

Proposed Multi-Family Housing Essex Road



**Ipswich, MA
February 21, 2017**

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Prepared for:

36 Essex Road LP

TRAFFIC IMPACT AND ACCESS STUDY

PROPOSED MULTI-FAMILY HOUSING

ESSEX ROAD IPSWICH, MASSACHUSETTS

Prepared for:

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SECTION 1: EXECUTIVE SUMMARY

Bayside Engineering has prepared a Traffic Impact and Access Study (TIAS) for the proposed multi-family development to be located on Essex Road (Route 133) in Ipswich, MA. The project is to contain 194 apartment units with two access points to Essex Road.

The study has been prepared to conform to the March 2014 MassDOT/EOEEA *Transportation Impact Assessment (TIA) Guidelines*. This report identifies existing traffic operating parameters on key roadways and intersections within the study area, evaluates the anticipated traffic volume increases as a result of the proposed project, analyzes the project's traffic-related impacts, determines the projects access/egress requirements and identifies appropriate mitigating measures designed to minimize the traffic-related impacts created by the project. The following provides a brief summary of the study findings.

PROJECT DESCRIPTION

The project site is located on the north side of Essex Road, east of County Street (Route 1A). Currently the site contains a single family home and is located behind a small mixed-use development (which includes the Lahey Health Primary Care Ipswich facility and Bruni Marketplace (small commercial space)).

The development will consist of the construction of 194 residential apartment units. Under proposed conditions, one additional curb cut will be constructed to Essex Road, east of the Bruni Market Place driveway. The existing driveway to the single family home (#28 Essex Road) will be modified to accommodate the western entrance to the project. 345 parking spaces are proposed for the apartments.

Figure 1 shows the site location in relation to the surrounding area.



Figure 1
Site Location Map

STUDY AREA

Roadway geometry and traffic control information was collected for the following locations:

- County Road (Route 1A) and Essex Road (Route 133)
- Essex Road and driveway to #28 Essex Road
- Essex Road and existing Bruni Marketplace driveways
- Essex Road and Ruth Way
- Essex Road and Heartbreak Road

EXISTING CONDITIONS

Evaluation of existing conditions within the study area includes a description of roadway geometrics, traffic constraints, land uses at the intersections, and quantification of traffic volumes.

Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in June 2015. Peak-period turning movement counts were conducted during the weekday morning peak period (7:00 to 9:00 AM) and

weekday evening period (4:00 to 6:00 PM). Daily traffic counts were conducted on Essex Road for a two-day period using automatic traffic recorders (ATR).

The traffic-volume data gathered as part of this study was collected during the month of June 2015. Data from the MassDOT was reviewed to determine the appropriate seasonal adjustments. Based on the MassDOT data, June represents slightly higher than average month conditions (approximately 0.2% higher). The June volumes were used to represent average month conditions.

Essex Road was recorded to carry approximately 10,900 vehicles per day (vpd) east of Ruth Way. During the weekday morning peak hour, approximately 826 vehicles per hour (vph) were recorded, and during the weekday evening peak hour, approximately 1,034 vph were recorded.

Motor Vehicle Crash Data

Motor vehicle crash data for the study area intersections and roadways were obtained from MassDOT from 2010 to 2014. The motor vehicle crash data was reviewed to determine crash trends in the study area. Eight (8) crashes were reported during the five and year interval. All of the crashes occurred at the intersection of County Road and Essex Road. Of these crashes, Five (5) were rear-end type collisions, There was one (1) angle-type collision, one (1) head-on collision and one (1) single-vehicle collision. The intersection does not experience a significant crash rate. No fatalities were reported at the intersection.

PROBABLE IMPACTS OF THE PROJECT

No-Build Traffic Volumes

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2023. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2023. The Metropolitan Area Planning Council and the Central Transportation Planning Staff were contacted to determine planning growth. Based on the CTPS modeling, growth is forecast at a rate of 0.4 percent per year. To be conservative, a one (1.0) percent compounded growth rate was used to develop future No-Build baseline conditions.

Discussions with the Town of Ipswich indicate that at this time there is one other potential project that has been identified that would need to be included in the No-Build projections. This is the proposed mixed-use on County Street. Potential traffic from this project was obtained from the traffic study prepared for the project and included in the background projections.

Build Traffic Volumes

Site generated traffic was based on trip-generation data published by the Institute of Transportation Engineers (ITE) in the *Trip Generation* manual¹. The trip generation data for Land Use Code (LUC) 220 – Apartments, published by the ITE were evaluated to determine the expected trip generation for the project's components.

On a typical weekday, the proposed apartments are expected to generate 1,300 daily vehicle trips (650 vehicles entering and 650 vehicles exiting). During the weekday morning peak hour, 99 vehicle trips (20 vehicles entering and 79 vehicles exiting) are expected. During the weekday evening peak hour, 124 vehicle trips (81 vehicles entering and 43 vehicles exiting) are expected. Most of this traffic is expected to be automobiles.

TRAFFIC OPERATIONS ANALYSIS

In order to assess the impacts of the proposed project on the roadway network, traffic operations analyses were performed at the study area intersections under 2015 Existing, 2022 No-Build and 2022 Build conditions. These analyses indicate that proposed project will not result in a significant impact on traffic operations at the study area intersections over No-Build conditions.

RECOMMENDATIONS

The project Proponent has proposed a combination of structural and non-structural mitigation measures to address the potential impacts of the proposed project. The proposed mitigation measures are identified below.

County Road and Essex Road

The critical movements at this intersection are projected to operate at level of service F during the weekday morning and evening peak hours, with or without the project. Observations of existing conditions indicate that actual operations are not as poor as the HCS model indicates. As part of the mitigation, the project proponent will monitor this intersection 12 and 24 months after issuance of the Final Certificate of Occupancy for the Project. If the resulting level of service is poor (resulting from the project), the Project proponent will commit to providing design plans for the signalization of the intersection.

Essex Road and West Site Driveway

It is recommended that the site driveway consist of one entering and one exiting lane. The exiting lane should be under STOP sign control. To improve sight distances to the east, it is recommended that approximately 12 feet of the existing retail building located within Bruni Marketplace be removed and landscaped. Landscaping should not exceed

¹*Trip Generation*, Ninth Edition; Institute of Transportation Engineers; Washington, DC; 2012.

three (3) feet in height and be maintained so as to not impact sight distances.

Essex Road and East Site Driveway

It is recommended that the site driveway consist of one entering and one exiting lane. The exiting lane should be under STOP sign control. Landscaping in the vicinity of the driveway should not exceed three (3) feet in height and be maintained so as to not impact sight distances.

Transportation Demand Management

A Transportation Demand Management (TDM) plan will be implemented to reduce the project's overall traffic impact through the implementation of measures that are aimed at minimizing the use of single occupancy vehicles the Proponent will implement a number of measures that will contribute toward the reduction of vehicular traffic to and from the site. As part of the TDM program, a transportation coordinator (commercial accommodations staff member) will be responsible for overseeing the TDM program. The program will include ridesharing opportunities.

Ridesharing - The Proponent will promote ridesharing to its tenants by way of carpools. Information regarding carpooling and its benefits will be distributed to all residents and posted in common areas. The on-site transportation coordinator will be responsible to ensure that the ridesharing program is promoted and provided.

Carpool Parking Spaces - Two parking spaces will be designated as "Carpool Only". Signage will be provided for each space clearly marking them as carpool spaces only.

Bicycle Facilities - Provide secure bicycle racks, which provides the cyclist with a degree of comfort, knowing their bicycle is safe, and as such more likely to be used as a means of travel to/from work or for recreation.

Monitoring - The applicant shall, in consultation with the Town of Ipswich, conduct a traffic monitoring and reporting program which will include a survey of residents and employee participation in the TDM program. The traffic monitoring program will include measuring traffic volumes at the access points to the project over a continuous 7-day, week-long period and will be conducted at 12 and 24 months after issuance of the Final Certificate of Occupancy for the project.

Zip Car - Explore the potential to provide one parking space reserved for Zipcar (Zipcar is a nationwide car-sharing service which is also used extensively in the Boston metropolitan area) or other similar ride share program. This will encourage people who do not own a vehicle to use the service and be rewarded with a parking spot when they come back to the site.

Traffic Monitoring

The Applicant shall, in consultation with the Town of Ipswich, conduct a traffic monitoring and reporting program which will include a survey of residents and employee participation in the TDM program. The traffic monitoring program will include measuring traffic volumes at the access point to the project over a continuous 7-day, week-long period and will be conducted at 12 and 24 months after issuance of the Final Certificate of Occupancy for the Project. This monitoring will also include the intersection of Essex Road and County Road.

SUMMARY

Review of the proposed project and access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed residential development will have minimal impact on the surrounding roadways and intersections. The existing roadway system has sufficient capacity for the proposed project.

SECTION 2: EXISTING TRAFFIC CONDITIONS

The evaluation of a proposed project's transportation impacts requires a complete understanding of the existing transportation system within the study area. Existing conditions include roadway geometrics, traffic control, daily and peak hour traffic flows, public transportation and vehicular crash data. Each of these is discussed below:

STUDY AREA

Based on a review of the anticipated trip generation and trip distribution for the proposed development, a study area was established. The study area includes the following intersections:

- County Road (Route 1A) and Essex Road (Route 133)
- Essex Road and driveway to #28 Essex Road
- Essex Road and existing Bruni Marketplace driveways
- Essex Road and Ruth Way
- Essex Road and Heartbreak Road

FIELD SURVEY

A comprehensive field inventory of the proposed site was conducted in June 2015. The inventory included collection of existing roadway geometrics, traffic volumes, and safety data for the existing study area intersections and site access driveway locations. Traffic volumes were measured by means of automatic traffic recorder (ATR) counts and substantiated by manual turning movement counts (TMCs) conducted at the study area intersections.

GEOMETRICS

Primary study area roadways are described below.

Roadways

Essex Road (Route 133)

Essex Road is a two-lane, Urban Principal Arterial under the jurisdiction of the Town of Ipswich. Essex Road traverses the study area in a general east/west direction through Ipswich. Additional turn lanes are provided at key intersections (including County Road). Travel lanes are generally separated by a double yellow centerline. Marked shoulders are also provided. The speed limit on Essex Road in the vicinity of Essex Road is 35 miles per hour (mph). East of the site, the speed limit increases to 45 mph. There is a bituminous concrete sidewalk along the north side of the road. Land use along Essex Road in the study area consists primarily of residential uses.

Intersections

Essex Road (Route 133) and County Road (Route 1A)

Essex Road intersects County Road from the west to form this four-way unsignalized intersection. A driveway to the Hellenic Community Center forms the west leg of the intersection (slightly offset to the south). The Essex Road westbound approach consists of a left-turn lane and a channelized exclusive right-turn lane. The County Road northbound approach consists of a single lane, approximately 12 feet wide, that permits all movements. The County Road southbound approach consists of an exclusive left-turn lane and a through lane, approximately 12 feet wide. The Hellenic Community Center Driveway eastbound approach consists of a single lane, approximately 12 feet wide, that permits all movements. Essex Road is under STOP-sign control. Land use in the vicinity of the intersection consists of a motel.

Essex Road (Route 133) and #28 Essex Road

The existing driveway to #28 Essex Road intersects Essex Road from the north to form this three-way unsignalized intersection. The Essex Road approaches each consist of a 12 foot wide through lane permitting left- or right-turn movements. The driveway approach consists of a single lane permitting left- or right-turn movements. There is a bituminous concrete sidewalk along the north side of the Essex Road. Land use in the vicinity of the intersection consists primarily of wooded land and residential homes.

Essex Road (Route 133), Bruni Market Place Exit and Ruth Way

The Bruni Marketplace exit driveway intersects Essex Road from the north to form this four-way unsignalized intersection with Ruth Way forming the south leg. Ruth Way is off-set from the exit driveway by approximately 50 feet. The Essex Road approaches consist of a 12 foot wide through lane permitting left or right turns. The Exit driveway

approach consists of a 19 foot wide, single lane, permitting all movements. The Ruth Way northbound approach consists of a 12 foot wide lane permitting left or right turns. The Bruni Marketplace and Ruth Way approaches are under STOP-like control. There is a bituminous concrete sidewalk along the north side of the Essex Road. Land use in the vicinity of the intersection consists of residential homes and the Bruni Marketplace.

Essex Road (Route 133) and Bruni Market Place Driveway

The Bruni Marketplace driveway intersects Essex Road from the north to form this three-way unsignalized intersection. The Essex Road approaches consist of a 12 foot wide through lane permitting left or right turns. The driveway approach consists of a 12 foot wide, single lane, permitting all movements. The driveway approach is under STOP-like control. There is a bituminous concrete sidewalk along the north side of the Essex Road. Land use in the vicinity of the intersection consists of residential homes and the Bruni Marketplace.

Essex Road (Route 133) and Heartbreak Road

Heartbreak Road intersects Essex Road from the north to form this three-way unsignalized intersection. The Essex Road approaches each consist of a 12 foot wide through lane permitting left- or right-turn movements. The Heartbreak Road southbound approach consists of a wide (approximately 20 foot) lane permitting left- or right-turn movements. The Heartbreak Road approach is under STOP-sign control. There is a crosswalk across the Heartbreak Road approach. There is a bituminous concrete sidewalk along the north side of the Essex Road. Land use in the vicinity of the intersection consists primarily of wooded land and residential homes.

TRAFFIC VOLUMES

Existing Traffic Volumes

To establish base traffic conditions within the study area, manual turning movement and vehicle classification counts were obtained in June 2015. Peak-period turning movement counts were conducted during the weekday morning peak period (7:00 to 9:00 AM) and weekday evening period (4:00 to 6:00 PM) at the following intersections:

- County Road (Route 1A) and Essex Road (Route 133)
- Essex Road and driveway to #28 Essex Road
- Essex Road and existing Bruni Marketplace driveways
- Essex Road and Ruth Way
- Essex Road and Heartbreak Road

Daily traffic counts were conducted on Essex Road for a two day period using automatic traffic recorders (ATR).

Analysis of the peak-period traffic counts indicated that the weekday morning commuter

peak hour generally occurs between 7:30 and 8:30 AM and the weekday evening commuter peak hour generally occurs between 4:30 and 5:30 PM. The traffic count worksheets are provided in the Appendix.

The manual turning movement traffic-volume data gathered as part of this study was collected during the month of June 2015. Data from the MassDOT was reviewed to determine the monthly variations of the traffic volumes. The traffic data showed June volumes to be slightly higher than average month conditions. Therefore, the June traffic volumes were used in order to provide for a conservative analysis scenario. The 2015 existing daily and peak-hour traffic volumes for average-month conditions are summarized below in Table 1. The 2015 Existing peak hour traffic flow networks are shown graphically on Figure 2 for the weekday morning peak hour and on Figure 3 for the weekday evening peak hour. The seasonal worksheets are provided in the Appendix.

**TABLE 1
EXISTING WEEKDAY TRAFFIC VOLUME SUMMARY^a**

Location	Weekday Traffic Volume ^b	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
		Traffic Volume ^c	K Factor ^d	Directional Distribution ^e	Traffic Volume	K Factor	Directional Distribution
Essex Road, east of Ruth Way	10,900	826	7.6	51.8% EB	1,034	9.5	57.2% WB

^aTwo-way traffic volume

^bDaily traffic expressed in vehicles per day.

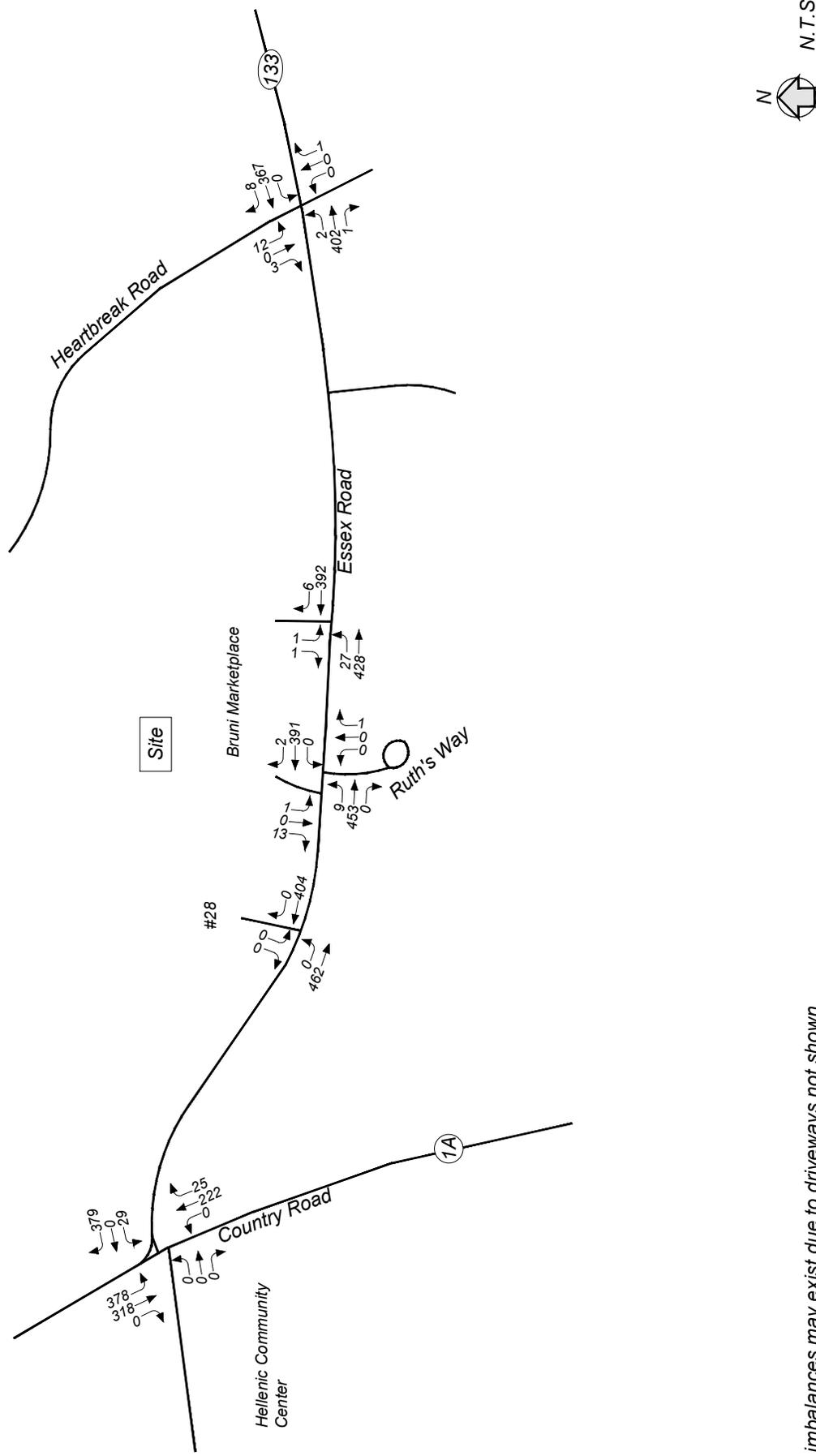
^cExpressed in vehicles per hour.

^dPercent of daily traffic volumes which occurs during the peak hour.

^ePercent of peak-hour volume in the predominant direction of travel.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound.

Essex Road was recorded to carry approximately 10,900 vehicles per day (vpd) east of Ruth Way. During the weekday morning peak hour, approximately 826 vehicles per hour (vph) were recorded, and during the weekday evening peak hour, approximately 1,034 vph were recorded.



Note: imbalances may exist due to driveways not shown.

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Figure 2
2015 Existing
Weekday Morning Peak Hour
Traffic Volumes

MOTOR VEHICLE CRASH DATA

Motor vehicle crash data for the study area intersections and roadways were obtained from the Massachusetts Department of Transportation (MassDOT) for 2010 through 2014, the most recent five-year period for which crash data is available. The motor vehicle crash data was reviewed to determine crash trends in the study area. Eight (8) crashes were reported during the five year interval. The crash data is included in the Appendix. The crash data is summarized in Table 2.

All of the crashes occurred at the intersection of County Road and Essex Road. Of these crashes, Five (5) were rear-end type collisions, There was one (1) angle-type collision, one (1) head-on collision and one (1) single-vehicle collision. The intersection does not experience a significant crash rate. No fatalities were reported at the intersection.

**TABLE 2
MOTOR VEHICLE CRASH DATA SUMMARY^a**

Scenario	Location				
	County Road and Essex Road	# 28 Driveway and Essex Road	Essex Road, Bruni Marketplace Exit and Ruth Wat	Essex Road and Bruni Marketplace Driveway	Essex Road Heartbreak Road
<i>Year:</i>					
2010	3	0	0	0	0
2011	2	0	0	0	0
2012	2	0	0	0	0
2013	0	0	0	0	0
2014	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	8	0	0	0	0
Average ^b	1.6	0.0	0.0	0.0	0.0
Crash Rate ^c	0.24	0.00	0.00	0.00	0.00
Significant ^d	No	No	No	No	No
<i>Type:</i>					
Angle	1	0	0	0	0
Rear-End	5	0	0	0	0
Sideswipe	0	0	0	0	0
Head-On	1	0	0	0	0
Single Vehicle Crash	1	0	0	0	0
Hit Fixed Object	0	0	0	0	0
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	8	0	0	0	0
<i>Time of Day:</i>					
Morning (7:00 to 9:00 AM)	1	0	0	0	0
Evening (4:00 to 6:00 PM)	0	0	0	0	0
<u>Remainder of Day</u>	<u>7</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	8	0	0	0	0
<i>Pavement Conditions:</i>					
Dry	5	0	0	0	0
Wet	1	0	0	0	0
Snow/Ice/Slush	2	0	0	0	0
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	8	0	0	0	0
<i>Severity:</i>					
Property Damage Only	6	0	0	0	0
Personal Injury	2	0	0	0	0
Fatal Accident	0	0	0	0	0
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	8	0	0	0	0

^aSource: MassDOT Safety Management/Traffic Operations Unit records..

^bAverage crashes over analysis period.

^cCrash rate per million entering vehicles (mev).

^dSignalized intersections are significant if rate >0.77 crashes per million vehicles, and unsignalized intersections are significant if rate >0.58 crashes per million vehicles.

VEHICLE SPEEDS

Existing speed data for Essex Road and Essex Road were also collected using the ATRs in June 2015. The speed data is summarized in Table 3.

**TABLE 3
OBSERVED VEHICLE SPEEDS**

Direction	Posted Speed Limit (mph)	Average Observed Speed ^a (mph)	85 th Percentile Speed (mph)
Essex Road Eastbound	35	43	47
Essex Road Westbound	35	41	45

^aBased on speed data compiled June 10 through 11, 2015.

As shown in Table 3, the average speed of vehicles travelling eastbound or westbound on Essex Road was observed to be 43 and 41 mph, respectively, exceeding the posted limit of 35 mph. The 85th percentile speed was found to be 47 mph for eastbound vehicles and 45 mph for westbound vehicles.

PUBLIC TRANSPORTATION

Located approximately 1 mile northeast of the site is the MBTAs Ipswich Commuter Rail Station on the Newbury/Rockport Line. This line provides commuter access from the north to North Station in Boston. Weekday service generally runs from 4:55 AM to 12:15 AM. Weekend service generally runs from 7:00 AM to 11:30 PM. The schedule is included in the Appendix.

PLANNED ROADWAY IMPROVEMENTS

Officials for MassDOT and the Town of Ipswich were contacted regarding roadway improvements planned for the study area intersections. There are currently no improvements planned that will improve capacity within the study area.

SECTION 3:

2022 NO-BUILD AND BUILD FUTURE CONDITIONS

To determine the impact of site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to the year 2022. Traffic volumes on the roadway network at that time, in the absence of the proposed project, would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2022. Consideration of these factors resulted in the development of 2022 No-Build traffic volumes. Anticipated site-generated traffic volumes were then superimposed upon these No-Build traffic flow networks to develop 2022 Build conditions.

2022 NO-BUILD TRAFFIC VOLUMES

Traffic growth on area roadways is a function of the expected land development in the immediate area as well as the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the study area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

Background Traffic Growth

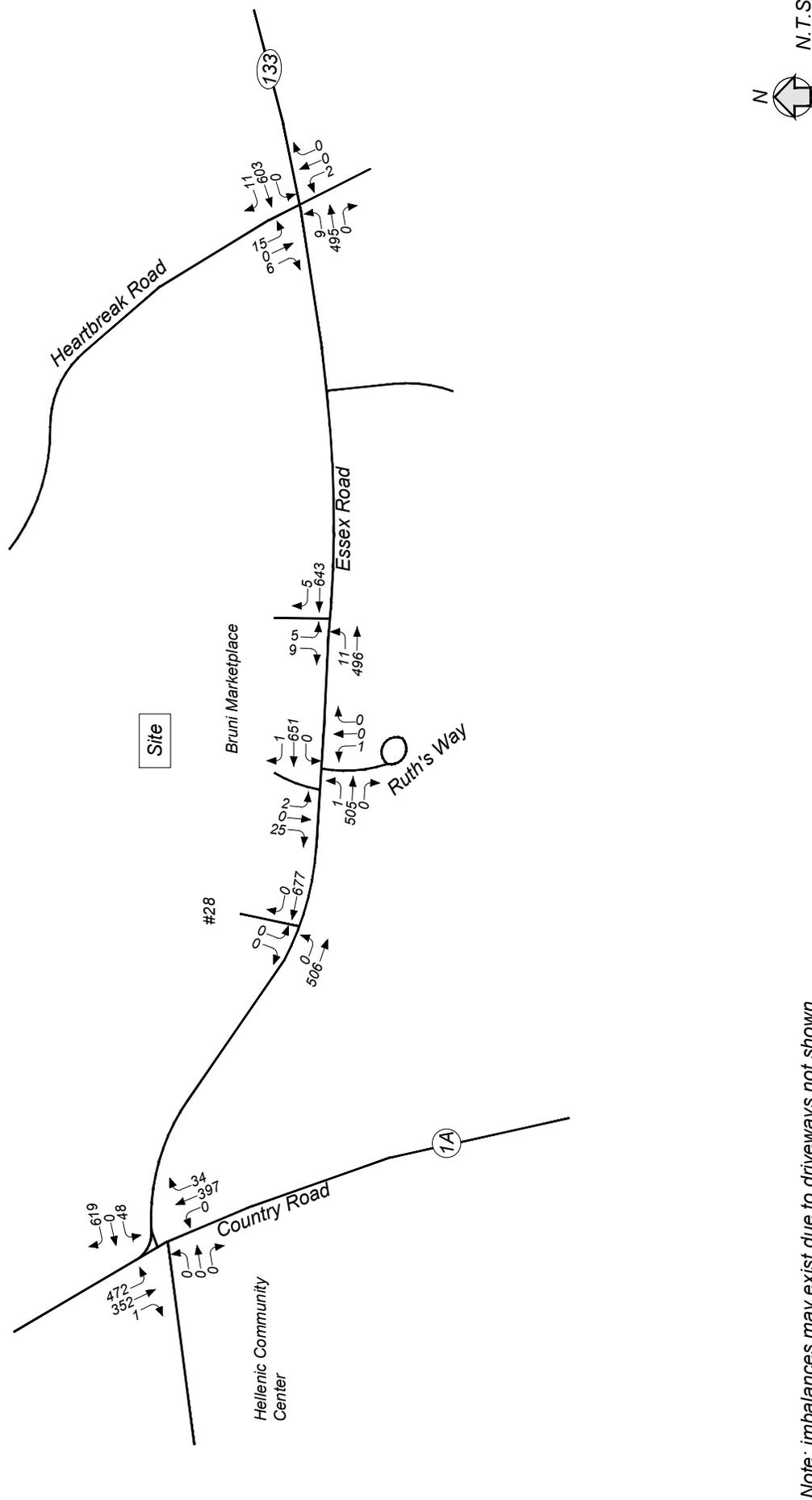
The Metropolitan Area Planning Council (MAPC) and the Central Transportation Planning Staff (CTPS) were contacted to determine regional growth for Ipswich and the surrounding area. Based on this data, growth is expected to occur at a rate of 0.40 percent per year. To provide a conservative analysis, a background growth rate of 1.0 percent per year was applied.

Specific Development by Others

Traffic volumes generated by the specific local developments by others were included in the 2022 No-Build condition. The Town of Ipswich was contacted to identify specific planned developments. One specific project, the redevelopment of the former O'Keefe automobile dealership site on County Road was identified. Traffic projections for this development were obtained from the traffic study performed for the project and included in the background projections.

No-Build Condition Traffic Volumes

The 2022 No-Build weekday morning peak hour traffic volumes were developed by applying a compounded one percent annual growth rate to the 2015 Existing peak hour traffic volumes and adding traffic from the identified background project. Figures 4 and 5 show the projected 2022 No-Build peak hour traffic volumes for the weekday morning and weekday evening peak hour conditions.



Note: imbalances may exist due to driveways not shown.

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Figure 5
2022 No-Build
Weekday Evening Peak Hour
Traffic Volumes

FUTURE 2022 BUILD CONDITIONS

Project Description

The development will consist of the construction of 194 residential apartment units. Under proposed conditions, one additional curb cut will be constructed to Essex Road, east of the Bruni Market Place driveway. The existing driveway to the single family home will be modified to accommodate the western entrance to the project.

Site Traffic Generation

Site generated traffic was based on trip-generation data published by the ITE *Trip Generation* manual². The trip generation data for Land Use Code (LUC) 220 – Apartments published by the ITE was evaluated to determine the expected trip generation for the proposed project. The expected trip generation is summarized in Table 4 and the trip generation worksheets are included in the Appendix.

TABLE 4
TRIP-GENERATION SUMMARY

	Proposed Residential Trips ^a
Average Weekday Daily Traffic	1,300
<i>Weekday Morning Peak Hour:</i>	
Entering	20
<u>Exiting</u>	<u>79</u>
Total	99
<i>Weekday Evening Peak Hour:</i>	
Entering	81
<u>Exiting</u>	<u>43</u>
Total	124

^aBased on LUC 230 – Townhouse/Condominium, 25 dwelling units.

On a typical weekday, the proposed apartments are expected to generate 1,300 daily vehicle trips (650 vehicles entering and 650 vehicles exiting). During the weekday morning peak hour, 99 vehicle trips (20 vehicles entering and 79 vehicles exiting) are expected. During the weekday evening peak hour, 124 vehicle trips (81 vehicles entering and 43 vehicles exiting) are expected. Most of this traffic is expected to be automobiles.

²*Trip Generation*, Ninth Edition; Institute of Transportation Engineers; Washington, DC; 2012.

Trip Distribution

The directional distribution of the vehicular traffic approaching and departing the site is a function of population densities, the location of employment, existing travel patterns, similar uses, and the efficiency of the existing roadway system. Journey to Work Census data was reviewed for the Town of Ipswich and a gravity model developed to determine the expected patterns of the site generated traffic. Table 5 summarizes the expected trip distribution for the residential project, which is also shown on Figure 6.

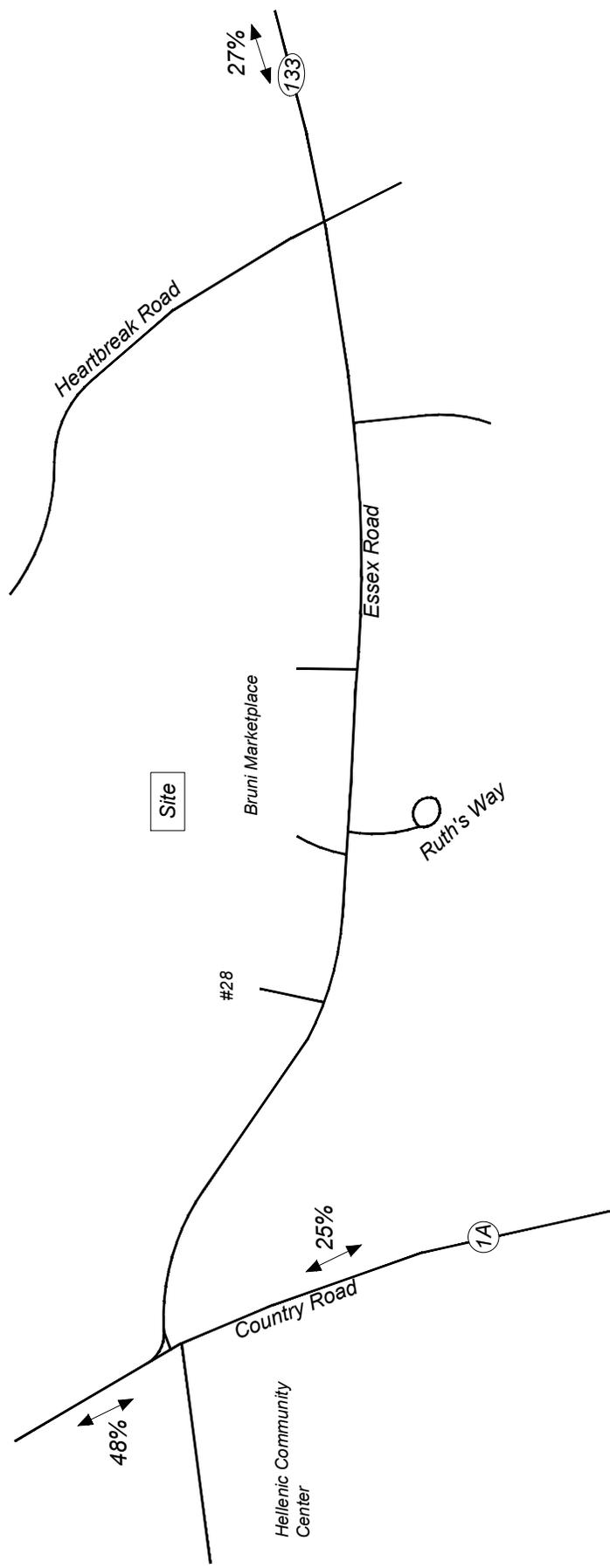
**TABLE 5
PROPOSED TRIP DISTRIBUTION**

<u>Route</u>	<u>Direction</u>	<u>Percent of Residential Development Trips</u>
County Road	North/West	48
Essex Road	East	27
County Road	South	<u>25</u>
TOTAL		100

Future Traffic Volumes - Build Condition

The site-generated traffic for the residential apartments shown in Table 4 were distributed within the study area according to the percentages summarized in Table 5. The resulting the site generated volumes and are shown on Figures 7 and 8 for the respective weekday morning and weekday evening peak hours.

The site generated traffic volumes were then superimposed onto the 2022 No-Build traffic volumes to represent the 2022 Build traffic-volume conditions. The anticipated 2022 Build weekday morning and weekday evening peak hour traffic volumes are graphically on Figures 9 and 10, respectively. These volumes were used as the basis for all analysis as well as to identify potential mitigation measures to ameliorate the project's impacts.



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Figure 6
 Trip Distribution

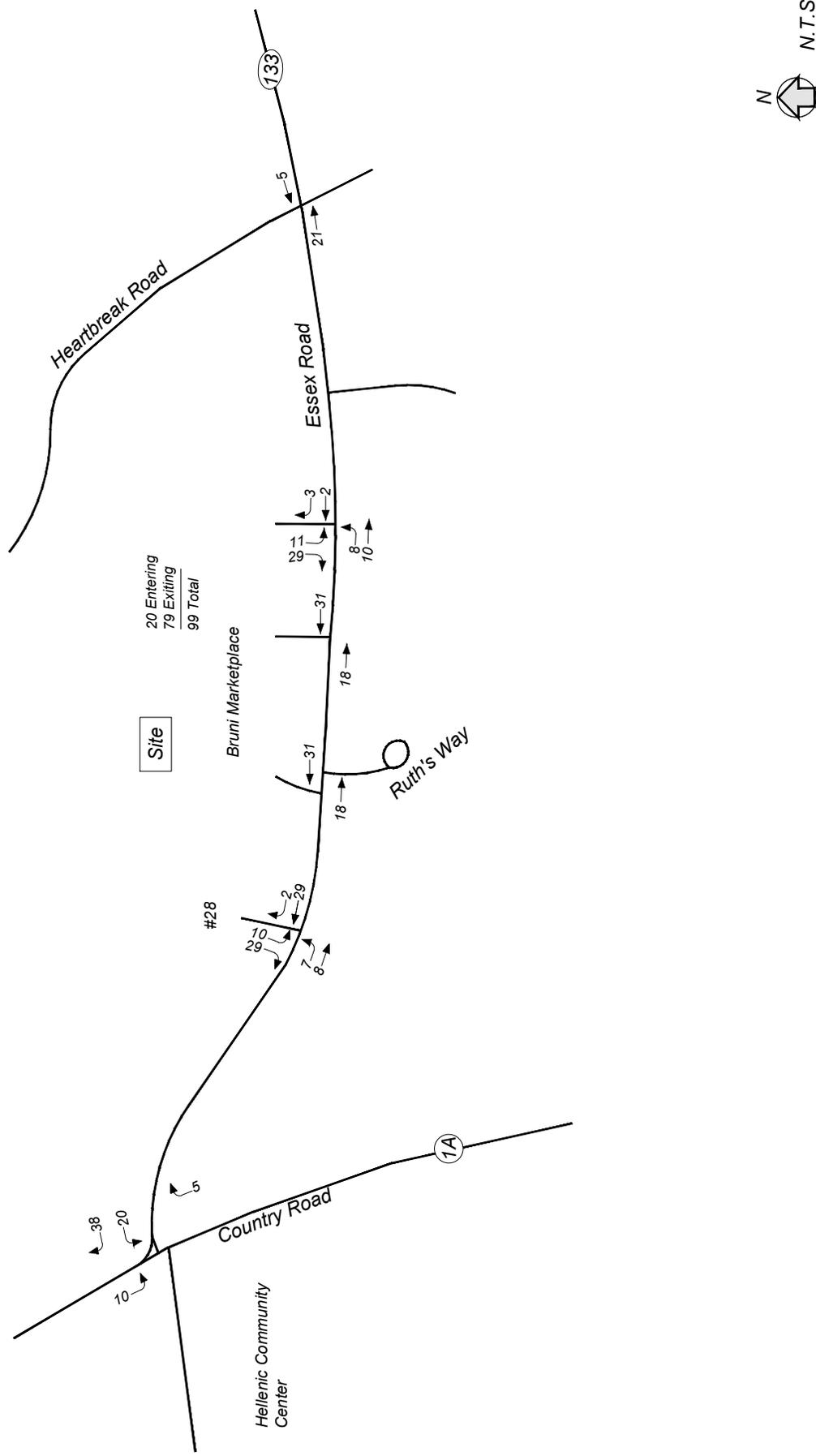
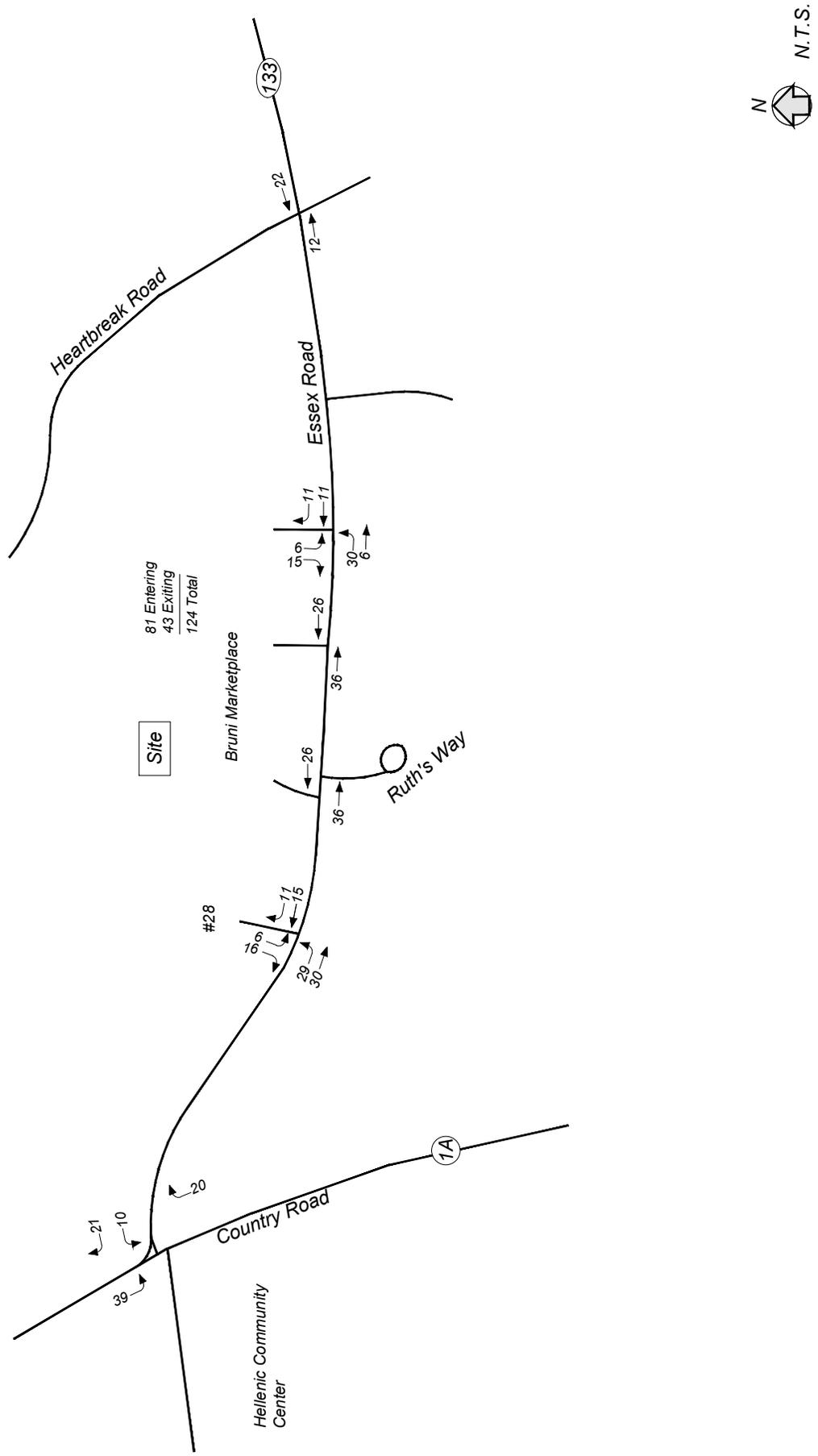


Figure 7
 Site Generated
 Weekday Morning Peak Hour
 Traffic Volumes

**Proposed Multi-Family
 Housing
 Ipswich, MA**

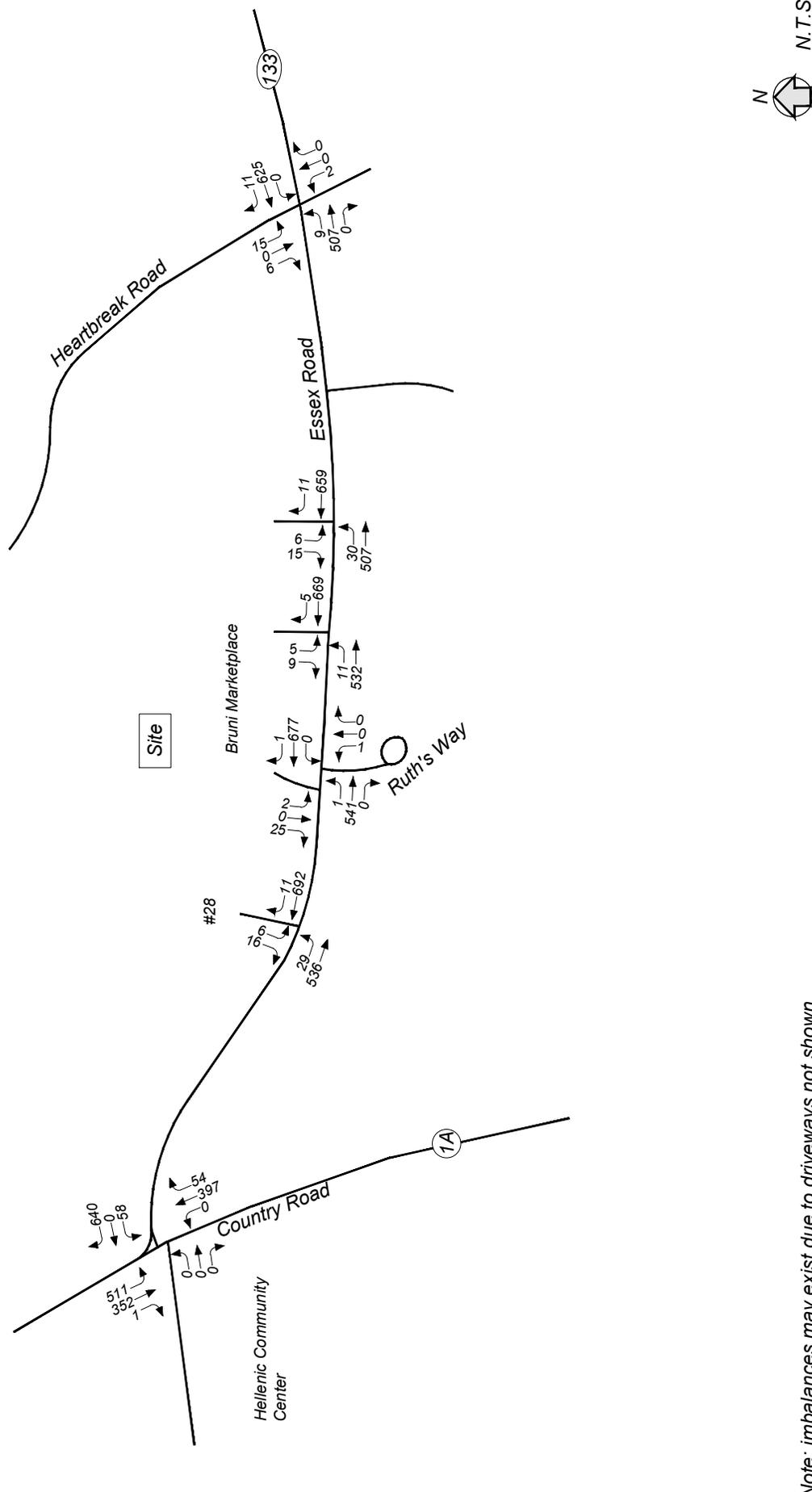
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Proposed Multi-Family Housing
 Ipswich, MA

Figure 8
 Site Generated Weekday Evening Peak Hour Traffic Volumes



Note: imbalances may exist due to driveways not shown.

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Figure 10
 2022 Build Weekday Evening Peak Hour Traffic Volumes

A summary of peak hour projected traffic-volume changes in the site vicinity are shown in Table 6. These volumes are based on the expected increases from the site traffic generation.

**TABLE 6
TRAFFIC-VOLUME INCREASES^a**

Location/Peak Hour	2022 No-Build	2022 Build	Volume Increase over No-Build	Percent Increase over No-Build
<i>Essex Road east of Heartbreak Road</i>				
Weekday Morning	863	889	26	3.0
Weekday Evening	1,124	1,158	34	3.0
<i>County Road north of Essex Road</i>				
Weekday Morning	1,421	1,469	48	3.4
Weekday Evening	1,841	1,901	60	3.3
<i>County Road, south of Essex Road</i>				
Weekday Morning	652	677	25	3.8
Weekday Evening	831	861	30	3.6

^aAll volumes are vehicles per hour, total of both directions.

As shown in Table 6, project-related increases are generally in the range of 25 to 48 bi-directional vehicles during the weekday morning peak hour. During the weekday evening peak hour, project-related increases are in the range of 34 to 60 bi-directional vehicles. This is approximately equivalent to one additional vehicle every two minutes on average during the peak hours.

SECTION 4: ANALYSIS

To assess intersection operations, capacity analyses were conducted for Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the study area intersections serve existing and projected traffic volumes. Vehicle queue analyses provide a secondary measure of the operational characteristics of an intersection or section of roadway under study in terms of lane use and demand.

CAPACITY ANALYSIS METHODOLOGY

Levels of Service

Level of service (LOS) is a quantitative measure used to describe the operation of an intersection or roadway segment. The level of service definition is described by the quality of traffic flow and is primarily defined in terms of traffic delays. The primary result of capacity analyses³ is the assignment of a level of service to traffic intersections or roadway segments under various traffic-flow conditions. Six levels of service are defined for traffic intersections and roadway segments. Levels of service range from LOS A to LOS F. LOS A represents very good operating conditions and LOS F represents very poor operating conditions.

Unsignalized Intersections

The level of service for an unsignalized intersection is determined by the methodology and procedures described in the 2010 *Highway Capacity Manual*.⁴ The level of service for unsignalized intersections is measured in terms of average delay for the critical movements (typically side street turning movements or mainline turning movements). The delay for the critical movements is a function of the available capacity for the movement and the degree of saturation of the lane group containing the critical

³The capacity analysis methodology is based on procedures presented in the *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

⁴*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

movement. The delay calculation includes the effects of initial deceleration delay approaching a STOP-sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. The definitions for level of service at unsignalized intersections are also provided in the 2010 *Highway Capacity Manual*. Table 7 summarizes the relationship between level of service and average control delay for the critical movements at unsignalized intersections.

TABLE 7
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS^a

Average Delay (seconds per vehicle)	Resulting Level of Service $v/c^b < 1.0$	Resulting Level of Service $v/c > 1.0$
≤ 10.0	A	F
10.1 to 15.0	B	F
15.1 to 25.0	C	F
25.1 to 35.0	D	F
35.1 to 50.0	E	F
>50.0	F	F

^a*Highway Capacity Manual*; Transportation Research Board; Elm, DC; 2010; page 19-2

^bVolume to capacity ratio.

The analytical methodologies used for the analysis of unsignalized intersections use conservative analysis parameters, such as high critical gaps. The critical gap is defined as the minimum time between successive main line vehicles for a side street vehicle to execute the appropriate turning maneuver. Actual field observations indicate that drivers on minor streets accept smaller gaps in traffic than those used in the analysis procedures and therefore experience less delay than calculated by the HCM methodology. **The analysis results overstate the actual delays experienced in the field. Based on existing intersection observations, actual operations will be better than the HCS methodology indicates under the future Build condition.** It should be noted that the unsignalized intersections along heavily trafficked roadways operate at constrained levels and the resulting calculated results of the unsignalized intersection analyses should be considered highly conservative.

Signalized Intersections

Levels of service for signalized intersections are calculated using the methodology and procedures described in the 2010 *Highway Capacity Manual*. The methodology assesses the intersection based on type of signal operation, signal timing and phasing, progression, vehicle mix, and intersection geometrics. Level-of-service designations are based on the delay per vehicle. Table 8 summarizes the relationship between level of service and delay. The calculated delay values result in level-of-service designations which are

applied to individual lane groups, to individual intersection approaches, and to the entire intersection.

TABLE 8
LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS^a

Delay per Vehicle (Seconds)	Resulting Level of Service $v/c^b < 1.0$	Resulting Level of Service $v/c^b > 1.0$
≤10.0	A	F
10.1 to 20.0	B	F
20.1 to 35.0	C	F
35.1 to 55.0	D	F
55.1 to 80.0	E	F
>80.0	F	F

^a*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010; page 18-6.

^bVolume to capacity ratio.

CAPACITY ANALYSIS RESULTS

Level-of-service analyses were conducted for 2015 Existing, 2022 No-Build and 2022 Build conditions for the intersections within the study area. The results of the unsignalized capacity analyses are summarized in Table 9. Detailed analysis sheets are presented in the Appendix.

**TABLE 9
UNIGNALIZED LEVEL-OF-SERVICE ANALYSIS SUMMARY**

Critical Movement/ Peak Hour	2015 Existing				2022 No-Build				2022 Build			
	Demand ^a	V/C ^b	Delay ^c	LOS ^d	Demand	V/C	Delay	LOS	Demand	V/C	Delay	LOS
County Road and Essex Road												
<i>Left-turn/through movements from Essex Road:</i>												
Weekday Morning	29	0.39	>50	F	31	0.52	>50	F	51	0.93	>50	F
Weekday Evening	45	0.80	>50	F	48	1.27	>50	F	58	1.91	>50	F
Essex Road and #28 Essex Road Driveway												
<i>All movements from driveway:</i>												
Weekday Morning	0	0.00	0.0	A	0	0.00	0.0	A	39	0.10	14.5	B
Weekday Evening	0	0.00	0.0	A	0	0.00	0.0	A	22	0.09	19.4	C
Essex Road, Bruni Marketplace Exit and Ruth Way												
<i>All movements from Exit:</i>												
Weekday Morning	14	0.04	11.6	B	14	0.05	12.0	B	14	0.05	12.4	B
Weekday Evening	27	0.08	14.2	B	27	0.09	15.3	C	27	0.10	15.9	C
<i>All movements from Ruth Way:</i>												
Weekday Morning	1	0.01	11.3	B	1	0.01	11.6	B	1	0.01	11.8	B
Weekday Evening	1	0.03	27.8	D	1	0.03	33.3	D	1	0.03	36.6	E
Essex Road and Bruni Marketplace Driveway												
<i>All movements from driveway:</i>												
Weekday Morning	2	0.01	14.3	B	2	0.01	15.3	C	2	0.01	16.0	C
Weekday Evening	14	0.05	16.1	C	14	0.05	17.8	C	14	0.06	18.7	C
Essex Road and Proposed Site Driveway												
<i>All movements from Driveway:</i>												
Weekday Morning	--	--	--	--	--	--	--	--	40	0.10	14.0	B
Weekday Evening	--	--	--	--	--	--	--	--	21	0.08	18.2	C
Essex Road and Heartbreak Road												
<i>All movements from Heartbreak Road:</i>												
Weekday Morning	15	0.06	17.3	C	16	0.08	19.1	C	16	0.08	19.8	C
Weekday Evening	20	0.12	22.3	C	21	0.15	26.7	D	21	0.16	28.1	D

^aDemand of critical movements in vehicles per hour.

^bVolume-to-capacity ratio.

^cDelay in seconds per vehicle.

^dLevel of service.

^eCalculated delay and v/c not representative of actual conditions when v/c exceeds 1.0.

Essex Road (Route 133) and County Road (Route 1A)

Under 2015 Existing conditions, during the weekday morning peak hour, the critical movements (shared left-turn/through movements from Essex Road) are projected to operate at LOS F during the weekday morning peak hour and at LOS F during the weekday evening peak hour. Based on existing intersection observations, actual operations are better than the HCS methodology indicates. Under future 2022 No-Build conditions, these critical movements are projected to continue to operate at LOS F during the weekday morning and weekday evening peak hours. Under future 2022 Build conditions, with the project, these critical movements are projected to continue to operate at LOS F during the weekday morning and weekday evening peak hours.

Essex Road (Route 133) and #28 Essex Road

Under 2015 Existing conditions, during the weekday morning peak hour, the critical movements (all movements from the driveway) are projected to operate at LOS A during the weekday morning and weekday evening peak hours. Under future 2022 No-Build conditions, these critical movements are projected to operate at LOS A during the weekday morning and weekday evening peak hours. Under future 2022 Build conditions, this driveway will become the westernmost site driveway and the critical movements are projected to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday evening peak hour.

Essex Road (Route 133), Bruni Market Place Exit and Ruth Way

Under 2015 Existing conditions, during the weekday morning peak hour, the critical movements (all movements from the driveway) are projected to operate at LOS B during the weekday morning and weekday evening peak hours. Under future 2022 No-Build conditions, these critical movements are projected to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under future 2022 Build conditions, the critical movements are projected to continue to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday evening peak hour.

Essex Road (Route 133) and Bruni Market Place Driveway

Under 2015 Existing conditions, during the weekday morning peak hour, the critical movements (all movements from the driveway) are projected to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under future 2022 No-Build conditions, these critical movements are projected to operate at LOS C during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under future 2022 Build conditions, these critical movements are projected to continue to operate at LOS C during the weekday morning peak hour and at LOS C during the weekday evening peak hour.

Essex Road (Route 133) and Proposed Site Driveway

Under future 2022 Build conditions, the critical movements (all movements from the site driveway) are projected to operate at LOS B during the weekday morning peak hour and at LOS C during the weekday evening peak hour.

Essex Road (Route 133) and Heartbreak Road

Under 2015 Existing conditions, during the weekday morning peak hour, the critical movements (all movements from Heartbreak Road) are projected to operate at LOS C during the weekday morning peak hour and at LOS C during the weekday evening peak hour. Under future 2022 No-Build conditions, these critical movements are projected to operate at LOS C during the weekday morning peak hour and at LOS D during the weekday evening peak hour. Under future 2022 Build conditions, these critical movements are projected to continue to operate at LOS C during the weekday morning peak hour and at LOS D during the weekday evening peak hour.

SIGHT DISTANCE

Sight distance measurements were performed at the intersection of Essex Road with the new driveways for the residential component of the project in accordance with Massachusetts Department of Transportation (MassDOT) and American Association of State Highway and Transportation Officials (AASHTO) standards. Stopping sight distance (SSD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. Intersection sight distance (ISD) or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway, to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. Table 10 presents the measured SSD at the intersections of the two proposed residential site driveways at Essex Road. The sight distance calculations are included in the Appendix.

**TABLE 10
SIGHT DISTANCE SUMMARY**

	Required Minimum (Feet) ^a	Measured (Feet)
<i>Essex Road and Proposed East Site Driveway</i>		
<i>Stopping Sight Distance:</i>		
Essex Road approaching from the east	359	500+
Essex Road approaching from the west	384	500+
<i>Intersection Sight Distance:</i>		
Driveway looking to the east	430 ^b /518 ^c	555
Driveway looking to the west	430 ^b /518 ^c	500+
<i>Essex Road and Proposed West Site Driveway (#28 Essex Road)</i>		
<i>Stopping Sight Distance:</i>		
Essex Road approaching from the east	359	400
Essex Road approaching from the west	384	450
<i>Intersection Sight Distance:</i>		
Driveway looking to the east	430 ^b /518 ^c	360 ^d
Driveway looking to the west	430 ^b /518 ^c	450

^aRecommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*; American Association of State Highway and Transportation Officials (AASHTO); 2010, and based on 85th percentile speed of 45 mph for Essex Road westbound and 47 mph for Essex Road eastbound.

^bRecommended minimum value for vehicles turning right exiting a roadway under STOP-sign control.

^cRecommended minimum value for vehicles turning left exiting a roadway under STOP-sign control.

^dExisting ISD impacted by existing building on site. Building to be partially removed and resulting ISD will be approximately 470 feet.

As can be seen in Table 10, the SSD measurements performed at proposed residential site driveway intersections with Essex Road indicate that the intersections exceed the recommended minimum requirements based on the 85th percentile speeds. In accordance with the AASHTO manual, “*If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road.*” Accordingly, the ISD should be at least equal to the SSD, which would allow a driver approaching the minor road to safely stop. It is recommended that any proposed landscaping be less than three (3) feet in height and maintained for sight lines.

SECTION 5: RECOMMENDATIONS AND CONCLUSION

RECOMMENDATIONS

The final phase of the analysis process is to identify the mitigation measures necessary to minimize the impact of the project on the transportation system. The proponent has made a commitment to implement the mitigation measures listed below.

The capacity analyses performed for the unsignalized study area intersections indicate that overall, the intersections operate at good levels of service, with minor delays for the critical movements.

The project Proponent has proposed a combination of structural and non-structural mitigation measures to address the potential impacts of the proposed project. The proposed mitigation measures are identified below.

County Road and Essex Road

The critical movements at this intersection are projected to operate at level of service F during the weekday morning and evening peak hours, with or without the project. Observations of existing conditions indicate that actual operations are not as poor as the HCS model indicates. As part of the mitigation, the project proponent will monitor this intersection 12 and 24 months after issuance of the Final Certificate of Occupancy for the Project. If the resulting level of service is poor (resulting from the project), the Project proponent will commit to providing design plans for the signalization of the intersection.

Essex Road and West Site Driveway

It is recommended that the site driveway consist of one entering and one exiting lane. The exiting lane should be under STOP sign control. To improve sight distances to the east, it is recommended that approximately 12 feet of the existing retail building located within Bruni Marketplace be removed and landscaped. Landscaping should not exceed three (3) feet in height and be maintained so as to not impact sight distances.

Essex Road and East Site Driveway

It is recommended that the site driveway consist of one entering and one exiting lane. The exiting lane should be under STOP sign control. Landscaping in the vicinity of the driveway should not exceed three (3) feet in height and be maintained so as to not impact sight distances.

Transportation Demand Management

A Transportation Demand Management (TDM) plan will be implemented to reduce the project's overall traffic impact through the implementation of measures that are aimed at minimizing the use of single occupancy vehicles the Proponent will implement a number of measures that will contribute toward the reduction of vehicular traffic to and from the site. As part of the TDM program, a transportation coordinator (commercial accommodations staff member) will be responsible for overseeing the TDM program. The program will include ridesharing opportunities.

Ridesharing - The Proponent will promote ridesharing to its tenants by way of carpools. Information regarding carpooling and its benefits will be distributed to all residents and posted in common areas. The on-site transportation coordinator will be responsible to ensure that the ridesharing program is promoted and provided.

Carpool Parking Spaces - Two parking spaces will be designated as "Carpool Only". Signage will be provided for each space clearly marking them as carpool spaces only.

Bicycle Facilities - Provide secure bicycle racks, which provides the cyclist with a degree of comfort, knowing their bicycle is safe, and as such more likely to be used as a means of travel to/from work or for recreation.

Monitoring - The applicant shall, in consultation with the Town of Ipswich, conduct a traffic monitoring and reporting program which will include a survey of residents and employee participation in the TDM program. The traffic monitoring program will include measuring traffic volumes at the access points to the project over a continuous 7-day, week-long period and will be conducted at 12 and 24 months after issuance of the Final Certificate of Occupancy for the project.

Zip Car - Explore the potential to provide one parking space reserved for Zipcar (Zipcar is a nationwide car-sharing service which is also used extensively in the Boston metropolitan area) or other similar ride share program. This will encourage people who do not own a vehicle to use the service and be rewarded with a parking spot when they come back to the site.

Traffic Monitoring

The Applicant shall, in consultation with the Town of Ipswich, conduct a traffic monitoring and reporting program which will include a survey of residents and employee participation in the TDM program. The traffic monitoring program will include

measuring traffic volumes at the access point to the project over a continuous 7-day, week-long period and will be conducted at 12 and 24 months after issuance of the Final Certificate of Occupancy for the Project. This monitoring will also include the intersection of Essex Road and County Road.

CONCLUSION

The project site is located on the north side of Essex Road, east of County Street (Route 1A). On a typical weekday, the proposed apartments are expected to generate 1,300 daily vehicle trips (650 vehicles entering and 650 vehicles exiting). During the weekday morning peak hour, 99 vehicle trips (20 vehicles entering and 79 vehicles exiting) are expected. During the weekday evening peak hour, 124 vehicle trips (81 vehicles entering and 43 vehicles exiting) are expected.

Capacity analyses were performed for each of the study area intersections for 2015 Existing, 2022 No-Build and 2022 Build conditions. Based on the analyses performed, there is no significant change in level of service from No-Build to Build conditions at the signalized study area intersections.

It is recommended that site driveways consist of one entering and one exiting lane. The exiting lanes should be under STOP sign control. To improve sight distances to the east, it is recommended that approximately 12 feet of the existing retail building located within Bruni Marketplace be removed and landscaped. Vegetation or proposed landscaping along Essex Road in front of the site and within the layout should be cleared and maintained so as to maintain sight distances.

Review of the proposed residential development and access plan shows that in relation to roadway capacity, traffic safety, and traffic impacts upon the surrounding roadway network, the proposed project will meet safety standards and have a minimal impact on existing traffic conditions. With the proposed access, in conjunction with the mitigation measures described above and maintaining sight distances from the driveway (clear sight lines along frontage), safe and efficient access can be provided to the clientele of the proposed residential development and to the motoring public in the area.