

SOUTHSIDE FLATS

KNOXVILLE, TENNESSEE

TRAFFIC IMPACT STUDY

Prepared for

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INTRODUCTION

This traffic impact study was commissioned to address the impact of a proposed residential development within the city limits of Knoxville, Tennessee. The traffic impact study follows guidelines and procedures as recommended by the Institute of Transportation Engineers. The study of this development required the collection of traffic data, generation of anticipated traffic volumes from the proposed site, development of future traffic volumes from both normal growth and the site, analysis of the resulting traffic conditions, and the development of measures necessary to mitigate traffic impacts of normal traffic growth and the proposed development. Methods and procedures utilized in the study are those required for a Level 1 traffic impact study as adopted by the Knoxville/Knox County Metropolitan Planning Commission.

Project Description

The proposed project is an apartment development adjacent to Lippencott Street and E. Martin Mill Pike. The site is approximately 6 acres with a current RP-2 zoning. The proposed development will be for 172 apartment units. An access driveway is proposed to Lippencott Street. **Figure 1** is the proposed site plan.

Site Location

The location of the site is located in the northeast corner of the Lippencott Street and E. Martin Mill Pike intersection and is east of Chapman Highway. The site is in the Knoxville city limits. The site is south of the Knoxville central business district (CBD). The adjacent land uses are residential and commercial. Lippencott Street primarily serves residential traffic. E. Martin Mill Pike serves both residential and commercial traffic. **Figure 2** illustrates this location relative to local and regional access.

**SITE
PLAN
Southside
Flats**



Figure 1

VICINITY MAP Southside Flats

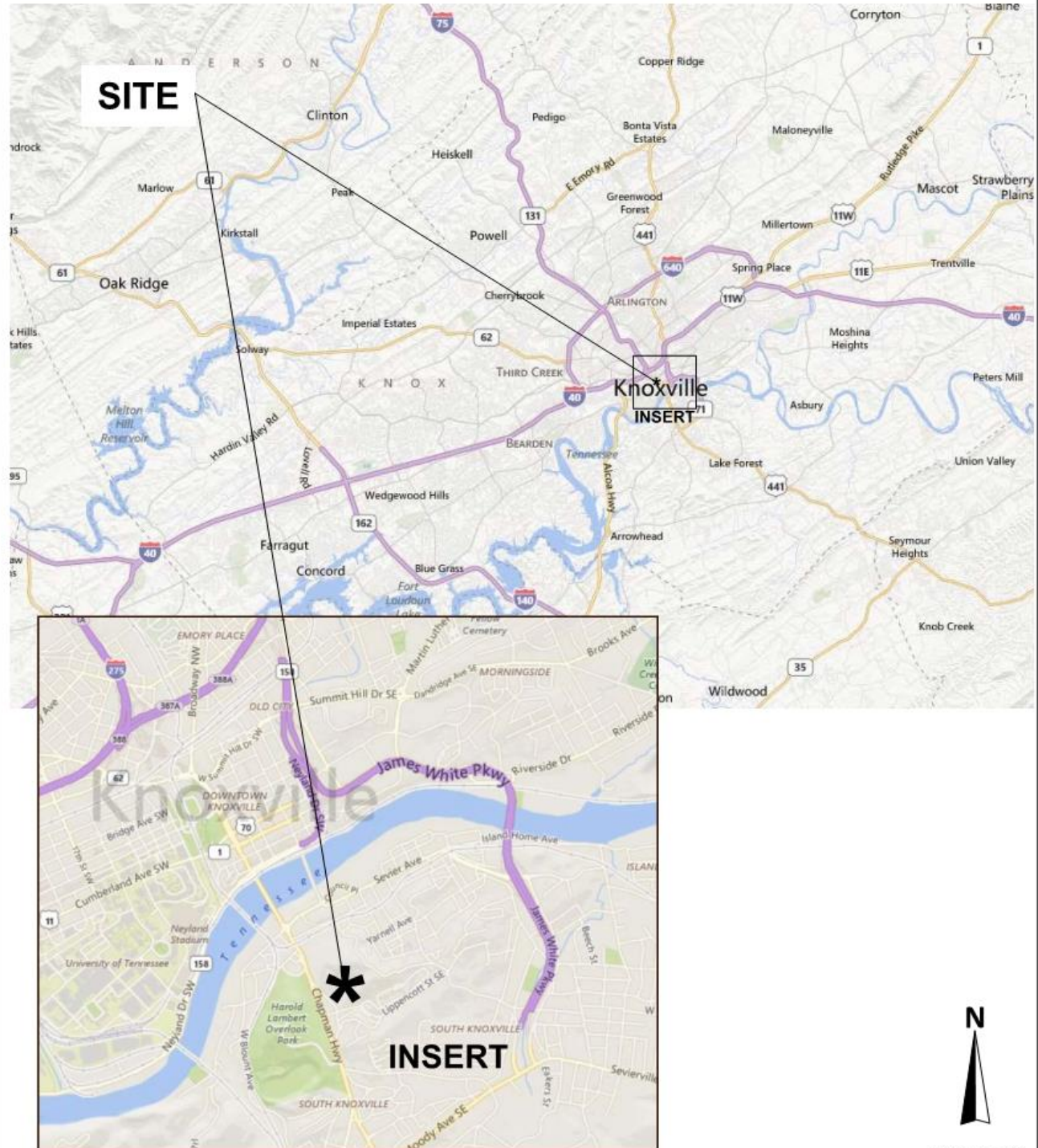


Figure 2

LOCAL AND REGIONAL ACCESS

Local Access

Site access is a proposed connection to Lippencott Street. Lippencott Street is a 2-lane minor collector extending from Chapman Highway (US 441) to Davenport Road. Lippencott Street is a curb and gutter section with a northside sidewalk adjacent to the site. An average weekday daily traffic (AWT) volume estimated for Lippencott Street is 3,980. East Martin Mill Pike is adjacent to the site and is a 2-lane minor collector extending between intersections with Chapman Highway north and south of the site. An estimated AWT for E. Martin Mill Pike is 2,750.

Regional Access

Chapman Highway (U.S. 441) is a 5-lane major arterial extending northwest into the Knoxville CBD and southeast towards the Sevier County line and Sevierville. Chapman Highway becomes Henley Street at the bridge over the Tennessee River and has a 2016 AADT of 43,225. Henley Street intersects I-40 and I-275 in the Knoxville CBD. Chapman Highway also intersects Governor John Sevier Highway (S.R. 168) to the southeast and has a junction with the Maryville Highway (S.R. 33) to the southeast. Governor John Sevier Highway extends between Interstate 40 east of the Knoxville CBD and Alcoa Highway (U.S. 129) south of Knoxville.

Interstate 40 extends east and west of the Knoxville CBD and joins I-75 to the west. Interstate 40 is an east and west facility extending between Nashville, Tennessee and Asheville, North Carolina. Interstate 75 is a north and south interstate extending south to Chattanooga and north to Lexington, Kentucky. The approximate 2016 ADT for I-40 west of the I-275 interchange is 139,840. To the east of the I-275 interchange, I-40 has an ADT of 154,010. Interstate 275 has an interchange with I-75 and I 640 to the north.

EXISTING TRAFFIC CONDITIONS

Existing Traffic Control

The posted speed limit for E Martin Mill Pike is 30mph. The speed limit for Lippencott Street is posted 30mph westbound from the Davenport Road but is unposted eastbound from Chapman Highway. The E. Martin Mill Pike approaches to Lippencott Street are STOP controlled.

Existing Traffic Volumes

This traffic impact study addresses the intersection of Lippencott Street and E. Martin Mill Pike. A peak-hour count was conducted August 29, 2017 for 7:00-9:00AM and 4:00-6:00PM. **Figure 3** illustrates the adjacent street traffic volumes. Peak hours were found 7:00-8:00AM and 4:45-5:45PM.

Existing Capacity and Level of Service

In order to evaluate the current operations of the traffic control devices, capacity and level of service were calculated using the **Highway Capacity Manual, Special Report 209** published by the Transportation Research Board (TRB). Signalized and unsignalized intersections are evaluated based on estimated intersection delays, which may be related to level of service (LOS).

Level of service and capacity are the measurements of an intersection's ability to accommodate traffic volumes. Levels of service for intersections range from A to F. LOS A is the best, and LOS F is failing. For signalized intersections, a LOS of A has an average estimated intersection delay of less than 10 seconds, and LOS F has an estimated delay of greater than 80 seconds. A LOS of C and D are typical design values. Within urban areas, a LOS D, delay between 35 and 55 seconds, is considered acceptable by the Institute of Transportation Engineers (ITE) for signalized intersections.

Unsignalized intersection levels of service have lower thresholds of delays. A LOS of F exceeds estimated delays of 50 seconds. For urban arterials, minor approaches may frequently experience levels of service E. A full level of service description for unsignalized intersections is presented in **Table 1**.

**2017
EXISTING
TRAFFIC
Southside
Flats**



LEGEND
 XXX AM PEAK
 (XXX) PM PEAK



Figure 3

**TABLE 1. LEVEL OF SERVICE (LOS) DESCRIPTION
FOR TWO-WAY STOP INTERSECTIONS**

Level of Service	Average Control Delay per Vehicle (seconds)		
A	≤ 10.0		
B	> 10.0	and	≤ 15.0
C	> 15.0	and	≤ 25.0
D	> 25.0	and	≤ 35.0
E	> 35.0	and	≤ 50.0
F	> 50.0		

SOURCE: Highway Capacity Manual, TRB Special Report
2009

The capacity and level of service analyses were conducted using Synchro 9, developed by Trafficware. **Table 2** presents the resulting unsignalized analyses. Levels of service were found acceptable with a minimum LOS B experienced for the E. Martin Mill Pike approaches to Lippencott Street

**TABLE 2. 2017 EXISTING
CAPACITY AND LEVEL OF SERVICE**

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	DELAY	LOS
Lippencott Street at E. Martin Mill Pike	STOP	AM	0.15 / 0.05	11.0 / 10.6	B / B
	NB/SB	PM	0.13 / 0.33	10.6 / 15.0	B / B

Note: Average vehicle delay estimated in seconds. STOP control analyses are presented by total minor approaches.

BACKGROUND TRAFFIC CONDITIONS

Background traffic is traffic that can be anticipated regardless of the proposed development. Traffic within the study area should continue to grow due to other development as well as the continued growth through the study area. This background traffic is projected for the purpose of establishing a baseline traffic condition.

Background Traffic Volumes

Traffic count histories in the vicinity were reviewed to estimate traffic growth trends. Based on the TDOT count stations in the site vicinity including Martin Mill Pike, south of Chapman Highway (Sta. 156), W. Moody Avenue (Sta. 375), and Henley Street (Sta. 93), traffic appears to be declining. Therefore, for the purpose of this study, background traffic was projected for the year 2020 using a 2.5-percent annual compounded growth rate. Completion of this development will depend largely upon market and economic conditions; however, a 3-year build-out is assumed for the purpose of this study. Background traffic was, therefore, obtained by growing existing traffic by a total of 7.9- percent. **Figure 4** illustrates the resulting 2020 background traffic.

Background Capacity and Level of Service

The intersection of Lippencott Street and E. Martin Mill Pike continues to operate at an acceptable level of service. **Table 3** presents the capacity and LOS findings.

TABLE 3. 2020 BACKGROUND CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	DELAY	LOS
Lippencott Street at E. Martin Mill Pike	STOP	AM	0.16 / 0.06	11.2 / 10.8	B / B
	NB/SB	PM	0.15 / 0.38	10.9 / 16.3	B / C

Note: Average vehicle delay estimated in seconds. STOP control analyses are presented by total minor approaches.

2020
BACKGROUND
TRAFFIC
Southside
Flats



LEGEND
XXX AM PEAK
(XXX) PM PEAK



Figure 4

PROJECT IMPACTS

Project conditions are developed by generating traffic based on the proposed land uses, distributing the trips to the transportation network, and again conducting analyses for capacity and level of service.

Trip Generation

Project traffic is typically generated using the publication, **Trip Generation, 9th Edition**. This reference is published by the Institute of Transportation Engineers (ITE) and represents national data collected for many different land uses including industrial, residential, and commercial uses. **Trip Generation** is an essential tool in calculating the traffic, which may be generated by a proposed development. However, trips generated for this multi-family development was determined using local trip generation rates adopted by the Knoxville-Knox County Metropolitan Planning Commission in July of 2000 for apartment developments. Local trip rates were studied in accordance with the publication, **Trip Generation, 6th Edition**.

Daily trips generated is approximately 1,550, and peak-hour trips are approximately 125, generated during the PM peak. **Table 4** presents the trip generation of this proposed site.

TABLE 4. TRIP GENERATION

Land Use	Land-Use Code	Units	Daily Trips	AM Peak-Hour Trips		PM Peak-Hour Trips	
				Enter	Exit	Enter	Exit
Apartments	220	172	1,554	19	69	69	56

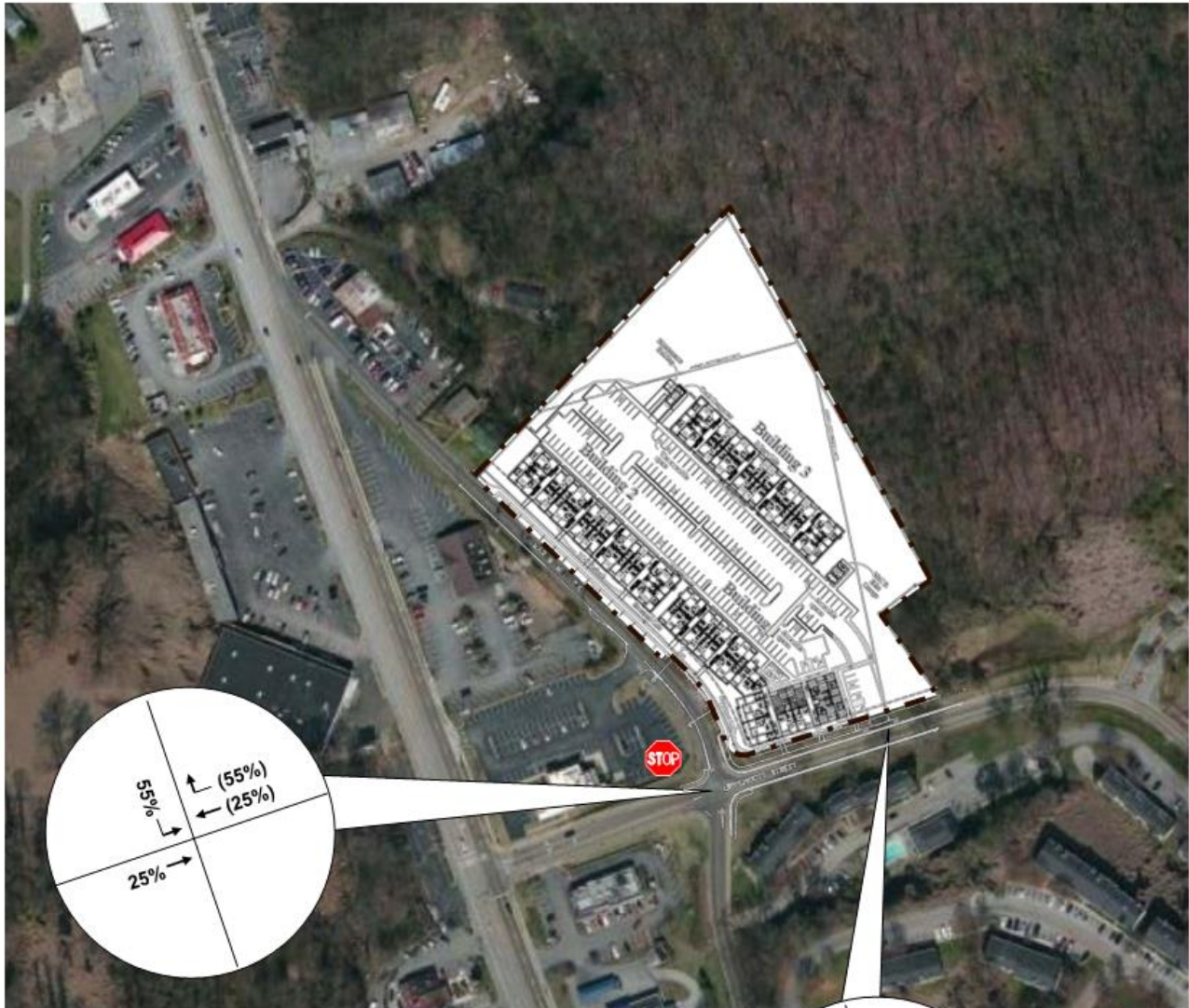
Reference: Knoxville/Knox Co. MPC trip rates adopted in July of 2000

Trip Distribution and Assignment

Using the TMC count conducted for the intersection of Lippencott Street and E. Martin Mill Pike, residential development characteristics, and the local and regional roadway network, generated trips are distributed to the adjacent streets with 60-percent distributed to and from the Knoxville CBD using Chapman Highway from both Lippencott Street and E. Martin Mill Street. Accessing Chapman Highway, 55-percent of the trips were assigned using E. Martin Mill Pike. Lippencott Street to and from the west was assigned 25-percent which would distribute to Chapman Highway to the north and south of the site vicinity. To and from the east of the site, the remaining 20-percent was distributed. This distribution is illustrated in **Figure 5**.

DISTRIBUTION & ASSIGNMENT

Southside Flats



LEGEND
 XXX ENTERING TRIPS
 (XXX) EXITING TRIPS

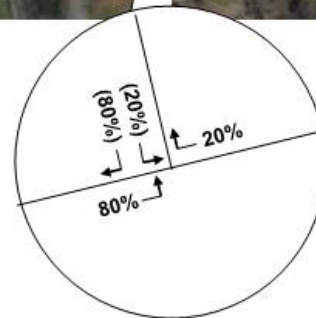


Figure 5

Project Traffic Volumes

By multiplying the trips generated by the distribution percentages, the project traffic volumes are determined. **Figure 6** illustrates the resulting project traffic volumes associated with the proposed project.

Total Projected Traffic Volumes

Background and project traffic volumes were added together to develop post-development traffic volumes for the year 2020. **Figure 7** illustrates this 2020 projection. Using these projections, mitigation measures including traffic control devices and roadway and intersection geometry can be evaluated. Projected traffic conditions did not determine requirements for turn lanes on Lippencott Street for the proposed site access as the projected left- and right-turn movements and the respective opposing and advancing traffic volumes are below the thresholds to require auxiliary lanes. The turn-lane analyses can be found in the Appendix of the report.

Projected Capacity and Level of Service

The development of the site has a manageable impact on the proposed access with Lippencott Street and the adjacent intersection of Lippencott Street and E. Martin Mill Pike. The projected capacity and LOS for the proposed access is presented in **Table 5**. With the proposed development, the levels of service are a minimum of a LOS C. **Table 6** summarizes the analyses for background and projected traffic conditions.

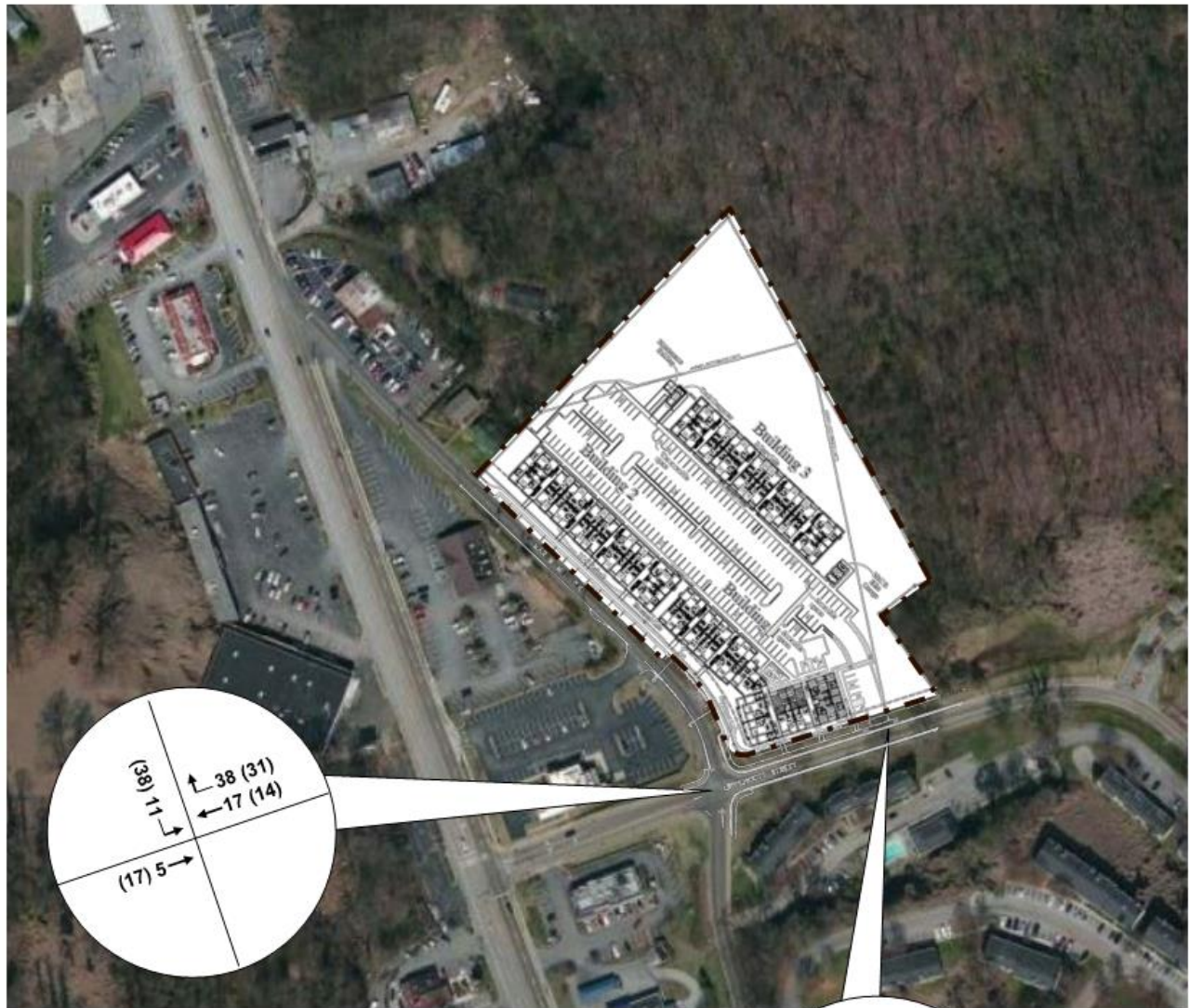
**TABLE 5.
2020 PROJECTED TRAFFIC
CAPACITY AND LEVEL OF SERVICE**

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	DELAY	LOS
Lippencott Street at E. Martin Mill Pike	STOP NB/SB	AM PM	0.17 / 0.10 0.16 / 0.53	11.8 / 11.9 11.5 / 21.7	B / B B / C
Lippencott Street at Proposed Access	STOP SB	AM PM	0.10 0.08	10.0 10.1	B B

Note: Average vehicle delay estimated in seconds. STOP control analyses are presented by total minor approaches.

DEVELOPMENT TRIPS

Southside Flats



LEGEND
 XXX AM PEAK
 (XXX) PM PEAK

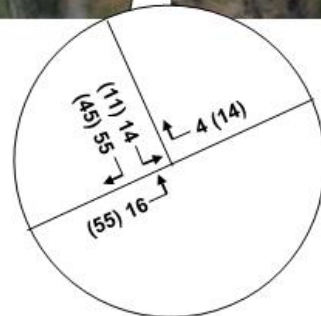
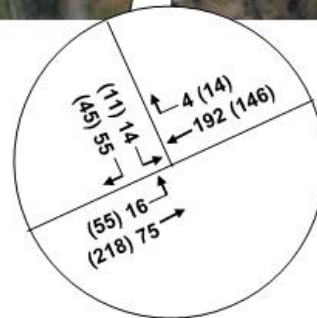
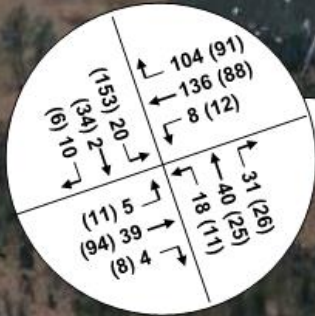
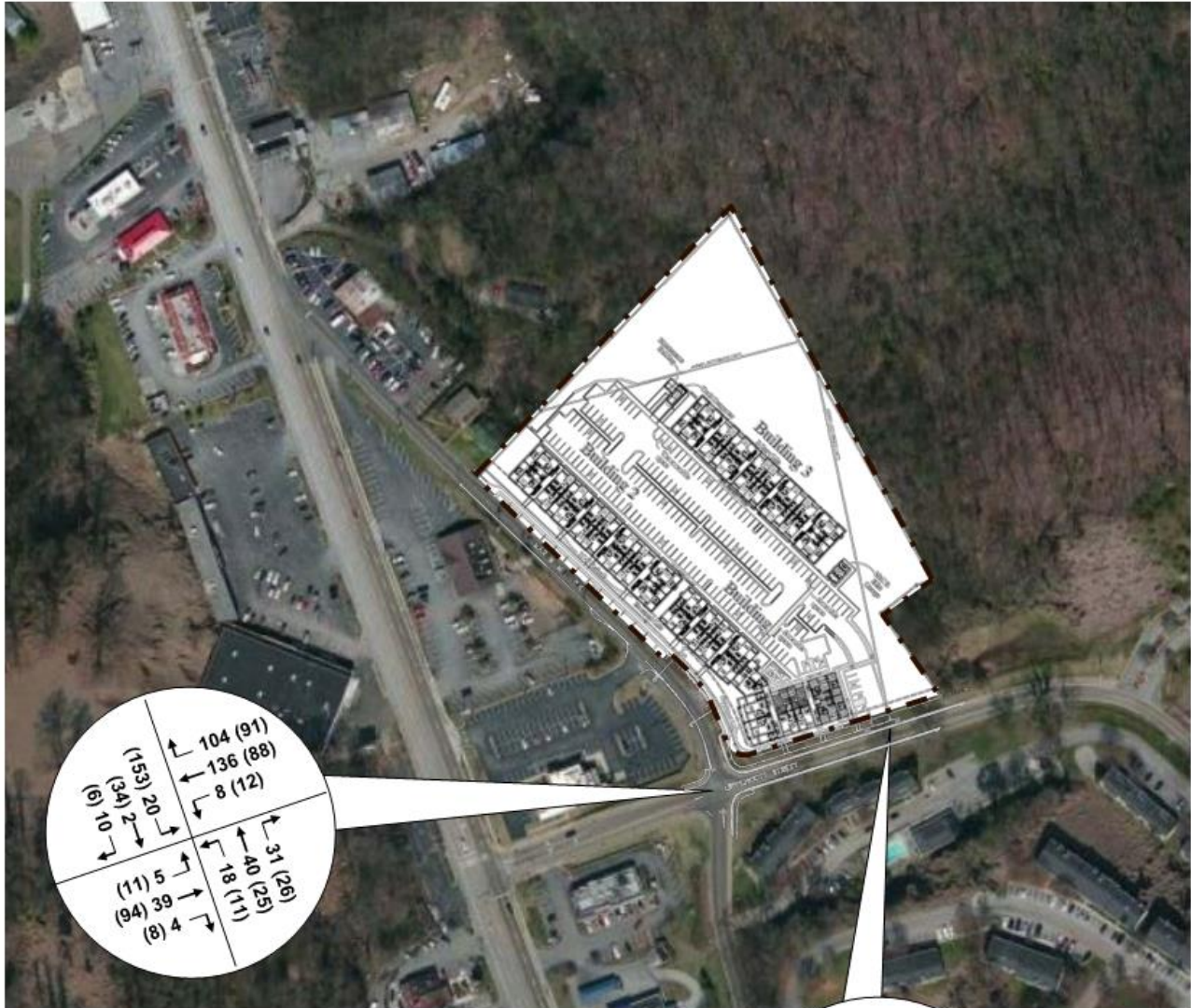


Figure 6

2020 PROJECTED TRAFFIC Southside Flats



LEGEND
 XXX AM PEAK
 (XXX) PM PEAK



Figure 7

**TABLE 6
CAPACITY AND LEVEL OF SERVICE SUMMARY**

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2017 TRAFFIC			2020 BACKGROUND			2020 PROJECTED		
			V/C	DELAY	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS
Lippencott Street at E. Martin Mill Pike	STOP	AM	0.15 / 0.05	11.0 / 10.6	B / B	0.16 / 0.06	11.2 / 10.8	B / B	0.17 / 0.10	11.8 / 11.9	B / B
	NB/SB	PM	0.13 / 0.33	10.6 / 15.0	B / B	0.15 / 0.38	10.9 / 16.3	B / C	0.16 / 0.53	11.5 / 21.7	B / C
Lippencott Street at Proposed Access	STOP	AM							0.10	10.0	B
	SB	PM							0.08	10.1	B

Note: Average vehicle delay estimated in seconds. STOP control analyses are presented by total minor approaches.

Sight Distance

The project is proposed to access Lippencott Street with a posted speed limit of 30mph. Estimated sight-distance for the proposed access to Lippencott Street exceeds 400 feet to the east and west. The line of sight restriction to the east is a horizontal curve and no restriction to the west. The speed limit of 30mph requires a minimum of 200 feet to meet the minimum stopping sight-distance for AASHTO and 300 feet to meet the MPC corner sight-distance standard. Therefore, the sight-distance is more than adequate for safe egress from the proposed development.

RECOMMENDATIONS

The analyses conducted and the review of the traffic volumes identified the following recommendations:

- Post STOP signs (R1-1) at the proposed site accesses to E. Martin Mill Pike and Lippencott Street.
- Minimize landscaping, using low growing vegetation, and signing at the proposed residential and commercial accesses to insure that safe sight distance is maintained.

Intersection design and commercial driveway should conform to the recommended standards and practices of the American Association of State Highway and Transportation Officials, the Institute of Transportation Engineers, and the City of Knoxville.

CONCLUSION

The study of this proposed residential multi-family development evaluated the projected traffic conditions with and without the proposed site. Background traffic was determined using a 2.5-percent annual compounded growth rate until the horizon year 2020. Traffic associated with the proposed project was then generated and distributed to the proposed site accesses. Using the identified turning movements for the projected traffic conditions, unsignalized capacity and level of service analyses were conducted using the **Highway Capacity Manual**. Unsignalized levels of service are found to be acceptable for the projected traffic conditions. The evaluation of the sight-distances for the proposed access was found to exceed that required for a 30mph speed zone. An evaluation for the requirement of left- and right-turn lanes determined auxiliary were not warranted for the proposed site access. Therefore, with the recommendations of this report, the efficient and safe flow of traffic should be maintained with the development of the proposed apartments.

APPENDIX

HCS Unsignalized Analyses

Turn Lane Analyses

Traffic Count Data