THE CRESCENT AT EBENEZER COMMERCIAL SITE & PHASE 2 APARTMENTS
Traffic Impact Study
Ebenezer Road
Knoxville, TN

A Traffic Impact Study for The Crescent at Ebenezer Commercial Site & Phase 2 Apartments

Submitted to

Knoxville – Knox County Planning Commission

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Executive Summary

Crescent Bend Development, LLC is proposing a mixed use development located in Knox County, Tennessee. The project is located between the intersections of Ebenezer Road at Westland Drive (north) and Ebenezer Road at Westland Drive (south).   The Crescent at Ebenezer Apartments – Phase 1 concept plan was approved in August 2018 for 249 apartment units and 180 assisted living units. The Crescent at Ebenezer Commercial concept plan was approved in July 2019 for a 13,000 SF commercial building with a drive-through window. Crescent Bend Development proposes to amend the Phase 1 concept plan to include 78 apartments instead of the 180 assisted living units. Construction is proposed to take place this year and this study assumes full build out for the development will occur in 2021.

The main entrance/exit for The Crescent at Ebenezer Commercial Site will connect to Crescent Lake Way, which is the proposed driveway location for the Crescent Bend Apartments located on Ebenezer Road.   Also proposed is a full access entrance/exit with separate right and left turn lanes on Westland Drive and a right-in/right-out entrance/exit on Ebenezer Road. The Crescent at Ebenezer Apartments Phase 1 & 2 will enter/exit the development at the intersection of Westland Drive at Serene Breeze Way and Ebenezer Road at Crescent Lake Way.

The property at the corner of Ebenezer Road at Westland Drive (north) has a concept plan that was approved for a Weigel's convenience market with gasoline pumps by the Knoxville-Knox County Planning Commission on July 12, 2012. The Weigel's will share access with The Crescent at Ebenezer Commercial Site and therefore was included in the traffic impact study.

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

Ebenezer Road @ Westland Drive (north)
After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the signalized intersection of Ebenezer Road at Westland Drive (north) will continue to operate at a LOS D during the AM peak hour and a LOS C during the PM peak hour using the existing signal timing provided by Knox County.

The LOS D during the AM peak hour is caused by the westbound thru/right lane having a volume to capacity ratio greater than 1.0. This is the case for the existing traffic volumes and the increase in delay caused by The Crescent at Ebenezer Commercial Site & Phase 2 Apartments is expected to be minimal.

Ebenezer Road @ Westland Drive (south)
After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the signalized intersection of Ebenezer Road at Westland Drive (south) will operate at a LOS B during the AM peak hour and a LOS D during the PM peak hour using the existing signal timing provided by Knox County.

The eastbound double left turn lanes operate at a LOS C during the existing traffic conditions and a LOS F during both the background traffic conditions and after the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments. The delay is caused by the turn lanes having a volume to capacity ratio greater than 1.0 and a queue storage ratio of greater than 2.0. The increase in delay caused by The Crescent at Ebenezer Commercial Site & Phase 2 Apartments is expected to be minimal.

Ebenezer Road @ Driveway Connection
Knox County Engineering and Public Works recommended that the Ebenezer Road driveway be a right-in/right-out driveway connection.

Ebenezer Road @ Crescent Lake Way
After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the westbound approach (Crescent Lake Way) will operate at a LOS E during the AM peak hour and a LOS D during the PM peak hours and the southbound approach (Ebenezer Road) will operate at a LOS C during the AM peak hour and a LOS B during the PM peak hour.

Westland Drive @ Commercial Driveway Connection
After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the westbound approach (Westland Drive) will continue to operate at a LOS A during both the AM and PM peak hours and the northbound approach (Commercial Driveway) will operate at a LOS D during the AM peak hour and a LOS F during the PM peak hour.

The capacity analyses shows that the 95% queue length at the full buildout at the signalized intersection of Ebenezer Road at Westland Drive (north) will block the proposed commercial driveway connection for a portion of time during both the AM and PM peak hours.

Westland Drive @ Serene Breeze Way
As a part of the construction of The Crescent at Ebenezer Apartments – Phase 1 a westbound left turn lane with a 75 foot storage length was installed at the intersection of Westland Drive at Serene Breeze Way. The unsignalized intersection capacity analysis shows the existing storage at the intersection is adequate and no change is necessary.

1 Introduction

1.1 Project Description

This report provides a summary of a traffic impact study that was performed for The Crescent at Ebenezer Commercial Site & Phase 2 Apartment Development. The project is located between the intersections of Ebenezer Road at Westland Drive (north) and Ebenezer Road at Westland Drive (south) in Knox County, Tennessee. The Crescent at Ebenezer Apartments – Phase 1 concept plan was approved in August 2018 for 249 apartment units and 180 assisted living units. The Crescent at Ebenezer Commercial concept plan was approved in July 2019 for a 13,000 SF commercial building with a drive-through window. Crescent Bend Development proposes to amend the Phase 1 concept plan to include 78 apartments instead of the 180 assisted living units. The location of the site is shown in Figure 1.

The full buildout of the commercial development includes six separate modules available for lease. Module 1 & 2 are a combined 3,434 SF coffee shop with a drive-through window. Module 3 is a 2,007 SF nail salon. Module 4 & 6 are separate fast casual restaurants with a total of 4,853 SF and Module 5 is a 2,800 Sf medical/dental office building. Construction for the Crescent Commercial Site started in 2019 and this study assumes full build out for the development will occur in 2021. FMA assumed a full build out for the phase 2 apartment development will also occur in 2021.

The main entrance/exit for The Crescent at Ebenezer Commercial Site will connect to Crescent Lake Way, which is the proposed driveway location for the Crescent Bend Apartments located on Ebenezer Road.   Also proposed is a full access entrance/exit with separate right and left turn lanes on Westland Drive and a right-in/right-out entrance/exit on Ebenezer Road. The proposed site layout is shown in Figure 2.

The Crescent at Ebenezer Apartments – Phase 2 will share the same driveway connections as The Crescent at Ebenezer Apartments – Phase 1. Traffic will enter/exit from both the intersection of Westland Drive at Serene Breeze Way and Ebenezer Road at Crescent Lake Way.

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

Figure 1: Location Map

WESTLAND DRIVE (NORTH)

EBENEZER ROAD

CRESCENT LAKE WAY

PHASE 2
APARTMENTS

Figure 2: Site Plan

1.2 Existing Site Conditions

Crescent Lake Way is located approximately 235 feet north of the intersection of Westland Drive (south) and approximately 735 feet south of the intersection of Westland Drive (north). The roadway has a width of approximately 40 feet with separate right and left turn lanes.

The additional right-in/right-out driveway connection to Ebenezer Road is located approximately 310 feet south of the intersection of Westland Drive (north).

The proposed driveway connection to Westland Drive is located approximately 435 feet south of Serene Breeze Way (The Crescent at Ebenezer Apartments driveway connection) and approximately 250 feet north of the intersection of Ebenezer Road at Westland Drive (north). The proposed driveway has a width of 30 feet with separate right and left turn lanes.

There is also a private driveway connection at 1040 Ebenezer road located approximately 195 feet north of the intersection of Westland Drive (south). The house and driveway are expected to be removed as a part of phase 1 of The Crescent at Ebenezer apartment development.

Westland Drive east of the intersection of Ebenezer Road is a two-lane road. Westland Drive west of the intersection of Ebenezer Road is a three-lane road with a two-way left turn lane. The Knoxville-Knox County Planning Commission classifies Westland Drive as a minor arterial (with an 88 foot ROW) per the Major Road Plan. The posted speed limit on Westland Drive is 40 mph.

Ebenezer Road is a five-lane road with a two-way left turn lane at the existing driveway connection. The Knoxville-Knox County Planning Commission classifies Ebenezer Road at the location of the development between S Peters Road and S Northshore Drive as a minor arterial (with a 100 foot ROW) per the Major Road Plan. The posted speed limit on Ebenezer Road is 45 mph.

The existing sidewalk on Ebenezer Road extends northbound to the intersection of S Peters Road at Kingston Pike and southbound to the intersection with S Northshore Drive. The existing sidewalk on Westland Drive (north) extends 425 feet eastbound from the intersection with Ebenezer Road.

Aerial photos of the existing intersections are included in Attachment 9.

2   Existing Traffic Volumes

FMA conducted a turning movement count at the intersection of Ebenezer Road at Westland Drive (north) on Thursday May 10, 2018. FMA also conducted a turning movement count at the intersection of Ebenezer Road at Westland Drive (south) on Thursday May 17, 2018.

The current AM peak hour and PM peak hour were determined using the turning movement count that FMA conducted. At the intersection of Ebenezer Road at Westland Drive (north) the AM peak hour occurred between 7:15 am and 8:15 am, and the PM peak hour occurred between 5:00 pm and 6:00 pm. At the intersection of Ebenezer Road at Westland Drive (south) the AM peak hour occurred between 7:30 am and 8:30 am, and the PM peak hour occurred between 5:00 pm and 6:00 pm.

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

LEGEND:

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

Figure 3: 2018 Existing Peak Hour Traffic

3   Background Growth

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

Knoxville TPO count station ID: 093M002 is located on Westland Drive 1000 feet east of Villa Crest Drive and northeast of the proposed development. The annual traffic growth rate for this station over the last five years is approximately 2.90% and the 2017 ADT was 9,870 vehicles per day.

Knoxville TPO count station ID: 093M001 is located on Westland Drive 100 feet east of Cloverhill Road and west of the proposed development. The annual growth rate for this station over the last five years is approximately 2.85% and the 2017 ADT was 12,110 vehicles per day.

TDOT count station #000286 is located on Ebenezer Road south of the intersection with Westland Drive. The annual growth rate for this station over the last ten years is approximately -1.02%. However the ADT has started to increase again and the annual growth rate for this station over the last four years is approximately 0.54%. The 2017 ADT was 14,691 vehicles per day.

For the purpose of this study, an annual growth rate of 2.0% was assumed for traffic at both intersections of Ebenezer Road at Westland Drive until full occupancy is reached in 2021. Attachment 2 shows the trend line growth charts for the Knoxville TPO and TDOT count stations.

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

Figure 4: 2021 Background Peak Hour Traffic

3.1   The Crescent at Ebenezer

A Level I traffic impact study was completed for The Crescent at Ebenezer development located between the intersections of Ebenezer Road at Westland Drive (north) and Ebenezer Road at Westland Drive (south) within Knox County. "The Crescent at Ebenezer Traffic Impact Study" was prepared by Fulghum, MacIndoe & Associates dated August 27, 2018 and Knoxville-Knox County Planning Commission approved the concept plan on September 13, 2018.

The Crescent at Ebenezer is a residential development with a combination of apartment buildings and senior adult housing units. The full buildout of the development will consist of 249 apartment units and 180 independent living units. The anticipated completion date was the year 2021.

The main entrance/exit for The Crescent at Ebenezer will connect to the existing driveway connection for the Cedar Row Nursery (Crescent Lake Way) located on Ebenezer Road. A second entrance/exit will connect to a proposed driveway location (Serene Breeze Way) on Westland Drive.

FMA recommended the installation of a northbound right turn lane at the intersection of Ebenezer Road at Crescent Lake Way to be built during the phase 1 (apartment development) construction and the installation of a westbound left turn lane at the intersection of Westland Drive at Serene Breeze Way be built during the phase 2 (independent living development) construction.

The total combined trips generated by The Crescent at Ebenezer was estimated to be 2,724 daily trips. The estimated trips are 160 trips during the AM peak hour and 222 trips during the PM peak hour. A trip generation summary is shown in Table 3.1-1.

Table 3.1-1
The Crescent at Ebenezer
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour Enter	Exit	PM Peak Hour Enter	Exit
The Crescent at Ebenezer						
Apartments (Local Trip Gen Study)	249 Units	2,167	27	97	97	80
Senior Adult Housing (LUC 252)	180 Units	557	12	24	24	21
The Crescent at Ebenezer		**2,724**	**39**	**121**	**121**	**101**

Figure 5 shows the combined peak hour site traffic for The Crescent at Ebenezer apartment and senior adult housing trips.

LEGEND:

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

Figure 5: Apartment & Senior Adult Housing Peak Hour Site Traffic

3.2   Weigel's

A Level I traffic impact study was done for Ebenezer Road at Westland Drive Weigel's located within Knox County. The "Ebenezer Road - Westland Drive Weigel's Convenience Store Traffic Impact Study" was prepared by CDM Smith dated May 21, 2012.

The proposed project is a 3,997 SF Weigel's convenience store with 16 fueling stations. A full access driveway connection is proposed for the Weigel's site from both Ebenezer Road and Westland Drive.

CDM Smith had the following recommendations:
- Minimize landscaping, using low growing vegetation, and signing at the proposed street access to insure that safe sight distance is maintained.
- Extend the planned northbound right-turn lane on Ebenezer Road for Westland Drive approximately another 100 feet to be also used by traffic entering the Weigel's convenience store.
- Provide separate left and right turn lanes from the site access.
- Post STOP signs (R1-1) for exiting traffic from the site driveways.
- Intersection design should conform to the recommended standards and practices of the Tennessee Department of Transportation, American Association of State Highway and Transportation Officials, the Institute of Transportation Engineers and the Knox County, Department of Engineering and Public Works.

Knoxville-Knox County Planning Commission approved the concept plan on July 12, 2012. Knox County Engineering and Public Works recommended that the Westland Road driveway connection remain a full access driveway and that the Ebenezer Road driveway be revised to a right-in/right-out driveway connection.

Due to the changes in the site access FMA recalculated the trip generation and trip distribution for the Weigel's convenience market with gasoline pumps and using the equations provided in the *Trip Generation, 10th Edition,* published by the Institute of Transportation Engineers. Site trips were calculated for a convenience market with gasoline pumps (Land Use 853) for a 3,997 SF building and up to 16 fueling stations. A pass-by rate reduction of 65% was used for Land Use 853 as recommended by the Knoxville-Knox County Planning Commission.

The total combined trips generated by the Weigel's Gasoline/Service Station was estimated to be 2,495 daily trips. The estimated trips are 56 new trips during the AM peak hour and 68 new trips during the PM peak hour. A trip generation summary is shown in Table 3.2-1 and the land use worksheets are included in Attachment 3.

Table 3.2-1
Weigel's Gasoline/Service Station
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
Weigel's Gasoline/Service Station						
Weigel's (LUC 853)	3,997 SF	2,495	81	81	99	99
65% Pass-By Reduction		1,622	53	53	64	64
35% New Trips		873	28	28	34	34

Figure 6 shows the Weigel's AM & PM peak hour trip distribution and Figures 7 and 8 show the Weigel's AM & PM peak hour trip distribution pass-by trips.

Figure 9 shows the Weigel's peak hour traffic and Figure 10 shows the Weigel's pass-by trips.

Figure 11 shows the background peak hour combined traffic including the 2021 background traffic, peak hour site traffic from the Crescent at Ebenezer apartment and senior adult living development and the peak hour site traffic from the Weigel's.

LEGEND:

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

Figure 6: Weigel's AM & PM Peak Hour Trip Distribution

LEGEND:

⟵ 50% (50%)   *TRIP DISTRIBUTION ENTERING (EXITING)*

Figure 7: Weigel's AM Peak Hour Trip Distribution Pass-By Trips

LEGEND:

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

Figure 8: Weigel's PM Peak Hour Trip Distribution Pass-By Trips

LEGEND:

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

Figure 9: Weigel's Peak Hour Site Traffic

LEGEND:

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

Figure 10: Weigel's Peak Hour Pass-By Trips

LEGEND:

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

Figure 11: Background Peak Hour Combined Traffic

4   Trip Generation and Trip Distribution

FMA updated the trip generation for The Crescent at Ebenezer Commercial Site to reflect the tenants for the commercial building.   The most updated tenant information for The Crescent at Ebenezer Commercial Site shows six modules to be leased. Module 1 & 2 are a combined 3,434 SF coffee shop with a drive-through window or Land Use 937. Module 3 is a 2,007 SF nail salon or Land Use 918. Module 4 is a 2,053 SF fast casual restaurant (Donato's Pizza) or LUC 930. Module 5 is a 2,800 SF Medical/Dental Office Building or Land Use 720 and Module 6 is a 2,800 SF fast casual restaurant or Land Use 930.

The equations and average rates provided in the *Trip Generation, 10th Edition,* published by the Institute of Transportation Engineers were used to calculate the expected site trips using the coffee/donut shop with drive-through window (Land Use 937), Hair Salon (Land Use 918), Medical-Dental Office Building (Land Use 720) and Fast Casual Restaurant (Land Use 930).

A pass-by trip occurs when a proposed development diverts traffic that is already traveling on a street adjacent to the site. A pass-by rate reduction of 40% was used for coffee/donut shop with a drive-through window or Land Use 937 and for the fast casual restaurant or Land Use 930 as referenced by the Memorandum issued by the Knoxville-Knox County Planning Commission and dated March 10, 1997.

The land use worksheets are included in Attachment 3.

An internal trip reduction of 10% was assumed for the commercial development to account for trips between land uses.

The total combined new trips generated by The Crescent at Ebenezer Commercial Site were estimated to be 1,608 new daily trips, 149 trips during the AM peak hour and 91 trips during the PM peak hour. The total combined new trips generated by The Crescent at Ebenezer Apartments – Phase 2 were estimated to be 206 new daily trips, 6 trips during the AM peak hour and 17 trips during the PM peak hour. A trip generation summary is shown in Table 4-1.

Table 4-1
The Crescent at Ebenezer
Trip Generation Summary

Land Use	Density	Daily Trips	AM Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit
The Crescent at Ebenezer Commercial Site						
Coffee/Donut Shop w/ Drive Through Window (LUC 937)	3,434 SF / 60 Seats	2,817	128	118	33	40
10% Internal Reduction		-282	-13	-12	-3	-4
40% Pass-By Reduction		1,014	46	42	12	14
Hair Salon (LUC 918)	2,007 SF	-	2	0	1	2
10% Internal Reduction		-	0	0	0	0
Medical-Dental Office (LUC 720)	2,800 SF	97	7	2	3	9
10% Internal Reduction		-10	-1	0	0	-1
Fast Casual Restaurant (LUC 720)	4,853 SF	1,530	7	3	38	31
10% Internal Reduction		-153	-1	0	-4	-3
40% Pass-By Trips		1,377	2	1	14	11
Phase 2 – Pass-By Trips		**2,391**	**48**	**43**	**26**	**25**
Phase 2 - New Trips		**1,608**	**81**	**68**	**42**	**49**
The Crescent at Ebenezer Apartments Phase 2						
Approved Land Use 2019						
Senior Adult Housing (LUC 252)	180 Units	557	12	24	24	21
Proposed Land Use 2021						
Phase 2 - Apartments (Local Trip Gen Study)	78 Units	763	9	33	34	28
Additional Trips		206	-3	9	10	7

Ebenezer Road at the existing driveway connection has a trip distribution of 67% northbound and 33% southbound during the AM peak hour and 40% northbound and 60% southbound during the PM peak hour.

Westland Drive at the proposed commercial driveway connection has a trip distribution of 45% eastbound and 55% westbound during the AM peak hour and 50% eastbound and 50% westbound during the PM peak hour.

The directional distribution of the traffic generated by The Crescent at Ebenezer Commercial Site was determined using the existing traffic volumes in combination with the concept plan layout. Crescent Lake Way was designed to operate as the main entrance/exit to the commercial development.

It was assumed that 20% of traffic would enter/exit using the Westland Drive commercial driveway connection and 80% of traffic would enter/exit using Crescent Lake Way. This assumption was made after measuring the existing traffic volume which is split 60% Ebenezer Road to/from the south, 25% Ebenezer Road to/from the north and 15% Westland Drive.

Figure 12 shows the commercial site AM & PM peak hour trip distribution and Figures 13 and 14 show the commercial site AM & PM peak hour trip distribution pass-by trips.

Figure 15 shows the commercial site peak hour traffic, Figure 16 shows the commercial site pass-by trips and Figure 17 shows the full buildout peak hour combined traffic.

The directional distribution of the traffic generated by The Crescent at Ebenezer Apartments – Phase 2 was determined using the previously approved trip generation for The Crescent at Ebenezer Apartments – Phase 1. FMA referenced Figure 5: AM Peak Hour Trip Distribution Westland Driveway, Figure 5A: AM Peak Hour Trip Distribution Ebenezer Driveway, Figure 6: PM Peak Hour Trip Distribution Westland Driveway and Figure 6A: PM Peak Hour Trip Distribution Ebenezer Driveway from "The Crescent at Ebenezer Traffic Impact Study" dated August 27, 2018. Figure 18 shows the Phase 2 Apartments peak hour site traffic and Figure 19 shows the Phase 2 Apartments peak hour combined traffic.

LEGEND:

⟵ 50% (50%) *TRIP DISTRIBUTION ENTERING (EXITING)*

Figure 12: Commercial AM & PM Peak Hour Trip Distribution

LEGEND:

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

Figure 13: Commercial AM Peak Hour Trip Distribution Pass-By Trips

LEGEND:

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

Figure 14: Commercial PM Peak Hour Trip Distribution Pass-By Trips

LEGEND:

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

Figure 15: Commercial Peak Hour Site Traffic

LEGEND:

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

Figure 16: Commercial Peak Hour Pass-By Trips

LEGEND:

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

Figure 17: Full Buildout Peak Hour Combined Traffic

LEGEND:

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

Figure 18: Phase 2 Apartments Peak Hour Site Traffic

LEGEND:

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

Figure 19: Phase 2 Apartments Peak Hour Combined Traffic

5   Projected Capacity and Level of Service

Unsignalized intersection capacity analyses were performed using the Highway Capacity Software (HCS7) for the AM and PM peak hours to evaluate the traffic conditions at the intersections of Ebenezer Road at the proposed driveway connection, Ebenezer Road at Crescent Lake Way and Westland Drive at the proposed commercial driveway location.

Signalized intersection capacity analyses were performed using Highway Capacity Software (HCS7) with the existing signal timing for the AM and PM peak hours to evaluate the traffic conditions at both intersections of Ebenezer Road at Westland Drive. The existing signal timing was provided by Knox County and is included in Attachment 4.

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, 7 and 10.

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

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

		Delay (sec)/LOS
Ebenezer Road @ Westland Drive (north) (Existing 2018)		
AM Peak	Intersection	36.8 / D
PM Peak	Intersection	14.4 / B
Ebenezer Road @ Westland Drive (south) (Existing 2018)		
AM Peak	Intersection	15.4 / B
PM Peak	Intersection	26.2 / C
Ebenezer Road @ Westland Drive (north) (Background 2021)		
AM Peak	Intersection	53.4 / D
PM Peak	Intersection	20.2 / C
Ebenezer Road @ Westland Drive (south) (Background 2021)		
AM Peak	Intersection	17.8 / B
PM Peak	Intersection	44.1 / D
Ebenezer Road @ Driveway Connection (Background 2021)		
AM Peak	WB Approach	12.1 / B
PM Peak	WB Approach	9.7 / A
Ebenezer Road @ Crescent Lake Way (Background 2021)		
AM Peak	WB Approach	22.0 / C
	SB Approach	16.6 / C
PM Peak	WB Approach	15.5 / C
	SB Approach	12.0 / B
Westland Drive @ Commercial Driveway Connection (Background 2021)		
AM Peak	WB Approach	8.6 / A
	NB Approach	24.5 / C
PM Peak	WB Approach	9.4 / A
	NB Approach	49.3 / E

Ebenezer Road @ Westland Drive (north) (Commercial Site 2021)

AM Peak	Intersection	54.1 / D
PM Peak	Intersection	20.3 / C

Ebenezer Road @ Westland Drive (south) (Commercial Site 2021)

AM Peak	Intersection	18.1 / B
PM Peak	Intersection	45.7 / D

Ebenezer Road @ Driveway Connection (Commercial Site 2021)

AM Peak	WB Approach	12.3 / B
PM Peak	WB Approach	9.8 / A

Ebenezer Road @ Crescent Lake Way (Commercial Site 2021)

AM Peak	WB Approach	46.7 / E
	SB Approach	19.1 / C
PM Peak	WB Approach	30.5 / D
	SB Approach	12.5 / B

Westland Drive @ Commercial Driveway Connection (Commercial Site 2021)

AM Peak	WB Approach	8.7 / A
	NB Approach	24.9 / C
PM Peak	WB Approach	9.5 / A
	NB Approach	51.8 / F

Ebenezer Road @ Westland Drive (north) (Phase 2 - Apartments 2021)

AM Peak	Intersection	54.4 / D
PM Peak	Intersection	20.3 / C

Ebenezer Road @ Westland Drive (south) (Phase 2 - Apartments 2021)

AM Peak	Intersection	18.1 / B
PM Peak	Intersection	46.0 / D

Ebenezer Road @ Driveway Connection (Phase 2 - Apartments 2021)

AM Peak	WB Approach	12.3 / B
PM Peak	WB Approach	9.8 / A

Ebenezer Road @ Crescent Lake Way (Phase 2 - Apartments 2021)		
AM Peak	WB Approach	46.6 / E
	SB Approach	19.0 / C
PM Peak	WB Approach	30.4 / D
	SB Approach	12.6 / B

Westland Drive @ Commercial Driveway Connection (Phase 2 - Apartments 2021)		
AM Peak	WB Approach	8.7 / A
	NB Approach	25.0 / D
PM Peak	WB Approach	9.5 / A
	NB Approach	52.3 / F

Westland Drive @ Serene Breeze Way (Phase 2 - Apartments 2021)		
AM Peak	WB Approach	8.6 / A
	NB Approach	21.6 / C
PM Peak	WB Approach	9.4 / A
	NB Approach	33.9 / D

6   Turn Lane Warrant Analysis

The intersection of Westland Drive at the commercial driveway connection and the intersection of Ebenezer Road at the driveway connection were evaluated to determine if a right turn lane is warranted. The Knox County Department of Engineering and Public Works handbook, "Access Control and Driveway Design Policy," was used to analyze the information. After the completion of the Crescent at Ebenezer Commercial Site both a right turn lane on Westland Drive at the commercial driveway location and on Ebenezer Road at the driveway location are warranted.   The turn lane warrant worksheets and analysis are included in Attachment 8.

The intersection of Ebenezer Road at Crescent Lake Way was not evaluated to determine if a turn lane is warranted. There is an existing two-way left turn lane on Ebenezer Road and a right turn lane is being built as a part of The Crescent at Ebenezer apartment development.

7 Conclusions and Recommendations

7.1 Ebenezer Road @ Westland Drive (north)

The existing traffic conditions at the signalized intersection of Ebenezer Road at Westland Drive (north) operate at a LOS D during the AM peak hour and a LOS B during the PM peak hour using the existing signal timing provided by Knox County.

The background traffic conditions at the signalized intersection of Ebenezer Road at Westland Drive (north) operate at a LOS D during AM peak hour and a LOS C during the PM peak hour using the existing signal timing provided by Knox County.

After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the signalized intersection of Ebenezer Road at Westland Drive (north) will continue to operate at a LOS D during the AM peak hour and a LOS C during the PM peak hour using the existing signal timing provided by Knox County.

The LOS D during the AM peak hour is caused by the westbound thru/right lane having a volume to capacity ratio greater than 1.0. This is the case for the existing traffic volumes and the increase in delay caused by The Crescent at Ebenezer Commercial Site & Phase 2 Apartments is expected to be minimal.

7.2 Ebenezer Road @ Westland Drive (south)

The existing traffic conditions at the signalized intersection of Ebenezer Road at Westland Drive (south) operate at a LOS B during the AM peak hour and a LOS C during the PM peak hour using the existing signal timing provided by Knox County.

The background traffic conditions at the signalized intersection of Ebenezer Road at Westland Drive (south) operate at a LOS B during the AM peak hour and a LOS D during the PM peak hour using the existing signal timing provided by Knox County.

After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the signalized intersection of Ebenezer Road at Westland Drive (south) will operate at a LOS B during the AM peak hour and a LOS D during the PM peak hour using the existing signal timing provided by Knox County.

The eastbound double left turn lanes operate at a LOS C during the existing traffic conditions and a LOS F during both the background traffic conditions and after the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments. The delay is caused by the turn lanes having a volume to capacity ratio greater than

1.0 and a queue storage ratio of greater than 2.0. The increase in delay caused by The Crescent at Ebenezer Commercial Site & Phase 2 Apartments is expected to be minimal.

7.3   Ebenezer Road @ Driveway Connection

Knox County Engineering and Public Works recommended that the Ebenezer Road driveway be a right-in/right-out driveway connection.

The background traffic conditions at the intersection of Ebenezer Road at the Driveway Connection for the westbound approach will operate at a LOS B during the AM peak hour and a LOS A during the PM peak hour.

After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the westbound approach will continue to operate at a LOS B during the AM peak hour and a LOS A during the PM peak hour.

A northbound right turn lane is warranted at the intersection of Ebenezer Road at the driveway connection during both the AM and PM peak hours after the completion of the Weigel's convenience market with gasoline pumps.   CDM Smith's recommendation was to "extend the planned northbound right-turn lane on Ebenezer Road for Westland Drive approximately another 100 feet to be also used by traffic entering the Weigel's convenience store." A sketch of the right-turn lane layout is included in Attachment 8. The turn lane improvements are expected to be installed prior to the construction of the Weigel's.

7.4   Ebenezer Road @ Crescent Lake Way

The background traffic conditions at the intersection of Ebenezer Road at the Crescent Lake Way for the westbound approach will operate at a LOS C during both the AM and PM peak hours and the southbound approach will operate at a LOS C during the AM peak hour and a LOS B during the PM peak hour.

After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the westbound approach (Ebenezer Road) will operate at a LOS E during the AM peak hour and a LOS D during the PM peak hours and the southbound approach (Crescent Lake Way) will operate at a LOS C during the AM peak hour and a LOS B during the PM peak hour.

The unsignalized intersection capacity analyses shows a 95% queue length after the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments at Crescent Lake Way of approximately four car lengths during the AM peak hour and two car lengths during the PM peak hour; therefore the existing storage at the intersection is adequate and no change is necessary.

It is estimated based on field observations that the intersection of Ebenezer Road at Crescent Lake Way is blocked by the traffic from the signalized intersection of Ebenezer Road at Westland Drive (north) and Ebenezer Road at Westland Drive (south) approximately 50% during the AM peak hour and 20% during the PM peak hour.

7.5   Westland Drive @ Commercial Driveway Connection

The background traffic conditions at the intersection of Westland Drive at the driveway connection for the westbound approach (Westland Drive) will operate at a LOS A during both the AM and PM peak hours and the northbound approach (Commercial Driveway) will operate at a LOS C during the AM peak hour and a LOS E during the PM peak hour.

After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the westbound approach (Westland Drive) will continue to operate at a LOS A during both the AM and PM peak hours and the northbound approach (Commercial Driveway) will operate at a LOS D during the AM peak hour and a LOS F during the PM peak hour.

The unsignalized intersection capacity analyses shows a 95% queue length at the full buildout for the commercial driveway connection of approximately 2 car lengths during the AM peak hour and approximately 3 car lengths during the PM peak hour; therefore the existing storage at the intersection is adequate and no change is necessary.

The signalized intersection capacity analyses shows a 95% queue length at the full buildout at the intersection of Ebenezer Road at Westland Drive (north) of 1,023 feet at the westbound thru/right lane and 156 feet at the westbound left turn lanes during the AM peak hour and 227 feet at the westbound thru/right lane and 323 feet for the westbound left turn lanes during the PM peak hour. Thus the queue from the signalized intersections of Ebenezer Road at Westland Drive (north) will block the proposed commercial driveway connection for a portion of time during both the AM and PM peak hours.

Westland Drive is classified as a minor arterial. The minimum intersection spacing required for an arterial is 400 feet per the "Minimum Subdivision Regulations" for Knoxville and Knox County.   The nearest road intersection to the proposed commercial driveway connection is currently 250 feet east at the intersection of Ebenezer Road. This intersection does not meet the required 400 feet spacing; however, given the constraints this location was determined to be the best fit and has been coordinated with Knox County Engineering & Public Works.

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An eastbound right turn lane is warranted at the intersection of Westland Drive at the commercial driveway connection during the PM peak hour after the completion of the Weigel's convenience market with gasoline pumps.

7.6   Westland Drive @ Serene Breeze Way

FMA referenced "The Crescent at Ebenezer Traffic Impact Study" dated August 27, 2018 Table 5-1 Intersection Analysis Level of Service (LOS) Summary in order to determine the result of amending the The Crescent at Ebenezer Phase 2 from 180 assisted living units to 78 apartment units.

After the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments the westbound approach (Westland Drive) will operate at a LOS A during both the AM and PM peak hours and the northbound approach (Serene Breeze Way) will operate at a LOS C during the AM peak hour and a LOS D during the PM peak hour.

Amending the land use from 180 assisted living units to 78 apartments units will cause no change to the westbound approach and add approximately 0.1 seconds of delay to the northbound approach during the AM peak hour and reduce the delay by 1.7 seconds of delay during the PM peak hour.

The unsignalized intersection capacity analyses shows a 95% queue length after the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments at Crescent Lake Way of approximately two car lengths during the peak hours; therefore the existing storage at the intersection is adequate and no change is necessary.

"The Crescent at Ebenezer Traffic Impact Study" concluded that a westbound left turn on Westland Drive is warranted after the full buildout of The Crescent at Ebenezer. As a part of the construction of The Crescent at Ebenezer Apartments – Phase 1 a westbound left turn lane with a 75 foot storage length was installed at the intersection of Westland Drive at Serene Breeze Way.

The unsignalized intersection capacity analyses shows a 95% queue length after the completion of The Crescent at Ebenezer Commercial Site & Phase 2 Apartments for the westbound left turn lane at the intersection of Westland Drive at Serene Breeze Way of less than one car length during both the AM and PM peak hours; therefore the existing storage at the intersection is adequate and no change is necessary.

Attachment 1
Traffic Counts

Project: The Crescent at Ebenezer
Intersection: Ebenezer Road at Westland Drive / Ebenezer United Methodist Church
Date Conducted: 05/10/2018

Start	Ebenezer UMC Eastbound				Westland Drive Westbound				Ebenezer Road Northbound				Ebenezer Road Southbound				Int. Total
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	
7:00 AM	0	1	0	1	32	0	37	69	0	161	40	201	12	102	0	114	385
7:15 AM	0	0	0	0	68	0	68	136	0	306	61	367	15	146	0	161	664
7:30 AM	0	0	0	0	51	0	93	144	0	406	101	507	39	167	0	206	857
7:45 AM	2	0	0	2	57	2	91	150	0	449	78	527	32	138	0	170	849
Total	2	1	0	3	208	2	289	499	0	1322	280	1602	98	553	0	651	2755
8:00 AM	0	0	3	3	59	0	85	144	3	399	120	522	36	163	0	199	868
8:15 AM	0	0	0	0	50	0	47	97	0	265	73	338	32	174	1	207	642
8:30 AM	0	0	0	0	61	0	54	115	0	211	91	302	20	128	1	149	566
8:45 AM	0	0	0	0	47	0	51	98	0	192	65	257	18	112	0	130	485
Total	0	0	3	3	217	0	237	454	3	1067	349	1419	106	577	2	685	2561
11:00 AM	2	0	0	2	35	0	29	64	1	141	44	186	30	133	0	163	415
11:15 AM	1	0	0	1	35	0	29	64	0	134	60	194	29	134	1	164	423
11:30 AM	0	0	0	0	34	0	41	75	0	138	47	185	32	142	1	175	435
11:45 AM	2	2	0	4	42	0	42	84	0	183	52	235	37	129	0	166	489
Total	5	2	0	7	146	0	141	287	1	596	203	800	128	538	2	668	1762
12:00 PM	7	2	0	9	38	0	45	83	1	126	37	164	24	151	0	175	431
12:15 PM	1	0	0	1	46	0	39	85	0	148	46	194	37	164	0	201	481
12:30 PM	2	1	2	5	50	1	32	83	1	150	39	190	38	164	1	203	481
12:45 PM	0	0	0	0	52	0	47	99	0	175	50	225	30	167	0	197	521
Total	10	3	2	15	186	1	163	350	2	599	172	773	129	646	1	776	1914
2:00 PM	0	0	0	0	62	0	41	103	0	127	51	178	53	184	1	238	519
2:15 PM	0	0	0	0	70	0	32	102	0	143	40	183	41	191	1	233	518
2:30 PM	0	0	0	0	64	1	32	97	1	147	28	176	36	202	0	238	511
2:45 PM	1	0	0	1	72	0	42	114	0	185	47	232	45	176	2	223	570
Total	1	0	0	1	268	1	147	416	1	602	166	769	175	753	4	932	2118
3:00 PM	0	0	0	0	53	0	52	105	0	193	49	242	40	186	0	226	573
3:15 PM	0	0	0	0	53	0	55	108	0	208	64	272	48	184	0	232	612
3:30 PM	0	1	1	2	83	0	56	139	0	169	37	206	54	242	1	297	644
3:45 PM	0	0	2	2	97	1	48	146	0	162	64	226	76	339	0	415	789
Total	0	1	3	4	286	1	211	498	0	732	214	946	218	951	1	1170	2618
4:00 PM	0	0	2	2	99	0	34	133	1	165	61	227	62	255	0	317	679
4:15 PM	1	1	0	2	72	0	43	115	1	187	77	265	59	259	0	318	700
4:30 PM	0	0	2	2	93	1	44	138	0	162	72	234	68	245	0	313	687
4:45 PM	0	0	0	0	106	1	47	154	0	181	99	280	74	277	0	351	785
Total	1	1	4	6	370	2	168	540	2	695	309	1006	263	1036	0	1299	2851
5:00 PM	1	0	0	1	129	1	49	179	2	189	78	269	75	309	2	386	835
5:15 PM	1	0	1	2	131	0	53	184	1	213	102	316	88	316	0	404	906
5:30 PM	1	1	1	3	126	0	36	162	2	224	83	309	80	308	2	390	864
5:45 PM	0	0	0	0	113	0	39	152	4	277	93	374	91	275	2	368	894
Total	3	1	2	6	499	1	177	677	9	903	356	1268	334	1208	6	1548	3499
Grand Total	6	4	12	22	1580	6	1082	2668	14	4719	1508	6241	1019	4325	9	5353	14284
Approach %	27.3	18.2	54.5		59.2	0.2	40.6		0.2	75.6	24.2		19.0	80.8	0.2		
Total %	0.0	0.0	0.1	0.2	11.1	0.0	7.6	18.7	0.1	33.0	10.6	43.7	7.1	30.3	0.1	37.5	

Project: The Crescent at Ebenezer
Date Conducted: 5/10/2018

AM Peak Hour	7:15 AM - 8:15 AM	3238
PM Peak Hour	5:00 PM - 6:00 PM	3499

Start	Ebenezer UMC Eastbound				Westland Drive Westbound				Ebenezer Road Northbound				Ebenezer Road Southbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM																	
AM Peak Hour begins at 7:30 AM																	
7:15 AM	0	**0**	0	0	**68**	0	68	136	0	306	61	367	15	146	0	161	664
7:30 AM	0	0	0	0	51	0	**93**	144	0	406	101	507	**39**	**167**	0	206	857
7:45 AM	**2**	0	0	2	57	**2**	91	150	0	**449**	78	527	32	138	0	170	849
8:00 AM	0	0	**3**	3	59	0	85	144	**3**	399	**120**	522	36	163	0	199	**868**
Total Volume	2	0	3	5	235	2	337	574	3	1560	360	1923	122	614	0	736	3238
Future (2% over 3 yrs)	2	0	3		249	2	358		3	1655	382		129	652	0		3436
PHF	0.25	-	0.25		0.86	0.25	0.91		0.25	0.87	0.75		0.78	0.92	-		0.93
Peak Hour Analysis from 3:00 PM to 6:00 PM																	
PM Peak Hour begins at 5:00 PM																	
5:00 PM	**1**	0	0	1	129	**1**	49	179	2	189	78	269	75	309	**2**	386	835
5:15 PM	1	0	**1**	2	**131**	0	**53**	184	1	213	**102**	316	88	**316**	0	404	**906**
5:30 PM	1	**1**	1	3	126	0	36	162	2	224	83	309	80	308	2	390	864
5:45 PM	0	0	0	0	113	0	39	152	**4**	**277**	93	374	**91**	275	2	368	894
Total Volume	3	1	2	6	499	1	177	677	9	903	356	1268	334	1208	6	1548	3499
Future (2% over 3 yrs)	3	1	2		530	1	188		10	958	378		354	1282	6		3713
PHF	0.75	0.25	0.50		0.95	0.25	0.83		0.56	0.81	0.87		0.92	0.96	0.75		0.97

Project: The Crescent at Ebenezer
Intersection: Ebenezer Road at Westland Drive
Date Conducted: 05/17/2018

Start	Westland Drive Eastbound			Ebenezer Road Northbound			Ebenezer Road Southbound			Int. Total
	Left	Right	Total	Left	Thru	Total	Thru	Right	Total	
7:00 AM	64	7	71	37	129	166	68	79	147	384
7:15 AM	97	11	108	27	196	223	76	164	240	571
7:30 AM	149	3	152	33	378	411	111	97	208	771
7:45 AM	168	4	172	34	331	365	130	72	202	739
Total	478	25	503	131	1034	1165	385	412	797	2465
8:00 AM	153	8	161	32	241	273	142	80	222	656
8:15 AM	112	12	124	32	199	231	134	85	219	574
8:30 AM	87	10	97	42	153	195	93	71	164	456
8:45 AM	79	14	93	29	154	183	99	51	150	426
Total	431	44	475	135	747	882	468	287	755	2112
11:00 AM	62	15	77	27	99	126	109	60	169	372
11:15 AM	73	15	88	13	126	139	110	71	181	408
11:30 AM	77	19	96	23	128	151	114	54	168	415
11:45 AM	52	15	67	20	143	163	125	61	186	416
Total	264	64	328	83	496	579	458	246	704	1611
12:00 PM	58	20	78	12	127	139	147	61	208	425
12:15 PM	72	21	93	21	123	144	132	94	226	463
12:30 PM	64	9	73	12	146	158	143	70	213	444
12:45 PM	52	18	70	21	133	154	160	84	244	468
Total	246	68	314	66	529	595	582	309	891	1800
2:00 PM	66	16	82	15	123	138	137	75	212	432
2:15 PM	54	17	71	19	111	130	154	93	247	448
2:30 PM	45	21	66	19	111	130	144	110	254	450
2:45 PM	66	34	100	33	170	203	142	105	247	550
Total	231	88	319	86	515	601	577	383	960	1880
3:00 PM	79	14	93	28	130	158	131	86	217	468
3:15 PM	103	31	134	23	154	177	165	103	268	579
3:30 PM	87	27	114	23	144	167	241	92	333	614
3:45 PM	69	20	89	20	139	159	289	138	427	675
Total	338	92	430	94	567	661	826	419	1245	2336
4:00 PM	83	32	115	29	144	173	208	105	313	601
4:15 PM	90	43	133	25	164	189	211	128	339	661
4:30 PM	98	37	135	37	149	186	231	116	347	668
4:45 PM	93	40	133	29	159	188	232	126	358	679
Total	364	152	516	120	616	736	882	475	1357	2609
5:00 PM	109	45	154	38	157	195	234	158	392	741
5:15 PM	98	46	144	27	179	206	291	184	475	825
5:30 PM	124	52	176	40	175	215	307	166	473	864
5:45 PM	98	39	137	36	188	224	232	138	370	731
Total	429	182	611	141	699	840	1064	646	1710	3161
Grand Total	2781	715	3496	856	5203	6059	5242	3177	8419	17974
Approach %	79.5	20.5		14.1	85.9		62.3	37.7		
Total %	15.5	4.0	19.5	4.8	28.9	33.7	29.2	17.7	46.8	

Project: The Crescent at Ebenezer
Date Conducted: 5/17/2018

AM Peak Hour	7:30 AM - 8:30 AM	2740
PM Peak Hour	5:00 PM - 6:00 PM	3161

Start	Westland Drive Eastbound			Ebenezer Road Northbound			Ebenezer Road Southbound			Int. Total
	Left	Right	App. Total	Left	Thru	App. Total	Thru	Right	App. Total	
Peak Hour Analysis from 7:00 AM to 9:00 AM										
AM Peak Hour begins at 7:30 AM										
7:30 AM	149	3	152	33	**378**	411	111	**97**	208	**771**
7:45 AM	**168**	4	172	**34**	331	365	130	72	202	739
8:00 AM	153	8	161	32	241	273	**142**	80	222	656
8:15 AM	112	**12**	124	32	199	231	134	85	219	574
Total Volume	582	27	609	131	1149	1280	517	334	851	2740
Future (2% over 3 yrs)	618	29		139	1219		549	354		2908
PHF	0.87	0.56		0.96	0.76		0.91	0.86		0.89
Peak Hour Analysis from 3:00 PM to 6:00 PM										
PM Peak Hour begins at 5:00 PM										
5:00 PM	109	45	154	38	157	195	234	158	392	741
5:15 PM	98	46	144	27	179	206	291	**184**	475	825
5:30 PM	**124**	**52**	176	**40**	175	215	**307**	166	473	**864**
5:45 PM	98	39	137	36	**188**	224	232	138	370	731
Total Volume	429	182	611	141	699	840	1064	646	1710	3161
Future (2% over 3 yrs)	455	193		150	742		1129	686		3354
PHF	0.86	0.88		0.88	0.93		0.87	0.88		0.91

	Year	Adjusted Average Daily Traffic
1	2001	15586
2	2002	17645
3	2003	15651
4	2004	16730
5	2005	16397
6	2006	17434
7	2007	16355
8	2008	15111
9	2009	14530
10	2010	15533
11	2011	14717
12	2012	15634
13	2013	16555
14	2014	14456
15	2015	14550
16	2016	14546
17	2017	14691

ADT Trend - TDOT Station #000286
Ebenezer Road - Southwest Knoxville

Most Recent Trend Line Growth

Year	ADT		Year	ADT
2007	16355		2014	14456
2017	14691		2017	14691

Annual Percent Growth   **-1.02%**   **Annual Percent Growth**   **0.54%**

	Year	Adjusted Average Daily Traffic
1	2001	9460
2	2002	8850
3	2003	9220
4	2004	11040
5	2005	10267
6	2006	11230
7	2007	9890
8	2008	9440
9	2009	8750
10	2010	9220
11	2011	8050
12	2012	8620
13	2013	9010
14	2014	9340
15	2015	9390
16	2016	10950
17	2017	9870

ADT Trend - TPO Station ID: 093M002
Westland Dr - 1000' E of Villa Crest Dr

Most Recent Trend Line Growth

Year	ADT
2012	8620
2017	9870

Annual Percent Growth   **2.90%**

	Year	Adjusted Average Daily Traffic
1	2001	7950
2	2002	8150
3	2003	7380
4	2004	0
5	2005	10094
6	2006	10080
7	2007	10330
8	2008	8730
9	2009	9670
10	2010	10190
11	2011	10580
12	2012	10600
13	2013	11010
14	2014	10680
15	2015	11070
16	2016	11480
17	2017	12110

ADT Trend - TPO Station ID: 093M001
Westland Dr - 100' E of Cloverhill Rd

Most Recent Trend Line Growth

Year	ADT
2012	10600
2017	12110

Annual Percent Growth   2.85%

Attachment 3
Trip Generation

Project: Crescent Commercial - Phase 2
Date Conducted: 7/7/2019

Coffee/Donut Shop with Drive-Through Window (LUC 937)
3,434 SF / 60 Seats

Average Daily Traffic
Average Rate = 470.95
T = 820.38 * (3.434)
T = 2817

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
T = 3.93(X) + 10.11
T = 3.93(60 seats) + 10.11
T = 246

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 1.22
T = 1.22 (60 seats)
T = 73

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	2817	50%	50%	1409	1409
AM Peak Hour	246	52%	48%	128	118
PM Peak Hour	73	45%	55%	33	40

Pass-By Trips 40%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1127	50%	50%	563	563
AM Peak Hour	98	52%	48%	51	47
PM Peak Hour	29	45%	55%	13	16

New Trips 60%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1690	50%	50%	845	845
AM Peak Hour	148	52%	48%	77	71
PM Peak Hour	44	45%	55%	20	24

Project: Crescent Commercial - Phase 2
Date Conducted: 2/18/2021

Medical-Dental Office Building (LUC 720)
2,800 SF

Average Daily Traffic	**Average Rate**
T = 38.42(X) - 87.62	Average Rate = 34.8
T = 38.42(2.80) - 87.62	T = 34.8 * (2.80)
T = 20	T = 97

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
$Ln(T) = 0.89\ Ln(X) + 1.31$
$Ln(T) = 0.89\ Ln(2.80) + 1.31$
T = 9

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
T = 3.39(X) + 2.02
T = 3.39(2.80) + 2.02
T = 12

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	97	50%	50%	49	49
AM Peak Hour	9	78%	22%	7	2
PM Peak Hour	12	28%	72%	3	9

Project: Crescent Commercial - Phase 2
Date Conducted: 2/19/2021

Hair Salon (LUC 918)
2,007 SF

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 1.21
T = 1.21 * (2.007)
T = 2

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 1.45
T = 1.45 * (2.007)
T = 3

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	-	50%	50%	-	-
AM Peak Hour	2	83%	17%	2	0
PM Peak Hour	3	17%	83%	1	2

Project: Crescent Commercial - Phase 2
Date Conducted: 3/1/2021

Fast Casual Restaurant (LUC 930)
4,853 SF

Average Daily Traffic
Average Rate = 315.17
T = 315.17 * (4.853)
T = 1530

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 2.07
T = 2.07 * (4.853)
T = 10

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 14.13
T = 14.13 * (4.853)
T = 69

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1530	50%	50%	765	765
AM Peak Hour	10	67%	33%	7	3
PM Peak Hour	69	55%	45%	38	31

Pass-By Trips 40%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	612	50%	50%	306	306
AM Peak Hour	4	67%	33%	3	1
PM Peak Hour	28	55%	45%	15	12

New Trips 60%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	918	50%	50%	459	459
AM Peak Hour	6	67%	33%	4	2
PM Peak Hour	41	55%	45%	23	19

Project: Westland and Ebenezer Development
Date Conducted: 3/24/2021

Local Apartment Trip Generation Study
78 Apartment Units

Average Daily Traffic
$T = 15.193 (X)^{0.899}$
$T = 15.193 (78)^{0.899}$
$T = 763$

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
$T = 0.758 (X)^{0.924}$
$T = 0.758 (78)^{0.924}$
$T = 42$

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
$T = 0.669 (X) + 10.069$
$T = 0.669 (78) + 10.069$
$T = 62$

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	763	50%	50%	382	382
AM Peak Hour	42	22%	78%	9	33
PM Peak Hour	62	55%	45%	34	28

Project: Westland and Ebenezer Development
Date Conducted: 7/7/2019

Gasoline/Service Station With Convenience Market - LUC 853
3,997 SF

Average Daily Traffic
Average Rate = 624.20
T = 624.20 (3.997)
T = 2495

Peak Hour of Adjacent Street Traffic
One Hour Between 7 and 9 a.m.
Average Rate = 40.59
T = 40.59 (3.997)
T = 162

Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.
Average Rate = 49.29
T = 49.29 (3.997)
T = 197

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	2495	50%	50%	1248	1248
AM Peak Hour	162	50%	50%	81	81
PM Peak Hour	197	50%	50%	99	99

Pass-By Trips 65%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	1622	50%	50%	811	811
AM Peak Hour	105	50%	50%	53	53
PM Peak Hour	128	50%	50%	64	64

New Trips 35%

Time Period	Total Trips	Percent		Number	
		Enter	Exit	Enter	Exit
Weekday (24 hours)	873	50%	50%	437	437
AM Peak Hour	57	50%	50%	28	28
PM Peak Hour	69	50%	50%	34	34

Hair Salon
(918)

Vehicle Trip Ends vs:	1000 Sq. Ft. GFA
On a:	Weekday,
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	General Urban/Suburban
Number of Studies:	1
1000 Sq. Ft. GFA:	4
Directional Distribution:	Not Available

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.21	1.21 - 1.21	*

Data Plot and Equation

Caution – Small Sample Size

X Study Site

- - - - Average Rate

Fitted Curve Equation: Not Given

R^2= ****

Hair Salon
(918)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	1
1000 Sq. Ft. GFA:	4
Directional Distribution:	17% entering, 83% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.45	1.45 - 1.45	*

Data Plot and Equation

Caution – Small Sample Size

× **Study Site**

- - - - **Average Rate**

Fitted Curve Equation: Not Given

R²= ****

Fast Casual Restaurant
(930)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	1
1000 Sq. Ft. GFA:	3
Directional Distribution:	67% entering, 33% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.07	2.07 - 2.07	*

Data Plot and Equation

Caution – Small Sample Size

X **Study Site**

- - - - **Average Rate**

Fitted Curve Equation: Not Given

$R^2 = ****$

Fast Casual Restaurant
(930)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	15
1000 Sq. Ft. GFA:	3
Directional Distribution:	55% entering, 45% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
14.13	5.94 - 34.83	7.72

Data Plot and Equation

X **Study Site**   - - - - **Average Rate**

Fitted Curve Equation: Not Given   R²= ****

Fast Casual Restaurant
(930)

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

Setting/Location:	**General Urban/Suburban**
Number of Studies:	1
1000 Sq. Ft. GFA:	3
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
315.17	315.17 - 315.17	*

Data Plot and Equation

Caution – Small Sample Size

X Study Site

- - - - Average Rate

Fitted Curve Equation: Not Given

R²= ****

Coffee/Donut Shop with Drive-Through Window
(937)

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

Setting/Location: General Urban/Suburban
Number of Studies: 2
1000 Sq. Ft. GFA: 2
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
820.38	738.66 - 869.00	*

Data Plot and Equation

Caution – Small Sample Size

X = 1000 Sq. Ft. GFA

✕ **Study Site**   - - - - **Average Rate**

Fitted Curve Equation: Not Given R^2= ****

Coffee/Donut Shop with Drive-Through Window
(937)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	61
1000 Sq. Ft. GFA:	2
Directional Distribution:	51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
88.99	18.32 - 353.57	48.19

Data Plot and Equation

X = 1000 Sq. Ft. GFA

✕ **Study Site**   - - - - **Average Rate**

Fitted Curve Equation: Not Given R^2= ****

Coffee/Donut Shop with Drive-Through Window
(937)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	26
1000 Sq. Ft. GFA:	2
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
43.38	2.09 - 92.31	18.88

Data Plot and Equation

X **Study Site**

– – – – **Average Rate**

Fitted Curve Equation: Not Given

$R^2=$ ****

Medical-Dental Office Building
(720)

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

Setting/Location: General Urban/Suburban
Number of Studies: 28
1000 Sq. Ft. GFA: 24
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
34.80	9.14 - 100.75	9.79

Data Plot and Equation

X = 1000 Sq. Ft. GFA

✕ Study Site ——— Fitted Curve – – – Average Rate

Fitted Curve Equation: T = 38.42(X) - 87.62 R^2= 0.95

Medical-Dental Office Building
(720)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	44
1000 Sq. Ft. GFA:	32
Directional Distribution:	78% entering, 22% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.78	0.85 - 14.30	1.28

Data Plot and Equation

X **Study Site**   ——— **Fitted Curve**   - - - - **Average Rate**

Fitted Curve Equation: Ln(T) = 0.89 Ln(X) + 1.31 R^2= 0.80

Medical-Dental Office Building
(720)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	65
1000 Sq. Ft. GFA:	28
Directional Distribution:	28% entering, 72% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.46	0.25 - 8.86	1.58

Data Plot and Equation

X Study Site   ————— Fitted Curve   - - - - Average Rate

Fitted Curve Equation: T = 3.39(X) + 2.02 R^2= 0.73

ite

Convenience Market with Gasoline Pumps
(853)

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

Setting/Location:	**General Urban/Suburban**
Number of Studies:	34
1000 Sq. Ft. GFA:	3
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
624.20	115.13 - 1167.27	283.35

Data Plot and Equation

X Study Site

- - - - Average Rate

Fitted Curve Equation: Not Given

$R^2 = ****$

Convenience Market with Gasoline Pumps
(853)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	57
1000 Sq. Ft. GFA:	3
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
40.59	6.30 - 104.76	19.18

Data Plot and Equation

X = 1000 Sq. Ft. GFA

X Study Site   - - - - Average Rate

Fitted Curve Equation: Not Given R^2= ****

Convenience Market with Gasoline Pumps
(853)

Vehicle Trip Ends vs:	**1000 Sq. Ft. GFA**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	67
1000 Sq. Ft. GFA:	3
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
49.29	9.66 - 115.71	22.49

Data Plot and Equation

X = 1000 Sq. Ft. GFA

✕ **Study Site**   - - - - **Average Rate**

Fitted Curve Equation: Not Given R^2= ****

Attachment 4
Signal Timing

LOCAL CONTROLLER PROGRAMMING

INTERSECTION NUMBER: **19** ZONE: **D**

INTERSECTION: **Ebenezer Road at Westland Drive (north)**
INSTALLATION DATE: _____
PROGRAMMED BY: _____
NOTES: _____
_____
_____

PEEK TRAFFIC — A Quixote Company

PEEK 3000 SERIES

MASTER TYPE: **PEEK 3000**

MASTER LOCATION: _____

TIME BY PHASE (SEC) & FUNCTIONS

PHASE	1	2	3	4	5	6	7	8
INITIAL	6	20	6	8				
PASSAGE	3.0	3.0	3.0	3.0				
YELLOW	4.0	4.5	3.0	3.5				
RED CLEAR	2.0	1.5	2.5	2.0				
WALK		7	7	7				
PED CLEAR		18	26	25				
MAX 1								
MAX 2								
MAX 3 LIMIT								
MAX 3 ADJUST								
CNA 1								
CNA 2								
WALK REST MOD.								
FLASH WALK								
INHIBIT MAX								
PED RECYCLE								
MIN RECALL								
MAX RECALL								
PED RECALL								
SOFT RECALL								
NON-LOCK								
VEHICLE OMIT								
PED OMIT								
MAX OUTS TO ADJ MAX 3								
GAP OUTS TO ADJ MAX 3								

CONTROLLER OPTIONS

PHASE	1	2	3	4	5	6	7	8
START UP								
UCF LAST								
UCF EXIT								
SIM. GAP								

MIN RED REVERT		UCF OVERRIDE HOLD				PRE-EMPT		
RED REVERT TIME		UCF TEST A OR B				OVERRIDES		
AUTO PED CLEAR		PASSAGE SEQUENTIAL				STOP TIME		
START UP FLASH		ENABLE SIM. GAP						
START UP INTERVAL		ENHANCED PED OPERATION						
START UP ALL RED		EXT. START OVERRIDES						
FLASH								
FREE								
SPECIAL								

SIGNAL DISPLAYS

WALK / WAIT / WALK / DONT WALK

PHASING SCHEMATIC

Main Line Street
2 1
Side Street 3 →
← 4 Side Street
North
2
Main Line Street

OFFICIAL SEAL — KNOX COUNTY TENN.

PHASING SEQUENCE

KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

INTERSECTION NUMBER: **19** ZONE: **D**

DETECTOR SETTINGS

PEEK
TRAFFIC
A Qbeta Company

PEEK 3000 SERIES

INTERSECTION: Ebenezer Road at Westland Drive (north)
INSTALLATION DATE: _____
PROGRAMMED BY: _____
NOTES: _____
_____
_____
_____

DETECTION DATA

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

DETECTOR ASSIGNMENTS

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

DETECTOR MODES & TIMING

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

DELAY INHIBITS

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

OFFICIAL SEAL
KNOX COUNTY, TENN.

KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

INTERSECTION: **Ebenezer Road at Westland Drive (north)**
INSTALLATION DATE: _____
PROGRAMMED BY: _____
NOTES: **Offset is referenced at beginning of yellow**

PEEK 3000 SERIES

PHASE ALLOCATIONS (SEC)

PHASE	1	2	3	4	5	6	7	8
CYCLE 1/SPLIT 1	16	66	13	15	16	66	13	15
CYCLE 1/SPLIT 2								
CYCLE 2/SPLIT 1	30	46	15	29	30	46	15	29
CYCLE 2/SPLIT 2								
CYCLE 3/SPLIT 1	16	34	20	20	16	34	20	20
CYCLE 3/SPLIT 2								
CYCLE 4/SPLIT 1								
CYCLE 4/SPLIT 2								

DYNAMIC OMITS

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

OPERATING MODE

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

CYCLE LENGTH / DWELL / OFFSETS

CYCLE	1	2	3	4	5	6
CYCLE LENGTH	110	120	90			
MAX DWELL						
OFFSET 1	21	47	40			
OFFSET 2						
OFFSET 3						
OFFSET 4						
OFFSET 5						

DUAL ENTRY

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

CYCLE / OFFSET / SPLIT / FREE TO TOD CIRCUITS

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

PHASE REVERSAL

PATTERN	MODE	PHASES	
		LEAD	LAG

COORD. PHASES

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

INTERSECTION NUMBER: **19**   ZONE: **D**

TIME OF DAY PROGRAMMING

PEEK TRAFFIC
A Quixote Company

PEEK 3000 SERIES

INTERSECTION: **Ebenezer Road at Westland Drive (north)**
INSTALLATION DATE: _____
PROGRAMMED BY: _____
NOTES: _____
_____
_____

WEEKLY PROGRAM PLAN

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

DAYLIGHT SAVINGS

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

CIRCUIT OVERRIDES

CKT	SYM	ON/OFF/TOD

TIME DEPENDENT SYNC REF

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

DAY PLAN EVENTS

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

TOD CIRCUIT PLANS

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

LOCAL CONTROLLER PROGRAMMING

INTERSECTION NUMBER: 20   **ZONE:** D

INTERSECTION: Ebenezer Road at Westland Drive (south)

INSTALLATION DATE: _____

PROGRAMMED BY: _____

NOTES: _____

_____

PEEK TRAFFIC *A Quote Company*

PEEK 3000 SERIES

MASTER TYPE: _____ **PEEK 3000**

MASTER LOCATION: _____

TIME BY PHASE (SEC) & FUNCTIONS

PHASE	1	2	3	4	5	6	7	8
INITIAL	6	16		8		16		
PASSAGE	3.0	5.0		3.0		5.0		
YELLOW	4.0	4.0		4.0		4.0		
RED CLEAR	2.0	2.0		2.0		2.0		
WALK		7		7				
PED CLEAR		23		22				
MAX 1	20	40		20		40		
MAX 2	12	20		20		20		
MAX 3 LIMIT								
MAX 3 ADJUST								
CNA 1								
CNA 2								
WALK REST MOD.								
FLASH WALK								
INHIBIT MAX								
PED RECYCLE								
MIN RECALL								
MAX RECALL								
PED RECALL								
SOFT RECALL								
NON-LOCK								
VEHICLE OMIT								
PED OMIT								
MAX OUTS TO ADJ MAX 3								
GAP OUTS TO ADJ MAX 3								

CONTROLLER OPTIONS

PHASE	1	2	3	4	5	6	7	8
START UP								
UCF LAST								
UCF EXIT								
SIM. GAP								

MIN RED REVERT	UCF OVERRIDE HOLD		PRE-EMPT
RED REVERT TIME	UCF TEST A OR B		OVERRIDES
AUTO PED CLEAR	PASSAGE SEQUENTIAL		STOP TIME
START UP FLASH	ENABLE SIM. GAP		
START UP INTERVAL	ENHANCED PED OPERATION		
START UP ALL RED	EXT. START OVERRIDES		
FLASH			
FREE			
SPECIAL			

SIGNAL DISPLAYS

PHASING SCHEMATIC

Main Line Street
2

Side Street 4

North

Driveway

1   6

Main Line Street

PHASING SEQUENCE

| INTERSECTION NUMBER: | **20** | ZONE: | **D** |

DETECTOR SETTINGS

PEEK TRAFFIC A Qfote Company

PEEK 3000 SERIES

INTERSECTION: Ebenezer Road at Westland Drive (south)
INSTALLATION DATE: _____
PROGRAMMED BY: _____
NOTES: _____
_____
_____
_____

DETECTION DATA

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

DETECTOR ASSIGNMENTS

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

DETECTOR MODES & TIMING

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

DELAY INHIBITS

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

KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

COORDINATION AND OPERATION

INTERSECTION NUMBER: 20 **ZONE:** D

INTERSECTION: Ebenezer Road at Westland Drive (south)

INSTALLATION DATE: _____

PROGRAMMED BY: _____

NOTES: Offset is referenced at beginning of yellow

_____
_____

PEEK TRAFFIC *A Quixote Company*

PEEK 3000 SERIES

PHASE ALLOCATIONS (SEC)

PHASE	1	2	3	4	5	6	7	8
CYCLE 1/SPLIT 1	18	58		34		76		34
CYCLE 1/SPLIT 2								
CYCLE 2/SPLIT 1	15	85		20		100		20
CYCLE 2/SPLIT 2								
CYCLE 3/SPLIT 1	18	44		28		62		28
CYCLE 3/SPLIT 2								
CYCLE 4/SPLIT 1								
CYCLE 4/SPLIT 2								

DYNAMIC OMITS

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

OPERATING MODE

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

CYCLE LENGTH / DWELL / OFFSETS

CYCLE	1	2	3	4	5	6
CYCLE LENGTH	110	120	90			
MAX DWELL						
OFFSET 1	31	76	44			
OFFSET 2						
OFFSET 3						
OFFSET 4						
OFFSET 5						

DUAL ENTRY

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

PHASE REVERSAL

PATTERN	MODE	PHASES LEAD	PHASES LAG

COORD. PHASES

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

CYCLE / OFFSET / SPLIT / FREE TO TOD CIRCUITS

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

KNOX COUNTY
DEPARTMENT OF ENGINEERING AND PUBLIC WORKS

INTERSECTION NUMBER: **20**   ZONE: **D**

INTERSECTION: **Ebenezer Road at Westland Drive (south)**

INSTALLATION DATE: _____

PROGRAMMED BY: _____

NOTES: _____

_____

_____

PEEK
TRAFFIC
A Qfpeta Company

PEEK 3000 SERIES

WEEKLY PROGRAM PLAN

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

DAYLIGHT SAVINGS

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

CIRCUIT OVERRIDES

CKT	SYM	ON/OFF/TOD

TIME DEPENDENT SYNC REF

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

DAY PLAN EVENTS

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

TOD CIRCUIT PLANS

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

Attachment 5
Intersection Worksheets – Existing AM/PM Peaks

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA
Analyst	Addie Kirkham
Jurisdiction	Knox County
Urban Street	Ebenezer Road
Intersection	Ebenezer Road at Westl...
Project Description	223.013 The Crescent at Ebenezer

Analysis Date	5/31/2018
Time Period	Existing AM Peak
Analysis Year	2018
File Name	Existing AM Peak_Westland (north).xus

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.93
Analysis Period	1> 7:00

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	2	0	3	235	2	337	3	1560	360	122	614	0

Signal Information

Cycle, s	110.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	Off	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	5.9	65.1	0.6	0.3	16.1	0.0
Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.4	6.1	21.9	21.6		71.6	10.4	82.0
Change Period, ($Y+R_c$), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.4	4.3	4.3		0.0	4.1	0.0
Queue Clearance Time (g_s), s	2.1	2.2	4.6	17.6			5.0	
Green Extension Time (g_e), s	0.0	0.0	1.9	0.0		0.0	0.2	0.0
Phase Call Probability	0.06	0.09	1.00	1.00			0.98	
Max Out Probability	0.07	0.14	0.09	1.00			0.13	

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	2	3		253	328		3	1677	387	131	660	0
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1585		1730	1587		774	1781	1585	1781	1870	0
Queue Service Time (g_s), s	0.1	0.2		2.6	15.6		0.1	29.4	5.4	3.0	2.2	0.0
Cycle Queue Clearance Time (g_c), s	0.1	0.2		2.6	15.6		0.1	29.4	5.4	3.0	2.2	0.0
Green Ratio (g/C)	0.00	0.01		0.15	0.14		0.59	0.59	0.74	0.66	0.69	
Capacity (c), veh/h	72	8		632	225		524	2108	1168	257	2568	
Volume-to-Capacity Ratio (X)	0.030	0.397		0.400	1.456		0.006	0.796	0.331	0.511	0.257	0.000
Back of Queue (Q), ft/ln (95 th percentile)	2.8	7		129.6	802.3		0.9	264.4	170.8	63.3	31.6	0
Back of Queue (Q), veh/ln (95 th percentile)	0.1	0.3		5.1	31.6		0.0	10.4	6.7	2.5	1.2	0.0
Queue Storage Ratio (RQ) (95 th percentile)	0.11	0.00		0.30	0.00		0.01	0.00	0.74	0.45	0.00	0.00
Uniform Delay (d_1), s/veh	54.5	54.5		38.3	44.6		4.7	7.8	12.7	14.3	1.6	
Incremental Delay (d_2), s/veh	0.2	28.5		0.4	228.3		0.0	3.2	0.8	1.6	0.2	0.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	54.7	82.9		38.7	272.9		4.8	11.0	13.5	15.9	1.8	
Level of Service (LOS)	D	F		D	F		A	B	B	B	A	
Approach Delay, s/veh / LOS	71.6		E	171.0		F	11.5		B	4.1		A
Intersection Delay, s/veh / LOS		36.8						D				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.4	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.4	A	2.2	B	1.1	A

HCS7™ Streets Version 7.2.1 Generated: 5/31/2018 4:58:51 PM

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA
Analyst	Addie Kirkham
Jurisdiction	Knox County
Urban Street	Ebenezer Road
Intersection	Ebenezer Road at Westl...
Project Description	223.013 The Crescent at Ebenezer

Analysis Date	May 31, 2018
Time Period	Existing AM Peak
Analysis Year	2018
File Name	Existing AM Peak_Westland (south).xus

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.89
Analysis Period	1> 7:00

Demand Information

Approach Movement	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Demand (*v*), veh/h	582		27				131	1149			517	334

Signal Information

Cycle, s	110.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	On	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	8.9	59.5	23.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		29.6			14.9	80.4		65.5
Change Period, (*Y+R c*), s		6.0			6.0	6.0		6.0
Max Allow Headway (*MAH*), s		4.1			4.1	0.0		0.0
Queue Clearance Time (*g s*), s		21.9			5.6			
Green Extension Time (*g e*), s		1.7			0.3	0.0		0.0
Phase Call Probability		1.00			0.99			
Max Out Probability		0.53			0.00			

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	654		30				147	1291			512	444
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730		1585				1781	1781			1870	1624
Queue Service Time (*g s*), s	19.9		1.4				3.6	7.5			20.5	13.2
Cycle Queue Clearance Time (*g c*), s	19.9		1.4				3.6	7.5			20.5	13.2
Green Ratio (*g/C*)	0.21		0.30				0.64	0.68			0.54	0.54
Capacity (*c*), veh/h	741		468				418	2410			1013	879
Volume-to-Capacity Ratio (*X*)	0.883		0.065				0.352	0.536			0.506	0.506
Back of Queue (*Q*), ft/ln (95 th percentile)	343.6		24				58.4	80.7			205.1	181.5
Back of Queue (*Q*), veh/ln (95 th percentile)	13.5		0.9				2.3	3.2			8.1	7.3
Queue Storage Ratio (*RQ*) (95 th percentile)	1.25		0.00				0.61	0.00			0.00	0.00
Uniform Delay (*d 1*), s/veh	38.0		25.3				10.5	2.1			8.9	8.9
Incremental Delay (*d 2*), s/veh	9.3		0.1				0.5	0.9			1.8	2.1
Initial Queue Delay (*d 3*), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	47.3		25.4				11.0	3.0			10.7	10.9
Level of Service (LOS)	D		C				B	A			B	B
Approach Delay, s/veh / LOS	46.3	D		0.0			3.8	A		10.8	B	
Intersection Delay, s/veh / LOS		15.4						B				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.7	C	0.7	A	2.4	B
Bicycle LOS Score / LOS		F			1.7	B	1.3	A

HCS7™ Streets Version 7.2.1 Generated: 5/31/2018 4:39:00 PM

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA
Analyst	Addie Kirkham
Jurisdiction	Knox County
Urban Street	Ebenezer Road
Intersection	Ebenezer Road at Westl...
Project Description	223.013 The Crescent at Ebenezer

Analysis Date	5/31/2018
Time Period	Existing PM Peak
Analysis Year	2018
File Name	Existing PM Peak_Westland (north).xus

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.97
Analysis Period	1> 7:00

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	3	1	2	499	1	177	9	903	356	334	1208	6

Signal Information

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

Green	12.9	66.6	0.6	0.5	17.4	0.0
Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.6	6.1	23.4	22.9		73.1	17.4	90.5
Change Period, ($Y+R_c$), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.3	4.2	4.2		0.0	4.1	0.0
Queue Clearance Time (g_s), s	2.2	2.2	14.8	12.3			11.6	
Green Extension Time (g_e), s	0.0	0.0	2.6	2.7		0.0	1.3	0.0
Phase Call Probability	0.10	0.10	1.00	0.99			1.00	
Max Out Probability	0.00	0.00	0.02	0.01			0.00	

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	3	3		514	146		9	931	367	344	626	625
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1670		1730	1587		444	1781	1585	1781	1870	1867
Queue Service Time (g_s), s	0.2	0.2		12.8	10.3		0.7	12.5	7.0	9.6	4.8	4.8
Cycle Queue Clearance Time (g_c), s	0.2	0.2		12.8	10.3		0.7	12.5	7.0	9.6	4.8	4.8
Green Ratio (g/C)	0.01	0.00		0.15	0.14		0.56	0.56	0.70	0.68	0.70	0.70
Capacity (c), veh/h	69	8		622	224		306	1977	1110	522	1309	1307
Volume-to-Capacity Ratio (X)	0.045	0.377		0.827	0.655		0.030	0.471	0.331	0.659	0.478	0.478
Back of Queue (Q), ft/ln (95 th percentile)	4.5	7		290.8	186		3.7	182.1	67.1	148.8	68	66.9
Back of Queue (Q), veh/ln (95 th percentile)	0.2	0.3		11.4	7.3		0.1	7.2	2.6	5.9	2.7	2.7
Queue Storage Ratio (RQ) (95 th percentile)	0.18	0.00		0.68	0.00		0.04	0.00	0.29	1.06	0.00	0.00
Uniform Delay (d_1), s/veh	59.3	59.4		45.0	46.0		7.0	8.6	8.5	9.3	1.4	1.4
Incremental Delay (d_2), s/veh	0.3	26.3		2.9	3.2		0.2	0.8	0.8	1.4	1.3	1.3
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	59.6	85.7		47.9	49.3		7.2	9.4	9.3	10.7	2.6	2.6
Level of Service (LOS)	E	F		D	D		A	A	A	B	A	A
Approach Delay, s/veh / LOS	72.7		E	48.2		D	9.3		A	4.4		A
Intersection Delay, s/veh / LOS		14.4						B				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.5	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.6	B	1.6	B	1.8	B

HCS7™ Streets Version 7.2.1 Generated: 5/31/2018 4:58:51 PM

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA
Analyst	Addie Kirkham
Jurisdiction	Knox County
Urban Street	Ebenezer Road
Intersection	Ebenezer Road at Westl...
Project Description	223.013 The Crescent at Ebenezer

Analysis Date	May 31, 2018
Time Period	Existing PM Peak
Analysis Year	2021
File Name	Existing PM Peak_Westland (south).xus

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.89
Analysis Period	1> 7:00

Demand Information

Approach Movement	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Demand (v), veh/h	429		182				141	699			1064	646

Signal Information

Cycle, s	110.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	On	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	8.9	64.2	18.9	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		24.9			14.9	85.1		70.2
Change Period, ($Y+R_c$), s		6.0			6.0	6.0		6.0
Max Allow Headway (MAH), s		4.2			4.1	0.0		0.0
Queue Clearance Time (g_s), s		16.5			7.3			
Green Extension Time (g_e), s		2.4			0.4	0.0		0.0
Phase Call Probability		1.00			0.99			
Max Out Probability		0.11			0.00			

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	482		204				158	785			964	957
Adjusted Saturation Flow Rate (s), veh/h/ln	1730		1585				1781	1781			1870	1646
Queue Service Time (g_s), s	14.5		11.9				5.3	1.4			64.4	63.3
Cycle Queue Clearance Time (g_c), s	14.5		11.9				5.3	1.4			64.4	63.3
Green Ratio (g/C)	0.17		0.25				0.68	0.72			0.58	0.58
Capacity (c), veh/h	594		401				210	2562			1091	960
Volume-to-Capacity Ratio (X)	0.812		0.510				0.754	0.307			0.883	0.997
Back of Queue (Q), ft/ln (95 th percentile)	256		198.2				196.5	19.8			426.2	649
Back of Queue (Q), veh/ln (95 th percentile)	10.1		7.8				7.7	0.8			16.8	26.0
Queue Storage Ratio (RQ) (95 th percentile)	0.93		0.00				2.07	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	40.7		32.7				31.9	0.7			9.5	12.1
Incremental Delay (d_2), s/veh	3.6		1.0				5.4	0.3			10.4	28.3
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	44.4		33.7				37.3	1.0			19.9	40.4
Level of Service (LOS)	D		C				D	A			B	D
Approach Delay, s/veh / LOS	41.2	D		0.0			7.1	A		30.1	C	
Intersection Delay, s/veh / LOS		26.2						C				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.7	C	0.7	A	2.4	B
Bicycle LOS Score / LOS		F			1.3	A	2.1	B

HCS7™ Streets Version 7.2.1 Generated: 6/2/2018 10:43:05 AM

Attachment 6
Intersection Worksheets – Background AM/PM Peaks

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA			
Analyst	Addie Kirkham	Analysis Date	Jul 7, 2019	
Jurisdiction	Knox County	Time Period	Background AM Peak	
Urban Street	Ebenezer Road	Analysis Year	2021	
Intersection	Westland (north)	File Name	Phase 3 AM Peak_Signalized.xus	
Project Description	223.013 The Crescent at Ebenezer			

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.93
Analysis Period	1> 7:00

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	2	0	3	278	2	377	3	1703	386	138	659	0

Signal Information

Cycle, s	110.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	Off	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	5.9	65.1	0.6	0.3	16.1	0.0
Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.4	6.1	21.9	21.6		71.6	10.4	82.0
Change Period, ($Y+R_c$), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.4	4.3	4.3		0.0	4.1	0.0
Queue Clearance Time (g_s), s	2.1	2.2	6.0	17.6			5.4	
Green Extension Time (g_e), s	0.0	0.0	2.1	0.0		0.0	0.2	0.0
Phase Call Probability	0.06	0.09	1.00	1.00			0.99	
Max Out Probability	0.07	0.14	0.18	1.00			0.20	

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	2	3		299	369		3	1718	389	148	709	0
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1585		1730	1586		740	1781	1585	1781	1870	0
Queue Service Time (g_s), s	0.1	0.2		4.0	15.6		0.1	43.3	8.6	3.4	2.4	0.0
Cycle Queue Clearance Time (g_c), s	0.1	0.2		4.0	15.6		0.1	43.3	8.6	3.4	2.4	0.0
Green Ratio (g/C)	0.00	0.01		0.15	0.14		0.59	0.59	0.74	0.66	0.69	
Capacity (c), veh/h	72	8		632	225		503	2107	1167	218	2568	
Volume-to-Capacity Ratio (X)	0.030	0.397		0.473	1.638		0.006	0.815	0.334	0.681	0.276	0.000
Back of Queue (Q), ft/ln (95 th percentile)	2.8	7		155.7	1001.3		1.1	590.5	271.5	113.6	34.2	0
Back of Queue (Q), veh/ln (95 th percentile)	0.1	0.3		6.1	39.4		0.0	23.2	10.7	4.5	1.3	0.0
Queue Storage Ratio (RQ) (95 th percentile)	0.11	0.00		0.37	0.00		0.01	0.00	1.18	0.81	0.00	0.00
Uniform Delay (d_1), s/veh	54.5	54.5		38.7	44.6		6.8	19.9	23.9	22.6	1.6	
Incremental Delay (d_2), s/veh	0.2	28.5		0.6	306.3		0.0	2.4	0.5	3.7	0.3	0.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	54.7	82.9		39.2	350.9		6.8	22.3	24.4	26.3	1.8	
Level of Service (LOS)	D	F		D	F		A	C	C	C	A	
Approach Delay, s/veh / LOS	71.6		E	211.4		F	22.7		C	6.1		A
Intersection Delay, s/veh / LOS	53.4						D					

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.5	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.6	B	2.3	B	1.2	A

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HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA				
Analyst	Addie Kirkham	Analysis Date	Jul 7, 2019		
Jurisdiction	Knox County	Time Period	Background AM Peak		
Urban Street	Ebenezer Road	Analysis Year	2021		
Intersection	Westland (south)	File Name	Phase 3 AM Peak_Signalized.xus		
Project Description	223.013 The Crescent at Ebenezer				

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.89
Analysis Period	1> 7:00

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	632		29				139	1246			577	374

Signal Information

Cycle, s	110.0	Reference Phase	2							
Offset, s	0	Reference Point	End	Green	8.9	58.0	25.1	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		31.1			14.9	78.9		64.0
Change Period, ($Y+R_c$), s		6.0			6.0	6.0		6.0
Max Allow Headway (MAH), s		4.1			4.1	0.0		0.0
Queue Clearance Time (g_s), s		23.6			6.0			
Green Extension Time (g_e), s		1.4			0.3	0.0		0.0
Phase Call Probability		1.00			0.99			
Max Out Probability		0.94			0.02			

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	710		33				156	1400			541	470
Adjusted Saturation Flow Rate (s), veh/h/ln	1730		1585				1781	1781			1870	1623
Queue Service Time (g_s), s	21.6		1.4				4.0	10.6			23.9	17.2
Cycle Queue Clearance Time (g_c), s	21.6		1.4				4.0	10.6			23.9	17.2
Green Ratio (g/C)	0.23		0.31				0.63	0.66			0.53	0.53
Capacity (c), veh/h	789		490				383	2361			986	856
Volume-to-Capacity Ratio (X)	0.900		0.067				0.408	0.593			0.549	0.549
Back of Queue (Q), ft/ln (95 th percentile)	373.8		24.9				66	108.1			320.9	233
Back of Queue (Q), veh/ln (95 th percentile)	14.7		1.0				2.6	4.3			12.6	9.3
Queue Storage Ratio (RQ) (95 th percentile)	1.36		0.00				0.69	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	37.1		24.1				12.2	2.8			15.1	12.0
Incremental Delay (d_2), s/veh	11.4		0.1				0.7	1.1			2.1	2.4
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	48.5		24.2				12.9	3.9			17.2	14.4
Level of Service (LOS)	D		C				B	A			B	B
Approach Delay, s/veh / LOS	47.5	D		0.0			4.8	A		15.9	B	
Intersection Delay, s/veh / LOS		17.8						B				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.7	C	0.7	A	2.4	B
Bicycle LOS Score / LOS		F			1.8	B	1.4	A

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Ebenezer at Crescent Lake
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	7/7/2019	East/West Street	Crescent Lake Way
Analysis Year	2021	North/South Street	Ebenezer Road
Time Analyzed	Background AM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	213.013 The Crescent at Ebenezer		

Site Information

(See General Information above)

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	1	0	1	2	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						19		42			1858	20		7	932	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked						0.500		0.500						0.500		
Percent Grade (%)				0												
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only							1							

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)						21		46						8		
Capacity, c (veh/h)						115		542						320		
v/c Ratio						0.18		0.08						0.03		
95% Queue Length, Q_{95} (veh)						0.6		0.3						0.1		
Control Delay (s/veh)						43.4		12.3						16.6		
Level of Service, LOS						E		B						C		
Approach Delay (s/veh)						22.0								0.1		
Approach LOS						C										

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HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	7/7/2019
Analysis Year	2021
Time Analyzed	Background AM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Driveway
Jurisdiction	Knox County
East/West Street	Weigel's Driveway
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	1	0	0	2	0
Configuration								R			T	R			T	
Volume, V (veh/h)								32			1819	49			939	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked								0.500								
Percent Grade (%)				0												
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								35								
Capacity, c (veh/h)								542								
v/c Ratio								0.06								
95% Queue Length, Q₉₅ (veh)								0.2								
Control Delay (s/veh)								12.1								
Level of Service, LOS								B								
Approach Delay (s/veh)				12.1												
Approach LOS				B												

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	7/7/2019
Analysis Year	2021
Time Analyzed	Background AM Peak
Intersection Orientation	East-West
Project Description	223.013 The Crescent at Ebenezer

Site Information

Intersection	Westland at Driveway
Jurisdiction	Knox County
East/West Street	Westland Drive
North/South Street	Driveway Connection
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		1	0	1		0	0	0
Configuration			TR		LT					L		R				
Volume, V (veh/h)		491		20		12	612			37		12				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
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

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)						13				40		13				
Capacity, c (veh/h)						1014				192		538				
v/c Ratio						0.01				0.21		0.02				
95% Queue Length, Q_{95} (veh)						0.0				0.8		0.1				
Control Delay (s/veh)						8.6				28.6		11.9				
Level of Service, LOS						A				D		B				
Approach Delay (s/veh)			0.3							24.5						
Approach LOS										C						

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HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA
Analyst	Addie Kirkham
Jurisdiction	Knox County
Urban Street	Ebenezer Road
Intersection	Westland (north)
Project Description	223.013 The Crescent at Ebenezer

Analysis Date	Jul 7, 2019
Time Period	Background PM Peak
Analysis Year	2021
File Name	Phase 3 PM Peak_Signalized.xus

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.97
Analysis Period	1> 7:00

Demand Information

Approach Movement	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Demand (v), veh/h	3	1	2	568	1	197	10	1005	388	371	1331	6

Signal Information

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

Green	15.2	61.7	0.6	0.5	20.0	0.0
Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.6	6.1	26.0	25.5		68.2	19.7	87.9
Change Period, ($Y+R_c$), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.3	4.2	4.2		0.0	4.1	0.0
Queue Clearance Time (g_s), s	2.2	2.2	17.0	14.9			13.8	
Green Extension Time (g_e), s	0.0	0.0	3.0	3.1		0.0	1.4	0.0
Phase Call Probability	0.10	0.10	1.00	1.00			1.00	
Max Out Probability	0.00	0.00	0.05	0.03			0.00	

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	3	3		586	185		9	906	350	382	690	689
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1670		1730	1586		393	1781	1585	1781	1870	1867
Queue Service Time (g_s), s	0.2	0.2		15.0	12.9		1.1	22.5	10.7	11.8	8.3	8.3
Cycle Queue Clearance Time (g_c), s	0.2	0.2		15.0	12.9		1.1	22.5	10.7	11.8	8.3	8.3
Green Ratio (g/C)	0.01	0.00		0.17	0.16		0.51	0.51	0.68	0.66	0.68	0.68
Capacity (c), veh/h	69	8		697	258		262	1831	1080	486	1269	1267
Volume-to-Capacity Ratio (X)	0.045	0.377		0.840	0.715		0.034	0.495	0.324	0.787	0.544	0.544
Back of Queue (Q), ft/ln (95 th percentile)	4.5	7		322.2	222.5		5.1	358	248.8	190.6	107.2	105.5
Back of Queue (Q), veh/ln (95 th percentile)	0.2	0.3		12.7	8.8		0.2	14.1	9.8	7.5	4.2	4.2
Queue Storage Ratio (RQ) (95 th percentile)	0.18	0.00		0.76	0.00		0.05	0.00	1.08	1.36	0.00	0.00
Uniform Delay (d_1), s/veh	59.3	59.4		43.2	44.4		12.0	23.7	15.4	14.5	2.2	2.2
Incremental Delay (d_2), s/veh	0.3	26.3		4.0	3.7		0.2	0.6	0.5	2.9	1.7	1.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	59.6	85.7		47.2	48.1		12.1	24.4	15.9	17.3	3.9	3.9
Level of Service (LOS)	E	F		D	D		B	C	B	B	A	A
Approach Delay, s/veh / LOS	72.7		E	47.4		D	22.0		C	6.8		A
Intersection Delay, s/veh / LOS		20.2							C			

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.4	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.8	B	1.7	B	1.9	B

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA			
Analyst	Addie Kirkham	Analysis Date	Jul 7, 2019	
Jurisdiction	Knox County	Time Period	Background PM Peak	
Urban Street	Ebenezer Road	Analysis Year	2021	
Intersection	Westland (south)	File Name	Phase 3 PM Peak_Signalized.xus	
Project Description	223.013 The Crescent at Ebenezer			

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.91
Analysis Period	1> 7:00

Demand Information

Approach Movement	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Demand (v), veh/h	480		193				150	784			1159	705

Signal Information

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

Green	9.0	79.0	14.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		20.0			15.0	100.0		85.0
Change Period, ($Y+R_c$), s		6.0			6.0	6.0		6.0
Max Allow Headway (MAH), s		4.2			4.1	0.0		0.0
Queue Clearance Time (g_s), s		16.0			5.6			
Green Extension Time (g_e), s		0.0			0.1	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	527		212				165	862			980	980
Adjusted Saturation Flow Rate (s), veh/h/ln	1730		1585				1781	1781			1870	1646
Queue Service Time (g_s), s	14.0		14.0				3.6	0.0			52.3	57.1
Cycle Queue Clearance Time (g_c), s	14.0		14.0				3.6	0.0			52.3	57.1
Green Ratio (g/C)	0.12		0.19				0.75	0.78			0.66	0.66
Capacity (c), veh/h	404		303				234	2790			1232	1084
Volume-to-Capacity Ratio (X)	1.307		0.699				0.704	0.309			0.795	0.904
Back of Queue (Q), ft/ln (95 th percentile)	580.5		259.8				169.6	5.1			551.9	635.7
Back of Queue (Q), veh/ln (95 th percentile)	22.9		10.2				6.7	0.2			21.7	25.4
Queue Storage Ratio (RQ) (95 th percentile)	2.11		0.00				1.79	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	50.7		43.3				29.4	0.0			12.5	13.6
Incremental Delay (d_2), s/veh	155.1		6.9				9.1	0.3			4.0	9.4
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	205.7		50.3				38.5	0.3			16.5	23.0
Level of Service (LOS)	F		D				D	A			B	C
Approach Delay, s/veh / LOS	161.1		F	0.0			6.4		A	19.7		B
Intersection Delay, s/veh / LOS			44.1						D			

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	0.6	A	2.4	B
Bicycle LOS Score / LOS		F			1.3	A	2.2	B

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	7/7/2019
Analysis Year	2021
Time Analyzed	Background PM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Crescent Lake
Jurisdiction	Knox County
East/West Street	Crescent Lake Way
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1		0	2	1		1	2	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						11		40			1228	36		49	1853	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked						0.200		0.200						0.200		
Percent Grade (%)							0									
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						12		43						53		
Capacity, c (veh/h)						131		766						566		
v/c Ratio						0.09		0.06						0.09		
95% Queue Length, Q_{95} (veh)						0.3		0.2						0.3		
Control Delay (s/veh)						35.2		10.0						12.0		
Level of Service, LOS						E		A						B		
Approach Delay (s/veh)			15.5											0.3		
Approach LOS			C													

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HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	7/7/2019
Analysis Year	2021
Time Analyzed	Background PM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Driveway
Jurisdiction	Knox County
East/West Street	Weigel's Driveway
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	1	0	0	2	0
Configuration								R			T	R			T	
Volume, V (veh/h)								26			1195	47			1902	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked								0.200								
Percent Grade (%)			0													
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								28								
Capacity, c (veh/h)								792								
v/c Ratio								0.04								
95% Queue Length, Q_{95} (veh)								0.1								
Control Delay (s/veh)								9.7								
Level of Service, LOS								A								
Approach Delay (s/veh)				9.7												
Approach LOS				A												

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	7/7/2019
Analysis Year	2021
Time Analyzed	Background PM Peak
Intersection Orientation	East-West
Project Description	223.013 The Crescent at Ebenezer

Site Information

Intersection	Westland at Driveway
Jurisdiction	Knox County
East/West Street	Westland Drive
North/South Street	Driveway Connection
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		1	0	1		0	0	0
Configuration				TR		LT				L		R				
Volume, V (veh/h)			694	37		14	703			54		18				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
Percent Grade (%)										0						
Right Turn Channelized		No				No				No				No		
Median Type/Storage				Undivided												

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
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

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)						15				59		20				
Capacity, c (veh/h)						827				120		398				
v/c Ratio						0.02				0.49		0.05				
95% Queue Length, Q_{95} (veh)						0.1				2.2		0.2				
Control Delay (s/veh)						9.4				61.1		14.5				
Level of Service, LOS						A				F		B				
Approach Delay (s/veh)					0.5				49.3							
Approach LOS									E							

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Attachment 7
Intersection Worksheets – Commercial Site AM/PM Peaks

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA			
Analyst	Addie Kirkham	Analysis Date	Mar 22, 2021	
Jurisdiction	Knox County	Time Period	Commercial AM Peak	
Urban Street	Ebenezer Road	Analysis Year	2021	
Intersection	Westland (north)	File Name	Phase 4 AM Peak_Signalized.xus	
Project Description	223.013 The Crescent at Ebenezer			

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.93
Analysis Period	1> 7:00

Demand Information

Approach Movement	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Demand (v), veh/h	2	0	3	278	2	380	3	1717	386	142	675	0

Signal Information

Cycle, s	110.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	Off	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	5.9	65.1	0.6	0.3	16.1	0.0
Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.4	6.1	21.9	21.6		71.6	10.4	82.0
Change Period, ($Y+R_c$), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.4	4.3	4.3		0.0	4.1	0.0
Queue Clearance Time (g_s), s	2.1	2.2	6.0	17.6			5.5	
Green Extension Time (g_e), s	0.0	0.0	2.2	0.0		0.0	0.2	0.0
Phase Call Probability	0.06	0.09	1.00	1.00			0.99	
Max Out Probability	0.07	0.14	0.19	1.00			0.22	

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	2	3		299	372		3	1765	397	153	726	0
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1585		1730	1586		728	1781	1585	1781	1870	0
Queue Service Time (g_s), s	0.1	0.2		4.0	15.6		0.1	45.5	8.8	3.5	2.4	0.0
Cycle Queue Clearance Time (g_c), s	0.1	0.2		4.0	15.6		0.1	45.5	8.8	3.5	2.4	0.0
Green Ratio (g/C)	0.00	0.01		0.15	0.14		0.59	0.59	0.74	0.66	0.69	
Capacity (c), veh/h	72	8		632	225		496	2106	1167	210	2568	
Volume-to-Capacity Ratio (X)	0.030	0.397		0.473	1.652		0.006	0.838	0.340	0.727	0.283	0.000
Back of Queue (Q), ft/ln (95 th percentile)	2.8	7		155.7	1017.2		1.1	615.8	278.4	119.8	35	0
Back of Queue (Q), veh/ln (95 th percentile)	0.1	0.3		6.1	40.0		0.0	24.2	11.0	4.7	1.4	0.0
Queue Storage Ratio (RQ) (95 th percentile)	0.11	0.00		0.37	0.00		0.01	0.00	1.21	0.86	0.00	0.00
Uniform Delay (d_1), s/veh	54.5	54.5		38.7	44.6		6.9	20.4	24.2	23.6	1.6	
Incremental Delay (d_2), s/veh	0.2	28.5		0.6	312.6		0.0	2.7	0.5	5.1	0.3	0.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	54.7	82.9		39.2	357.2		6.9	23.1	24.7	28.7	1.8	
Level of Service (LOS)	D	F		D	F		A	C	C	C	A	
Approach Delay, s/veh / LOS	71.6		E	215.5		F	23.4		C	6.5		A
Intersection Delay, s/veh / LOS		54.1						D				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.5	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.6	B	2.4	B	1.2	A

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HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA				
Analyst	Addie Kirkham	Analysis Date	Mar 22, 2021		
Jurisdiction	Knox County	Time Period	Commercial AM Peak		
Urban Street	Ebenezer Road	Analysis Year	2021		
Intersection	Westland (south)	File Name	Phase 4 AM Peak_Signalized.xus		
Project Description	223.013 The Crescent at Ebenezer				

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.89
Analysis Period	1> 7:00

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	648		29				139	1279			601	391

Signal Information

Cycle, s	110.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	On	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	8.9	57.5	25.5	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		31.5			14.9	78.5		63.5
Change Period, ($Y+R_c$), s		6.0			6.0	6.0		6.0
Max Allow Headway (MAH), s		4.1			4.1	0.0		0.0
Queue Clearance Time (g_s), s		24.2			6.0			
Green Extension Time (g_e), s		1.3			0.3	0.0		0.0
Phase Call Probability		1.00			0.99			
Max Out Probability		1.00			0.03			

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (*v*), veh/h	728		33				156	1437			550	478
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1730		1585				1781	1781			1870	1623
Queue Service Time (g_s), s	22.2		1.4				4.0	11.7			25.4	17.7
Cycle Queue Clearance Time (g_c), s	22.2		1.4				4.0	11.7			25.4	17.7
Green Ratio (g/C)	0.23		0.31				0.62	0.66			0.52	0.52
Capacity (*c*), veh/h	803		497				370	2346			978	849
Volume-to-Capacity Ratio (*X*)	0.906		0.066				0.422	0.613			0.563	0.563
Back of Queue (*Q*), ft/ln (95 th percentile)	383.8		24.7				67.1	118.2			326.3	236.6
Back of Queue (*Q*), veh/ln (95 th percentile)	15.1		1.0				2.6	4.7			12.8	9.5
Queue Storage Ratio (*RQ*) (95 th percentile)	1.40		0.00				0.71	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	36.8		23.8				12.9	3.0			15.2	12.2
Incremental Delay (d_2), s/veh	12.3		0.1				0.8	1.2			2.2	2.6
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (*d*), s/veh	49.1		23.8				13.7	4.2			17.5	14.7
Level of Service (LOS)	D		C				B	A			B	B
Approach Delay, s/veh / LOS	48.0	D		0.0			5.1	A		16.2	B	
Intersection Delay, s/veh / LOS	18.1						B					

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.7	C	0.7	A	2.4	B
Bicycle LOS Score / LOS		F			1.8	B	1.4	A

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Commercial AM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Crescent Lake
Jurisdiction	Knox County
East/West Street	Crescent Lake Way
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1		0	2	1		1	2	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						69		67			1829	98		33	922	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked						0.500		0.500						0.500		
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						75		73						36		
Capacity, c (veh/h)						116		542						291		
v/c Ratio						0.64		0.13						0.12		
95% Queue Length, Q_{95} (veh)						3.3		0.5						0.4		
Control Delay (s/veh)						79.8		12.7						19.1		
Level of Service, LOS						F		B						C		
Approach Delay (s/veh)		46.7												0.7		
Approach LOS		E														

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Phase 4 AM Peak_Crescent Lake.xtw

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HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Ebenezer at Driveway
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	3/22/2021	East/West Street	Weigel's Driveway
Analysis Year	2021	North/South Street	Ebenezer Road
Time Analyzed	Commercial AM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	213.013 The Crescent at Ebenezer		

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	1	0	0	2	0
Configuration								R			T	R			T	
Volume, V (veh/h)								43			1833	49			955	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked								0.500								
Percent Grade (%)			0													
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								47								
Capacity, c (veh/h)								542								
v/c Ratio								0.09								
95% Queue Length, Q_{95} (veh)								0.3								
Control Delay (s/veh)								12.3								
Level of Service, LOS								B								
Approach Delay (s/veh)				12.3												
Approach LOS				B												

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Phase 4 AM Peak_Ebenezer Driveway.xtw

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Westland at Driveway
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	3/22/2021	East/West Street	Westland Drive
Analysis Year	2021	North/South Street	Driveway Connection
Time Analyzed	Commercial AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	223.013 The Crescent at Ebenezer		

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		1	0	1		0	0	0
Configuration				TR		LT				L		R				
Volume, V (veh/h)			488	27		31	605			46		28				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
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)						34				50		30				
Capacity, c (veh/h)						1011				179		539				
v/c Ratio						0.03				0.28		0.06				
95% Queue Length, Q_{95} (veh)						0.1				1.1		0.2				
Control Delay (s/veh)						8.7				32.7		12.1				
Level of Service, LOS						A				D		B				
Approach Delay (s/veh)		0.9								24.9						
Approach LOS										C						

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HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA
Analyst	Addie Kirkham
Jurisdiction	Knox County
Urban Street	Ebenezer Road
Intersection	Westland (north)
Project Description	223.013 The Crescent at Ebenezer

Analysis Date	Mar 22, 2021
Time Period	Commercial PM Peak
Analysis Year	2021
File Name	Phase 4 PM Peak_Signalized.xus

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.97
Analysis Period	1> 7:00

Demand Information

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	3	1	2	568	1	200	10	1015	388	373	1340	6

Signal Information

Cycle, s	120.0	Reference Phase	2							
Offset, s	0	Reference Point	End	Green	15.3	61.6	0.6	0.5	20.0	0.0
Uncoordinated	No	Simult. Gap E/W	Off	Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.6	6.1	26.0	25.5		68.1	19.8	87.9
Change Period, ($Y+R_c$), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.3	4.2	4.2		0.0	4.1	0.0
Queue Clearance Time (g_s), s	2.2	2.2	17.0	15.2			13.9	
Green Extension Time (g_e), s	0.0	0.0	3.0	3.1		0.0	1.4	0.0
Phase Call Probability	0.10	0.10	1.00	1.00			1.00	
Max Out Probability	0.00	0.00	0.05	0.04			0.00	

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	3	3		586	188		9	922	353	385	694	693
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1670		1730	1586		390	1781	1585	1781	1870	1867
Queue Service Time (g_s), s	0.2	0.2		15.0	13.2		1.2	23.0	10.7	11.9	8.4	8.5
Cycle Queue Clearance Time (g_c), s	0.2	0.2		15.0	13.2		1.2	23.0	10.7	11.9	8.4	8.5
Green Ratio (g/C)	0.01	0.00		0.17	0.16		0.51	0.51	0.68	0.66	0.68	0.68
Capacity (c), veh/h	69	8		698	258		260	1828	1078	482	1268	1266
Volume-to-Capacity Ratio (X)	0.045	0.377		0.839	0.727		0.035	0.504	0.327	0.798	0.547	0.548
Back of Queue (Q), ft/ln (95 th percentile)	4.5	7		322.1	226.1		5.1	361.6	246.9	192.9	108.5	106.7
Back of Queue (Q), veh/ln (95 th percentile)	0.2	0.3		12.7	8.9		0.2	14.2	9.7	7.6	4.3	4.3
Queue Storage Ratio (RQ) (95 th percentile)	0.18	0.00		0.76	0.00		0.05	0.00	1.07	1.38	0.00	0.00
Uniform Delay (d_1), s/veh	59.3	59.4		43.2	44.5		11.9	23.7	15.3	14.9	2.3	2.3
Incremental Delay (d_2), s/veh	0.3	26.3		4.0	3.9		0.2	0.7	0.5	3.1	1.7	1.7
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	59.6	85.7		47.2	48.4		12.1	24.4	15.8	18.0	4.0	4.0
Level of Service (LOS)	E	F		D	D		B	C	B	B	A	A
Approach Delay, s/veh / LOS	72.7		E	47.5		D	22.0		C	7.0		A
Intersection Delay, s/veh / LOS		20.3						C				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.4	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.8	B	1.7	B	1.9	B

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HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA
Analyst	Addie Kirkham
Jurisdiction	Knox County
Urban Street	Ebenezer Road
Intersection	Westland (south)
Project Description	223.013 The Crescent at Ebenezer

Analysis Date	Mar 22, 2021
Time Period	Commercial PM Peak
Analysis Year	2021
File Name	Phase 4 PM Peak_Signalized.xus

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.91
Analysis Period	1> 7:00

Demand Information

Approach Movement	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Demand (v), veh/h	488		193				150	801			1176	717

Signal Information

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

Green	9.0	79.0	14.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		20.0			15.0	100.0		85.0
Change Period, ($Y+R_c$), s		6.0			6.0	6.0		6.0
Max Allow Headway (MAH), s		4.2			4.1	0.0		0.0
Queue Clearance Time (g_s), s		16.0			5.8			
Green Extension Time (g_e), s		0.0			0.1	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	536		212				165	880			985	985
Adjusted Saturation Flow Rate (s), veh/h/ln	1730		1585				1781	1781			1870	1646
Queue Service Time (g_s), s	14.0		14.0				3.8	0.0			54.2	57.9
Cycle Queue Clearance Time (g_c), s	14.0		14.0				3.8	0.0			54.2	57.9
Green Ratio (g/C)	0.12		0.19				0.75	0.78			0.66	0.66
Capacity (c), veh/h	404		303				232	2790			1232	1084
Volume-to-Capacity Ratio (X)	1.329		0.699				0.710	0.316			0.799	0.908
Back of Queue (Q), ft/ln (95 th percentile)	601.1		259.8				170.7	5.3			558	645.8
Back of Queue (Q), veh/ln (95 th percentile)	23.7		10.2				6.7	0.2			22.0	25.8
Queue Storage Ratio (RQ) (95 th percentile)	2.19		0.00				1.80	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	50.7		43.3				30.0	0.0			12.5	13.7
Incremental Delay (d_2), s/veh	164.2		6.9				9.6	0.3			4.1	9.7
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	214.9		50.3				39.6	0.3			16.6	23.4
Level of Service (LOS)	F		D				D	A			B	C
Approach Delay, s/veh / LOS	168.2	F		0.0			6.5	A		20.0		C
Intersection Delay, s/veh / LOS			45.7						D			

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	0.6	A	2.4	B
Bicycle LOS Score / LOS		F			1.3	A	2.2	B

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Commercial PM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Crescent Lake
Jurisdiction	Knox County
East/West Street	Crescent Lake Way
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1		0	2	1		1	2	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						49		54			1218	71		67	1844	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked						0.200		0.200						0.200		
Percent Grade (%)				0												
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						53		59						73		
Capacity, c (veh/h)						125		774						550		
v/c Ratio						0.42		0.08						0.13		
95% Queue Length, Q_{95} (veh)						1.8		0.2						0.5		
Control Delay (s/veh)						53.3		10.0						12.5		
Level of Service, LOS						F		B						B		
Approach Delay (s/veh)			30.5											0.4		
Approach LOS			D													

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Commercial PM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Driveway
Jurisdiction	Knox County
East/West Street	Weigel's Driveway
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	1	0	0	2	0
Configuration								R			T	R			T	
Volume, V (veh/h)								30			1205	47			1911	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked								0.200								
Percent Grade (%)				0												
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								33								
Capacity, c (veh/h)								784								
v/c Ratio								0.04								
95% Queue Length, Q_{95} (veh)								0.1								
Control Delay (s/veh)								9.8								
Level of Service, LOS								A								
Approach Delay (s/veh)					9.8											
Approach LOS					A											

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HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Commercial PM Peak
Intersection Orientation	East-West
Project Description	223.013 The Crescent at Ebenezer

Site Information

Intersection	Westland at Driveway
Jurisdiction	Knox County
East/West Street	Westland Drive
North/South Street	Driveway Connection
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		1	0	1		0	0	0
Configuration				TR		LT				L		R				
Volume, V (veh/h)			692	41		24	699			60		30				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
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)						26				65		33				
Capacity, c (veh/h)						825				115		398				
v/c Ratio						0.03				0.56		0.08				
95% Queue Length, Q_{95} (veh)						0.1				2.7		0.3				
Control Delay (s/veh)						9.5				70.6		14.9				
Level of Service, LOS						A				F		B				
Approach Delay (s/veh)				0.8					51.8							
Approach LOS									F							

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Phase 4 PM Peak_Westland Driveway.xtw

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Attachment 8
Turn Lane Warrant Analysis

Project: The Crescent at Ebenezer Commercial Site

Background (Weigel's)

Westland Drive	VOLUMES				
at Proposed Driveway					
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		491	20	99	NO
PM		694	37	25	YES

Ebenezer Road	VOLUMES				
at Proposed Driveway					
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		955*	49	25	YES
PM		627*	47	25	YES

Commercial Site

Westland Drive	VOLUMES				
at Proposed Driveway					
RIGHT TURN		Thru	RT	RT MAX	Warrant Met
AM		487	27	99	NO
PM		693	41	25	YES

* The volume per lane was multiplied by 1.05 in accordance with the Knox County
Department of Engineering and Public Works "Access Control and Driveway Design Policy"

BEGIN FULL WIDTH
EXISTING RIGHT
TURN LANE

100'

138'

EBENEZER ROAD

Future Turn Lane
Scale: 1"=40'

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						
100 - 149						
150 - 199						
200 - 249						Yes
250 - 299					Yes	Yes
300 - 349				Yes	Yes	Yes
350 - 399			Yes	Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499		Yes	Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599	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			*(AM Peak 20 RT)*		Yes	Yes
25 - 49				Yes	Yes	Yes
50 - 99						Yes *(PM Peak 37 RT)*
100 - 149			Yes	Yes	Yes	Yes
150 - 199		Yes	Yes	Yes	Yes	Yes
200 - 249	Yes	Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	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 6B

RIGHT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 46 TO 55 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						
100 - 149						
150 - 199						Yes
200 - 249					Yes	Yes
250 - 299				Yes	Yes	Yes
300 - 349			Yes	Yes	Yes	Yes
350 - 399			Yes	Yes	Yes	Yes
400 - 449		Yes	Yes	Yes	Yes	Yes
450 - 499		Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	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				Yes	Yes PM Peak 47 RT	(Yes)
50 - 99			Yes	Yes	Yes AM Peak 49 RT	(Yes)
100 - 149		Yes	Yes	Yes	Yes	Yes
150 - 199	Yes	Yes	Yes	Yes	Yes	Yes
200 - 249	Yes	Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	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 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						
100 - 149						
150 - 199						
200 - 249						Yes
250 - 299					Yes	Yes
300 - 349				Yes	Yes	Yes
350 - 399			Yes	Yes	Yes	Yes
400 - 449				Yes	Yes	Yes
450 - 499		Yes	Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599	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					Yes	Yes
50 - 99			(AM Peak 27 RT)	Yes	Yes	Yes (PM Peak 41 RT)
100 - 149			Yes	Yes	Yes	Yes
150 - 199		Yes	Yes	Yes	Yes	Yes
200 - 249	Yes	Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	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
Aerial Photos

Westland (north)

Printed: 5/13/2019 at 7:19:44 PM

0   25   50   100

ft

Knoxville - Knox County - KUB Geographic Information System

Westland (south)

Knoxville - Knox County - KUB Geographic Information System

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0   25   50   100

ft

Attachment 10
Intersection Worksheets – Phase 2 Apartments AM/PM Peaks

HCS7 Signalized Intersection Results Summary

General Information

				Intersection Information		
Agency	FMA			Duration, h	0.25	
Analyst	Addie Kirkham	Analysis Date	Mar 22, 2021	Area Type	Other	
Jurisdiction	Knox County	Time Period	Phase 2 Apartments AM Peak	PHF	0.93	
Urban Street	Ebenezer Road	Analysis Year	2021	Analysis Period	1> 7:00	
Intersection	Westland (north)	File Name	Phase 2 Apartments AM Peak_Signalized.xus			
Project Description	223.013 The Crescent at Ebenezer					

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	2	0	3	279	2	381	3	1721	386	141	675	0

Signal Information

Cycle, s	110.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	Off
Force Mode	Fixed	Simult. Gap N/S	On

Green	5.9	65.1	0.6	0.3	16.1	0.0
Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.4	6.1	21.9	21.6		71.6	10.4	82.0
Change Period, ($Y+R_c$), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.4	4.3	4.3		0.0	4.1	0.0
Queue Clearance Time (g_s), s	2.1	2.2	6.0	17.6			5.5	
Green Extension Time (g_e), s	0.0	0.0	2.2	0.0		0.0	0.2	0.0
Phase Call Probability	0.06	0.09	1.00	1.00			0.99	
Max Out Probability	0.07	0.14	0.19	1.00			0.22	

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	2	3		300	373		3	1765	396	152	726	0
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1585		1730	1586		728	1781	1585	1781	1870	0
Queue Service Time (g_s), s	0.1	0.2		4.0	15.6		0.1	45.5	8.8	3.5	2.4	0.0
Cycle Queue Clearance Time (g_c), s	0.1	0.2		4.0	15.6		0.1	45.5	8.8	3.5	2.4	0.0
Green Ratio (g/C)	0.00	0.01		0.15	0.14		0.59	0.59	0.74	0.66	0.69	
Capacity (c), veh/h	72	8		632	225		496	2106	1167	210	2568	
Volume-to-Capacity Ratio (X)	0.030	0.397		0.475	1.657		0.006	0.838	0.339	0.722	0.283	0.000
Back of Queue (Q), ft/ln (95 th percentile)	2.8	7		156.3	1022.5		1.1	615.8	277.8	118.4	35	0
Back of Queue (Q), veh/ln (95 th percentile)	0.1	0.3		6.2	40.3		0.0	24.2	10.9	4.7	1.4	0.0
Queue Storage Ratio (RQ) (95 th percentile)	0.11	0.00		0.37	0.00		0.01	0.00	1.21	0.85	0.00	0.00
Uniform Delay (d_1), s/veh	54.5	54.5		38.7	44.6		6.9	20.4	24.2	23.6	1.6	
Incremental Delay (d_2), s/veh	0.2	28.5		0.6	314.7		0.0	2.7	0.5	4.8	0.3	0.0
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	54.7	82.9		39.2	359.2		6.9	23.1	24.7	28.4	1.8	
Level of Service (LOS)	D	F		D	F		A	C	C	C	A	
Approach Delay, s/veh / LOS	71.6		E	216.6		F	23.4		C	6.4		A
Intersection Delay, s/veh / LOS		54.4						D				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.5	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.6	B	2.4	B	1.2	A

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HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA		
Analyst	Addie Kirkham	Analysis Date	Mar 22, 2021
Jurisdiction	Knox County	Time Period	Phase 2 Apartments AM Peak
Urban Street	Ebenezer Road	Analysis Year	2021
Intersection	Westland (south)	File Name	Phase 2 Apartments AM Peak_Signalized.xus
Project Description	223.013 The Crescent at Ebenezer		

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.89
Analysis Period	1> 7:00

Demand Information

Approach Movement	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Demand (v), veh/h	648		29				139	1278			603	391

Signal Information

Cycle, s	110.0	Reference Phase	2	
Offset, s	0	Reference Point	End	
Uncoordinated	No	Simult. Gap E/W	On	
Force Mode	Fixed	Simult. Gap N/S	On	

Green	8.9	57.5	25.5	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		31.5			14.9	78.5		63.5
Change Period, ($Y+R_c$), s		6.0			6.0	6.0		6.0
Max Allow Headway (MAH), s		4.1			4.1	0.0		0.0
Queue Clearance Time (g_s), s		24.2			6.0			
Green Extension Time (g_e), s		1.3			0.3	0.0		0.0
Phase Call Probability		1.00			0.99			
Max Out Probability		1.00			0.03			

Movement Group Results

	EB L	EB T	EB R	WB L	WB T	WB R	NB L	NB T	NB R	SB L	SB T	SB R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	728		33				156	1436			551	478
Adjusted Saturation Flow Rate (s), veh/h/ln	1730		1585				1781	1781			1870	1623
Queue Service Time (g_s), s	22.2		1.4				4.0	11.7			25.5	17.8
Cycle Queue Clearance Time (g_c), s	22.2		1.4				4.0	11.7			25.5	17.8
Green Ratio (g/C)	0.23		0.31				0.62	0.66			0.52	0.52
Capacity (c), veh/h	803		497				370	2346			978	849
Volume-to-Capacity Ratio (X)	0.906		0.066				0.422	0.612			0.563	0.563
Back of Queue (Q), ft/ln (95 th percentile)	383.8		24.7				67.1	118.1			326.6	236.9
Back of Queue (Q), veh/ln (95 th percentile)	15.1		1.0				2.6	4.6			12.9	9.5
Queue Storage Ratio (RQ) (95 th percentile)	1.40		0.00				0.71	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	36.8		23.8				13.0	3.0			15.2	12.2
Incremental Delay (d_2), s/veh	12.3		0.1				0.8	1.2			2.2	2.6
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	49.1		23.8				13.7	4.2			17.5	14.7
Level of Service (LOS)	D		C				B	A			B	B
Approach Delay, s/veh / LOS	48.0	D		0.0			5.1	A		16.2	B	
Intersection Delay, s/veh / LOS			18.1						B			

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.7	C	0.7	A	2.4	B
Bicycle LOS Score / LOS		F			1.8	B	1.4	A

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HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Ebenezer at Driveway
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	3/22/2021	East/West Street	Weigel's Driveway
Analysis Year	2021	North/South Street	Ebenezer Road
Time Analyzed	Phase 2 Apartment AM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	213.013 The Crescent at Ebenezer		

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	1	0	0	2	0
Configuration								R			T	R			T	
Volume, V (veh/h)								43			1837	49			955	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked								0.500								
Percent Grade (%)				0												
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								47								
Capacity, c (veh/h)								542								
v/c Ratio								0.09								
95% Queue Length, Q_{95} (veh)								0.3								
Control Delay (s/veh)								12.3								
Level of Service, LOS								B								
Approach Delay (s/veh)				12.3												
Approach LOS				B												

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Phase 2 Apartment AM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Crescent Lake
Jurisdiction	Knox County
East/West Street	Crescent Lake Way
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1		0	2	1		1	2	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						70		71			1829	97		33	924	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked						0.500		0.500						0.500		
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						76		77						36		
Capacity, c (veh/h)						116		542						292		
v/c Ratio						0.65		0.14						0.12		
95% Queue Length, Q_{95} (veh)						3.4		0.5						0.4		
Control Delay (s/veh)						81.0		12.7						19.0		
Level of Service, LOS						F		B						C		
Approach Delay (s/veh)						46.6								0.7		
Approach LOS						E										

HCS7™ TWSC Version 7.2.1

Phase 2 Apartments AM Peak_Crescent Lake.xtw

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Phase 2 Apartment AM Peak
Intersection Orientation	East-West
Project Description	223.013 The Crescent at Ebenezer

Site Information

Intersection	Westland at Driveway
Jurisdiction	Knox County
East/West Street	Westland Drive
North/South Street	Driveway Connection
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		1	0	1		0	0	0
Configuration				TR		LT				L		R				
Volume, V (veh/h)			487	27		31	607			46		28				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
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)						34				50		30				
Capacity, c (veh/h)						1012				179		539				
v/c Ratio						0.03				0.28		0.06				
95% Queue Length, Q_{95} (veh)						0.1				1.1		0.2				
Control Delay (s/veh)						8.7				32.8		12.1				
Level of Service, LOS						A				D		B				
Approach Delay (s/veh)		0.9								25.0						
Approach LOS										D						

HCS7™ TWSC Version 7.2.1 Generated: 3/26/2021 1:21:11 PM
Phase 2 Apartments AM Peak_Westland Driveway.xtw

HCS7 Two-Way Stop-Control Report

General Information

		Site Information	
Analyst	Addie Kirkham	Intersection	Westland at Driveway
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	3/24/2021	East/West Street	Westland Drive
Analysis Year	2021	North/South Street	Serene Breeze Way
Time Analyzed	Phase 2 Apartment AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	223.013 The Crescent at Ebenezer		

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	1	0		0	1	0		0	0	0
Configuration			TR			L	T				LR					
Volume, V (veh/h)		510	5			5	606			32		32				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
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)						5				70						
Capacity, c (veh/h)						1011				287						
v/c Ratio						0.00				0.24						
95% Queue Length, Q_{95} (veh)						0.0				0.9						
Control Delay (s/veh)						8.6				21.6						
Level of Service, LOS						A				C						
Approach Delay (s/veh)			0.1						21.6							
Approach LOS									C							

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA		
Analyst	Addie Kirkham	Analysis Date	Mar 22, 2021
Jurisdiction	Knox County	Time Period	Phase 2 Apartments PM Peak
Urban Street	Ebenezer Road	Analysis Year	2021
Intersection	Westland (north)	File Name	Phase 2 Apartments PM Peak_Signalized.xus
Project Description	223.013 The Crescent at Ebenezer		

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.97
Analysis Period	1> 7:00

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	3	1	2	569	1	201	10	1018	389	373	1344	6

Signal Information

Cycle, s	120.0	Reference Phase	2						
Offset, s	0	Reference Point	End	Green	15.3	61.6	0.6	0.5	20.1	0.0
Uncoordinated	No	Simult. Gap E/W	Off	Yellow	3.0	4.5	3.5	0.0	3.5	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.5	2.0	2.0	0.0	2.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		2	1	6
Case Number	1.2	4.0	1.3	4.0		5.3	1.0	4.0
Phase Duration, s	6.6	6.1	26.1	25.6		68.1	19.8	87.8
Change Period, (Y+R c), s	6.0	5.5	6.0	6.0		6.5	4.5	6.5
Max Allow Headway (MAH), s	3.9	4.3	4.2	4.2		0.0	4.1	0.0
Queue Clearance Time (g s), s	2.2	2.2	17.0	15.3			13.9	
Green Extension Time (g e), s	0.0	0.0	3.0	3.1		0.0	1.4	0.0
Phase Call Probability	0.10	0.10	1.00	1.00			1.00	
Max Out Probability	0.00	0.00	0.05	0.04			0.00	

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	3	3		587	189		9	925	353	385	696	695
Adjusted Saturation Flow Rate (s), veh/h/ln	1781	1670		1730	1586		388	1781	1585	1781	1870	1867
Queue Service Time (g s), s	0.2	0.2		15.0	13.3		1.2	23.0	10.8	11.9	8.5	8.5
Cycle Queue Clearance Time (g c), s	0.2	0.2		15.0	13.3		1.2	23.0	10.8	11.9	8.5	8.5
Green Ratio (g/C)	0.01	0.00		0.17	0.16		0.51	0.51	0.68	0.66	0.68	0.68
Capacity (c), veh/h	69	8		699	259		259	1827	1078	481	1268	1266
Volume-to-Capacity Ratio (X)	0.045	0.377		0.840	0.729		0.035	0.506	0.328	0.799	0.549	0.549
Back of Queue (Q), ft/ln (95 th percentile)	4.5	7		322.6	227.1		5.1	362.6	246.6	193.4	109.2	107.4
Back of Queue (Q), veh/ln (95 th percentile)	0.2	0.3		12.7	8.9		0.2	14.3	9.7	7.6	4.3	4.3
Queue Storage Ratio (RQ) (95 th percentile)	0.18	0.00		0.76	0.00		0.05	0.00	1.07	1.38	0.00	0.00
Uniform Delay (d 1), s/veh	59.3	59.4		43.1	44.5		11.9	23.8	15.3	14.9	2.3	2.3
Incremental Delay (d 2), s/veh	0.3	26.3		4.0	3.9		0.2	0.7	0.5	3.1	1.7	1.7
Initial Queue Delay (d 3), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	59.6	85.7		47.2	48.4		12.1	24.4	15.8	18.1	4.0	4.0
Level of Service (LOS)	E	F		D	D		B	C	B	B	A	A
Approach Delay, s/veh / LOS	72.7		E	47.5		D	22.0		C	7.0		A
Intersection Delay, s/veh / LOS		20.3						C				

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	3.0	C	2.9	C	2.4	B	2.2	B
Bicycle LOS Score / LOS	0.5	A	1.8	B	1.7	B	2.0	B

HCS7™ Streets Version 7.2.1

HCS7 Signalized Intersection Results Summary

General Information

Agency	FMA		
Analyst	Addie Kirkham	Analysis Date	Mar 22, 2021
Jurisdiction	Knox County	Time Period	Phase 2 Apartments PM Peak
Urban Street	Ebenezer Road	Analysis Year	2021
Intersection	Westland (south)	File Name	Phase 2 Apartments PM Peak_Signalized.xus
Project Description	223.013 The Crescent at Ebenezer		

Intersection Information

Duration, h	0.25
Area Type	Other
PHF	0.91
Analysis Period	1> 7:00

Demand Information

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	489		193				150	804			1177	717

Signal Information

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

Green	9.0	79.0	14.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0

Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4			5	2		6
Case Number		9.0			1.0	4.0		8.3
Phase Duration, s		20.0			15.0	100.0		85.0
Change Period, ($Y+R_c$), s		6.0			6.0	6.0		6.0
Max Allow Headway (MAH), s		4.2			4.1	0.0		0.0
Queue Clearance Time (g_s), s		16.0			5.9			
Green Extension Time (g_e), s		0.0			0.1	0.0		0.0
Phase Call Probability		1.00			1.00			
Max Out Probability		1.00			1.00			

Movement Group Results

	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7		14				5	2			6	16
Adjusted Flow Rate (v), veh/h	537		212				165	884			987	987
Adjusted Saturation Flow Rate (s), veh/h/ln	1730		1585				1781	1781			1870	1646
Queue Service Time (g_s), s	14.0		14.0				3.9	0.0			54.3	58.3
Cycle Queue Clearance Time (g_c), s	14.0		14.0				3.9	0.0			54.3	58.3
Green Ratio (g/C)	0.12		0.19				0.75	0.78			0.66	0.66
Capacity (c), veh/h	404		303				231	2790			1232	1084
Volume-to-Capacity Ratio (X)	1.331		0.699				0.713	0.317			0.801	0.910
Back of Queue (Q), ft/ln (95 th percentile)	603.7		259.8				171.3	5.3			560.3	650.1
Back of Queue (Q), veh/ln (95 th percentile)	23.8		10.2				6.7	0.2			22.1	26.0
Queue Storage Ratio (RQ) (95 th percentile)	2.20		0.00				1.80	0.00			0.00	0.00
Uniform Delay (d_1), s/veh	50.7		43.3				30.3	0.0			12.6	13.7
Incremental Delay (d_2), s/veh	165.3		6.9				9.8	0.3			4.1	9.9
Initial Queue Delay (d_3), s/veh	0.0		0.0				0.0	0.0			0.0	0.0
Control Delay (d), s/veh	216.0		50.3				40.2	0.3			16.7	23.6
Level of Service (LOS)	F		D				D	A			B	C
Approach Delay, s/veh / LOS	169.1	F		0.0			6.6	A		20.2	C	
Intersection Delay, s/veh / LOS		46.0					D					

Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.9	C	2.8	C	0.6	A	2.4	B
Bicycle LOS Score / LOS		F			1.4	A	2.2	B

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HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Phase 2 Apartment PM Peak
Intersection Orientation	North-South
Project Description	213.013 The Crescent at Ebenezer

Site Information

Intersection	Ebenezer at Driveway
Jurisdiction	Knox County
East/West Street	Weigel's Driveway
North/South Street	Ebenezer Road
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	1	0	0	2	1	0	0	2	0
Configuration								R			T	R			T	
Volume, V (veh/h)								30			1208	47			1915	
Percent Heavy Vehicles (%)								2								
Proportion Time Blocked								0.200								
Percent Grade (%)				0												
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)								33								
Capacity, c (veh/h)								783								
v/c Ratio								0.04								
95% Queue Length, Q_{95} (veh)								0.1								
Control Delay (s/veh)								9.8								
Level of Service, LOS								A								
Approach Delay (s/veh)					9.8											
Approach LOS					A											

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham	Intersection	Ebenezer at Crescent Lake
Agency/Co.	FMA	Jurisdiction	Knox County
Date Performed	3/22/2021	East/West Street	Crescent Lake Way
Analysis Year	2021	North/South Street	Ebenezer Road
Time Analyzed	Phase 2 Apartment PM Peak	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	213.013 The Crescent at Ebenezer		

Lanes

Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1		0	2	1		1	2	0
Configuration						L		R			T	R		L	T	
Volume, V (veh/h)						49		57			1219	74		71	1845	
Percent Heavy Vehicles (%)						2		2						2		
Proportion Time Blocked						0.200		0.200						0.200		
Percent Grade (%)			0													
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Left Only								1						

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						53		62						77		
Capacity, c (veh/h)						124		774						548		
v/c Ratio						0.43		0.08						0.14		
95% Queue Length, Q_{95} (veh)						1.9		0.3						0.5		
Control Delay (s/veh)						54.2		10.1						12.6		
Level of Service, LOS						F		B						B		
Approach Delay (s/veh)		30.4												0.5		
Approach LOS		D														

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/22/2021
Analysis Year	2021
Time Analyzed	Phase 2 Apartment PM Peak
Intersection Orientation	East-West
Project Description	223.013 The Crescent at Ebenezer

Site Information

Intersection	Westland at Driveway
Jurisdiction	Knox County
East/West Street	Westland Drive
North/South Street	Driveway Connection
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		1	0	1		0	0	0
Configuration				TR		LT				L		R				
Volume, V (veh/h)			693	41		24	701			60		30				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
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)						26				65		33				
Capacity, c (veh/h)						824				115		397				
v/c Ratio						0.03				0.57		0.08				
95% Queue Length, Q_{95} (veh)						0.1				2.7		0.3				
Control Delay (s/veh)						9.5				71.3		14.9				
Level of Service, LOS						A				F		B				
Approach Delay (s/veh)		0.8								52.3						
Approach LOS										F						

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Phase 2 Apartments PM Peak_Westland Driveway.xtw

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Addie Kirkham
Agency/Co.	FMA
Date Performed	3/24/2021
Analysis Year	2021
Time Analyzed	Phase 2 Apartment PM Peak
Intersection Orientation	East-West
Project Description	223.013 The Crescent at Ebenezer

Site Information

Intersection	Westland at Driveway
Jurisdiction	Knox County
East/West Street	Westland Drive
North/South Street	Serene Breeze Way
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes

Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	1	1	0		0	1	0		0	0	0
Configuration			TR			L	T				LR					
Volume, V (veh/h)		703	20			19	698			27		27				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked						0.000				0.000		0.000				
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				58						
Capacity, c (veh/h)						832				182						
v/c Ratio						0.03				0.32						
95% Queue Length, Q_{95} (veh)						0.1				1.3						
Control Delay (s/veh)						9.4				33.9						
Level of Service, LOS						A				D						
Approach Delay (s/veh)			0.3							33.9						
Approach LOS										D						

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Phase 2 Apartments PM Peak_Serene Breeze Way.xtw

Generated: 3/26/2021 1:18:38 PM

Date: May 19, 2021

Project Name: Crescent Commercial & Phase 2 Apartments

To: Knoxville-Knox County Planning

Subject: TIS Review for Crescent Commercial & Phase 2 Apartments (6-D-21-UR)

Dear Knoxville-Knox County Planning staff,

The following comment response document is submitted to address comments dated May 17, 2021:

1. **Reviewer Comment:** On page 5, the engineer discusses improvements at the Westland Drive driveway. This appears to be the access that will serve the commercial site and not the apartments directly.
    a. Please add "commercial" to the description of this access point here and throughout the TIA.
    b. Add a summary of the discussion for Westland Drive at Serene Breeze Way.

    Response: Revised the description of the intersection to Westland Drive at Commercial Driveway Connection throughout the report and included a summary of the discussion for Westland Drive at Serene Breeze Way.

2. **Reviewer Comment:** Page 42 – see first bullet for page 5 above.

    Response: Revised the name of the intersection to Westland Drive at Commercial Driveway Connection.

3. **Reviewer Comment:** Page 43 – The original apartments TIA noted that a westbound left-turn lane is warranted at the apartment driveway (now Serene Breeze Way). That needs to be included here.

    Response: "As a part of the construction of The Crescent at Ebenezer Apartments – Phase 1 a westbound left turn lane with a 75 foot storage length was installed at the intersection of Westland Drive at Serene Breeze Way."

Sincerely,
Addie Kirkham, P.E.