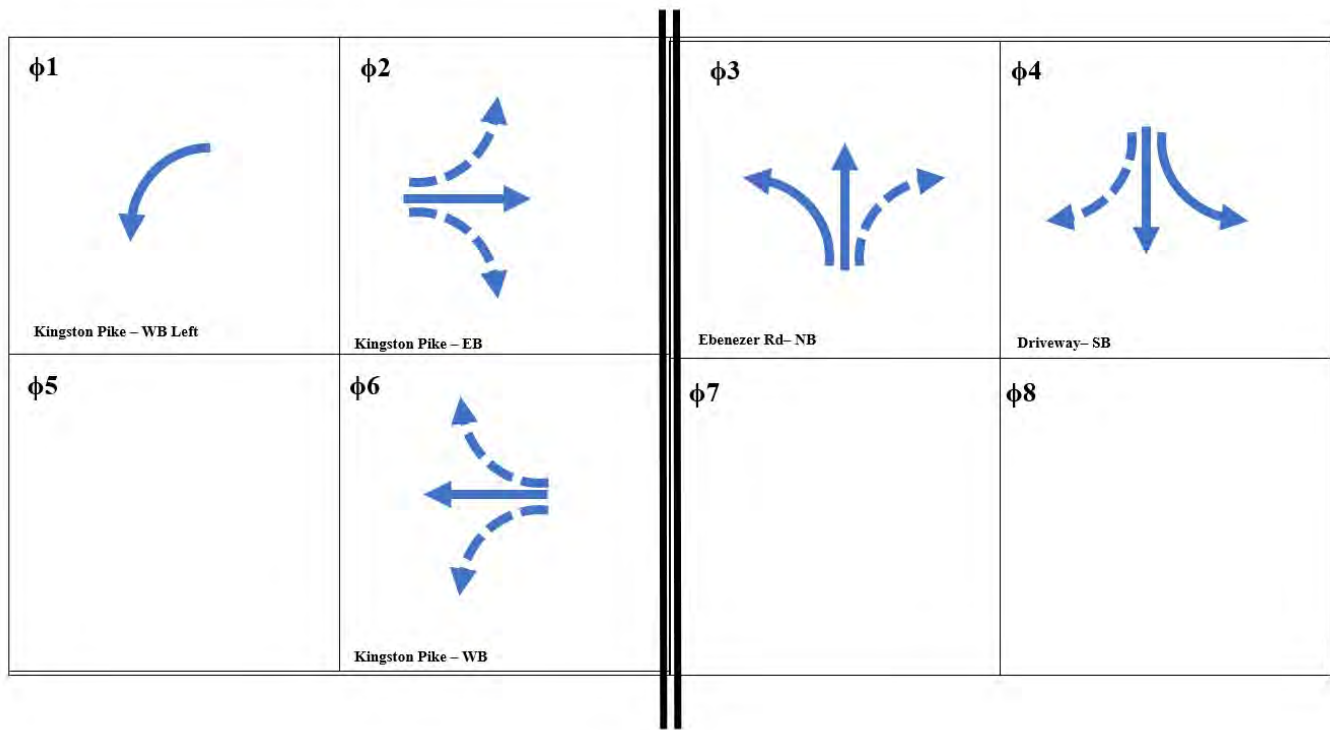
Day Plan Events					
Day Plan	HH:MM	Pattern	Day Plan	HH:MM	Pattern
1	00:00	54	2	00:00	54
1	6:00	2	2	7:00	1
1	9:30	3	2	8:00	5
1	14:00	4	2	21:00	1
1	18:30	1	2	23:00	54
1	23:00	54			

Year Plan Scheduler					
Plan	Month of Year: 01 - 12		Day of Month: 01 - 31		Plan
M - F	1-12		01-31		1
SAT	1-12		01-31		2
SUN	1-12		01-31		2

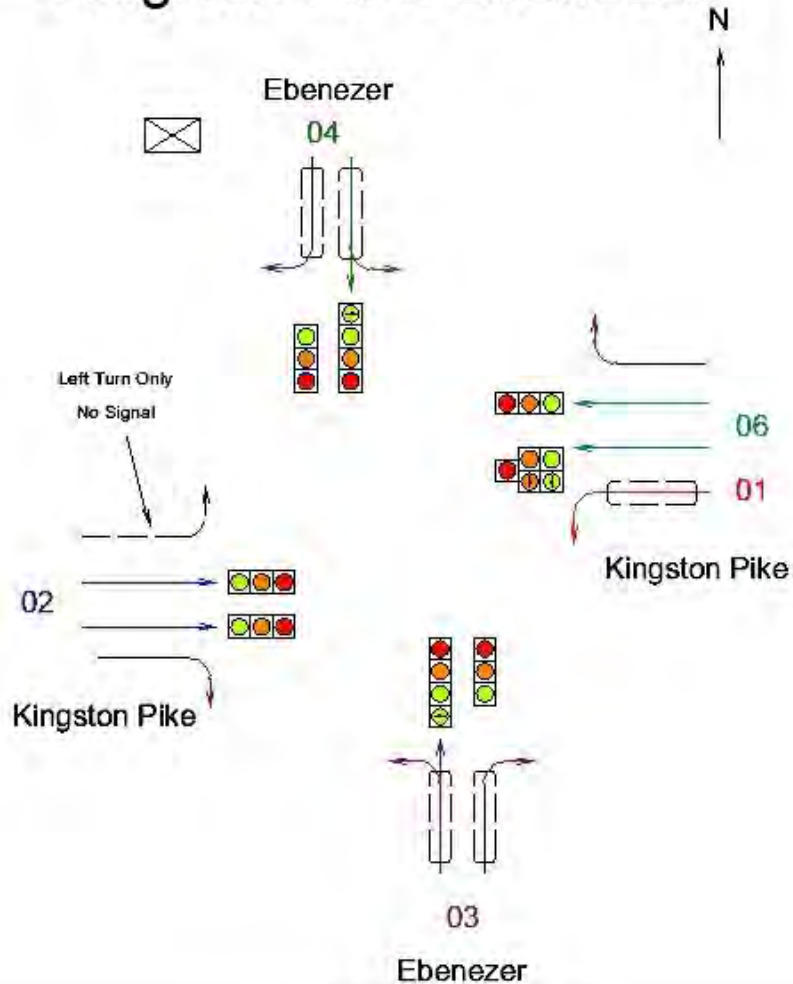
Notes :

Ring and Barrier Diagram:

Sequence 1:



Kingston Pk & Ebenezer



Attachment 6
Intersection Worksheets – Existing AM/PM Peaks

HCM Signalized Intersection Capacity Analysis

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	793	45	73	629	28	105	14	173	10	6	11
Future Volume (vph)	10	793	45	73	629	28	105	14	173	10	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1784	1583		1806	1583
Flt Permitted	0.41	1.00	1.00	0.22	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (perm)	756	3539	1583	403	3539	1583		1784	1583		1806	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	10	818	46	75	648	29	108	14	178	10	6	11
RTOR Reduction (vph)	0	0	27	0	0	13	0	0	139	0	0	10
Lane Group Flow (vph)	10	818	19	75	648	16	0	122	39	0	16	1
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases		2		1	6		3	3		4	4	
Permitted Phases	2		2	6		6			3			4
Actuated Green, G (s)	42.3	42.3	42.3	54.2	54.2	54.2		22.0	22.0		4.8	4.8
Effective Green, g (s)	42.3	42.3	42.3	54.2	54.2	54.2		22.0	22.0		4.8	4.8
Actuated g/C Ratio	0.42	0.42	0.42	0.54	0.54	0.54		0.22	0.22		0.05	0.05
Clearance Time (s)	6.0	6.0	6.0	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	319	1496	669	305	1918	857		392	348		86	75
v/s Ratio Prot		c0.23		0.02	c0.18			c0.07			c0.01	
v/s Ratio Perm	0.01		0.01	0.12		0.01			0.02			0.00
v/c Ratio	0.03	0.55	0.03	0.25	0.34	0.02		0.31	0.11		0.19	0.01
Uniform Delay, d1	16.9	21.7	16.9	12.7	12.8	10.6		32.7	31.2		45.7	45.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	1.4	0.1	0.4	0.1	0.0		2.1	0.7		1.0	0.0
Delay (s)	17.1	23.1	16.9	13.1	12.9	10.6		34.7	31.8		46.8	45.4
Level of Service	B	C	B	B	B	B		C	C		D	D
Approach Delay (s)		22.7			12.9			33.0			46.2	
Approach LOS		C			B			C			D	

Intersection Summary

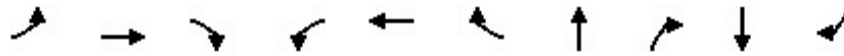
HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	24.5
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	10	818	46	75	648	29	122	178	16	11
v/c Ratio	0.03	0.50	0.06	0.22	0.32	0.03	0.31	0.37	0.11	0.04
Control Delay	21.0	22.8	0.1	13.1	13.0	0.1	35.3	7.4	44.7	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.0	22.8	0.1	13.1	13.0	0.1	35.3	7.4	44.7	0.3
Queue Length 50th (ft)	4	217	0	23	124	0	66	0	10	0
Queue Length 95th (ft)	16	292	0	46	164	0	118	54	31	0
Internal Link Dist (ft)		551			715		608		380	
Turn Bay Length (ft)			140			100		50		50
Base Capacity (vph)	348	1634	821	375	2016	948	392	487	198	314
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.50	0.06	0.20	0.32	0.03	0.31	0.37	0.08	0.04

Intersection Summary

HCM Signalized Intersection Capacity Analysis

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	1277	107	147	1011	41	104	19	136	104	54	17
Future Volume (vph)	19	1277	107	147	1011	41	104	19	136	104	54	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.5	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1787	1583		1803	1583
Flt Permitted	0.27	1.00	1.00	0.07	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (perm)	495	3539	1583	132	3539	1583		1787	1583		1803	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	20	1359	114	156	1076	44	111	20	145	111	57	18
RTOR Reduction (vph)	0	0	60	0	0	17	0	0	128	0	0	16
Lane Group Flow (vph)	20	1359	54	156	1076	27	0	131	17	0	168	2
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases		2		1	6		3	3		4	4	
Permitted Phases	2		2	6		6			3			4
Actuated Green, G (s)	56.9	56.9	56.9	74.2	74.2	74.2		14.0	14.0		12.8	12.8
Effective Green, g (s)	56.9	56.9	56.9	74.2	74.2	74.2		14.0	14.0		12.8	12.8
Actuated g/C Ratio	0.47	0.47	0.47	0.62	0.62	0.62		0.12	0.12		0.11	0.11
Clearance Time (s)	6.5	6.5	6.5	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	234	1678	750	235	2188	978		208	184		192	168
v/s Ratio Prot		c0.38		c0.06	0.30			c0.07			c0.09	
v/s Ratio Perm	0.04		0.03	0.35		0.02			0.01			0.00
v/c Ratio	0.09	0.81	0.07	0.66	0.49	0.03		0.63	0.09		0.88	0.01
Uniform Delay, d1	17.3	26.9	17.2	25.2	12.6	8.9		50.5	47.3		52.8	47.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.7	4.3	0.2	6.9	0.2	0.0		13.6	1.0		32.8	0.0
Delay (s)	18.0	31.3	17.4	32.1	12.7	8.9		64.1	48.3		85.6	48.0
Level of Service	B	C	B	C	B	A		E	D		F	D
Approach Delay (s)		30.0			15.0			55.8			82.0	
Approach LOS		C			B			E			F	

Intersection Summary

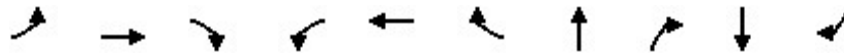
HCM 2000 Control Delay	29.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	20	1359	114	156	1076	44	131	145	168	18
v/c Ratio	0.09	0.81	0.14	0.66	0.49	0.04	0.63	0.46	0.88	0.06
Control Delay	20.5	32.4	2.2	33.7	13.6	0.1	64.9	13.1	91.9	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.5	32.4	2.2	33.7	13.6	0.1	64.9	13.1	91.9	0.4
Queue Length 50th (ft)	8	455	0	59	225	0	98	0	130	0
Queue Length 95th (ft)	27	#622	22	128	277	1	#169	61	#257	0
Internal Link Dist (ft)		551			715		608		380	
Turn Bay Length (ft)			140			100		50		50
Base Capacity (vph)	234	1677	824	361	2187	1013	208	312	195	292
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.81	0.14	0.43	0.49	0.04	0.63	0.46	0.86	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Attachment 7
Intersection Worksheets – Background AM/PM Peaks

HCM Signalized Intersection Capacity Analysis

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶	↷	↷	↶	↷	↷		↷	↷		↷	↷
Traffic Volume (vph)	10	817	46	75	648	29	108	14	178	10	6	11
Future Volume (vph)	10	817	46	75	648	29	108	14	178	10	6	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1784	1583		1806	1583
Flt Permitted	0.40	1.00	1.00	0.21	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (perm)	741	3539	1583	384	3539	1583		1784	1583		1806	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	10	842	47	77	668	30	111	14	184	10	6	11
RTOR Reduction (vph)	0	0	27	0	0	14	0	0	144	0	0	10
Lane Group Flow (vph)	10	842	20	77	668	16	0	125	40	0	16	1
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases		2		1	6		3	3		4	4	
Permitted Phases	2		2	6		6			3			4
Actuated Green, G (s)	42.2	42.2	42.2	54.2	54.2	54.2		22.0	22.0		4.8	4.8
Effective Green, g (s)	42.2	42.2	42.2	54.2	54.2	54.2		22.0	22.0		4.8	4.8
Actuated g/C Ratio	0.42	0.42	0.42	0.54	0.54	0.54		0.22	0.22		0.05	0.05
Clearance Time (s)	6.0	6.0	6.0	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	312	1493	668	298	1918	857		392	348		86	75
v/s Ratio Prot		c0.24		0.02	c0.19			c0.07			c0.01	
v/s Ratio Perm	0.01		0.01	0.12		0.01			0.03			0.00
v/c Ratio	0.03	0.56	0.03	0.26	0.35	0.02		0.32	0.12		0.19	0.01
Uniform Delay, d1	16.9	21.9	16.9	12.9	12.9	10.6		32.7	31.2		45.7	45.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	1.5	0.1	0.5	0.1	0.0		2.1	0.7		1.0	0.0
Delay (s)	17.1	23.5	17.0	13.4	13.0	10.6		34.8	31.9		46.8	45.4
Level of Service	B	C	B	B	B	B		C	C		D	D
Approach Delay (s)		23.1			13.0			33.1			46.2	
Approach LOS		C			B			C			D	

Intersection Summary

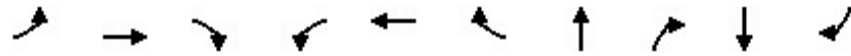
HCM 2000 Control Delay	21.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	24.5
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	10	842	47	77	668	30	125	184	16	11
v/c Ratio	0.03	0.52	0.06	0.24	0.33	0.03	0.32	0.37	0.11	0.04
Control Delay	21.0	23.1	0.1	13.2	13.1	0.1	35.4	7.4	44.7	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.0	23.1	0.1	13.2	13.1	0.1	35.4	7.4	44.7	0.3
Queue Length 50th (ft)	4	226	0	24	129	0	67	0	10	0
Queue Length 95th (ft)	16	303	0	48	171	0	120	55	31	0
Internal Link Dist (ft)		551			715		608		380	
Turn Bay Length (ft)			140			100		50		50
Base Capacity (vph)	342	1632	821	366	2016	948	392	491	198	314
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.52	0.06	0.21	0.33	0.03	0.32	0.37	0.08	0.04

Intersection Summary

HCM Signalized Intersection Capacity Analysis

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	1316	110	151	1042	42	107	20	140	107	56	18
Future Volume (vph)	20	1316	110	151	1042	42	107	20	140	107	56	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.5	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1787	1583		1804	1583
Flt Permitted	0.26	1.00	1.00	0.06	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (perm)	479	3539	1583	119	3539	1583		1787	1583		1804	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	1400	117	161	1109	45	114	21	149	114	60	19
RTOR Reduction (vph)	0	0	62	0	0	17	0	0	128	0	0	17
Lane Group Flow (vph)	21	1400	55	161	1109	28	0	135	21	0	174	2
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases		2		1	6		3	3		4	4	
Permitted Phases	2		2	6		6			3			4
Actuated Green, G (s)	56.4	56.4	56.4	74.0	74.0	74.0		14.0	14.0		13.0	13.0
Effective Green, g (s)	56.4	56.4	56.4	74.0	74.0	74.0		14.0	14.0		13.0	13.0
Actuated g/C Ratio	0.47	0.47	0.47	0.62	0.62	0.62		0.12	0.12		0.11	0.11
Clearance Time (s)	6.5	6.5	6.5	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	225	1663	744	232	2182	976		208	184		195	171
v/s Ratio Prot		c0.40		c0.07	0.31			c0.08			c0.10	
v/s Ratio Perm	0.04		0.03	0.36		0.02			0.01			0.00
v/c Ratio	0.09	0.84	0.07	0.69	0.51	0.03		0.65	0.11		0.89	0.01
Uniform Delay, d1	17.6	27.9	17.5	29.1	12.8	9.0		50.7	47.4		52.8	47.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	5.4	0.2	8.7	0.2	0.0		14.6	1.3		36.1	0.0
Delay (s)	18.4	33.2	17.7	37.8	13.0	9.0		65.3	48.7		88.9	47.8
Level of Service	B	C	B	D	B	A		E	D		F	D
Approach Delay (s)		31.9			15.9			56.6			84.9	
Approach LOS		C			B			E			F	

Intersection Summary

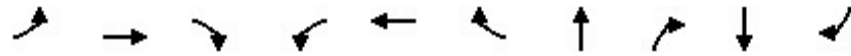
HCM 2000 Control Delay	30.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	76.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	21	1400	117	161	1109	45	135	149	174	19
v/c Ratio	0.09	0.84	0.14	0.69	0.51	0.04	0.65	0.48	0.89	0.07
Control Delay	20.9	34.4	2.4	38.5	13.9	0.1	66.0	14.0	94.7	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.9	34.4	2.4	38.5	13.9	0.1	66.0	14.0	94.7	0.4
Queue Length 50th (ft)	9	481	0	69	236	0	101	3	135	0
Queue Length 95th (ft)	28	#691	24	139	288	1	#180	65	#268	0
Internal Link Dist (ft)		551			715		608		380	
Turn Bay Length (ft)			140			100		50		50
Base Capacity (vph)	224	1663	818	355	2182	1011	208	312	195	292
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.84	0.14	0.45	0.51	0.04	0.65	0.48	0.89	0.07

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Attachment 8
Intersection Worksheets – Full Buildout AM/PM Peaks

HCM Signalized Intersection Capacity Analysis

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶	↷	↷	↶	↷	↷		↷	↷		↷	↷
Traffic Volume (vph)	10	817	58	97	648	29	149	20	249	10	8	11
Future Volume (vph)	10	817	58	97	648	29	149	20	249	10	8	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1784	1583		1812	1583
Flt Permitted	0.40	1.00	1.00	0.20	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (perm)	741	3539	1583	378	3539	1583		1784	1583		1812	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	10	842	60	100	668	30	154	21	257	10	8	11
RTOR Reduction (vph)	0	0	35	0	0	14	0	0	158	0	0	10
Lane Group Flow (vph)	10	842	25	100	668	16	0	175	99	0	18	1
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases		2		1	6		3	3		4	4	
Permitted Phases	2		2	6		6			3			4
Actuated Green, G (s)	41.6	41.6	41.6	54.2	54.2	54.2		22.0	22.0		4.8	4.8
Effective Green, g (s)	41.6	41.6	41.6	54.2	54.2	54.2		22.0	22.0		4.8	4.8
Actuated g/C Ratio	0.42	0.42	0.42	0.54	0.54	0.54		0.22	0.22		0.05	0.05
Clearance Time (s)	6.0	6.0	6.0	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	308	1472	658	303	1918	857		392	348		86	75
v/s Ratio Prot		c0.24		0.02	c0.19			c0.10			c0.01	
v/s Ratio Perm	0.01		0.02	0.16		0.01			0.06			0.00
v/c Ratio	0.03	0.57	0.04	0.33	0.35	0.02		0.45	0.28		0.21	0.01
Uniform Delay, d1	17.3	22.4	17.3	13.2	12.9	10.6		33.7	32.4		45.8	45.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	1.6	0.1	0.6	0.1	0.0		3.6	2.0		1.2	0.0
Delay (s)	17.5	24.0	17.4	13.8	13.0	10.6		37.4	34.5		47.0	45.4
Level of Service	B	C	B	B	B	B		D	C		D	D
Approach Delay (s)		23.5			13.0			35.7			46.4	
Approach LOS		C			B			D			D	

Intersection Summary

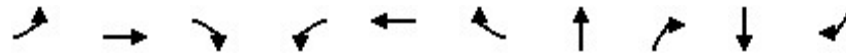
HCM 2000 Control Delay	22.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	24.5
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



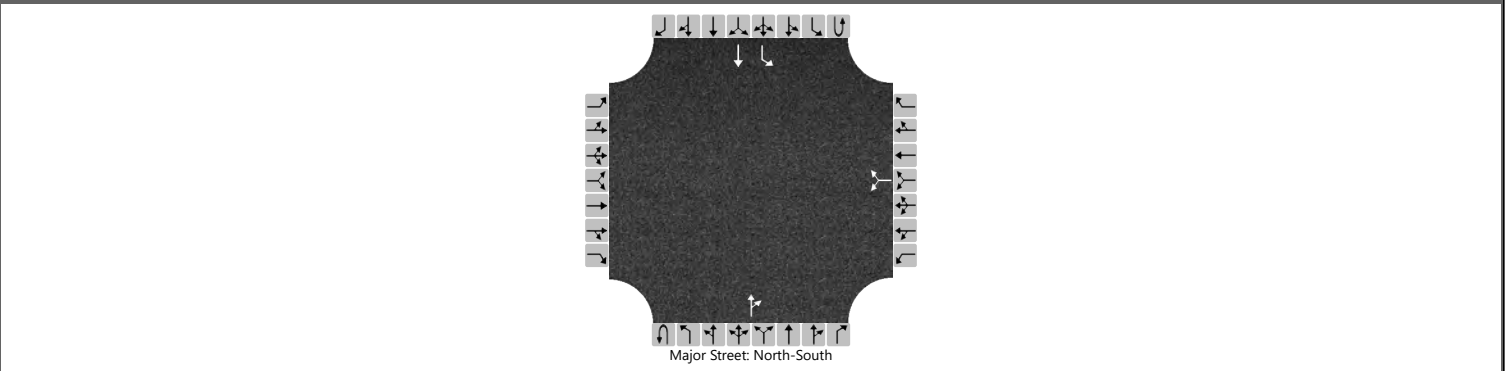
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	10	842	60	100	668	30	175	257	18	11
v/c Ratio	0.03	0.52	0.07	0.30	0.33	0.03	0.45	0.51	0.12	0.04
Control Delay	21.8	23.8	0.2	13.9	13.1	0.1	38.0	12.5	44.9	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.8	23.8	0.2	13.9	13.1	0.1	38.0	12.5	44.9	0.3
Queue Length 50th (ft)	4	230	0	31	129	0	97	28	11	0
Queue Length 95th (ft)	16	310	0	59	171	0	163	101	33	0
Internal Link Dist (ft)		551			715		608		380	
Turn Bay Length (ft)			140			100		50		50
Base Capacity (vph)	336	1609	812	364	2015	948	392	506	199	314
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.52	0.07	0.27	0.33	0.03	0.45	0.51	0.09	0.04

Intersection Summary

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Addie Kirkham	Intersection	Ebenezer Road at Apartment Driveway
Agency/Co.	Ardurra	Jurisdiction	Knox County
Date Performed	4/13/2024	East/West Street	Apartment Driveway
Analysis Year	2027	North/South Street	Ebenezer Road
Time Analyzed	Full Buildout AM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	330.029 - Ebenezer Subdivision		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
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	1	0		0	1	0
Configuration							LR					TR		L	T	
Volume (veh/h)						32		75			343	9		21	142	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
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		

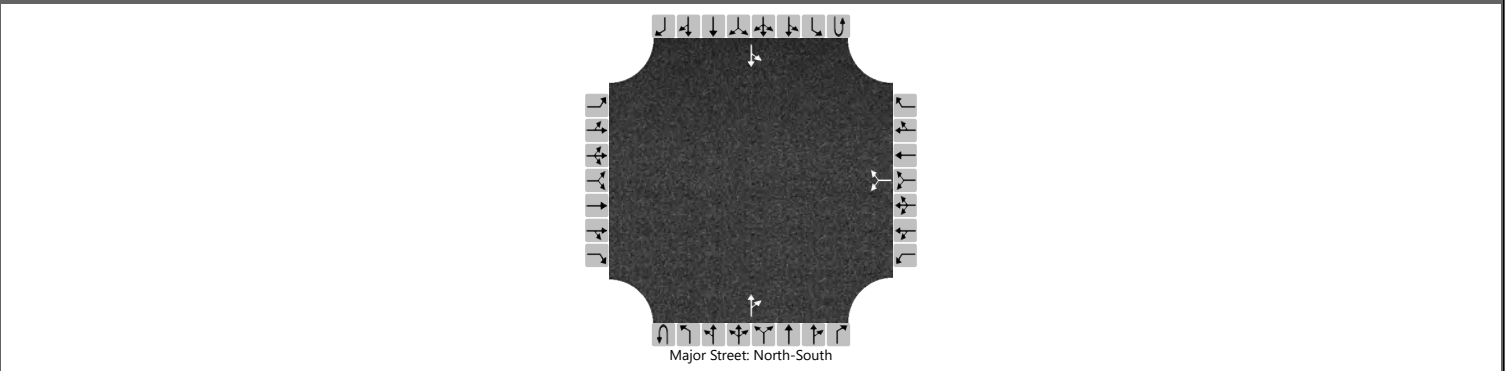
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						116								23		
Capacity, c (veh/h)						593								1176		
v/c Ratio						0.20								0.02		
95% Queue Length, Q ₉₅ (veh)						0.7								0.1		
Control Delay (s/veh)						12.5								8.1	0.1	
Level of Service (LOS)						B								A	A	
Approach Delay (s/veh)					12.5								1.2			
Approach LOS					B								A			

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	Addie Kirkham			Intersection	Ebenezer Road at Driveway		
Agency/Co.	Ardurra			Jurisdiction	Knox County		
Date Performed	4/13/2024			East/West Street	Subdivision Driveway		
Analysis Year	2027			North/South Street	Ebenezer Road		
Time Analyzed	Full Buildout AM Peak			Peak Hour Factor	0.92		
Intersection Orientation	North-South			Analysis Time Period (hrs)	0.25		
Project Description	330.029 - Ebenezer Subdivision						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	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 (veh/h)						19		43			309	7		15	159	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
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)						67								16	
Capacity, c (veh/h)						621								1216	
v/c Ratio						0.11								0.01	
95% Queue Length, Q ₉₅ (veh)						0.4								0.0	
Control Delay (s/veh)						11.5								8.0	0.1
Level of Service (LOS)						B								A	A
Approach Delay (s/veh)						11.5						0.8			
Approach LOS						B						A			

HCM Signalized Intersection Capacity Analysis

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	1316	153	226	1042	42	138	26	194	107	63	18
Future Volume (vph)	20	1316	153	226	1042	42	138	26	194	107	63	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.5	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1788	1583		1806	1583
Flt Permitted	0.26	1.00	1.00	0.07	1.00	1.00		0.96	1.00		0.97	1.00
Satd. Flow (perm)	479	3539	1583	128	3539	1583		1788	1583		1806	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	1400	163	240	1109	45	147	28	206	114	67	19
RTOR Reduction (vph)	0	0	80	0	0	17	0	0	128	0	0	17
Lane Group Flow (vph)	21	1400	83	240	1109	28	0	175	78	0	181	2
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases		2		1	6		3	3		4	4	
Permitted Phases	2		2	6		6			3			4
Actuated Green, G (s)	52.1	52.1	52.1	74.0	74.0	74.0		14.0	14.0		13.0	13.0
Effective Green, g (s)	52.1	52.1	52.1	74.0	74.0	74.0		14.0	14.0		13.0	13.0
Actuated g/C Ratio	0.43	0.43	0.43	0.62	0.62	0.62		0.12	0.12		0.11	0.11
Clearance Time (s)	6.5	6.5	6.5	5.5	6.0	6.0		6.0	6.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	207	1536	687	296	2182	976		208	184		195	171
v/s Ratio Prot		c0.40		c0.11	0.31			c0.10			c0.10	
v/s Ratio Perm	0.04		0.05	0.39		0.02			0.05			0.00
v/c Ratio	0.10	0.91	0.12	0.81	0.51	0.03		0.84	0.42		0.93	0.01
Uniform Delay, d1	20.1	31.8	20.3	35.2	12.8	9.0		51.9	49.2		53.0	47.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	1.0	9.7	0.4	15.4	0.2	0.0		31.8	7.0		44.0	0.0
Delay (s)	21.1	41.5	20.6	50.5	13.0	9.0		83.7	56.2		97.1	47.8
Level of Service	C	D	C	D	B	A		F	E		F	D
Approach Delay (s)		39.1			19.4			68.8			92.4	
Approach LOS		D			B			E			F	

Intersection Summary

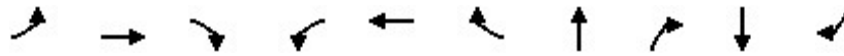
HCM 2000 Control Delay	37.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues

1: Ebenezer Road/Driveway & Kingston Pike

04/13/2024



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	21	1400	163	240	1109	45	175	206	181	19
v/c Ratio	0.10	0.91	0.21	0.81	0.51	0.04	0.84	0.66	0.93	0.07
Control Delay	23.9	42.5	6.1	49.3	13.9	0.1	84.3	27.6	101.5	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.9	42.5	6.1	49.3	13.9	0.1	84.3	27.6	101.5	0.4
Queue Length 50th (ft)	10	530	10	128	236	0	135	44	141	0
Queue Length 95th (ft)	29	#731	54	215	288	1	#259	127	#281	0
Internal Link Dist (ft)		551			715		608		380	
Turn Bay Length (ft)			140			100		50		50
Base Capacity (vph)	208	1537	767	360	2182	1011	208	312	195	292
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.91	0.21	0.67	0.51	0.04	0.84	0.66	0.93	0.07

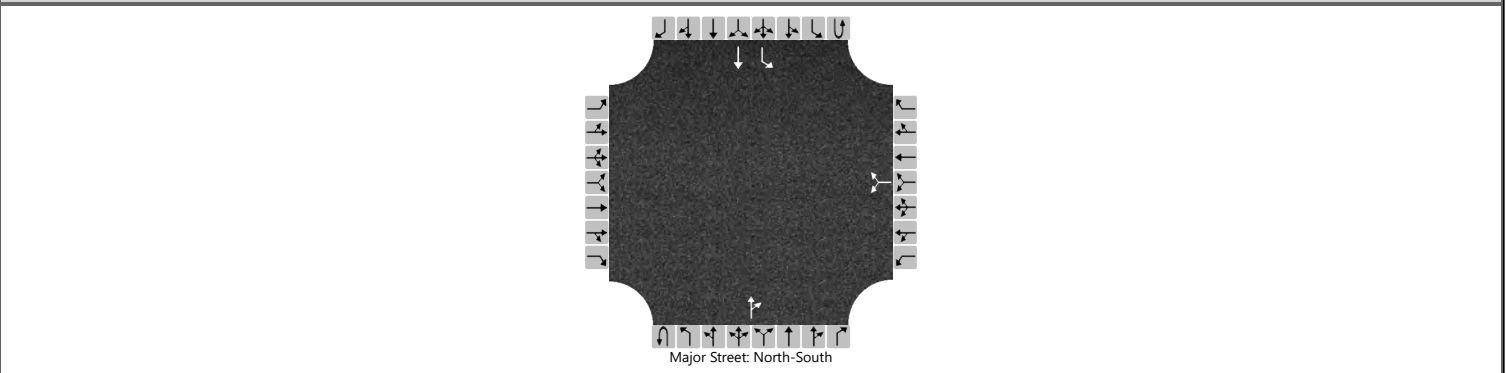
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Addie Kirkham	Intersection	Ebenezer Road at Apartment Driveway
Agency/Co.	Ardurra	Jurisdiction	Knox County
Date Performed	4/13/2024	East/West Street	Apartment Driveway
Analysis Year	2027	North/South Street	Ebenezer Road
Time Analyzed	Full Buildout PM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	330.029 - Ebenezer Subdivision		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
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	1	0		0	1	0
Configuration							LR					TR		L	T	
Volume (veh/h)						26		62			296	32		76	367	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
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		

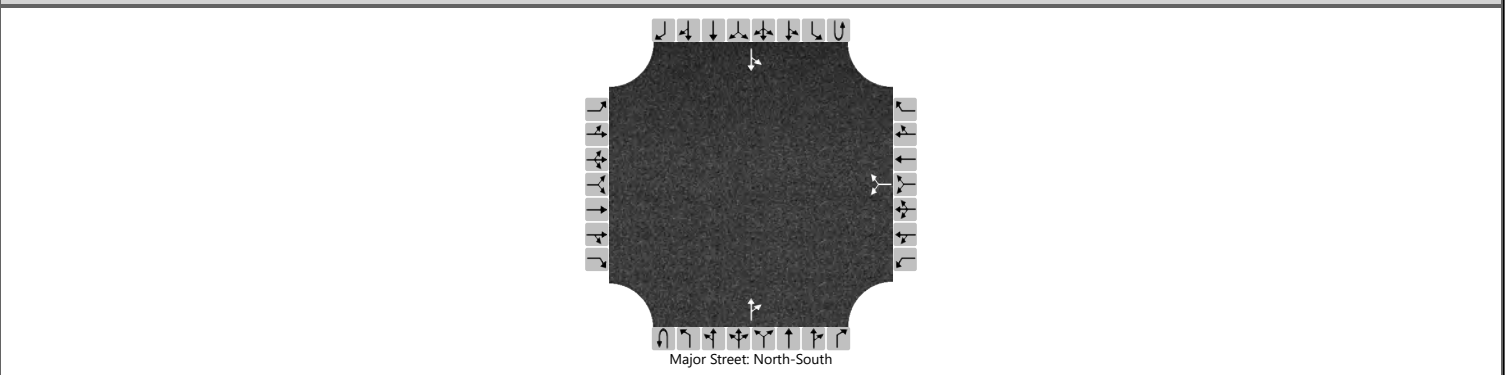
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						96								83		
Capacity, c (veh/h)						492								1202		
v/c Ratio						0.19								0.07		
95% Queue Length, Q ₉₅ (veh)						0.7								0.2		
Control Delay (s/veh)						14.1								8.2	0.4	
Level of Service (LOS)						B								A	A	
Approach Delay (s/veh)					14.1								1.7			
Approach LOS					B								A			

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Addie Kirkham	Intersection	Ebenezer Road at Driveway
Agency/Co.	Ardurra	Jurisdiction	Knox County
Date Performed	4/13/2024	East/West Street	Subdivision Driveway
Analysis Year	2027	North/South Street	Ebenezer Road
Time Analyzed	Full Buildout PM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	330.029 - Ebenezer Subdivision		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	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 (veh/h)						12		29			299	21		50	343	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized																
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)						45								54		
Capacity, c (veh/h)						526								1211		
v/c Ratio						0.08								0.04		
95% Queue Length, Q ₉₅ (veh)						0.3								0.1		
Control Delay (s/veh)						12.5								8.1	0.5	
Level of Service (LOS)						B								A	A	
Approach Delay (s/veh)						12.5								1.4		
Approach LOS						B								A		

Attachment 9
Turn Lane Warrants

Project: Ebenezer Road Subdivision

Ebenezer Road at Apartment Roadway

Ebenezer Road at Apartment Roadway		VOLUMES			
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	352	142	21	135	NO
PM	328	367	76	65	YES

**Ebenezer Road
at Apartment Roadway**

Ebenezer Road at Apartment Roadway		VOLUMES			
RIGHT TURN	Thru	RT	RT MAX	Warrant Met	
AM	343	9	299	NO	
PM	296	32	349	NO	

Ebenezer Road at Subdivision Roadway

Ebenezer Road at Subdivision Roadway		VOLUMES			
LEFT TURN	Opposing	Thru	LT	LT MAX	Warrant Met
AM	316	159	15	135	NO
PM	320	343	50	80	NO

**Ebenezer Road
at Subdivision Roadway**

Ebenezer Road at Subdivision Roadway		VOLUMES			
RIGHT TURN	Thru	RT	RT MAX	Warrant Met	
AM	309	7	299	NO	
PM	299	21	349	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	300	235	185	145	120	100
150 - 199	245	200	160	130	110	90
200 - 249	205	170	140	115	100	80
250 - 299	175	150	125	105	90	70
300 - 349	155	135	110	95	76	65
350 - 399	135	120	100	85	76 LT	60
400 - 449	120	105	90	75	65	55
450 - 499	105	90	80	70	60	50
500 - 549	95	80	70	65	55	50
550 - 599	85	70	65	60	50	45
600 - 649	75	65	60	55	45	40
650 - 699	70	60	55	50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

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

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

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 9 RT
100 - 149 150 - 199				PM Peak 32 RT		
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	300	235	185	145	120	100
150 - 199	245	200	160	130	110	90
200 - 249	205	170	140	115	100	80
250 - 299	175	150	125	105	90	70
300 - 349	155	135	110	95	80	65
350 - 399	135	120	100	85	70	50
400 - 449	120	105	90	75	65	50
450 - 499	105	90	80	70	60	50
500 - 549	95	80	70	65	55	50
550 - 599	85	70	65	60	50	45
600 - 649	75	65	60	55	45	40
650 - 699	70	60	55	50	40	35
700 - 749	65	55	50	45	35	30
750 or More	60	50	45	40	35	30

AM Peak
15 LT

PM Peak
80 LT

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

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

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 21 RT			AM Peak 7 LT
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 10
Sight Distance



Ebenezer Road at Subdivision Roadway – Looking Left (Southbound)



Ebenezer Road at Subdivision Roadway – Looking Right (Northbound)