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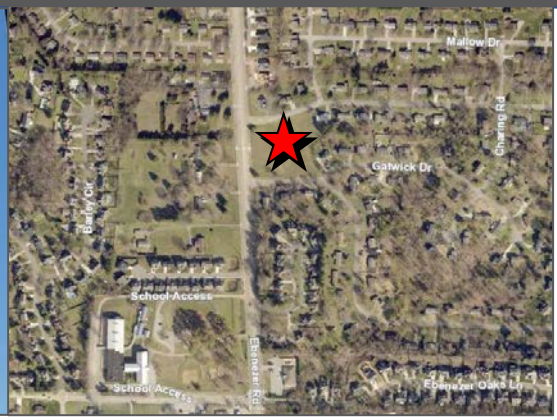
CIVIL ENGINEERING / TRAFFIC ENGINEERING

Transportation Impact Study

The Shops at Bexhill

Knox County, Tennessee



Revised September 2021

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9/17/2021

Case #10-H-21-UR
TIS Revision 1
9/17/2021

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EXECUTIVE SUMMARY

Preface:

MCS Enterprises, LLC is proposing a commercial development on the east side of Ebenezer Road between Bexhill Drive and Gatwick Drive in West Knox County, TN. This proposed development is "The Shops at Bexhill" and will consist of three sit-down restaurants and a mix of either small office, medical, or retail shops on 2.51± acres. The exact mixture of the non-restaurant shops and tenants is not currently known. The commercial development will consist of 3 buildings, parking lot areas, and outdoor patios. This development is anticipated to be fully built out and occupied by 2023 and will have two entrances, one on Bexhill Drive and one on Gatwick Drive. This study's primary purpose is to determine and evaluate the potential impacts of the development on the adjacent transportation system. The study includes a review of the primary access roads and intersections and is a Level 1 study established by Knoxville/Knox County Planning. Recommendations and mitigation measures will be offered if transportation operations were projected to be below recognized engineering standards and guidelines.

Study Results:

The findings of this study include the following:

- The Shops at Bexhill with three high turnover (sit-down) restaurants and an assumed mixture of clinical offices are calculated to generate up to 1,282 trips on an average weekday at full build-out and occupancy. Of these trips, 14 will occur during the AM peak hour and 121 trips in the PM peak hour in 2023. Some of these trips are expected to be from motorists already passing through the Ebenezer Road corridor. The estimated AM peak hour generated trips are low since the restaurants will only operate during lunch and dinner.
- This commercial development will have two entrances. The analyses indicated that the entrances will operate acceptably with respect to vehicle delays, queues, and sight distance. The existing intersections of Ebenezer Road at Bexhill Drive and Ebenezer Road at Gatwick Drive are also projected to operate adequately with respect to vehicle delays and vehicle queues in 2023. The projected 2023 traffic volumes from the proposed commercial development are calculated to marginally increase vehicle delays at these intersections compared to the existing conditions. The projected vehicle queues are also expected to be fully contained within the storage lengths provided by the existing intersection turn lanes.

Recommendations:

The following recommendations are offered based on the study analyses. The recommendations are offered to minimize the traffic impacts of the proposed development on the adjacent road system while attempting to achieve an acceptable traffic flow and safety level. The recommendation marked with an asterisk indicates an existing transportation need and is not associated with the proposed development's projected impacts.

* • It is recommended that the existing pavement markings on Bexhill Drive be re-applied. These pavement markings should include the white stop bar, white edge lines, white left-turn arrow, and double yellow centerline. The double yellow centerline and white edge lines are recommended to begin at the white stop bar at Ebenezer Road up to the Buxton Drive intersection with a gap where the North Driveway will tie into Bexhill Drive. It also recommended that a white crosswalk be applied to the pavement across Bexhill Drive at Ebenezer Road.

* • It is recommended that the existing pavement markings on Gatwick Drive be re-applied. These pavement markings should include the white stop bar, white edge lines, white left-turn arrow, and double yellow centerline. The double yellow centerline and white edge lines are recommended to begin at the white stop bar at Ebenezer Road up to the Bexhill Drive intersection with a gap where the South Driveway will tie into Gatwick Drive. A white crosswalk is also recommended to be applied to the pavement across Gatwick Drive at Ebenezer Road.

- Sight distance at the intersections of Bexhill Drive and Gatwick Drive at Ebenezer Road should not be impacted by new signage or landscaping for the commercial development.
- Stop Signs (R1-1) and 24" white stop bars should be installed at the new internal driveways, as shown in the report.
- Sight distance at the new internal intersections and aisleways within the development must not be impacted by new signage or future landscaping.
- Due to the long, straight internal north-south parking lot aisleway in between the entrances, it is recommended that speed humps or tables be considered to reduce internal traffic speeds in the development.
- All drainage grates and covers for the development need to be pedestrian and bicycle safe.
- Internal sidewalks are proposed throughout the development. Sidewalks should

have appropriate ADA-compliant curbed ramps at intersection corners, and the sidewalks are recommended to be 5 feet minimum in width. Internally, white crosswalks should be marked on the pavement where pedestrians are expected to cross. Internal sidewalks should connect to the existing sidewalk system on Ebenezer Road.

- All internal and external road grade and intersection elements should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.

* • Knox County should repair the non-functioning pushbutton in the center median refuge area on Ebenezer Road in between Bexhill Drive and Gatwick Drive as soon as possible. This mid-block pedestrian crossing pushbutton should trigger the RRFB's (Rectangular Rapid Flashing Beacons) and is an important safety feature.

DESCRIPTION OF EXISTING CONDITIONS

- **STUDY AREA:**

The proposed location of this new development is shown on a map in Figure 1. The proposed development will be located on the east side of Ebenezer Road between Bexhill Drive and Gatwick Drive in West Knox County, TN. The commercial development will comprise two driveway entrances and several parking areas on 2.51± acres built for three high turnover (sit-down) restaurants and, for the purposes of the study, an assumed mixture of clinical offices. Transportation impacts associated with the proposed development were analyzed at the following existing and proposed roadways and intersections, where the most significant impact is expected and as requested by Knoxville/Knox County Planning:

- Ebenezer Road at Bexhill Drive
- Ebenezer Road at Gatwick Drive
- Bexhill Drive at Proposed North Driveway
- Gatwick Drive at Proposed South Driveway

View of Proposed Development Site
(Looking Northwest from Gatwick Drive)

The proposed development property is in a suburbanized area of West Knox County, TN. There are many single-family residences, established residential subdivisions, a few remaining unused/woodland properties, an animal hospital, and a public elementary school near this development. The proposed development property is relatively flat, is entirely open with a maintained grass field and a handful of trees. Over the years, the site has been undeveloped and used as a green space for exercise and other purposes by nearby residents.

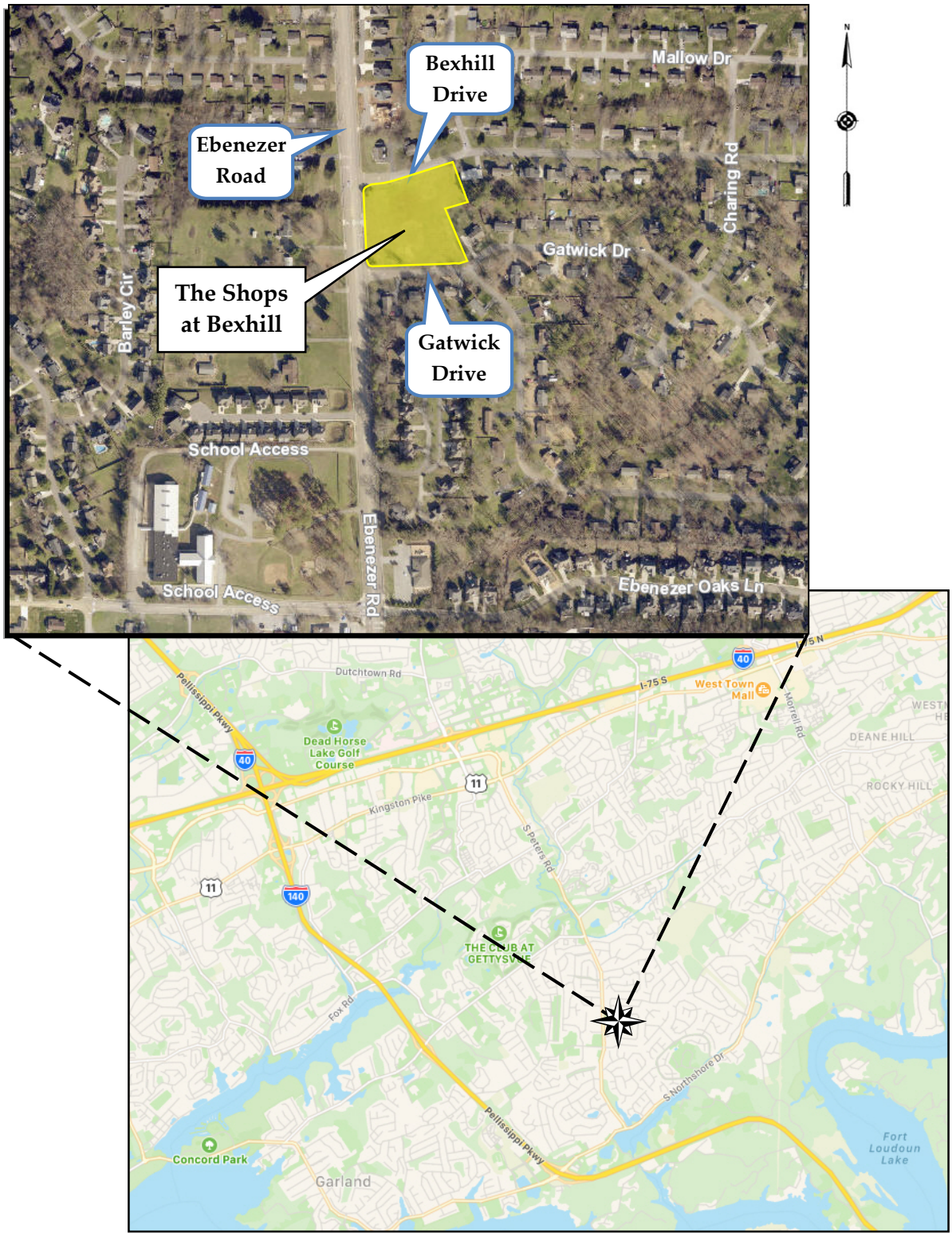

Figure 1
Location Map

- **EXISTING ROADWAYS:**

Table 1 lists the characteristics of the existing primary roadways adjacent to the development property and included in the study:

TABLE 1
STUDY CORRIDOR CHARACTERISTICS

NAME	CLASSIFICATION [1]	SPEED LIMIT	LANES	ROAD WIDTH [2]	TRANSIT [3]	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
Ebenezer Road	Minor Arterial	40 mph	4 with TWLTL	60 feet	None	5' sidewalk on west side / 4.5' sidewalk on east side	No bike lanes
Bexhill Drive	Local Street	25 mph	2 undivided	28 feet	None	No Sidewalks	No bike lanes
Gatwick Drive	Local Street	25 mph	2 undivided	28 feet	None	No Sidewalks	No bike lanes

[1] 2018 Major Road Plan by Knoxville/Knox County Planning
[2] Edge of curb to edge of curb or edge of pavements near project site
[3] According to Knoxville Area Transit System Map
TWLTL – Two-Way Left Turn Lane

Ebenezer Road is a 4-lane minor arterial with a center two-way left-turn lane (TWLTL) and generally traverses north-south. Ebenezer Road is 3.7 miles in length and runs between Kingston Pike (US 11/US 70/SR 1) on the north side to the signalized t-intersection of South Northshore Drive (SR 332) on the south side at Bluegrass Lake. Along its length, Ebenezer Road merges with South Peters Road and continues as Ebenezer Road to the south. Ebenezer Road provides access to the Cedar Bluff area, Kingston Pike, and Interstate 40 and 75 further to the north. To the south, Ebenezer Road intersects South Northshore Drive less than a mile away from Interstate 140. The posted speed limit on Ebenezer Road is 40 mph at the project site.

Ebenezer Road has several mid-block pedestrian islands, with one adjacent to the proposed development site. These crossings are delineated with raised concrete, pavement markings, signage, and pushbuttons for Rectangular Rapid Flashing Beacons (RRFB). These pedestrian islands were installed in 2017 and were part of an effort to improve pedestrian safety for nearby residents and children walking to and from the nearby Blue Grass Elementary School.

RRFB on Ebenezer Road Between Bexhill Drive and Gatwick Drive

One-hundred-foot marked separate southbound left-turn lanes are provided on Ebenezer Road at Bexhill Drive and Gatwick Drive as part of the center TWLTL. Ebenezer Road has 6" concrete curbs, 24" gutters, and sidewalks are available on both sides, with a narrower sidewalk on the east side. The development site along Ebenezer Road is within the signed and flashing Blue Grass school zone with a speed limit of 15 mph. Blue Grass Elementary has school hours of 7:45 am to 2:45 pm.

Utility street lights are not provided along Ebenezer Road in the adjacent study area except for single utility lights at the intersection of Ebenezer Road at Bexhill Drive and Ebenezer Road at Gatwick Drive.

Bexhill Drive is a 0.9-mile long, 2-lane local street that traverses in a circuitous route to the east of Ebenezer Road and serves the residents of Bexhill Subdivision. Bexhill Drive begins at Ebenezer Road and ends at a Y-intersection with Gatwick Drive. Bexhill Subdivision is comprised of 316 single-family detached homes. Bexhill Drive does not have a posted speed limit at its beginning off Ebenezer Road but is assumed to be 25-mph. Bexhill Drive has two exiting lanes at Ebenezer Road, one for left turns and one for right turns, and is controlled by a Stop Sign (R1-1). The westbound left-turn lane has approximately 95 feet of storage on Bexhill Drive.

Gatwick Drive is 1,600 feet in length and is a 2-lane local street that traverses in a generally east and west direction between Ebenezer Road and ends at a cul-de-sac inside Bexhill Subdivision. Gatwick Drive is located 350 feet to the south of Bexhill Drive and roughly parallels Bexhill Drive up to a Y-intersection where Gatwick Drive splits to the north, and the other end of Bexhill Drive continues to the south. Gatwick Drive has a posted speed limit of 25-mph off Ebenezer Road. At Ebenezer Road, Gatwick Drive has two exiting lanes, one for left turns and one for right turns, and is controlled by a Stop Sign (R1-1). The westbound left-turn lane has approximately 70 feet of storage on Gatwick Drive.

Figure 2 shows the lane configurations of the roadways and intersections examined in the study, traffic count locations, and traffic signage in the near vicinity. The traffic signage shown only includes warning and regulatory signage. The pages following Figure 2 give an overview of the site study area with photographs.

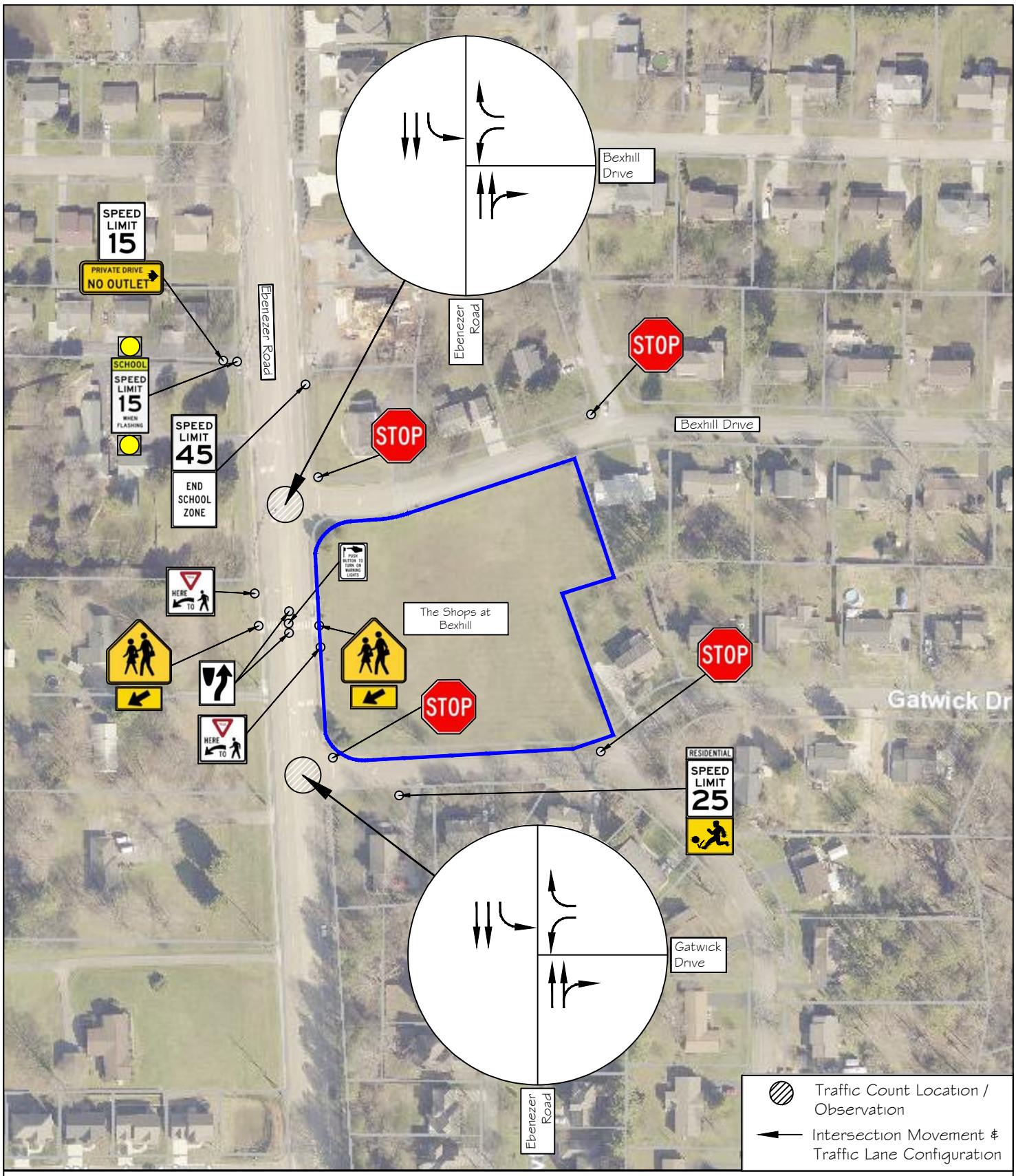

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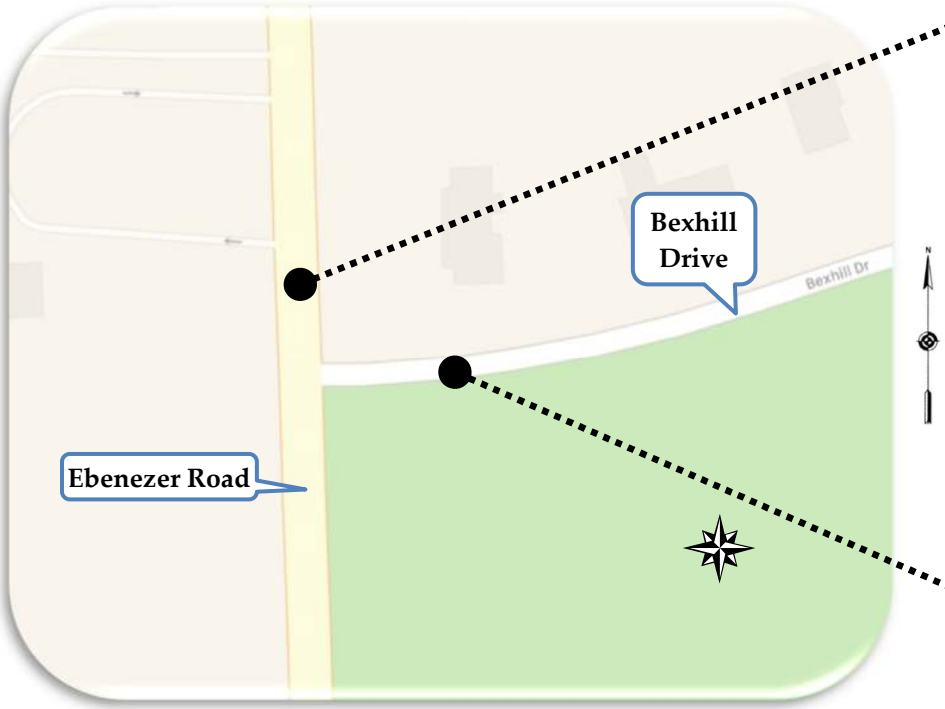
FIGURE 2

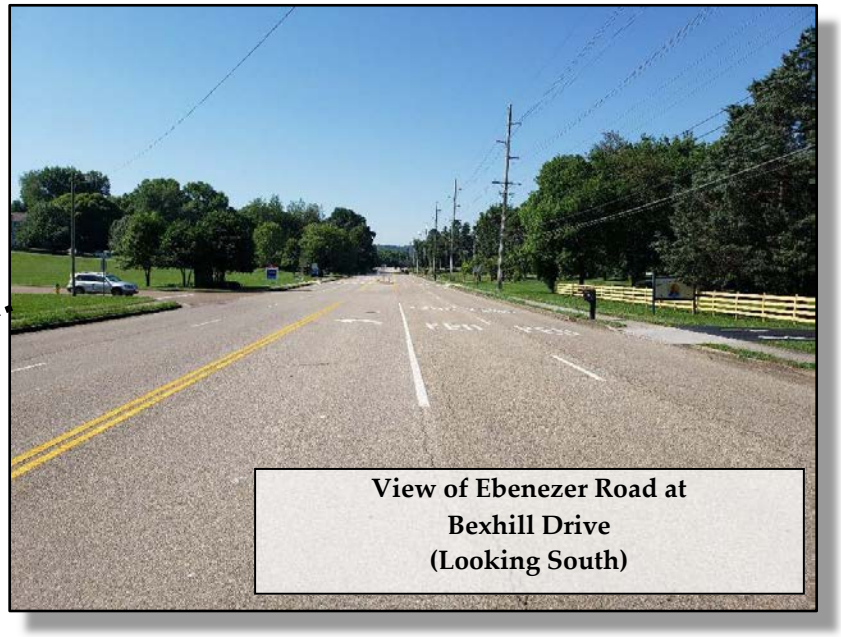
The Shops at Bexhill

Traffic Count Locations, Traffic Signage & Existing Lane Configurations

PHOTO EXHIBITS

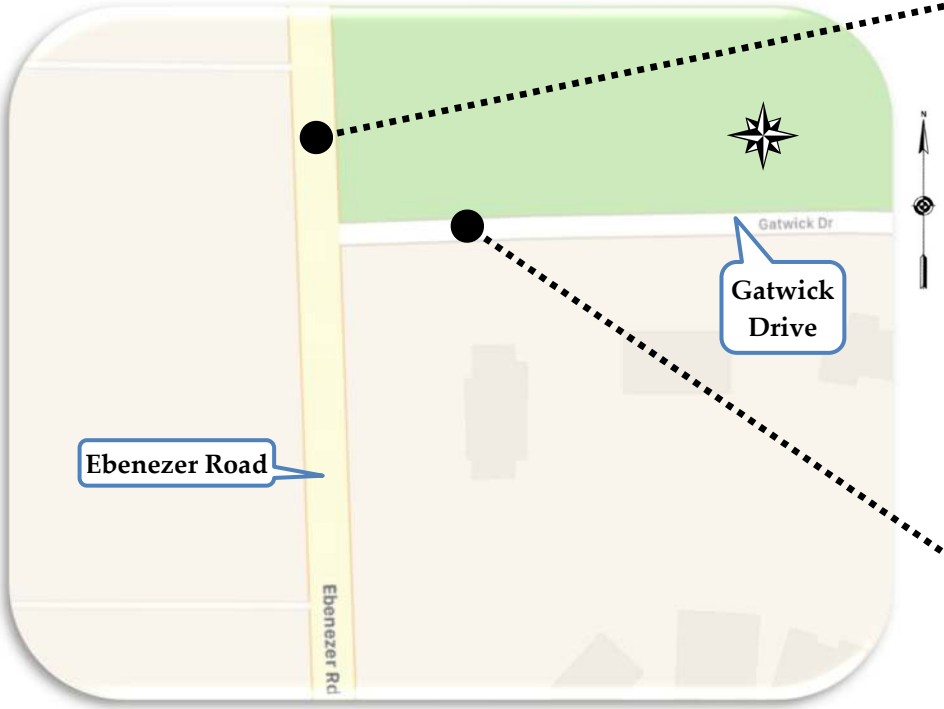


Ebenezer Road at Bexhill Drive

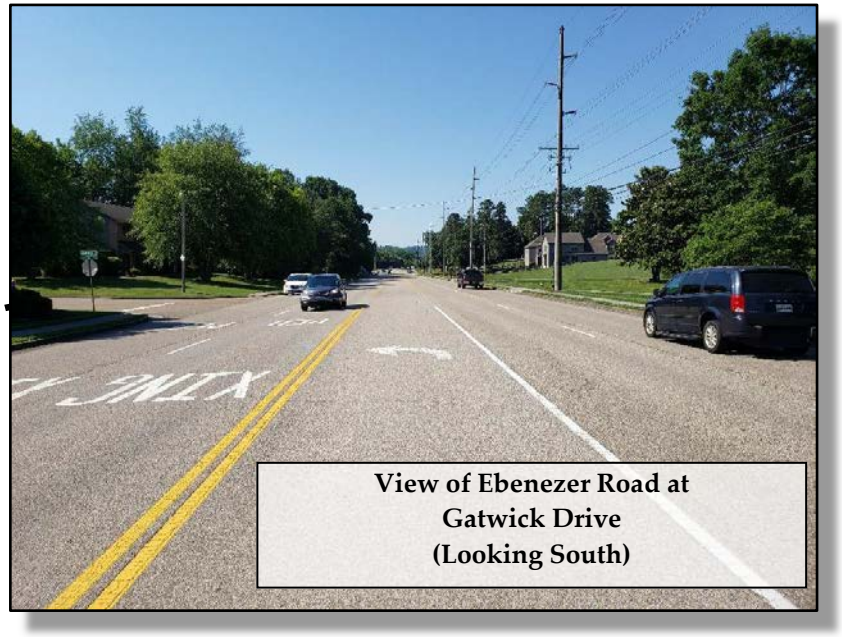


View of Ebenezer Road at Bexhill Drive (Looking South)

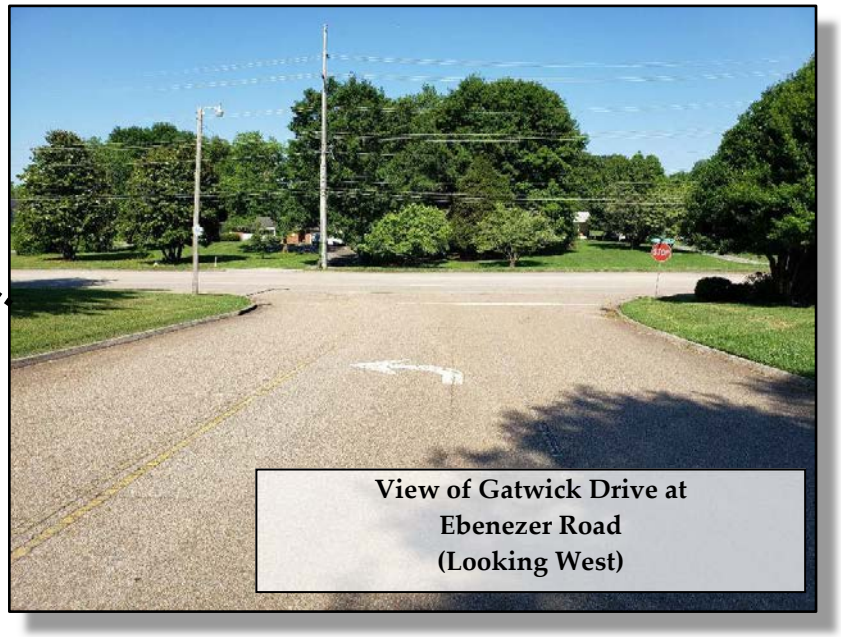
View of Bexhill Drive at Ebenezer Road (Looking West)



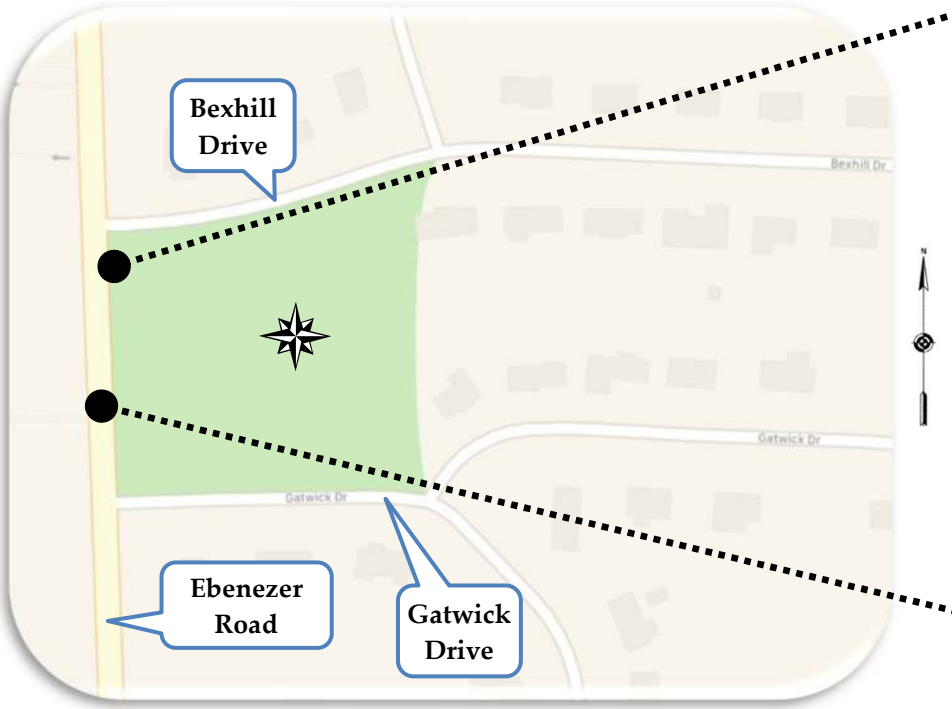
Ebenezer Road at Gatwick Drive



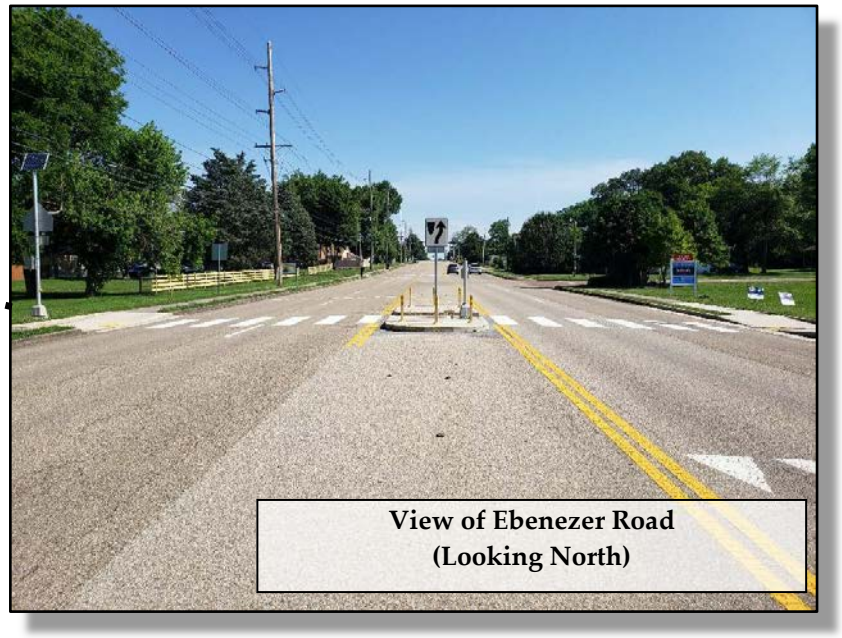
View of Ebenezer Road at Gatwick Drive (Looking South)



View of Gatwick Drive at Ebenezer Road (Looking West)



Ebenezer Road at Bexhill Drive and Gatwick Drive



- **EXISTING TRANSPORTATION VOLUMES PER MODE:**

There is one annual vehicular traffic count location near the development site. This count location is conducted by the Tennessee Department of Transportation (TDOT). The count location data is the following:

- Existing vehicular roadway traffic:
  TDOT reported an Average Daily Traffic (ADT) on Ebenezer Road to the south of Nubbin Ridge Road and north of the project site at 16,586 vehicles per day in 2021. From 2011 – 2021, this count station has indicated a 1.2% average annual growth rate. The researched historical traffic count data for this report can be viewed in Appendix A.

- Existing bicycle and pedestrian volumes:
  The average daily pedestrian and bicycle traffic along and around the study area is not known. Several dozen pedestrians and joggers were observed during the manual traffic counts for this study. Five bicyclists were observed during the manual traffic counts. An online website, Strava, provides "heat" maps detailing exercise routes taken by pedestrians, joggers, and bicyclists. This data is gathered from individuals allowing their smart devices to track and compile their routes (over 700 million activities). Based on the heat maps, more pedestrians/joggers use the adjacent roads than bicyclists. The data showed some cut-thru pedestrian/jogger and bicycle traffic on the property.

Strava Data for Bicyclists

Strava Data for Pedestrians/Joggers

- **ON-STREET PARKING:**

On-street parking was not observed on any of the studied roadways adjacent to the project site during the field reviews. On-street parking is not allowed on Ebenezer Road, but it is assumed that some residents occasionally park on Bexhill Drive and Gatwick Drive.

- **PEDESTRIAN AND BICYCLE FACILITIES:**

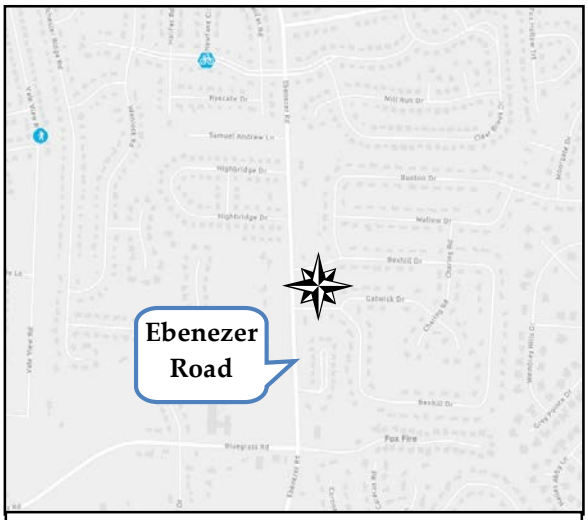
Bicycle lanes are not currently available within the project site study area. Concrete sidewalks are provided along both sides of Ebenezer Road. The sidewalk on the east side is 4.5 feet in width, and the west side sidewalk is 5 feet in width. A pedestrian crosswalk and island are provided on Ebenezer Road midway between Bexhill Drive and Gatwick Drive. This crossing is provided with pushbuttons on each side and one on the center island. The pushbuttons initiate Rapid Rectangular Flashing Beacons (RRFB) to notify motorists traveling northbound and southbound on Ebenezer Road. The center island is located midway in the roadway within the TWLTL. Sidewalks are not provided along Bexhill Drive and Gatwick Drive.

Pedestrian Island in Center of Ebenezer Road (Looking North)

Ebenezer Road at Blue Grass Road Intersection School Dismissal (Looking Northeast)

The signalized intersection of Ebenezer Road at Bluegrass Road is located 1,400 feet to the south of the development site. This intersection has marked crosswalks on all approaches and has pedestrian pushbuttons. Blue Grass Elementary School is located to the northwest of this signalized intersection. During the school arrival in the morning, a crossing guard was observed at this intersection, assisting students crossing this intersection. During the school dismissal at approximately 2:45 pm, a school crossing guard

and a marked Knox County Sheriff's vehicle were observed protecting the school children as they crossed the intersection.



Pedestrian and Bicycle Crashes in Study Area

The Knoxville Regional Transportation Planning Organization (TPO) provided a 2020 update to bicycle and pedestrian crash data for Knox County and a few other surrounding counties. According to the data, no incidents of these types have occurred within the vicinity of the study area. The closest incident was a bicycle crash in February 2018 on Shoreham Boulevard.

- **TRANSIT SERVICES:**

The City of Knoxville has a network of public transit opportunities offered by Knoxville Area Transit (KAT). Bus service is not available in this area. The overall KAT bus system map is in Appendix B. The closest public transit bus stop is 3 miles away, just south of North Peters Road on North Cedar Bluff Road, and is located on Route 16, "Cedar Bluff Connector". It operates on weekdays and weekends, and this route map is also included in Appendix B. Other transit services include the East Tennessee Human Resource Agency (ETHRA) and the Community Action Committee (CAC), which provides transportation services when requested.

PROJECT DESCRIPTION

- **LOCATION AND SITE PLAN:**

The proposed plan layout with three sit-down restaurants and a mix of either small office, medical, or retail shops as designed by Site, Inc. is shown in Figure 3. As shown in the figure, two new driveways will be constructed for the development, one on Bexhill Drive and one on Gatwick Drive. The North Driveway on Bexhill Drive will be 180 feet (centerline to centerline) to the east of Ebenezer Road, and the South Driveway on Gatwick Drive will be 185 feet to the east of Ebenezer Road.

The current plan shown in Figure 3 shows three standalone buildings with attached patios. The smaller out-lot restaurant, Building #3, will have a building size of 2,240 ft^2 with a 400 ft^2 patio. Building #1 will contain a 3,000 ft^2 restaurant with an 860 ft^2 patio and either a retail/medical/clinic business of 1,900 ft^2. Building #2 will contain a 3,000 ft^2 restaurant with a 750 ft^2 patio and either a retail/medical/clinic business of 1,900 ft^2. For the study purposes, it is assumed that these other businesses will be clinic-related. The potential restaurant seating numbers are not known at this time.

A total of 121 parking spaces will be provided in the internal parking lots and includes six ADA-accessible parking spaces. Five-foot and seven-foot-wide concrete sidewalks will be provided around the buildings, with 4-foot sidewalks on the north and south sides that will tie to the existing sidewalk on the eastern side of Ebenezer Road.

The schedule for completion of this new commercial development is dependent on economic factors and construction timelines. This project is also contingent on permitting, design, and other regulatory approvals. However, this study assumed that the total construction build-out of the development and full occupancy would be rapid and occur within the next two years (2023).

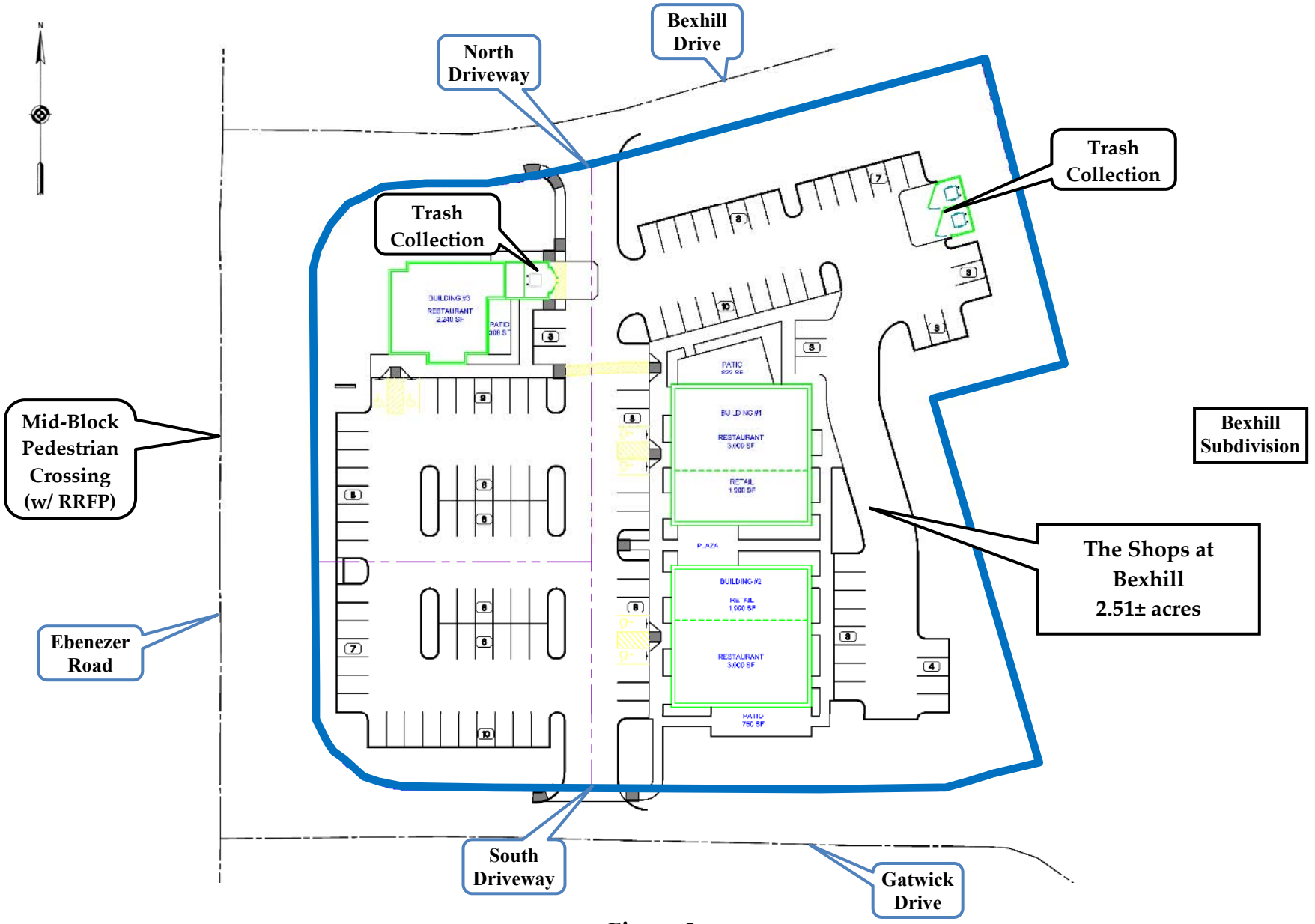


Figure 3
Proposed Plan Layout
The Shops at Bexhill

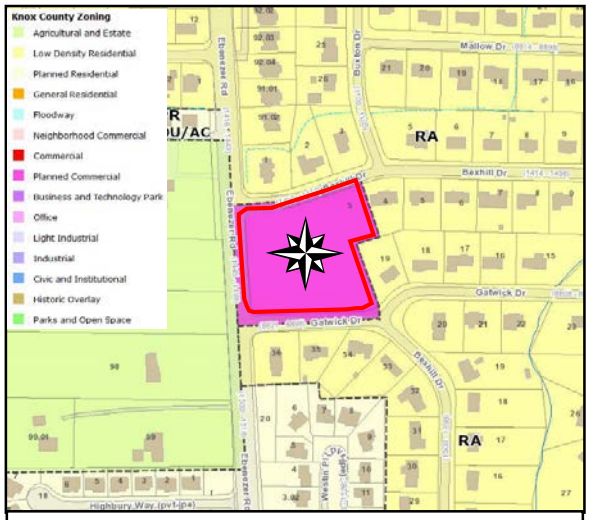
Not to Scale

- **PROPOSED USES AND ZONING REQUIREMENTS:**

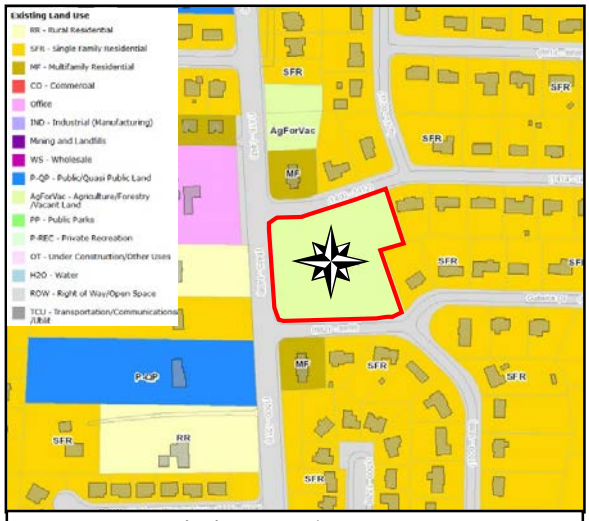
The development property parcel has been zoned as Planned Commercial for decades. It was rezoned on July 26th, 2021, to Neighborhood Commercial Office (CN). The most recent published online KGIS zoning map prior to the rezoning is provided in Appendix C. As stated by the Zoning Ordinance for Knox County, Tennessee, this zone "provides the opportunity to locate limited retail and service uses in a manner convenient to, and yet not disruptive to, established residential neighborhoods. It is intended to provide for the recurring shopping and personal service needs of nearby residential areas."

The existing adjacent surrounding zoning and land uses are the following:

- All the north, east, and south properties are in the Low Density Residential (RA) zone and consist of single-family homes in the Bexhill Subdivision.
- Ebenezer Road bounds the development property to the west. Across Ebenezer Road, several properties are in the Agricultural (A) zone. These properties consist of standalone single-family residential homes. One of these properties consists of Bluegrass Animal Hospital.



Zoning Map Prior to Rezoning



Existing Land Use Map

- **ON-SITE CIRCULATION:**

The driveway and parking lot aisleways will be designed and constructed to Knox County, TN specifications. The internal drive and aisleways will be asphalt paved and include 6" concrete curbs. The lane widths will be 13 feet each for a total 26-foot pavement driveway width and parking lot aisle width. The parking spaces will be 17.5 feet in length and 9 feet in width. Five-foot and seven-foot concrete sidewalks are being proposed internally. The driveway entrance and aisleways will be private and will be maintained in the future by the development.

- **SERVICE AND DELIVERY VEHICLE ACCESS AND CIRCULATION:**

Besides passenger vehicles, the commercial driveways will also provide access for service, delivery, maintenance, and fire protection/rescue vehicles. These non-passenger vehicles will not impact roadway operations other than when they occasionally enter and exit the development. Three trash collection areas are designed for the tenants in the development. A concrete pad is shown in front of the trash collection areas to provide heavy-duty pavement to resist surface damage. The new entrances and parking lot aisleways will be designed and constructed to Knox County specifications and are expected to be adequate for fire protection and rescue vehicles. The development's internal drive will accommodate the larger vehicle types and customers' standard passenger vehicles.

ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

EXISTING TRAFFIC CONDITIONS:

Over the past year and a half, the Covid-19 pandemic has not only closed schools and eliminated school-related traffic, but overall general traffic has been affected due to stay-at-home orders, work layoffs, job furloughs, and general anxiety with travel outside the home. More recently, while overall travel has noticeably increased and returned closer to pre-pandemic levels in the area, there is still a potential reduction in overall travel due to the pandemic. This reduction can be attributed to some school-age children and families choosing to learn virtually online and due to professions and jobs that have transitioned to at-home work for the time being. Knox County Planning compiled traffic count data during the Fall of 2020 and determined that overall traffic volumes were reduced compared to pre-pandemic Fall 2019. A few of the Fall 2020 traffic counts compiled by Knox County Planning showed slight increases in growth over the past year, but most counts showed decreases ranging from 5% up to 30%. More recent counts and comparisons have not been conducted.

For this study, traffic counts were conducted at the existing unsignalized intersections of Ebenezer Road at Bexhill Drive and Ebenezer Road at Gatwick Drive as requested.

Manual traffic counts were obtained on Wednesday, May 19th, 2021, for a total of six hours at the intersection of Ebenezer Road at Bexhill Drive and Ebenezer Road at Gatwick Drive. The counts were conducted to tabulate the morning and afternoon peak periods. Local county public schools were in session when the traffic counts were conducted. Based on the traffic volumes counted, the AM and PM peak traffic hours were observed at 7:30 – 8:30 AM and 5:00 – 6:00 PM at both intersections.

The manual tabulated traffic counts can be reviewed in Appendix D, and some observations are listed below.

- Many Knox County school buses were observed during the traffic counts on Ebenezer Road. Garbage collection trucks and a handful of larger tractor-trailers were also observed on Ebenezer Road. However, most of the traffic observed during the traffic counts were typical passenger vehicles with large trucks and heavy vehicles primarily

observed in the thru movements on Ebenezer Road, but a large moving truck was observed entering and exiting the Bexhill Subdivision at Bexhill Drive.

- Five bicyclists were observed during the six-hour traffic count, and all bicyclists were observed operating on the sidewalks on Ebenezer Road.
- A total of 57 pedestrians were observed during the six-hour traffic count. These pedestrians comprised walkers, walkers with dogs, a walker with a stroller, and several joggers. Some of these observed movements were "repeat" pedestrians traveling back and forth on Ebenezer Road. Most of the pedestrians were observed on the sidewalk on the west side of Ebenezer Road. Only one pedestrian was observed crossing Ebenezer Road at the mid-block crossing between Bexhill Drive and Gatwick Drive. This pedestrian did not use the pushbuttons to activate the RRFB's. One pedestrian was observed jaywalking across Ebenezer Road just to the north of the intersection with Bexhill Drive. A few school-age children were observed walking to and from the nearby Blue Grass Elementary School, and a parent accompanied most of them.
- Many motorists making westbound left-turns from Bexhill Drive onto Ebenezer Road were observed using the TWLTL as a temporary refuge and the pedestrian island as a buffer to enter the southbound Ebenezer Road traffic stream after crossing the northbound stream.

As discussed, Knox County Planning has determined that traffic volumes in the area are still potentially reduced due to the ongoing pandemic. At the direction of Knox County Planning, to account for potentially reduced traffic volumes due to the pandemic, this study uses analyses with the raw tabulated traffic volumes increased by 10%. Figure 4a shows the raw volumes from the existing traffic counts during the AM and PM peak hours observed at the studied intersections. Figure 4b shows the raw volumes from the existing traffic counts during the AM and PM peak hours observed at the studied intersections increased by 10%.

While Knox County Planning has requested that this report base the study on increasing the existing raw volumes by 10% to account for the pandemic, it could be debated that increasing the raw traffic counts by 10% could overestimate the existing traffic conditions since local travel currently appears to have returned to pre-pandemic conditions. However, including a 10% increase would absorb and include trips generated in the projected conditions for a nearby high-end retail development under construction located to the north near the intersection of Ebenezer Road at Westland Drive that otherwise would not be accounted for in this analysis.

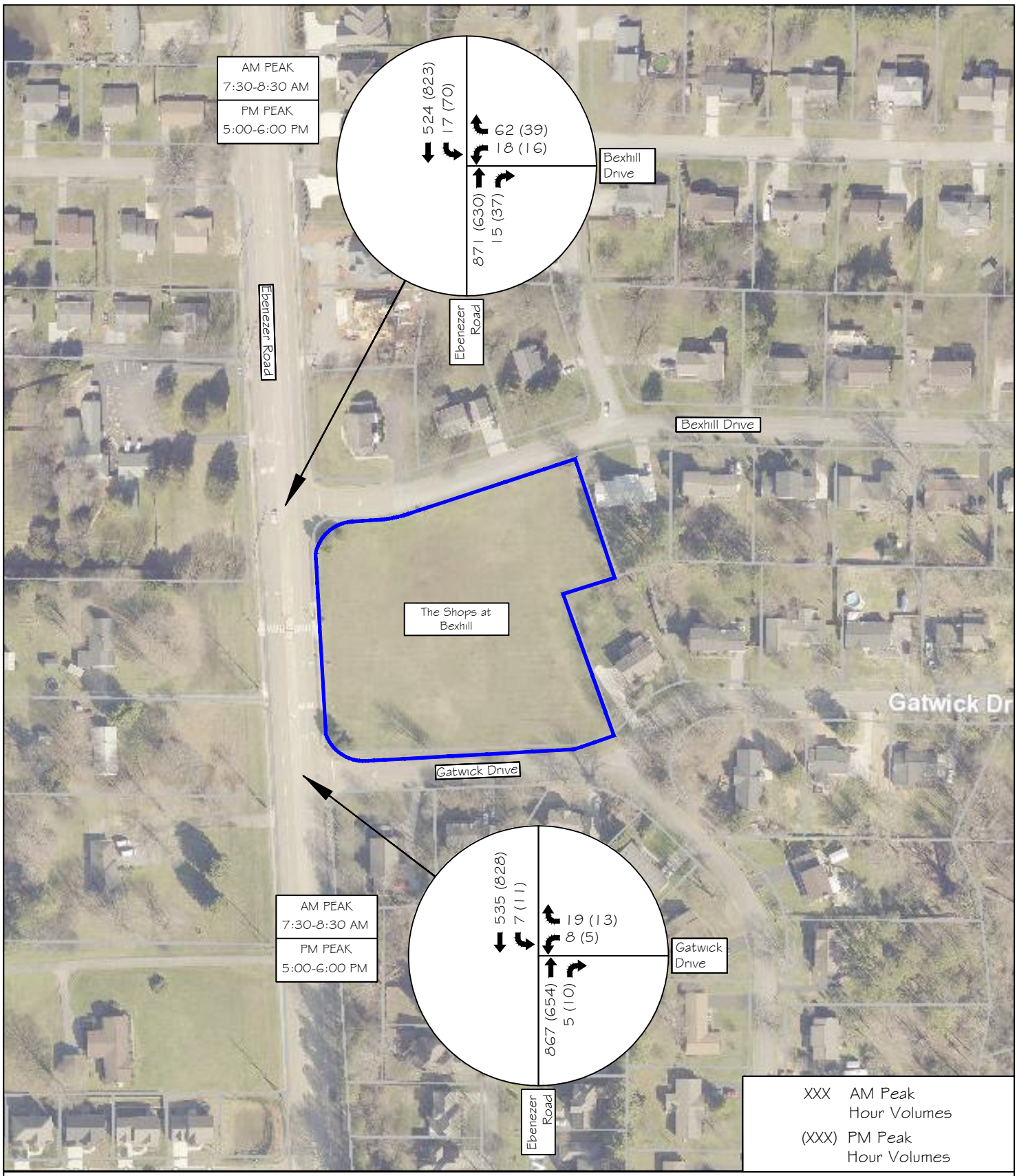


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FIGURE 4a

The Shops at Bexhill

2021 Peak Hour Traffic Volumes - EXISTING TRAFFIC CONDITIONS

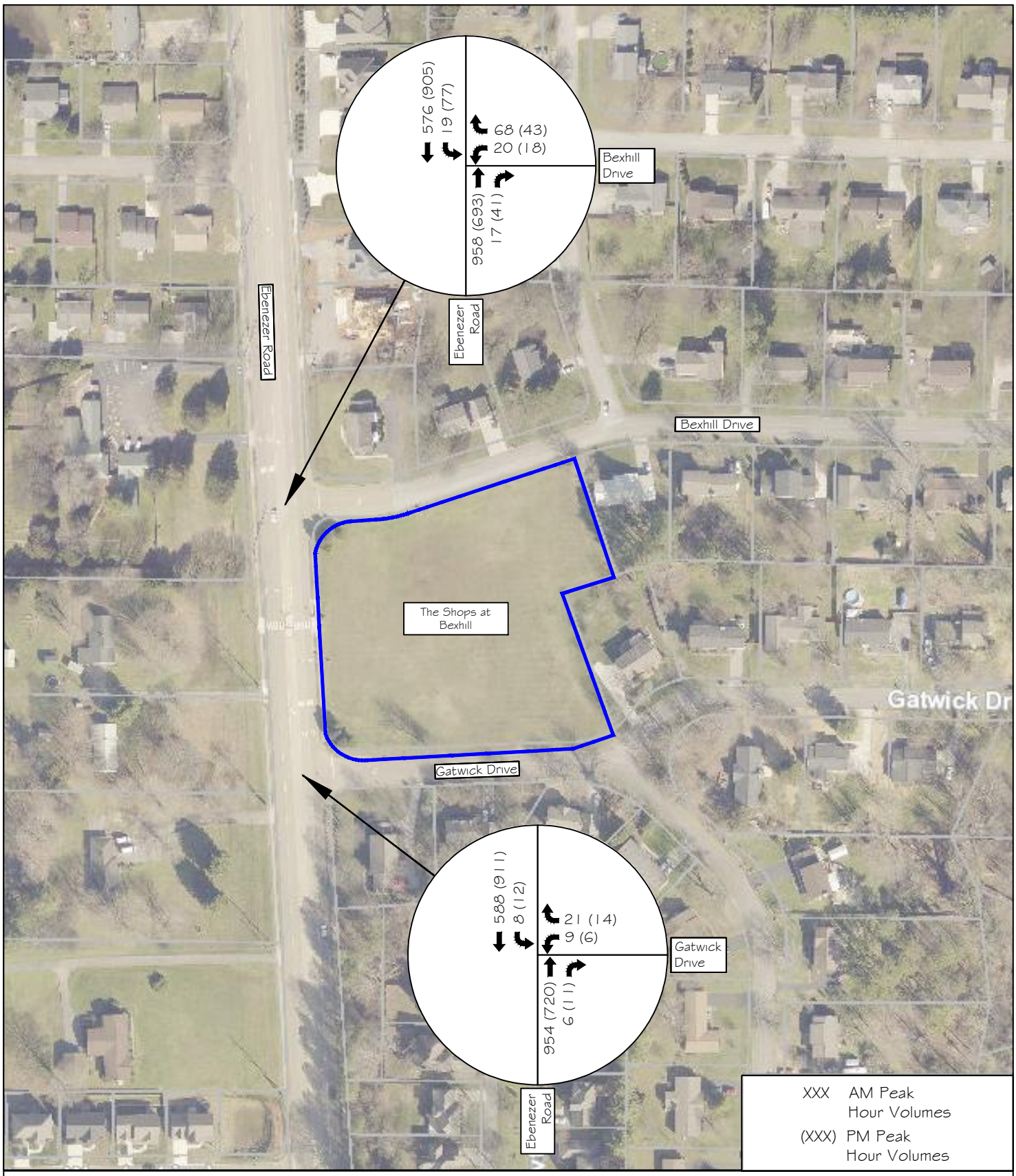

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FIGURE 4b

The Shops at Bexhill

2021 Peak Hour Traffic Volumes with 10% Factor Increase - EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the Level of Service (LOS) at the studied intersections for the existing year 2021 traffic volumes shown in Figure 4a and Figure 4b with a 10% increase. The capacity analyses were calculated following the Highway Capacity Manual (HCM) methods and utilizing Synchro Traffic Software (Version 8).

Methodology:

LOS is a qualitative measurement developed by the transportation profession to express how well an intersection or roadway performs based on a driver's perception. LOS designations include LOS A through LOS F. The designation of LOS A signifies a roadway or intersection operating at best, while LOS F signifies road operations at worst. This grading system provides a reliable, straightforward means to communicate road operations to the public. The HCM lists level of service criteria for unsignalized intersections and signalized intersections.

A/B  C/D  E/F 

LOS is defined by delay per vehicle (seconds), and roadway facilities are also characterized by the volume-to-capacity ratio (v/c). For example, a delay of 20 seconds at an unsignalized intersection would indicate LOS C. This delay represents the additional delay a motorist would experience traveling through the intersection. Also, for example, a v/c ratio of 0.75 for an approach at an unsignalized intersection would indicate that it operates at 75% of its available capacity. LOS designations, which are based on delay, are reported differently for unsignalized and signalized intersections. This difference is primarily due to motorists having different expectations between the two road facilities. Generally, for most instances, the LOS D / LOS E boundary is considered the upper limit of acceptable delay during peak periods in urban and suburban areas.

For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure attempts to quantify delay that includes travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline

> thru and right turn traffic does not stop and is not affected by the traffic on the minor side streets. Thus, the LOS for a two-way stop (or yield) controlled intersection is defined by the delay for each minor approach and major street left-turn movements. Table 2 lists the level of service criteria for unsignalized intersections. The analysis results of unsignalized intersections using the HCM methodologies are conservative due to the more significant vehicle gap parameters used in the method. More often, in normal road conditions, drivers are more willing to accept smaller gaps in traffic than what is modeled using the HCM methodology. The unsignalized intersection methodology also does not account for more significant gaps sometimes produced by nearby upstream and downstream signalized intersections. For unsignalized intersections, in most instances, the upper limit of acceptable delay during peak hours is the LOS D/E boundary at 35 seconds.

Intersection capacity results from the existing peak hour traffic are shown in Tables 3a and 3b. Table 3a shows the results based on the existing raw tabulated traffic counts. Table 3b shows the results based on the existing raw tabulated traffic counts with a 10% increase. The intersections in the tables are shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. Appendix E includes the worksheets for the existing peak hour vehicular traffic capacity analyses.

As seen in Tables 3a and 3b, all the intersections' traffic movements are currently calculated to operate with good to average LOS and vehicle delays. The exception is the westbound left-turn lane of Ebenezer Road at Bexhill Drive, which is calculated to operate at LOS D in the AM peak hour when the existing raw volumes are increased by 10%, as shown in Table 3b.

TABLE 2
LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	DESCRIPTION	CONTROL DELAY (seconds/vehicle)
A	Little or no delay	0 - 10
B	Short Traffic Delays	>10 -15
C	Average Traffic Delays	>15 - 25
D	Long Traffic Delays	>25 - 35
E	Very Long Traffic Delays	>35 - 50
F	Extreme Traffic Delays	>50

Source: Highway Capacity Manual, 6th Edition

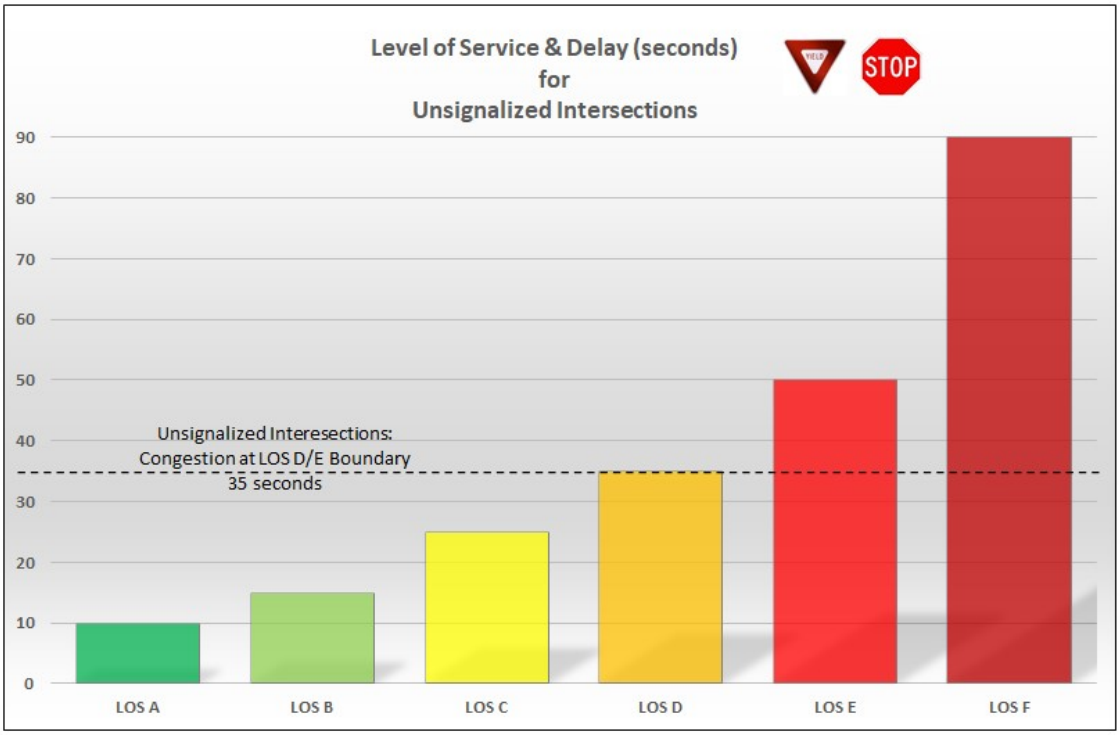


TABLE 3a
2021 INTERSECTION CAPACITY ANALYSIS RESULTS -
EXISTING TRAFFIC CONDITIONS

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Ebenezer Road at Bexhill Drive	Unsignalized	Westbound Left	C	22.8	0.165	C	19.4	0.087
		Westbound Right	B	13.6	0.153	B	11.2	0.082
		Southbound Left	B	10.8	0.037	A	9.7	0.110
Ebenezer Road at Gatwick Drive	Unsignalized	Westbound Left	C	19.8	0.076	C	16.3	0.036
		Westbound Right	B	12.5	0.063	B	10.8	0.025
		Southbound Left	B	10.6	0.018	A	9.3	0.019

Note: Analysis of 2-way Stop calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

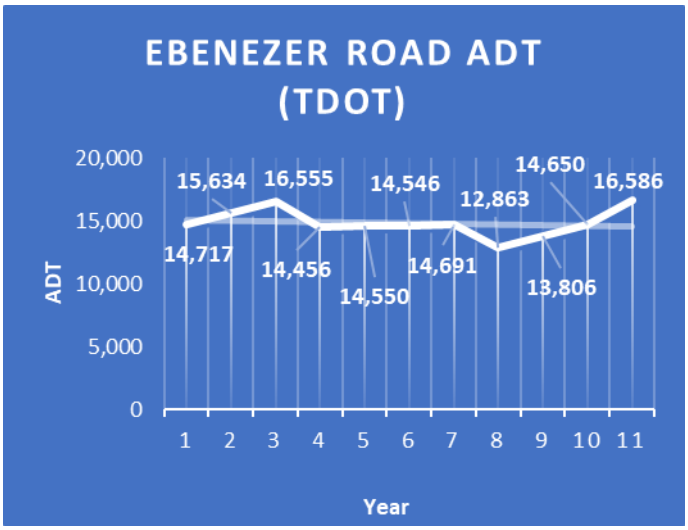
TABLE 3b
2021 INTERSECTION CAPACITY ANALYSIS RESULTS -
EXISTING TRAFFIC CONDITIONS (+10%)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Ebenezer Road at Bexhill Drive	Unsignalized	Westbound Left	D	26.3	0.209	C	21.6	0.110
		Westbound Right	B	14.6	0.181	B	11.6	0.095
		Southbound Left	B	11.4	0.045	B	10.1	0.129
Ebenezer Road at Gatwick Drive	Unsignalized	Westbound Left	C	22.1	0.097	C	17.6	0.048
		Westbound Right	B	13.2	0.075	B	11.2	0.029
		Southbound Left	B	11.1	0.023	A	9.6	0.022

Note: Analysis of 2-way Stop calculated in Synchro 8 software and reported with HCM 2010 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio

- **PROJECTED HORIZON YEAR TRAFFIC CONDITIONS (WITHOUT THE PROJECT):**

Projected horizon year traffic conditions represent the future traffic volumes in the study area without the proposed project being developed (no-build option). As previously stated, the build-out and full occupancy for this proposed development is assumed will occur by 2023. This horizon year corresponds to two years for this development to reach full capacity and occupancy.



Vehicular traffic on Ebenezer Road has shown moderate growth (1.2%) over the past ten years, according to the TDOT traffic count station and as shown in Appendix A. An average annual growth rate of 1.5% was used to calculate future growth up to 2023 for the studied intersections to account for potential traffic growth in the study area. The 1.5% growth factor was only applied to the thru volumes on Ebenezer Road. The turn movements at Bexhill Drive and Gatwick Drive were not increased since the Bexhill Subdivision is entirely built out and is not expected to experience increased traffic volumes. This growth rate was applied to the existing raw volumes increased by 10%. The results of this growth rate applied to the existing 2021 traffic volumes from Figure 4b (with 10% factor) are shown in Figure 5. Figure 5 shows the projected horizon year traffic volumes at the studied intersections in 2023 during the AM and PM peak hours without the project.

Intersection capacity analyses were conducted for the projected 2023 traffic volumes without the project being developed. The 2023 projected traffic results without the project can be seen in Table 4 for the intersections. The results are similar to those obtained when the existing raw volumes are increased by 10%. The calculation worksheets are in Appendix E.

It is essential to point out that these intersection LOS projections could reasonably exist in the future, even without the proposed commercial development being constructed and developed.

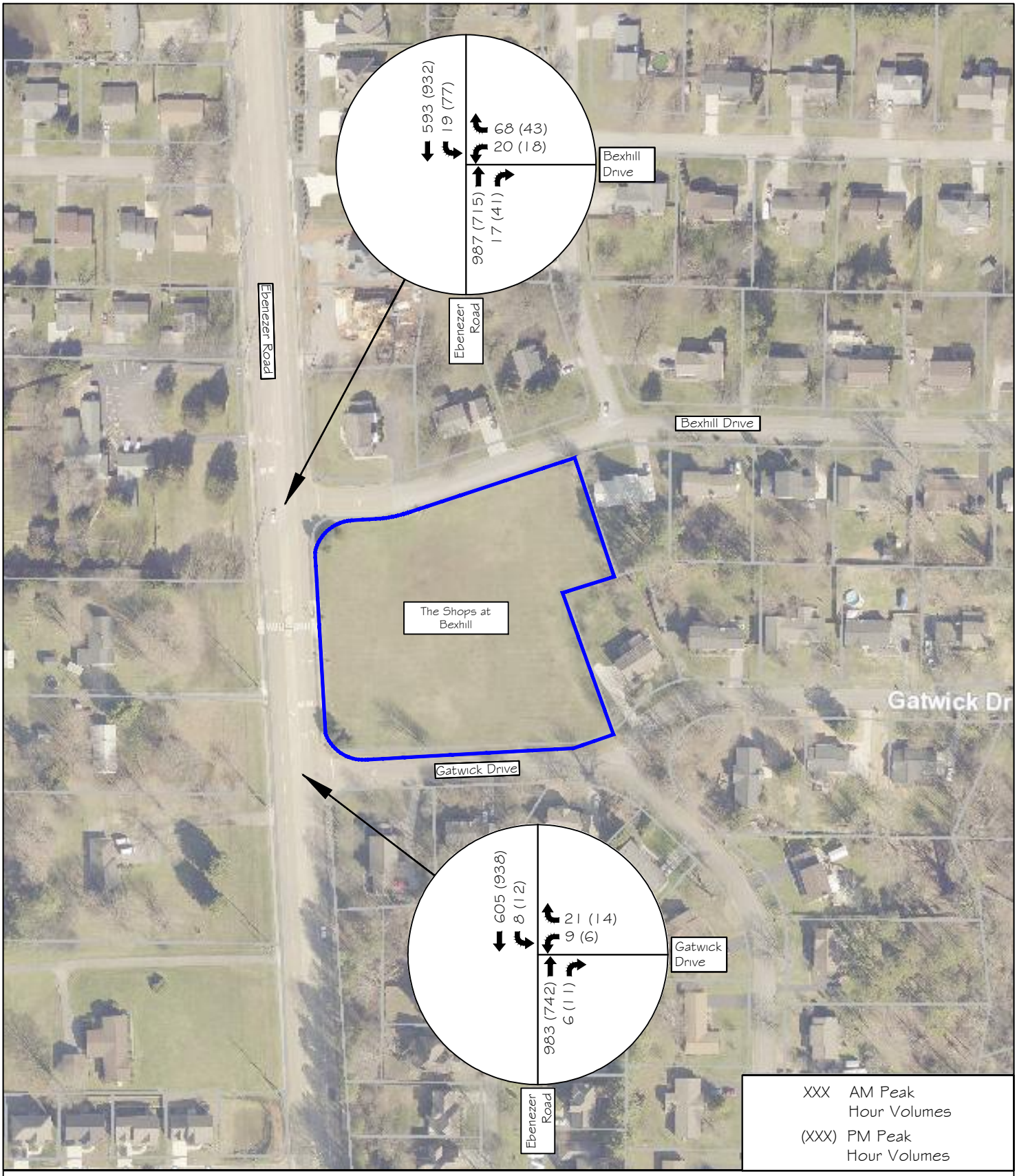


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FIGURE 5

The Shops at Bexhill

2023 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITHOUT THE PROJECT)

TABLE 4
2023 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITHOUT THE PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY [b] (seconds)	v/c [c]
Ebenezer Road at Bexhill Drive	Unsignalized	Westbound Left	D	27.5	0.218	C	22.2	0.114
		Westbound Right	B	14.9	0.186	B	11.7	0.097
		Southbound Left	B	11.6	0.047	B	10.2	0.132
Ebenezer Road at Gatwick Drive	Unsignalized	Westbound Left	C	22.9	0.100	C	18.0	0.049
		Westbound Right	B	13.5	0.077	B	11.3	0.029
		Southbound Left	B	11.3	0.024	A	9.7	0.022

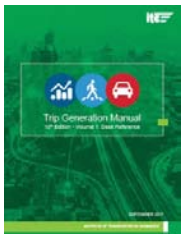
Note: Analysis of 2-way Stop calculated in Synchro 8 software and reported with HCM 2010 methodology

[a] Level of Service

[b] Average Delay (sec/vehicle)

[c] Volume-to-Capacity Ratio

- **TRIP GENERATION:**



The estimated amount of traffic that the commercial development will generate was calculated based upon rates and equations provided by the Trip Generation Manual, 10th Edition, a publication of the Institute of Transportation Engineers (ITE). A generated trip is a single or one-direction vehicle movement that enters or exits the study site. The Trip Generation Manual is the most popular resource for determining trip generation rates when transportation impact studies are produced. The Manual includes data for various land uses and provides for the calculation of generated trips based on different variables such as dwelling units and square footage. The data and calculations from ITE for the proposed land uses in The Shops at Bexhill are shown in Appendix F. The proposed restaurants will only serve lunch and dinner. ITE states that outdoor seating is not included in the overall gross floor area data, and the number of seats may be a more reliable variable. However, the number of seats is not known at this point. The patio square footage for the restaurants is included in the overall gross floor area in the trip generation calculations to present a conservative analysis. The other building uses in the development are assumed to be clinic-related. A summary of this information is presented in the following:

TABLE 5a
TRIP GENERATION FOR THE SHOPS AT BEXHILL

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	TRIPS GENERATED ON WEEKDAY	TRIPS GENERATED IN AM PEAK HOUR			TRIPS GENERATED IN PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#932	High-Turnover (Sit-Down) Restaurant #1	3,000 ft^2 (+822 ft^2 Patio)	429	55%	45%		62%	38%	
				21	17	38	23	14	37
#932	High-Turnover (Sit-Down) Restaurant #2	3,000 ft^2 (+750 ft^2 Patio)	421	55%	45%		62%	38%	
				20	17	37	23	14	37
#932	High-Turnover (Sit-Down) Restaurant #3	2,240 ft (+308 ft^2 Patio)	286	55%	45%		62%	38%	
				14	11	25	16	9	25
#630	Clinic	1,900 ft2	73	78%	22%		29%	71%	
				5	2	7	3	8	11
#630	Clinic	1,900 ft^2	73	78%	22%		29%	71%	
				5	2	7	3	8	11
Total New Volume Site Development Trips			**1,282**	**10**	**4**	**14**	**68**	**53**	**121**

ITE Trip Generation Manual, 10th Edition

As a broad category, generated trips can be categorized further as primary (new), pass-by, and internal trips.

> *Methodology:*
> Not all trips generated by a development are primary (new) trips. For some land uses, the trips generated by a proposed development are captured from the adjacent street system and do not generate an entirely "new" trip. For example, a person returning home from work may stop off at a gas station on the way home. These trips are an intermediate stop between an existing origin and a destination without a route diversion. These types of trips are known as pass-by trips and are assumed to be already occurring on the adjacent street. Considerable research has examined these types of trips, and national and local rates have been published. Fast food restaurants and larger convenience markets can include pass-by trip rates up to 75%.
>
> Other trips generated by a development that should not be added to the adjacent street or intersections are internal. These trips are self-explanatory and categorized for developments with complementary land uses such as retail, residential, office, hotel, and restaurants. As another example, a customer of a retail shop may decide to eat at the adjacent restaurant in the same development. Similarly, nearby residents within a reasonable distance may decide to walk and eat at an adjacent restaurant instead of utilizing a vehicle for travel.

For high-turnover sit-down restaurants, ITE lists an average pass-by trip percentage of 43%. However, to preserve a conservative analysis, the calculations in this study assumed that 20% of the restaurants' generated trips would be pass-by trips. In Knox County, fast-food restaurants are allowed a 40% pass-by trip rate. Thus, a lower percentage of 20% was used for the high-turnover sit-down restaurants for this development to remain conservative. This pass-by trip percentage was agreed to with Knox County Engineering. Pass-by trip percentage data from ITE and Knox County are shown in Appendix G.

Pass-by trips are shown in the entering and exiting volumes and subtracted from the adjacent thru volumes. No pass-by trips were assumed for the clinics.

While it could be expected that some internal trips will occur at this development, no internal trip discounts were applied. Thus, once considering pass-by trips and the business operating

hours, the overall trip generation volumes can be tabulated as the following:

TABLE 5b
TRIP GENERATION FOR THE SHOPS AT BEXHILL WITH PASS-BY TRIPS

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	TRIPS GENERATED IN AM PEAK HOUR			TRIPS GENERATED IN PM PEAK HOUR		
			ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#932	High-Turnover (Sit-Down) Restaurant #1	3,000 ft^2 (+822 ft^2 Patio)	55%	45%		62%	38%	
						23	14	37
#932	High-Turnover (Sit-Down) Restaurant #2	3,000 ft^2 (+750 ft^2 Patio)	55%	45%		62%	38%	
						23	14	37
#932	High-Turnover (Sit-Down) Restaurant #3	2,240 ft^2 (+308 ft^2 Patio)	55%	45%		62%	38%	
						16	9	25
#630	Clinic	2,100 ft^2	78%	22%		29%	71%	
			5	2	7	3	8	11
#630	Clinic	1,900 ft^2	78%	22%		29%	71%	
			5	2	7	3	8	11
External Vehicle Trips - Total			**10**	**4**	**14**	**68**	**53**	**121**
Pass-by Vehicle Trips (Restaurants)			0	0	0	-12	-7	-19
Total New Primary Vehicle Trips			**10**	**4**	**14**	**56**	**46**	**102**

ITE Trip Generation Manual, 10th Edition
Pass-by Trip %: Restaurant = 20%

For the proposed development, it is estimated that 10 vehicles will enter and 4 will exit, for a total of 14 new trips during the AM peak hour in the year 2023. Similarly, it is estimated that 56 vehicles will enter, and 46 will exit, for a total of 102 new trips during the PM peak hour in the year 2023. The difference between the total external trips and the total new primary trips will comprise motorists already traveling on Ebenezer Road (none were assumed from Bexhill Drive and Gatwick Drive). As shown previously in Table 5a, the total weekday traffic volumes generated by this development could be expected to be 1,282 vehicles. However, this volume is calculated on rates assuming the restaurants will be open for breakfast, lunch, and dinner, which will not be the case for this development.

- **TRIP DISTRIBUTION AND ASSIGNMENT:**

Figures 6a and 6b show the projected distribution of traffic entering and exiting the proposed development based on the site plan. The percentages shown only pertain to the trips generated by the commercial development calculated from the ITE trips shown in Tables 5a and 5b. Figure 6a shows the percentages for the primary trips, and Figure 6b shows the percentages assumed for the pass-by trips. The pass-by trips were assumed to occur only from the traffic stream from Ebenezer Road, only for the restaurants, and only during the PM peak hour.

The percentages assumed and shown in Figures 6a and 6b are based on the observed existing traffic flow. The existing traffic counts revealed that approximately 60% of traffic traveled northbound in the AM peak hour and 40% southbound. The opposite occurred in the PM peak hour, with 60% of traffic traveled southbound and 40% northbound. The pass-by trips were based on the observed split on Ebenezer Road and only applied during the PM peak hours since the restaurants will not be open in the morning hours.

To account for some trips being captured from the adjacent subdivision, 3% of traffic was assumed to occur to and from Bexhill Drive and 2% to and from Gatwick Drive. The slightly higher rate on Bexhill Drive reflects that most homes located in the subdivision have access via Bexhill Drive compared to Gatwick Drive.

Overall, the study used a 60% / 35% split on Ebenezer Road for the primary trips, with 5% of trips assumed to and from the east from Bexhill Subdivision.

Since the development will have two entrances with several directions of traffic flow, spreadsheets were developed for this study to calculate trip distribution and volumes at all the studied intersections. These spreadsheets are presented in Appendix H.

Figures 7a and 7b show the Traffic Assignment of the computed trips generated by the development (from Tables 5a and 5b) based on the assumed distribution of trips shown in Figures 6a and 6b. Figure 7a shows the distribution of the primary generated trips, and Figure 7b shows the pass-by trips assigned to the site study intersections.

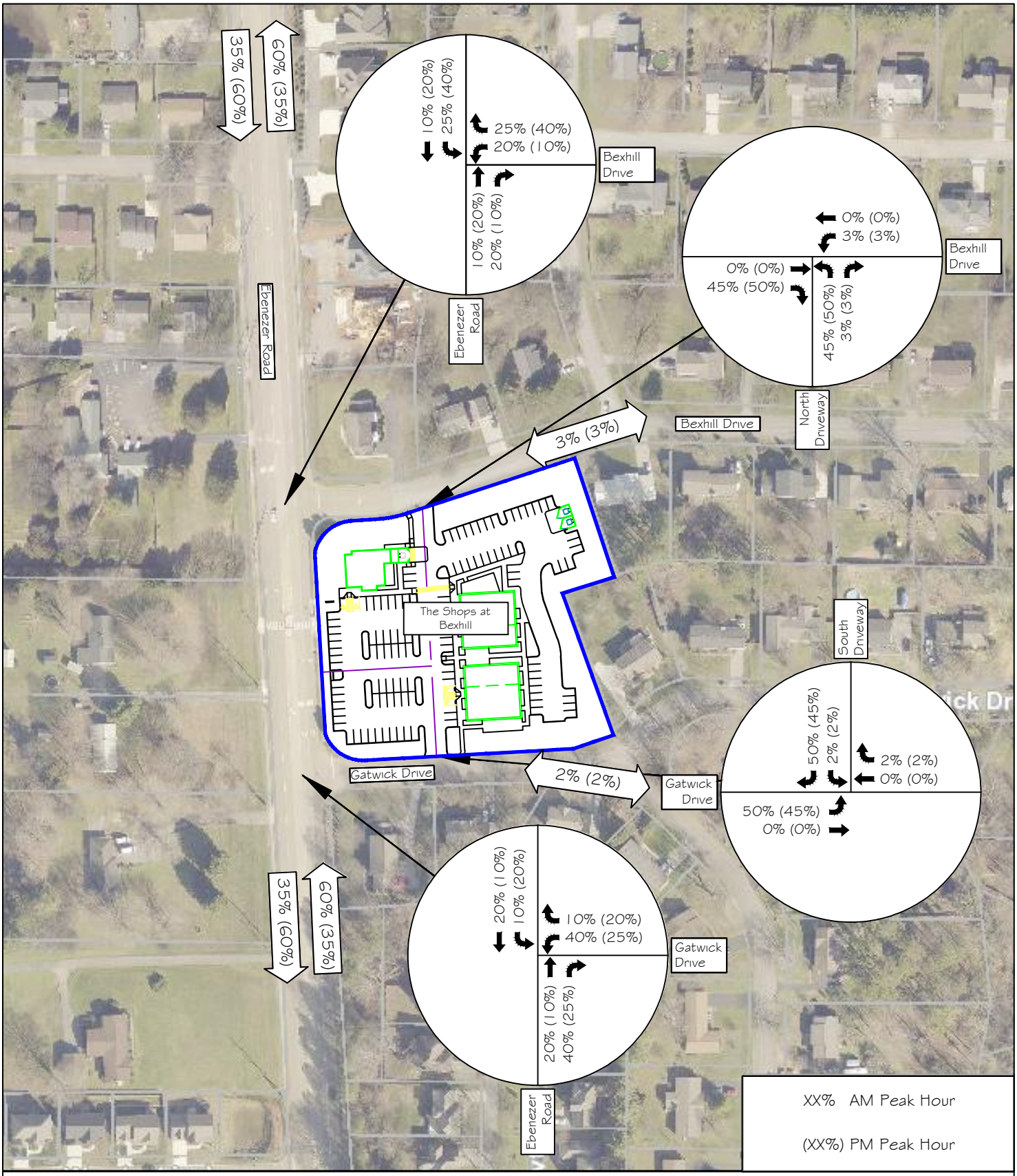


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FIGURE 6a

The Shops at Bexhill

Directional Distribution of Generated Traffic during AM and PM Peak Hour - Primary Trips

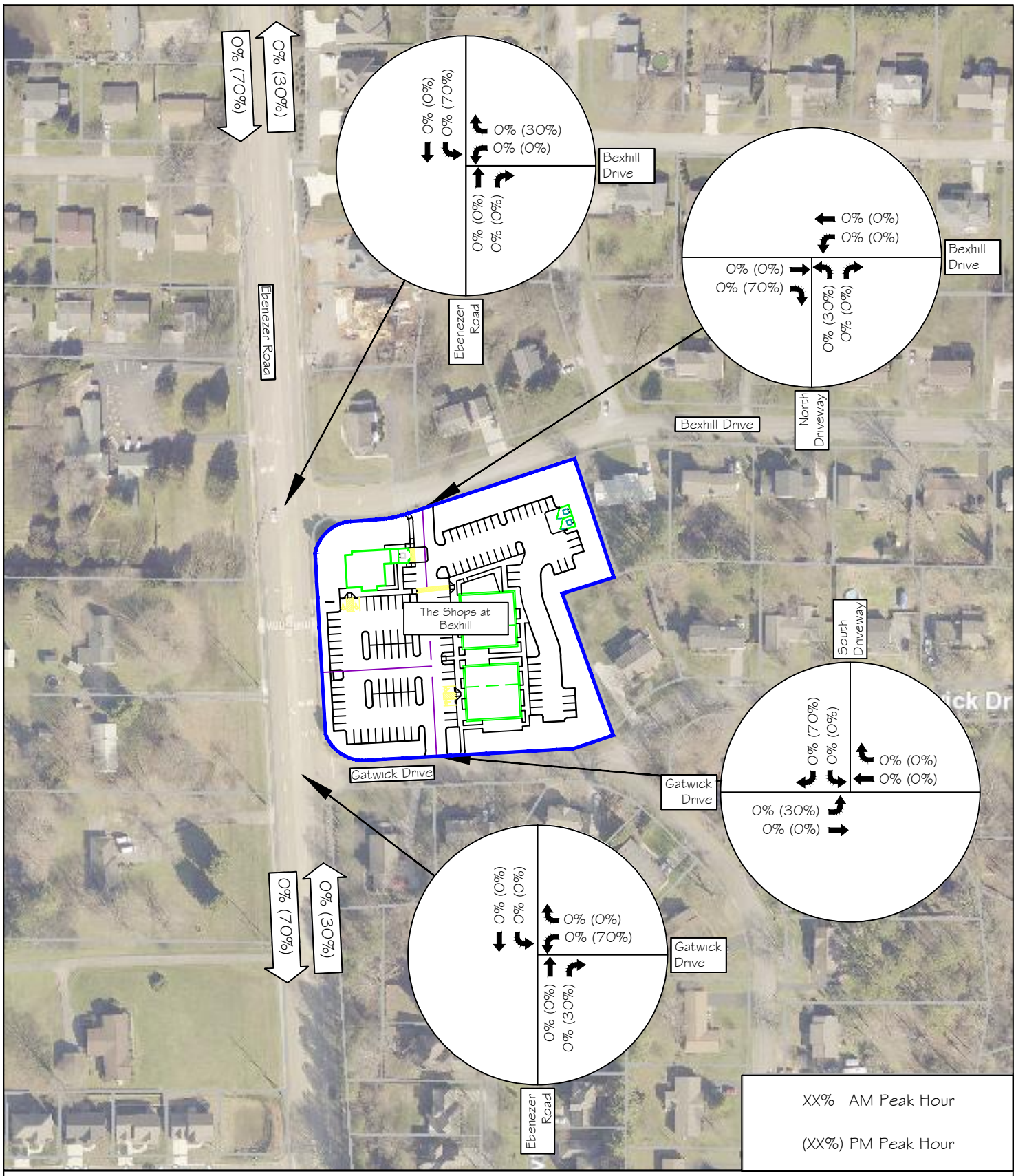

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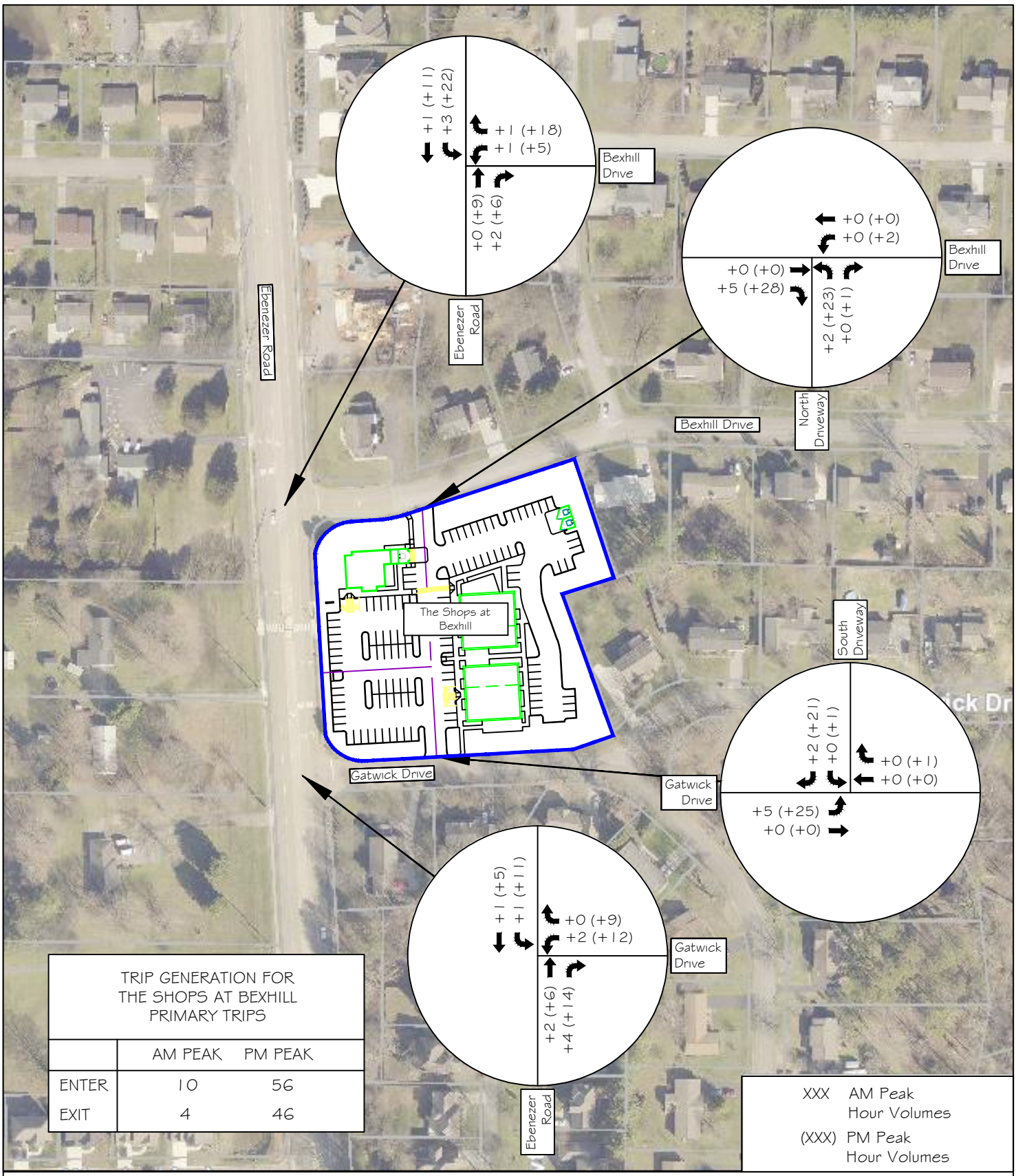
FIGURE 6b

The Shops at Bexhill

Directional Distribution of Generated Traffic during AM and PM Peak Hour - Pass-By Trips



TRIP GENERATION FOR THE SHOPS AT BEXHILL PRIMARY TRIPS

	AM PEAK	PM PEAK
ENTER	10	56
EXIT	4	46

XXX AM Peak Hour Volumes

(XXX) PM Peak Hour Volumes

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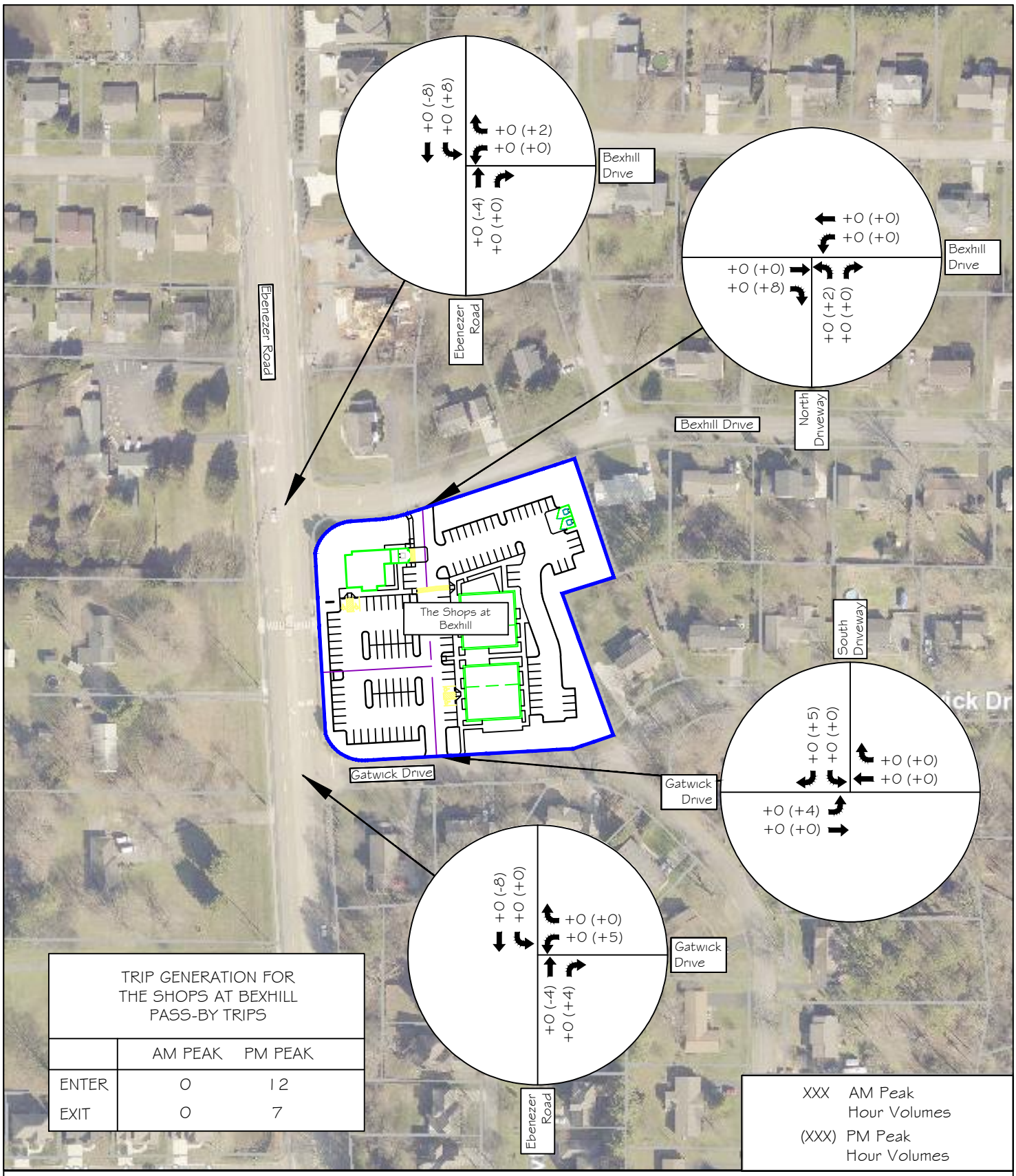
FIGURE 7a

The Shops at Bexhill

Traffic Assignment of Generated Traffic during AM and PM Peak Hour - Primary Trips



TRIP GENERATION FOR
THE SHOPS AT BEXHILL
PASS-BY TRIPS

	AM PEAK	PM PEAK
ENTER	0	12
EXIT	0	7

XXX AM Peak Hour Volumes

(XXX) PM Peak Hour Volumes

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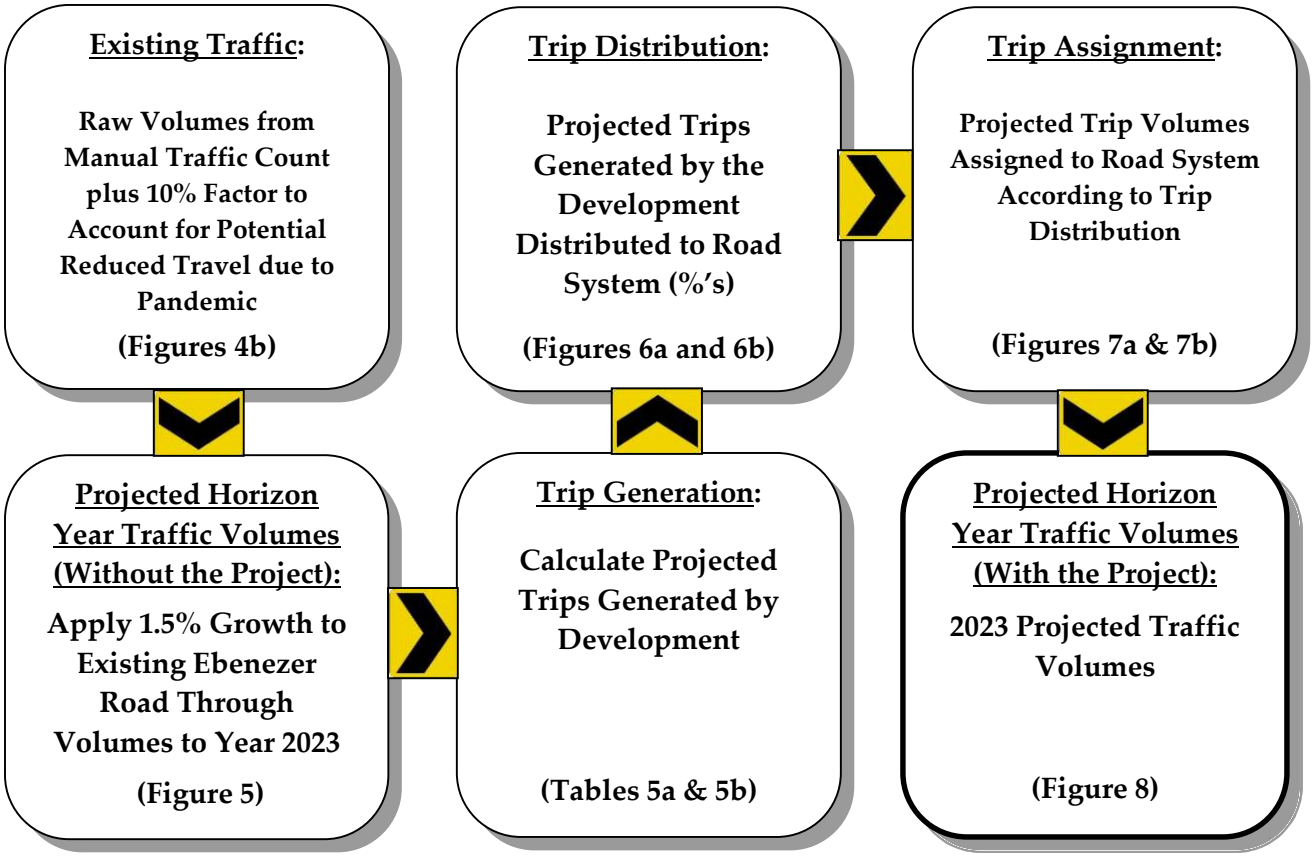
FIGURE 7b

The Shops at Bexhill

Traffic Assignment of Generated Traffic during AM and PM Peak Hour - Pass-By Trips

- **PROJECTED HORIZON YEAR TRAFFIC CONDITIONS (WITH THE PROJECT):**

Overall, several additive steps were taken to estimate the projected total horizon year traffic volumes at the studied intersections when The Shops at Bexhill is entirely constructed and occupied by 2023. The steps are illustrated below for clarity:



To calculate the total future projected traffic volumes at the studied intersections, the calculated peak hour traffic volumes) generated by The Shops at Bexhill was added to the 2023 projected horizon year traffic volumes (Figure 5) by following the predicted directional distributions and assignments (Figures 6a & 6b and 7a & 7b). This procedure was completed to obtain the total projected traffic volumes when the development is fully built out and occupied in 2023. Figure 8 shows the projected AM and PM peak hour volumes at the studied intersections in 2023 with the development traffic.

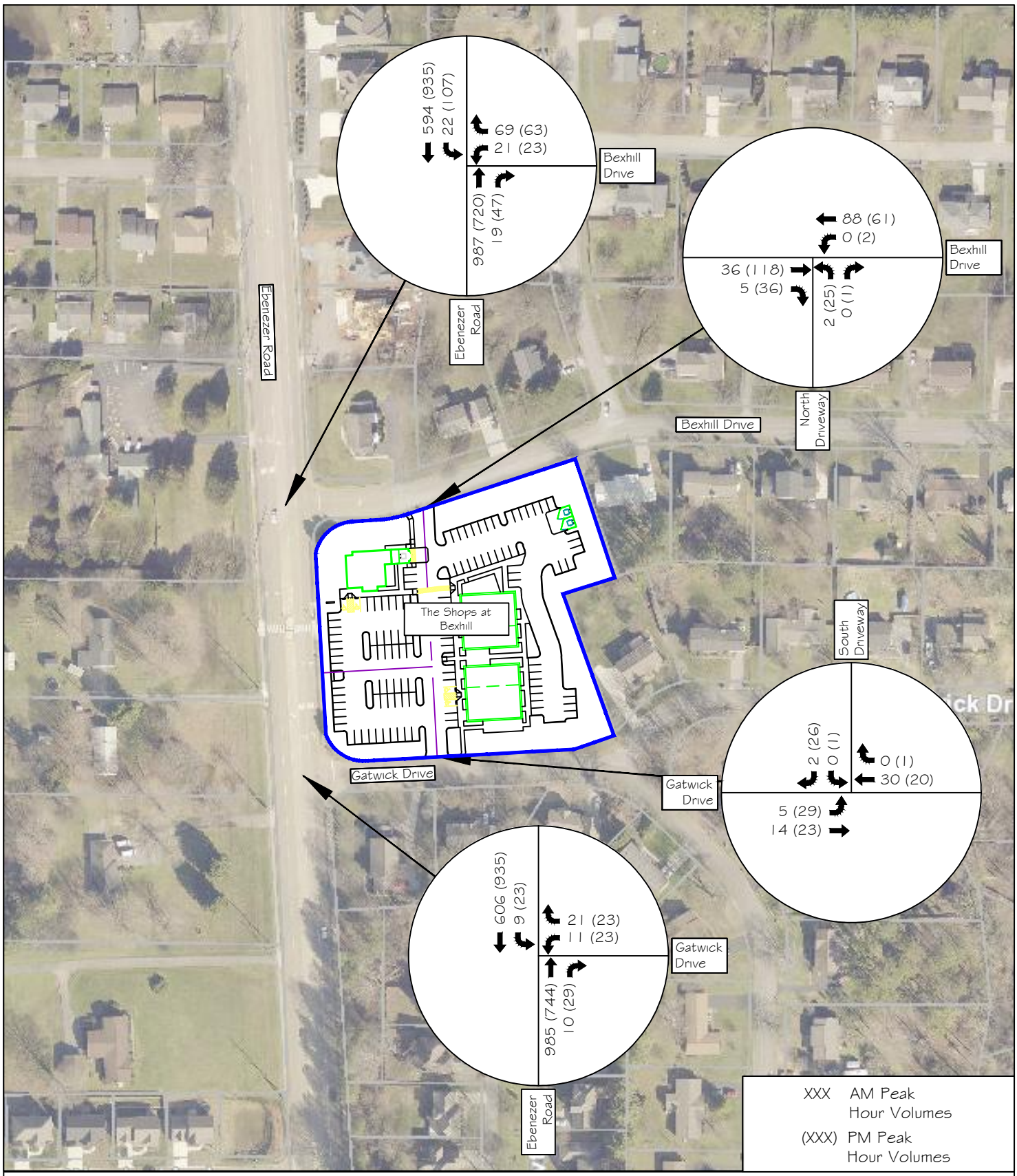


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FIGURE 8

The Shops at Bexhill

2023 Peak Hour Traffic Volumes - PROJECTED HORIZON YEAR TRAFFIC (WITH THE PROJECT)

Intersection capacity analyses were conducted to determine the projected Level of Service for vehicles with the development traffic in 2023. Appendix F includes the worksheets for these capacity analyses. The additional traffic generated from the proposed commercial development increased the calculated vehicle delays at the intersections minimally.

The projected 2023 peak hour vehicular traffic results at the studied intersections can be seen in Table 6 for the AM and PM peak hours. These results are reported with the proposed North and South Driveways on Bexhill Drive and Gatwick Drive, respectively.

A summary of the Ebenezer Road at Bexhill Drive and Ebenezer Road at Gatwick Drive intersection analysis results are presented in Tables 7a and 7b. Graphs follow these tables highlighting the LOS results. The tables provide a side-by-side summary and comparison of the intersections for 2021 existing conditions, projected horizon year 2023 conditions without the project, and projected horizon year 2023 conditions with the project. The proposed North and South Driveway intersections are not included since they only exist in the future conditions.

TABLE 6
2023 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED HORIZON YEAR (WITH THE PROJECT)

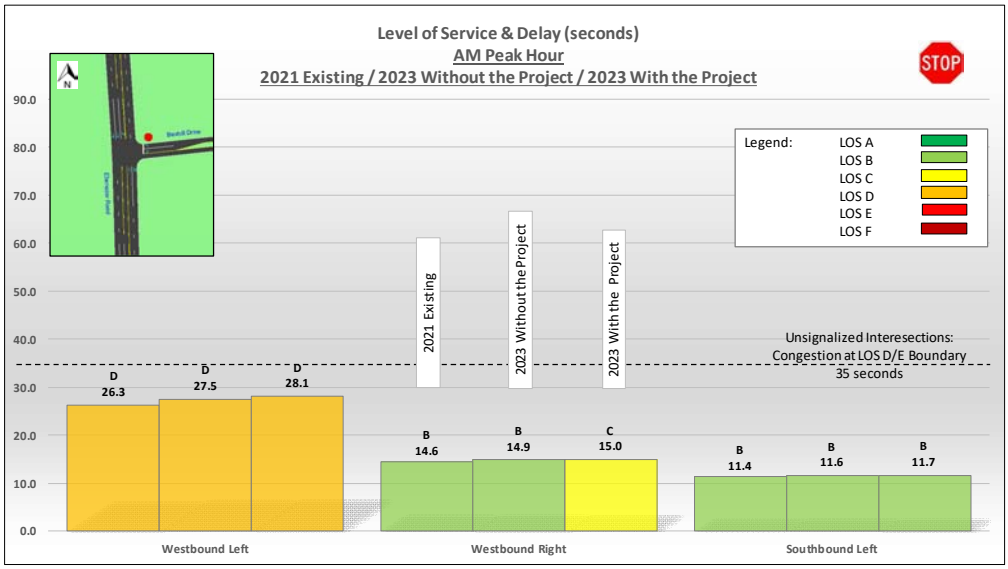
INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	AM PEAK			PM PEAK		
			LOS [a]	DELAY [b] (seconds)	v/c [c]	LOS [a]	DELAY (seconds)	v/c
Ebenezer Road at Bexhill Drive	Unsignalized	Westbound Left	D	28.1	0.231	D	25.5	0.163
		Westbound Right	C	15.0	0.190	B	12.3	0.155
		Southbound Left	B	11.7	0.054	B	10.6	0.188
Ebenezer Road at Gatwick Drive	Unsignalized	Westbound Left	C	23.5	0.124	C	21.3	0.206
		Westbound Right	B	13.6	0.078	B	11.6	0.049
		Southbound Left	B	11.4	0.027	A	9.9	0.044
Bexhill Drive at North Driveway	Unsignalized	Northbound Left/Right	A	9.2	0.003	A	9.8	0.037
		Westbound Left	A	-	-	A	7.5	0.002
Gatwick Drive at South Driveway	Unsignalized	Eastbound Left	A	7.3	0.003	A	7.3	0.020
		Southbound Left/Right	A	8.4	0.002	A	8.5	0.030

Note: Analysis of 2-way Stop calculated in Synchro 8 software and reported with HCM 2010 methodology
Level of Service
Average Delay (sec/vehicle)
Volume-to-Capacity Ratio

TABLE 7a
INTERSECTION CAPACITY ANALYSIS SUMMARY
EBENEZER ROAD AT BEXHILL DRIVE

LOCATION / PEAK HOUR MOVEMENT	2021 EXISTING (+10%)			2023 WITHOUT THE PROJECT			2023 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]	LOS	Delay	v/c
AM Peak									
Westbound Left	D	26.3	0.209	D	27.5	0.218	D	28.1	0.231
Westbound Right	B	14.6	0.181	B	14.9	0.186	C	15.0	0.190
Southbound Left	B	11.4	0.045	B	11.6	0.047	B	11.7	0.054
PM Peak									
Westbound Left	C	21.6	0.110	C	22.2	0.114	D	25.5	0.163
Westbound Right	B	11.6	0.095	B	11.7	0.097	B	12.3	0.155
Southbound Left	B	10.1	0.129	B	10.2	0.132	B	10.6	0.188

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2000 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio



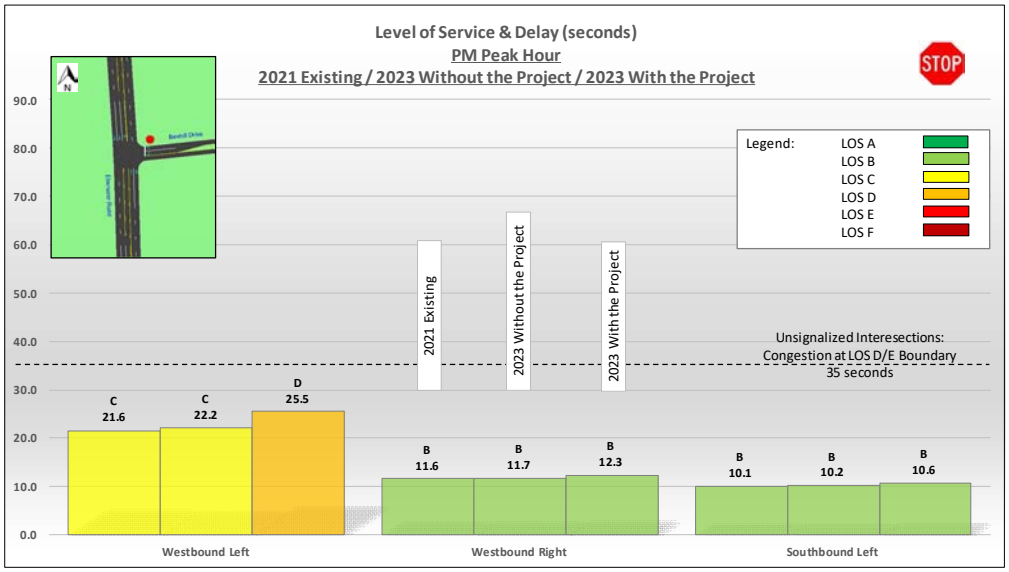
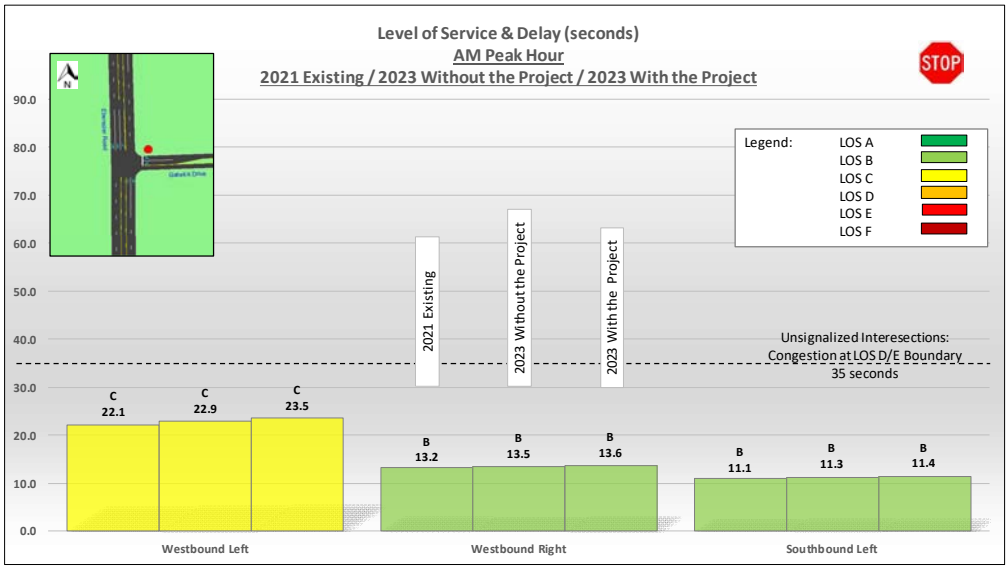
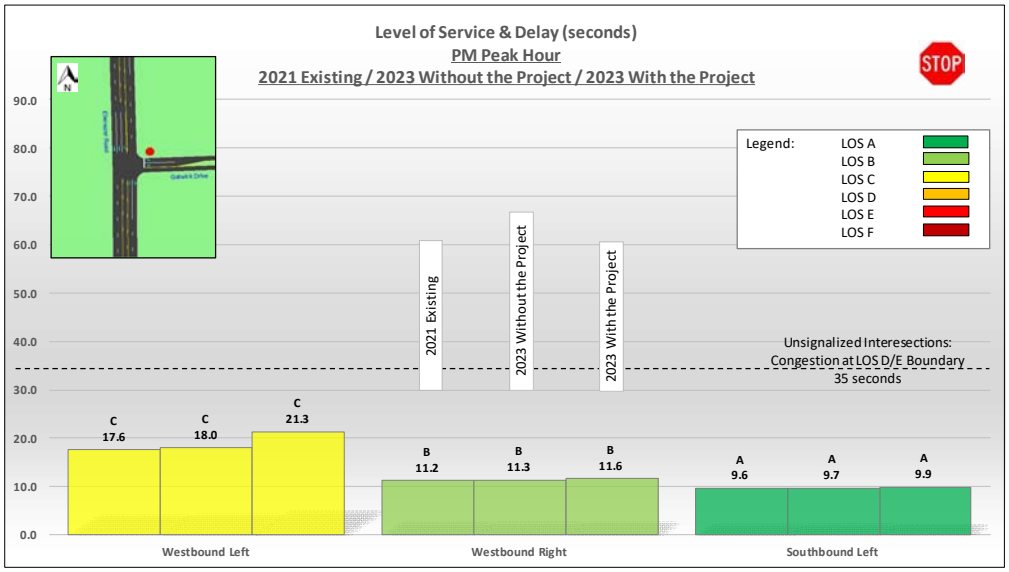


TABLE 7b
INTERSECTION CAPACITY ANALYSIS SUMMARY
EBENZER ROAD AT GATWICK DRIVE

LOCATION / PEAK HOUR MOVEMENT	2021 EXISTING (+10%)			2023 WITHOUT THE PROJECT			2023 WITH THE PROJECT		
	LOS[a]	Delay[b]	v/c[c]	LOS[a]	Delay[b]	v/c[c]	LOS	Delay	v/c
AM Peak									
Westbound Left	C	22.1	0.097	C	22.9	0.100	C	23.5	0.124
Westbound Right	B	13.2	0.075	B	13.5	0.077	B	13.6	0.078
Southbound Left	B	11.1	0.023	B	11.3	0.024	B	11.4	0.027
PM Peak									
Westbound Left	C	17.6	0.048	C	18.0	0.049	C	21.3	0.206
Westbound Right	B	11.2	0.029	B	11.3	0.029	B	11.6	0.049
Southbound Left	A	9.6	0.022	A	9.7	0.022	A	9.9	0.044

Note: Analysis of 2-way Stops calculated in Synchro 8 software and reported with HCM 2000 methodology
[a] Level of Service
[b] Average Delay (sec/vehicle)
[c] Volume-to-Capacity Ratio





▪ POTENTIAL TRANSPORTATION SAFETY ISSUES:

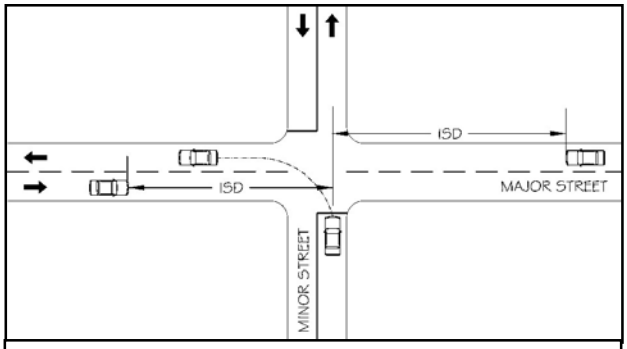
The study area was investigated for potential existing and future safety issues. A couple of features of the adjacent transportation system are discussed in the following pages.

☛ EVALUATION OF SIGHT DISTANCE

For intersections, sight distance evaluations have two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD).

Methodology:

SSD is the distance required for a motorist to perceive, react, and the vehicle to come to a complete stop before colliding with an object in the road. For evaluating intersections, this object would be another vehicle entering the intersection from a minor street. SSD can be considered the minimum visibility distance standard for evaluating the safety of an intersection.



Intersection Sight Distance Diagram

ISD is based on the time required to perceive, react, and complete the desired traffic maneuver once a motorist on a minor street decides to perform a traffic maneuver. Three traffic maneuvers are available for vehicles stopped on a minor street at a 4-way intersection: left-turn, right-turn, or a crossing maneuver across the major road. For turns from the minor street, ISD is needed for a stopped motorist on a minor street to turn onto a major street without being overtaken by an approaching vehicle. The most critical ISD is for left-turns from the minor street. The ISD for this maneuver includes the time to turn left and clear half of the intersection without conflicting with the oncoming traffic from the left and accelerating to the road's operating speed without causing the approaching vehicles from the right to reduce their speed substantially. SSD is considered the desirable visibility distance for evaluating the safety of an intersection. In general, SSD is generally more critical than ISD; however, the ISD must be at least the same distance or greater than SSD to provide safe operations at an intersection.

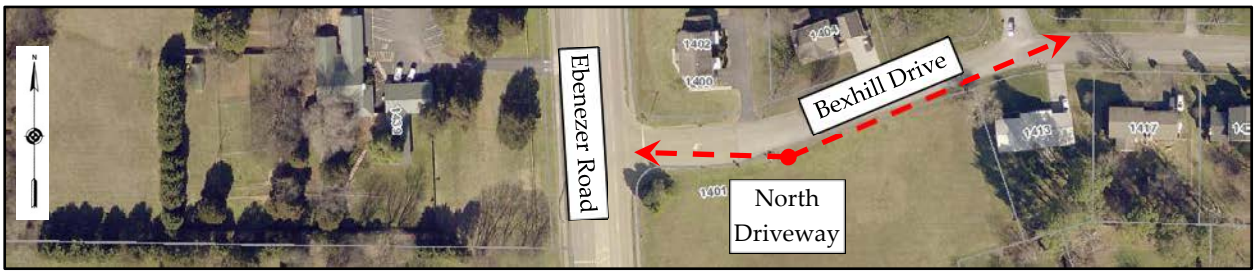
With a posted speed limit of 25-mph on Bexhill Drive and Gatwick Drive, the Intersection Sight Distance (ISD) would be 250 feet looking east and west from the proposed North and South Driveways based on Knox County policy of requiring 10 feet of sight distance per 1-mph of speed.

Based on a posted speed limit of 25-mph on Bexhill Drive and an existing 5% road grade (downhill to the west), the Stopping Sight Distance (SSD) is 145 feet for eastbound vehicles and 165 feet for westbound vehicles at the North Driveway.

Based on a posted speed limit of 25-mph on Gatwick Drive and an existing 6% road grade (downhill to the west), the Stopping Sight Distance (SSD) is 145 feet for eastbound vehicles and 165 feet for westbound vehicles at the South Driveway.

Visual observation of the sight distances on Bexhill Drive and Gatwick Drive at the proposed North and South Driveways was undertaken. It appears that the intersection sight distances from the proposed driveways will be adequate. The available sight distances at the driveways looking to the west are limited to the spacing between the driveways and Ebenezer Road but will be adequate. Using a Nikon Laser Rangefinder at the proposed driveway locations, the intersection sight distance looking to the east was estimated to be 350+ feet and 250+ feet at the North Driveway and South Driveway, respectively.

Images of the existing sight distances from the Proposed North and South Driveway locations are presented in the following.

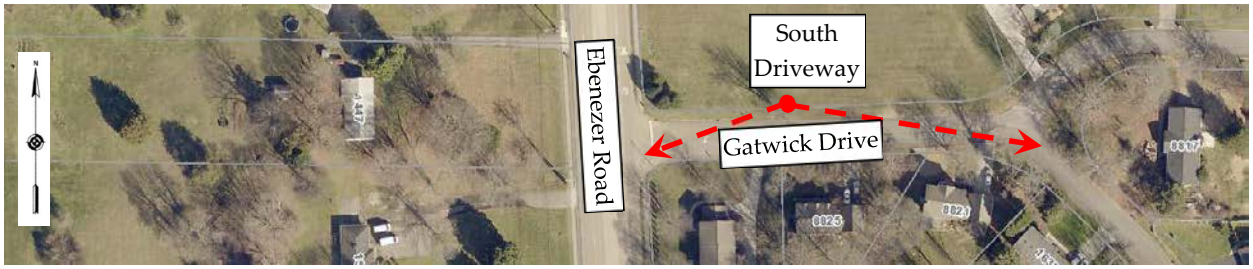


View of Sight Distance on Bexhill Drive at North Driveway (Looking West)

View of Sight Distance on Bexhill Drive at North Driveway (Looking East)

View of Sight Distance on Gatwick Drive at South Driveway (Looking West)

View of Sight Distance on Gatwick Drive at South Driveway (Looking East)



EVALUATION OF TURN LANE THRESHOLDS

For most transportation impact analyses, the need for auxiliary turn lanes is evaluated based on safety, traffic volume, and road capacity considerations. A continuous center two-way left-turn lane (TWLTL) is provided on Ebenezer Road at the existing intersections with Bexhill Drive and Gatwick Drive. Since a TWLTL is already provided on Ebenezer Road that separates and provides a left-turn lane, only the need for a separate right-turn lane was evaluated at Bexhill Drive and Gatwick Drive. The evaluation was conducted with the projected traffic volumes in 2023.

The design policy used for these right-turn lane evaluations is based on "Knox County's Access Control and Driveway Design Policy". This design policy relates vehicle volume thresholds based on prevailing speeds for two-lane and four-lane roadways. This Knox County policy is based on TDOT and nationally accepted guidelines for unsignalized intersections.

These evaluations were based on the posted speed limit of 40-mph on Ebenezer Road. Northbound right-turn lanes are not warranted based on the projected 2023 AM and PM Peak Hour traffic volumes at the intersections on Ebenezer Road. The Knox County turn lane policy worksheets are in Appendix I.

CONCLUSIONS & RECOMMENDATIONS

The results show that the addition of The Shops at Bexhill will not appreciably increase vehicle delays at the studied intersections in 2023.

The following is an overview of recommendations to minimize the traffic impacts of the proposed development on the adjacent road system while attempting to achieve an acceptable traffic flow and safety level.

Ebenezer Road at Bexhill Drive: This intersection was calculated to operate adequately in the existing and projected 2023 conditions. The development trips are not expected to substantially increase vehicle delays at the intersection; however, a couple of recommendations for improvement are offered.

1a) As part of evaluating the projected conditions, vehicle queue lengths at the intersection were calculated based on the projected 2023 traffic volumes. The previously mentioned Synchro Traffic Software includes SimTraffic. The Synchro portion of the software performs the macroscopic calculations for intersections, and SimTraffic performs micro-simulation and animation of vehicular traffic. SimTraffic (Version 8) software was utilized to estimate whether the existing turn lane storage lengths at the intersection will be adequate with the projected 2023 volumes.

Based on the software results from this scenario, the 95th percentile vehicle queue lengths were calculated based on the intersection operating in unsignalized conditions. The 95th percentile vehicle queue is the recognized measurement in the traffic engineering profession as the design standard used when considering queue lengths. A 95th percentile vehicle queue length means 95% certainty that the vehicle queue will not extend beyond that point. The calculated vehicle queue results were based on averaging the outcome obtained during ten traffic simulations. The vehicle queue results from the SimTraffic software are in Appendix I. The 95th percentile queue lengths at the intersection are shown in Table 8.

These results indicated that the existing westbound left and right-turn lanes and the southbound left-turn storage turn lane lengths at the intersection would be adequate in the projected conditions in 2023, operating under unsignalized conditions. The

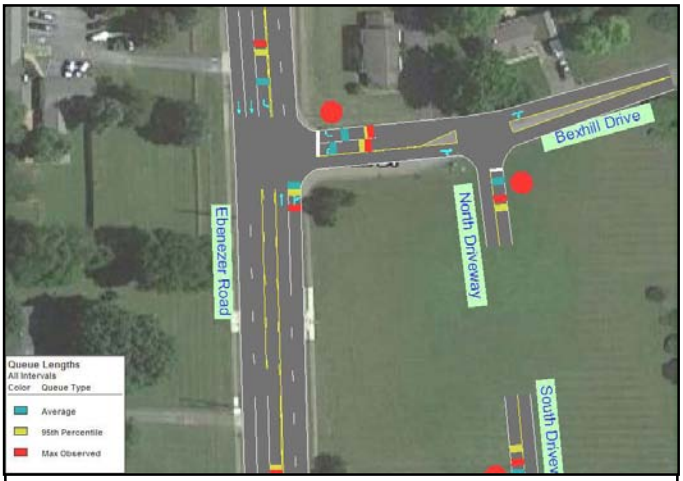
projected vehicle queues will not be long enough to impact operations at the proposed North Driveway on Bexhill Drive.

TABLE 8
TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -
2023 PROJECTED PEAK HOUR TRAFFIC VOLUMES

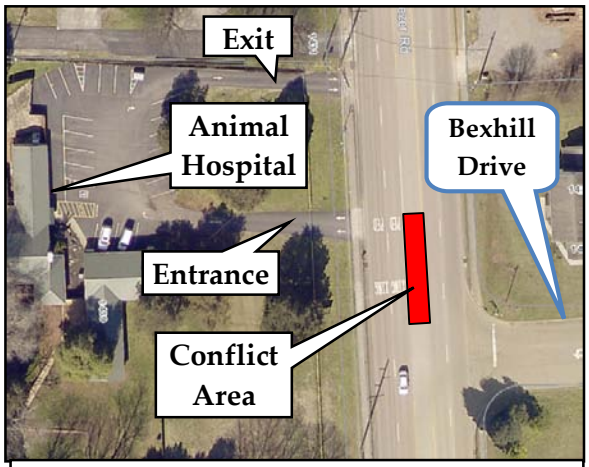
INTERSECTION	APPROACH/ MOVEMENT	EXISTING STORAGE (ft)	SIMTRAFFIC 95th PERCENTILE QUEUE LENGTH (ft)		ADEQUATE LENGTH?
			AM PEAK HOUR	PM PEAK HOUR	
Ebenezer Road at Bexhill Drive	Westbound Left	95	48	50	YES
	Westbound Right	N/A	54	48	YES
	Southbound Left	100	40	68	YES

Note: 95th percentile queues were calculated in SimTraffic 8 software

A visual representation from SimTraffic of the projected PM peak hour vehicle queues is shown in the image.



Intersection of Ebenezer Road at Bexhill Drive
Projected PM Peak Hour 2023 Vehicle Queues



Bluegrass Animal Hospital
1439 Ebenezer Road

Currently, there is a vehicle left-turn conflict area on Ebenezer Road just north of Bexhill Drive. In the center lane, southbound left-turns at Bexhill Drive conflict with northbound left-turns for an adjacent animal hospital across Ebenezer Road. This hospital, Bluegrass Animal Hospital, has a one-way entrance and a one-way exit. The entrance is on the south side of the hospital property and is approximately 90 feet (centerline

to centerline) from the Bexhill Drive intersection. The exit is located on the north side of the hospital property and is approximately 175 feet from the Bexhill Drive intersection. To avoid this conflict, the animal hospital should have reversed its entrance and exit locations. However, to reverse this now would take considerable cost and modifications to the internal parking lot area for the animal hospital. This conflict area will need to be monitored and reviewed further if incidents increase.

1b) It is recommended that the existing pavement markings on Bexhill Drive be re-applied. These pavement markings should include the white stop bar, white edge lines, white left-turn arrow, and double yellow centerline. The double yellow centerline and white edge lines are recommended to begin at the white stop bar at Ebenezer Road up to the Buxton Drive intersection with a gap where the North Driveway will tie into Bexhill Drive. It also recommended that a white crosswalk be applied to the pavement across Bexhill Drive at Ebenezer Road.

1c) Sight distance at the intersection of Bexhill Drive at Ebenezer Road should not be impacted by new signage or landscaping for the commercial development.

2 **Ebenezer Road at Gatwick Drive:** This intersection was calculated to operate adequately in the existing and projected 2023 conditions. The development trips are not expected to substantially increase vehicle delays at the intersection; however, a couple of recommendations for improvement are offered.

2a) As part of evaluating the projected conditions, vehicle queue lengths at the intersection were calculated based on the projected 2023 traffic volumes. The vehicle queue results from the SimTraffic software are in Appendix I. The 95th percentile queue lengths at the intersection are shown in Table 9.

These results indicated that the existing westbound left and right-turn lanes and the southbound left-turn storage turn lane lengths at the intersection would be adequate in the projected conditions in 2023, operating under unsignalized conditions. The projected vehicle queues will not be long enough to impact operations at the proposed South Driveway on Gatwick Drive.

TABLE 9
TURN LANE STORAGE & VEHICLE QUEUE SUMMARY -
2023 PROJECTED PEAK HOUR TRAFFIC VOLUMES

INTERSECTION	APPROACH/ MOVEMENT	EXISTING STORAGE (ft)	SIMTRAFFIC 95th PERCENTILE QUEUE LENGTH (ft)		ADEQUATE LENGTH?
			AM PEAK HOUR	PM PEAK HOUR	
Ebenezer Road at Gatwick Drive	Westbound Left	70	33	46	YES
	Westbound Right	N/A	43	42	YES
	Southbound Left	100	24	34	YES

Note: 95 percentile queues were calculated in SimTraffic 8 software

A visual representation from SimTraffic of the projected PM peak hour vehicle queues is shown in the image.

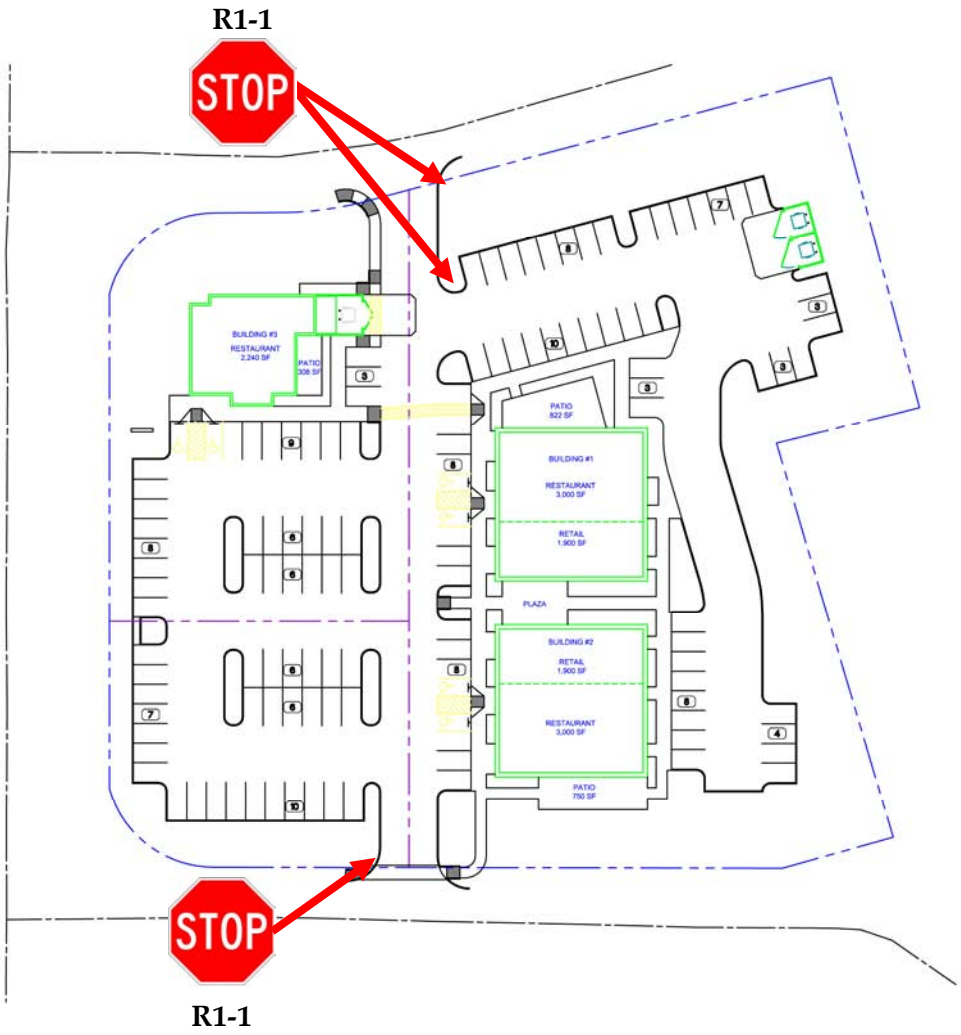
Intersection of Ebenezer Road at Gatwick Drive
Projected PM Peak Hour 2023 Vehicle Queues

2b) It is recommended that the existing pavement markings on Gatwick Drive be re-applied. These pavement markings should include the white stop bar, white edge lines, white left-turn arrow, and double yellow centerline. The double yellow centerline and white edge lines are recommended to begin at the white stop bar at Ebenezer Road up to the Bexhill Drive intersection with a gap where the South Driveway will tie into Gatwick Drive. It also recommended that a white crosswalk be applied to the pavement across Gatwick Drive at Ebenezer Road.

2c) Sight distance at the intersection of Gatwick Drive at Ebenezer Road should not be impacted by new signage or landscaping for the commercial development.

3 **The Shops at Bexhill Driveways and Parking Lots:** The current layout plan shows two driveways with several parking lot aisleways constructed for the development, as shown in Figure 3.

3a) Stop Signs (R1-1) and 24" white stop bars should be installed at the new internal driveways, as shown below:



Internal Traffic Sign Locations

As shown above, it is recommended that an internal Stop Sign (R1-1) be installed at the north side east/west aisleway approaching the main aisleway. Alternatively, a white stop bar and the word "STOP" may be applied to the pavement at this location.

3b) Sight distance at the new internal intersections and aisleways within the development must not be impacted by new signage or future landscaping.

3c) Due to the long, straight internal north-south parking lot aisleway in between the proposed entrances, it is recommended that speed humps or tables be considered to reduce internal traffic speeds in the development.

3d) All drainage grates and covers for the development need to be pedestrian and bicycle safe.

3e) Internal sidewalks are proposed throughout the development. Sidewalks should have appropriate ADA-compliant curbed ramps at intersection corners, and the sidewalks are recommended to be 5 feet minimum in width. Internally, white crosswalks should be marked on the pavement where pedestrians are expected to cross. Internal sidewalks should connect to the existing sidewalk system on Ebenezer Road.

3f) On-street parking by adjacent residents on Bexhill Drive and Gatwick Drive could become an issue near the proposed driveway entrances. On-street parking was not observed during the field review, but there are currently no prohibitions. The County may need to institute no-parking areas in the development area if this becomes an issue.

3f) All internal and external road grade and intersection elements should be designed to AASHTO, TDOT, and Knox County specifications and guidelines to ensure proper operation.

4

Ebenezer Road Mid-Block Pedestrian Crossing: The following is a recommendation outside the scope of this study but observed and noted during the study process.

During the field review (May 2021), it was noted that the existing pushbutton in the center median refuge area for the RRFP was non-functioning. When pushed, it did not trigger the RRFB's located on the sidewalks. Knox County Engineering was notified of this via email. Knox County Engineering responded that they were aware of the problem and have contacted their traffic signal contractor to install conduit and cabling to hard-wire the island pushbutton to the sidewalk beacons. Even though only one person was observed during the traffic counts utilizing this mid-block crossing, this should be rectified as soon as possible.

Pedestrian Push Button in Center Median Refuge Area on Ebenezer Road for RRFB

APPENDIX A

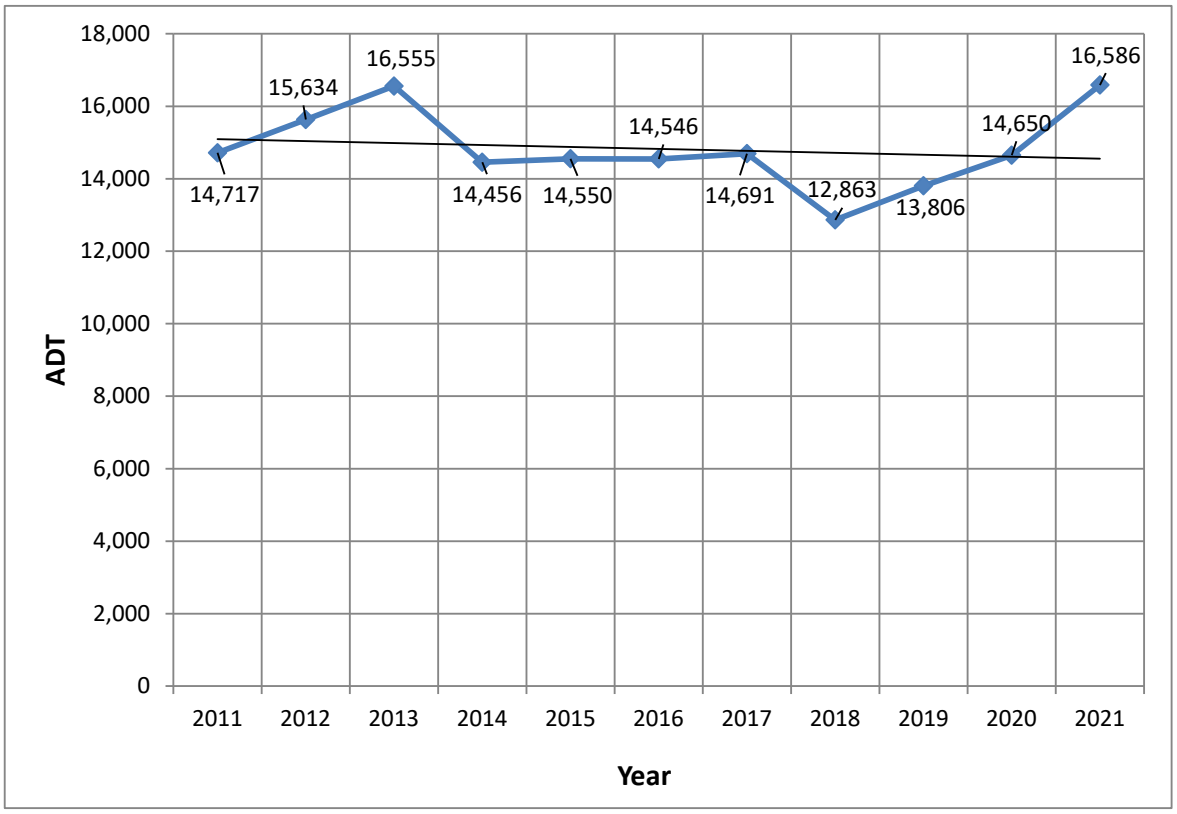
HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

Organization: TDOT
Station ID #: 47000286
Location: Ebenezer Road - south of Nubbin Ridge Road

YEAR	ADT
2011	14,717
2012	15,634
2013	16,555
2014	14,456
2015	14,550
2016	14,546
2017	14,691
2018	12,863
2019	13,806
2020	14,650
2021	16,586

Trendline



2011 - 2021 Growth Rate = 12.7%
Average Annual Growth Rate = 1.2%

TN TDOT Department of Transportation

TCDS Help MS2 Transportation Data Management System

Home | TMC | TCLS | TTDS | PMS | RSMS | NMDS | WOTS | RTTV

Login | Locate | Locate All | Email This

Auto Locate OFF

List View | All DIRs

Record 1 of 2 Goto Record go

Location ID	47000286	MPO ID	
Type	SPOT	HPMS ID	
On NHS		On HPMS	
LRS ID	4701281001	LRS Loc Pt.	2.18
SF Group	Urban	Route Type	
AF Group	16	Route	
GF Group	Knox	Active	Yes
Class Dist Grp	16	Category	CC
Seas Clss Grp			
WIM Group			
QC Group	Default		
Fnct'l Class	Minor Arterial	Milepost	
Located On	EBENEZER RD.		
Loc On Alias			
	SOUTHWEST KNOXVILLE		
More Detail			

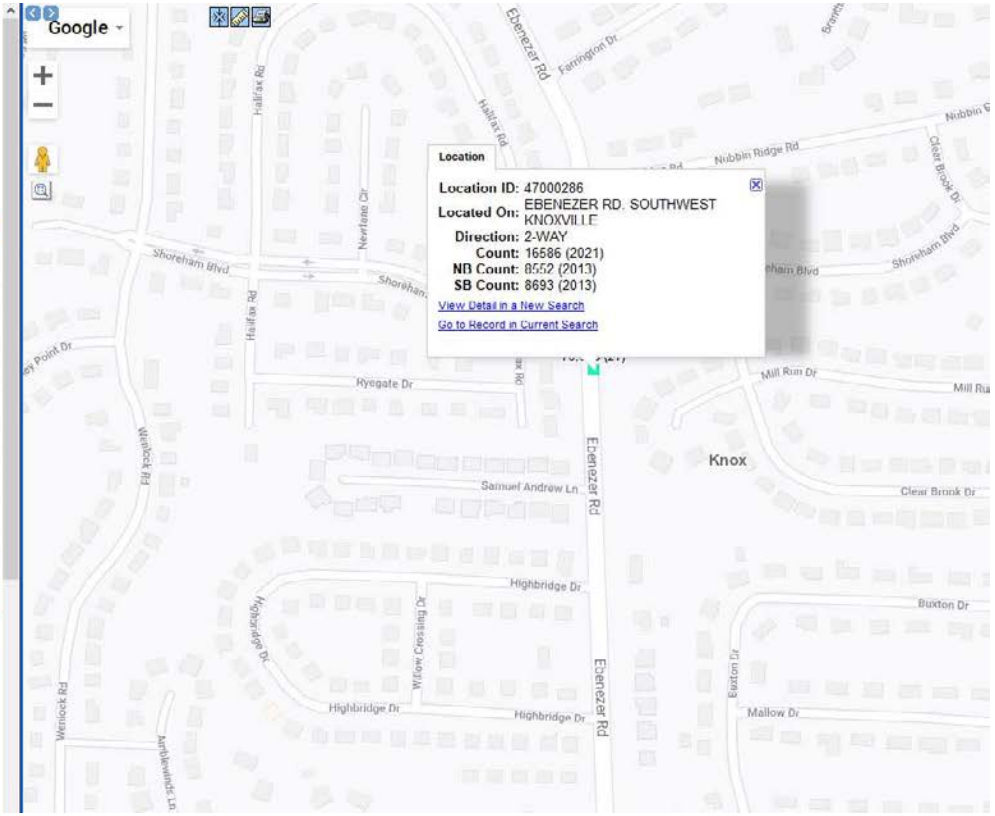
STATION DATA

Directions: 2-WAY | NB | SB

AADT

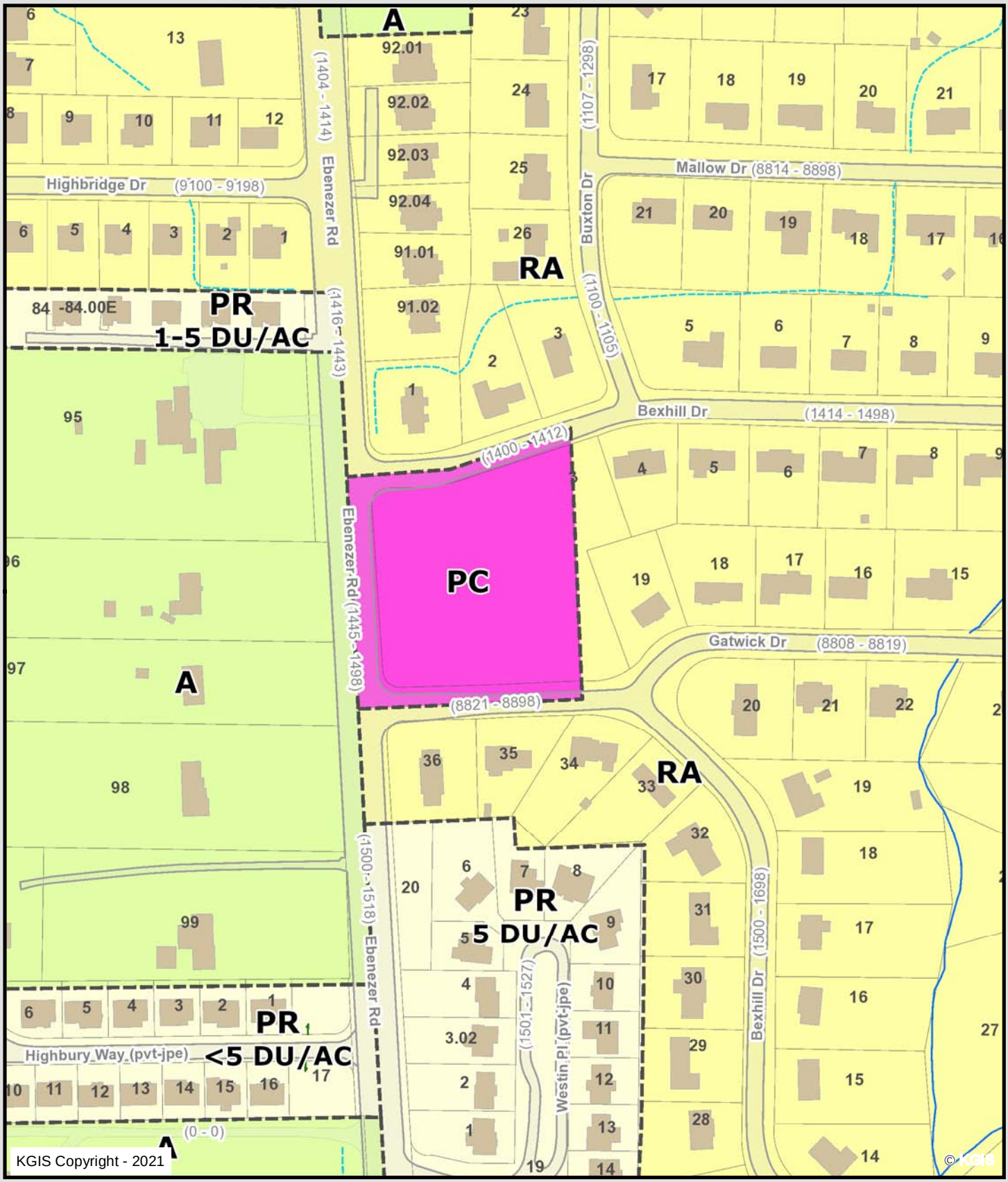
	Year	AADT	DHV-30	K %	D %	PA	BC	Src
	2020	14,650	1,742	12	65	14,093 (96%)	557 (4%)	
	2019	13,806		13	65			
	2018	12,863		11	65			
	2017	14,691[2]						
	2016	14,546		10	65			

|<< | < | > | >>| 1-5 of 36



APPENDIX B

ZONING MAP



Existing Zoning Map

Knoxville - Knox County - KUB Geographic Information System

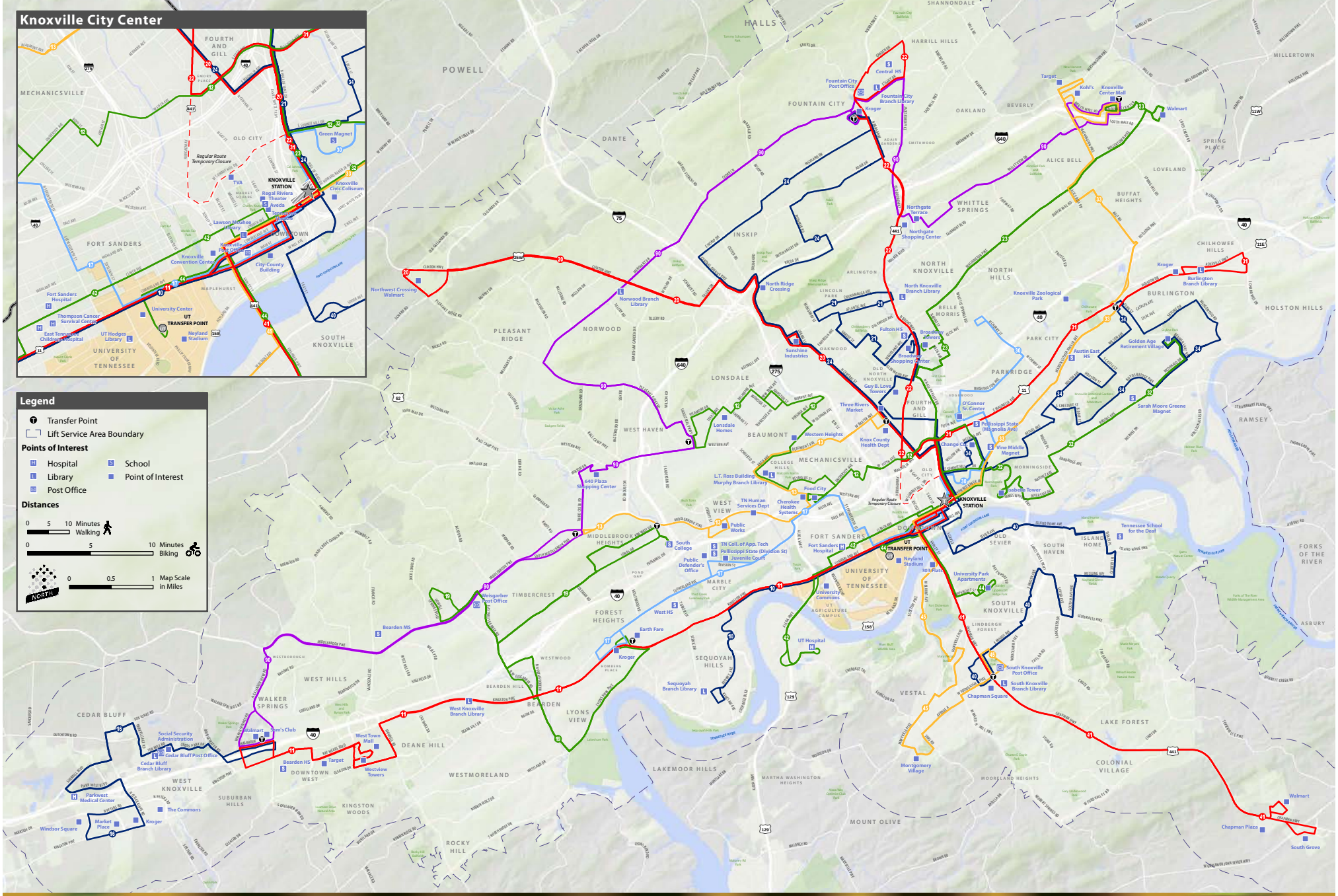
Printed: 6/17/2021 at 11:48:05 AM

0 100 200 400

ft

APPENDIX C

KNOXVILLE AREA TRANSIT MAP AND INFORMATION



FARE INFORMATION

With a base fare of $1.50, KAT offers a variety of passes. Please note that only the fares marked with an asterisk can be purchased when boarding the bus. Others are available at KAT's Customer Service Counter at Knoxville Station (301 Church Ave.) or by mail via katbus.com.

FARE TYPE	REGULAR FARE	REDUCED FARE
One-Ride Pass*	$1.50	$0.75
1 Day Pass*	$4.00	$2.00
7 Day Pass	$15.00	$7.50
30 Day Pass	$50.00	$25.00
20 Ride Pass	$25.00	$12.50
Transfer*	$0.50	$0.25

REDUCED FARE INFORMATION

A reduced fare is available to those who qualify. Qualifying individuals include seniors age 65 or over, Medicare card holders, students under the age of 18, and persons with disabilities. Proper identification (Medicare card or a valid KAT I.D. card) is required before boarding. For more information on how to obtain a discounted-fare I.D. visit katbus.com/fares or call 637-3000.

BUS STOPS ONLY!

KAT buses stop ONLY at locations designated by bus stop signs. Generally, bus stops are located at least every ¼ mile along the route.

KAT HOLIDAYS

KAT buses do not run on the following holidays:

- New Year's Day
- Independence Day
- Thanksgiving
- Christmas

Please note that KAT's Knoxville Station Customer Service counter is also closed during those days.

KAT buses run on a Saturday schedule on the following holidays:

- Martin Luther King, Jr. Day
- Memorial Day
- Labor Day
- Day after Thanksgiving
- Christmas Eve

KAT's administrative offices are closed on all holidays listed above.

16 CEDAR BLUFF CONNECTOR

(Weekdays and Saturdays)

Legend

- Route Timepoint
- Transfer Point
- Bus Stop

Points of Interest

- Hospital
- Library
- Point of Interest
- Post Office
- School
- Park & Ride

N W E S

0 0.25 0.5 Miles

Map revised: 02.21

16 CEDAR BLUFF CONNECTOR

(Weekdays and Saturdays)

SERVES:

- Cedar Bluff
- Knoxville Catholic High School
- Kroger at The Landing
- Parkwest Hospital
- Social Security Administration
- Walmart
- Windsor Square

kat KNOXVILLE AREA TRANSIT

Information Updated: February 1, 2021

	Going from Wal Mart to Windsor Square				*Going from Windsor Square to Wal Mart*		
	Transfer to:						*Rts. 11 & 90*
	Walmart 1	Park Village at Woodpark 2	Parkwest Hospital 3	Windsor Square 4	Parkwest Hospital 5	Cedar Bluff at Fox Lonas 6	Walmart 7
WEEKDAY SCHEDULE							
A.M.	6:15	6:27	6:32	6:42	6:50	6:54	7:10
	7:15	7:27	7:32	7:42	7:50	7:54	8:10
	8:15	8:27	8:32	8:42	8:50	8:54	9:10
	9:15	9:27	9:32	9:42	9:50	9:54	10:10
	10:15	10:27	10:32	10:42	10:50	10:54	11:10
	11:15	11:27	11:32	11:42	11:50	11:54	**12:10**
P.M.	**12:15**	**12:27**	**12:32**	**12:42**	**12:50**	**12:54**	**1:10**
	1:15	**1:27**	**1:32**	**1:42**	**1:50**	**1:54**	**2:10**
	2:15	**2:27**	**2:32**	**2:42**	**2:50**	**2:54**	**3:10**
	3:15	**3:27**	**3:32**	**3:42**	**3:50**	**3:54**	**4:10**
	4:15	**4:27**	**4:32**	**4:42**	**4:50**	**4:54**	**5:10**
	5:15	**5:27**	**5:32**	**5:42**	**5:50**	**5:54**	**6:10**
	6:15	**6:27**	**6:32**	**6:42**	**6:50**	**6:54**	**7:10**
	7:15	**7:27**	**7:32**	**7:42**	**7:50**	**7:54**	**8:10**
	8:15	**8:27**	**8:32**	**8:42**	**8:50**	**8:54**	**9:10**
	9:15	**9:27**	**9:32**	**9:42**	**9:50**	**9:54**	**10:10**
SATURDAY SCHEDULE							
A.M.	7:15	7:27	7:32	7:42	7:50	7:54	8:10
	8:15	8:27	8:32	8:42	8:50	8:54	9:10
	9:15	9:27	9:32	9:42	9:50	9:54	10:10
	10:15	10:27	10:32	10:42	10:50	10:54	11:10
	11:15	11:27	11:32	11:42	11:50	11:54	**12:10**
P.M.	**12:15**	**12:27**	**12:32**	**12:42**	**12:50**	**12:54**	**1:10**
	1:15	**1:27**	**1:32**	**1:42**	**1:50**	**1:54**	**2:10**
	2:15	**2:27**	**2:32**	**2:42**	**2:50**	**2:54**	**3:10**
	3:15	**3:27**	**3:32**	**3:42**	**3:50**	**3:54**	**4:10**
	4:15	**4:27**	**4:32**	**4:42**	**4:50**	**4:54**	**5:10**
	5:15	**5:27**	**5:32**	**5:42**	**5:50**	**5:54**	**6:10**
	6:15	**6:27**	**6:32**	**6:42**	**6:50**	**6:54**	**7:10**
	7:15	**7:27**	**7:32**	**7:42**	**7:50**	**7:54**	**8:10**
	8:15	**8:27**	**8:32**	**8:42**	**8:50**	**8:54**	**9:10**
	9:15	**9:27**	**9:32**	**9:42**	**9:50**	**9:54**	**10:10**

Need help reading this schedule?
Need other general information on how to ride?
Visit www.katbus.com or call 865-637-3000

APPENDIX D

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: Ebenezer Road (SB-NB)
Minor Street: Bexhill Drive (WB)
Traffic Control: Stop Control on Bexhill Drive

5/19/2021 (Wednesday)
Sunny, Warm
Conducted by: Ajax Engineering

	Ebenezer Road		Bexhill Drive		Ebenezer Road			
TIME	SOUTHBOUND		WESTBOUND		NORTHBOUND		VEHICLE	PEAK
BEGIN	LT	THRU	LT	RT	THRU	RT	TOTAL	HOUR
7:00 AM	4	56	10	9	81	0	160	
7:15 AM	3	104	15	20	161	1	304	
7:30 AM	2	125	10	19	264	7	427	**7:30 AM - 8:30 AM**
7:45 AM	5	107	4	17	230	2	365	
8:00 AM	6	130	1	15	199	3	354	
8:15 AM	4	162	3	11	178	3	361	
8:30 AM	6	112	3	7	148	1	277	
8:45 AM	1	87	2	7	135	1	233	
TOTAL	31	883	48	105	1396	18	2481	
11:00 AM	15	114	5	8	108	1	251	
11:15 AM	8	108	5	15	103	4	243	
11:30 AM	7	113	4	5	107	6	242	
11:45 AM	13	119	3	14	113	2	264	
12:00 PM	4	118	6	4	122	1	255	**12:00 PM - 1:00 PM**
12:15 PM	7	155	3	8	128	6	307	
12:30 PM	10	127	2	6	120	6	271	
12:45 PM	6	115	3	9	140	1	274	
TOTAL	70	969	31	69	941	27	2107	
2:00 PM	12	142	5	10	110	1	280	
2:15 PM	6	152	4	7	112	2	283	
2:30 PM	9	131	4	10	114	3	271	
2:45 PM	6	140	2	7	158	11	324	
3:00 PM	9	137	3	5	165	4	323	
3:15 PM	9	136	3	6	158	3	315	
3:30 PM	11	186	5	8	134	3	347	
3:45 PM	18	240	2	8	131	2	401	
4:00 PM	14	179	3	6	112	6	320	
4:15 PM	15	181	2	12	138	6	354	
4:30 PM	8	173	2	12	174	6	375	
4:45 PM	12	182	4	7	150	4	359	
5:00 PM	24	205	3	8	145	8	393	**5:00 PM - 6:00 PM**
5:15 PM	9	221	4	11	173	14	432	
5:30 PM	13	216	3	7	157	9	405	
5:45 PM	24	181	6	13	155	6	385	
TOTAL	199	2802	55	137	2286	88	5567	

2021 AM Peak Hour **7:30 AM - 8:30 AM**

	Ebenezer Road		Bexhill Drive		Ebenezer Road	
TIME	SOUTHBOUND		WESTBOUND		NORTHBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
7:30 AM	2	125	10	19	264	7
7:45 AM	5	107	4	17	230	2
8:00 AM	6	130	1	15	199	3
8:15 AM	4	162	3	11	178	3
TOTAL	**17**	**524**	**18**	**62**	**871**	**15**
PHF	**0.71**	**0.81**	**0.45**	**0.82**	**0.82**	**0.54**

2021 PM Peak Hour **5:00 PM - 6:00 PM**

	Ebenezer Road		Bexhill Drive		Ebenezer Road	
TIME	SOUTHBOUND		WESTBOUND		NORTHBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
5:00 PM	24	205	3	8	145	8
5:15 PM	9	221	4	11	173	14
5:30 PM	13	216	3	7	157	9
5:45 PM	24	181	6	13	155	6
TOTAL	**70**	**823**	**16**	**39**	**630**	**37**
PHF	**0.73**	**0.93**	**0.67**	**0.75**	**0.91**	**0.66**

TRAFFIC COUNT DATA

Major Street: Ebenezer Road (SB-NB)
Minor Street: Gatwick Drive (WB)
Traffic Control: Stop Control on Gatwick Drive

5/19/2021 (Wednesday)
Sunny, Warm
Conducted by: Ajax Engineering

	Ebenezer Road		Gatwick Drive		Ebenezer Road			
TIME	SOUTHBOUND		WESTBOUND		NORTHBOUND		VEHICLE	PEAK
BEGIN	LT	THRU	LT	RT	THRU	RT	TOTAL	HOUR
7:00 AM	1	65	2	0	81	0	149	
7:15 AM	1	118	3	3	159	0	284	
7:30 AM	0	135	5	8	263	3	414	**7:30 AM - 8:30 AM**
7:45 AM	2	109	2	6	226	1	346	
8:00 AM	2	129	0	2	200	0	333	
8:15 AM	3	162	1	3	178	1	348	
8:30 AM	1	114	2	2	147	0	266	
8:45 AM	0	89	0	3	133	0	225	
TOTAL	10	921	15	27	1387	5	2365	
11:00 AM	1	118	2	2	107	3	233	
11:15 AM	3	110	1	0	107	0	221	
11:30 AM	2	115	1	0	113	1	232	
11:45 AM	6	116	1	2	113	2	240	
12:00 PM	3	121	2	2	121	0	249	**12:00 PM - 1:00 PM**
12:15 PM	3	155	0	1	133	0	292	
12:30 PM	2	127	2	1	125	0	257	
12:45 PM	2	116	0	0	141	1	260	
TOTAL	22	978	9	8	960	7	1984	
2:00 PM	2	145	1	1	110	0	259	
2:15 PM	6	150	1	3	111	3	274	
2:30 PM	1	134	1	1	116	0	253	
2:45 PM	0	142	1	2	167	4	316	
3:00 PM	2	138	1	4	165	2	312	
3:15 PM	1	138	0	1	160	2	302	
3:30 PM	1	190	2	2	135	0	330	
3:45 PM	5	237	2	2	131	2	379	
4:00 PM	4	178	1	3	115	0	301	
4:15 PM	4	179	3	4	140	0	330	
4:30 PM	2	173	1	2	178	4	360	
4:45 PM	5	181	2	0	154	3	345	
5:00 PM	4	204	0	4	149	3	364	**5:00 PM - 6:00 PM**
5:15 PM	4	221	3	2	185	0	415	
5:30 PM	2	217	1	4	162	2	388	
5:45 PM	1	186	1	3	158	5	354	
TOTAL	44	2813	21	38	2336	30	5282	

2021 AM Peak Hour **7:30 AM - 8:30 AM**

	Ebenezer Road		Gatwick Drive		Ebenezer Road	
TIME	SOUTHBOUND		WESTBOUND		NORTHBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
7:30 AM	0	135	5	8	263	3
7:45 AM	2	109	2	6	226	1
8:00 AM	2	129	0	2	200	0
8:15 AM	3	162	1	3	178	1
TOTAL	**7**	**535**	**8**	**19**	**867**	**5**
PHF	**0.58**	**0.83**	**0.40**	**0.59**	**0.82**	**0.42**

2021 PM Peak Hour **5:00 PM - 6:00 PM**

	Ebenezer Road		Gatwick Drive		Ebenezer Road	
TIME	SOUTHBOUND		WESTBOUND		NORTHBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
5:00 PM	4	204	0	4	149	3
5:15 PM	4	221	3	2	185	0
5:30 PM	2	217	1	4	162	2
5:45 PM	1	186	1	3	158	5
TOTAL	**11**	**828**	**5**	**13**	**654**	**10**
PHF	**0.69**	**0.94**	**0.42**	**0.81**	**0.88**	**0.50**

APPENDIX E

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 8) & PROJECTED TRAFFIC SIGNAL TIMING AND PHASING

EXISTING TRAFFIC CONDITIONS

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	18	62	871	15	17	524
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	45	82	82	54	71	81
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	40	76	1062	28	24	647

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1447	545	0	0	1090	0
Stage 1	1076	-	-	-	-	-
Stage 2	371	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	135	495	-	-	648	-
Stage 1	311	-	-	-	-	-
Stage 2	688	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	130	495	-	-	648	-
Mov Cap-2 Maneuver	242	-	-	-	-	-
Stage 1	311	-	-	-	-	-
Stage 2	663	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.8	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	242	495	648	-
HCM Lane V/C Ratio	-	-	0.165	0.153	0.037	-
HCM Control Delay (s)	-	-	22.8	13.6	10.8	-
HCM Lane LOS	-	-	C	B	B	-
HCM 95th %tile Q(veh)	-	-	0.6	0.5	0.1	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	8	19	867	5	7	535
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	40	59	82	42	58	83
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	20	32	1057	12	12	645

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1409	535	0	0	1069	0
Stage 1	1063	-	-	-	-	-
Stage 2	346	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	154	510	-	-	660	-
Stage 1	335	-	-	-	-	-
Stage 2	721	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	151	510	-	-	660	-
Mov Cap-2 Maneuver	264	-	-	-	-	-
Stage 1	335	-	-	-	-	-
Stage 2	708	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.3	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	264	510	660	-
HCM Lane V/C Ratio	-	-	0.076	0.063	0.018	-
HCM Control Delay (s)	-	-	19.8	12.5	10.6	-
HCM Lane LOS	-	-	C	B	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0.2	0.1	-

Intersection	
Int Delay, s/veh	1.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	16	39	630	37	70	823
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	67	75	91	66	73	93
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	24	52	692	56	96	885

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1354	374	0	0	748	0
Stage 1	720	-	-	-	-	-
Stage 2	634	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	155	636	-	-	870	-
Stage 1	467	-	-	-	-	-
Stage 2	514	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	138	636	-	-	870	-
Mov Cap-2 Maneuver	274	-	-	-	-	-
Stage 1	467	-	-	-	-	-
Stage 2	457	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.8	0	0.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	274	636	870	-
HCM Lane V/C Ratio	-	-	0.087	0.082	0.11	-
HCM Control Delay (s)	-	-	19.4	11.2	9.7	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	0.3	0.3	0.4	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	5	13	654	10	11	828
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	42	81	88	50	69	94
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	12	16	743	20	16	881

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1225	382	0	0	763	0
Stage 1	753	-	-	-	-	-
Stage 2	472	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	199	635	-	-	859	-
Stage 1	469	-	-	-	-	-
Stage 2	632	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	195	635	-	-	859	-
Mov Cap-2 Maneuver	330	-	-	-	-	-
Stage 1	469	-	-	-	-	-
Stage 2	620	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.1	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	330	635	859	-
HCM Lane V/C Ratio	-	-	0.036	0.025	0.019	-
HCM Control Delay (s)	-	-	16.3	10.8	9.3	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0.1	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	20	68	958	17	19	576
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	45	82	82	54	71	81
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	44	83	1168	31	27	711

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1593	600	0	0	1200	0
Stage 1	1184	-	-	-	-	-
Stage 2	409	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	109	457	-	-	589	-
Stage 1	275	-	-	-	-	-
Stage 2	660	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	104	457	-	-	589	-
Mov Cap-2 Maneuver	213	-	-	-	-	-
Stage 1	275	-	-	-	-	-
Stage 2	630	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.7	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	213	457	589	-
HCM Lane V/C Ratio	-	-	0.209	0.181	0.045	-
HCM Control Delay (s)	-	-	26.3	14.6	11.4	-
HCM Lane LOS	-	-	D	B	B	-
HCM 95th %tile Q(veh)	-	-	0.8	0.7	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	9	21	954	6	8	588
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	40	59	82	42	58	83
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	22	36	1163	14	14	708

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1553	589	0	0	1178	0
Stage 1	1171	-	-	-	-	-
Stage 2	382	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	126	472	-	-	600	-
Stage 1	297	-	-	-	-	-
Stage 2	694	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	123	472	-	-	600	-
Mov Cap-2 Maneuver	233	-	-	-	-	-
Stage 1	297	-	-	-	-	-
Stage 2	678	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	233	472	600	-
HCM Lane V/C Ratio	-	-	0.097	0.075	0.023	-
HCM Control Delay (s)	-	-	22.1	13.2	11.1	-
HCM Lane LOS	-	-	C	B	B	-
HCM 95th %tile Q(veh)	-	-	0.3	0.2	0.1	-

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	18	43	693	41	77	905
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	67	75	91	66	73	93
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	27	57	762	62	105	973

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1491	412	0	0	824	0
Stage 1	793	-	-	-	-	-
Stage 2	698	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	127	602	-	-	815	-
Stage 1	430	-	-	-	-	-
Stage 2	478	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	111	602	-	-	815	-
Mov Cap-2 Maneuver	244	-	-	-	-	-
Stage 1	430	-	-	-	-	-
Stage 2	416	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.8	0	1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	244	602	815	-
HCM Lane V/C Ratio	-	-	0.11	0.095	0.129	-
HCM Control Delay (s)	-	-	21.6	11.6	10.1	-
HCM Lane LOS	-	-	C	B	B	-
HCM 95th %tile Q(veh)	-	-	0.4	0.3	0.4	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	6	14	720	11	12	911
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	42	81	88	50	69	94
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	14	17	818	22	17	969

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1348	420	0	0	840	0
Stage 1	829	-	-	-	-	-
Stage 2	519	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	168	602	-	-	804	-
Stage 1	432	-	-	-	-	-
Stage 2	601	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	164	602	-	-	804	-
Mov Cap-2 Maneuver	300	-	-	-	-	-
Stage 1	432	-	-	-	-	-
Stage 2	588	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.1	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	300	602	804	-
HCM Lane V/C Ratio	-	-	0.048	0.029	0.022	-
HCM Control Delay (s)	-	-	17.6	11.2	9.6	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0.1	-

PROJECTED HORIZON YEAR TRAFFIC CONDITIONS (WITHOUT THE PROJECT)

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	20	68	987	17	19	593
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	45	82	82	54	71	81
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	44	83	1204	31	27	732

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1639	618	0	0	1235	0
Stage 1	1219	-	-	-	-	-
Stage 2	420	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	102	445	-	-	571	-
Stage 1	264	-	-	-	-	-
Stage 2	652	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	97	445	-	-	571	-
Mov Cap-2 Maneuver	204	-	-	-	-	-
Stage 1	264	-	-	-	-	-
Stage 2	621	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.3	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	204	445	571	-
HCM Lane V/C Ratio	-	-	0.218	0.186	0.047	-
HCM Control Delay (s)	-	-	27.5	14.9	11.6	-
HCM Lane LOS	-	-	D	B	B	-
HCM 95th %tile Q(veh)	-	-	0.8	0.7	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	9	21	983	6	8	605
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	40	59	82	42	58	83
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	22	36	1199	14	14	729

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1598	607	0	0	1213	0
Stage 1	1206	-	-	-	-	-
Stage 2	392	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	118	460	-	-	582	-
Stage 1	286	-	-	-	-	-
Stage 2	687	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	115	460	-	-	582	-
Mov Cap-2 Maneuver	224	-	-	-	-	-
Stage 1	286	-	-	-	-	-
Stage 2	670	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.1	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	224	460	582	-
HCM Lane V/C Ratio	-	-	0.1	0.077	0.024	-
HCM Control Delay (s)	-	-	22.9	13.5	11.3	-
HCM Lane LOS	-	-	C	B	B	-
HCM 95th %tile Q(veh)	-	-	0.3	0.2	0.1	-

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	18	43	715	41	77	932
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	67	75	91	66	73	93
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	27	57	786	62	105	1002

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1529	424	0	0	848	0
Stage 1	817	-	-	-	-	-
Stage 2	712	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	120	591	-	-	798	-
Stage 1	418	-	-	-	-	-
Stage 2	471	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	104	591	-	-	798	-
Mov Cap-2 Maneuver	236	-	-	-	-	-
Stage 1	418	-	-	-	-	-
Stage 2	409	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.1	0	1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	236	591	798	-
HCM Lane V/C Ratio	-	-	0.114	0.097	0.132	-
HCM Control Delay (s)	-	-	22.2	11.7	10.2	-
HCM Lane LOS	-	-	C	B	B	-
HCM 95th %tile Q(veh)	-	-	0.4	0.3	0.5	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	6	14	742	11	12	938
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	42	81	88	50	69	94
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	14	17	843	22	17	998

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1388	433	0	0	865	0
Stage 1	854	-	-	-	-	-
Stage 2	534	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	159	590	-	-	787	-
Stage 1	421	-	-	-	-	-
Stage 2	592	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	156	590	-	-	787	-
Mov Cap-2 Maneuver	291	-	-	-	-	-
Stage 1	421	-	-	-	-	-
Stage 2	579	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14.3	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	291	590	787	-
HCM Lane V/C Ratio	-	-	0.049	0.029	0.022	-
HCM Control Delay (s)	-	-	18	11.3	9.7	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	0.1	-

PROJECTED HORIZON YEAR TRAFFIC CONDITIONS (WITH THE PROJECT)

Intersection	
Int Delay, s/veh	1.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	21	69	987	19	22	594
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	45	82	82	54	71	81
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	47	84	1204	35	31	733

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1650	619	0	0	1239	0
Stage 1	1221	-	-	-	-	-
Stage 2	429	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	100	444	-	-	569	-
Stage 1	263	-	-	-	-	-
Stage 2	645	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	95	444	-	-	569	-
Mov Cap-2 Maneuver	202	-	-	-	-	-
Stage 1	263	-	-	-	-	-
Stage 2	610	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.7	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	202	444	569	-
HCM Lane V/C Ratio	-	-	0.231	0.19	0.054	-
HCM Control Delay (s)	-	-	28.1	15	11.7	-
HCM Lane LOS	-	-	D	C	B	-
HCM 95th %tile Q(veh)	-	-	0.9	0.7	0.2	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	11	21	985	10	9	606
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	40	59	82	42	58	83
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	28	36	1201	24	16	730

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1609	613	0	0	1225	0
Stage 1	1213	-	-	-	-	-
Stage 2	396	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	116	456	-	-	576	-
Stage 1	284	-	-	-	-	-
Stage 2	684	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	113	456	-	-	576	-
Mov Cap-2 Maneuver	222	-	-	-	-	-
Stage 1	284	-	-	-	-	-
Stage 2	665	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.9	0	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	222	456	576	-
HCM Lane V/C Ratio	-	-	0.124	0.078	0.027	-
HCM Control Delay (s)	-	-	23.5	13.6	11.4	-
HCM Lane LOS	-	-	C	B	B	-
HCM 95th %tile Q(veh)	-	-	0.4	0.3	0.1	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	5	14	30	0	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	5	-5	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	6	16	33	0	0	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	33	0	-	0	60	33
Stage 1	-	-	-	-	33	-
Stage 2	-	-	-	-	27	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1592	-	-	-	952	1046
Stage 1	-	-	-	-	995	-
Stage 2	-	-	-	-	1001	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1592	-	-	-	948	1046
Mov Cap-2 Maneuver	-	-	-	-	948	-
Stage 1	-	-	-	-	995	-
Stage 2	-	-	-	-	997	-

Approach	EB	WB	SB
HCM Control Delay, s	1.9	0	8.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1592	-	-	-	1046
HCM Lane V/C Ratio	0.003	-	-	-	0.002
HCM Control Delay (s)	7.3	0	-	-	8.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	36	5	0	88	2	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	1	-	-	-1	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	40	6	0	98	2	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	46	0	141	43
Stage 1	-	-	-	-	43	-
Stage 2	-	-	-	-	98	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1575	-	857	1033
Stage 1	-	-	-	-	985	-
Stage 2	-	-	-	-	931	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1575	-	857	1033
Mov Cap-2 Maneuver	-	-	-	-	857	-
Stage 1	-	-	-	-	985	-
Stage 2	-	-	-	-	931	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	857	-	-	1575	-
HCM Lane V/C Ratio	0.003	-	-	-	-
HCM Control Delay (s)	9.2	-	-	0	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	23	68	720	47	108	934
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	95	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-1	-	2	-	-	-2
Peak Hour Factor	67	75	91	66	73	93
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	34	91	791	71	148	1004

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1625	431	0	0	862	0
Stage 1	827	-	-	-	-	-
Stage 2	798	-	-	-	-	-
Critical Hdwy	6.6	6.8	-	-	4.1	-
Critical Hdwy Stg 1	5.6	-	-	-	-	-
Critical Hdwy Stg 2	5.6	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	104	585	-	-	789	-
Stage 1	414	-	-	-	-	-
Stage 2	427	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	84	585	-	-	789	-
Mov Cap-2 Maneuver	210	-	-	-	-	-
Stage 1	414	-	-	-	-	-
Stage 2	347	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.9	0	1.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	210	585	789	-
HCM Lane V/C Ratio	-	-	0.163	0.155	0.188	-
HCM Control Delay (s)	-	-	25.5	12.3	10.6	-
HCM Lane LOS	-	-	D	B	B	-
HCM 95th %tile Q(veh)	-	-	0.6	0.5	0.7	-

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	24	23	744	29	23	934
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	70	0	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	-2	-	2	-	-	-2
Peak Hour Factor	42	81	88	50	69	94
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	57	28	845	58	33	994

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1437	452	0	0	903	0
Stage 1	874	-	-	-	-	-
Stage 2	563	-	-	-	-	-
Critical Hdwy	6.4	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	148	575	-	-	761	-
Stage 1	412	-	-	-	-	-
Stage 2	574	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	142	575	-	-	761	-
Mov Cap-2 Maneuver	278	-	-	-	-	-
Stage 1	412	-	-	-	-	-
Stage 2	549	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.1	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	278	575	761	-
HCM Lane V/C Ratio	-	-	0.206	0.049	0.044	-
HCM Control Delay (s)	-	-	21.3	11.6	9.9	-
HCM Lane LOS	-	-	C	B	A	-
HCM 95th %tile Q(veh)	-	-	0.8	0.2	0.1	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	29	23	20	1	1	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	5	-5	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	32	26	22	1	1	30

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	23	0	-	0	113	23
Stage 1	-	-	-	-	23	-
Stage 2	-	-	-	-	90	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1605	-	-	-	888	1060
Stage 1	-	-	-	-	1005	-
Stage 2	-	-	-	-	939	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1605	-	-	-	870	1060
Mov Cap-2 Maneuver	-	-	-	-	870	-
Stage 1	-	-	-	-	1005	-
Stage 2	-	-	-	-	920	-

Approach	EB	WB	SB
HCM Control Delay, s	4.1	0	8.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1605	-	-	-	1052
HCM Lane V/C Ratio	0.02	-	-	-	0.03
HCM Control Delay (s)	7.3	0	-	-	8.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	118	37	2	61	25	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	-1	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	131	41	2	68	28	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	172	0	224	152
Stage 1	-	-	-	-	152	-
Stage 2	-	-	-	-	72	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1417	-	769	900
Stage 1	-	-	-	-	881	-
Stage 2	-	-	-	-	956	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1417	-	768	900
Mov Cap-2 Maneuver	-	-	-	-	768	-
Stage 1	-	-	-	-	881	-
Stage 2	-	-	-	-	955	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	9.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	772	-	-	1417	-
HCM Lane V/C Ratio	0.037	-	-	0.002	-
HCM Control Delay (s)	9.8	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

APPENDIX F

ITE TRIP GENERATION RATES

Land Use: 630
Clinic

Description

A clinic is any facility that provides limited diagnostic and outpatient care but is unable to provide prolonged in-house medical and surgical care. Clinics commonly have lab facilities, supporting pharmacies, and a wide range of services (compared to the medical office, which may only have specialized or individual physicians). Hospital (Land Use 610), free-standing emergency room (Land Use 650), and medical-dental office building (Land Use 720) are related uses.

Additional Data

Time-of-day distribution data for this land use are presented in Appendix A. For the three general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 10:30 and 11:30 a.m. and 3:30 and 4:30 p.m., respectively.

The average numbers of person trips per vehicle trip at the five general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.40 during Weekday, AM Peak Hour of Generator
- 1.69 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 1.52 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), California, New Hampshire, Texas, and Vermont.

Source Numbers

440, 734, 878, 926, 972

Clinic
(630)

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

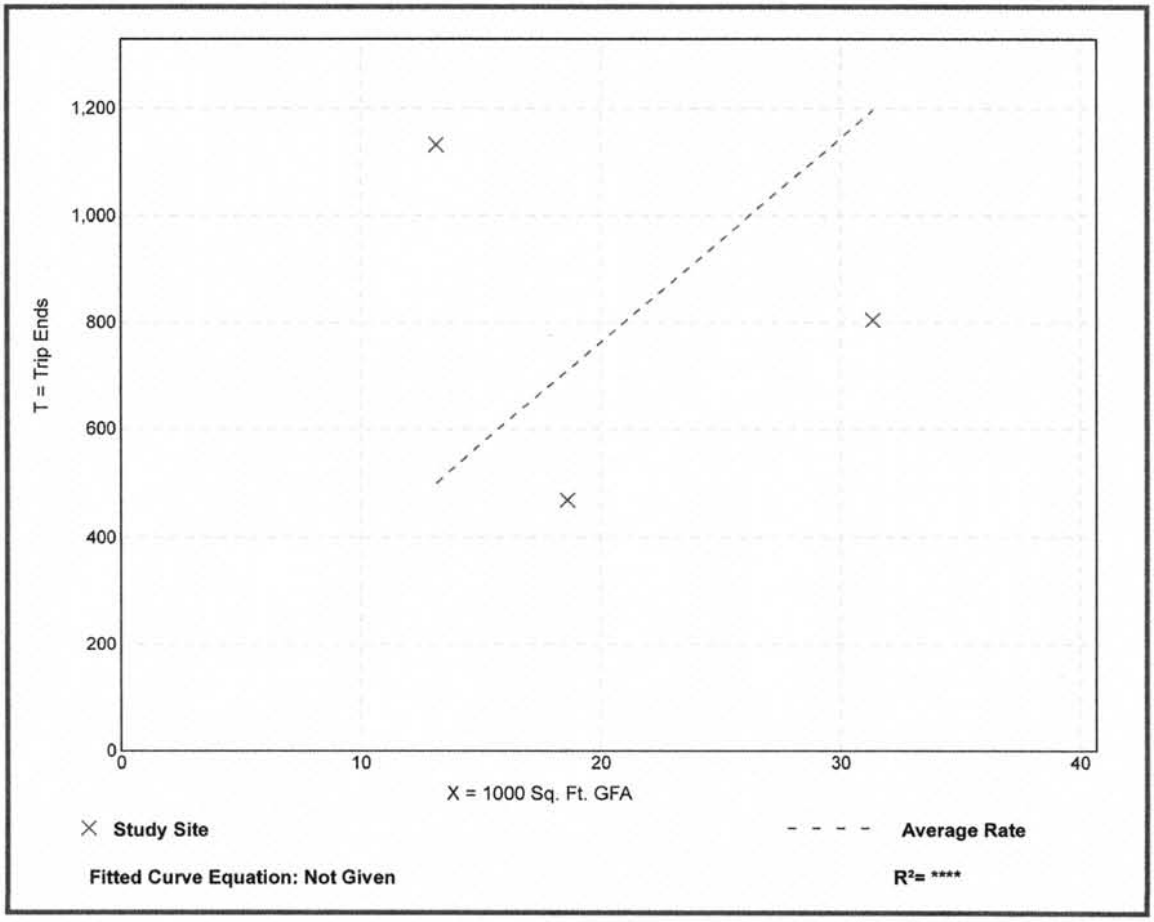
Setting/Location: **General Urban/Suburban**
Number of Studies: 3
1000 Sq. Ft. GFA: 21
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
38.16	25.25 - 86.21	66.06

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= ****

Clinic
(630)

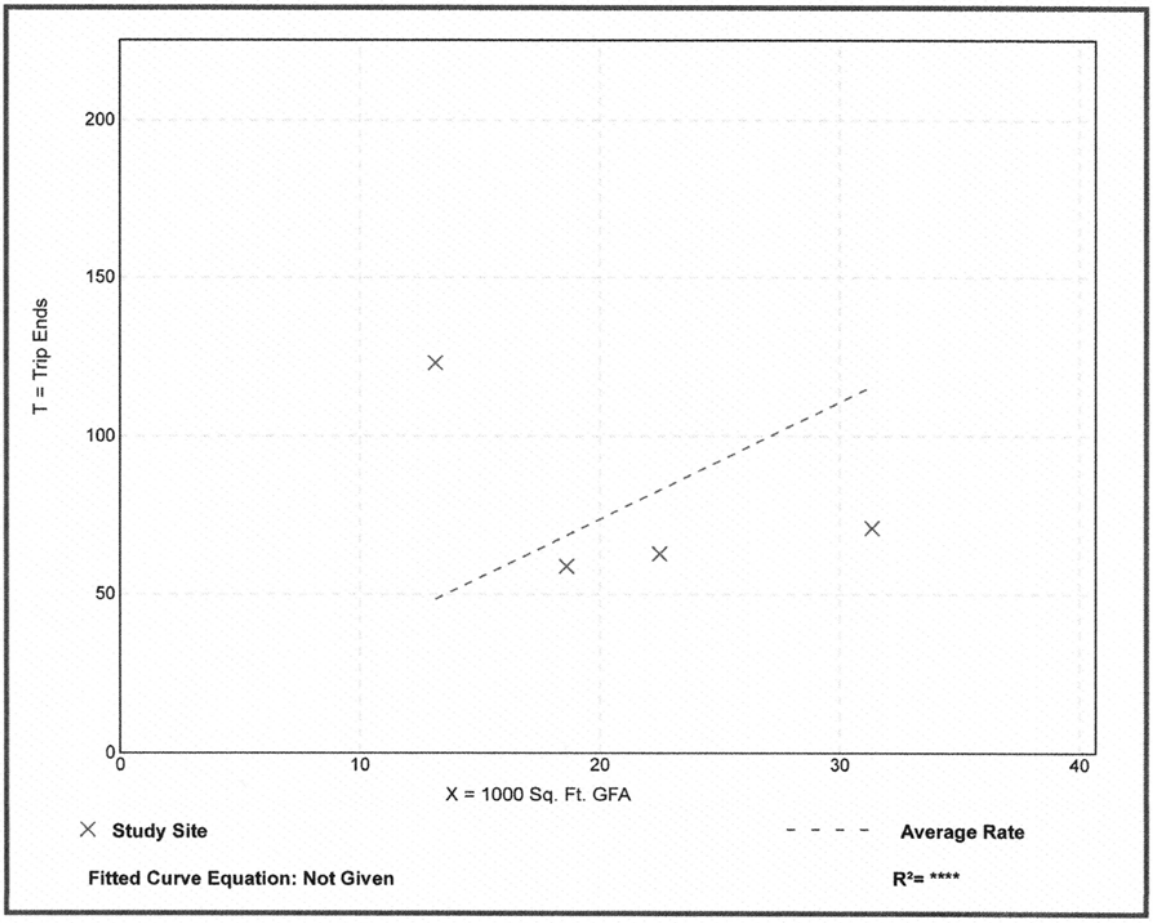
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 4
1000 Sq. Ft. GFA: 21
Directional Distribution: 78% entering, 22% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.69	2.27 - 9.36	2.82

Data Plot and Equation

Caution – Small Sample Size



Clinic
(630)

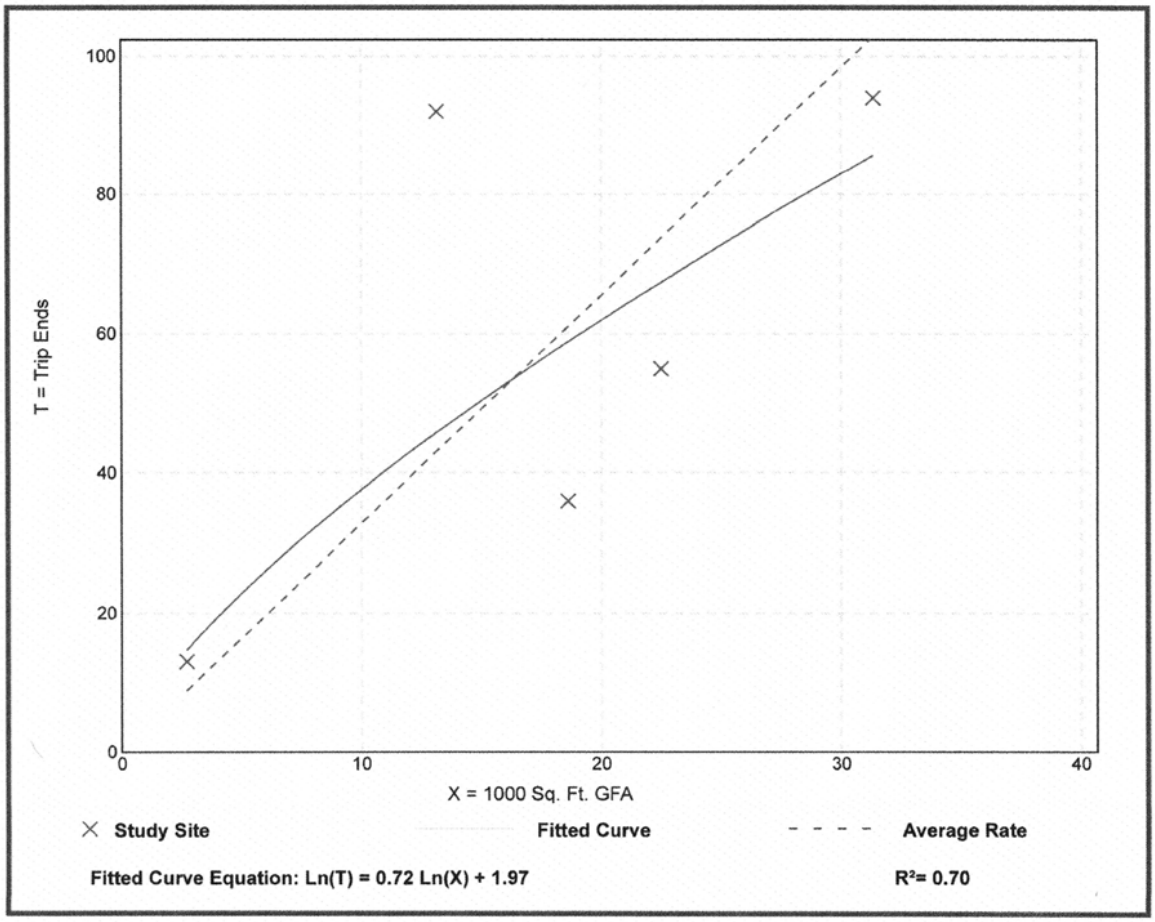
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 5
1000 Sq. Ft. GFA: 18
Directional Distribution: 29% entering, 71% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
3.28	1.93 - 7.00	1.84

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Ln(T) = 0.72 Ln(X) + 1.97

R^2= 0.70

Land Use: 932
High-Turnover (Sit-Down) Restaurant

Description

This land use consists of sit-down, full-service eating establishments with typical duration of stay of approximately one hour. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain. Generally, these restaurants serve lunch and dinner; they may also be open for breakfast and are sometimes open 24 hours a day. These restaurants typically do not take reservations. Patrons commonly wait to be seated, are served by a waiter/waitress, order from menus and pay for their meal after they eat. Some facilities contained within this land use may also contain a bar area for serving food and alcoholic drinks. Fast casual restaurant (Land Use 930), quality restaurant (Land Use 931), fast-food restaurant without drive-through window (Land Use 933), fast-food restaurant with drive-through window (Land Use 934), and fast-food restaurant with drive-through window and no indoor seating (Land Use 935) are related uses.

Additional Data

Users should exercise caution when applying statistics during the AM peak periods, as the sites contained in the database for this land use may or may not be open for breakfast. In cases where it was confirmed that the sites were not open for breakfast, data for the AM peak hour of the adjacent street traffic were removed from the database.

The outdoor seating area is not included in the overall gross floor area. Therefore, the number of seats may be a more reliable independent variable on which to establish trip generation rates for facilities having significant outdoor seating.

Time-of-day distribution data for this land use for a weekday, Saturday, and Sunday are presented in Appendix A. For the 38 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:00 and 1:00 p.m., respectively.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), California, Florida, Georgia, Indiana, Kentucky, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Texas, Vermont, and Wisconsin.

Source Numbers

126, 269, 275, 280, 300, 301, 305, 338, 340, 341, 358, 384, 424, 432, 437, 438, 444, 507, 555, 577, 589, 617, 618, 728, 868, 884, 885, 903, 927, 944, 961, 962, 977

High-Turnover (Sit-Down) Restaurant
(932)

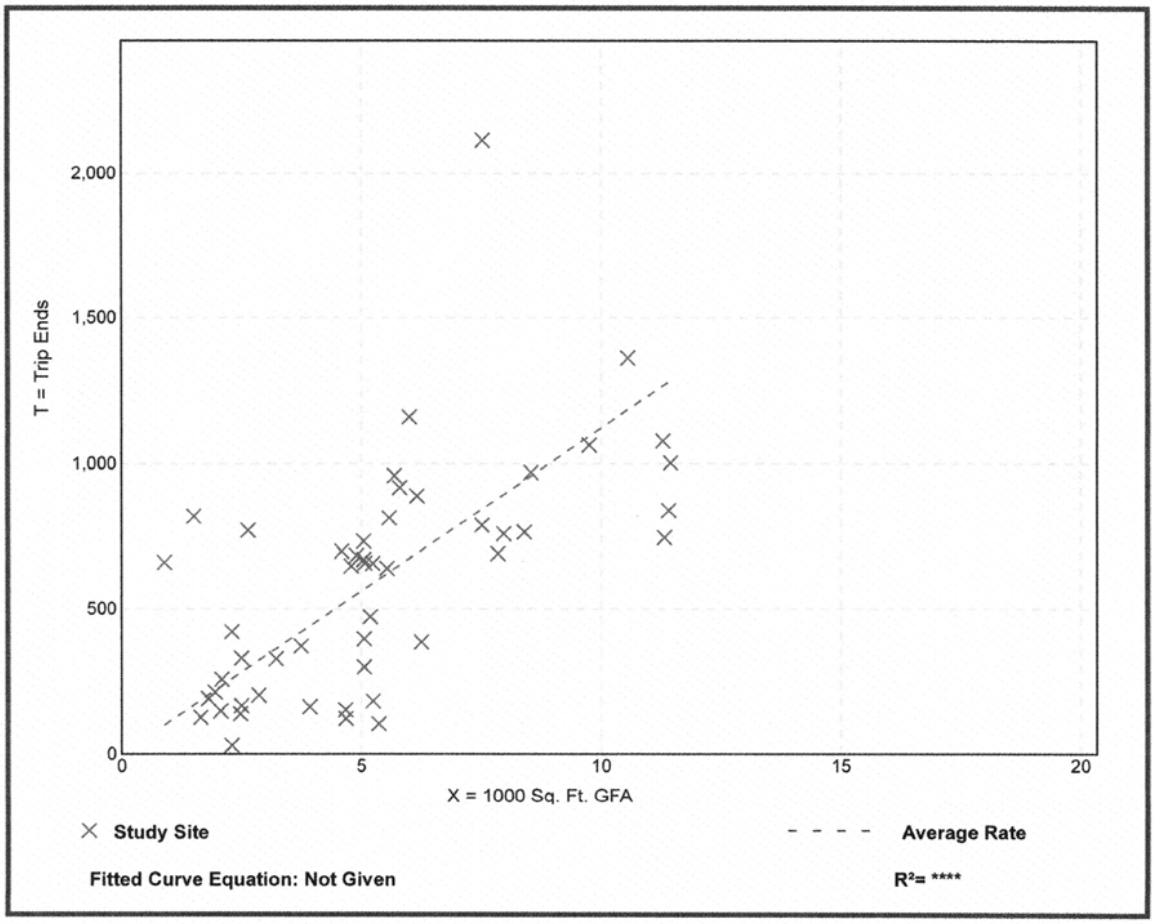
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 50
1000 Sq. Ft. GFA: 5
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
112.18	13.04 - 742.41	72.51

Data Plot and Equation



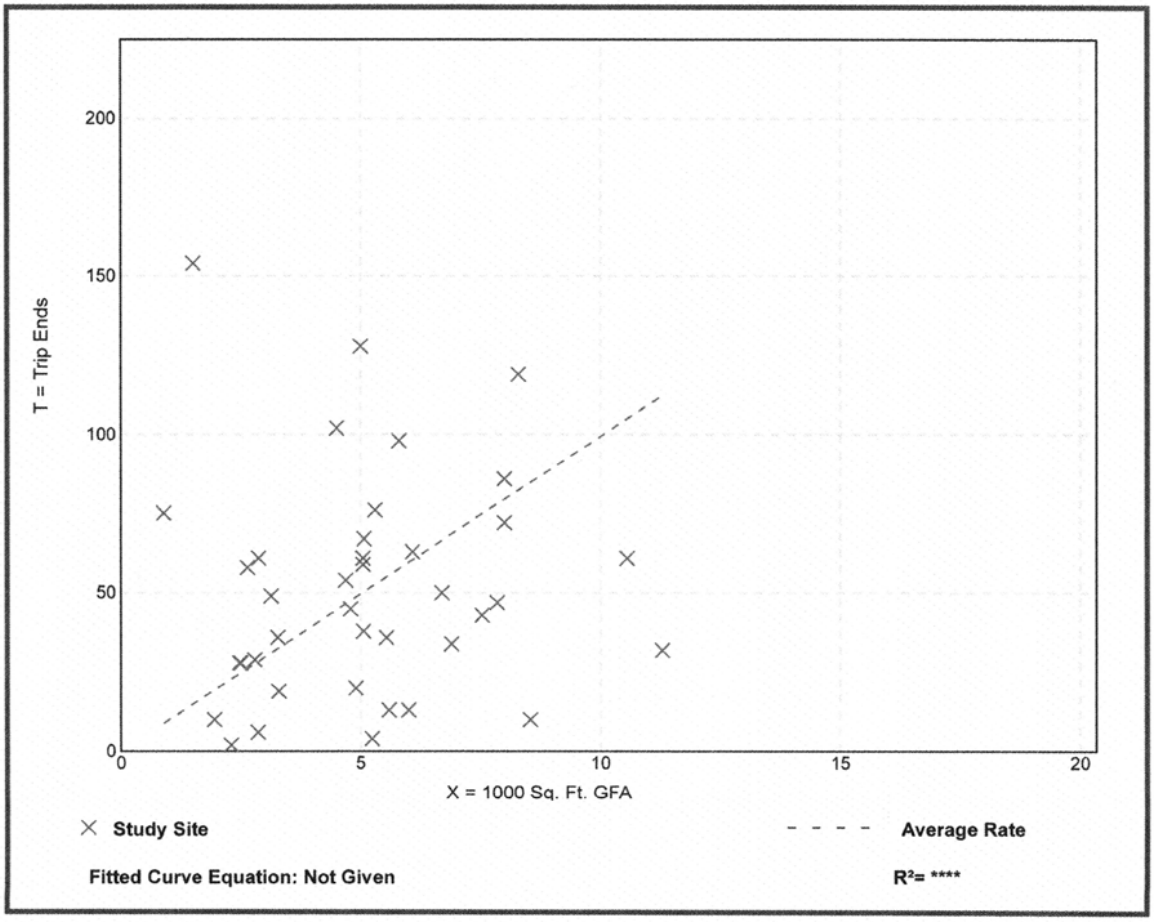
High-Turnover (Sit-Down) Restaurant
(932)

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:	39
1000 Sq. Ft. GFA:	5
Directional Distribution:	55% entering, 45% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.94	0.76 - 102.39	11.33

Data Plot and Equation



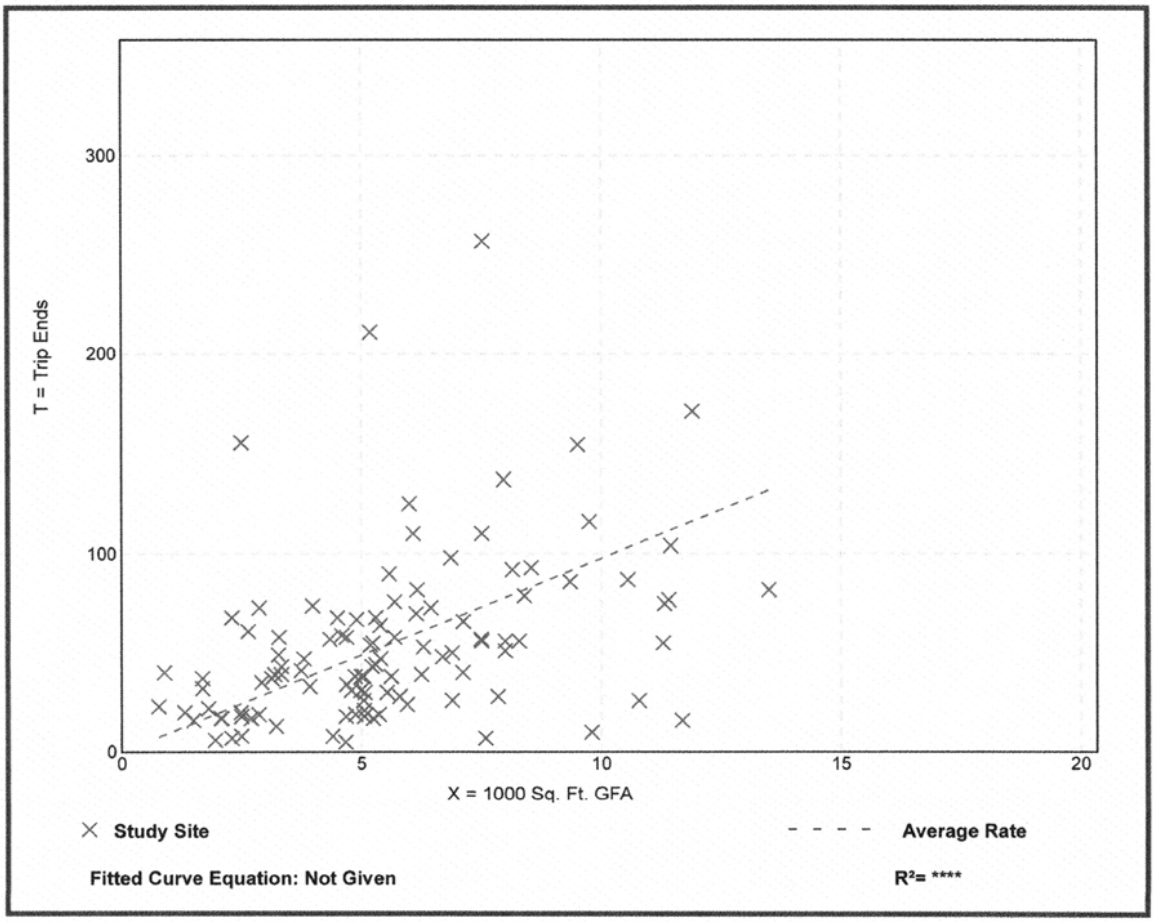
High-Turnover (Sit-Down) Restaurant
(932)

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: 107
1000 Sq. Ft. GFA: 6
Directional Distribution: 62% entering, 38% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.77	0.92 - 62.00	7.37

Data Plot and Equation



TRIP GENERATION FOR THE SHOPS AT BEXHILL

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	TRIPS GENERATED ON WEEKDAY	TRIPS GENERATED IN AM PEAK HOUR			TRIPS GENERATED IN PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#932	High-Turnover (Sit-Down) Restaurant #1	3,000 ft^2 (+822 ft^2 Patio)	429	55%	45%		62%	38%	
				~~21~~	~~17~~	~~38~~	23	14	37
#932	High-Turnover (Sit-Down) Restaurant #2	3,000 ft^2 (+750 ft^2 Patio)	421	55%	45%		62%	38%	
				~~20~~	~~17~~	~~37~~	23	14	37
#932	High-Turnover (Sit-Down) Restaurant #3	2,240 ft^2 (+308 ft^2 Patio)	286	55%	45%		62%	38%	
				~~14~~	~~11~~	~~25~~	16	9	25
#630	Clinic	1,900 ft2	73	78%	22%		29%	71%	
				5	2	7	3	8	11
#630	Clinic	1,900 ft^2	73	78%	22%		29%	71%	
				5	2	7	3	8	11
Total New Volume Site Development Trips			**1,282**	**10**	**4**	**14**	**68**	**53**	**121**

ITE Trip Generation Manual, 10th Edition

TRIP GENERATION FOR THE SHOPS AT BEXHILL
3,000 ft^2 High-Turnover (Sit-Down) Restaurant (+860 ft ^{2} Patio)
Land Use #932

1000 Sq. ft. GFA = X

Weekday:

Average Rate: T = 112.18 (X)

T = 112.18 * 3.8
T = 429 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

Average Rate: T = 9.94 (X)

T = 9.94 * 3.8
T = 38 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Average Rate: T = 9.77 (X)

T = 9.77 * 3.8
T = 37 trips

TRIP GENERATION FOR THE SHOPS AT BEXHILL
3,000 ft^2 High-Turnover (Sit-Down) Restaurant (+750 ft ^{2} Patio)
Land Use #932

1000 Sq. ft. GFA = X

Weekday:

Average Rate: T = 112.18 (X)

T = 112.18 * 3.8
T = 421 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

Average Rate: T = 9.94 (X)

T = 9.94 * 3.8
T = 37 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Average Rate: T = 9.77 (X)

T = 9.77 * 3.8
T = 37 trips

TRIP GENERATION FOR THE SHOPS AT BEXHILL
2,240 ft^2 High-Turnover (Sit-Down) Restaurant (+400 ft ^{2} Patio)
Land Use #932

1000 Sq. ft. GFA = X

Weekday:

Average Rate: T = 112.18 (X)

T = 112.18 * 2.5
T = 286 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

Average Rate: T = 9.94 (X)

T = 9.94 * 2.5
T = 25 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Average Rate: T = 9.77 (X)

T = 9.77 * 2.5
T = 25 trips

TRIP GENERATION FOR THE SHOPS AT BEXHILL
1,900 ft^2 Clinic
Land Use #630

1000 Sq. ft. GFA = X

Weekday:

Average Rate: T = 38.16 (X)

T = 38.16 * 1.9
T = 73 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

Average Rate: T = 3.69 (X)

T = 3.69 * 1.9
T = 7 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Average Rate: Ln(T) = 0.72 Ln(X) + 1.97

Ln(T) = 0.72 * 0.64 + 1.97
Ln(T) = 2.43
T = 11 trips

TRIP GENERATION FOR THE SHOPS AT BEXHILL
1,900 ft^2 Clinic
Land Use #630

1000 Sq. ft. GFA = X

Weekday:

Average Rate: T = 38.16 (X)

T = 38.16 * 1.9
T = 73 trips

Peak Hour of Adjacent Traffic between 7 and 9 am:

Average Rate: T = 3.69 (X)

T = 3.69 * 1.9
T = 7 trips

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Average Rate: Ln(T) = 0.72 Ln(X) + 1.97

Ln(T) = 0.72 * 0.64 + 1.97
Ln(T) = 2.43
T = 11 trips

TRIP GENERATION FOR THE SHOPS AT BEXHILL WITH PASS-BY TRIPS

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	TRIPS GENERATED IN AM PEAK HOUR			TRIPS GENERATED IN PM PEAK HOUR		
			ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
#932	High-Turnover (Sit-Down) Restaurant #1	3,000 ft^2 (+822 ft^2 Patio)	55%	45%		62%	38%	
						23	14	37
#932	High-Turnover (Sit-Down) Restaurant #2	3,000 ft^2 (+750 ft^2 Patio)	55%	45%		62%	38%	
						23	14	37
#932	High-Turnover (Sit-Down) Restaurant #3	2,240 ft^2 (+308 ft^2 Patio)	55%	45%		62%	38%	
						16	9	25
#630	Clinic	2,100 ft^2	78%	22%		29%	71%	
			5	2	7	3	8	11
#630	Clinic	1,900 ft^2	78%	22%		29%	71%	
			5	2	7	3	8	11
	External Vehicle Trips - Total		**10**	**4**	**14**	**68**	**53**	**121**
	Pass-by Vehicle Trips (Restaurants)		0	0	0	-12	-7	-19
	Total New Primary Vehicle Trips		**10**	**4**	**14**	**56**	**46**	**102**

ITE Trip Generation Manual, 10th Edition

Pass-by Trip %: Restaurant = 20%

APPENDIX G

ITE AND MPC PASS-BY TRIP RATES

Table E.30 Pass-By and Non-Pass-By Trips Weekday, PM Peak Period
Land Use Code 932—High-Turnover (Sit-Down) Restaurant

SEATS	SIZE (1,000 SQ. FT. GFA)	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIPS (%)			ADJ. STREET PEAK HOUR VOLUME	SOURCE
							PRIMARY	DIVERTED	TOTAL		
—	5.8	Orlando, FL	1992	150	2:00–6:00 p.m.	32	—	—	68	—	TPD Inc.
—	5	Casselberry, FL	1992	65	2:00–6:00 p.m.	58	—	—	42	—	TPD Inc.
168	5.3	Louisville area, KY	1993	24	4:00–6:00 p.m.	50	37	13	50	1,615	Barton-Aschman Assoc.
169	2.9	Louisville area, KY	1993	41	4:00–6:00 p.m.	37	27	36	63	3,935	Barton-Aschman Assoc.
150	3.1	Louisville area, KY	1993	21	4:00–6:00 p.m.	38	29	33	62	2,580	Barton-Aschman Assoc.
250	7.1	New Albany, IN	1993	—	4:00–6:00 p.m.	23	23	54	77	1,565	Barton-Aschman Assoc.
—	8	Kissimmee, FL	1995	664	2:00–6:00 p.m.	40	39	21	60	—	TPD Inc.
—	11	Orlando, FL	1996	267	2:00–6:00 p.m.	38	43	19	62	—	TPD Inc.
—	12	Orlando, FL	1996	317	2:00–6:00 p.m.	29	51	20	71	—	TPD Inc.
—	4.6	Orlando, FL	1992	276	2:00–6:00 p.m.	63	—	—	37	—	TPD Inc.
—	5.7	Orlando, FL	1994	308	2:00–6:00 p.m.	57	—	—	43	—	TPD Inc.
—	6.2	Orlando, FL	1995	521	2:00–6:00 p.m.	46	43	11	54	—	TPD Inc.

Average Pass-By Trip Percentage: 43
"—" means no data were provided

KNOXVILLE•KNOX COUNTY
MPC
METROPOLITAN PLANNING COMMISSION
TENNESSEE

MEMORANDUM

TO: Traffic Impact Study Reviewers and Preparers
FROM: Cindy Pionke
DATE: March 10, 1997
SUBJECT: Minutes from October 11, 1996 Meeting

Two items were presented for discussion at our last meeting. Hollis Loveday did a presentation on pass-by rates for a few specific land uses and Darcy Sullivan did a presentation on auxiliary lane issues. These specific matters seemed to cause some problems over the past year.

Percentage of pass-by trips for fast-food restaurants, supermarkets, convenience markets and shopping centers were discussed. The following percentages were agreed upon.

LAND USE	PERCENTAGE
Fast-food Restaurant	40
Supermarket	
> 50,000 SF	10
25,000 - 50,000 SF	35
< 25,000 SF	55
Convenience Market	
< 10,000 ADT	60
10,000 - 20,000 ADT	65
20,000 - 30,000 ADT	70
30,000 - 40,000 ADT	75
> 40,000 ADT	80
Shopping Center	
Use GLA formula up to 30%	

Attached is the draft "Procedure for Determining Need for and Design of Auxiliary Lanes on Uncontrolled Approaches to Intersections and Driveways". **Please note that the bay taper rates have changed since we met.** The proposed 15:1 and 20:1 taper rates were previously 14:1 and 16:1, respectively. This procedure is for left and right turn lanes on two-lane roadways. The recommendation for four-lane roadways was to exercise judgment because no particular quantification method leads to consistent results.

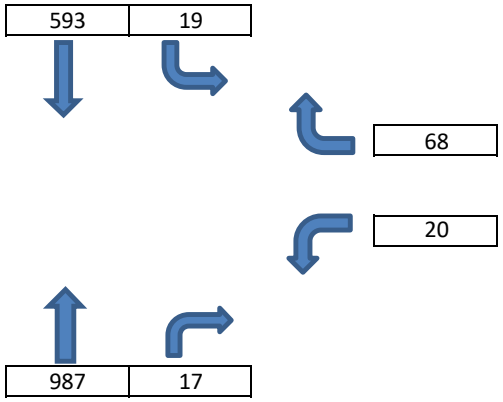
Suite 403 • City County Building
400 Main Street
Knoxville, Tennessee 37902
423 • 215 • 2500
FAX • 215 • 2068

APPENDIX H

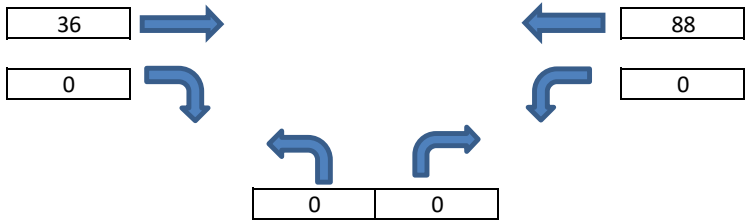
TRIP DISTRIBUTION SPREADSHEETS

2023 AM PEAK HOUR - Peak Hour Volumes

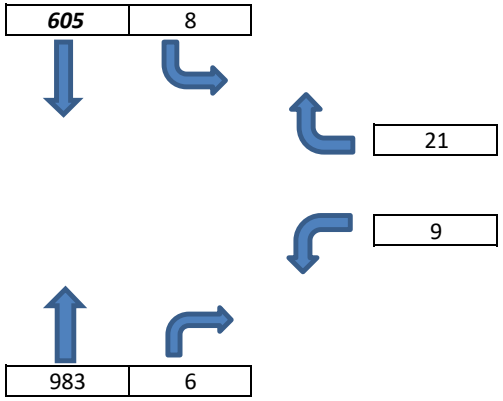
Intersection of Ebenezer Road at Bexhill Drive



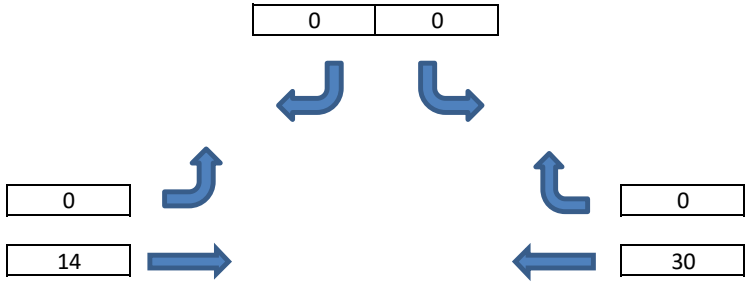
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive



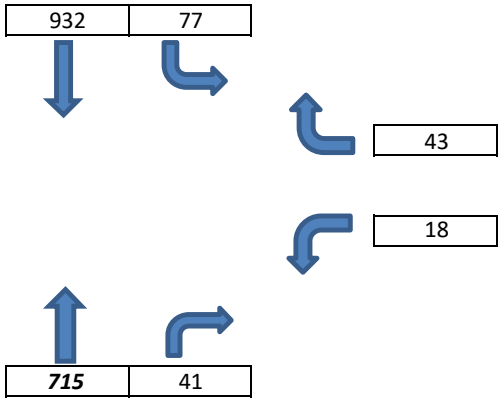
Intersection of Bexhill Drive at South Entrance



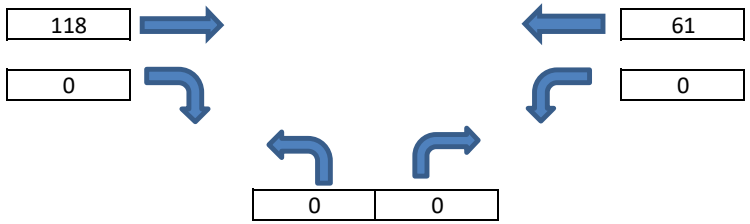
* Bold Italic = Hard Coded to Balance

2023 PM PEAK HOUR - Peak Hour Volumes

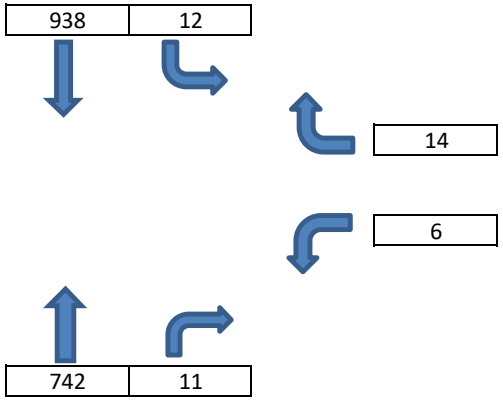
Intersection of Ebenezer Road at Bexhill Drive



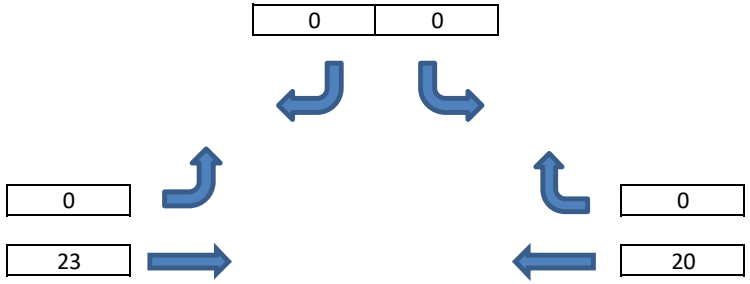
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive



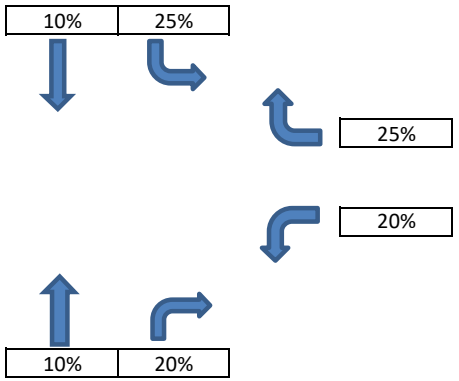
Intersection of Bexhill Drive at South Entrance



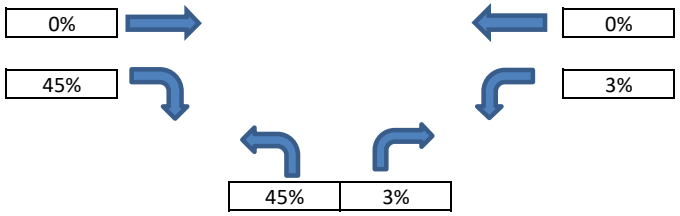
* Bold Italic = Hard Coded to Balance

2023 AM PEAK HOUR - Trip Distribution - Primary Trips

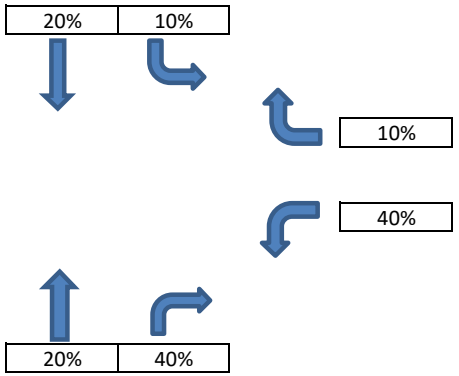
Intersection of Ebenezer Road at Bexhill Drive



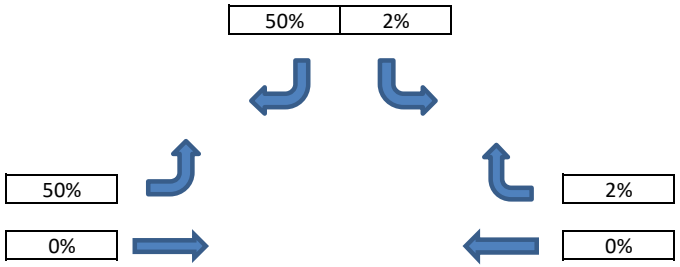
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive

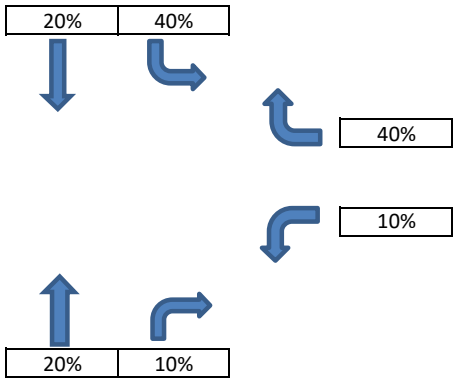


Intersection of Bexhill Drive at South Entrance

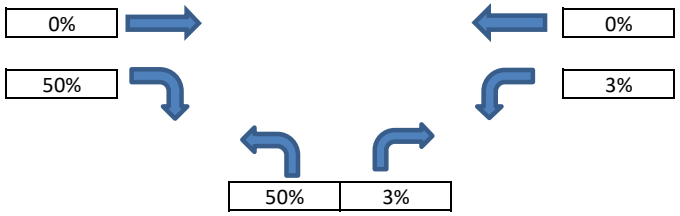


2023 PM PEAK HOUR - Trip Distribution - Primary Trips

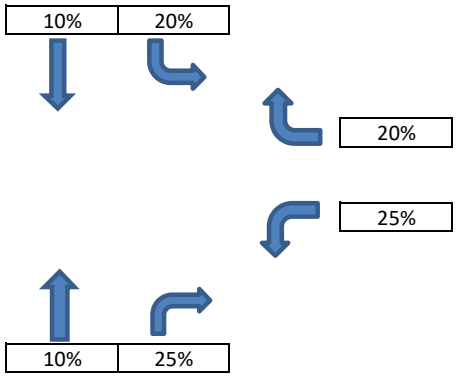
Intersection of Ebenezer Road at Bexhill Drive



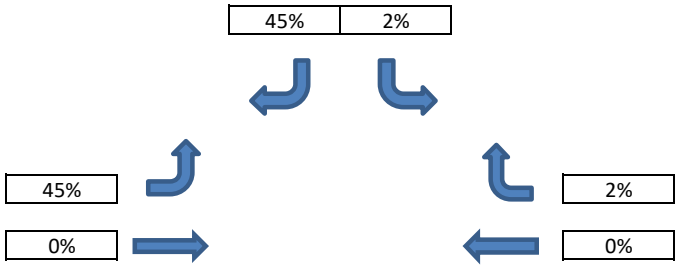
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive

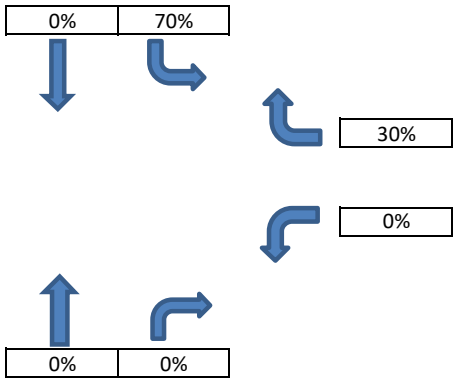


Intersection of Bexhill Drive at South Entrance

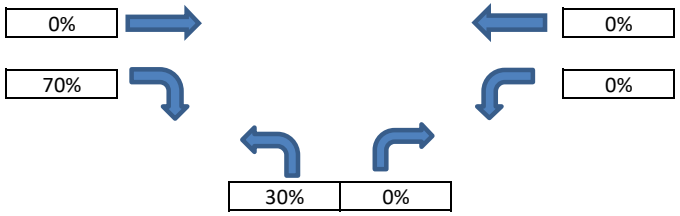


2023 PM PEAK HOUR - Trip Distribution - Pass-by Trips

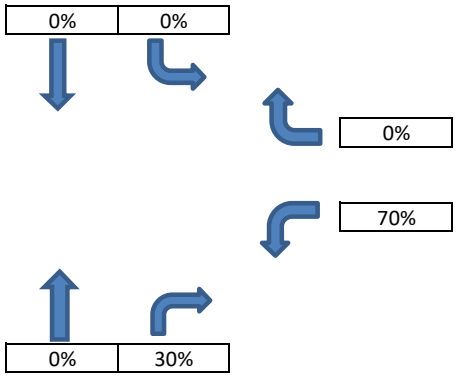
Intersection of Ebenezer Road at Bexhill Drive



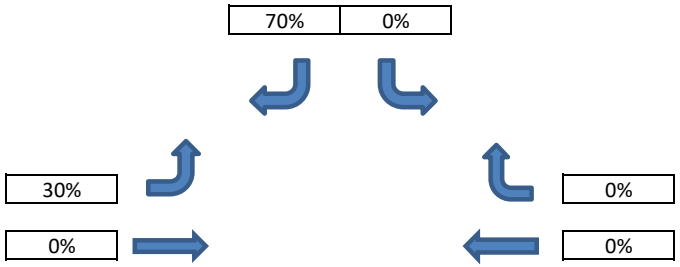
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive

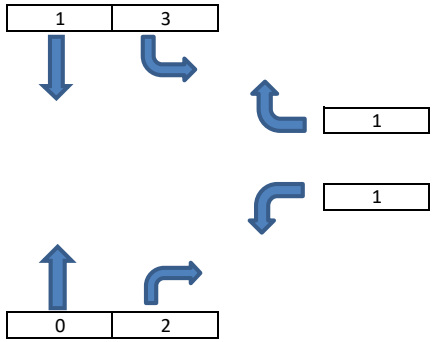


Intersection of Bexhill Drive at South Entrance

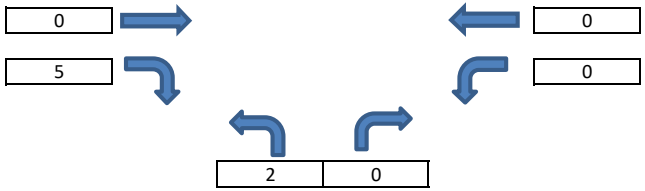


2023 AM PEAK HOUR - Trip Assignment - Primary Trips

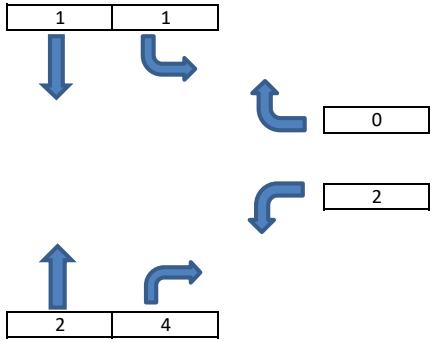
Intersection of Ebenezer Road at Bexhill Drive



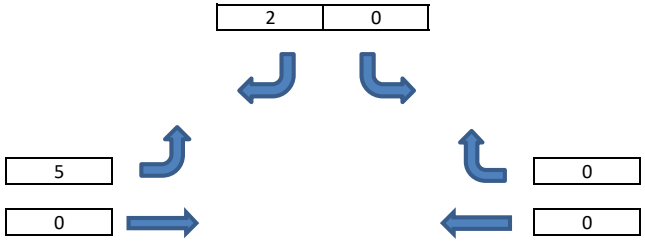
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive



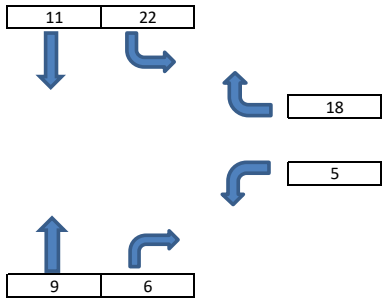
Intersection of Bexhill Drive at South Entrance



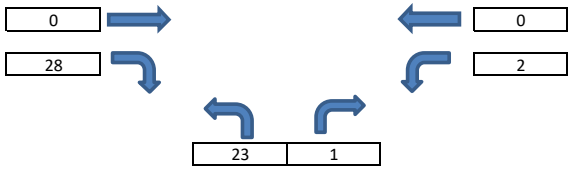
ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	TRIPS GENERATED IN AM PEAK HOUR ENTER	EXIT	TOTAL
#630	Clinic	1,900 ft2	5	2	7
#630	Clinic	1,900 ft2	5	2	7
		External Vehicle Trips - Total	10	4	14

2023 PM PEAK HOUR - Trip Assignment - Primary Trips

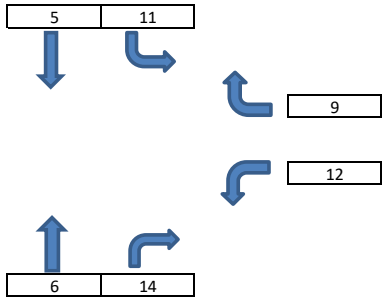
Intersection of Ebenezer Road at Bexhill Drive



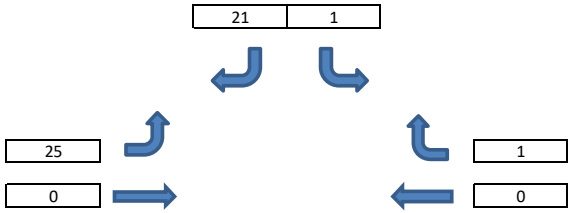
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive



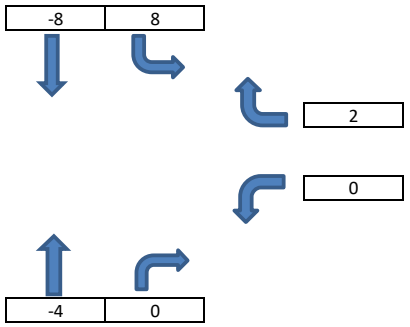
Intersection of Bexhill Drive at South Entrance



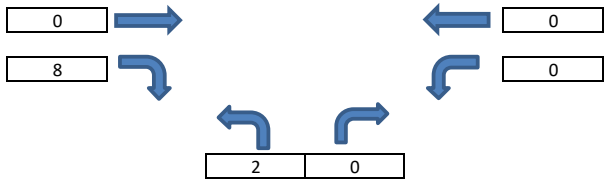
ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	TRIPS GENERATED IN PM PEAK HOUR ENTER	EXIT	TOTAL
#932	Restaurant	3,000 ft2	23	14	37
#932	Restaurant	3,000 ft2	23	14	37
#932	Restaurant	2,240 ft2	16	9	25
#630	Clinic	1,900 ft2	3	8	11
#630	Clinic	1,900 ft2	3	8	11
		External Vehicle Trips - Total	68	53	121
	Pass-by %	20%	-12	-7	-19
			56	**46**	**102**

2023 PM PEAK HOUR - Trip Assignment - Pass-by Trips

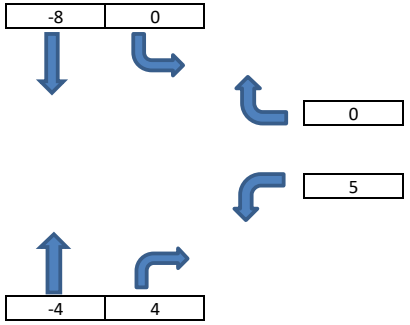
Intersection of Ebenezer Road at Bexhill Drive



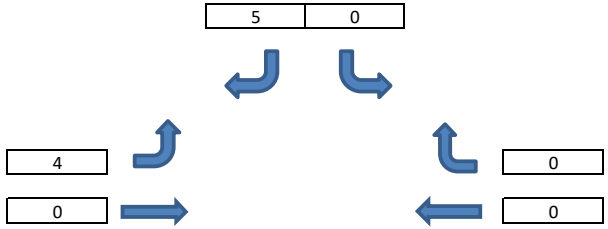
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive



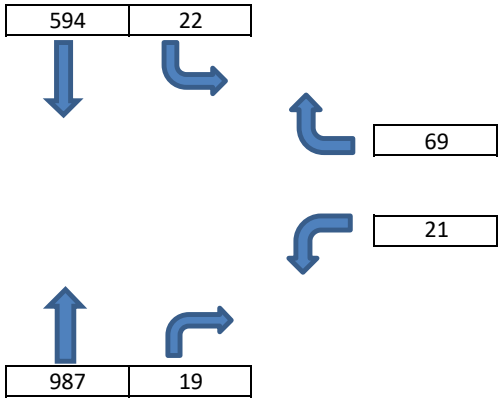
Intersection of Bexhill Drive at South Entrance



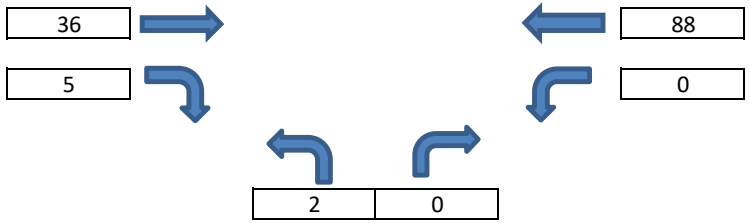
ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	TRIPS GENERATED IN PM PEAK HOUR ENTER	EXIT	TOTAL
#932	Restaurant	3,000 ft2	23	14	37
#932	Restaurant	3,000 ft2	23	14	37
#932	Restaurant	2,240 ft2	16	9	25
		External Vehicle Trips - Total	62	37	99
	Pass-by %	20%	12	7	19

2023 AM PEAK HOUR - Projected Peak Hour Volumes

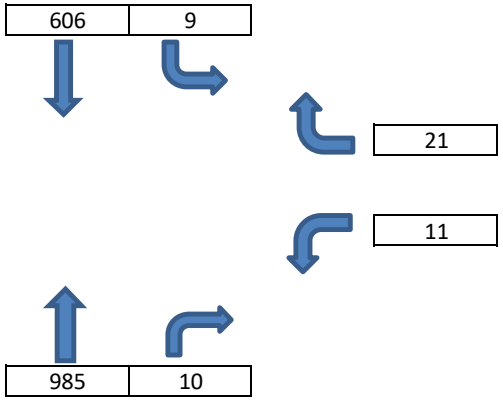
Intersection of Ebenezer Road at Bexhill Drive



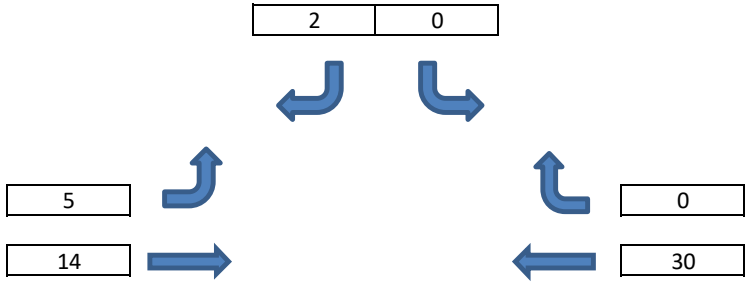
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive

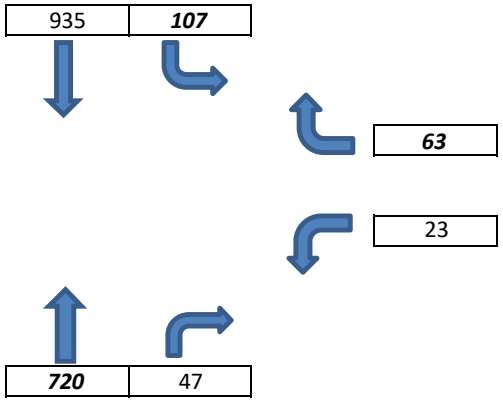


Intersection of Bexhill Drive at South Entrance

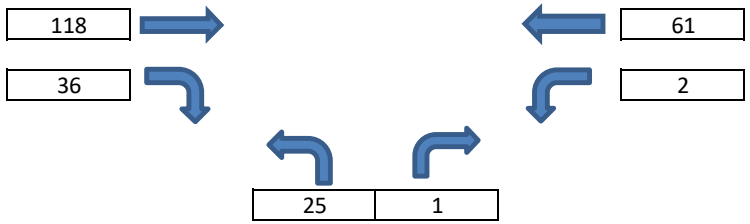


2023 PM PEAK HOUR - Projected Peak Hour Volumes

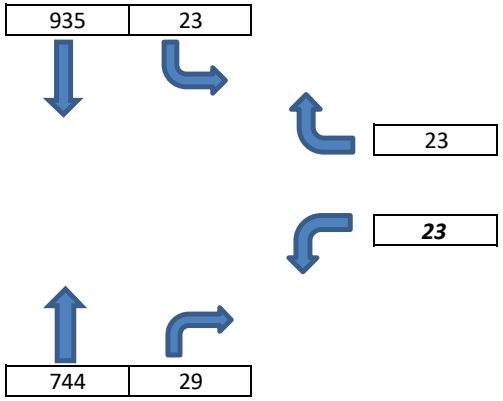
Intersection of Ebenezer Road at Bexhill Drive



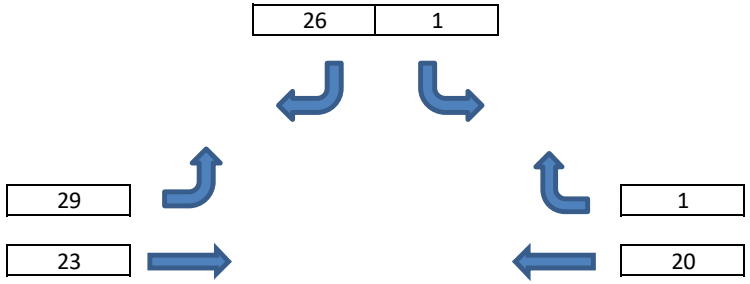
Intersection of Bexhill Drive at North Entrance



Intersection of Ebenezer Road at Gatwick Drive



Intersection of Bexhill Drive at South Entrance



* Bold Italic = Hard Coded to Balance

APPENDIX I

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

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 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

(987/2) * 1.05 = 518

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

Ebenezer Road at Bexhill Drive

2023 Projected AM NB Right Turns = 19

Right Turn Lane NOT Warranted

* 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 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

(720/2) * 1.05 = 378

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

Ebenezer Road at Bexhill Drive

2023 Projected PM NB Right Turns = 47

Right Turn Lane NOT Warranted

* 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 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

(985/2) * 1.05 = 517

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

Ebenezer Road at Gatwick Drive

2023 Projected AM NB Right Turns = 10

Right Turn Lane NOT Warranted

* 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 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

(744/2) * 1.05 = 391

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

Ebenezer Road at Gatwick Drive

2023 Projected PM NB Right Turns = 29

Right Turn Lane NOT Warranted

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

APPENDIX J

SIMTRAFFIC VEHICLE QUEUE LENGTHS

Intersection: 4: Ebenezer Road & Bexhill Drive

Movement	WB	WB	SB
Directions Served	L	R	L
Maximum Queue (ft)	56	64	39
Average Queue (ft)	18	32	14
95th Queue (ft)	48	54	40
Link Distance (ft)		130	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	95		100
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 6: Ebenezer Road & Gatwick Drive

Movement	WB	WB	NB	SB
Directions Served	L	R	TR	L
Maximum Queue (ft)	37	40	2	30
Average Queue (ft)	10	16	0	5
95th Queue (ft)	33	43	2	24
Link Distance (ft)		134	294	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70			100
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Intersection: 8: Gatwick Drive & South Driveway

Movement	SB
Directions Served	LR
Maximum Queue (ft)	27
Average Queue (ft)	2
95th Queue (ft)	13
Link Distance (ft)	84
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9: North Driveway & Bexhill Drive

Movement	NB
Directions Served	LR
Maximum Queue (ft)	30
Average Queue (ft)	2
95th Queue (ft)	16
Link Distance (ft)	93
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 0

Intersection: 4: Ebenezer Road & Bexhill Drive

Movement	WB	WB	NB	SB	SB
Directions Served	L	R	TR	L	T
Maximum Queue (ft)	56	55	15	86	16
Average Queue (ft)	20	28	1	39	1
95th Queue (ft)	50	48	6	68	15
Link Distance (ft)		130	294		242
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	95			100	
Storage Blk Time (%)	0			0	
Queuing Penalty (veh)	0			1	

Intersection: 6: Ebenezer Road & Gatwick Drive

Movement	WB	WB	NB	SB
Directions Served	L	R	TR	L
Maximum Queue (ft)	52	35	6	34
Average Queue (ft)	18	17	0	10
95th Queue (ft)	46	42	5	34
Link Distance (ft)		160	295	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70			100
Storage Blk Time (%)	0			
Queuing Penalty (veh)	0			

Intersection: 7: Gatwick Drive & South Driveway

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	6	38
Average Queue (ft)	0	16
95th Queue (ft)	4	42
Link Distance (ft)	160	89
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: North Driveway & Bexhill Drive

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	9	40
Average Queue (ft)	0	17
95th Queue (ft)	5	43
Link Distance (ft)	157	71
Upstream Blk Time (%)		0
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 1

APPENDIX K

LETTER RESPONSE TO KNOXVILLE/KNOX COUNTY PLANNING COMMENTS

AJAX ENGINEERING
CIVIL ENGINEERING / TRAFFIC ENGINEERING

11812 Black Road
Knoxville, Tennessee 37932
Phone (865) 556-0042
ajaxengineering@gmail.com

September 17, 2021

PROJECT NAME: The Shops at Bexhill TIS

TO: Knoxville-Knox County Planning

SUBJECT: TIS Comment Response Document for The Shops at Bexhill
Review Comments dated September 17, 2021

Dear Knoxville-Knox County Planning Staff:

The following comment response document is submitted to address comments from an email dated September 17, 2021, and this letter is added to the end of the revised report.

1. **Page 45 appears to have been inadvertently left blank where the text indicated there should be images of the existing sight distances.**

   Response: Page 45 was unfortunately left out in the original submittal. The revised report includes Page 45.

2. **There appear to be some minor discrepancies between the results from the Synchro analyses for the Year 2023 Projected Conditions With Project in the PM Peak Hour as shown in the outputs included in Appendix E versus what was shown in Table 6 on Page 40. Please review and revise as necessary.**

   Response: A total of six values in Table 6 were updated to reflect the results shown in Appendix E. None of these updated values changed the LOS and were minor. These updates were also reflected in Tables 7a and 7b.

   In addition to the requested revisions, other changes in the report include the following:

   - Updated Title Page
   - Updated Table of Contents
   - Updated Page Footers

- Added Appendix K to include this response letter

If you have any questions or further comments, please feel free to contact me at any time. I look forward to your review and approval.

Sincerely,

Ajax Engineering, LLC
Robert W. Jacks, P.E.

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