Traffic Impact and Access Study

Proposed 40B Residential Development
133 West Union Street

Ashland, Massachusetts

Prepared for

Capital Group Properties

June 2014
Revised August 2014

Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

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TABLE OF CONTENTS

1.0 INTRODUCTION & EXECUTIVE SUMMARY 1

2.0 EXISTING TRAFFIC CONDITIONS 5

2.1 EXISTING ROADWAY NETWORK 5

2.1.1 West Union Street (Route 135) 2
2.1.2 Route 135 at Chestnut Street/Homer Ave 2
2.1.3 Route 135 at Main Street 3
2.1.4 Route 135 (West Union Street/Union Street) at Summer Street 3
2.1.5 Route 135 at MBTA Access Road/Voyagers Lane 4
2.1.6 Route 135 at James Jackson Way 5
2.1.7 Route 135 at Frankland Road and Route 135 at Olive Street 5

2.2 TRAFFIC VOLUMES 6

2.3 CRASH EXPERIENCE 10

2.4 EXISTING PUBLIC TRANSIT NETWORK 12

3.0 PROBABLE IMPACTS OF THE PROJECT 14

3.1 NO-BUILD TRAFFIC VOLUMES 14

3.1.1 Background Traffic Growth 14
3.1.2 Site Specific Developments 14
3.1.3 No-Build Traffic Volumes 15

3.2 PROPOSED PROJECT DESCRIPTION 18

3.3 SITE GENERATED TRAFFIC VOLUMES 18

3.3.1 Site Trip Generation 18
3.3.2 Trip Distribution/Assignment 19
3.3.3 Build Traffic Volumes 19

4.0 ANALYSIS 25

4.1 TRAFFIC VOLUME INCREASES 25

4.2 CAPACITY/LEVEL OF SERVICE (LOS) ANALYSIS 26

4.3 SIGHT DISTANCE ANALYSIS 35

5.0 CONCLUSION AND RECOMMENDATIONS 37

APPENDICES

Appendix A- Traffic Volumes
Appendix B- Crash Rate Calculations
Appendix C- Trip Generation/ Trip Distribution Calculations and Specific Development Projects
Appendix D- Level of Service Computation Sheets

FIGURES

Figure 1- Project Location 2
Figure 2- Study Intersections 5
Figure 3- Estimated Existing Weekday AM Peak Hour Traffic Volumes 8
Figure 4- Estimated Existing Weekday PM Peak Hour Traffic Volumes 9
Figure 5- Estimated Future No Build Weekday AM Peak Hour Traffic Volumes 16
Figure 6- Estimated Future No Build Weekday PM Peak Hour Traffic Volumes 17
Figure 7- Trip Distribution 20
Figure 8-AM Peak Hour Site Generated Trips 21
Figure 9- PM Peak Hour Site Generated Trips 22
Figure 10- Full Build AM Peak Hour Traffic Volumes 23
Figure 11- Full Build PM Peak Hour Traffic Volumes 24

TABLES

Table 2.1- ATR Data Summary, February 2014 6
Table 2.2- Summary of ATR Data, July 2013, West Union Street, east of Frankland Road 7
Table 2.3- Summary of Speed Data (MPH) 7
Table 2.4 Summary of Reported Crashes 2009-2011 11
Table 2.4 (continued) Summary of Reported Crashes 2009-2011 12
Table 3.1- Summary of Estimated Site Generated Vehicle Trips 18
Table 4.1- Summary of Estimated Roadway Traffic Increases 25
Table 4.2- Level of Service Criteria for Signalized and Unsignalized Intersections 26
Table 4.3 Summary of Level of Service Analysis, AM Peak Hour 27
Table 4.3 (Continued) - Summary of Level of Service Analysis, AM Peak Hour 28
Table 4.4 - Summary of Level of Service Analysis, PM Peak Hour 29
Table 4.4 (Continued) - Summary of Level of Service Analysis, PM Peak Hour 30
Table 4.5- Phase 1 Commercial Summary 32
Table 4.6 Summary of Level of Service Analysis, Build vs Build Plus AM Peak Hour 32
Table 4.6 (Continued) Summary of Level of Service Analysis, Build vs Build Plus AM Peak Hour 33
Table 4.7 Summary of Level of Service Analysis, Build vs Build Plus PM Peak Hour 34
Table 4.7 (Continued) Summary of Level of Service Analysis, Build vs Build Plus PM Peak Hour 35
TABLE 4.8- Summary of Sight Distance Analysis 36

1.0 INTRODUCTION & EXECUTIVE SUMMARY

This transportation study provides an analysis of the traffic impacts, area circulation and access impacts associated with the proposed residential development located at 133 West Union Street (Route 135) in Ashland, MA. The site abuts State Route 135. The site location is shown on Figure 1 with respect to the study area on Route 135 and its intersections with Main Street, Chestnut Street/Homer Ave, Summer Street, MBTA Access/Voyagers Lane, Ashland Junior High School, Frankland Road and Olive Street.

This traffic analysis for the Residences at 133 West Union Street is focused on the current plan to construct apartments consisting of 140 units of housing; 74 units with one bedroom and 66 units with two bedrooms. Currently, the proposed site will consist of two four-story buildings composed of 40 units each, two three-story buildings composed of 29 units each, one separate building with 2 units and a total of 260 parking spaces. The study area chosen for the traffic analysis considered previous work in the area, the proposed site and general knowledge of the surrounding area.

This study includes an evaluation of existing and future (No-Build and Build) traffic volume networks, roadway/site access, traffic circulation and safety considerations. In general, the traffic study follows guidelines established by the Massachusetts Department of Transportation, the Institute of Transportation Engineers (ITE), and the input from the Town of Ashland. As part of the study, a series of traffic counts were collected, safety aspects of the abutting roadway system were evaluated, and forecasts of project traffic completed. The August 2014 report was updated to clarify future condition assumptions. The following sections of the report describe the data, analysis methods and results of the analysis.

EXISTING CONDITIONS

The study focuses on the evaluation of the site drive intersection as well as nearby intersections on Route 135 including the following intersections:

- Union Street and Main Street
- Union Street and Chestnut Street/Homer Avenue
- Union Street and Summer Street
- West Union Street and MBTA Access/Voyagers Lane
- West Union Street and Ashland Junior High School Drive
- West Union Street and Frankland Road and Olive Street

Route 135 is a two-way two-lane roadway classified as an urban principal arterial that is maintained by the Town of Ashland in the project area. In the vicinity of the project and in an overall sense, Route 135 is considered an east-west highway and will be referred to as the east-west approach in this report. In the project area, Route 135 provides connections to Hopkinton and I-495 to the west and Framingham to the east. Locally, Route 135 is known as West Union Street west of the intersection with Summer Street, and Union Street east of the intersection.

The MBTA Access Road is a local two lane roadway providing access to Ashland MBTA train station. Ashland Middle School is located at the end of a 500 foot driveway which intersects Route 135, and was included in this study. The other streets (Chestnut Street, Homer Avenue, Summer Street, Voyagers Lane, Frankland Road and Olive Street) are all considered local roadways.

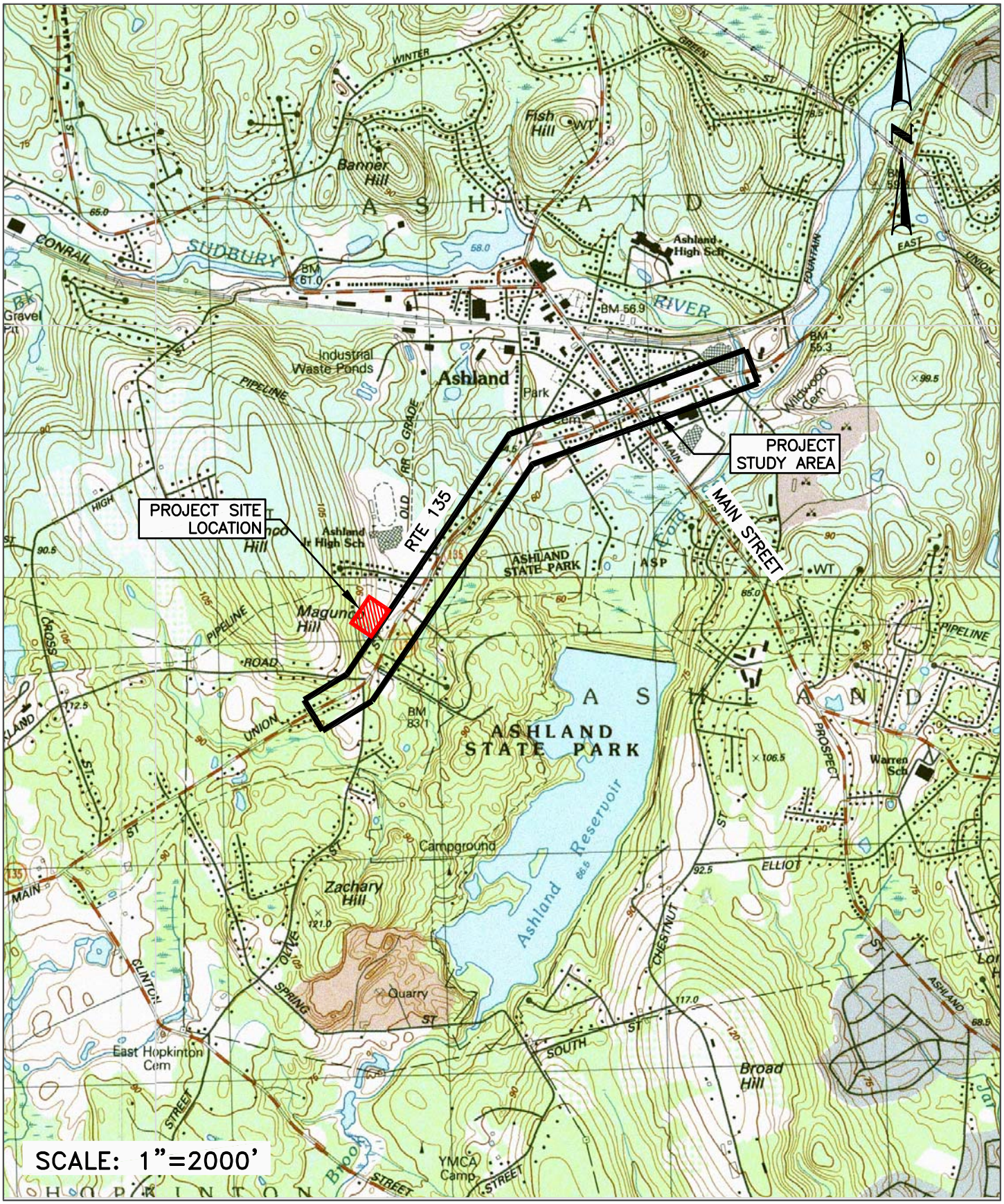

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Figure 1
Project Location
133 West Union Street Development
Ashland, Massachusetts

Recent daily traffic volume data collected on Route 135 in this area showed the roadway to be carrying approximately 14,300 vehicles per day (vpd). The evaluation of the signalized intersections at Summer Street and at Voyagers Lane indicate operations currently at LOS B or higher during the peak periods. The evaluation of the signalized intersections of Union Street and Main Street and Union Street and Chestnut Street indicate operations currently at LOS E or higher during peak hours.

FUTURE CONDITIONS

The analysis of the proposed residential development focused on the year 2021. It included estimating traffic conditions for the year 2021 with and without the specifically proposed project. Forecasts of the project were based on guidelines and trip models published by the Institute of Transportation Engineers (ITE). The project is to consist of 140 housing units with access to the residential development site on the north side of Route 135.

Based on the ITE models, the proposed development at full development in total is estimated to generate 972 vehicle trips on a typical weekday. These trips include 486 entering trips and 486 exiting trips over the 24-hour period. The weekday morning peak hour is expected to generate 72 new vehicle trips with 14 inbound and 58 outbound trips. The weekday afternoon peak hour is estimated to generate 95 new vehicle trips with 62 inbound and 33 outbound.

In addition to project site related traffic, a background growth rate was added along with traffic expected from specific development projects in Ashland that are either underway or planned and unrelated to this project. The future conditions also included consideration of the Legacy Farms development in Hopkinton that began occupancy in the fall of 2013.

The analysis examined the No-Build and Build conditions to determine the incremental impact of the proposed development. The analysis showed the proposed development resulting in relatively small changes in traffic operating conditions at the signalized study intersections. Route 135 was also shown to have the capacity to accommodate the new project related traffic, although motorists exiting the site during the peak hours and turning left will be delayed, but on site and not affecting Route 135 traffic. In addition to operating conditions, the evaluation of sight distances in relation to the proposed site drive location indicated that safety criteria would be satisfied under prevailing travel speeds.

RECOMMENDATIONS

While the analyses shows the proposed project can be accommodated on the study area, several recommendations have been made to enhance the transportation system and reduce the project's impact. The proposed actions are as follows:

Project Related

- Any landscaping and signing proposed at the site driveway intersection with Route 135 should be designed and maintained in such a manner so as to not impede sight distances at the driveway.
- Install STOP sign and marked STOP bar for the site driveway approach to Route 135.
- The site drive should be designed to accommodate two exit lanes to be designated as left and right turn lanes.

- Consideration should be given to installing a sidewalk along the north side of West Union Street between the site and the end of sidewalk near the Middle School. This work assumes adequate right of way exists.
- Vegetation and brush on the northerly side of Route 135 within the public right of way along the site's frontage west of the site driveway should be trimmed or cleared further to enhance the sight distance. In addition, this area can also be regraded to approximately the existing road grade to further enhance sight distance.
- To enhance driver awareness along Route 135 of the proposed site driveway, an advanced intersection warning sign (W2-2) and distance plaque (W16-2a) should be installed on Route 135 approximately 400 feet west of the proposed driveway.

Non-Project Related

- The delays at Ashland Junior High School could be reduced with a traffic control person or police detail, although the duration of the delays are relatively short. Our understanding is that a pedestrian crossing guard is in place at the drive but this does not result in consistent vehicular traffic control.
- The specific development projects included in this study such as the Rail District Project are expected to cause an increase in vehicle delay at the intersection of Summer Street and Union Street; mitigation including signal timing updates should be considered prior to construction of these projects.
- As discussed above, advanced intersection warning signs (W2-2) and speed plaque (W13-1P) should be installed at the intersection of Route 135 and Frankland Road/ Olive Street. To increase corner or stopping sight distances, it may also be desirable to remove or trim back several trees and re-grade the side slopes within the public layout as they relate to the Frankland Avenue approach to Route 135.

Independent of the project, it would appear to be beneficial if an increase in speed enforcement in the area of West Union Street and Olive Street could be periodically implemented. Alternatively, it may be possible to install an electronic speed check/display sign in relation to eastbound traffic west of Olive Street to encourage lower speeds as motorists enter the more dense area of Route 135.

In conclusion, while the proposed project will increase traffic on the study area network, with the above recommendations, it can be safely accommodated, and its potential impact on traffic operations on roadways and intersections within the study area can be adequately alleviated.

2.0 EXISTING TRAFFIC CONDITIONS

In studying the impacts of the proposed development, an understanding of the area transportation system is needed. Inventories were completed to identify the physical and operational characteristics of the system. The following sections describe the existing transportation system.

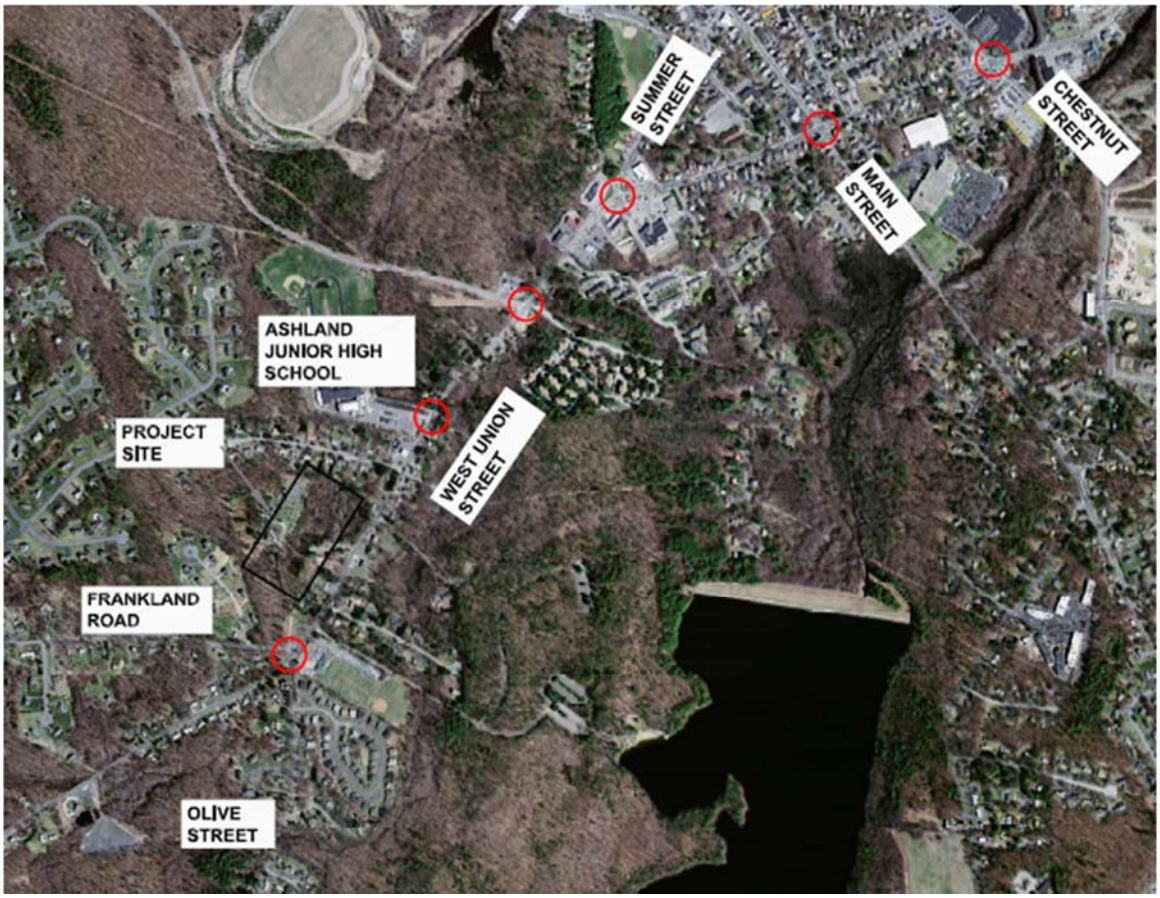
2.1 Existing Roadway Network

The study area was selected based on previous work and knowledge of the project area. It has also considered traffic related issues that have been raised in the past at the State as well as regional planning levels. The study area intersections for this analysis included:

- Route 135 at Chestnut Street/Homer Ave
- Route 135 at Union Street
- Route 135 (West Union Street/Union Street) at Summer Street
- Route 135 at MBTA Access/Voyagers Lane
- Route 135 at Ashland Middle School Drive
- Route 135 at Frankland Road
- Route 135 at Olive Street

Figure 2 illustrates the study area roadways and intersections while subsequent photographs show the current conditions of the study network.

Figure 2- Study Intersections



A general description of these roadways follows:

2.1.1 *West Union Street (Route 135)*

Route 135, which is an urban principal arterial roadway, comes under the jurisdiction of the Town of Ashland. It has a general northeast-southwest alignment within the area; as stated earlier in this report it will be referenced as east-west. It begins at U.S. Route 20 in Northborough and ends at the interchange with Interstate 95 (Route 128) in Dedham. Within the Ashland area, Route 135 is two-lane roadway. Starting from Town of Ashland border with Hopkinton, it is called West Union Street, provides connections to East Main Street in Hopkinton. West Union Street extends to the west, connects with Olive Street on the south side of Route 135 and Frankland Road on the north side to form two closely-spaced three-way unsignalized intersections. Route 135 continues to the east direction, passing Ashland Middle School on the north side, and connects with MBTA Access Road on the north side and Voyagers Lane on the south side to form a four-way signalized intersection. Continuing to the east, Route 135 connects with Summer Street on the north side to form a three-way signalized intersection. East of Summer Street, West Union Street becomes Union Street until a signalized intersection approximately 1 mile east of Summer Street where Union Street splits into two directions. The north leg of this fork becomes Waverly Street (Route 135) which extends to Framingham, while the south leg becomes East Main Street.

Within the Ashland area, the posted speed limit on Route 135 is 35 miles per hour (mph) for both directions, with the exception of posted speed limit of 20 mph for both directions in the vicinity of Ashland Middle School during school related periods. Pavement is in fairly good condition and within the project, area roadway width is approximately 28 feet. A sidewalk currently exists on the north side of Route 135 east of Indian Spring Road to the end of the east study area. There is also a sidewalk on the south side of Route 135 approximately 350 feet to the west of Summer Street to the east end of the study area. Sidewalks are in fairly good condition, however, several handicap ramps are in relatively poor condition. There are no sidewalks immediately near the project. Pavement markings along the roadway consist of double yellow center lines and single white edge lines; markings are in fairly good condition.

Route 135 is considered an east-west highway. For the purpose of this report, it will be referred to as eastbound-westbound approach while the intersecting roadways will be referred to as northbound-southbound approach.

2.1.2 *Route 135 at Chestnut Street/Homer Ave*

Route 135 intersects Chestnut Street and Homer Ave at a signalized intersection. Route 135 provides the eastbound and westbound approaches, Chestnut Street provides the northbound approach and Homer Ave provides the southbound approach. Route 135 contains a left turn lane on both approaches, and Chestnut Street contains a right turn lane. The intersection contains approximately 11 foot lanes with 2 foot shoulders. There are 10 foot crosswalks on each approach, and there are sidewalks along each side. The signal is fully actuated with an all

Looking north from Chestnut Street

pedestrian phase. At the southwest corner of the intersection, there is a parking lot for an office building that is located at the northeast corner of the intersection. The location of the parking lot results in a high pedestrian volume during peak hours. Chestnut Street provides access to mostly residential streets, while Homer Ave and Route 135 provide access to downtown Ashland.

Main Street at Route 135
Looking east toward Route 135

2.1.3 *Route 135 at Main Street*

Route 135 intersects Main Street at a signalized intersection. Route 135 provides the eastbound and westbound approaches, while Main Street provides the northbound and southbound approaches. Each approach provides a left turn lane. Lanes are approximately 11 feet wide on each approach with 2 foot shoulders and 10 foot crosswalks. There are sidewalks on all sides. The signal is fully actuated with an all pedestrian phase. Main Street provides access to downtown Ashland to the north.

2.1.4 *Route 135 (West Union Street/Union Street) at Summer Street*

Looking east toward Summer Street on Route 135

The Route 135 signalized intersection with Summer Street is a three-way intersection, with Summer Street providing the southbound approach and Route 135 providing the eastbound and westbound approaches. The Route 135 eastbound approach (West Union Street) contains a left turn lane and a through travel lane, and Route 135 westbound approach (Union Street) to this intersection contains a shared through/right travel lane. The southbound approach (Summer Street) contains a shared left/right turn lane. In the vicinity of the intersection, eastbound and westbound traffic is divided by 6 to 10-foot concrete or yellow painted median. Lanes are approximately 12 feet in width and with no shoulders. Each roadway contains granite curbs and about 6-foot wide concrete sidewalks along both sides. There are two 8-foot wide crosswalks on each approach.

The traffic signal is a fully actuated signal with exclusive pedestrian phase. The pavement is in fair condition. However, the majority of pavement markings are faded.

In general, land uses currently around the intersection are primarily business. Northeast to the intersection locates Rite Aid, northwest to the intersection is K Plaza, and to the south of the intersection is Ashland Square Shopping Center.

Looking south towards Route 135 from the Summer Street/Cherry Street intersection

2.1.5 *Route 135 at MBTA Access Road/Voyagers Lane*

Route 135 forms a signalized four way intersection with MBTA Access Road and Voyagers Lane. The Route 135 eastbound approach contains a left-turn lane and a through/right travel lane; the Route 135 westbound approach provides a short right-turn lane and a through/left travel lane. Lanes on MBTA Access Road and both approaches for West Union Street are approximately 12 feet in width. Voyagers Lane is approximately 20 feet wide approaching the intersection and approximately 13 feet leaving the intersection with a raised island dividing the two travel lanes. Five-foot wide bituminous concrete sidewalk with granite curb is provided on the north side of Route 135. At the southbound approach, MBTA Access Road has no pavement markings other than a STOP bar. A 10-foot wide crosswalk is provided on this approach.. The Voyagers Lane northbound approach includes a wide left/through/right travel lane. The MBTA Access Road and Voyagers Lane approaches are not in align with each other therefore the intersection is an offset intersection. An 8-foot wide crosswalk is provided across the westbound approach, connecting the east side of MBTA Access Road to the west side of Voyagers Lane.

The traffic signal is a fully actuated signal with exclusive pedestrian phase. The pavement is in fair condition. However, some pavement markings, especially those on MBTA Access Road are faded.

The majority of the area along Route 135 in the vicinity of the intersection is residential. Dunkin Donuts is located to the east on MBTA Access Road. MBTA Access Road extends northwest to provide access to the MBTA Ashland Train Station parking lot. Ashland Junior High School is located to the west of the MBTA Access Road. Voyagers Lane is the only entrance/exit roadway to Pine Lake Condos, an 88-unit condominium complex that is located to the southeast of the intersection.

Looking northeast toward MBTA Access Road/Voyagers Lane

2.1.6 *Route 135 at James Jackson Way*

Route 135 intersects James Jackson Way to form a three-way unsignalized intersection. James Jackson way provides access to Ashland Junior High School. The entrance and exit to the Junior High School is separated by a tree line approximately 18 feet wide. The entrance is approximately 20 feet wide with no pavement markings. The exit has two lanes, each approximately 12 feet wide. The lanes have pavement markings indicating a left turn lane and a right turn lane. There is a 10 foot sidewalk on both the entrance and exit with an 8 foot wide crosswalk connecting them across James Jackson Way.

View of Route 135 intersection James Jackson Way (Ashland Junior High School)

Route 135 has a school zone speed limit of 20 miles per hour in the vicinity of the school. There are pavement markings and signs indicating a school zone. There are 12 inch wide bars across Route 135 approaching the school, but no signs indicating that motorists should stop. The line is set back approximately 40 feet on the eastbound approach and 30 feet on the westbound approach. There is an 8 foot wide sidewalk on the north side of the road. While this is currently an unsignalized intersection, there are periods where a crossing guard is employed and directing traffic during the peak school arrival or departure periods.

2.1.7 *Route 135 at Frankland Road and Route 135 at Olive Street*

Frankland Road and Olive Street extend to the north and south, respectively. These two streets are at skewed angles to form two closely-spaced unsignalized three-way intersections. The distance between the centers of the two intersections is about 45 feet.

Looking southwest towards Frankland Road/ Olive Street

Frankland Road intersection is under stop control with each approach containing one travel lane approximately 12 feet in width. The southbound approach is fairly narrow until approximately 50 feet from the intersection where it widens to become approximately 110 feet at the intersection. Currently, there is a 41 foot long 12 inch wide STOP line on the approach. No other pavement marking is observed in this approach. The pavement is in good condition.

At the intersection of Route 135 and Olive Street, each approach contains one travel lane. The Olive Street northbound approach is under stop control with each approach containing one travel lane approximately 12 feet in width. Olive Street widens to

approximately 110 feet at the intersection, and at the intersection is a small triangular shaped island which separates Olive Street into two functioning intersection. The east leg of the intersection is used by the westbound left movement, the northbound right movement and the southbound through movement from Frankland Road. The west leg of the intersection is used by the eastbound right movement and the northbound left movement. Currently, there is a 20 foot long 12 inch wide stop line for traffic exiting left onto Route 135, and a 28 foot long 12 inch wide stop line for traffic exiting to the right onto Route 135. No other pavement marking is observed in this approach. The pavement is in good condition.

Ashland Community Center and Ashland State Park are located to the east of the two intersections. The majority of the area land use in the vicinity of the intersections is residential, with the exceptions just noted.

2.2 Traffic Volumes

New data collected was used to provide traffic volume analysis for this study. The traffic data was collected along Route 135 during the month of February. Data collection consisted of two 48 hour automatic traffic recorder (ATR) counts and manual peak period turning movement counts (TMC) from 7-9 AM and 4-6 PM at the study intersections. Table 2.1 summarizes the volume data collected on Route 135. The TMC and ATR data collected as a part of the traffic study are included in the Appendix.

As indicated in Table 2.1, the average weekday traffic volume is approximately 14,300 vehicles per day (vpd) on Route 135 close to the proposed site, 12,420 vpd on Route 135 east of Summer Street, and 3,270 vpd on Summer Street, south of Linden Street. During the AM peak hour, Route 135 volume at the project location was approximately 1,130 vehicles with 70.1% in the eastbound direction and representing approximately 7.9% of the weekday total. There were approximately 1,240 vehicles in the PM peak with 63.3% in the westbound direction and representing approximately 8.1% of the weekday total. On Union Street east of Summer Street, there were 1,008 vehicles during the AM peak hour with 59.9% in the eastbound direction and representing 8.1% of the daily volume. There were approximately 930 vehicles during the PM peak hour with 52.8% in the westbound direction and representing 7.5% of the daily traffic. On Summer Street south of Linden Street, there were 329 vehicles during the AM peak hour with 73.8% in the northbound direction representing 10.1% of the daily traffic. There were 280 vehicles in the PM peak hour with 64.3% in the southbound direction and representing 8.6% of the daily traffic.

Table 2.1- ATR Data Summary, February 2014

		AM Peak Hour			PM Peak Hour		
Location	24 Hour Weekday	Volume	K-Factor	Direction Distribution	Volume	K-Factor	Direction Distribution
West Union St, east of Edgewood Dr	14,296 vpd	1,132 vph	7.9%	70.1% EB	1,238 vph	8.7%	63.3% WB
Union St, east of Summer St	12,417 vpd	1,008 vph	8.1%	59.9% EB	929 vph	7.5%	52.8% WB
Summer St, south of Linden St	3,268 vpd	329 vph	10.1%	73.8% NB	280 vph	8.6%	64.3% SB

[1] vpd = vehicles per day; vph = vehicles per hour

[2] K-Factor = Percentage of daily traffic that occurs during the peak hour

Note: Data has been rounded. February 2014 (ATR) data.

In developing the estimated average or typical volume conditions for the study, a review of permanent traffic count station data maintained by the Massachusetts Department of Transportation (MassDOT) was completed. This review determined the seasonal variation of traffic flow on roadways similar to the function and/or in the general region and if the data collected in the field needed to be adjusted to reflect appropriate analysis conditions. The permanent count station (Sta. 0307) maintained by MassDOT was identified and reviewed to evaluate seasonal and year-to-year changes. Station 0307 (Westborough) is a town within close proximity of the site and on a route with relatively similar traffic patterns. The data for this station indicated that February volumes tend to be approximately 3%-4% below average monthly conditions. The data collected in February was also compared to the data that was originally collected in July as part of this project. The overall daily traffic was approximately 8% lower in February than July on Route 135 near the project site. A summary of the ATR data from July is provided in Table 2.2. Three of the study intersections were also observed in July. Comparison of turning movement counts at the study intersections showed a slightly higher peak hour volumes in February than July. Based on the findings, the traffic counts collected in February were increased by 3% in order to more accurately reflect average daily traffic.

Table 2.2- Summary of ATR Data, July 2013, West Union Street, east of Frankland Road

		AM Peak Hour			PM Peak Hour		
Date of Count	24 Hour Weekday	Volume	K-factor	Direction %	Volume	K-Factor	Direction %
7/9/2013	15,551 vpd	1,345 vph	8.6%	65.3% EB	1,248	8.0%	59.4% WB
7/10/2013	15,618 vpd	1,279 vph	8.2%	69.7% EB	1,354	8.7%	60.0% WB
Average	15,590* vpd	1,312 vph	8.4%	67.5% EB	1,301	8.3%	59.5% WB

Note: Data has been rounded. July 2013 (ATR) data.

Figure 3 and Figure 4 illustrate the estimated existing weekday morning and evening peak hour traffic volume networks for the study area, respectively, including the seasonal adjustment.

Table 2.3 summarizes the observed speed data collected in February 2014 as part of the ATR count on Route 135 and on Summer Street. As can be seen, the average speed on Route 135 near the project site is approximately 40 mph for the eastbound traffic and 30 mph for westbound traffic. The eastbound and westbound 85th percentile speed is approximately 45 and 35 mph, respectively.

Table 2.3- Summary of Speed Data (MPH)

Location	Direction	Average Speed	85th %tile Speed	Posted Speed	Pace Speed (mph)	% in Pace
West Union St, east of Edgewood Dr	Eastbound	40	47	35	37-46	57%
	Westbound	30	34	35	26-35	80%
Union St, east of Summer St	Eastbound	25	32	-	24-33	50%
	Westbound	19	28	-	20-29	36%
Summer Str, south of Linden St	Northbound	30	35	-	27-36	69%
	Southbound	30	35	25	27-36	68%

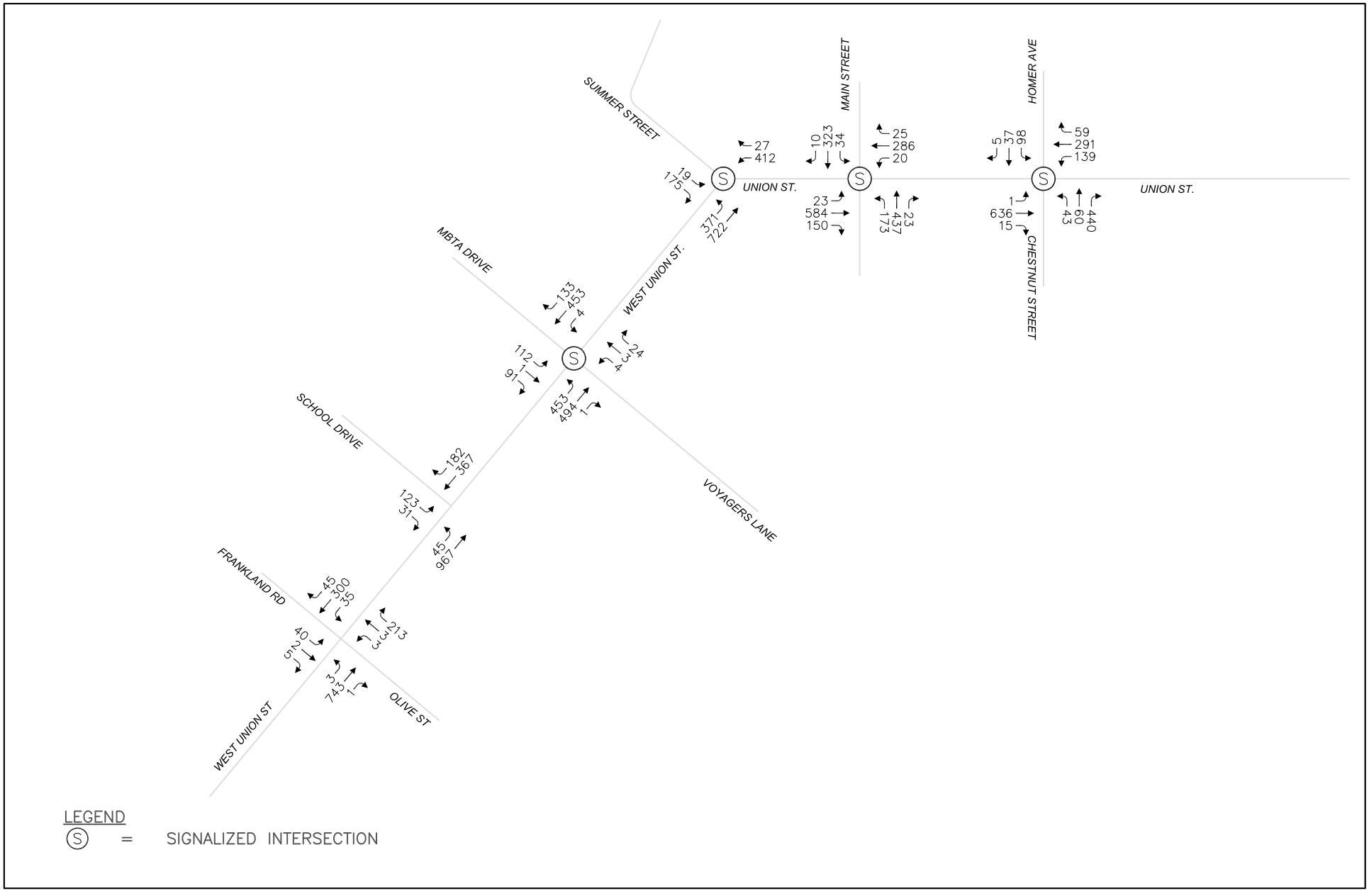


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Figure 3
2014 Existing AM Peak Hour Traffic Volumes
133 West Union Street Development
Ashland, Massachusetts

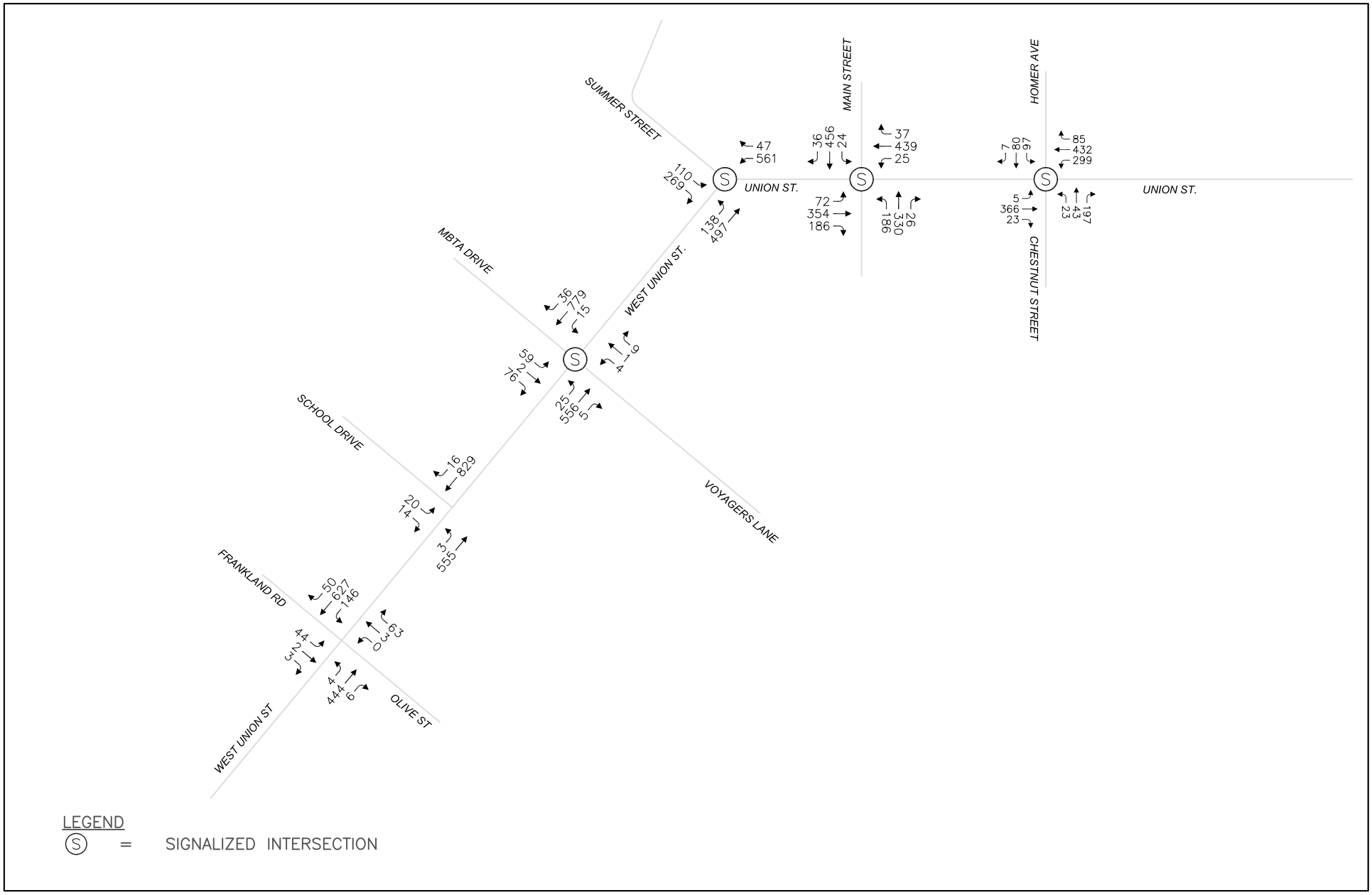

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Figure 4
2014 Existing PM Peak Hour Traffic Volumes
133 West Union Street Development
Ashland, Massachusetts

2.3 Crash Experience

Crash history was compiled and reviewed for the study locations using the most recent crash data available at the time the original inventories were initiated including data from 2009 to 2011. The review was completed for Route 135 at Chestnut Street/Homer Ave, Route 135 at Main Street, Route 135 at Summer Street, Route 135 at MBTA Access/Voyagers Lane, Route 135 at Frankland Road and Route 135 at Olive Street. The data are summarized in Table 3. Crash data for the Town of Ashland were obtained from the MassDOT Crash Record System (CRS), which is compiled with information from the Registry of Motor Vehicles (RMV).

Review of intersection crash data summarized in Table 3 indicated that the intersection of Route 135 at Summer Street reported a total of eleven (11) crashes for an average of 3.7 crashes per year over the three year period. Most of the reported crashes were classified as angle or rear-end type. All of the eleven reported crashes were classified as property damage only crashes. There were a total of eight (8) reported crashes in three years at the intersection of Route 135 and Main Street for an average of 2.6 crashes per year over the three year period. Three of the eight crashes were sideswipe collisions. Two of the crashes resulted in injury. There were sixteen (16) reported crashes at the intersection of Route 135 and Chestnut Street/Homer Ave for an average of 5.3 crashes per year over the three year period. Most of the reported crashes were classified as angle or rear end type. Three of the sixteen reported crashes resulted in injuries. There were three reported crashes on Route 135 at MBTA Access/Voyagers Lane, five on Route 135 at Ashland Middle School, four on Route 135 at Frankland Road, and five on Route 135 at Olive Street.

As part of this safety review, the “crash rate” for the study intersections was also determined. The calculation of the crash rate accounts for the amount of traffic that enters the intersection, and relates the number of accidents at a location directly to the amount of traffic that passes through the location. It becomes a more comprehensive measure for identifying potentially hazardous locations compared to simple averages. The calculated rate is compared to the District wide averages. Intersections experiencing crash rates greater than the above averages are potentially experiencing an unusually high number or higher than expected number of crashes relative to traffic volumes at that particular location and may warrant further investigation or improvements. For the MassDOT District 3 area, which covers the study area Cities and Towns, has an average crash rate of 0.66 crashes per million entering vehicles (MEV) for unsignalized intersections and 0.89 crashes per MEV for signalized intersections. From Table 3, it can be seen that all the signalized and unsignalized intersections had lower crash rates than the current MassDOT District 3 averages. Based on the review of crash frequency and crash rates, it was concluded that none of the study intersections are deficient in terms of crash experience. Detailed intersection crash rate worksheets for the study intersections are included in the Appendix.

Table 2.4 Summary of Reported Crashes 2009-2011

	Route 135 at Frankland Street			Route 135 at Olive Street			Route 135 at Middle School			Route 135 at Voyager Lane (Signalized)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
Severity												
Property Damage	1	1	1		2			3	2	1	1	
Injury	1					2				1		
Fatality												
Unknown					1							
Collision Type												
Rear End	1	1			1	1		3		2	1	
Angle			1		1							
Side Swipe									1			
Head On						1						
Single Vehicle	1				1				1			
Collision with Ped												
Collision with Bike												
Other/Unknown												
Roadway Conditions												
Dry	1	1	1		2	2		2	2	2	1	
Wet												
Snow/Ice	1				1			1				
Other/Unknown												
Totals	2	1	1	0	3	2	1	3	2	2	1	0
Annual Average Crashes	1.33			1.66			2.0			1.0		
Intersection Crash Rate	0.24			0.38			0.30			0.17		
MassDOT District 3 Average Crash Rate	0.66			0.66			0.66			0.89		

Table 2.4 (continued) Summary of Reported Crashes 2009-2011

	Route 135 at Summer Street (Signalized)			Route 135 at Main Street (Signalized)			Route 135 at Chestnut St/Homer Ave (Signalized)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
Severity									
Property Damage	6	2	3	2	1	3	5	7	1
Injury						2	1	2	
Fatality									
Unknown									
Collision Type									
Rear End	2		1		1	1	5	4	
Angle	4	1				1	1	2	1
Side Swipe			2			3		1	
Head On				1				1	
Single Vehicle				1					
Collision with Ped									
Collision with Bike								1	
Other/Unknown									
Roadway Conditions									
Dry	6	2	2	2	1	4	5	7	1
Wet			1			1	1	1	
Snow/Ice								1	
Other/Unknown									
Totals	6	2	3	2	1	5	6	9	1
Annual Average Crashes	3.66			2.66			5.33		
Intersection Crash Rate	0.59			0.32			0.84		
MassDOT District 3 Average Crash Rate	0.89			0.89			0.89		

2.4 Existing Public Transit Network

Ashland is part of the community served by the MetroWest Regional Transit Authority. The Route 5 bus provides access from Hopkinton to downtown Framingham via Route 135. The bus currently stops at the corner of Homer Ave and Main Street, at Ashland House on Main Street, and at Ashland Junior High School; the bus will stop on call at the Ashland Community Center. Each of these stops is within the study area of this project. The bus leaves approximately every 1 hour and 10 minutes between 5:30AM and 7:00PM from Framingham and from Hopkinton. The bus provides access to and from the Framingham

MBTA station, which provides access to Boston and Worcester. The bus trip to the Framingham MBTA station is scheduled to take twelve (12) minutes from Ashland Junior High School and seven (7) minutes from the corner of Homer Ave and Main Street.

In addition, the town is served by the MBTA commuter rail line with a station located on High Street. Parking is available near the station and accessible via High Street, Pleasant Street, and MBTA Access Road. The train provides access to Boston and to Worcester.

3.0 PROBABLE IMPACTS OF THE PROJECT

The impact of the proposed development project on the roadway network within the study area was evaluated and the results are described in this section. For study purposes, this study used the year 2021 for the analysis year that represents a 2 year permitting-construction period and a 5 year build out timeframe.

3.1 No-Build Traffic Volumes

A year 2021 No-Build traffic volume network was developed by taking into account existing traffic volumes, and identifying potential area wide background traffic volume growth as well as known site specific condition (background) developments that could contribute to traffic flow on the 2021 study network.

3.1.1 *Background Traffic Growth*

To establish a traffic growth rate for the study area, historical traffic count data from the Massachusetts Department of Transportation (MassDOT) Traffic Count Reports were researched. As indicated previously, the historical traffic data from the MassDOT permanent count station 307 was reviewed to determine an appropriate background growth rate. Data from 2010 through 2013 showed an increase in traffic between -0.3% and 1.6% annually. A traffic growth rate of 0.5% per year was selected and applied to the existing peak hour traffic volumes. These rates would presumably account for some of the more remote growth in the region as well as general nearby residential/small business growth that could potentially result in added traffic through the study area, including the following projects:

- Robert Hill Way Development
- 21 Main Street Development
- Downtown Revitalization Project

These projects were not included in the site specific volumes. The Robert Hill Way Development and the 21 Main Street Development were not included due to the small size and large distance from the project site. The Downtown Revitalization project is at a planning level and not clearly defined.

3.1.2 *Site Specific Developments*

In addition to general background growth, research on site specific developments or uses that are likely to occur within the study time frame in the vicinity of the proposed project and that could impact the traffic flow at the analysis intersections was completed. Discussions were conducted with the Ashland Planning Department and combined with field observations, several site specific developments not yet fully occupied or built out were identified and incorporated into the analysis. The Rail District development, which is a large residential development that has not been started but involved planning studies more than five years ago, was fully included in this update study although its actual timeframe for development is unknown at this time. The following projects were included as specific development projects:

- 250 West Union Street[1]
- Rail District[2]

[1] Proposed #250 West Union Street Development, MS Transportation Systems, Inc, Januaray 2007
[2] Proposed Residential Development, Vanasse & Associates, Inc, December 12, 2007

- Ashland Woods Development[3]
- Village of Americas Development[4]

In addition to the above, there is the Legacy Farms (LF) project that is located in Hopkinton just over the Ashland town line. That project has been master planned but is envisioned to be a long term development with two major phases. While having a master plan, each specific development element is required to go through detailed design review with site-specific update studies before being approved for construction. Currently, portions of the Phase 1 residential component are under construction including the multi-family apartments, townhouse condominium and single family homes. Additionally, the LF proponent received approval to convert approximately 86,000 square feet of Phase 2 commercial to 127 units of senior assisted living. While construction has yet to begin, this conversion was considered. All of these are located on the south side of Route 135 and west of Clinton Street. In total, there are 652 residential units that make up the Phase 1 residential LF component. As part of this updated traffic study for the proposed West Union 40B development, the status of Legacy Farms was reviewed at the time of the new traffic count program. At that time, approximately 100 apartment units and 30 condominium units were occupied resulting in a portion of the LF development to be included in the latest traffic counts. Based on the LF traffic study[5] and the ITE trip models, it was determined that the differences between the total Phase 1 residential component and what is currently built and occupied are represented in the background growth forecasts of Route 135 in Ashland.

The LF Phase 1 commercial component to be located on the north side of Route 135 was not included in the No-Build or Build conditions for this update study as it is not approved for construction, its details could change, there is no currently anticipated timeframe when this component will begin the local planning board review/approval process and an updated traffic study will need to be prepared. This is also the situation with most of the Phase 2 elements. However, as part of this traffic update, a *Build Plus* condition that includes an estimate for the LF Phase 1 commercial component has been developed for informational purposes. The LF Phase 1 commercial component is anticipated to include 20,000 square feet of retail/commercial space, a small grocery store, restaurant space and it would retain the existing nursery/garden center in some form that currently exists on this area of the LF site. Estimates of the additional traffic due to this component were taken from the VHB referenced study. Details of the VHB study are included in the Appendix. The *Build Plus* condition is discussed later in the report.

3.1.3 *No-Build Traffic Volumes*

Consequently, the year 2021 No-Build traffic volumes were determined by adding the seven (7) years background traffic growth of half a percent annually as well as projected traffic from the site specific development noted above to the existing traffic volumes. The estimated year 2021 No-Build traffic volumes projected for the weekday morning and evening peak hours at the study intersections are shown in Figure 5 and Figure 6, respectively. In general, the growth assumptions result in Route 135 peak hour traffic increases near the project site of 175 trips in the AM peak hour and 211 trips during the PM peak hour.

[3] Ashland Woods, Gillon Associates, February 2013
[4] See appendix for trip generation and trip distribution
[5] VHB, Traffic Impact & Access Study, Proposed Legacy Farms Development, March 2008.

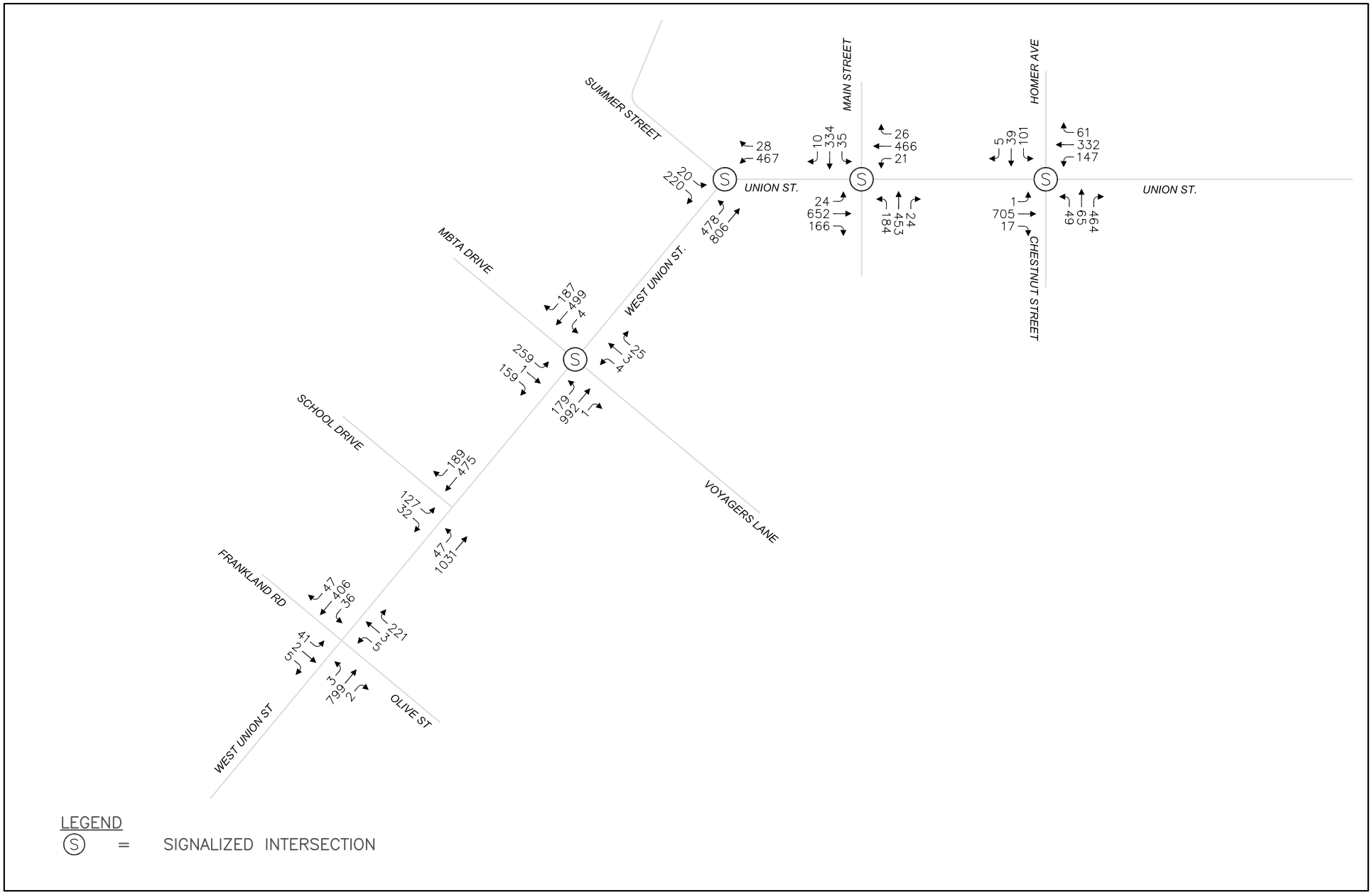

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Figure 5
2021 No-Build AM Peak Hour Traffic Volumes
133 West Union Street Development
Ashland, Massachusetts

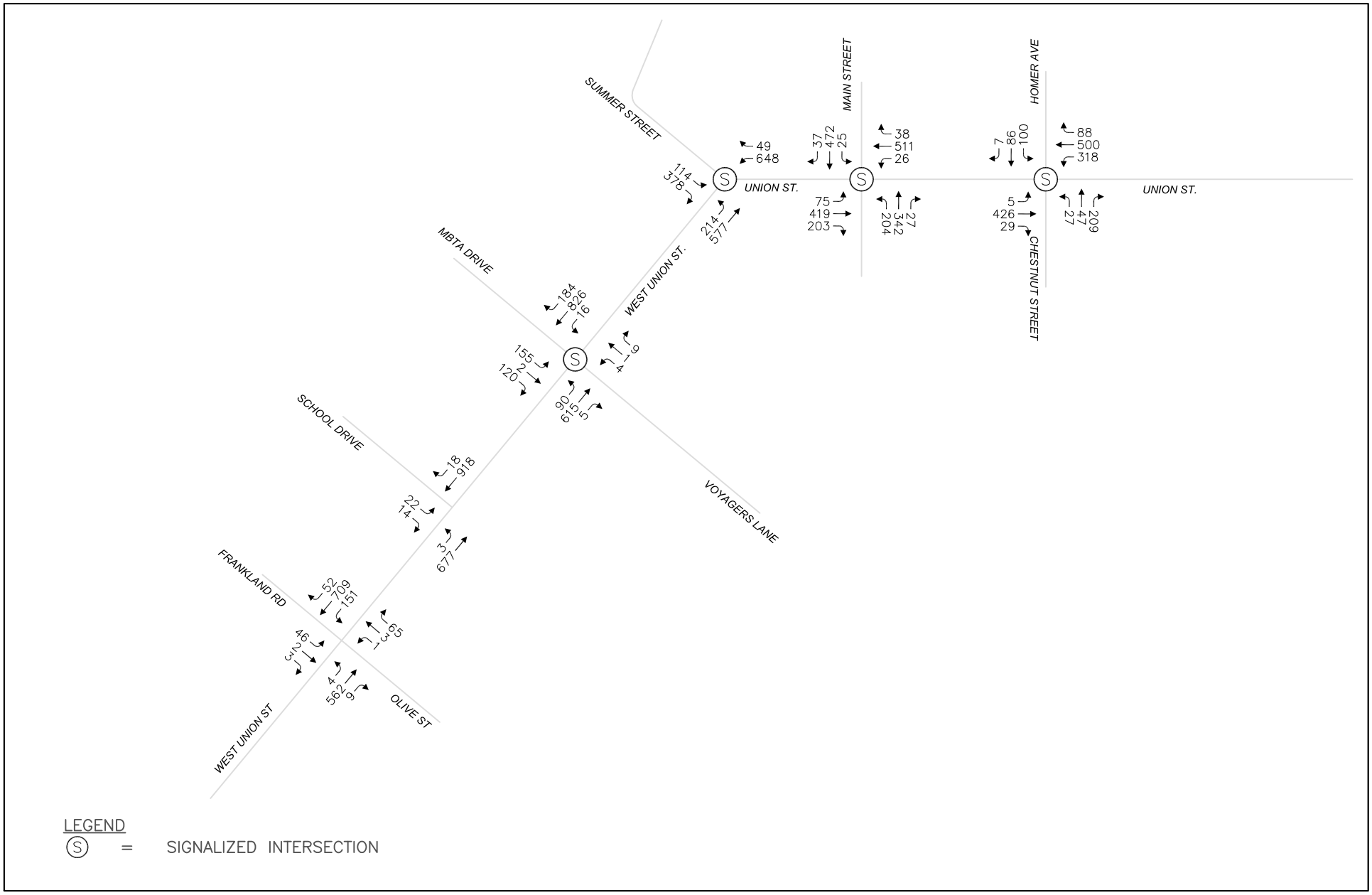

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Figure 6
2021 No-Build PM Peak Hour Traffic Volumes
133 West Union Street Development
Ashland, Massachusetts

3.2 Proposed Project Description

The 133 West Union Street project is proposed under the Commonwealth's 40B program. The proposed development program is to construct 140 apartment units within two four-story buildings and two three-story buildings. The two four-story buildings are composed of 40 units and the two three-story buildings are composed of 29 units. A small building to the rear of the site will contain two dwelling units. In addition, there is a clubhouse with a maintenance facility attached. As described previously, the site is located east of the intersection of Route 135/Frankland Road and west of the intersection of Route 135/Voyagers Lane/MBTA Access Road. Access for the project will be via a single driveway on the north side of Route 135. As originally planned, the site drive consists of one entering and one exiting lane.

3.3 Site Generated Traffic Volumes

In this section an estimate of traffic to be generated by the proposed residential development was completed and assigned to roadways/intersections within the study area and added to the No-Build traffic volume network to develop the Build traffic condition.

3.3.1 *Site Trip Generation*

In order to estimate the number of trips that could be generated by the proposed residential development, statistics published by the Institute of Transportation Engineers (ITE) in Trip Generation for similar land uses were examined. The ITE trip generation statistics represent compilations of data from studies/projects throughout the United States collected over the past 30+ years on trip generation characteristics for different types of land uses. The data has been compiled to provide transportation analysts with guidelines in forecasting 24 hour and peak hour volumes for the specified use.

Based on a review of the ITE database and the various residential models, Land Use Code (LUC) 220 Apartment was selected as the most similar to the project type of unit. This was determined to best reflect the project's travel characteristics and was selected for estimating purposes. The estimated trips generated by the project are presented in Table 3.1. Detailed trip generation calculations for the proposed use are included in the Appendix.

Table 3.1- Summary of Estimated Site Generated Vehicle Trips

	ENTERING	EXITING	TOTAL
Weekday	486	486	972
AM Peak Hour	14	58	72
PM Peak Hour	62	33	95

Source: ITE Trip Generation, 9th Edition, 2012, LUC 220

As shown in Table 3.1, the proposed development is expected to generate a total of approximately 972 vehicle trips over the course of an average weekday that will include 486 entering and 486 exiting trips over the 24 hour period. The weekday morning peak hour is expected to generate 72 total trips with 14 inbound and 58 outbound trips. The weekday evening peak hour is expected to generate 95 total trips with 62 inbound and 33 outbound trips.

3.3.2 *Trip Distribution/Assignment*

Once the number of trips projected to be generated by the development has been determined, trips are assigned to the site driveway and study area roadways based on trip distribution patterns determined for the project. For this project, directional distribution of generated trips to and from the site is expected to follow existing traffic patterns, which in turn, are a function of regional population densities, shopping opportunities, areas of employment, and recreational activities. As a result of the analysis, the assigned percentages by direction are presented in Figure 7. The estimated project trips distributed about the study are presented in Figure 8 for the AM peak hour, and Figure 9 for the PM peak hour.

3.3.3 *Build Traffic Volumes*

Trips estimated for the proposed development were assigned to the site driveway and study area roadway using the trip distribution percentages shown in Figure 5. Peak hour site traffic volumes were then added to the No-Build traffic volumes to establish the 2021 Build condition traffic networks. Figures 10 and 11 present the Build traffic volumes for the weekday morning and evening peak hours, respectively.

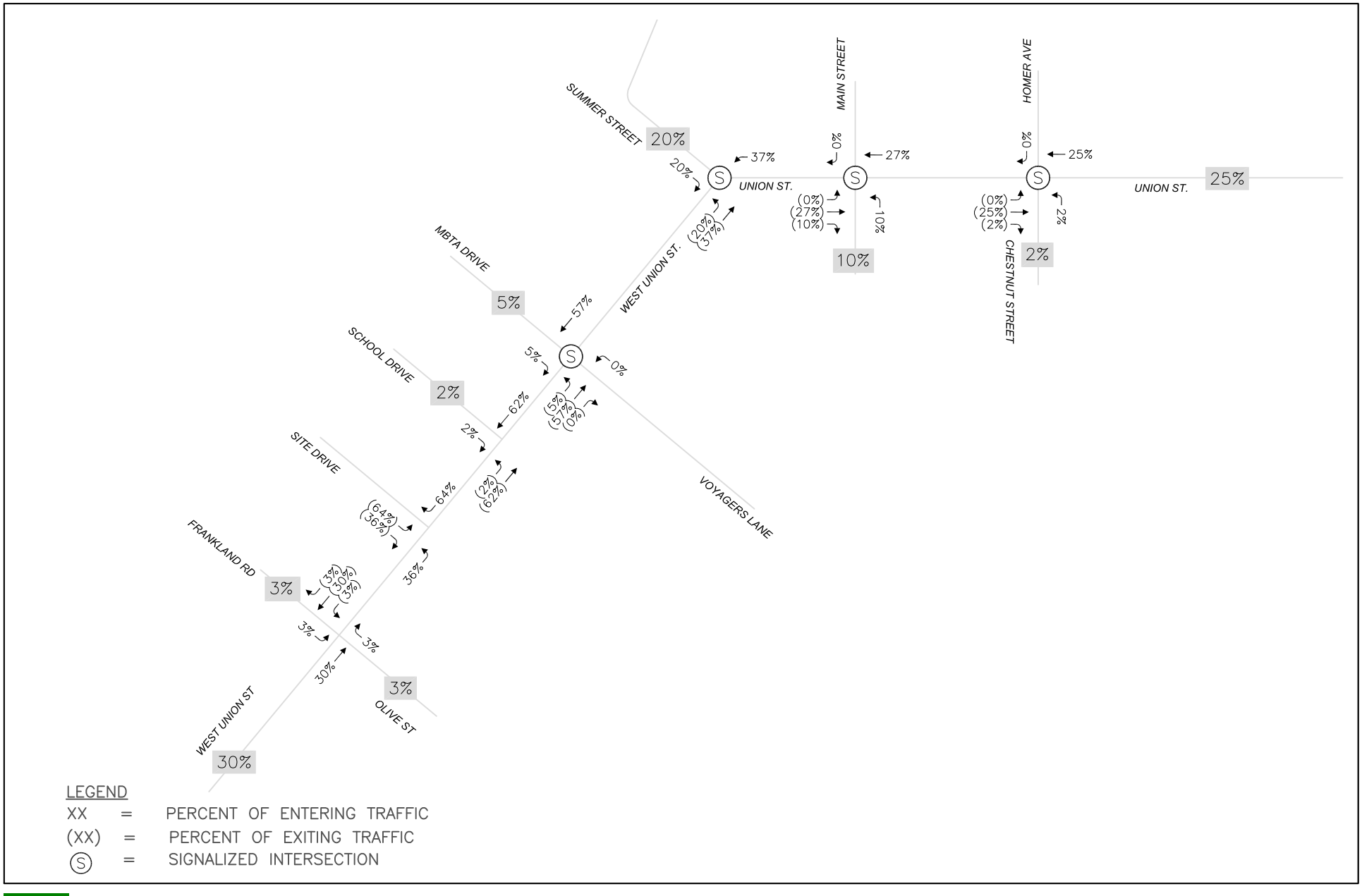

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Figure 7
Trip Distrubtion
133 West Union Street Development
Ashland, Massachusetts

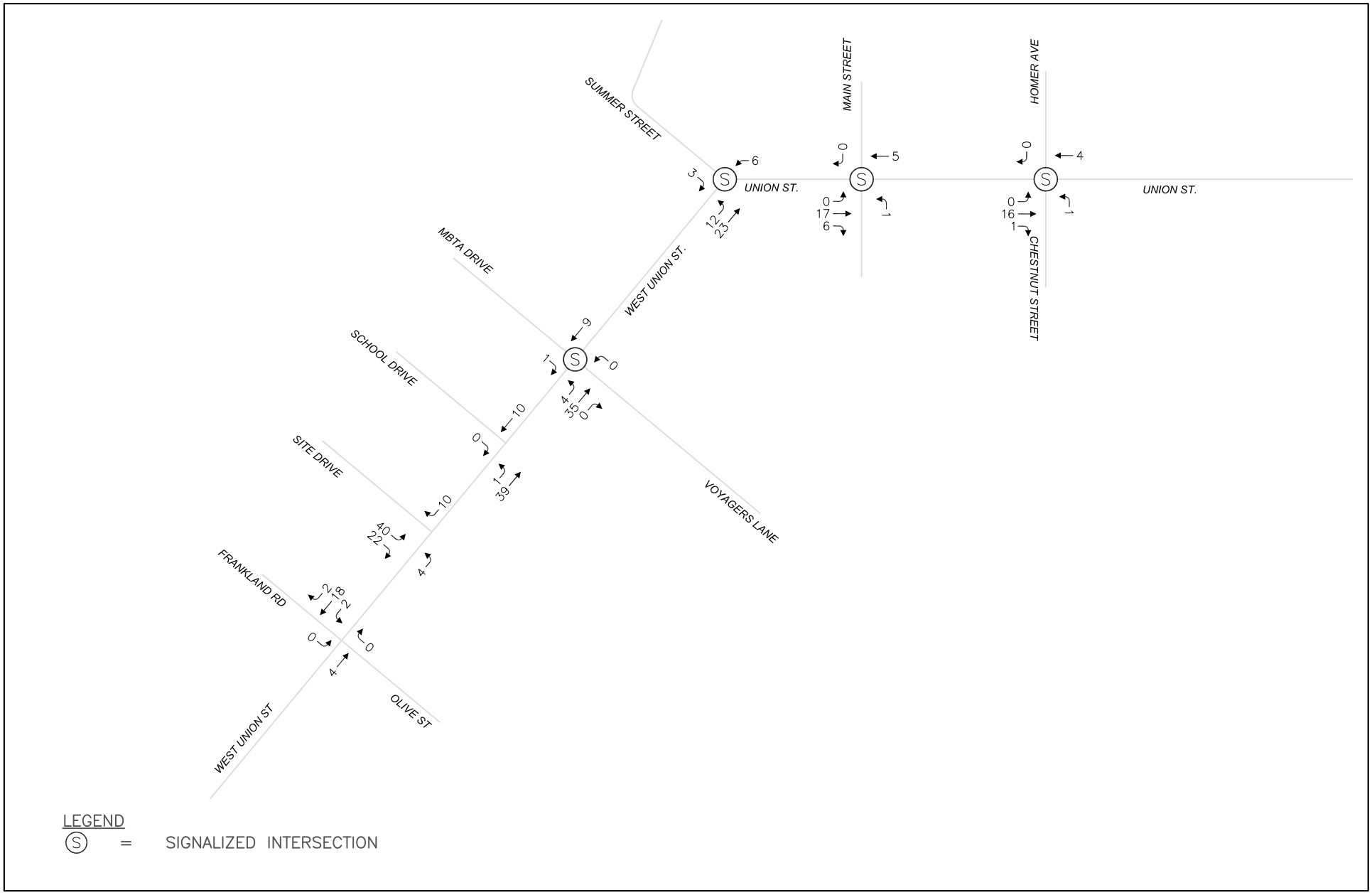

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Figure 8
AM Peak Hour Site Generated Trips
133 West Union Street Development
Ashland, Massachusetts

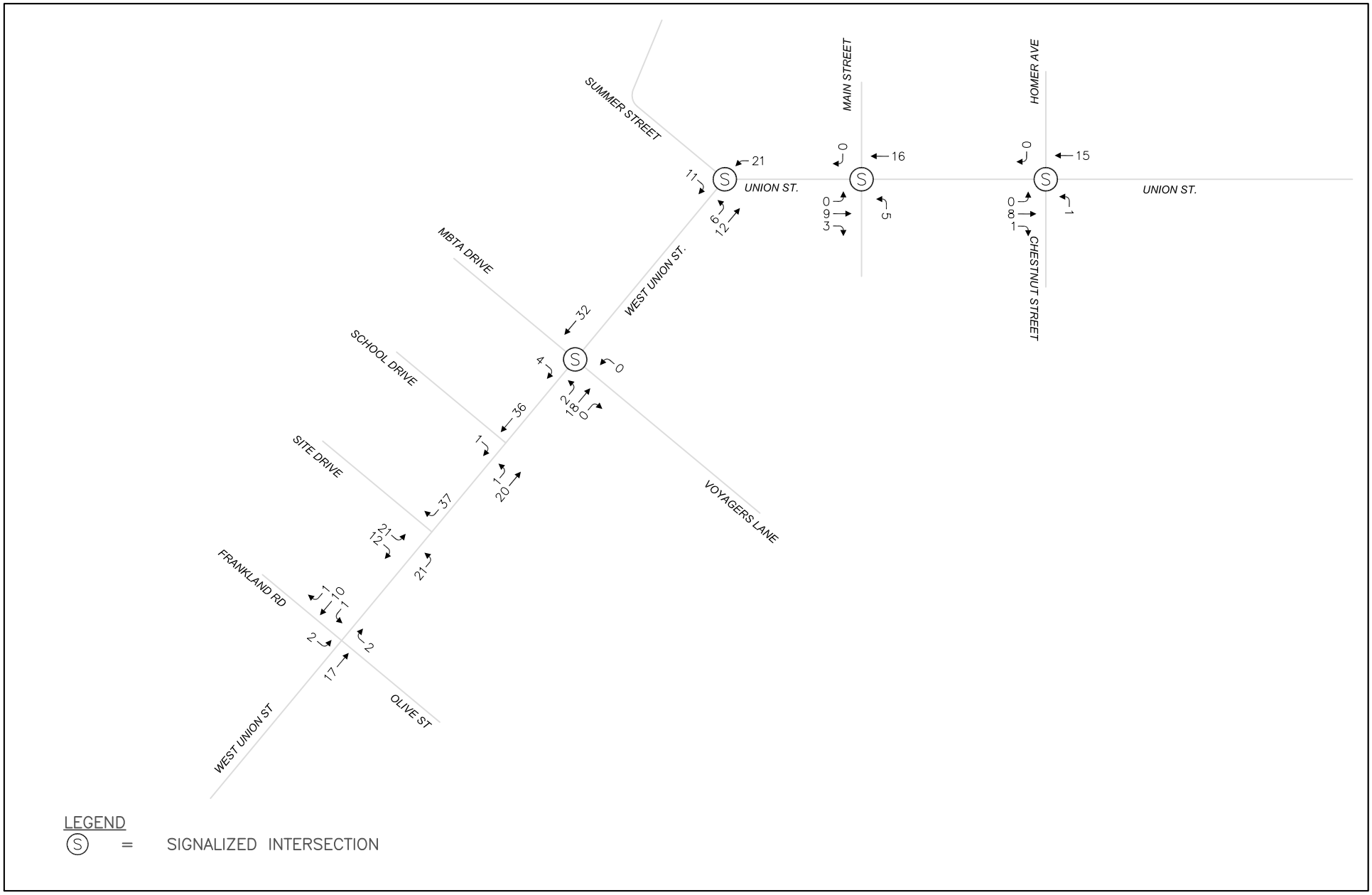

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Figure 9
PM Peak Hour Site Generated Trips
133 West Union Street Development
Ashland, Massachusetts

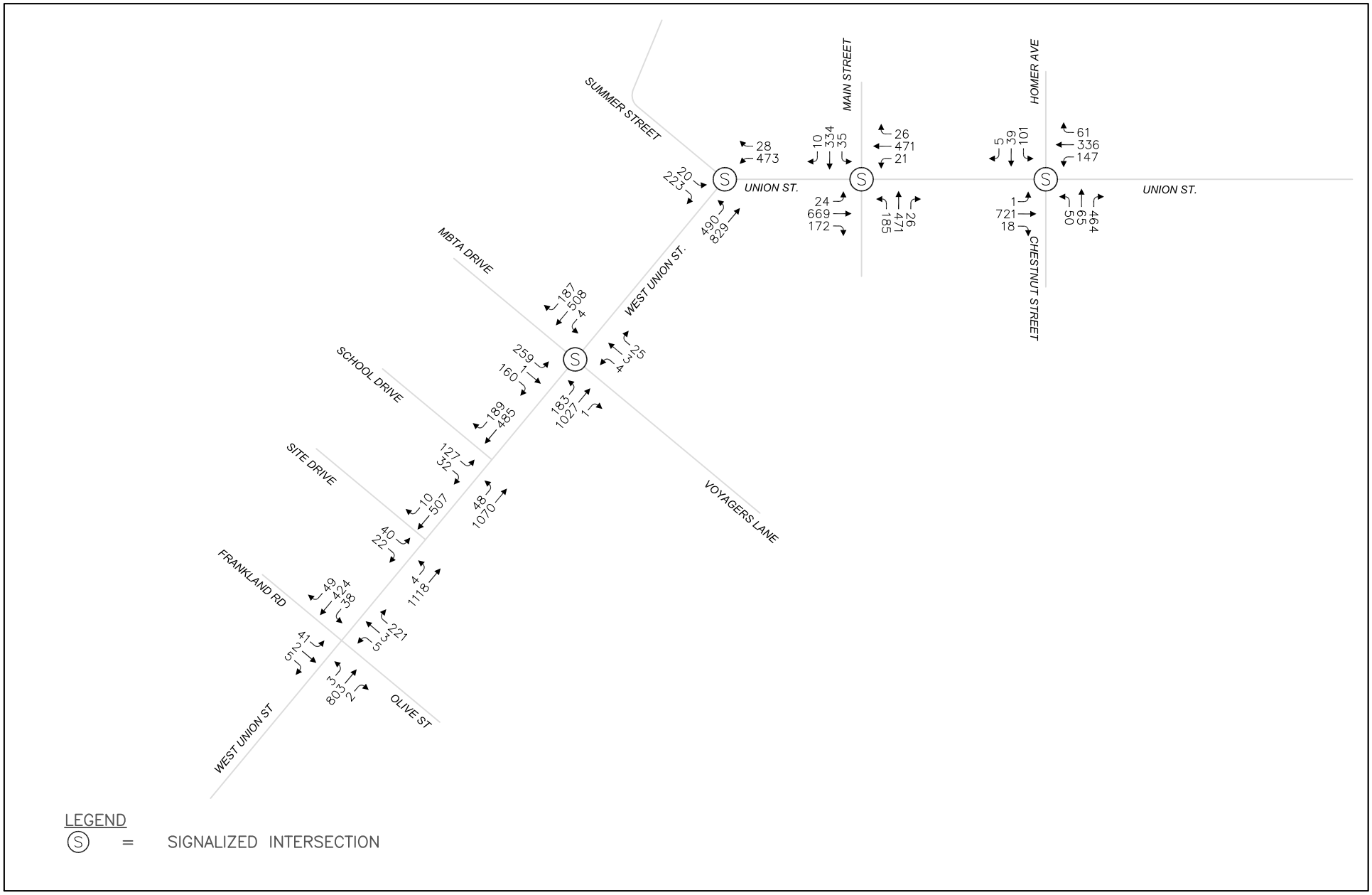

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Figure 10
2021 Full-Build AM Peak Hour Traffic Volumes
133 West Union Street
Ashland, Massachusetts

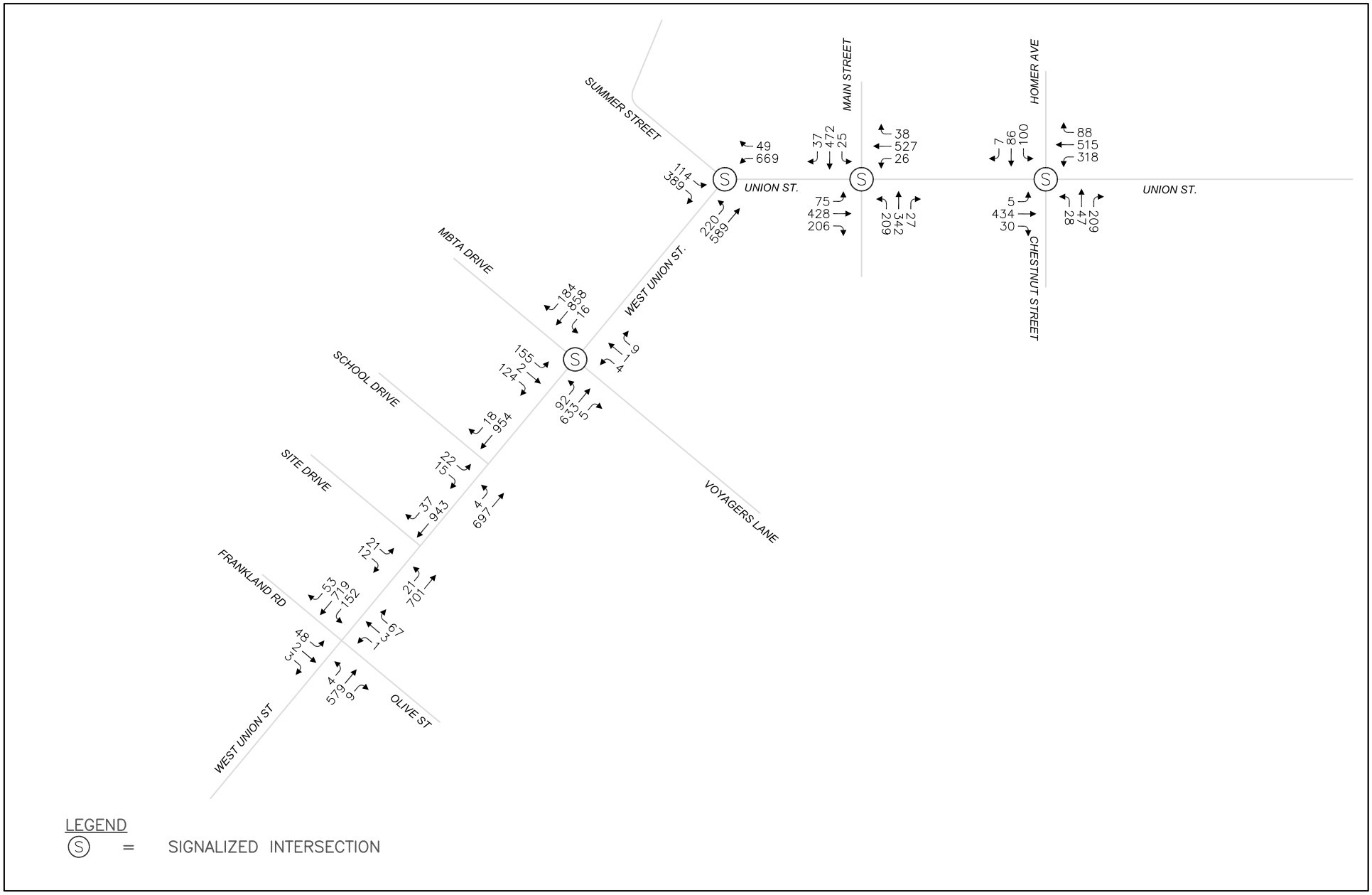

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Figure 11
2021 Full-Build PM Peak Hour Traffic Volumes
133 West Union Street Development
Ashland, Massachusetts

4.0 ANALYSIS

Previous sections of this report described the current conditions of nearby intersections, the development of the 2021 No-Build and 2021 Build traffic volume networks including the site generated trip forecasts. Included in this section is an examination of the volume changes, capacity/Level of Service (LOS) analysis for the study intersection under each condition and sight distances relative to the site access drive were reviewed.

4.1 Traffic Volume Increases

Initially, a comparison of No-Build and Build volumes on the surrounding roadway system was completed. Table 4.1 summarizes the increases in traffic volumes for the study area roadways.

Table 4.1- Summary of Estimated Roadway Traffic Increases

	Weekday AM Peak Hour				Weekday PM Peak Hour			
Location	No-Build	Build	Δ in Volume	% Δ in Volume	No-Build	Build	Δ in Volume	% Δ in Volume
Route 135								
West of Olive St	1220	1242	22	1.8%	1288	1315	27	2.1%
East of MBTA Rd	1966	2010	44	2.2%	1805	1855	50	2.7%
East of Summer St	1321	1350	29	2.2%	1388	1421	33	2.4%
West of Chestnut St	1109	1131	22	2.0%	994	1019	25	2.5%
Summer Street								
North of Route 135	746	761	15	2.0%	755	772	17	2.3%
Olive Street								
South of Route 135	269	271	2	0.7%	231	234	3	1.3%

The key findings include the following:

- In general, Route 135 will experience traffic increases compared to the No-Build condition due to the proposed project, however, they are relatively small ranging between 1.8% and 2.7% depending on the location and time period.
- Increases on the streets off Route 135 will also be around 2% or less, equivalent to only one vehicle every four minutes on Summer Street and one vehicle every thirty minutes on Olive Street.

In general, the increased levels of roadway volume will remain within the capacity of the affected roadways. Route 135 generally carries moderately high traffic volumes while Frankland Road, Olive Street, MBTA Access Road and Voyager's Lane carry moderately low traffic volumes. It is anticipated that the roadway network will accommodate the increase in traffic generated by the proposed project. Overall, the relative peak hour traffic volume increases due to this project are relatively small.

4.2 Capacity/Level of Service (LOS) Analysis

For this analysis, the study intersections in the vicinity of the project were examined with regard to flow rates, capacity, and delay characteristics to determine the Level of Service (LOS) provided under existing and future (No-Build and Build) traffic conditions. The initial analyses were completed for the existing, future No-Build and the future Build conditions. This updated report also includes an LOS analysis for the Build Plus condition that adds the Legacy Farms Phase 1 commercial portion to the networks based on the referenced planning study completed for that project.

Level of Service is an indicator of operating conditions which occur on a given roadway feature while accommodating varying levels of traffic volumes. It is a qualitative measure that accounts for a number of operational factors including roadway geometry, speed, traffic composition, peak hour factors, travel delay, freedom to maneuver and driver expectation. When all of these measures are assessed and a Level of Service is assigned to a roadway or intersection, it is equivalent to presenting an "index" to the operational qualities of the section under study. Level of Service is classified in the Highway Capacity Manual[6] into six levels that are designated 'A' through 'F' based on the control delay ranges they fall under. These are presented in Table 4.2 for both unsignalized and signalized intersections.

In practice, any given roadway/intersection may operate at a wide LOS range depending upon time of day, day of week or period of year. It should be noted that for unsignalized intersections, the Level of Service is not computed for the intersection as a whole. Instead, the level of service is determined by the computed or measured control delay for each individual critical movement.

Table 4.2- Level of Service Criteria for Signalized and Unsignalized Intersections

LOS	UNSIGNALIZED INTERSECTION (SEC)	SIGNALIZED INTERSECTION (SEC)
A	≤10	<= 10
B	>10 and ≤15	> 10 and <= 20
C	>15 and ≤25	> 20 and <= 35
D	>25 and ≤35	> 35 and <= 55
E	>35 and ≤50	> 55 and <= 80
F	>50	> 80

The study intersections were evaluated using the SYNCHRO 8 computer models that follows the procedures established in the HCM. Using existing roadway features and the intersection controls, traffic operations at the study intersections were evaluated for existing as well as future conditions. Analysis results for the study intersections are presented in Table 4.3 and Table 4.4 for morning and evening peak period, respectively. Detailed analysis results can be found in the Appendix.

[6] Transportation Research Board. Highway Capacity Manual, Washington, D.C. 2010.

Table 4.3 Summary of Level of Service Analysis, AM Peak Hour

	Existing Conditions				Future No-Build				Future Build Conditions			
	v/c	95th % Q (ft)	Delay (s)	LOS	v/c	95th % Q (ft)	Delay (s)	LOS	v/c	95th % Q (ft)	Delay (s)	LOS
Union Street and Main Street (Signalized)												
Union Street EB L	0.06	37	21.0	C	0.45	37	21.6	C	0.10	37	21.6	C
Union St EB TR	0.99	1321	62.2	E	0.42	1499	117.9	F	1.19	1553	>120	F
Union St WB L	0.14	34	22.6	C	0.45	35	22.8	C	0.14	35	22.8	C
Union St WB TR	0.44	395	29.8	C	0.42	741	36.1	D	0.69	751	36.3	D
Main Street NB L	0.73	267	45.8	D	0.37	298	50.1	D	0.79	300	50.5	D
Main St NB TR	0.84	827	52.7	D	0.32	858	54.1	E	0.9	905	58.3	E
Main St SB L	0.21	54	29.6	C	0.31	55	29.4	C	0.22	55	29.4	C
Main St SB TR	0.80	521	55.4	E	0.25	541	55.5	E	0.81	541	55.5	E
overall	-	-	*51.5*	*D*	-	-	*71.1*	*E*	-	-	*76.8*	*E*
Union Street and Chestnut Street/Homer Ave (Signalized)												
Union St EB L	0.00	4	22.0	C	0.00	4	22.0	C	0.00	4	22.0	C
Union St EB TR	1.28	736	>120	F	0.32	835	>120	F	1.34	862	>120	F
Union St WB L	0.61	103	27.0	C	0.49	119	26.5	C	0.60	119	26.5	C
Union St WB TR	0.47	219	18.9	B	0.49	253	18.8	B	0.48	256	18.9	B
Chestnut St NB LT	0.51	111	43.1	D	0.52	121	42.9	D	0.52	122	43.0	D
Chestnut St NB R	0.60	70	5.9	A	0.6	72	5.7	A	0.60	76	5.7	A
Homer Ave SB LTR	0.75	166	60.3	E	0.77	184	60.4	E	0.76	182	60.3	E
overall	-	-	*74.9*	*E*	-	-	*78.5*	*E*	-	-	*84.6*	*F*
Union Street and Summer Street (Signalized)												
Union Street EB L	0.64	108	9.2	A	0.86	275	21.8	C	0.89	292	25.0	C
Union Street EB T	0.64	229	6.2	A	0.70	302	8.4	A	0.72	321	8.9	A
Union St WB TR	0.65	236	13.6	B	0.74	284	19.3	B	0.75	291	20.1	C
Summer St SB LR	0.70	59	26.3	C	0.84	65	31.7	C	0.85	65	32.3	C
overall	-	-	*11.0*	*B*	-	-	*17.1*	*B*	-	-	*18.2*	*B*

Table 4.3 (Continued) - Summary of Level of Service Analysis, AM Peak Hour

	Existing Conditions				Future No-Build				Future Build Conditions			
	v/c	95th % Q (ft)	Delay (s)	LOS	v/c	95th % Q (ft)	Delay (s)	LOS	v/c	95th % Q (ft)	Delay (s)	LOS
West Union Street and MBTA Access/Voyaers Lane (Signalized)												
West Union St EB L	0.35	91	8.1	B	0.47	85	12.8	C	0.48	85	13.2	B
W Union St EB TR	0.88	775	17.5	B	0.90	986	22.9	D	0.92	1032	25.6	C
W Union St WB LT	0.55	224	11.4	B	0.54	340	13.9	C	0.53	340	13.7	B
W Union St WB R	0.19	43	8.9	A	0.24	71	11.0	C	0.23	69	10.7	B
Voyager Ln NB LTR	0.72	29	49.0	D	0.82	36	78.0	B	0.82	36	79.2	E
MBTA SB LT	0.62	103	30.0	C	0.88	356	59.3	E	0.90	368	66.8	E
MBTA SB R	0.56	39	29.5	C	0.60	103	39.5	C	0.62	107	42.4	D
overall			*15.3*	*B*			*25.2*	*C*			*27.3*	*C*
West Union Street and Ashland Junior High School Drive												
Middle School L	1.39	254	>120	F	1.97	315	>120	F	2.19	333	>120	F
Middle School R	0.06	5	11.7	B	0.07	5.00	12.9	B	0.07	13	13	B
W Union St EB L	0.05	5	8.9	A	0.06	5	9.2	A	0.06	5	9.4	A
West Union Street and Frankland Road												
Frankland SB LT	0.26	25	31.6	D	0.348	35	43.3	E	0.54	38	62.4	F
W Union St EB L	0.01	0	8.1	A	0.01	0	8.5	A	0.01	0	8.5	A
West Union Street and Olive Street												
Olive Street NB L	0.01	0	23.0	C	0.032	2.5	28.4	D	0.03	3	29.5	D
Olive Street NB R	0.56	82	24.8	C	0.626	103	29.7	D	0.63	103	29.9	D
W Union St EB L	0.05	3	9.6	A	0.05	5	9.8	A	0.05	5	9.9	A
West Union Street at Site Drive												
Site Drive ST LR	-	-	-	-	-	-	-	-	0.54	65	62.4	F
W Union St EB L	-	-	-	-	-	-	-	-	0.00	0	8.6	A

Table 4.4 - Summary of Level of Service Analysis, PM Peak Hour

	Existing Conditions				Future No-Build				Future Build Conditions			
	v/c	95th Q (ft)	Delay (s)	LOS	v/c	95th Q (ft)	Delay (s)	LOS	v/c	95th Q (ft)	Delay (s)	LOS
Union Street and Main Street (Signalized)												
Union St EB L	0.33	87	24.8	C	0.46	91	30.1	C	0.5	96	32.2	C
Union St EB TR	0.78	857	41.2	D	0.90	1048	51.1	D	0.92	1077	53.4	D
Union St WB L	0.13	38	22.6	C	0.19	40	24.0	C	0.19	40	24.0	C
Union St WB TR	0.74	703	42.4	D	0.86	875	49.7	D	0.88	915	52.5	D
Main St NB L	1.01	375	98.9	F	1.11	422	>120	F	1.10	420	>120	F
Main St NB TR	0.61	557	41.9	D	0.64	589	42.5	D	0.64	589	42.5	D
Main St SB L	0.10	41	27.5	C	0.10	42	27.6	C	0.10	42	27.6	C
Main St SB TR	1.04	896	94.5	F	1.08	937	104.6	F	1.08	937	104.6	F
overall	-	-	*57.7*	*E*	-	-	*66.2*	*E*	-	-	*67.2*	*E*
Union Street and Chestnut Street/Homer Ave(Signalized)												
Union St EB L	0.02	10	23.0	C	0.03	10	23.2	C	0.03	2	23.2	C
Union St EB TR	0.71	357	35.3	D	0.84	455	43.6	D	0.32	273	45.2	D
Union St WB L	0.96	306	63.7	E	1.24	371	>120	F	0.48	208	>120	F
Union St WB TR	0.64	364	22.5	C	0.73	450	25.8	C	0.48	307	26.7	C
Chestnut St NB LT	0.29	77	36.7	D	0.32	84	37.4	D	0.17	41	37.6	D
Chestnut St NB R	0.33	49	5.1	A	0.34	51	5.0	A	0.32	0	5.0	A
Homer Ave SB LTR	0.83	233	65.4	E	0.86	249	68.7	E	0.17	116	68.7	E
overall	-	-	*36.2*	*D*	-	-	*55.7*	*E*	-	-	*58.3*	*E*
Union Street and Summer Street (Signalized)												
Union St EB L	0.44	41	9.8	A	0.85	112	36.7	D	0.93	119	53.2	D
Union St EB T	0.51	165	9.3	A	0.57	205	9.1	A	0.59	211	9.3	A
Union St WB TR	0.82	367	24.9	C	0.95	451	39.8	D	0.98	471	45.5	D
Summer St SB LR	0.75	57	19.9	B	1.23	238	>120	F	1.26	252	>120	F
overall	-	-	*17.7*	*B*	-	-	*56.7*	*E*	-	-	*63.6*	*E*

Table 4.4 (Continued) - Summary of Level of Service Analysis, PM Peak Hour

	Existing Conditions				Future No-Build				Future Build Conditions			
	v/c	95th Q (ft)	Delay (s)	LOS	v/c	95th Q (ft)	Delay (s)	LOS	v/c	95th Q (ft)	Delay (s)	LOS
West Union Street and MBTA Access/Voyaers Lane (Signalized)												
W Union St EB L	0.09	14	9.6	A	0.38	41	15.8	B	0.41	42	17.5	B
W Union St EB TR	0.48	254	5.3	A	0.52	329	6.8	A	0.53	343	6.9	A
W Union St WB LT	0.78	613	11.2	B	0.87	818	17.1	B	0.86	869	18.4	B
W Union St WB R	0.04	0	5.5	A	0.22	62	8	A	0.21	62	7.8	A
Voyager Ln NB LTR	0.62	25	56.2	E	0.64	25	67.7	E	0.64	25	69.8	E
MBTA SB LT	0.46	86	32.5	C	0.77	188	42.9	D	0.78	188	45.4	D
MBTA SB R	0.65	31	36.1	D	0.66	54	40.2	D	0.69	55	42.2	D
overall			*11.4*	*B*			*16.8*	*B*			*17.7*	*B*
West Union Street and Ashland Junior High School Drive												
Middle School L	0.08	15	19.0	C	0.26	23	56.6	F	0.28	25	63.2	F
Middle School R	0.05	3	16.3	C	0.05	5	18	C	0.06	5	18.8	C
W Union St EB L	0.00	0	9.9	A	0.01	0	10.3	B	0.01	0	10.5	B
West Union Street and Frankland Road												
Frankland SB LT	0.30	30	35.4	E	0.41	45	51.5	F	0.44	50	55.8	F
W Union St EB L	0.01	0	9.7	A	0.01	0	10.1	B	0.01	0	10.1	B
West Union Street and Olive Street												
Olive St NB L	0.04	3	36.9	E	0.01	0	50.6	F	0.01	0	53.0	F
Olive St NB R	0.11	10	11.0	B	0.14	13	13.2	B	0.15	13	13.5	B
W Union St WB L	0.14	13	8.9	A	0.16	15	9.5	A	0.16	15	9.5	A
West Union Street at Site Drive												
Site Drive SB LR	-	-	-	-	-	-	-	-	0.35	35	57.6	F
W Union St EB L	-	-	-	-	-	-	-	-	0.04	3	10.7	B

The Level of Service analysis is summarized below:

Existing:

- There are long peak hour delays at the signalized intersections of Union Street with Main Street and with Homer Ave/Chestnut Street under current conditions.
- At the unsignalized intersections, the minor street exiting left turns experience long delay during the peak hours.
- The left turn out of Ashland Junior High School is expected to experience significant delays during the morning peak hour. The delays are expected to last only several minutes when drop off is most common. It should be noted, however, that the analysis was completed as an unsignalized

condition. When a crossing guard is employed and directing traffic at this driveway, exiting buses and private vehicles are able to efficiently and safely enter Route 135 while motorists on Route 135 are stopped; the intersection operates at LOS B.

Future No-Build

- The future No-Build analysis assumed no mitigation at the intersections.
- The specific development projects are expected to cause an increase in delay at the intersection of Union Street and Summer Street during the evening peak hour.
- The minor street exiting left turns at the unsignalized intersections experience an increase in delay as the volumes increase.

Future Build

- Motorists are expected to be able to enter the site with minimal delays and no substantive impact to Route 135.
- The analysis also has shown that the intersections will continue to operate with similar conditions and motorists are expected to see smaller changes from No-Build to Full-Build conditions.
- The intersections with estimated significant delays also experience the delays in the No-Build condition.
- Again, the Middle School driveway was modeled as an unsignalized intersection. With a crossing guard employed and directing traffic, the intersection is expected to operate at LOS C.
- Exiting the site drive is estimated that motorists will experience a delay of more than 50 seconds that indicates an LOS 'F' during peak hours. Vehicle queuing is expected to be minimal and delays are incurred by vehicles on the site drive with no or minimal impact to Route 135 flow.

In conclusion, the analysis for the Build conditions has shown that traffic will be able to enter and exit the site and the nearby intersections can adequately accommodate the additional traffic generated by the proposed project.

Build Plus Condition

As indicated previously, the conditions in which the Phase 1 Legacy Farms commercial portion of that development was estimated and analyzed. The anticipated timeframe for the construction of the LF Phase 1 commercial is not currently known and further approvals and studies will be required by the Town of Hopkinton before it goes forward. However, for informational purposes and to obtain a sense of potential effect that would have on the West Union 40B project, a LOS analysis was completed and is summarized in Tables 4.6 and 4.7. The Phase 1 commercial element and the resulting net additional peak hour traffic is summarized in Table 4.5. The forecasts and traffic assignment is taken directly from the traffic study completed for the master plan and reference earlier.

Table 4.5- Phase 1 Commercial Summary

List of Land Uses	
Type	**Area (ksf)**
General Retail	20
Grocery Store	25
Restaurants	15
Office	30
Nursery	8- retail, 30-greenhouse

Total Net Trips		
	AM	**PM**
entering	190	260
exiting	100	320
total	290	580

Table 4.6 Summary of Level of Service Analysis, Build vs Build Plus AM Peak Hour

	Future Build Conditions				Future Build Plus			
	v/c	**95th % Q (FT)**	**Delay (s)**	**LOS**	**v/c**	**95th % Q (FT)**	**Delay (s)**	**LOS**
Union Street and Main Street (Signalized)								
Union Street EB L	0.10	37	21.6	C	0.11	37	21.7	C
Union Street EB TR	1.19	1553	>120	F	1.21	1569	>120	F
Union Street WB L	0.14	35	22.8	C	0.14	35	22.8	C
Union Street WB TR	0.69	751	36.3	D	0.71	784	37	D
Main Street NB L	0.79	300	50.5	D	0.79	304	51.3	D
Main Street NB TR	0.90	905	58.3	E	0.90	905	58.3	E
Main Street SB L	0.22	55	29.4	C	0.22	55	29.4	C
Main Street SB TR	0.81	541	55.5	E	0.81	541	55.5	E
overall	-	-	*76.8*	*E*			78.4	E
Union Street and Chestnut Street/Homer Ave(Signalized)								
Union Street EB L	0.00	4	22	C	0.00	4	22	C
Union Street EB TR	1.34	862	>120	F	1.35	868	>120	F
Union Street WB L	0.60	119	26.5	C	0.60	119	26.5	C
Union Street WB TR	0.48	256	18.9	B	0.50	266	19.2	B
Chestnut Street NB LT	0.52	122	43	D	0.52	122	43	D
Chestnut Street NB R	0.60	76	5.7	A	0.60	73	5.7	A
Homer Ave SB LTR	0.76	182	60.3	E	0.76	182	60.3	E
overall	-	-	*84.6*	*F*			85.8	F
Union Street and Summer Street (Signalized)								
Union Street EB L	0.89	292	25	C	0.91	300	28.1	C
Union Street EB T	0.72	321	8.9	A	0.72	328	9.1	A
Union Street WB TR	0.75	291	20.1	C	0.77	306	21	C
Summer Street SB LR	0.85	65	32.3	C	0.87	65	32.7	C
overall	-	-	*18.2*	*B*			19.3	B

Table 4.6 (Continued) Summary of Level of Service Analysis, Build vs Build Plus AM Peak Hour

	Future Build Conditions				Future Build Plus Conditions			
	v/c	95th Q	Delay	LOS	v/c	95th Q	Delay	LOS
West Union Street and MBTA Access/Voyaers Lane (Signalized)								
West Union Street EB L	0.48	85	13.2	B	0.49	85	13.6	B
West Union Street EB TR	0.92	1032	25.6	C	0.92	1045	26.5	C
West Union Street WB LT	0.53	340	13.7	B	0.55	362	13.9	B
West Union Street WB R	0.23	69	10.7	B	0.23	69	10.7	B
Voyager Lane NB LTR	0.82	36	79.2	E	0.82	36	79.5	E
MBTA SB LT	0.90	368	66.8	E	0.89	368	67.7	E
MBTA SB R	0.62	107	42.4	D	0.62	107	42.8	D
overall			*27.3*	*C*			27.8	C
West Union Street and Ashland Middle School								
Middle School L	2.19	333	>120	F	2.30	340	>120	F
Middle School R	0.07	13	13.0	B	0.07	5	13.3	B
West Union Street EBL	0.06	5	9.4	A	0.06	5	9.4	A
West Union Street and Frankland Road								
Frankland SB LT	0.54	38	62.4	F	0.38	40	48.3	E
West Union Street EBL	0.01	0	8.5	A	0.01	0	8.6	A
West Union Street and Olive Street								
Olive Street NB L	0.03	3	29.5	D	0.04	3	30.6	D
Olive Street NB R	0.63	103	29.9	D	0.64	105	30.7	D
West Union Street WBL	0.05	5	9.9	A	0.05	5	9.9	A
West Union Street at Site Drive								
Site Drive ST LR	0.54	65	62.4	F	0.55	68	66	F
West Union Street EBL	0.00	0	8.6	A	0.00	0	8.6	A

Table 4.7 Summary of Level of Service Analysis, Build vs Build Plus PM Peak Hour

	Future Build Conditions				Future Build Plus Conditions			
	v/c	95th Q	Delay	LOS	v/c	95th Q	Delay	LOS
Union Street and Main Street (Signalized)								
Union Street EB L	0.50	96	32.2	C	0.52	109	34.0	C
Union Street EB TR	0.92	1077	53.4	D	0.95	1129	58.9	E
Union Street WB L	0.19	40	24	C	0.19	40	24	C
Union Street WB TR	0.88	915	52.5	D	0.91	950	55.5	E
Main Street NB L	1.10	420	>120	F	1.12	429	>120	F
Main Street NB TR	0.64	589	42.5	D	0.64	589	42.5	D
Main Street SB L	0.10	42	27.6	C	0.10	42	27.6	C
Main Street SB TR	1.08	937	104.6	F	1.08	937	104.6	F
overall	-	-	*67.2*	*E*			69.7	E
Union Street and Chestnut Street/Homer Ave(Signalized)								
Union Street EB L	0.03	2	23.2	C	0.03	10	23.4	C
Union Street EB TR	0.32	273	45.2	D	0.88	492	48.4	D
Union Street WB L	0.48	208	>120	F	1.32	389	>120	F
Union Street WB TR	0.48	307	26.7	C	0.77	525	27.7	C
Chestnut Street NB LT	0.17	41	37.6	D	0.32	85	37.6	D
Chestnut Street NB R	0.32	0	5	A	0.34	51	5.0	A
Homer Ave SB LTR	0.17	116	68.7	E	0.86	249	68.7	E
overall	-	-	*58.3*	*E*			62.3	E
Union Street and Summer Street (Signalized)								
Union Street EB L	0.93	119	53.2	D	0.99	123	69.9	E
Union Street EB T	0.59	211	9.3	A	0.61	224	9.7	A
Union Street WB TR	0.98	471	45.5	D	1.01	487	52.0	F
Summer Street SB LR	1.26	252	>120	F	1.27	261	>120	F
overall	-	-	*63.6*	*E*			68.2	E

Table 4.7 (Continued) Summary of Level of Service Analysis, Build vs Build Plus PM Peak Hour

	Future Build Conditions				Future Build Plus Conditions			
	v/c	95th Q	Delay	LOS	v/c	95th Q	Delay	LOS
West Union Street and MBTA Access/Voyaers Lane (Signalized)								
West Union Street EB L	0.41	42	17.5	B	0.42	42	18.8	B
West Union Street EB TR	0.53	343	6.9	A	0.55	369	7.0	A
West Union Street WB LT	0.86	869	18.4	B	0.87	909	19.5	B
West Union Street WB R	0.21	62	7.8	A	0.21	62	7.8	A
Voyager Lane NB LTR	0.64	25	69.8	E	0.65	25	71.2	E
MBTA SB LT	0.78	188	45.4	D	0.78	188	47.1	D
MBTA SB R	0.69	55	42.2	D	0.69	55	43.3	D
overall			*17.7*	*B*			18.3	B
West Union Street and Ashland Junior High School Drive								
Middle School L	0.28	25	63.2	F	0.31	28	70.4	F
Middle School R	0.06	5	18.8	C	0.06	5	19.3	C
West Union Street EBL	0.01	0	10.5	B	0.01	0	10.6	B
West Union Street and Frankland Road								
Frankland SB LT	0.44	50	55.8	F	0.48	53	62.7	F
West Union Street EBL	0.01	0	10.1	B	0.01	0	10.2	B
West Union Street and Olive Street								
Olive Street NB L	0.01	0	53	F	0.02	0	58.0	F
Olive Street NB R	0.15	13	13.5	B	0.15	13	13.9	B
West Union Street WBL	0.16	15	9.5	A	0.17	15	9.7	A
West Union Street at Site Drive								
Site Drive SB LR	0.35	35	57.6	F	0.37	38	63.3	F
West Union Street EBL	0.04	3	10.7	B	0.03	11	2.5	B

As can be seen, there is little change in delay from the Build to Build Plus in both the morning and afternoon peak hours. The added traffic from Phase 1 commercial component of the LF project is not expected to have a significant impact on the study intersections. Again, the build out time frame is unknown.

4.3 Sight Distance Analysis

Adequate sight distance is an important safety consideration at intersections. Route 135 has the available resource capacity to accept the new traffic. The focus of this sight distance analysis was the intersection of Route 135 at the proposed site drive. The study examined stopping sight distance (SSD) and intersection sight distance (ISD).

SSD, which is the more important of the two, is the distance required for an approaching driver at a height of 3.5 feet to perceive and react accordingly to an object 2 feet high at the driveway. The values are based on a perception and reaction time of 2.5 seconds and braking distance required under wet, level pavements. CSD, also known as intersection sight distance, is based on the time required to perceive,

react, and complete desired exiting maneuver from a driveway once the driver decides to execute the maneuver. Values for exiting sight distance represent the time to (1) turn left or right, in addition to accelerating to the operating speed of the roadway, without causing approaching vehicles to reduce speed by more than 10 mph, and (2) upon turning left, to clear the near half of the intersection without conflicting with the vehicles approaching from the left.

CID is more related to operations and to some degree, the convenience or inconvenience of on-coming motorists. When the roadway is either on an upgrade or downgrade, grade correction factors may be applied. Minimum criteria are defined by the American Association of State and Highway and Transportation Officials (AASHTO)[7]. SSD relates specifically to safety. As indicated by AASHTO, if the ISD at least meets or exceeds the SSD criteria, then there is adequate safe sight distance available for motorists to avoid collisions.

The posted speed limit noted on Route 135 in the vicinity of the project site is 35 mph. The measured 85th percentile speed for eastbound and westbound are 46 mph and 34 mph, respectively. The 85th percentile speeds were used for analysis of sight distance. Table 4.8 presents the AASHTO criteria and a summary of the sight distance analysis for the site drive.

In addition to the site drive, it was noted during the field inventories that the visibility in relation to Frankland Road to and from the west may be affected by the roadway curve and some of the vegetation along the north side of the roadway. Advance warning signs and/or trimming vegetation would address this matter.

TABLE 4.8- Summary of Sight Distance Analysis

	MEASURED DISTANCE (FT)	CRITERIA (FT) 34 MPH	CRITERIA (FT) 46 MPH	CRITERIA MET FOR 34 MPH	CRITERIA MET FOR 46 MPH
Route 135 at Site Drive					
Stopping Sight Distance					
Approaching from East	600+	236	372	Yes	Yes
Approaching from West	600+	236	372	Yes	Yes
Corner Sight Distance – Exit Left Turn					
Looking East	600+	375	507	Yes	Yes
Looking West	600+	375	507	Yes	Yes

Source: Based on AASHTO 2011.
Measured Distances were based on field measurements under existing conditions and a preliminary site plan. Distances assume clearing and grading within the site drive area.

There is adequate stopping sight distance and intersection sight distance at the site drive.

[7] American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets, Washington, D.C., 2011.

5.0 CONCLUSION AND RECOMMENDATIONS

The previous sections of this traffic report described the analysis procedures, assumptions and results of this traffic study. The roadways and intersections within the study area were seen to have the ability to accommodate the proposed 40B residential development related traffic. The following summarizes the traffic analysis:

- The project is estimated to generate 972 additional daily vehicle trips with entering and exiting trips split evenly and spread over the course of the day. The weekday morning and weekday evening peak hours are expected to generate 72 and 95 additional vehicle trips, respectively. The study area roadways are expected to be able to accommodate additional traffic volumes.
- Site traffic is expected to be able to enter and exit the site and abutting network safely. Traffic volume increases are expected on the study area roadways as a result of the project; however, the effect of the project traffic to the network is expected to be relatively minimal during the study periods.
- Field review of sight distances at the site driveway indicated that the most critical safety criteria (stopping sight distances) would exceed the minimum distances in both directions for speeds well above the posted speed limit. In addition, corner sight distances will exceed the minimum safety SSD criteria for the 85th percentile speeds of 34 mph eastbound and 46 mph westbound.

While the analyses shows the proposed project can be accommodated on the study area, several recommendations have been made to enhance the transportation system and reduce the project's impact. The proposed actions are as follows:

Project Related

- Any landscaping and signing proposed at the site driveway intersection with Route 135 should be designed and maintained in such a manner so as to not impede sight distances at the driveway.
- Install STOP sign and marked STOP bar for the site driveway approach to Route 135.
- Consideration should be given to installing a sidewalk along the north side of West Union Street between the site and the end of sidewalk near the Middle School. This work assumes adequate right of way exists.
- Vegetation and brush on the northerly side of Route 135 within the public right of way along the site's frontage west of the site driveway should be trimmed or cleared further to enhance the sight distance. In addition, this area can also be regraded to approximately the existing road grade to further enhance sight distance.
- To enhance driver awareness along Route 135 of the proposed site driveway, an advanced intersection warning sign (W2-2) and distance plaque (W16-2a) should be installed on Route 135 approximately 400 feet west of the proposed driveway.

Non-Project Related

- The delays at Ashland Junior High School could be reduced with a traffic control person or police detail, although the duration of the delays are relatively short.
- The specific development projects included in this study cause a delay at the intersection of Summer Street and Union Street; mitigation including signal timing updates should be considered prior to construction of these projects.

- Advanced intersection warning signs (W2-2) and speed plaque (W13-1P) should be installed at the intersection of Route 135 and Frankland Road/ Olive Street. To increase corner or stopping sight distances, it may also be desirable to remove or trim back several trees and re-grade the side slopes within the public layout as they relate to the Frankland Avenue approach to Route 135.

Independent of the project, it would be beneficial if an increase in speed enforcement, particularly in the area of West Union Street and Olive Street, could be periodically implemented. Alternatively, it may be possible to install a speed check sign in the vicinity of Olive Street in relation to eastbound traffic to encourage lower speeds.

In conclusion, while the proposed project will increase traffic on the study area network, with the above recommendations, it can be safely provided, and its potential impact on traffic operations on roadways and intersections within the study area can be adequately alleviated.