Draft Environmental Impact Report
Transportation Impact Assessment

Rocky Hill Residential Development
Elm Street
Amesbury, Massachusetts
EEA No. 16837

Prepared for:

Dale Development, LLC
Rye, New Hampshire

November 2024

Prepared by:

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Dear Reviewer:

This letter shall certify that this *Transportation Impact Assessment* has been prepared under my direct supervision and responsible charge. I am a Registered Professional Engineer (P.E.) in the Commonwealth of Massachusetts (Massachusetts P.E. No. 38871, Civil) and hold Certification as a Professional Traffic Operations Engineer (PTOE) from the Transportation Professional Certification Board, Inc. (TPCB), an independent affiliate of the Institute of Transportation Engineers (ITE) (PTOE Certificate No. 993). I am also a Fellow of the Institute of Transportation Engineers (FITE).

Sincerely,

VANASSE & ASSOCIATES, INC.

Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner

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EXECUTIVE SUMMARY

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) as a part of this Draft Environmental Impact Report (DEIR) in order to determine the potential impacts on the transportation infrastructure associated with the proposed construction of a residential development to be located off of Elm Street in the "Rocky Hill" area that is generally between Elm Street, Interstate 95 (I-95) and I-495 in Amesbury, Massachusetts (hereafter referred to as the "Project"). This assessment is responsive to the scope of work that was identified in the July 26, 2024 Certificate issued by the Secretary of Energy and Environmental Affairs on the June 7, 2024 Environmental Notification Form (ENF) that was filed for the Project and was prepared in consultation with the Massachusetts Department of Transportation (MassDOT), the City of Amesbury and the Town of Salisbury, and was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports.

Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the Institute of Transportation Engineers (ITE)[1] and without adjustment to account for the use of alternative modes of transportation to SOVs by residents of the Project, the Project is expected to generate approximately 2,738 vehicle trips on an average weekday (two-way, 24-hour volume), with 163 vehicle trips expected during the weekday morning peak-hour and 208 vehicle trips expected during the weekday evening peak-hour;

2. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over anticipated future conditions without the Project (No-Build condition), acknowledging that one or more movements at the study area intersections are currently or predicted to operate at or over capacity (i.e., level-of-service (LOS "E" or "F", respectively) independent of the Project. Project-related impacts at off-site intersections are generally defined as a predicted increase in average motorist delay that resulted in a corresponding increase in vehicle queuing of up to six (6) vehicles;

3. All movements exiting the Project site driveway to Elm Street are predicted to operate with extended delay (i.e., LOS "F") due to the relatively large volume of conflicting traffic traveling along Elm Street during the peak periods; however, the resulting residual vehicle queue (up to five (5) vehicles), can be contained along the Project site driveway without

[1] *Trip Generation,* 11th Edition; Institute of Transportation Engineers; Washington, DC; 2021.

inhibiting access, or the movement of vehicles, pedestrians or bicyclists along Elm Street. All movements along Elm Street approaching the Project site driveway are predicted to operate at LOS A with negligible vehicle queuing;

4. Independent of the Project, the Route 110/Merrill Street/Rabbit Road and Route 110/ Elm Street/Clarks Road intersections were identified to have a motor vehicle crash rate that exceeded the MassDOT average crash rates for similar intersections, with the Route 110/ Merrill Street/Rabbit Road intersection also identified by MassDOT as high crash cluster locations for the 2019-2021 reporting period and Highway Safety Improvement Program (HSIP) eligible. As such, specific recommendations have been provided at these intersections in an effort to advance safety-related improvements; and

5. Lines of sight at the Project site driveway intersection with Elm Street were found to exceed the recommended minimum sight distance to function in a safe and efficient manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The following improvements have been recommended as a part of this assessment and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits and approvals.

Project Access

Access to the Project site will be provided by way of a full access driveway that will intersect the east side of Elm Street generally opposite the south driveway to the Hampton Inn Amesbury. Secondary access for emergency vehicles will be provided through a connection to the abutting property to the north at 227 Elm Street which will be secured by a gate or other means acceptable to the Amesbury Fire Department. The following recommendations are offered with respect to the design and operation of the Project site access and internal circulation:

- The Project site driveway and internal intersections should be a minimum of 22-feet in width (24 feet desirable) and designed to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle. Consideration should be given to widening the driveway approaching Elm Street to provide an area for parent/caregiver vehicles to park when waiting for the school bus.

- The emergency vehicle access road should be 20-feet in width and paved or constructed of a stabilized base material that will support travel by the largest responding emergency vehicle under all weather conditions, and should be gated or otherwise secured in a means acceptable to the Amesbury Fire Department.

- Where a boulevard type roadway is proposed within the Project site, the one-way travel lanes on either side of the raised median should be a minimum of 20 feet in width unless a

reduced width is approved by the Amesbury Fire Department. On-street parking should be restricted in locations where the roadway width will be less than 24 feet.

- Where perpendicular parking is proposed, the maneuvering area behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.

- Vehicles exiting the Project site driveway to Elm Street and at intersections of minor streets with the main circulating roadway within the Project site should be placed under STOP-sign control with a marked STOP-line provided.

- Appropriate signs and pavement markings should be provided to regulate the flow of traffic on the approaches to and within the roundabout that is planned within the Project site, including "Yield" signs and accompanying pavement markings on the approaches and "One-Way" signs within the roundabout. In addition, splitter islands should be provided on all approaches to the roundabout that provide proper deflection to reduce approach speeds and reinforce the one-way circulation.

- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[2]

- Sidewalks should be provided along both sides of the Project site driveway and internal roadways within the Project site and should connect to the existing sidewalk along the northeast side of Elm Street.

- Americans with Disabilities Act (ADA)-compliant wheelchair ramps should be provided at pedestrian crossings to be modified or constructed in conjunction with the Project, including for crossing the Project site driveway along Elm Street or the driveway should be designed so that the sidewalk crosses the driveways (i.e., pan-type driveway).

- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas should be designed and maintained so as not to restrict lines of sight.

- Snow accumulations (windrows) within sight triangle areas should be promptly removed where such accumulations would impede sight lines.

Off-Site

- **Route 110 Coordinated Traffic Signal System**

The addition of Project-related traffic to the signalized intersections along Route 110 within the study area was shown to result in an increase in motorist delays and vehicle queuing over No-Build conditions, with the Route 110/Merrill Street/Rabbit Road and Route 110/ Elm Street/Clarks Road intersections identified as high crash locations. In order to enhance safety and to off-set the predicted impact of the Project, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan (where applicable) for the following intersections:

1. Route 110 at the Carriagetown Marketplace Driveway;
2. Route 110 at Elm Street and Clark's Road;
3. Route 110 at the I-95 Southbound Off-Ramp (future); and

[2] *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

4. Route 110 at Merrill Street and Rabbit Road (not currently coordinated)

The initial traffic signal timing improvements will be completed prior to the issuance of any Certificate of Occupancy for the Project subject to receipt of all necessary rights, permits and approvals, and will include a review of the "yellow" and "all-red" clearance intervals and the pedestrian phase timings. Operating conditions at the subject intersections will reviewed thereafter as a part of the annual traffic Monitoring and Reporting Program (discussion follows) and the traffic signal timing, phasing and coordination will be further adjusted based on the results of the monitoring program again, subject to receipt of all necessary rights, permits and approvals. With the traffic signal timing improvements, operating conditions are predicted to generally improve over or to be restored to No-Build conditions.

❖ **Route 110 Corridor Improvements**

Route 110 at the I-95 North and Southbound Ramps

Independent of the Project, right-turn movements from the I-95 northbound ramp to Route 110 westbound and left-turn movements from the I-95 southbound off-ramp to Route 110 westbound are currently operating at or over capacity during both peak hours, with vehicle queues on the I-95 northbound off-ramp extending up to 72 vehicles. In order to improve operating conditions at the I-95 ramp intersections with Route 110, a review of geometric and traffic control improvements was undertaken, including the installation of a traffic control signal or modern roundabout at the Route 110/I-95 southbound off-ramp intersection. Based on this review, it was determined that the Route 110/I-95 southbound off-ramp intersection appears to meet the warrants identified in the MUTCD[3] for the installation of a traffic signal and that the traffic signal control alternative combined with the geometric improvements that have been recommended at the Route 110/ Elm Street/Clark's Road intersection (discussion follows) would result in improved operating conditions over the modern roundabout alternative such that the I-95 northbound off-ramp to Route 110 westbound would no longer be blocked thereby also improving traffic operations for the I-95 northbound off-ramp to Route 110 westbound.

With the installation of a traffic control signal at the Route 110/I-95 southbound off-ramp intersection, the integration of the new traffic signal into the Route 110 coordinated traffic signal system and the completion of the associated geometric improvements along Route 110, operating conditions at both I-95 ramp intersections will be improved over No-Build conditions such that all movements are predicted to operate at LOS D or better with a significant reduction in vehicle queuing along the I-95 northbound off-ramp to Route 110 westbound (predicted to be no more than two (2) vehicles).

With the reconstruction of the Route 110/I-95 southbound ramps intersection to operate under modern roundabout control, all movements at the intersection are predicted to operate at LOS D or better consistent with the traffic signal control alternative; however, vehicle queuing along the Route 110 westbound approach during the weekday evening peak-hour is predicted to extend beyond the I-95 northbound off-ramp such that operations on that approach would be negatively impacted.

In an effort to improve traffic operations within the Route 110/I-95 interchange and recognizing the limited impact of the Project at the off-ramp intersections (defined as a predicted increase

[3]Federal Highway Administration, op. cit. 3.

in vehicle queuing of up to six (6) vehicles), the Project proponent will prepare an Interchange Improvement Study (IIS) and a MassWorks grant application for submission by the City for the design and construction of the identified improvements. The IIS and MassWorks grant application will be prepared in consultation with MassDOT and provided to the City prior to the issuance of any Certificate of Occupancy for the Project.

Route 110 at Elm Street and Clark's Road

Independent of the Project, specific movements along Route 110 at the Route 110/Elm Street/ Clark's Road intersection are currently or are predicted to operate at or over capacity, with residual vehicle queuing along the Route 110 westbound approach that extends through the Route 110/I-95 southbound ramps intersection. In an effort improve operating conditions at the Route 110/Elm Street/Clark's Road intersection and within the Route 110/I-95 interchange, the Project proponent will undertake the following improvements at the Route 110/Elm Street/ Clark's Road intersection:

- Widen Route 110 westbound to accommodate three (3) through travel lanes between the I-95 southbound off-ramp to a point approximately 300 feet west of Elm Street;

- Reconstruct the intersection and traffic signal system to accommodate the additional through travel lane, including a section of the Salisbury Point Ghost Trail that is situated along the north side Route 110; and

- Design and implement an optimal traffic signal timing, phasing and coordination plan.

These improvements will be designed and constructed prior to the issuance of a Certificate of Occupancy for the Project and subject to receipt of all necessary rights, permits and approvals.

❖ **Safety Improvements**

Route 110 at Merrill Street and Rabbit Road/Route 110 at Elm Street and Clarks Road

Independent of the Project, the Route 110/Merril Street/Rabbit Road and Route 110/Elm Street/ Clarks Road intersection were found to have motor vehicle crash rates above the MassDOT statewide and District average crash rate for similar intersections. Additionally, the Route 110/Merrill Street/Rabbit Road intersection has been identified by MassDOT as a high crash location for the 2019 through 2021 reporting period. In an effort to off-set the predicted impact of the Project and to improve safety at these intersections, the Project proponent will: i) facilitate the completion of a Road Safety Audit (RSA) at both intersections; and ii) design and implement the short-term, low-cost improvements that are identified as an outcome of the RSA. The results of the RSA at the Route 110/Elm Street/Clarks Road intersection will be used to inform the design of the intersection improvements described above. The RSA will be completed prior to the filing of the Final Environmental Impact Report (FEIR) for the Project. The FEIR will identify the suggested improvement measures that are an outcome of the RSA along with those that will be undertaken as a part of the Project.

Elm Street Pedestrian Crossing

In order to facilitate pedestrian access to the Project and connectivity to public transportation (discussion follows), the Carriagetown Marketplace and the Salisbury Point Ghost Trail, a pedestrian actuated Rectangular Rapid Flashing Beacon (RRFB) will be installed at the existing

crosswalk across the Elm Street northwest leg of the Elm Street/Hampton Inn Amesbury driveway intersection to include pedestrian crossing warning signs at and in advance of the crossing. These improvements will be completed prior to the issuance of a Certificate of Occupancy for the Project and subject to receipt of all necessary rights, permits and approvals.

Transportation Demand Management

Public transportation services are provided within the study area by Merrimack Valley Transit (MeVA). MeVA operates fixed-route bus service along Elm Street and Route 110 by way of bus Route 17, *Salisbury Beach via Amesbury*, and Route 19, *Amesbury/Costello*. The Route 17 bus provides service between the Washington Square Transit Center in Haverhill and Salisbury Beach and travels along Elm Street past the Project to Route 110. The closest regular stop for the Route 17 bus to the Project site is at the Elm Street/Carriagetown Marketplace Driveway intersection, approximately 600 feet (or a 2-minute walk) from the Project site. The Route 19 bus provides service between the Nicholas J. Costello Transportation Center in Amesbury and the Newburyport MBTA Station, and travels along Route 110 to the I-95 interchange. The closest regular stop for the Route 19 bus to the Project site located within the Carriagetown Marketplace, approximately 0.25 miles (or a 5-minute walk) from the Project site. MeVA buses also operate in a "flag stop" mode, where a rider can request a stop anywhere along the regular service route by signaling to the driver.

In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- A transportation coordinator will be designated for the Project, who may have other duties and responsibilities, to coordinate the elements of the TDM program;
- The transportation coordinator will facilitate a rideshare matching program for residents to encourage carpooling;
- A "welcome packet" will be provided to new residents detailing available public transportation services, bicycle and walking alternatives, and other commuting options;
- Amenities will be provided to support telecommuting by residents of the Project that may take the form of meeting space or collaboration areas within the clubhouse;
- Information regarding public transportation services, maps, schedules, and fare information will be posted in a central location and/or otherwise made available to residents;
- Pedestrian accommodations will be incorporated within the Project and consist of sidewalks that connect to the existing sidewalk infrastructure along Elm Street; and
- Secure bicycle parking will be provided at appropriate locations within the Project site, such as by the clubhouse and recreation areas.

In addition, the Project proponent will consult with MeVA and the City to establish a bus stop along Elm Street at the Project site. To the extent that a bus stop is established and if so desired by MeVA, a bus shelter will be provided at a location determined in consultation with MeVA and MassDOT.

With implementation of the aforementioned recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

Traffic Monitoring Program

The Project proponent will conduct a post-development traffic monitoring and resident survey program in order to evaluate the success and to refine the elements of the TDM program, and to validate the trip projections for the Project. The monitoring program will include:

i) Obtaining traffic-volume information over a continuous seven-day, weeklong period on the driveway serving the Project;

ii) Performing manual turning movement and vehicle classification counts at the following intersections (the "Monitored Intersections") during the weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak periods:

- Elm Street at the Project site driveway
- Route 110 at the Carriagetown Marketplace Driveway;
- Route 110 at Elm Street and Clark's Road;
- Route 110 at the I-95 Southbound Ramps
- Route 110 at the I-95 Northbound Ramps
- Route 110 at Merrill Street and Rabbit Road;

iii) Evaluating motor vehicle crash data at the Monitored Intersections; and

iv) Performing a survey of resident commuting modes.

The monitoring program will commence six (6) months after issuance of the first Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report (the "Traffic Monitoring Report") to be provided to MassDOT, the Merrimack Valley Planning Commission (MVPC) and the City of Amesbury within 2-months after the completion of the data collection effort. The Traffic Monitoring Report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the Monitored Intersections; and iii) the elements of the TDM program that have been implemented and use of alternative modes of transportation to SOVs by residents.

If and to the extent any of the following occur: i) the volume of traffic attributable to the Project as measured at the Project site driveway exceeds the projected traffic volumes on a daily or peak-hour basis by more than 10 percent; ii) there is an increase in the frequency of occurrence of motor vehicle crashes at the Monitored Intersections that can be attributed to the Project; or iii) traffic operations at the Monitored Intersections are materially degraded as a result of the addition of Project-related traffic; the Project proponent will coordinate with the appropriate approving authorities to implement one or more of the following measures subject to receipt of all necessary rights, permits and approvals:

- Traffic signal timing, phasing and coordination improvements
- Sign and pavement marking installation
- Expansion or refinement of the elements of the TDM program

The specific improvement measure(s) will be summarized in the Traffic Monitoring Report and their status and effectiveness will be evaluated in the subsequent Traffic Monitoring Report.

INTRODUCTION

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) as a part of this Draft Environmental Impact Report (DEIR) in order to determine the potential impacts on the transportation infrastructure associated with the proposed construction of a residential development to be located off of Elm Street in the "Rocky Hill" area that is generally between Elm Street Interstate 95 (I-95) and I-495 in Amesbury, Massachusetts (hereafter referred to as the "Project"). This assessment is responsive to the scope of work that was identified in the July 26, 2024 Certificate issued by the Secretary of Energy and Environmental Affairs on the June 7, 2024 Environmental Notification Form (ENF) that was filed for the Project and evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing traffic conditions and future traffic conditions, both with and without the Project, along Elm Street and Route 110 (Macy Street and Elm Street, in Salisbury), and at major intersections located along these roadways through which Project-related traffic will travel.

PROJECT DESCRIPTION

The Project will entail the construction of a residential development to be located off of Elm Street in Amesbury, Massachusetts. The Project will include the construction of up to 400 residential units in several buildings clustered within the Project site to include up to 309 multifamily residential units, 83 single-family attached homes (townhomes and duplex units) and eight (8) single-family detached cottage-type homes, with amenities and supporting parking. It is expected that a portion of the residents of the Project will be "empty nesters" that are looking to downsize their living area and remain within the City of Amesbury. The Project site includes multiple lots in both the City of Amesbury and the Town of Salisbury, with the area that is to be developed located entirely within the City of Amesbury and encompasses approximately 87.36± acres of land that is bounded by residential properties and areas of open and wooded space to the north; I-495, residential properties and areas of open and wooded space to the south and east; and Elm Street, residential and commercial properties and areas of open and wooded space to the west. The Project site currently contains three (3) single-family homes with associated driveways and appurtenances, all of which will be removed to accommodate the Project. Figure 1 depicts the Project site location in relation to the existing roadway network, with Figure 2 displaying roadway functional classification and jurisdiction, and the location of railroads and sensitive receptors.

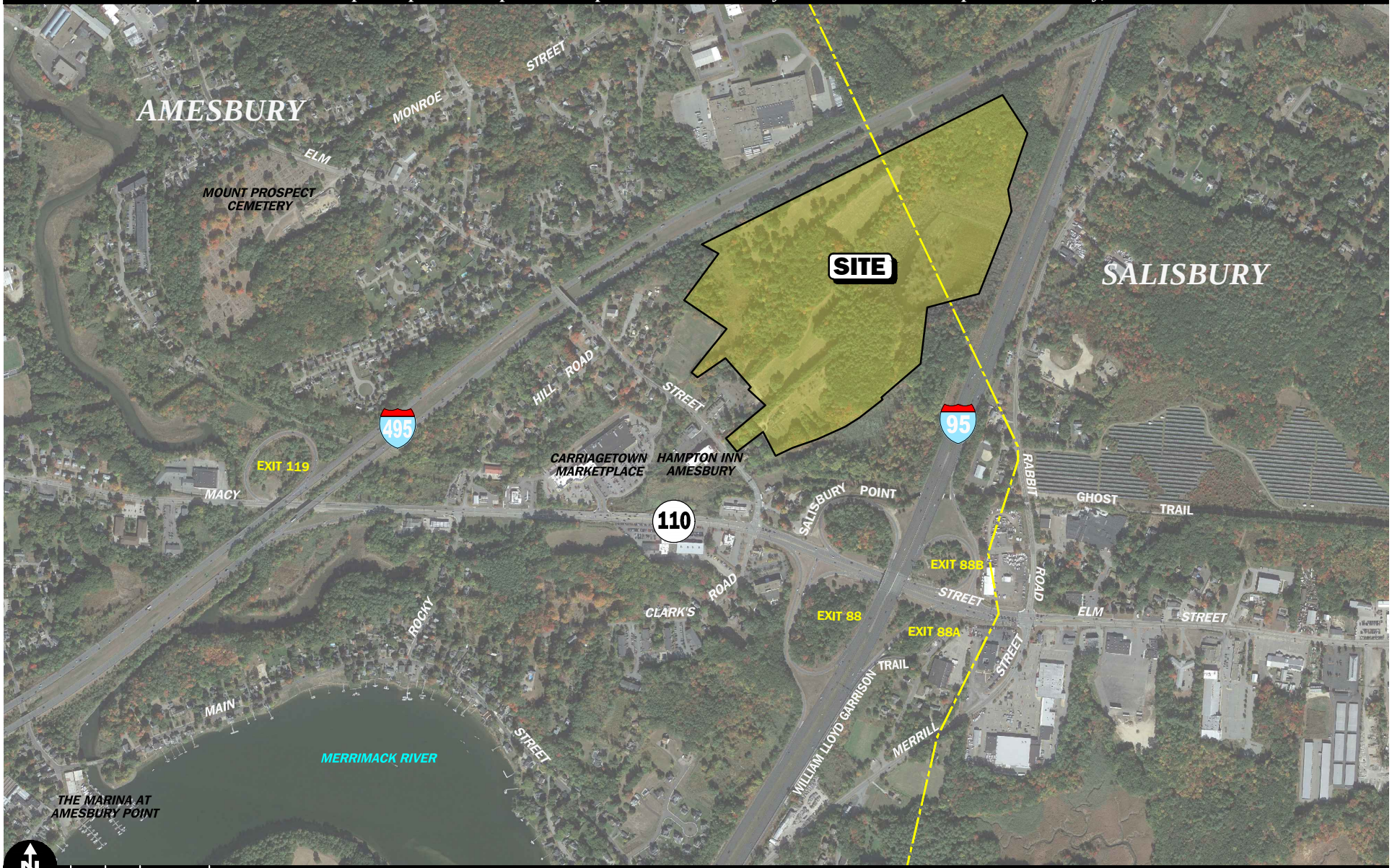

Figure 1

Site Location Map

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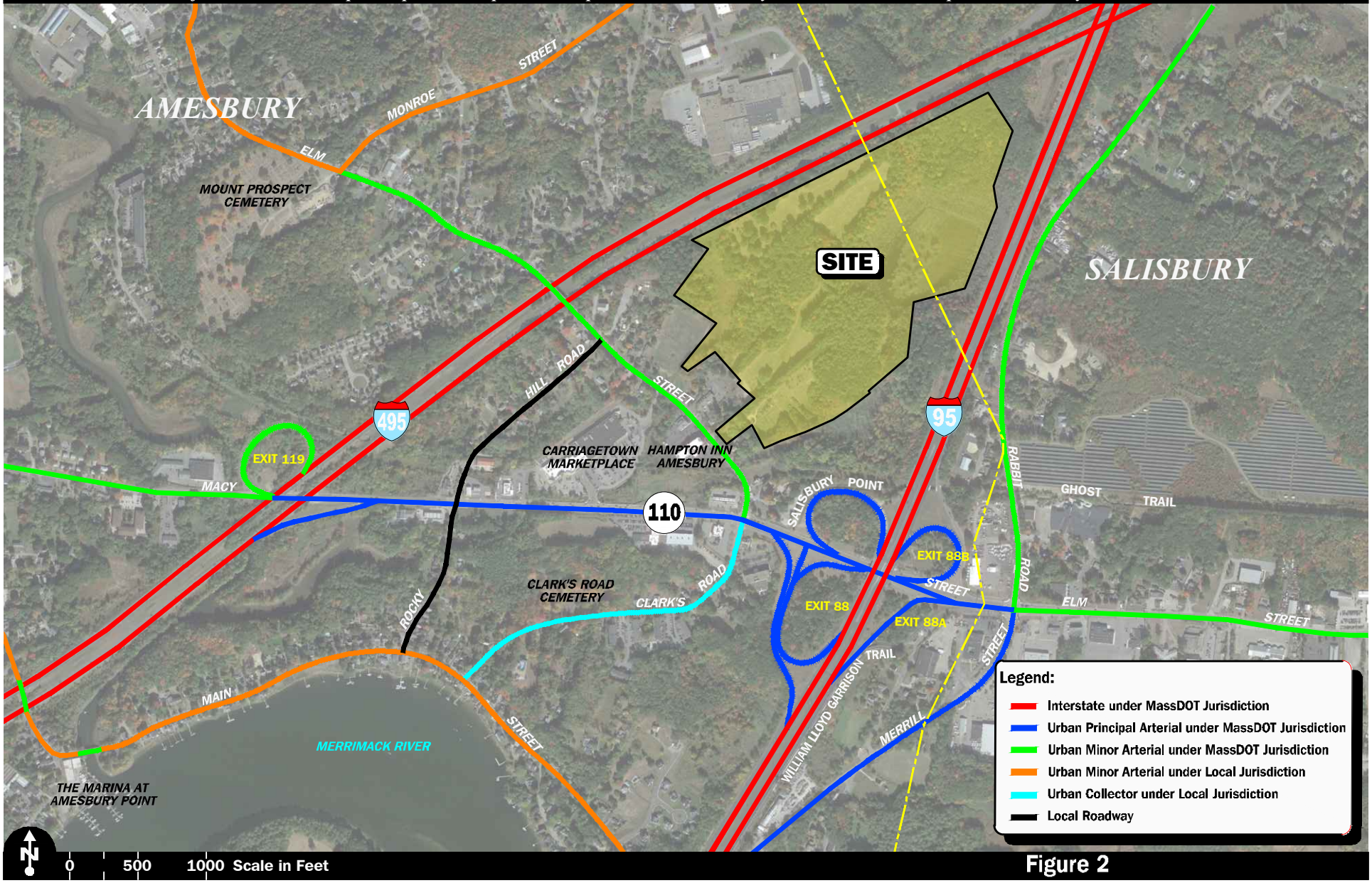


Figure 2

Roadway Jurisdiction, Railroad, and Sensitive Receptors

Vanasse & Associates inc

Access to the Project site will be provided by way of a full access driveway that will intersect the east side of Elm Street generally opposite the south driveway to the Hampton Inn Amesbury. Secondary access for emergency vehicles will be provided through a connection to the abutting property to the north at 227 Elm Street which will be secured by a gate or other means acceptable to the Amesbury Fire Department. The Project will require the issuance of a State Highway Access Permit from the Massachusetts Department of Transportation (MassDOT) for access to Elm Street as the section of roadway along which the Project site is located is a State Highway that is under MassDOT jurisdiction, as well as to implement the improvements along Route 110 that have been identified as a part of this assessment.

On-site parking will be provided in individual driveways and garages for the single-family attached and detached units, and by surface and on-street parking for the multifamily units, with a targeted parking ratio of 1.5 parking spaces per residential unit to be provided. Additional parking will be provided for guests and at the amenity building. The proposed parking supply (a minimum of 1.5 parking spaces per unit) will meet or exceed the parking requirements of Section VIII, *Off Street Parking and Loading*, of the City of Amesbury Zoning Ordinance.[4]

STUDY METHODOLOGY

This assessment is responsive to the scope of work that was identified in the July 26, 2024 Certificate issued by the Secretary of Energy and Environmental Affairs on the June 7, 2024 ENF that was filed for the Project, and was: i) prepared in consultation with MassDOT, the City of Amesbury and Town of Salisbury; ii) performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports; and iii) was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian and bicycle facilities; public transportation services; observations of traffic flow; and collection of daily and peak-period traffic counts.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the Project were assessed along with future traffic demands due to expected traffic growth independent of the Project. A seven-year time horizon was selected for analyses consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. The traffic analysis conducted in stage two identifies existing or projected future roadway capacity, traffic safety, and site access issues.

The third stage of the study presents and evaluates measures to address traffic and safety issues, if any, identified in stage two of the study.

[4]The City of Amesbury Zoning Ordinance requires a minimum of 1.5 parking spaces per dwelling or apartment unit.

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in July 2023 and in February and September 2024. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; public transportation services; traffic volumes; and operating characteristics; as well as posted speed limits and land use information within the study area. The study area that was assessed for the Project consisted of Elm Street and Route 110, and the following specific intersections through which Project-related traffic will travel:

- Route 110 at the I-495 Southbound On-Ramp;
- Route 110 at the I-495 Northbound Off-Ramp;
- Route 110 at Rocky Hill Road;
- Route 110 at the Carriagetown Marketplace Driveway;
- Route 110 at Elm Street and Clark's Road;
- Route 110 at the I-95 Southbound Ramps;
- Route 110 at the I-95 Northbound Ramps;
- Route 110 at Merrill Street and Rabbit Road;
- Elm Street at Rocky Hill Road;
- Elm Street at the Carriagetown Marketplace Driveway; and
- Elm Street at the Hampton Inn Amesbury Driveway.

The following describes the study area roadways and intersections.

ROADWAYS

Route 110 (Macy Street and Elm Street)

- Between I-495 and Merrill Street, Route 110 provides four travel lanes (two lanes in each direction) and is classified as an urban principal arterial roadway that is under MassDOT jurisdiction;
- To the east of Merrill Street and the west of I-495, Route 110 provides two to three travel lanes (one to two lanes in each direction) and is classified as an urban minor arterial roadway that is under MassDOT jurisdiction;

- Route 110 traverses a general east-west alignment providing a full access interchange with I-95 to the east of the Project site and a limited access interchange with I-495 to the west;
- Within the study area, Route 110 generally provides two (2) 11 to 12-foot wide travel lanes per direction that are separated by a raised or painted median or a double-yellow centerline with variable width marked shoulders and additional travel lanes provided at major intersections;
- Within the City of Amesbury, Route 110 is known as Macy Street, changing to Elm Street east of the I-95 northbound ramps;
- The posted speed limit along the roadway within the study area varies from 40 to 45 miles per hour (mph);
- A sidewalk is provided along the south side of the roadway extending to Rocky Hill Road where the sidewalk shifts to the north side to Elm Street and then along both sides to Merrill Street where the sidewalk is provided along the north side of the roadway only;
- Illumination is provided by way of street lights mounted on wood poles;
- Land use within the study area consists of commercial properties and areas of open and wooded space.

Elm Street

- Two lane urban minor arterial roadway under MassDOT jurisdiction between Route 110 and a point just east of Monroe Street where the roadway is under the jurisdiction of the City of Amesbury;
- Traverses a general northwest-southeast alignment between Route 110 and the Main Street/Market Street (Route 150) intersection;
- In the vicinity of the Project site, Elm Street provides two (2) 11 to 12-foot wide travel lanes that are separated by a double-yellow centerline with 5-foot wide bike lanes and additional travel lanes provided at major intersections;
- A posted speed limit is not provided within the study area and, as such, the statutory speed limit pursuant to M.G.L. c. 90 § 17C is 25 mph;[5]
- Pedestrian facilities (shared-use path or a sidewalk) are provided along the northeast side of Elm Street between Route 110 and the Project site, and along both sides to the north. The sidewalk to the south of the Project site connects to the Salisbury Point Ghost Trail shared-use path;
- Illumination is provided by way of street lights mounted on wood poles;
- Land use within the study area consists of the Project site, the Carriagetown Marketplace, residential and commercial properties, and areas of open and wooded space.

[5]The statutory or "prima facie" speed limit is defined in M.G.L. Chapter 90, Section 17, as the speed which would be deemed reasonable and proper to operate a motor vehicle. On May 12, 2021, the City of Amesbury adopted a citywide speed limit of 25 mph on roadways located within a thickly settled or business district where a special speed regulation (posted speed limit) is not provided.

INTERSECTIONS

Table 1 and Figure 3 summarize existing lane use, traffic control, and pedestrian and bicycle accommodations at the study area intersections as observed in February and September 2024.

Table 1
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Rte. 110/ I-495 Southbound On-Ramp	None[b]	1 through travel lane and 1 right-turn lane on Rte. 110 westbound approach; 1 through lane on the Rte. 110 eastbound approach	Yes; 3-to 9-feet on Rte. 110 west of the intersection; 10-feet on Rte. 110 east of the intersection; and 2-to 3-feet on the I-495 southbound on-ramp	Yes; a sidewalk is provided along the south side of Rte. 110	Yes; shared traveled-way[c] provided on Rte. 110 west of the intersection
Rte. 110/ I-495 Northbound Off-Ramp	None[d]	2 through travel lanes on Rte. 110 westbound approach; 1 through travel lane on the Rte. 110 eastbound approach; 1 travel lane on the I-495 northbound off-ramp approach	Yes; 1 to 8-feet on all legs	Yes; a sidewalk is provided along the south sides of Rte. 110; a marked crosswalk is provided across the I-495 northbound off-ramp	No
Rte. 110/ Rocky Hill Rd.	S	1 through and 1 through/ right-turn lane on Rte. 110 approaches; 1 right-turn lane on Rocky Hill Rd. approaches; Rte. 110 is median divided at the intersection restricting left-turns	Yes; 3-feet on Rte. 110	Yes; a sidewalk is provided along the south side of Rte. 110 west of the intersection, the north side for Rte. 110 east of the intersection and the west side of Rocky Hill Rd. south of the intersection; a marked crosswalk is provided along the Rocky Hill Rd. south leg and the Rte. 110 east leg	No
Rte. 110/ Carriagetown Marketplace Dwy	TS	1 left-turn lane and 2 through travel lanes on Rte. 110 eastbound approach; 1 through travel lane and 1 through/right-turn lane on Rte. 110 westbound approach; 1 left-turn and 1 right-turn lane on the Carriagetown Marketplace Dwy approach.	Yes; 1 to 3-feet on all legs	Yes; a sidewalk is provided along the north side of Rte. 110 and the west side of the Carriagetown Marketplace Dwy; a marked crosswalk is provided across the Carriagetown Marketplace Dwy; Pedestrian traffic signal equipment and phasing (exclusive) is provided	No

See notes at end of table.

Table 1 (Continued)
STUDY AREA INTERSECTION DESCRIPTION

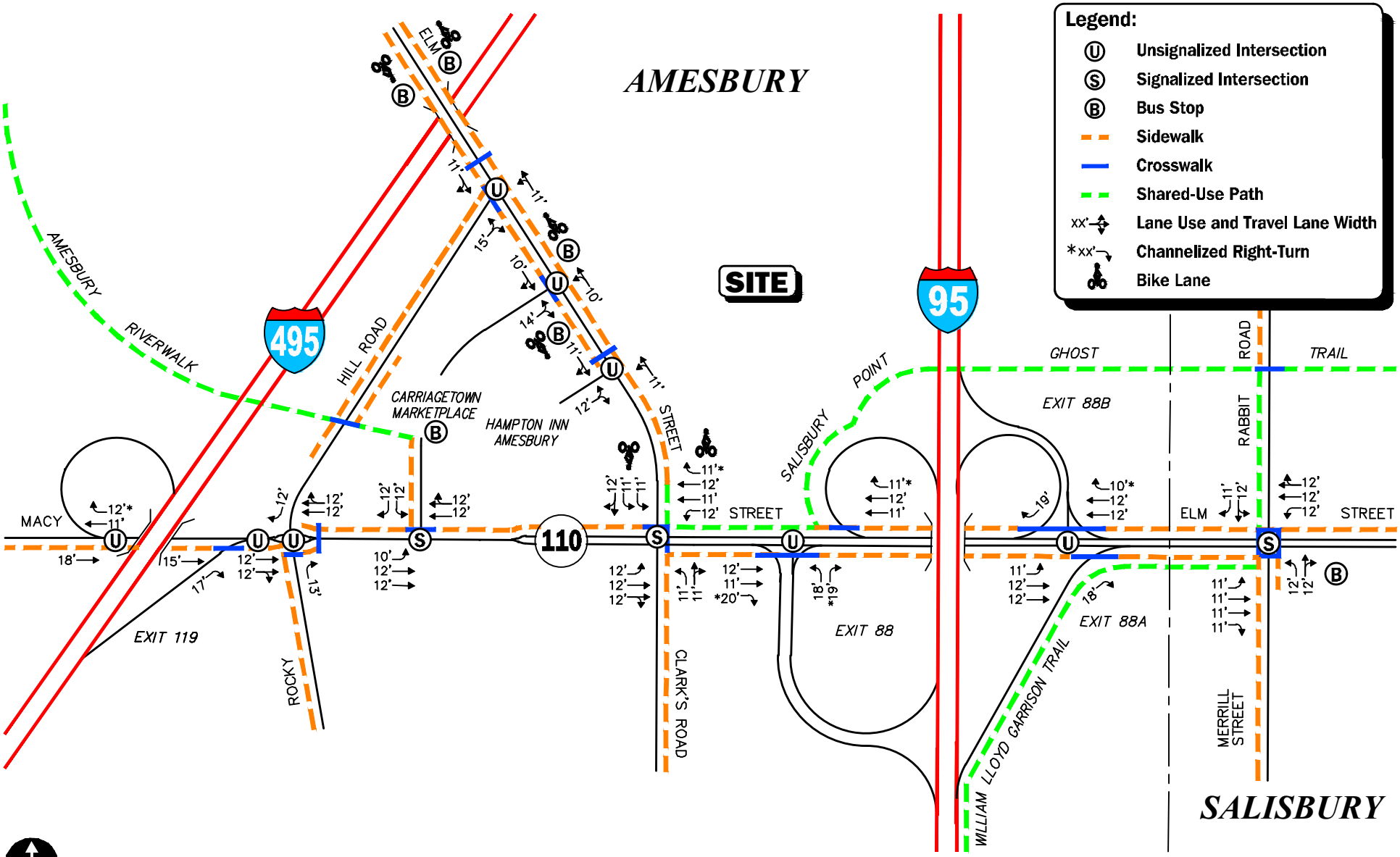
Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Rte. 110/ Elm St./ Clark's Rd.	TS	1 left-turn lane, 1 through travel lane and 1 through/right-turn lane on Rte. 110 eastbound approach; 1 left-turn lane, 2 through travel lanes on Rte. 110 westbound approach with right-turns exiting prior to the intersection by way of a channelized right-turn lane; 1 left-turn lane and 1 though/ right-turn lane on Clark's Rd. approach; 2 left-turn lanes and 1 through/right-turn lane on Elm St. approach	Yes; 1 to 4-feet on all legs	Yes; a sidewalk or shared-use path is provided along the north side of Rte. 110 west of the intersection; along both sides of Rte. 110 east of the intersection and the along the east sides of Clark's Rd. and Elm St.; pedestrian traffic signal equipment and phasing (exclusive) is provided	Yes; a shared-use path is provided along the Rte. 110 westbound approach that continues along the east side of Elm St.; bicycle detection equipment is provided
Rte. 110/ I-95 Southbound Ramps	Y	2 through travel lanes provided on Rte. 110 approaches; 1 left-turn lane provided on I-95 southbound off-ramp approach; eastbound, westbound and northbound right-turns exit prior to the intersection by way of a channelized right-turn lanes	Yes; 2 to 12-feet on all legs	Yes; a sidewalk or shared-use path is provided along both sides of Rte. 110; marked crosswalks are provided across the I-95 southbound ramps	Yes; a shared-use path is provided along the north side of Rte. 110 west of the intersection
Rte. 110/ I-95 Northbound Ramps	Y	1 left-turn lane and 2 through travel lanes provided on Rte. 110 eastbound approach; 2 through lanes provided on Rte. 110 westbound approach; 1 right-turn lane on the I-95 northbound off-ramp approach; westbound and southbound right-turns exit prior to the intersection by way of channelized right-turn lanes	Yes; 1 to 10-feet on all legs	Yes; sidewalks are provided along both sides of Rte. 110; marked crosswalks are provided across the I-95 northbound ramps	No

See notes at end of Table.

Table 1 (Continued)
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Rte. 110/ Merrill St./ Rabbit Rd.	TS	1 left-turn lane, 2 through travel lanes and 1 right-turn lane on Rte. 110 eastbound approach; 1 left-turn lane, 1 through travel lane and 1 through/ right-turn lane on Rte. 110 westbound approach; 1 left-turn lane and 1 through/right-turn lane on Merrill St. approach; 1 left-turn/ through lane and 1 right-turn lane on Rabbit Rd. approach	Yes; 1 to 7-feet on all legs	Yes; sidewalks are provided along both sides of Rte. 110 west of the intersection and Merrill St., and along the north side of Rte. 110 east of the intersection; a shared-use path approaches the intersection from the southwest that continues along the west side of Rabbit Rd.; marked crosswalks are provided across all legs; pedestrian traffic signal equipment and phasing (exclusive) provided	Yes; a shared-use path approaches the intersection from the southwest and continues along the west side of Rabbit Rd.
Elm St./ Rocky Hill Rd.	S	1 general purpose travel lane provided on all approaches	Yes; 5-feet (bike lanes) on Elm St.	Yes; sidewalks are provided along both sides of Elm St. and the west side of Rocky Hill Rd.; marked crosswalks provided for crossing Rocky Hill Rd. south leg and Elm St. east leg	Yes; bike lanes provided along Elm St.
Elm St./ Carriagetown Marketplace Dwy	S	1 general purpose travel lane provided on all approaches	Yes; 5-feet (bike lanes) on Elm St.	Yes; sidewalks are provided along both sides of Elm St. and the west side of the Carriagetown Marketplace Dwy; a marked crosswalk is provided for crossing the Carriagetown Marketplace Dwy	Yes; bike lanes provided along Elm St.
Elm St./ Hampton Inn Amesbury Dwy	S	1 general purpose travel lane provided on all approaches	Yes; 5 to 8-feet (bike lanes) on Elm St.	Yes; sidewalks are provided along both sides of Elm St. north of the intersection; and the east side of Elm St. to the south; a marked crosswalk is provided across Elm St. north leg	Yes; bike lanes provided along Elm St.

[a]TS = traffic signal control; S = STOP-sign control; Y = Yield-sign control.
[b]No traffic control is present as the intersection consists of vehicles diverging from one another to access the on-ramp.
[c]Combined shoulder and travel lane width equal to or exceed 14 feet.
[d]No traffic control is present as the I-495 off-ramp adds a lane on Route 110.



Not to Scale

Figure 3

Existing Intersection Lane Use, Travel Lane Width, and Pedestrain Facilities

Vanasse & Associates inc

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EXISTING TRAFFIC VOLUMES

In order to determine existing traffic-volume demands and flow patterns within the study area, automatic traffic recorder (ATR) counts, turning movement counts (TMCs), and vehicle classification counts were completed in July 2023 and in February and September 2024. The ATR counts were conducted on February 14th through 15th, 2024 (Wednesday through Thursday, respectively) on Elm Street in the vicinity of the Project site in order to record weekday traffic conditions over an extended period, with peak-period TMCs performed at the study intersections during the weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak-periods on: Thursday, July 13th, 2023; Wednesday, February 14th, 2024; Tuesday, February 27th, 2024; and Wednesday, September 4th, 2024. These time periods were selected for analysis purposes as they are representative of the peak traffic-volume hours for both the Project and the adjacent roadway network.

Traffic-Volume Adjustments

In order to evaluate the potential for seasonal fluctuation of traffic volumes within the study area, MassDOT weekday seasonal factors for Urban Group 3 (other principal arterials) and 4-7 (minor arterials, major and minor collectors and local roadways) roadways, which include the functional classifications of the study area roadways were reviewed.[6] Based on a review of this data, it was determined that, with exception of February traffic volumes which were found to be approximately 2.9 percent *below* average month conditions, the July and September traffic volumes were found to be up to 8.7 percent *above* average month conditions. As such, no adjustment was made to the July and September traffic counts as they represent above average-month traffic volumes conditions. The February traffic counts were adjusted upwards by 2.9 percent in order to be representative of average-month traffic volume conditions.

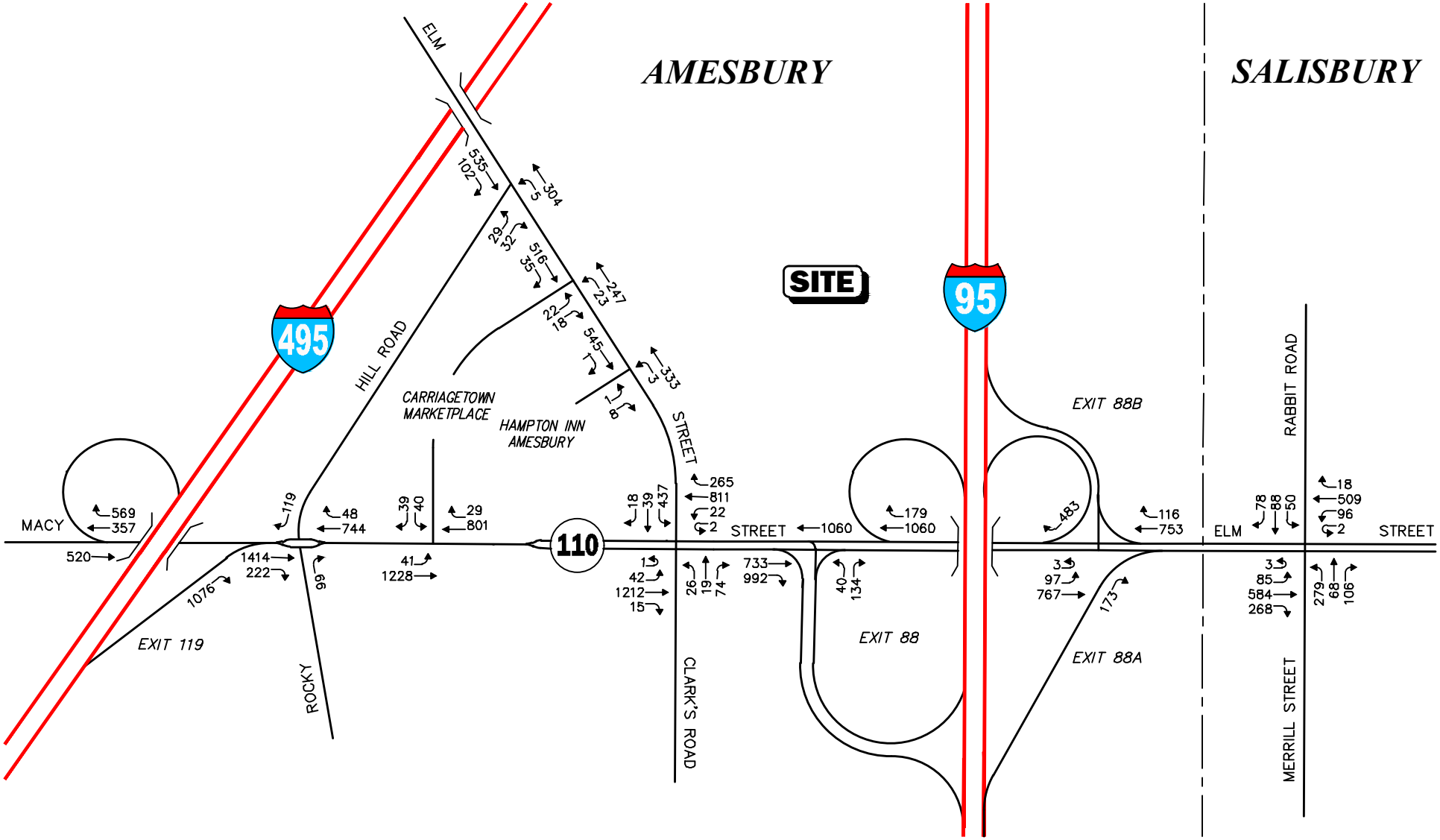
Based on updated guidance from MassDOT,[7] adjustments to account for the impact on traffic volume and trip patterns resulting from the COVID-19 pandemic for traffic counts taken on or after March 1, 2022 are only recommended in areas where the predominant land use is office properties. As the predominant land use within the study area consists of residential and commercial uses, a pandemic-related adjustment was not required.

Additionally, the 2023 traffic volumes were adjusted to 2024 by applying a 1.5 percent growth rate consistent with the identified general background traffic growth rate (see *General Background Traffic Growth Rate* section of this assessment).

The 2024 Existing traffic volumes are summarized in Table 2, with the weekday morning and evening peak-hour traffic volumes graphically depicted on Figures 4 and 5, respectively. Note that the peak-hour traffic volumes that are presented in Table 2 were obtained from the aforementioned figures.

[6] MassDOT statewide Traffic Data Collection; 2019 Weekday Seasonal Factors, Groups U3.

[7] *25% Design Submission Guidelines*; MassDOT Highway Division, Traffic and Safety Engineering; Revised May 31, 2022.



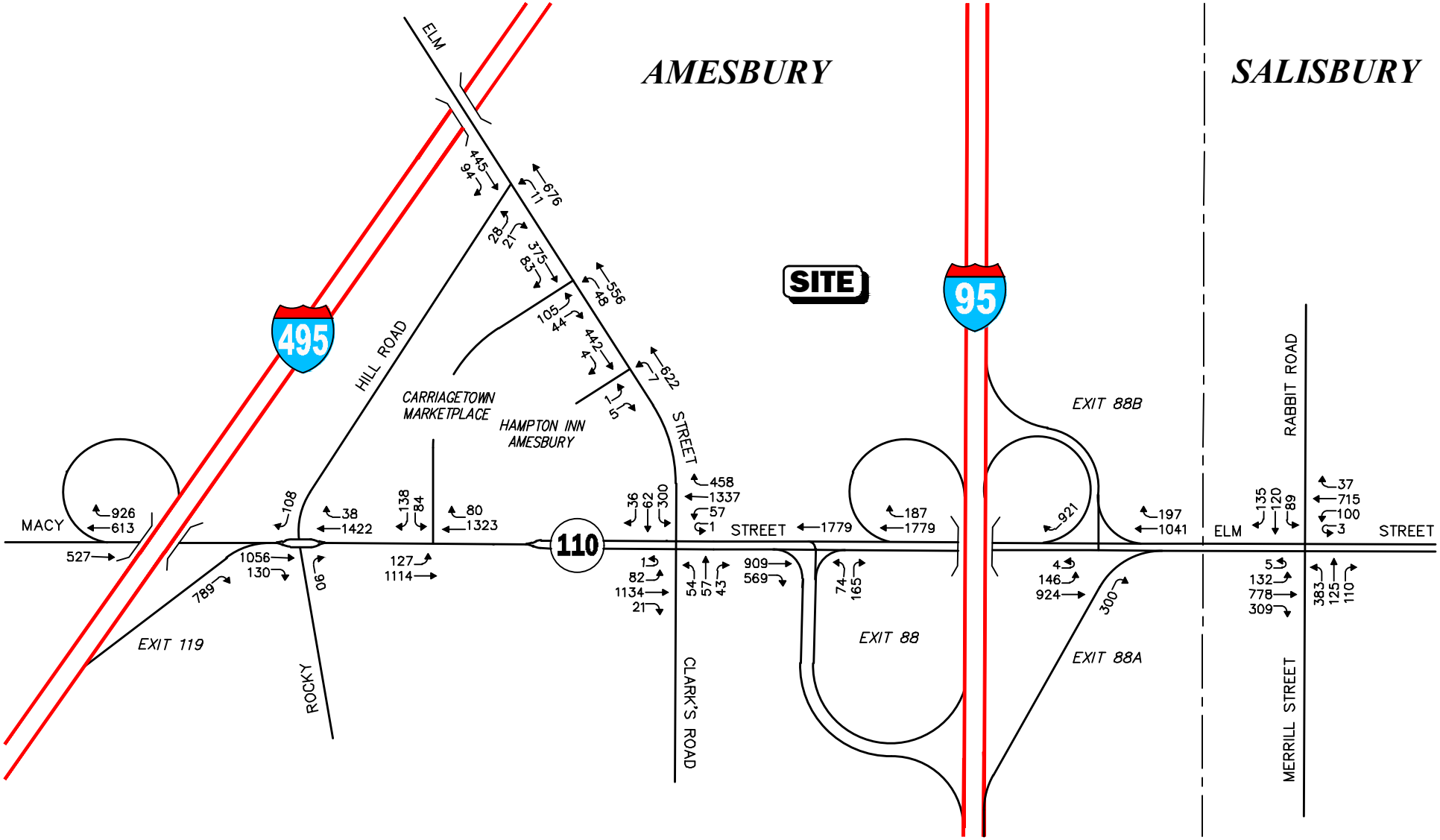
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not to Scale

Figure 4

2024 Existing
Weekday Morning
Peak-Hour Traffic Volumes

Vanasse & Associates inc



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not to Scale

Figure 5

2024 Existing
Weekday Evening
Peak-Hour Traffic Volumes

Vanasse & Associates inc

Table 2
2024 EXISTING TRAFFIC VOLUMES

Location/Peak Hour	AWT[a]	VPH[b]	K Factor[c]	Directional Distribution[d]
Elm Street, north of Route 110:	11,180	--	--	--
Weekday Morning (7:30 – 8:30 AM)	--	820	7.3	60.2% SEB
Weekday Evening (4:30 – 5:30 PM)	--	995	8.9	60.0% NWB

[a]Average weekday traffic in vehicles per day.
[b]Vehicles per hour.
[c]Percent of daily traffic occurring during the peak hour.
[d]Percent traveling in peak direction.
SEB = southeastbound; NWB = northwestbound.

As can be seen in Table 2, Elm Street in the vicinity of the Project site was found to accommodate approximately 11,180 vehicles on an average weekday (two-way 24-hour volume), with approximately 820 vehicles per hour (vph) during the weekday morning peak-hour and 995 vph during the weekday evening peak-hour.

PEDESTRIAN AND BICYCLE FACILITIES

Pedestrian and bicycle counts were performed at the study area intersections in conjunction with the TMCs and a comprehensive field inventory of pedestrian and bicycle facilities within the study area was also undertaken in February and September 2024. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study intersections, as well as the location of existing and planned future bicycle facilities.

Pedestrian Facilities

As can be seen in Figure 3, pedestrian facilities (sidewalks or shared-use paths) are provided along one or both sides of the study area roadways, with marked crosswalks provided for crossing one or more legs of the study area intersections. Pedestrian signal equipment and phasing are provided at the signalized study area intersections. With exception of the intersections of Route 110 at Elm Street and Clark's Road and Route 110 at Merrill Street and Rabbit Road, observed pedestrian activity within the study area was found to be generally low, with three (3) or fewer pedestrians observed at the study area intersections during the peak periods. Pedestrian activity at the intersections of Route 110 at Elm Street and Clark's Road and Route 110 at Merrill Street and Rabbit Road were found to range from four (4) to eight (8) pedestrians during the peak periods. The Salisbury Point Ghost Trail and the William Lloyd Garrison Trail are situated proximate to these intersections and may correspond to the increased pedestrian activity.

Bicycle Facilities

Within the study area, marked bicycle lanes are provided along Elm Street north of Route 110. To the southeast of the Project site, the Salisbury Point Ghost Trail traverses an east-west alignment between Elm Street in Amesbury and Lion's Park in Salisbury, a distance of approximately 2.1 miles, and provides connections to the William Lloyd Garrison Trail and the Old Eastern Marsh Trail. Similar to pedestrian activity within the study area, with exception of the Elm Street corridor

and crossing the Route 110 west leg of the Route 110/Merrill Street/Rabbit Road intersection, observed bicycle activity within the study area was found to be generally low, with up to three (3) bicyclists observed traveling along the study area roadways during the peak periods. Up to 13 bicyclists were observed to travel along Elm Street during the peak periods for which data was collected, with up to seven (7) bicyclists observed at the Route 110/Merrill Street/Rabbit Road intersection.

PUBLIC TRANSPORTATION

Public transportation services are provided within the study area by Merrimack Valley Transit (MeVA). MeVA operates fixed-route bus service along Elm Street and Route 110 by way of bus Route 17, *Salisbury Beach via Amesbury*, and Route 19, *Amesbury/Costello*. The Route 17 bus provides service between the Washington Square Transit Center in Haverhill and Salisbury Beach and travels along Elm Street past the Project to Route 110. The closest regular stop for the Route 17 bus to the Project site is at the Elm Street/Carriagetown Marketplace Driveway intersection, approximately 600 feet (or a 2-minute walk) from the Project site. The Route 19 bus provides service between the Nicholas J. Costello Transportation Center in Amesbury and the Newburyport MBTA Station, and travels along Route 110 to the I-95 interchange. The closest regular stop for the Route 19 bus to the Project site located within the Carriagetown Marketplace, approximately 0.25 miles (or a 5-minute walk) from the Project site. MeVA buses also operate in a "flag stop" mode, where a rider can request a stop anywhere along the regular service route by signaling to the driver.

The public transportation schedules and fare information are provided in the Appendix.

SPOT SPEED MEASUREMENTS

Vehicle travel speed measurements were performed on Elm Street in the vicinity of the Project site in conjunction with the ATR counts. Table 3 summarizes the vehicle travel speed measurements.

Table 3
VEHICLE TRAVEL SPEED MEASUREMENTS

	Elm Street	
	Northwestbound	Southeastbound
Mean Travel Speed (mph)	29	27
85th Percentile Speed (mph)	33	29
Statutory Speed Limit (mph)	25	25

mph = miles per hour.

As can be seen in Table 3, the mean vehicle travel speed along Elm Street in the vicinity of the Project site was found to be 29 mph in the northwestbound direction and 27 mph southeastbound. The measured 85th percentile vehicle travel speed, or the speed at which 85 percent of the observed

vehicles traveled at or below, was found to be 33 mph in the northwestbound direction and 29 mph southeastbound, which is 4 to 8 mph *above* the statutory speed limit along Elm Street in the vicinity of the Project site (25 mph).

MOTOR VEHICLE CRASH DATA

Motor vehicle crash information for the study area intersections was provided by the MassDOT Highway Division Safety Management/Traffic Operations Unit for the 2015 through 2019, inclusive, review period requested in MassDOT's comment letter on the ENF filing for the Project, in order to examine motor vehicle crash trends occurring within the study area. The data is summarized by intersection, type, severity, roadway and weather conditions, and day of occurrence, and is presented in Table 4.

As can be seen in Table 4, with the exception of the Route 110/Merrill Street/Rabbit Road and Route 110/Elm Street/Clark's Road intersections, the study area intersections were found to have experienced an average of 6.0 or fewer reported motor vehicle crashes per year over the five-year review period and were found to have motor vehicle crash rates *below* the MassDOT statewide and District average crash rates for similar intersections for the MassDOT Highway Division District in which the intersections are located (District 4). The majority of the reported crashes occurred on a weekday; under clear weather conditions; during daylight; and involved rear-end type collisions that resulted in property damage only.

The Route 110/Merrill Street/Rabbit Road and Route 110/Elm Street/Clark's Road intersections were found to have experienced a total of 49 and 59 reported motor vehicle crashes over the five-year review period, respectively, and were found to have a motor vehicle crash rate *above* the MassDOT statewide and District average crash rates for similar intersections. The majority of the reported crashes occurred on a weekday; under clear weather conditions; during daylight; and involved rear-end type collisions that resulted in property damage only. In addition, the intersection of Route 110 at Merrill Street and Rabbit Road is included on MassDOT's Highway Safety Improvement Program (HSIP) listing as a high crash location (Top 5% Intersection crash cluster 2019-2021). MassDOT defines a HSIP eligible cluster as: *"…one in which the total number of 'equivalent property damage only' crashes is within the top 5% in the region." The Equivalent Property Damage Only (EPDO) index is a method of combining the number of crashes with the severity of crashes based on a weighted scale, where a property damage only crash is worth 1 point and injury and fatal crashes are worth 21 points."* Designation as a HSIP location allows for MassDOT to prioritize funding for safety-related improvements in a specific region of the state. As such, specific safety-related recommendations have been provided for the Route 110/ Merrill Street/Rabbit Road and Route 110/Elm Street/Clarks Road intersections in an effort to advance safety-related improvements at the intersections (see *Recommendations* section of this assessment).

No motor vehicle crashes that resulted in a fatality were reported to have occurred within the study area during the five-year review period. The detailed MassDOT Crash Rate Worksheets and High Crash Location mapping is provided in the Appendix.

Table 4
MOTOR VEHICLE CRASH DATA SUMMARY[a]

	Rte. 110/ I-495 SB On-Ramp	Rte. 110/ I-495 NB Off-Ramp	Rte. 110/ Rocky Hill Rd.	Rte. 110/ Carriagetown Marketplace	Rte. 110/ Elm St./ Clark's Rd.	Rte. 110/ I-95 SB Ramps	Rte. 110/ I-95 NB Ramps	Rte. 110/ Merrill St./ Rabbit Rd.	Elm St./ Rocky Hill Rd.	Elm St./ Carriagetown Marketplace	Elm St./ Hampton Inn Amesbury
Traffic Control Type:[b]	U	U	U	TS	TS	U	U	TS	U	U	U
Year:											
2015	2	2	10	4	7	2	5	14	1	3	0
2016	1	1	0	2	8	1	2	10	1	0	0
2017	2	0	5	3	12	1	6	10	0	0	0
2018	1	2	9	7	14	1	1	7	1	1	2
2019	1	0	6	5	18	3	3	8	0	0	0
Total	7	5	30	21	59	8	17	49	3	4	2
Average	1.40	1.00	6.00	4.20	11.80	1.60	3.40	9.80	0.60	0.80	0.40
Rate[c]	0.17	0.09	0.52	0.36	0.80	0.11	0.23	0.79	0.12	0.16	0.07
MassDOT Crash Rate:[d]	0.57/0.57	0.57/0.57	0.57/0.57	0.78/0.73	0.78/0.73	0.57/0.57	0.57/0.57	0.78/0.73	0.57/0.57	0.57/0.57	0.57/0.57
Significant?[e]	No	No	No	No	Yes	No	No	Yes	No	No	No
Type:											
Angle	2	1	7	3	13	1	5	6	3	3	0
Rear-End	3	2	14	11	25	4	6	28	0	0	0
Head-On	0	0	0	0	1	0	1	5	0	0	0
Sideswipe	1	0	5	4	15	3	3	8	0	0	1
Fixed Object	0	1	3	0	1	0	0	1	0	0	0
Pedestrian/Bicycle	0	0	0	1	1	0	0	0	0	0	0
Animal	1	0	0	1	1	0	1	0	0	0	1
Unknown/Other	0	1	1	1	2	0	1	1	0	1	0
Total	7	5	30	21	59	8	17	49	3	4	2
Day of Week:											
Weekday	7	4	20	18	49	8	13	34	1	3	2
Saturday	0	1	5	1	7	0	3	8	2	0	0
Sunday	0	0	5	2	3	0	1	7	0	1	0
Total	7	5	30	21	59	8	17	49	3	4	2
Conditions:											
Clear	6	4	23	19	44	6	15	36	3	3	1
Cloudy	1	0	3	0	6	2	0	8	0	1	0
Rain	0	1	3	2	6	0	0	3	0	0	1
Snow/Ice	0	0	1	0	3	0	1	2	0	0	0
Not Reported	0	0	0	0	0	0	1	0	0	0	0
Total	7	5	30	21	59	8	17	49	3	4	2
Lighting:											
Daylight	5	5	26	19	45	8	9	37	3	3	1
Dawn/Dusk	0	0	0	0	3	0	0	1	0	0	0
Dark (Road Lit)	1	0	4	0	10	0	6	9	0	1	1
Dark (Road Unlit)	1	0	0	2	1	0	2	2	0	0	0
Total	7	5	30	21	59	8	17	49	3	4	2
Severity:											
Property Damage Only	5	4	24	16	56	5	16	45	1	4	2
Personal Injury	2	0	6	5	3	3	1	4	2	0	0
Fatality	0	0	0	0	0	0	0	0	0	0	0
Not Reported	0	1	0	0	0	0	0	0	0	0	0
Total	7	5	30	21	59	8	17	49	3	4	2

[a]Source: MassDOT Safety Management/Traffic Operations Unit records, 2015 through 2019.
[b]Traffic Control Type: U= unsignalized, TS = traffic signal control.
[c]Crash rate per million vehicles entering the intersection.
[d]Statewide/District crash rates.
[e]The intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the MassDOT Highway Division District in which the Project is located (District 4).

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2031, which reflects a seven-year planning horizon consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. Independent of the Project, traffic volumes on the roadway network in the year 2031 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon the 2031 No-Build traffic volumes reflect 2031 Build traffic-volume conditions with the Project.

FUTURE TRAFFIC GROWTH

Future traffic growth is a function of the expected land development in the immediate area and 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 procedure produces a more realistic estimate of growth for local traffic; however, potential population growth and development external to the study area would not be accounted for in the resulting traffic projections.

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

Specific Development by Others

The City of Amesbury and the Town of Salisbury were contacted in order to determine if there were any projects planned within the study area that would have an impact on future traffic volumes at the study intersections. Based on this consultation, the following developments were identified for review in conjunction with this assessment:

- ***Proposed Starbucks Coffee Shop, 37 Clark's Road, Amesbury, Massachusetts.*** This project entails the construction of a 2,460± sf Starbucks coffee shop with a drive-through window facility to be located at 37 Clark's Road, south of the project site. Traffic volumes associated with this development were obtained from a traffic study prepared for the project[8] and were added to the future condition traffic volumes.

[8] *Transportation Impact Assessment*, Proposed Starbucks Coffee Shop, 37 Clark's Road, Amesbury, Massachusetts; VAI; September 2023.

- ***The Marina at Amesbury Point, 14 Merrimac Street, Amesbury Massachusetts.*** This project entails the redevelopment of The Marina at Amesbury Point to include a new 2,265± sf marina and associated 4,663± sf restaurant, southwest of the Project site. Traffic volumes associated with this development were obtained from a traffic study prepared for the project[9] and were added to the future condition traffic volumes.

- ***Proposed Elm Street 40R Residential Development, Elm Street, Amesbury, Massachusetts.*** This project entails the construction of 115 multifamily residential units to be located off of Elm Street, south of the Project site. Traffic volumes associated with this development were estimated using trip generation statistics published by the Institute of Transportation Engineers (ITE)[10] and were added to the future condition traffic volumes based on existing traffic patterns.

- ***Proposed Clarks Road 40R Residential Development, Clark's Road, Amesbury, Massachusetts.*** This project entails the construction of eight (8) single-family homes and 110 multifamily residential units to be located off of Clark's Road to the south of the Project site. Traffic volumes associated with this development were estimated using trip generation statistics published by the ITE and were added to the future condition traffic volumes based on existing traffic patterns.

- ***Barewolf Brewery, 12 Oakland Street, Amesbury, Massachusetts.*** This project entails the construction of an 8,165± sf brewery and restaurant to be located at 12 Oakland Street, northwest of the Project site. Traffic volumes associated with this project within the study area are expected to be relatively minor and would be reflected in the general background traffic growth rate (discussion follows).

- ***The Hedgehog General Store Market, Cafe & Butchery, 6 Morrill Street, Amesbury, Massachusetts.*** This project entails the construction of a 1,120± sf retail bakery and café to be located at 6 Morrill Street, northwest of the Project site. Traffic volumes associated with this project within the study area are expected to be minor and would be reflected in the general background traffic growth rate.

No other developments were identified at this time that are expected to result in an increase in traffic within the study area beyond the general traffic growth rate.

General Background Traffic Growth

Traffic-volume data compiled by MassDOT from permanent count stations located in and around Amesbury were reviewed in order to determine general traffic growth trends in the area. This data indicates that traffic volumes have fluctuated over the 10-year period between 2009 and 2019, with an average traffic growth rate of 1.37 percent. In order to provide conservative (high) traffic volumes from which to assess the impact of the Project, a slightly higher 1.5 percent per year compounded annual background traffic growth rate was used to account for future traffic growth and presently unforeseen development within the study area.

[9] *Transportation Impact Assessment*, The Marina at Amesbury Point, 14 Merrimac Street, Amesbury, Massachusetts; VAI; July 2023.

[10] Institute of Transportation Engineers, op. cit. 1.

Roadway Improvement Projects

MassDOT, the City of Amesbury and the Town of Salisbury were contacted in order to determine if there were any planned future roadway improvement projects expected to be complete by 2031 within the study area. Based on these discussions, no state or municipal roadway improvement projects aside from routine maintenance activities were identified to be planned within the study area at this time.

As a part of the mitigation commitment for the proposed Starbucks coffee shop to be located at 37 Clark's Road, the developer for that project has committed to widening Clarks Road to provide two (2) travel lanes for a distance of approximately 250 feet (from the STOP-bar to the southern driveway to the Fairfield Inn Amesbury). These improvements are anticipated to be complete by 2031 and, as such, are modeled in the future year conditions (No-Build and Build).

No-Build Traffic Volumes

The 2031 No-Build condition peak-hour traffic-volumes were developed by applying the 1.5 percent per year compounded annual background traffic growth rate to the 2024 Existing peak-hour traffic volumes and then adding the peak-hour traffic associated with the identified specific development projects by others (Starbucks coffee shop, The Marina at Amesbury Point and the Elm Street and Clarks Road 40R residential developments). The resulting 2031 No-Build weekday morning and evening peak-hour traffic volumes are shown on Figures 6 and 7, respectively.

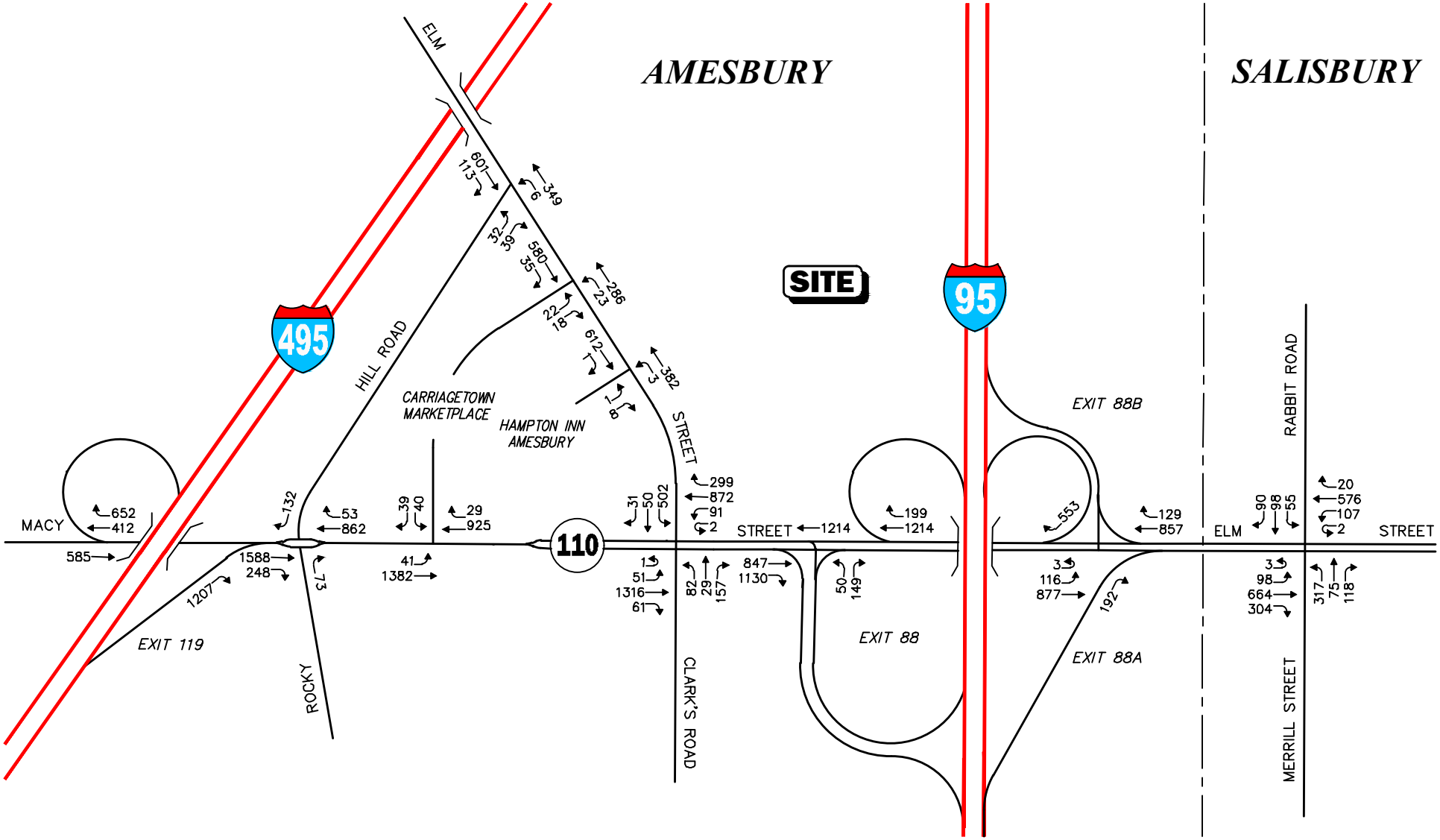
PROJECT-GENERATED TRAFFIC

Design year (2031 Build) traffic volumes for the study area roadways were determined by estimating Project-generated traffic volumes and assigning those volumes on the study roadways. The following sections describe the methodology used to develop the anticipated traffic characteristics of the Project.

The Project will include the construction of up to 400 residential units in several buildings clustered within the Project site to include up to 309 multifamily residential units, 83 single-family attached homes (townhomes and duplex units) and eight (8) single-family detached cottage-type homes. As discussed previously, it is expected that a portion of the residents of the Project will be "empty nesters" and may be retired, thereby reducing trips during the traditional commuter peak hours; however, for the purpose of this assessment, no adjustment was applied to account for reduced peak-hour trips. ITE Land Use Codes (LUCs) 210, *Single-Family Detached Housing*; 215, *Single-Family Attached Housing*; and 220, *Multifamily Housing (Low-Rise)*; were used to establish the base trip characteristics of the Project.

Alternative Modes of Transportation

Given the availability of public transportation services to the Project site (MeVA bus services) and the interconnected network of sidewalks and bicycle accommodations, it is expected that a portion of the residents of the Project will use public transportation services, walk, or bicycle, thereby reducing the number of single-occupant vehicle (SOV) trips that may be associated with the Project. That being said, in order to provide a conservative (high) estimate of traffic volumes from which to assess the impact of the Project, an adjustment to the base ITE trip-generation calculations was



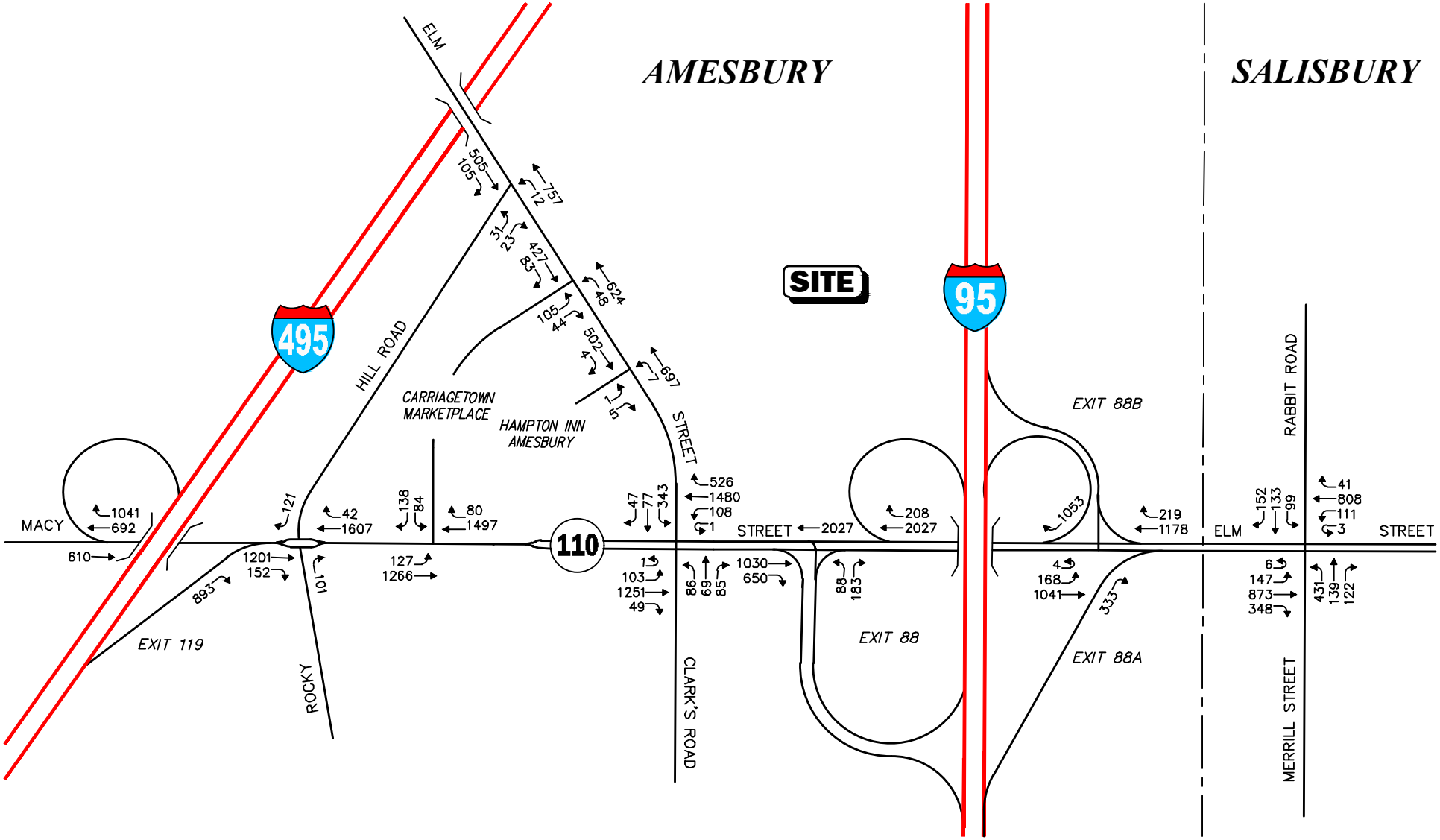
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not to Scale

Figure 6

2031 No-Build
Weekday Morning
Peak-Hour Traffic Volumes

Vanasse & Associates inc



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not to Scale

Figure 7

2031 No-Build
Weekday Evening
Peak-Hour Traffic Volumes

Vanasse & Associates inc

not applied to account for the use of alternative modes of transportation to SOVs by residents of the Project.

Table 5 summarizes the anticipated traffic characteristics of the Project using the above methodology.

Table 5
TRIP GENERATION SUMMARY

Time Period	Vehicle Trips[a]		
	Entering	Exiting	Total
Average Weekday	1,369	1,369	2,738
Weekday Morning Peak-Hour	39	124	163
Weekday Evening Peak-Hour	130	78	208

[a]Based on ITE LUCs 210, *Single-Family Detached Housing* (8 units); 215, *Single-Family Attached Housing* (83 units); and 220, *Multifamily Housing (Low-Rise)* (309 units).

Project-Generated Traffic-Volume Summary

As can be seen Table 5 and without adjustment to account for the use of alternative modes of transportation to SOVs by residents of the Project, the Project is expected to generate approximately 2,738 vehicle trips on an average weekday (two-way, 24-hour volume, or 1,369 vehicles entering and 1,369 exiting), with 163 vehicle trips (39 vehicles entering and 124 exiting) expected during the weekday morning peak-hour and 208 vehicle trips (130 vehicles entering and 78 exiting) expected during the weekday evening peak-hour.

TRIP DISTRIBUTION AND ASSIGNMENT

The directional distribution of generated trips to and from the Project site was determined based on a review of Journey-to-Work data obtained from the U.S. Census for persons residing in the City of Amesbury and then refined based on existing traffic patterns within the study area during the peak periods. The general trip distribution pattern for the Project is graphically depicted on Figure 8 with the additional traffic expected to be generated by the Project assigned onto the study area roadway network as shown on Figures 9 and 10 for the weekday morning and evening peak hours, respectively.

FUTURE TRAFFIC VOLUMES – BUILD CONDITION

The 2031 Build condition traffic volumes were developed by adding the additional traffic expected to be generated by the Project to the 2031 No-Build condition traffic volumes. The resulting 2031 Build weekday morning and evening peak-hour traffic volumes are graphically depicted on Figures 11 and 12, respectively.

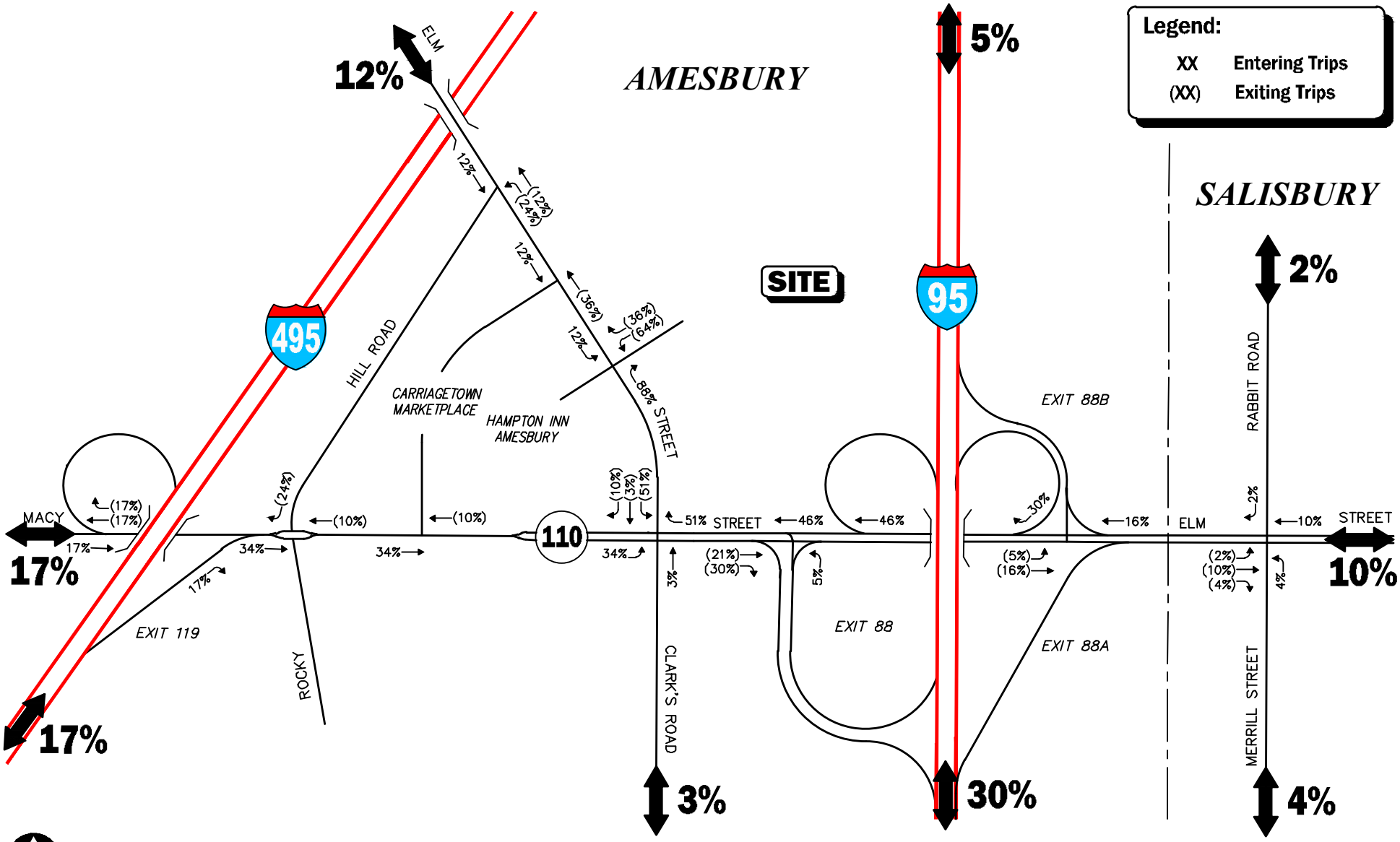


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Figure 8

Trip Distribution Map

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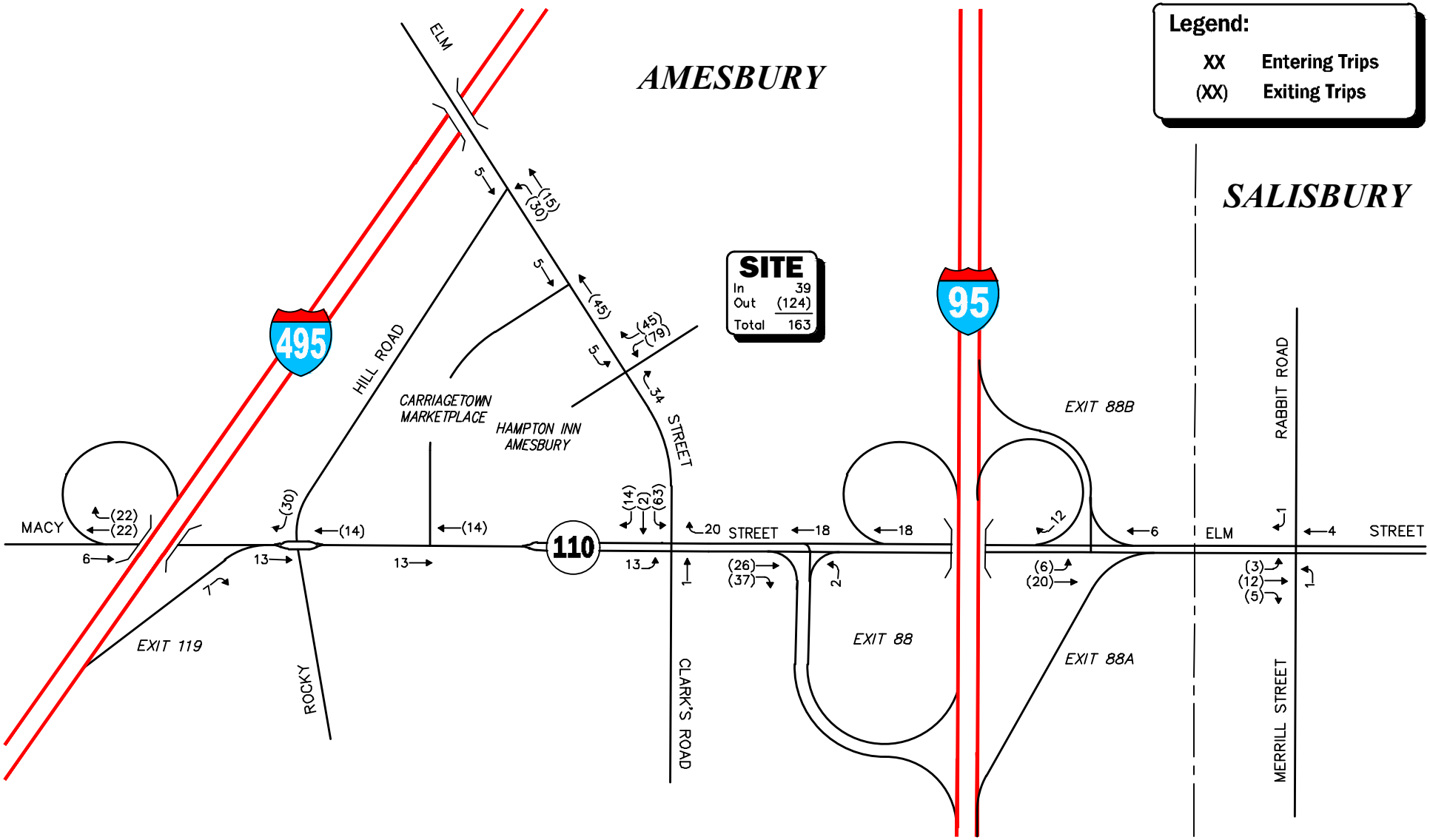

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Figure 9

Project-Generated Weekday Morning Peak-Hour Traffic Volumes

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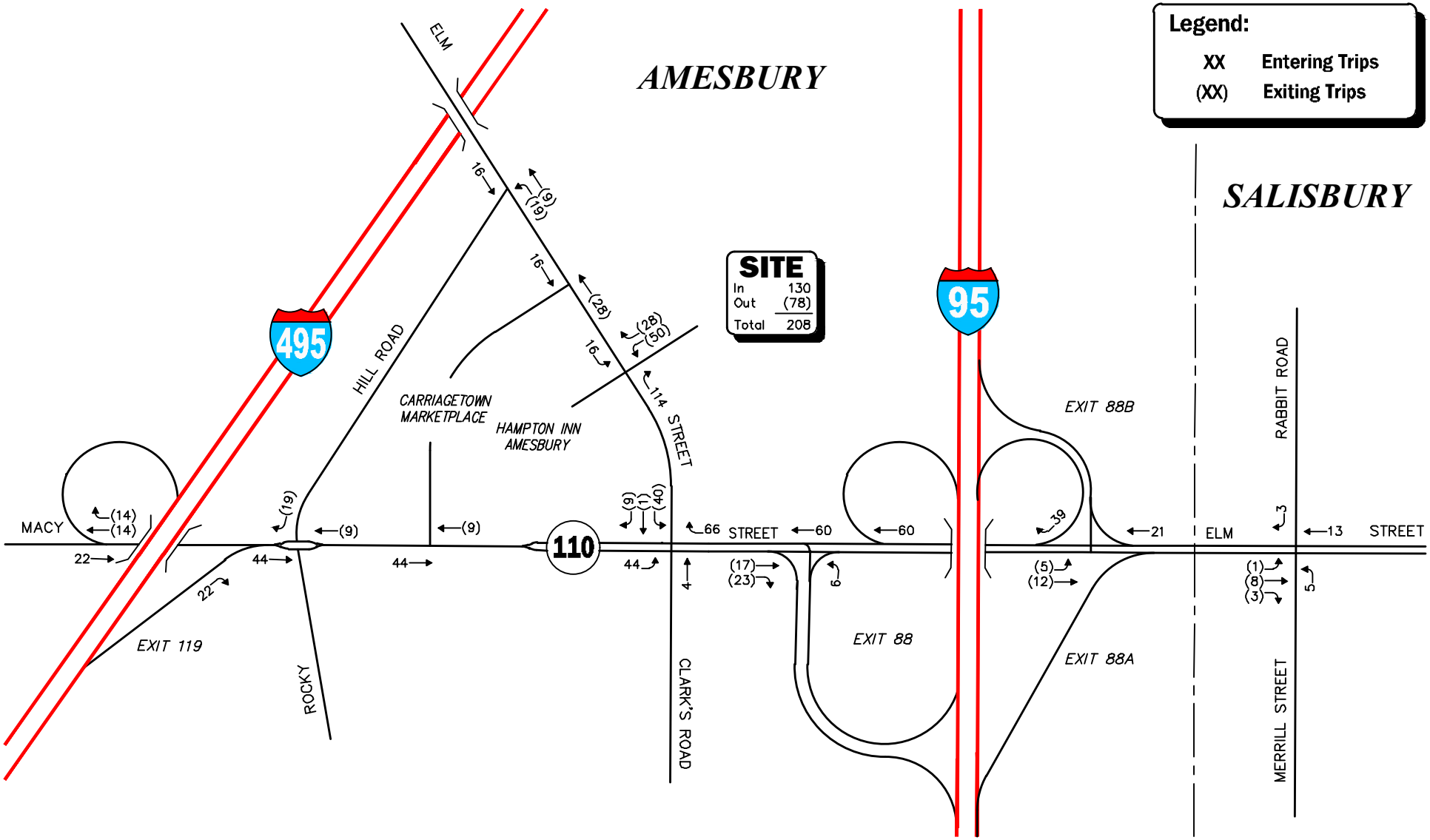

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Figure 10

Project-Generated
Weekday Evening
Peak-Hour Traffic Volumes

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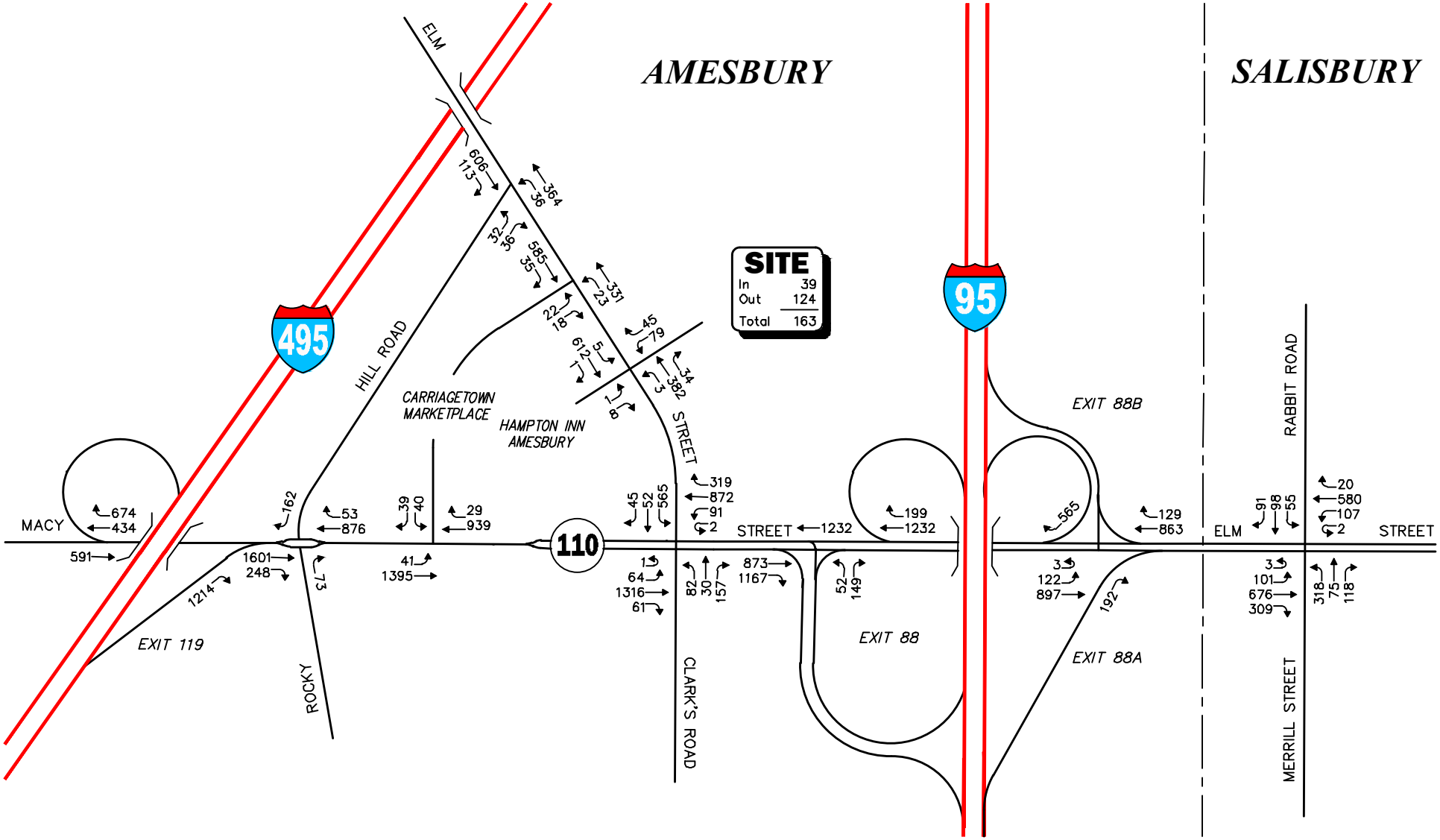


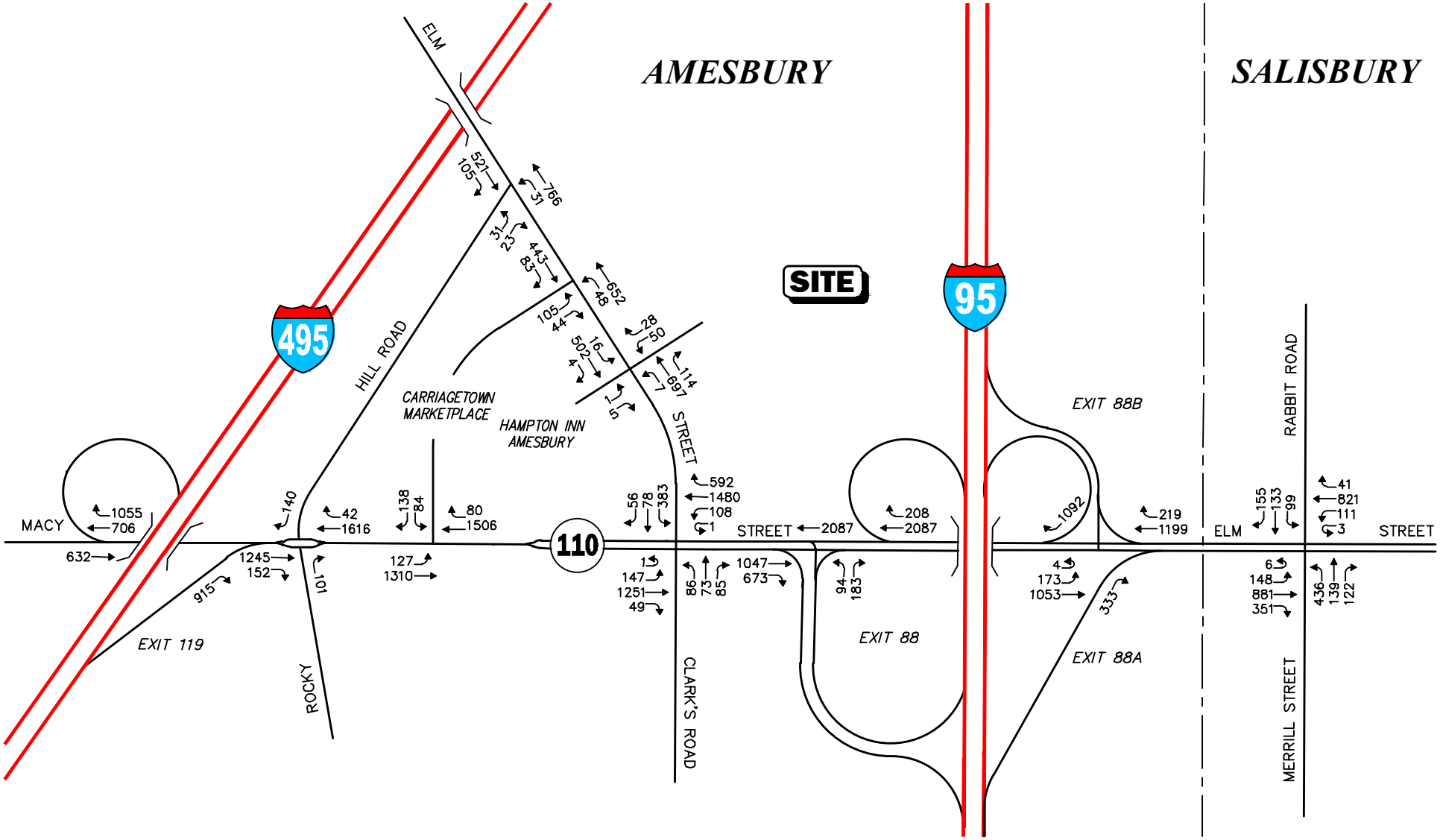
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not to Scale

Figure 11

2031 Build
Weekday Morning
Peak-Hour Traffic Volumes

Vanasse & Associates inc



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not to Scale

Figure 12

2031 Build
Weekday Evening
Peak-Hour Traffic Volumes

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A summary of peak-hour projected traffic-volume changes outside of the study area that is the subject of this assessment is shown in Table 6. These changes are a result of the construction of the Project.

Table 6
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak-Hour	2024 Existing	2031 No-Build	2031 Build	Traffic-Volume Increase Over No-Build	Percent Increase Over No-Build
Route 110, west of I-495:					
Weekday Morning	877	997	1,025	28	2.8
Weekday Evening	1,140	1,302	1,338	36	2.8
Route 110, east of Merrill Street:					
Weekday Morning	1,365	1,542	1,558	16	1.0
Weekday Evening	1,832	2,057	2,078	21	1.0
Elm Street, north Rocky Hill Road:					
Weekday Morning	970	1,095	1,115	20	1.8
Weekday Evening	1,243	1,398	1,423	25	1.8
Clarks Road, south of Route 110:					
Weekday Morning	195	470	473	3	0.6
Weekday Evening	294	474	479	5	1.1
Merrill Street, south of Route 110:					
Weekday Morning	905	1,019	1,025	6	0.6
Weekday Evening	1,147	1,284	1,292	8	0.6
Rabbit Road, north of Route 110:					
Weekday Morning	307	436	440	4	0.9
Weekday Evening	638	711	715	4	0.6

As shown in Table 6, Project-related traffic-volume increases outside of the study area relative to 2031 No-Build conditions are anticipated to range from 0.6 to 2.8 percent during the peak periods, with vehicle increases shown to range from 4 to 36 vehicles. ***When dispersed over the respective peak hours and to the roadway network that serves the Project site, the identified traffic volume increases outside of the immediate study area are not expected to result in a significant increase in motorist delays or vehicle queuing over anticipated future conditions without the Project (i.e., No-Build conditions).***

TRAFFIC OPERATIONS ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

METHODOLOGY

Levels of Service

A primary result of capacity analyses is the assignment of level of service to traffic facilities under various traffic-flow conditions.[11] The concept of level of service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operating conditions.

Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

[11]The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual;* Transportation Research Board; Washington, DC; 2016.

Signalized Intersections

The six levels of service for signalized intersections may be described as follows:

- *LOS A* describes operations with very low control delay; most vehicles do not stop at all.
- *LOS B* describes operations with relatively low control delay. However, more vehicles stop than LOS A.
- *LOS C* describes operations with higher control delays. Individual cycle failures may begin to appear. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
- *LOS D* describes operations with control delay in the range where the influence of congestion becomes more noticeable. Many vehicles stop and individual cycle failures are noticeable.
- *LOS E* describes operations with high control delay values. Individual cycle failures are frequent occurrences.
- *LOS F* describes operations with high control delay values that often occur with over-saturation. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Levels of service for signalized intersections are calculated using the operational analysis methodology of the 2000 *Highway Capacity Manual*[12] and implemented as a part of the Synchro® 12 software. This method assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on delay. Level-of-service designations are based on the criterion of control or signal delay per vehicle. Control or signal delay is a measure of driver discomfort, frustration, and fuel consumption, and includes initial deceleration delay approaching the traffic signal, queue move-up time, stopped delay and final acceleration delay. Table 7 summarizes the relationship between level of service and control delay. The tabulated control delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to entire intersections.

Table 7
LEVEL-OF-SERVICE CRITERIA
FOR SIGNALIZED INTERSECTIONS[a]

Level of Service	Control (Signal) Delay Per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

[a]Source: *Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2000; page 16-2.

[12]*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2000.

Unsignalized Intersections

The six levels of service for unsignalized intersections may be described as follows:

- *LOS A* represents a condition with little or no control delay to minor street traffic.
- *LOS B* represents a condition with short control delays to minor street traffic.
- *LOS C* represents a condition with average control delays to minor street traffic.
- *LOS D* represents a condition with long control delays to minor street traffic.
- *LOS E* represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
- *LOS F* represents a condition where minor street demand volume exceeds capacity of an approach lane, with extreme control delays resulting.

The levels of service of unsignalized intersections are determined by application of a procedure described in the *Highway Capacity Manual 7th Edition.*[13] Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay 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. Definitions for level of service at unsignalized intersections are also given in the *Highway Capacity Manual 7th Edition*. Table 8 summarizes the relationship between level of service and average control delay for two-way stop controlled and all-way stop controlled intersections.

Table 8
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS[a]

Level-Of-Service by Volume-to-Capacity Ratio		Average Control Delay
v/c ≤ 1.0	v/c > 1.0	(Seconds Per Vehicle)
A	F	≤10.0
B	F	10.1 to 15.0
C	F	15.1 to 25.0
D	F	25.1 to 35.0
E	F	35.1 to 50.0
F	F	>50.0

[a]Source: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2023.

[13]*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2023.

Vehicle Queue Analysis

Vehicle queue analyses are a direct measurement of an intersection's ability to process vehicles under various traffic control and volume scenarios and lane use arrangements. The vehicle queue analysis was performed using the Synchro® intersection capacity analysis software. The Synchro® vehicle queue analysis methodology is a simulation-based model which reports the number of vehicles that experience a delay of six seconds or more at an intersection. For signalized intersections, Synchro® reports both the average (50^{th} percentile) and the 95^{th} percentile vehicle queue. For unsignalized intersections, Synchro® reports the 95^{th} percentile vehicle queue. Vehicle queue lengths are a function of the capacity of the movement under study and the volume of traffic being processed by the intersection during the analysis period. The 95^{th} percentile vehicle queue is the vehicle queue length that will be exceeded only 5 percent of the time, or approximately 3 minutes out of 60 minutes during the peak one hour of the day (during the remaining 57 minutes, the vehicle queue length will be less than the 95^{th} percentile queue length).

ANALYSIS RESULTS

Level-of-service and vehicle queue analyses were conducted for 2024 Existing, 2031 No-Build and 2031 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized in Tables 9 and 10, with the detailed analysis results presented in the Appendix.

The following is a summary of the level-of-service and vehicle queue analyses for the intersections within the study area. For context, we note that an LOS of "D" or better is generally defined as "acceptable" operating conditions.

Signalized Intersections (Table 9)

Route 110 at the Carriagetown Marketplace Driveway

No change in level of service is predicted to occur for any movement over No-Build conditions as a result of the addition of Project-related traffic, with Project-related impacts generally defined as a predicted increase in overall average motorist delay of less than 1.0 seconds that resulted in a corresponding increase in vehicle queuing of up to one (1) vehicle.

Route 110 at Elm Street and Clark's Road

No change in overall level of service was shown to occur over No-Build conditions as a result of the addition of Project-related traffic, with Project-related impacts generally defined as a predicted increase in overall average motorist delay that resulted in a corresponding increase in vehicle queuing of up to three (3) vehicles. Focusing on individual movements, the following changes in level of service were shown to occur as a result of the addition of Project-related traffic: *weekday morning peak-hour* – Route 110 eastbound U-turn/left-turn movements changed from LOS D to LOS E (7.1 second increase in average motorist delay) and Route 110 westbound U-turn/left-turn changed from LOS D to LOS E (7.7 second increase in average motorist delay); *weekday evening peak-hour* – Route 110 eastbound U-turn/left-turn movements changed from LOS E to LOS F (77.3 second increase in average motorist delay) and Clark's Road through/right-turn movements changed from LOS D to LOS E (21.8 second increase in average motorist delay). Independent of the Project, specific movements along Route 110 are currently or are predicted to operate at or over capacity (i.e., LOS "E" or "F", respectively).

Route 110 at Merrill Street and Rabbit Road

The addition of Project-related traffic was shown to result in an increase in overall average motorist delay of 1.9 seconds during the weekday evening peak-hour that resulted in a change in level of service from LOS D to LOS E. Vehicle queuing at the intersection was shown to increase by up to one (1) vehicle as a result of the addition of Project-related traffic. Independent of the Project, specific movements along Route 110 are currently or are predicted to operate at or over capacity (i.e., LOS "E" or "F", respectively).

Unsignalized Intersections (Table 10)

Route 110 at the I-495 Southbound On-Ramp

No change in average motorist delay was shown to occur over No-Build conditions as a result of the addition of Project-related traffic with all movements continuing to operate at LOS A.

Route 110 at the I-495 Northbound Off-Ramp

No change in average motorist delay was shown to occur over No-Build conditions as a result of the addition of Project-related traffic with all movements continuing to operate at LOS A.

Route 110 at Rocky Hill Road

No change in level of service is predicted to occur for any movement over No-Build conditions as a result of the addition of Project-related traffic, with Project-related impacts generally defined as a predicted increase in average motorist delay of up to 20.1 seconds that resulted in a corresponding increase in vehicle queuing of up to two (2) vehicles. Independent of the Project, right-turn movements from the Rocky Hill Road southbound approach are predicted to operate over capacity under 2031 No-Build conditions.

Route 110 at the I-95 Southbound Ramps

No change in level of service is predicted to occur for any movement over No-Build conditions as a result of the addition of Project-related traffic, with Project-related impacts generally defined as an increase in average motorist delay of up to 18.8 seconds that resulted in a corresponding increase in vehicle queuing of up to one (1) vehicle. Independent of the Project, left-turn movements from the I-95 southbound off-ramp are currently operating at or over capacity during both peak hours.

Route 110 at the I-95 Northbound Ramps

No change in level of service is predicted to occur for any movement over No-Build conditions as a result of the addition of Project-related traffic, with Project-related impacts generally defined as a predicted increase in average motorist delay that resulted in a corresponding increase in vehicle queuing of up to six (6) vehicles. Independent of the Project, U-turn/left-turn movements from the Route 110 eastbound approach and right-turns from the I-95 northbound off-ramp are currently operating over capacity during both peak hours, with vehicle queues on the off-ramp extending up to 72 vehicles under 2024 Existing conditions.

Elm Street at Rocky Hill Road

The addition of Project-related traffic was shown to result in an increase in average motorist delay of 6.2 seconds for the Rocky Hill Road approach during the weekday evening peak-hour that resulted in a change in level of service from LOS D to LOS E. No change in vehicle queuing is predicted to occur over No-Build conditions as a result of the addition of Project-related traffic.

Elm Street at the Carriagetown Marketplace Driveway

No change in level of service is predicted to occur over No-Build conditions as a result of the addition of Project-related traffic, with Project-related impacts generally defined as a predicted increase in average motorist delay of up to 13.0 seconds that resulted in a corresponding increase in vehicle queuing of up to one (1) vehicle. Independent of the Project, the Carriagetown Marketplace is currently operating at capacity during the weekday evening peak-hour.

Elm Street at the Hampton Inn Amesbury and Project Site Driveways

All movements exiting the Project site driveway to Elm Street are predicted to operate with extended delay (i.e., LOS "F") due to the relatively large volume of conflicting traffic traveling along Elm Street during the peak periods. That being said, the resulting residual vehicle queue (up to five (5) vehicles, can be contained along the Project site driveway without inhibiting access, or the movement of vehicles, pedestrians or bicyclists along Elm Street. All movements along Elm Street are predicted to operate at LOS A with negligible vehicle queuing.

Table 9
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-Hour/Movement	2024 Existing				2031 No-Build				2031 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 110 at Carriagetown Marketplace												
Weekday Morning:												
Route 110 EB LT	0.30	43.6	D	1/3	0.30	43.6	D	1/3	0.30	43.6	D	1/3
Route 110 EB TH	0.51	4.7	A	4/18	0.57	5.2	A	5/21	0.58	5.3	A	5/22
Route 110 WB TH/RT	0.40	5.4	A	1/5	0.46	2.2	A	0/19	0.46	2.3	A	0/18
Carriagetown Marketplace SB LT	0.41	47.1	D	1/3	0.41	47.1	D	1/3	0.41	47.1	D	1/3
Carriagetown Marketplace SB RT	0.03	36.5	D	0/1	0.03	36.5	D	0/1	0.03	36.5	D	0/1
Overall	--	**7.1**	**A**	--	--	**6.0**	**A**	--	--	**6.1**	**A**	--
Weekday Evening:												
Route 110 EB LT	0.58	43.6	D	4/6	0.56	42.3	D	3/9	0.56	42.3	D	3/9
Route 110 EB TH	0.46	5.3	A	4/15	0.53	6.4	A	5/16	0.55	6.6	A	5/17
Route 110 WB TH/RT	0.73	10.2	B	1/27	0.84	7.5	A	1/5	0.85	7.5	A	2/5
Carriagetown Marketplace SB LT	0.57	47.3	D	3/4	0.51	44.1	D	3/5	0.51	44.1	D	3/5
Carriagetown Marketplace SB RT	0.10	30.4	C	0/2	0.10	29.0	C	0/2	0.10	29.0	C	0/2
Overall	--	**12.0**	**B**	--	--	**10.5**	**B**	--	--	**10.5**	**B**	--
Route 110 at Elm Street and Clarks Road												
Weekday Morning:												
Route 110 EB UT/LT	0.35	56.1	E	1/3	0.42	50.3	D	2/3	0.61	57.4	E	2/4
Route 110 EB TH/RT	1.03	64.7	E	8/16	1.49	>80.0	F	26/32	1.49	>80.0	F	26/32
Route 110 WB UT/LT	0.26	47.0	D	1/2	0.60	49.9	D	3/6	0.69	57.6	E	3/6
Route 110 WB TH	0.73	32.9	C	10/19	0.90	45.7	D	12/17	0.90	46.5	D	12/17
Route 110 WB RT	0.19	8.6	A	0/2	0.21	9.5	A	0/1	0.22	8.6	A	0/1
Clarks Road NB LT	0.20	42.7	D	1/2	0.54	45.2	D	3/6	0.62	50.3	D	3/6
Clarks Road NB TH/RT	0.22	42.9	D	1/2	0.33	42.4	D	1/4	0.37	44.1	D	1/4
Elm Street SB LT	0.52	31.4	C	5/12	0.54	30.1	C	6/13	0.56	28.8	C	6/15
Elm Street SB TH/RT	0.10	27.4	C	1/3	0.13	25.8	C	1/4	0.14	24.2	C	1/4
Overall	--	**44.3**	**D**	--	--	**>80.0**	**F**	--	--	**>80.0**	**F**	--
Weekday Evening:												
Route 110 EB UT/LT	0.45	43.8	D	2/5	0.77	71.3	E	3/7	1.09	>80.0	F	5/10
Route 110 EB TH/RT	0.90	36.4	D	12/33	1.25	>80.0	F	23/27	1.25	>80.0	F	14/25
Route 110 WB UT/LT	0.35	43.5	D	2/3	0.79	70.2	E	3/7	0.79	70.2	E	3/7
Route 110 WB TH	1.04	67.8	E	18/38	1.37	>80.0	F	27/32	1.37	>80.0	F	27/32
Route 110 WB RT	0.41	13.2	B	2/8	0.45	13.9	B	2/4	0.49	12.5	B	2/5
Clarks Road NB LT	0.34	41.6	D	2/3	0.42	39.6	D	3/6	0.55	45.1	D	3/6
Clarks Road NB TH/RT	0.46	42.9	D	2/4	0.60	43.3	D	4/9	0.81	65.1	E	4/9
Elm Street SB LT	0.54	38.2	D	4/7	0.47	33.4	C	4/10	0.46	30.7	C	5/11
Elm Street SB TH/RT	0.28	35.9	D	2/4	0.29	31.8	C	2/6	0.27	30.3	C	3/7
Overall	--	**45.6**	**D**	--	--	**>80.0**	**F**	--	--	**>80.0**	**F**	--

See notes at end of table.

Table 9 (Continued)
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-Hour/Movement	2024 Existing				2031 No-Build				2031 Build			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 110 at Merrill Street and Rabbit Road												
Weekday Morning:												
Route 110 EB UT/LT	0.44	30.4	C	2/5	0.43	29.2	C	2/5	0.44	29.3	C	2/5
Route 110 EB TH	0.56	19.9	B	5/11	0.64	21.8	C	5/13	0.65	22.0	C	6/13
Route 110 EB RT	0.20	13.1	B	0/1	0.23	13.7	B	0/1	0.23	13.7	B	0/1
Route 110 WB UT/LT	0.85	74.3	E	2/8	0.97	>80.0	F	2/9	0.98	>80.0	F	2/9
Route 110 WB TH/RT	0.58	23.9	C	4/14	0.74	29.5	C	5/17	0.74	29.6	C	5/17
Merrill Street NB LT	0.87	42.8	D	4/17	1.00	72.2	E	5/20	1.01	76.2	E	5/20
Merrill Street NB TH/RT	0.26	18.2	B	1/5	0.29	18.3	B	2/6	0.29	18.5	B	2/6
Rabbit Road SB LT/TH	0.53	28.4	C	2/7	0.56	29.0	C	3/8	0.56	29.4	C	3/8
Rabbit Road SB TH	0.06	14.1	B	0/1	0.07	12.8	B	0/1	0.07	12.9	B	0/1
Overall	--	**25.7**	**C**	--	--	**32.5**	**C**	--	--	**33.2**	**C**	--
Weekday Evening:												
Route 110 EB UT/LT	0.95	>80.0	F	3/10	1.06	>80.0	F	3/11	1.07	>80.0	F	3/11
Route 110 EB TH	0.85	35.2	D	7/19	0.96	48.3	D	8/22	0.97	50.0	D	9/22
Route 110 EB RT	0.21	15.3	B	0/1	0.24	15.5	B	0/1	0.24	15.5	B	0/1
Route 110 WB UT/LT	0.93	>80.0	F	2/8	1.03	>80.0	F	2/9	1.03	>80.0	F	2/9
Route 110 WB TH/RT	0.85	36.6	D	7/18	0.96	50.9	D	8/21	0.98	54.2	D	8/22
Merrill Street NB LT	0.95	50.6	D	5/22	1.13	>80.0	F	7/26	1.14	>80.0	F	7/26
Merrill Street NB TH/RT	0.31	15.5	B	2/8	0.35	15.8	B	3/9	0.35	15.8	B	3/9
Rabbit Road SB LT/TH	0.71	35.2	D	4/12	0.81	42.9	D	5/14	0.81	42.9	D	5/14
Rabbit Road SB TH	0.10	16.4	B	0/2	0.12	16.5	B	0/2	0.12	16.5	B	0/2
Overall	--	**37.7**	**D**	--	--	**54.4**	**D**	--	--	**56.3**	**E**	--

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level of service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound.
UT = U-turning movement; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 10
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2024 Existing				2031 No-Build				2031 Build			
Unsignalized Intersection/Peak-hour/Movement	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Route 110 at the I-495 SB On-Ramp												
Weekday Morning:												
Route 110 WB TH	357	0.0	A	0	412	0.0	A	0	434	0.0	A	0
I-495 SB On-Ramp WB RT	569	0.0	A	0	652	0.0	A	0	674	0.0	A	0
Weekday Evening:												
Route 110 WB TH	613	0.0	A	0	692	0.0	A	0	706	0.0	A	0
Interstate 495 On Ramp WB RT	926	0.0	A	0	1,041	0.0	A	0	1,055	0.0	A	0
Route 110 at the I-495 NB Off-Ramp												
Weekday Morning:												
Route 110 EB TH	520	0.0	A	0	585	0.0	A	0	591	0.0	A	0
Interstate 495 Off Ramps NB RT	1,076	0.0	A	0	1,207	0.0	A	0	1,214	0.0	A	0
Weekday Evening:												
Route 110 EB TH	527	0.0	A	0	610	0.0	A	0	632	0.0	A	0
Interstate 495 Off Ramps NB RT	789	0.0	A	0	893	0.0	A	0	915	0.0	A	0
Route 110 at Rocky Hill Road												
Weekday Morning:												
Route 110 EB TH/RT	1,636	0.0	A	0	1,836	0.0	A	0	1,849	0.0	A	0
Route 110 WB TH/RT	792	0.0	A	0	915	0.0	A	0	929	0.0	A	0
Rocky Hill Road NB RT	66	21.9	C	1	73	27.5	D	2	73	27.9	D	2
Rocky Hill Road SB RT	119	12.7	B	1	132	14.0	B	1	162	14.9	B	2
Weekday Evening:												
Route 110 EB TH/RT	1,186	0.0	A	0	1,353	0.0	A	0	1,397	0.0	A	0
Route 110 WB TH/RT	1,460	0.0	A	0	1,649	0.0	A	0	1,658	0.0	A	0
Rocky Hill Road NB RT	90	16.5	C	1	101	19.7	C	2	101	20.5	C	2
Rocky Hill Road SB RT	108	30.5	D	4	121	>50.0	F	6	140	>50.0	F	8

See notes at the end of Table.

Table 10 (Continued)
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/Peak-Hour/Movement	2024 Existing				2031 No-Build				2031 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Route 110 at the I-95 SB Ramps												
Weekday Morning:												
Route 110 EB TH	733	0.0	A	0	847	0.0	A	0	873	0.0	A	0
Route 110 EB RT	992	0.0	A	0	1,130	0.0	A	0	1,167	0.0	A	0
Route 110 WB TH	1,060	0.0	A	0	1,214	0.0	A	0	1,232	0.0	A	0
Route 110 WB RT	179	0.0	A	0	199	0.0	A	0	199	0.0	A	0
I-95 SB Off-Ramp NB LT	40	46.0	E	2	50	>50.0	F	4	52	>50.0	F	4
I-95 SB Off-Ramp NB RT	134	13.5	B	2	149	15.3	C	2	149	15.6	C	2
Weekday Evening:												
Route 110 EB TH	909	0.0	A	0	1,030	0.0	A	0	1,047	0.0	A	0
Route 110 EB RT	569	0.0	A	0	650	0.0	A	0	673	0.0	A	0
Route 110 WB TH	1,779	0.0	A	0	2,027	0.0	A	0	2,087	0.0	A	0
Route 110 WB RT	187	0.0	A	0	208	0.0	A	0	208	0.0	A	0
I-95 SB Off-Ramp NB LT	74	>50.0	F	7	88	>50.0	F	11	94	>50.0	F	12
I-95 SB Off-Ramp NB RT	165	15.6	C	2	183	18.3	C	2	183	18.6	C	2
Route 110 at the I-95 NB Ramps												
Weekday Morning:												
Route 110 EB UT/LT	100	>50.0	F	4	119	>50.0	F	N/C	125	>50.0	F	N/C
Route 110 EB TH	767	0.0	A	0	877	0.0	A	0	897	0.0	A	0
Route 110 WB TH	753	0.0	A	0	857	0.0	A	0	863	0.0	A	0
Route 110 WB RT	116	0.0	A	0	129	0.0	A	0	129	0.0	A	0
I-95 NB Off-Ramp NB RT	173	0.0	A	0	192	0.0	A	0	195	0.0	A	0
I-95 NB Off-Ramp SB RT	483	>50.0	F	14	553	>50.0	F	25	565	>50.0	F	27
Weekday Evening:												
Route 110 EB UT/LT	150	>50.0	F	N/C	172	>50.0	F	N/C	177	>50.0	F	N/C
Route 110 EB TH	924	0.0	A	0	1,041	0.0	A	0	1,053	0.0	A	0
Route 110 WB TH	1,041	0.0	A	0	1,178	0.0	A	0	1,199	0.0	A	0
Route 110 WB RT	197	0.0	A	0	219	0.0	A	0	219	0.0	A	0
I-95 NB Off-Ramp NB RT	300	0.0	A	0	333	0.0	A	0	333	0.0	A	0
I-95 NB Off-Ramp SB RT	921	>50.0	F	72	1,053	>50.0	F	95	1,092	>50.0	F	101

See notes at the end of Table.

Table 10 (Continued)
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/Peak-Hour/Movement	2024 Existing				2031 No-Build				2031 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Elm Street at Rocky Hill Road												
Weekday Morning:												
Rocky Hill Road EB LT/RT	61	19.6	C	1	71	24.0	C	2	71	24.6	C	2
Elm Street NB LT/TH	309	0.2	A	0	355	0.2	A	0	370	0.2	A	0
Elm Street SB TH/RT	637	0.0	A	0	714	0.0	A	0	719	0.0	A	0
Weekday Evening:												
Rocky Hill Road EB LT/RT	49	25.3	D	1	54	33.6	D	2	54	39.8	E	2
Elm Street NB LT/TH	687	0.1	A	0	769	0.1	A	0	797	0.4	A	0
Elm Street SB TH/RT	539	0.0	A	0	610	0.0	A	0	626	0.0	A	0
Elm Street at the Carriagetown Marketplace												
Weekday Morning:												
Carriagetown Marketplace EB LT/RT	40	16.6	C	1	40	18.7	C	1	40	19.6	C	1
Elm Street NB LT/TH	270	0.8	A	0	309	0.8	A	0	354	0.6	A	0
Elm Street SB TH/RT	551	0.0	A	0	615	0.0	A	0	620	0.0	A	0
Weekday Evening:												
Carriagetown Marketplace EB LT/RT	149	44.8	E	5	149	>50.0	F	6	149	>50.0	F	7
Elm Street NB LT/TH	604	0.7	A	0	672	0.7	A	0	700	0.6	A	0
Elm Street SB TH/RT	458	0.0	A	0	510	0.0	A	0	526	0.0	A	0
Elm Street at Hampton Inn and Project Site												
Weekday Morning:												
Hampton Inn Driveway EB LT/RT	9	14.1	B	0	9	15.4	C	0	9	16.3	C	0
Project Site Driveway WB LT/RT	--	--	--	--	--	--	--	--	124	>50.0	F	5
Elm Street NB LT/TH/RT	336	0.1	A	0	384	0.1	A	0	419	0.1	A	0
Elm Street SB LT/TH/RT	546	0.0	A	0	613	0.0	A	0	618	0.1	A	0
Weekday Evening:												
Hampton Inn Driveway EB LT/RT	6	13.2	B	0	6	14.4	B	0	6	16.5	C	0
Project Site Driveway WB LT/RT	--	--	--	--	--	--	--	--	78	>50.0	F	3
Elm Street NB LT/TH/RT	629	0.1	A	0	704	0.1	A	0	818	0.1	A	0
Elm Street SB LT/TH/RT	446	0.0	A	0	506	0.0	A	0	522	0.3	A	0

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level of service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

SIGHT DISTANCE EVALUATION

Sight distance measurements were performed at the Project site driveway intersection with Elm Street in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)[14] requirements. Stopping sight distance (SSD) and intersection sight distance (ISD) 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. 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. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 11 presents the measured SSD and ISD at the subject intersection.

[14] *A Policy on Geometric Design of Highway and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2018.

Table 11
SIGHT DISTANCE MEASUREMENTS[a]

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD)[b]	Measured
Elm Street at the Project Site Driveway			
Stopping Sight Distance:			
Elm Street approaching from the northwest	250	--	323
Elm Street approaching from the southeast	250	--	487
Intersection Sight Distance:			
Looking to the northwest from the Project Site	250	390	419
Looking to the southeast from the Project Site	250	335	494

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2018; and based on an approach speed of 35 mph along Elm Street.

[b]Values shown are the intersection sight distance for a vehicle turning right or left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.

As can be seen in Table 11, the available lines of sight to and from the Project site driveway intersection with Elm Street were found to exceed the recommended minimum sight distance to function in a safe (SSD) and efficient (ISD) manner based on a 35 mph approach speed along Elm Street, which is above both the measured 85th percentile vehicle travel speeds (29/33 mph) and the statutory speed limit along Elm Street (25 mph).

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

VAI has completed a detailed assessment of the potential impacts on the transportation infrastructure associated with the proposed construction of a residential development to be located off of Elm Street in Amesbury, Massachusetts. This assessment is responsive to the scope of work that was identified in the July 26, 2024 Certificate issued by the Secretary of Energy and Environmental Affairs on the June 7, 2024 ENF that was filed for the Project and has evaluated the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; under existing and future conditions, both with and without the Project. Based on this assessment we have concluded the following about the Project:

1. Using trip-generation statistics published by the ITE[15] and without adjustment to account for the use of alternative modes of transportation to SOVs by residents of the Project, the Project is expected to generate approximately 2,738 vehicle trips on an average weekday (two-way, 24-hour volume), with 163 vehicle trips expected during the weekday morning peak-hour and 208 vehicle trips expected during the weekday evening peak-hour;

2. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over anticipated future conditions without the Project (No-Build condition), acknowledging that one or more movements at the study area intersections are currently or predicted to operate at or over capacity (i.e., level-of-service (LOS "E" or "F", respectively) independent of the Project. Project-related impacts at off-site intersections are generally defined as a predicted increase in average motorist delay that resulted in a corresponding increase in vehicle queuing of up to six (6) vehicles;

3. All movements exiting the Project site driveway to Elm Street are predicted to operate with extended delay (i.e., LOS "F") due to the relatively large volume of conflicting traffic traveling along Elm Street during the peak periods; however, the resulting residual vehicle queue (up to five (5) vehicles), can be contained along the Project site driveway without inhibiting access, or the movement of vehicles, pedestrians or bicyclists along Elm Street. All movements along Elm Street approaching the Project site driveway are predicted to operate at LOS A with negligible vehicle queuing;

[15] Institute of Transportation Engineers, op. cit. 1.

4. Independent of the Project, the Route 110/Merrill Street/Rabbit Road and Route 110/ Elm Street/Clarks Road intersections were identified to have a motor vehicle crash rate that exceeded the MassDOT average crash rates for similar intersections, with the Route 110/ Merrill Street/Rabbit Road intersection also identified by MassDOT as high crash cluster locations for the 2019-2021 reporting period and Highway Safety Improvement Program (HSIP) eligible. As such, specific recommendations have been provided at these intersections in an effort to advance safety-related improvements; and

5. Lines of sight at the Project site driveway intersection with Elm Street were found to exceed the recommended minimum sight distance to function in a safe and efficient manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The following improvements have been recommended as a part of this assessment and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits and approvals.

Project Access

Access to the Project site will be provided by way of a full access driveway that will intersect the east side of Elm Street generally opposite the south driveway to the Hampton Inn Amesbury. Secondary access for emergency vehicles will be provided through a connection to the abutting property to the north at 227 Elm Street which will be secured by a gate or other means acceptable to the Amesbury Fire Department. The following recommendations are offered with respect to the design and operation of the Project site access and internal circulation:

- The Project site driveway and internal intersections should be a minimum of 22-feet in width (24 feet desirable) and designed to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle. Consideration should be given to widening the driveway approaching Elm Street to provide an area for parent/caregiver vehicles to park when waiting for the school bus.

- The emergency vehicle access road should be 20-feet in width and paved or constructed of a stabilized base material that will support travel by the largest responding emergency vehicle under all weather conditions, and should be gated or otherwise secured in a means acceptable to the Amesbury Fire Department.

- Where a boulevard type roadway is proposed within the Project site, the one-way travel lanes on either side of the raised median should be a minimum of 20 feet in width unless a reduced width is approved by the Amesbury Fire Department. On-street parking should be restricted in locations where the roadway width will be less than 24 feet.

- Where perpendicular parking is proposed, the maneuvering area behind the parking should be a minimum of 23 feet in order to facilitate parking maneuvers.

- Vehicles exiting the Project site driveway to Elm Street and at intersections of minor streets with the main circulating roadway within the Project site should be placed under STOP-sign control with a marked STOP-line provided.

- Appropriate signs and pavement markings should be provided to regulate the flow of traffic on the approaches to and within the roundabout that is planned within the Project site, including "Yield" signs and accompanying pavement markings on the approaches and "One-Way" signs within the roundabout. In addition, splitter islands should be provided on all approaches to the roundabout that provide proper deflection to reduce approach speeds and reinforce the one-way circulation.

- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[16]

- Sidewalks should be provided along both sides of the Project site driveway and internal roadways within the Project site and should connect to the existing sidewalk along the northeast side of Elm Street.

- Americans with Disabilities Act (ADA)-compliant wheelchair ramps should be provided at pedestrian crossings to be modified or constructed in conjunction with the Project, including for crossing the Project site driveway along Elm Street or the driveway should be designed so that the sidewalk crosses the driveways (i.e., pan-type driveway).

- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas should be designed and maintained so as not to restrict lines of sight.

- Snow accumulations (windrows) within sight triangle areas should be promptly removed where such accumulations would impede sight lines.

Off-Site

❖ **Route 110 Coordinated Traffic Signal System**

The addition of Project-related traffic to the signalized intersections along Route 110 within the study area was shown to result in an increase in motorist delays and vehicle queuing over No-Build conditions, with the Route 110/Merrill Street/Rabbit Road and Route 110/ Elm Street/Clarks Road intersections identified as high crash locations. In order to enhance safety and to off-set the predicted impact of the Project, the Project proponent will design and implement an optimal traffic signal timing, phasing and coordination plan (where applicable) for the following intersections:

5. Route 110 at the Carriagetown Marketplace Driveway;
6. Route 110 at Elm Street and Clark's Road;
7. Route 110 at the I-95 Southbound Off-Ramp (future); and
8. Route 110 at Merrill Street and Rabbit Road (not currently coordinated)

[16]Federal Highway Administration, op. cit. 3.

The initial traffic signal timing improvements will be completed prior to the issuance of any Certificate of Occupancy for the Project subject to receipt of all necessary rights, permits and approvals, and will include a review of the "yellow" and "all-red" clearance intervals and the pedestrian phase timings. Operating conditions at the subject intersections will reviewed thereafter as a part of the annual traffic Monitoring and Reporting Program (discussion follows) and the traffic signal timing, phasing and coordination will be further adjusted based on the results of the monitoring program again, subject to receipt of all necessary rights, permits and approvals. As can be seen in Table 12, with the traffic signal timing improvements, operating conditions are predicted to generally improve over or to be restored to No-Build conditions.

❖ **Route 110 Corridor Improvements**

Route 110 at the I-95 North and Southbound Ramps

Independent of the Project, right-turn movements from the I-95 northbound ramp to Route 110 westbound and left-turn movements from the I-95 southbound off-ramp to Route 110 westbound are currently operating at or over capacity during both peak hours, with vehicle queues on the I-95 northbound off-ramp extending up to 72 vehicles. In order to improve operating conditions at the I-95 ramp intersections with Route 110, a review of geometric and traffic control improvements was undertaken, including the installation of a traffic control signal or modern roundabout at the Route 110/I-95 southbound off-ramp intersection. Based on this review, it was determined that the Route 110/I-95 southbound off-ramp intersection appears to meet the warrants identified in the MUTCD[17] for the installation of a traffic signal and that the traffic signal control alternative combined with the geometric improvements that have been recommended at the Route 110/ Elm Street/Clark's Road intersection (discussion follows) would result in improved operating conditions over the modern roundabout alternative such that the I-95 northbound off-ramp to Route 110 westbound would no longer be blocked thereby also improving traffic operations for the I-95 northbound off-ramp to Route 110 westbound.

As can be seen in Tables 12 and 13, with the installation of a traffic control signal at the Route 110/I-95 southbound off-ramp intersection, the integration of the new traffic signal into the Route 110 coordinated traffic signal system and the completion of the associated geometric improvements along Route 110, operating conditions at both I-95 ramp intersections will be improved over No-Build conditions such that all movements are predicted to operate at LOS D or better with a significant reduction in vehicle queuing along the I-95 northbound off-ramp to Route 110 westbound such that the approach operates with negligible vehicle queuing.

As can be seen in Table 14, with the reconstruction of the Route 110/I-95 southbound ramps intersection to operate under modern roundabout control, all movements at the intersection are predicted to operate at LOS D or better consistent with the traffic signal control alternative; however, vehicle queuing along the Route 110 westbound approach during the weekday evening peak-hour is predicted to extend beyond the I-95 northbound off-ramp such that operations on that approach would be negatively impacted.

In an effort to improve traffic operations within the Route 110/I-95 interchange and recognizing the limited impact of the Project at the off-ramp intersections (defined as a predicted increase in vehicle queuing of up to six (6) vehicles), the Project proponent will prepare an Interchange Improvement Study (IIS) and a MassWorks grant application for submission by the City for

[17]Federal Highway Administration, op. cit. 3.

the design and construction of the identified improvements. The IIS and MassWorks grant application will be prepared in consultation with MassDOT and provided to the City prior to the issuance of any Certificate of Occupancy for the Project. The geometry required to accommodate a traffic signal or modern roundabout at the Route 110/I-95 southbound ramps intersection is depicted on Figures 13 and 14, respectively.

Route 110 at Elm Street and Clark's Road

Independent of the Project, specific movements along Route 110 at the Route 110/Elm Street/ Clark's Road intersection are currently or are predicted to operate at or over capacity, with residual vehicle queuing along the Route 110 westbound approach that extends through the Route 110/I-95 southbound ramps intersection. In an effort improve operating conditions at the Route 110/Elm Street/Clark's Road intersection and within the Route 110/I-95 interchange, the Project proponent will undertake the following improvements at the Route 110/Elm Street/ Clark's Road intersection which are depicted on both Figure 13 and 14:

- Widen Route 110 westbound to accommodate three (3) through travel lanes between the I-95 southbound off-ramp to a point approximately 300 feet west of Elm Street;

- Reconstruct the intersection and traffic signal system to accommodate the additional through travel lane, including a section of the Salisbury Point Ghost Trail that is situated along the north side Route 110; and

- Design and implement an optimal traffic signal timing, phasing and coordination plan.

These improvements will be designed and constructed prior to the issuance of a Certificate of Occupancy for the Project and subject to receipt of all necessary rights, permits and approvals.

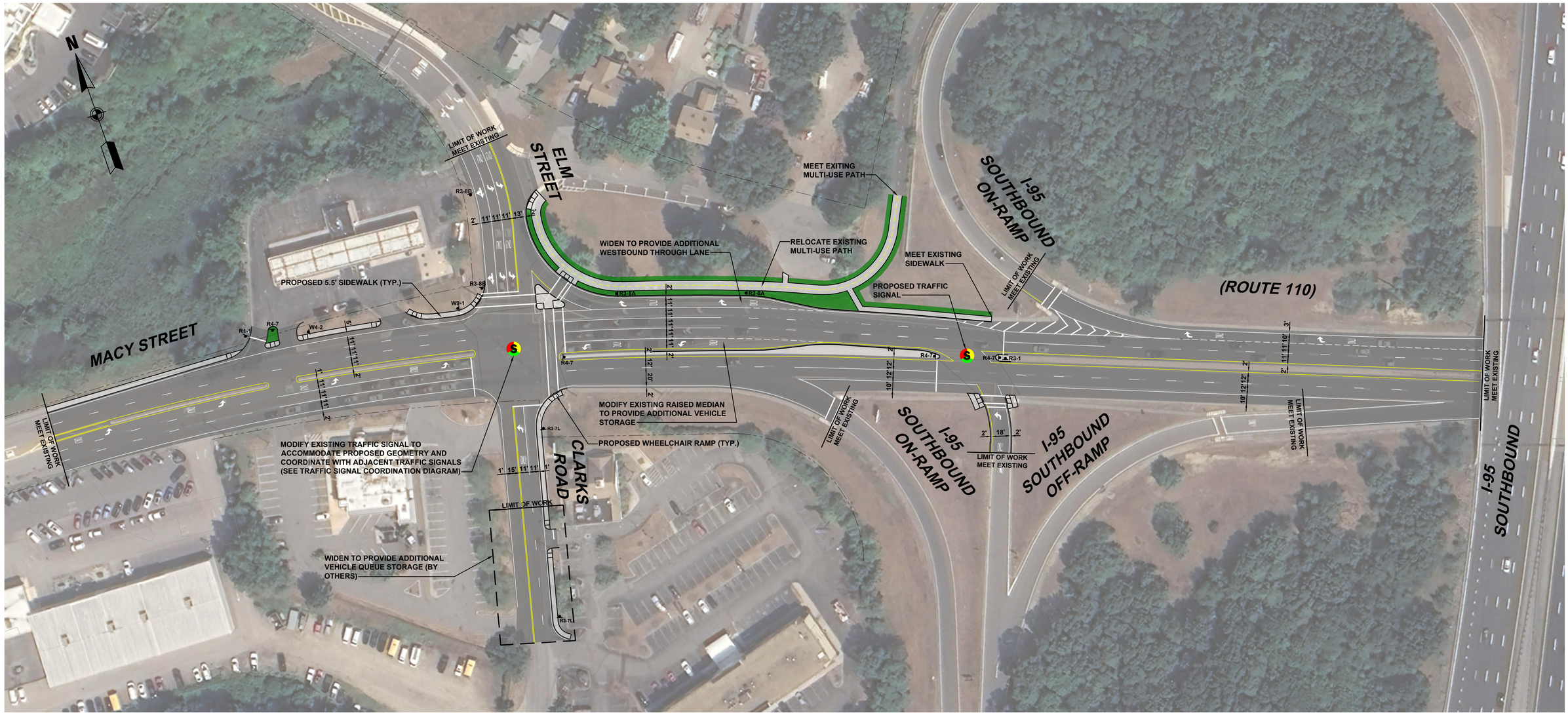
❖ **Safety Improvements**

Route 110 at Merrill Street and Rabbit Road/Route 110 at Elm Street and Clarks Road

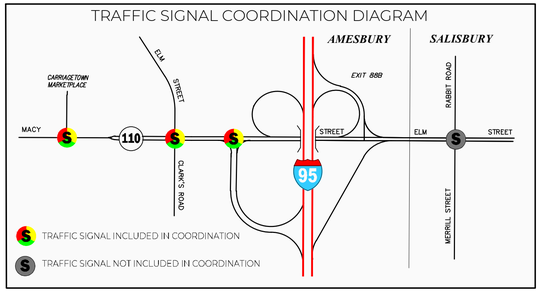
Independent of the Project, the Route 110/Merril Street/Rabbit Road and Route 110/Elm Street/ Clarks Road intersections were found to have motor vehicle crash rates above the MassDOT statewide and District average crash rate for similar intersections. Additionally, the Route 110/Merrill Street/Rabbit Road intersection has been identified by MassDOT as a high crash location for the 2019 through 2021 reporting period. In an effort to off-set the predicted impact of the Project and to improve safety at these intersections, the Project proponent will: i) facilitate the completion of a Road Safety Audit (RSA) at both intersections; and ii) design and implement the short-term, low-cost improvements that are identified as an outcome of the RSA. The results of the RSA at the Route 110/Elm Street/Clarks Road intersection will be used to inform the design of the intersection improvements described above. The RSA will be completed prior to the filing of the Final Environmental Impact Report (FEIR) for the Project. The FEIR will identify the suggested improvement measures that are an outcome of the RSA along with those that will be undertaken as a part of the Project.

Elm Street Pedestrian Crossing

In order to facilitate pedestrian access to the Project and connectivity to public transportation (discussion follows), the Carriagetown Marketplace and the Salisbury Point Ghost Trail, a pedestrian actuated Rectangular Rapid Flashing Beacon (RRFB) will be installed at the existing



SIGN LEGEND			
R1-1	STOP	W4-2R	
R3-1		W9-1R	RIGHT LANE ENDS
R3-7L	LEFT LANE MUST TURN LEFT	R3-8A	ONLY ONLY
R4-7		R3-8B	ONLY ONLY



50 0 50 100
SCALE IN FEET

NOTES:
1. THIS PLAN IS FOR REVIEW PURPOSES ONLY AND IS NOT INTENDED FOR CONSTRUCTION.
2. BASE PLAN INFORMATION OBTAINED FROM GOOGLE EARTH.

FIGURE 13
CONCEPTUAL IMPROVEMENT PLAN
ROUTE 110 AT ELM STREET / CLARKS ROAD AND I-95 SOUTHBOUND RAMPS
TRAFFIC SIGNAL CONTROL ALTERNATIVE

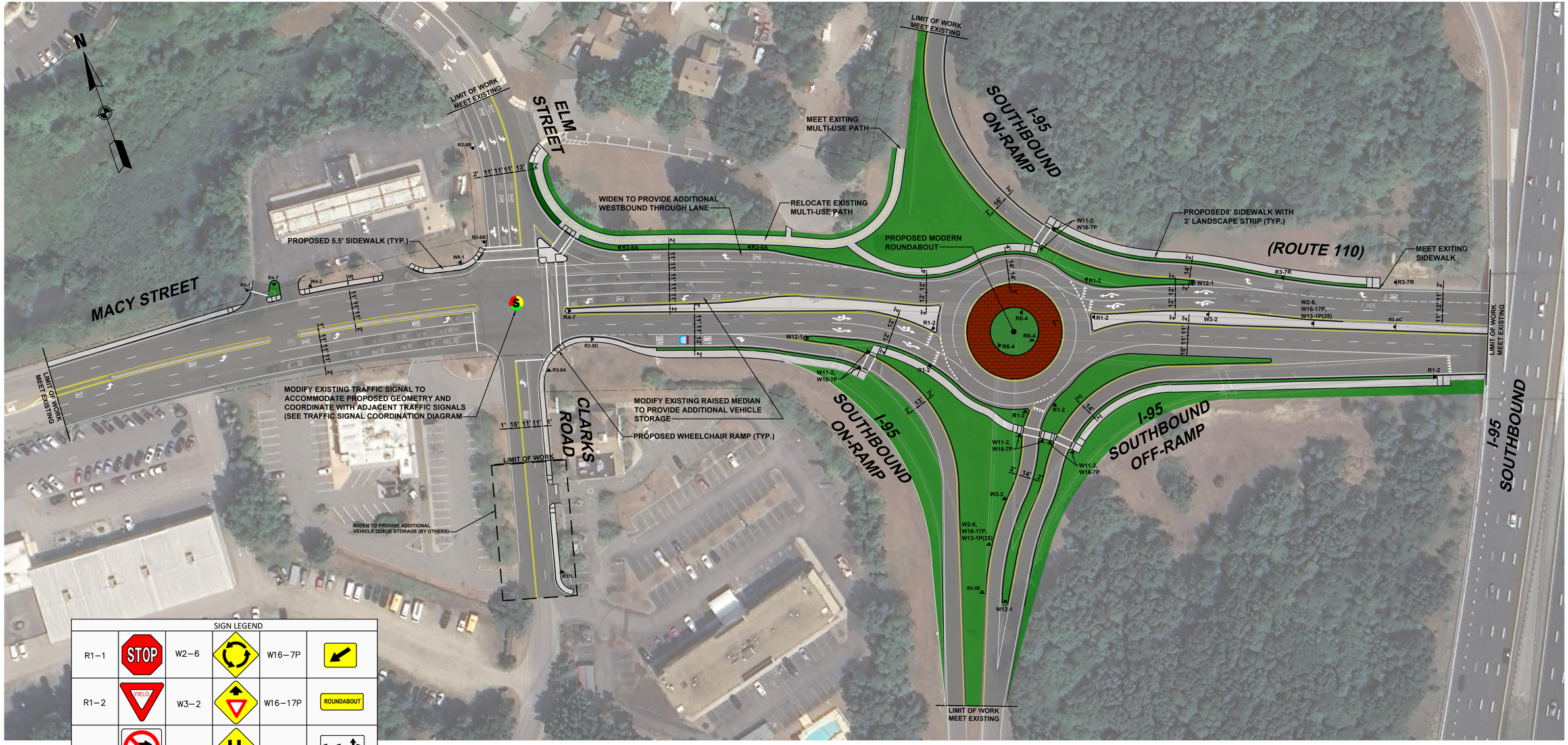
PROJECT:
ROCKY HILL RESIDENTIAL DEVELOPMENT
AMESBURY, MASSACHUSETTS

PROPONENT:
DALE DEVELOPMENT, LLC
RYE, NEW HAMPSHIRE

NO.	REVISIONS	DATE

Vanasse & Associates inc
Transportation Engineers & Planners
35 New England Business Center Drive - Suite 140 - Andover, MA 01810
www.vaiva.com
978-474-8900

DESIGNED BY:	DCL	DATE:	10/31/2024
DRAWN BY:	JTG	SCALE:	1" = 50'
CHECKED BY:	JSD	SHEET	1 OF 1



SIGN LEGEND					
R1–1	STOP	W2–6		W16–7P	
R1–2	YIELD	W3–2		W16–17P	ROUNDABOUT
R3–1		W4–2R		R3–8A	ONLY ONLY
R3–7L	LEFT LANE MUST TURN LEFT	W9–1R	RIGHT LANE ENDS	R3–8B	ONLY ONLY
R3–7R	RIGHT LANE MUST TURN RIGHT	W11–2		R3–8C	
R4–7		W12–1		R3–8D	ONLY
R6–4		W13–1P	25 M.P.H.	R3–8E	

50 0 50 100
SCALE IN FEET

NOTES:
1. THIS PLAN IS FOR REVIEW PURPOSES ONLY AND IS NOT INTENDED FOR CONSTRUCTION.
2. BASE PLAN INFORMATION OBTAINED FROM GOOGLE EARTH.

FIGURE 14
CONCEPTUAL IMPROVEMENT PLAN
ROUTE 110 AT ELM STREET / CLARKS ROAD AND I-95 SOUTHBOUND RAMPS
MODERN ROUNDABOUT ALTERNATIVE

PROJECT:
ROCKY HILL RESIDENTIAL DEVELOPMENT
AMESBURY, MASSACHUSETTS

PROPONENT:
DALE DEVELOPMENT, LLC
RYE, NEW HAMPSHIRE

NO.	REVISIONS	DATE

Vanasse & Associates inc
Transportation Engineers & Planners
35 New England Business Center Drive - Suite 140 - Andover, MA 01810
www.vai.com 978-474-8900

DESIGNED BY:	DCL	DATE:	10/31/2024
DRAWN BY:	JTG	SCALE:	1" = 50'
CHECKED BY:	JSD	SHEET	1 OF 1

crosswalk across the Elm Street northwest leg of the Elm Street/Hampton Inn Amesbury driveway intersection to include pedestrian crossing warning signs at and in advance of the crossing. These improvements will be completed prior to the issuance of a Certificate of Occupancy for the Project and subject to receipt of all necessary rights, permits and approvals.

Transportation Demand Management

Public transportation services are provided within the study area by Merrimack Valley Transit (MeVA). MeVA operates fixed-route bus service along Elm Street and Route 110 by way of bus Route 17, *Salisbury Beach via Amesbury*, and Route 19, *Amesbury/Costello*. The Route 17 bus provides service between the Washington Square Transit Center in Haverhill and Salisbury Beach and travels along Elm Street past the Project to Route 110. The closest regular stop for the Route 17 bus to the Project site is at the Elm Street/Carriagetown Marketplace Driveway intersection, approximately 600 feet (or a 2-minute walk) from the Project site. The Route 19 bus provides service between the Nicholas J. Costello Transportation Center in Amesbury and the Newburyport MBTA Station, and travels along Route 110 to the I-95 interchange. The closest regular stop for the Route 19 bus to the Project site located within the Carriagetown Marketplace, approximately 0.25 miles (or a 5-minute walk) from the Project site. MeVA buses also operate in a "flag stop" mode, where a rider can request a stop anywhere along the regular service route by signaling to the driver.

In an effort to encourage the use of alternative modes of transportation to single-occupant vehicles (SOVs), the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- A transportation coordinator will be designated for the Project, who may have other duties and responsibilities, to coordinate the elements of the TDM program;
- The transportation coordinator will facilitate a rideshare matching program for residents to encourage carpooling;
- A "welcome packet" will be provided to new residents detailing available public transportation services, bicycle and walking alternatives, and other commuting options;
- Amenities will be provided to support telecommuting by residents of the Project that may take the form of meeting space or collaboration areas within the clubhouse;
- Information regarding public transportation services, maps, schedules, and fare information will be posted in a central location and/or otherwise made available to residents;
- Pedestrian accommodations will be incorporated within the Project and consist of sidewalks that connect to the existing sidewalk infrastructure along Elm Street; and
- Secure bicycle parking will be provided at appropriate locations within the Project site, such as by the clubhouse and recreation areas.

In addition, the Project proponent will consult with MeVA and the City to establish a bus stop along Elm Street at the Project site. To the extent that a bus stop is established and if so desired by MeVA, a bus shelter will be provided at a location determined in consultation with MeVA and MassDOT.

With implementation of the aforementioned recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

Traffic Monitoring Program

The Project proponent will conduct a post-development traffic monitoring and resident survey program in order to evaluate the success and to refine the elements of the TDM program, and to validate the trip projections for the Project. The monitoring program will include:

i) Obtaining traffic-volume information over a continuous seven-day, weeklong period on the driveway serving the Project;

ii) Performing manual turning movement and vehicle classification counts at the following intersections (the "Monitored Intersections") during the weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak periods:

- Elm Street at the Project site driveway
- Route 110 at the Carriagetown Marketplace Driveway;
- Route 110 at Elm Street and Clark's Road;
- Route 110 at the I-95 Southbound Ramps
- Route 110 at the I-95 Northbound Ramps
- Route 110 at Merrill Street and Rabbit Road;

iii) Evaluating motor vehicle crash data at the Monitored Intersections; and

iv) Performing a survey of resident commuting modes.

The monitoring program will commence six (6) months after issuance of the first Certificate of Occupancy for the Project and will continue on an annual basis thereafter for a period not to exceed 5-years after completion of the Project. The results of the monitoring program will be summarized in a report (the "Traffic Monitoring Report") to be provided to MassDOT, the Merrimack Valley Planning Commission (MVPC) and the City of Amesbury within 2-months after the completion of the data collection effort. The Traffic Monitoring Report will document: i) traffic volumes associated with the Project; ii) motorist delays, vehicle queuing, crash severity and calculated crash rates at the Monitored Intersections; and iii) the elements of the TDM program that have been implemented and use of alternative modes of transportation to SOVs by residents.

If and to the extent any of the following occur: i) the volume of traffic attributable to the Project as measured at the Project site driveway exceeds the projected traffic volumes on a daily or peak-hour basis by more than 10 percent; ii) there is an increase in the frequency of occurrence of motor vehicle crashes at the Monitored Intersections that can be attributed to the Project; or iii) traffic operations at the Monitored Intersections are materially degraded as a result of the addition of Project-related traffic; the Project proponent will coordinate with the appropriate approving authorities to implement one or more of the following measures subject to receipt of all necessary rights, permits and approvals:

- Traffic signal timing, phasing and coordination improvements
- Sign and pavement marking installation
- Expansion or refinement of the elements of the TDM program

The specific improvement measure(s) will be summarized in the Traffic Monitoring Report and their status and effectiveness will be evaluated in the subsequent Traffic Monitoring Report.

Table 12
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Signalized Intersection/Peak-Hour/Movement	2031 No-Build				2031 Build				2031 Build (Mitigated)			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 110 at Carriagetown Marketplace												
Weekday Morning:												
Route 110 EB LT	0.30	43.6	D	1/3	0.30	43.6	D	1/3	0.32	44.3	D	1/3
Route 110 EB TH	0.57	5.2	A	5/21	0.58	5.3	A	5/22	0.58	5.3	A	5/22
Route 110 WB TH/RT	0.46	2.2	A	0/19	0.46	2.3	A	0/18	0.46	4.4	A	4/18
Carriagetown Marketplace SB LT	0.41	47.1	D	1/3	0.41	47.1	D	1/3	0.41	47.1	D	1/3
Carriagetown Marketplace SB RT	0.03	36.5	D	0/1	0.03	36.5	D	0/1	0.03	37.0	D	0/1
Overall	--	**6.0**	**A**	--	--	**6.1**	**A**	--	--	**6.9**	**A**	--
Weekday Evening:												
Route 110 EB LT	0.56	42.3	D	3/9	0.56	42.3	D	3/9	0.56	42.3	D	3/9
Route 110 EB TH	0.53	6.4	A	5/16	0.55	6.6	A	5/17	0.55	6.6	A	5/17
Route 110 WB TH/RT	0.84	7.5	A	1/5	0.85	7.5	A	2/5	0.85	10.2	B	7/32
Carriagetown Marketplace SB LT	0.51	44.1	D	3/5	0.51	44.1	D	3/5	0.51	44.1	D	3/5
Carriagetown Marketplace SB RT	0.10	29.0	C	0/2	0.10	29.0	C	0/2	0.10	29.0	C	0/2
Overall	--	**10.5**	**B**	--	--	**10.5**	**B**	--	--	**11.8**	**B**	--
Route 110 at Elm Street and Clarks Road												
Weekday Morning:												
Route 110 EB UT/LT	0.42	50.3	D	2/3	0.61	57.4	E	2/4	0.48	46.1	D	2/4
Route 110 EB TH/RT	1.49	>80.0	F	26/32	1.49	>80.0	F	26/32	1.64	>80.0	F	26/34
Route 110 WB UT/LT	0.60	49.9	D	3/6	0.69	57.6	E	3/6	0.55	46.5	D	3/6
Route 110 WB TH	0.90	45.7	D	12/17	0.90	46.5	D	12/17	0.68	35.3	D	8/10
Route 110 WB RT	0.21	9.5	A	0/1	0.22	8.6	A	0/1	0.22	10.1	B	0/1
Clarks Road NB LT	0.54	45.2	D	3/6	0.62	50.3	D	3/6	0.52	44.2	D	3/6
Clarks Road NB TH/RT	0.33	42.4	D	1/4	0.37	44.1	D	1/4	0.33	42.0	D	1/4
Elm Street SB LT	0.54	30.1	C	6/13	0.56	28.8	C	6/15	0.58	29.9	C	7/14
Elm Street SB TH/RT	0.13	25.8	C	1/4	0.14	24.2	C	1/4	0.15	25.1	C	1/4
Overall	--	**>80.0**	**F**	--	--	**>80.0**	**F**	--	--	**>80.0**	**F**	--
Weekday Evening:												
Route 110 EB UT/LT	0.77	71.3	E	3/7	1.09	>80.0	F	5/10	1.09	>80.0	F	5/10
Route 110 EB TH/RT	1.25	>80.0	F	23/27	1.25	>80.0	F	14/25	1.21	>80.0	F	13/27
Route 110 WB UT/LT	0.79	70.2	E	3/7	0.79	70.2	E	3/7	0.79	70.3	E	3/5
Route 110 WB TH	1.37	>80.0	F	27/32	1.37	>80.0	F	27/32	0.93	36.9	D	14/15
Route 110 WB RT	0.45	13.9	B	2/4	0.49	12.5	B	2/5	0.41	13.9	B	2/2
Clarks Road NB LT	0.42	39.6	D	3/6	0.55	45.1	D	3/6	0.63	50.1	D	3/6
Clarks Road NB TH/RT	0.60	43.3	D	4/9	0.81	65.1	E	4/9	0.92	>80.0	F	4/9
Elm Street SB LT	0.47	33.4	C	4/10	0.46	30.7	C	5/11	0.45	30.4	C	5/11
Elm Street SB TH/RT	0.29	31.8	C	2/6	0.27	30.3	C	3/7	0.27	28.7	C	2/8
Overall	--	**>80.0**	**F**	--	--	**>80.0**	**F**	--	--	**69.3**	**E**	--

See notes at end of Table.

Table 12 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2031 No-Build				2031 Build				2031 Build (Mitigated)			
Signalized Intersection/Peak-Hour/Movement	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 110 at Merrill Street and Rabbit Road												
Weekday Morning:												
Route 110 EB UT/LT	0.43	29.2	C	2/5	0.44	29.3	C	2/5	0.69	47.3	D	2/8
Route 110 EB TH	0.64	21.8	C	5/13	0.65	22.0	C	6/13	0.76	30.1	C	7/16
Route 110 EB RT	0.23	13.7	B	0/1	0.23	13.7	B	0/1	0.23	12.5	B	0/1
Route 110 WB UT/LT	0.97	>80.0	F	2/9	0.98	>80.0	F	2/9	0.69	48.2	D	2/8
Route 110 WB TH/RT	0.74	29.5	C	5/17	0.74	29.6	C	5/17	0.64	27.7	C	6/13
Merrill Street NB LT	1.00	72.2	E	5/20	1.01	76.2	E	5/20	0.78	28.8	C	5/15
Merrill Street NB TH/RT	0.29	18.3	B	2/6	0.29	18.5	B	2/6	0.26	18.1	B	2/6
Rabbit Road SB LT/TH	0.56	29.0	C	3/8	0.56	29.4	C	3/8	0.81	54.8	D	3/11
Rabbit Road SB TH	0.07	12.8	B	0/1	0.07	12.9	B	0/1	0.07	21.4	C	0/2
Overall	--	**32.5**	**C**	--	--	**33.2**	**C**	--	--	**28.9**	**C**	--
Weekday Evening:												
Route 110 EB UT/LT	1.06	>80.0	F	3/11	1.07	>80.0	F	3/11	0.96	>80.0	F	5/14
Route 110 EB TH	0.96	48.3	D	8/22	0.97	50.0	D	9/22	0.81	42.7	D	13/25
Route 110 EB RT	0.24	15.5	B	0/1	0.24	15.5	B	0/1	0.24	14.3	B	0/1
Route 110 WB UT/LT	1.03	>80.0	F	2/9	1.03	>80.0	F	2/9	1.15	>80.0	F	4/12
Route 110 WB TH/RT	0.96	50.9	D	8/21	0.98	54.2	D	8/22	0.85	48.8	D	13/25
Merrill Street NB LT	1.13	>80.0	F	7/26	1.14	>80.0	F	7/26	0.94	54.9	D	10/28
Merrill Street NB TH/RT	0.35	15.8	B	3/9	0.35	15.8	B	3/9	0.33	21.7	C	5/11
Rabbit Road SB LT/TH	0.81	42.9	D	5/14	0.81	42.9	D	5/14	0.97	>80.0	F	8/19
Rabbit Road SB TH	0.12	16.5	B	0/2	0.12	16.5	B	0/2	0.19	30.0	C	1/4
Overall	--	**54.4**	**D**	--	--	**56.3**	**E**	--	--	**52.3**	**D**	--

See notes at end of Table.

Table 12 (Continued)
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2031 No-Build				2031 Build				2031 Build (Mitigated)			
Signalized Intersection/Peak-Hour/Movement	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Route 110 at the I-95 SB Ramps												
Weekday Morning:												
Route 110 EB TH									0.36	2.4	A	2/3
Route 110 EB RT									0.78	4.0	A	0.0
Route 110 WB TH									0.52	3.0	A	3/5
Route 110 WB RT									0.14	0.2	A	0/0
I-95 SB Off-Ramp NB LT									0.40	23.2	C	1/2
I-95 SB Off-Ramp NB RT									0.13	0.2	A	0/0
Overall			***See Unsignalized Capacity Analysis Table***						--	**3.2**	**A**	--
Weekday Evening:												
Route 110 EB TH									0.39	2.6	A	1/4
Route 110 EB RT									0.46	0.3	A	0/0
Route 110 WB TH									0.75	6.5	A	13/14
Route 110 WB RT									0.14	0.2	A	0/0
I-95 SB Off-Ramp NB LT									0.54	44.8	D	3/5
I-95 SB Off-Ramp NB RT									0.13	0.2	A	0/0
Overall									--	**4.8**	**A**	--

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level of service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound.
UT = U-turning movement; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 13
MITIGATED UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/Peak-Hour/Movement	2031 No-Build				2031 Build				2031 Build (Mitigated)			
	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Route 110 at the I-95 NB Ramps												
Weekday Morning:												
Route 110 EB UT/LT	119	>50.0	F	N/C	125	>50.0	F	N/C	125	11.4	B	1
Route 110 EB TH	877	0.0	A	0	897	0.0	A	0	897	0.0	A	0
Route 110 WB TH	857	0.0	A	0	863	0.0	A	0	863	0.0	A	0
Route 110 WB RT	129	0.0	A	0	129	0.0	A	0	129	0.0	A	0
I-95 NB Off-Ramp NB RT	192	0.0	A	0	195	0.0	A	0	195	0.0	A	0
I-95 NB Off-Ramp SB RT	553	>50.0	F	25	565	>50.0	F	27	565	0.0	A	0
Weekday Evening:												
Route 110 EB UT/LT	172	>50.0	F	N/C	177	>50.0	F	N/C	177	15.4	C	2
Route 110 EB TH	1,041	0.0	A	0	1,053	0.0	A	0	1,053	0.0	A	0
Route 110 WB TH	1,178	0.0	A	0	1,199	0.0	A	0	1,199	0.0	A	0
Route 110 WB RT	219	0.0	A	0	219	0.0	A	0	219	0.0	A	0
I-95 NB Off-Ramp NB RT	333	0.0	A	0	333	0.0	A	0	333	0.0	A	0
I-95 NB Off-Ramp SB RT	1,053	>50.0	F	95	1,092	>50.0	F	101	1,092	0.0	A	0

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level of service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 14
MITIGATED ROTARY INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2031 No-Build				2031 Build				2031 Build (Mitigated)			
Roundabout Intersection/Peak Hour/Movement	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Route 110 at the I-95 Southbound Ramps												
Weekday Morning:												
I-95 Southbound Off-Ramp NB LT									72	7.0	A	1
Route 110 WB TH/RT									1,573	10.1	B	6
Route 110 EB TH/RT									2,170	6.7	A	0
Overall									--	**8.1**	**A**	--
Weekday Evening:												
I-95 Southbound Off-Ramp NB LT									106	9.7	A	1
Route 110 WB TH/RT									2,391	29.4	D	48
Route 110 EB TH/RT									1,870	6.0	A	0
Overall									--	**18.9**	**C**	--

See Unsignalized Capacity Analysis Table

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level of service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.