BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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MEMORANDUM

DATE: **January 23, 2014**

TO: **Boston Region Metropolitan Planning Organization (MPO)**

FROM: **Chen-Yuan Wang, MPO Staff**

RE: **Route 3A Subregional Priority Roadway Study in Cohasset and Scituate**

1 INTRODUCTION

The roadway segment of Route 3A from the driveway of the Massachusetts Bay Transit Authority (MBTA) commuter rail station in Cohasset to Henry Turner Bailey Road in Scituate is one of two corridors selected for analysis as part of a larger study funded by the Boston Region MPO: Addressing Safety, Mobility, and Access on Subregional Priority Roadways.[1]

This memorandum summarizes the existing conditions and issues, roadway operations and safety analyses, and the proposed short-, medium-, and long-term improvements for the entire corridor and at specific locations. It contains the following sections:

1. Introduction
2. Existing Conditions and Issues
3. Crash Data Analysis
4. Roadway Operations Analysis
5. Proposed Improvements
6. Summary and Recommendations

This memorandum also includes technical appendices that contain relevant data and methods applied in the study.

1.1 Study Background

During the MPO's outreach for the development of the Unified Planning Work Program (UPWP) and the Long-Range Transportation Plan (LRTP), Metropolitan Area Planning Council (MAPC) subregional groups and other entities submit comments and identify transportation problems and issues that

[1] The study work program was approved on December 6, 2012. The other selected corridor is Routes 127A/127 in Gloucester and Rockport, and findings for that corridor are reported in a separate memorandum.

concern them. Often these issues are related to bicycle, pedestrian, and freight accommodation, bottlenecks, safety, or lack of safe or convenient access for abutters along roadway corridors. Such issues can affect not only mobility and safety along a roadway and its side streets, but also livability and quality of life, including economic development and air quality.

To address these kinds of concerns, this study was included in the federal fiscal year (FFY) 2013 UPWP.[2] The purpose of this study is to identify roadway segments in the MPO region that are of concern to subregional groups but that have not been identified in the LRTP regional needs assessment.

This study focusses on issues identified by relevant subregional groups and the recommendations developed to address these issues. In addition to mobility, safety, and access, the study will consider transit feasibility, truck issues, bicycle and pedestrian transportation, preservation, and other topics.

1.2 Selection Procedure

The study area, Route 3A in Cohasset and Scituate, was selected through a comprehensive process. First, MPO staff identified potential study locations via various sources: soliciting suggestions during the outreach process for the FFY 2014 UPWP; reviewing meeting records from the UPWP outreach process for the past-five years; and appraising potential locations in the MPO's LRTP Priority Corridors study and monitored roadways in the MPO's Congestion Management Process (CMP) program.

MPO staff identified 20 roadway sections in the MPO region as potential study locations. Staff assembled detailed data on the identified roadways and evaluated them according to five selection criteria:

- Safety Conditions: Location has a high crash rate for its functional class or contains areas with a high number of crashes or a significant number of pedestrian/bicycle crashes.
- Multimodal Significance: Location supports transit, bicycle, or pedestrian activity or has an implementation project to support one or more of these activities.
- Subregional Significance: Location carries a significant proportion of subregional vehicle, bicycle, or pedestrian traffic.[3]

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[2] Boston Region Metropolitan Planning Organization, Unified Planning Work Program, Federal Fiscal Year 2013, Endorsed by the Boston Region Metropolitan Planning Organization on June 28, 2012.

[3] Geographic equity among subregions was also considered in this criterion.

- Subregional Priority: Location is endorsed by a subregion and is a priority for that subregion.
- Implementation Potential: Location is proposed by the roadway agency or related agencies that have identified prospective funding resources for design and implementation.

Two roadway sections were selected and approved by the Boston Region MPO for study:[4]

- Route 3A in Cohasset and Scituate (from the MBTA commuter rail station in Cohasset to Henry Turner Bailey Road in Scituate)
- Routes 127A/127 in Gloucester and Rockport (also known as the Cape Ann Loop)

The Route 3A corridor is located in an area currently being developed. It serves residents, commuters, and local businesses, and connects two major MBTA commuter rail stations. The South Shore Coalition and the Towns of Cohasset and Scituate strongly support this corridor for study.

1.3 Study Objectives

The objectives of this study are to:

- Identify the safety, mobility, accesses, and other transportation-related problems in the corridor.
- Develop and evaluate potential multimodal transportation solutions to the problems, including pedestrian, bicycle, trucks, and transit modes.

1.4 Study Area and Data Collection

This study focuses on a three-mile section of Route 3A from the driveway of the MBTA commuter rail station in Cohasset to Henry Turner Bailey Road in Scituate. The entire section is under the jurisdiction of Massachusetts Department of Transportation (MassDOT), Highway Division District 5.

With the assistance of MassDOT and Cohasset and Scituate, MPO staff collected intensive roadway traffic and speed data; intersection turning movement counts (including pedestrian and bike movements and heavy vehicle percentages); information about current and future adjacent developments; and multiple-year crash reports (from police departments) for the study corridor.

[4] Selection of Study Locations: Addressing Safety, Mobility, and Access on Subregional Priority Roadways, Memorandum to Boston Region MPO, Chen-Yuan Wang, February 7, 2013.

In addition, to support the analyses in this study, staff collected relevant transportation and land use data in the South Shore region adjacent to the study corridor.

1.5 Study Advisory Meetings

During the course of the study, MPO staff conducted two meetings with representatives from the Towns of Cohasset and Scituate, MassDOT, and MAPC. The purpose of the first meeting, held on March 14, 2013, was to introduce and coordinate the study and to discuss the concerns of the two Towns and MassDOT about the study corridor. The second and final meeting, on September 5, 2013, was held to present the analyses and findings and review the proposed improvements with the Towns and MassDOT. Meeting participants included board members, planners, engineers, and police and fire officers from the Towns, and officials from MassDOT District 5. Appendix A contains a list of participants in the two meetings.

2 EXISTING CONDITIONS AND ISSUES

This section describes the corridor's location; adjacent major transportation facilities' roadway configuration and facilities; and observed operational and safety conditions. It inventories current and future developments, and summarizes issues and concerns raised in the study advisory meetings.

2.1 Study Corridor and Major Transportation Facilities in the Area

Route 3A is a major state roadway in eastern Massachusetts, which runs north from Plymouth to Tyngsborough, at the northern New Hampshire state line. Its southern portion, mostly parallel to Route 3 and located near the coast, connects Route 3 in Plymouth and Interstate 93 (I-93) in Boston's Dorchester neighborhood. Route 3A traverses a number of communities including Plymouth, Kingston, Duxbury, Marshfield, Scituate, Cohasset, Hingham, Weymouth, and Quincy. Along with Route 3, Route 3A is regarded as a significant travel corridor on the South Shore.

Figure 1 shows the location of the study corridor and major transportation facilities in the area. Most of the three-mile corridor selected for this study is located in Cohasset, with a short section in Scituate. The entire section is classified as a principal urban arterial. It is mainly a two-lane roadway (one travel lane in each direction), except for a four-lane section (two travel lanes in each direction) about a quarter mile long in a Cohasset business district south of Beechwood Street. The roadway's travel lanes are about 12 feet wide, with a shoulder of about two feet or less. There are no sidewalks on either side of the roadway and no exclusive bike lanes.

The corridor serves both local and regional traffic from residents and businesses and is located in an area that currently is being developed. It is also a major commuting route for people working in Boston, Quincy, and other South Shore communities. Based on the traffic counts collected for this study (April-May 2013), the corridor carries about 15,500 to nearly 22,000 vehicles per day.

In the study area, Route 3A intersects three minor arterials: King Street (northern segment) and Sohier Street in Cohasset and Henry Turner Bailey Road in Scituate, and three collector streets: King Street (southern segment), Pond street, and Beechwood Street in Cohasset, all of which are two-lane roadways.

There are not many alternative commuting routes to Route 3A in the study area. The major parallel route is North/South Main Street in Cohasset, which is classified as a minor arterial. However, it is located in a relatively dense residential area and mostly is used by Cohasset and Scituate residents. King Street contains a relatively short section parallel to Route 3A. It connects to Beechwood Street, which links Summer Street further south in Norwell, and mostly is used by local and regional residents.

The MBTA Green Bush commuter rail line is the major transit service in the area. The commuter rail runs along the coast parallel to Route 3A and serves two stations in the study area: North Scituate Station and Cohasset Station. North Situate Station has 279 parking spaces, with an average weekday utilization rate of about 50 percent. Cohasset Station has 410 parking spaces, with an average weekday utilization rate of about 30 percent. A few MBTA buses reach Hingham Center or Hingham Shipyard (from Quincy Center), but no MBTA bus services exist in Cohasset and Scituate.

To provide added access to the two commuter rail stations, the Towns have designated North/South Main Street between the two stations as a bike route, with roadside signs indicating that the street is a shared roadway. The bike route also provides access to the coastal areas for local residents.

In addition to residential and commercial areas, the study corridor is adjacent to some conservation areas, including Wompatuck State Park, Weir River Farm, and Whitney and Thayer Woods, which are popular with local and regional residents. Access to these conservation areas is limited to motorized travel modes, as there are no sidewalks or bike accommodations in the corridor.

2.2 Roadway Conditions and Adjacent Developments

Route 3A is primarily woodland, with single-family houses scattered in between. Relatively more developed, the study corridor segment includes

various kinds of business and multi-unit residential developments, in addition to the existing individual houses abutting Route 3A.

The three-mile corridor is mainly a two-lane roadway with four signalized intersections and three major unsignalized intersections. The four signalized intersections are:

- Route 3A at MBTA Cohasset Station Driveway
- Route 3A at King Street/Cohasset Plaza Driveway
- Route 3A at Pond Street in Cohasset
- Route 3A at Beechwood Street in Cohasset

The three major unsignalized intersections (with cross streets under stop controls) are:

- Route 3A at King Street (northern segment) in Cohasset
- Route 3A at Sohier Street in Cohasset
- Route 3A at Henry Turner Bailey Road in Scituate

In addition to these major intersections, business districts in the corridor have many driveways directly connected to Route 3A, which are potential traffic conflict points.

Three of the four signalized intersections and one of the three unsignalized intersections have crash rates higher than the MassDOT District 5 average (detailed analyses in Section 4: Crash Data Analysis). The corridor also has a relatively high crash rate in the business districts.

Because of the variety of land use, the posted speed limits in the corridor range from 35, to 45, to 50 miles per hour (mph). Most sections of the corridor are designated as 45- or 50-mph zones, except at the business district between Beechwood Street and the Cohasset/Scituate town line, which is a 35-mph zone. Recent MassDOT speed counts performed for this study indicate that some speed limits in the corridor potentially could be adjusted to maintain a more consistent speed range, making for a smoother transition between speed-limit zones (detailed analyses in Section 3.1: Speed Regulations and Travel Speeds).

For the purpose of analysis, based on its land-use characteristics, the corridor can be divided into three sections:

- North Section: Route 3A from the MBTA Cohasset Station to Cohasset Plaza Shopping Center (business, office and residential uses)
- Middle Section: Route 3A from the south of Cohasset Plaza to the north of Beechwood Street (mostly residential uses in a wooded area)

- South Section: Route 3A from Beechwood Street in Cohasset to Henry Turner Bailey Road in Scituate (mostly business uses)

2.2.1 Route 3A North Section

Figure 2 shows the existing roadway conditions and adjacent developments in the north section of the study corridor. The section contains two signalized intersections and two major unsignalized intersections.

The signalized intersection at Route 3A at the driveway of the MBTA Cohasset Station operates adequately because of light traffic to and from the driveway. The signalized intersection at Route 3A at King Street/Cohasset Plaza operates acceptably in general, although drivers on King Street and the peak direction of Route 3A experience some delays in the morning (AM) peak hour (detailed analyses in Section 3.3: Intersection Capacity Analyses).

Under a stop control, the side streets of the two unsignalized intersections, i.e., King Street and Sohier Street, operate unacceptably during the peak traffic hours. At times, drivers on Sohier Street experience extensive delays as a result of the surge of traffic from the adjacent primary schools and commuting traffic on Route 3A northbound.

Most adjacent areas of this section are designated as different types of business districts in the Cohasset zoning plan (Appendix B: Zoning District Map, Town of Cohasset).

The large area west of Route 3A from the intersection at the MBTA Cohasset Station to the north of Sohier Street is zoned as a Technology Business District. Major developments in the district include:

- Avalon Cohasset: A recently completed complex consisting of 218 residential units of various sizes in an exclusive community
- Scituate Hill Commercial Subdivision: A 65,000-square-foot mixed-use development that incudes retail, office, and warehouse spaces (construction currently suspended)
- Stop & Shop Gas Station: A newly completed facility located across from the Cohasset Plaza Shopping Center
- Other Existing Developments: Hingham Lumber Company, Cohasset Sports Complex, Cohasset Collision Center, Cohasset Family Health Center, Sunrise Assisted Living, etc.

The area east of Route 3A, from the parking lot of the MBTA Cohasset Station to south of Laugelle Lane, is designated as a Light Industrial District. The major development in the district is a recently completed transit-oriented center called Old Colonial Square. The development contains 32,400 square feet of retail

space and 16 residential apartments. There are also a few individual businesses located on Route 3A and Laugelle Lane in the district.

The area east of Route 3A from Sanctuary Pond Road to the existing Stop & Shop supermarket is zoned as a Highway Business District. The major development in the district is the Cohasset Plaza Shopping Center, which contains the Stop & Shop supermarket and a number of retail stores. The supermarket and the stores are only accessible via a driveway connected to the signalized intersection at Route 3A and King Street.

North of Sohier Street, the same district is segmented into a number of business subdivisions along Route 3A, which include a gas station, several retail stores (including a Dunkin' Donuts and a few restaurants), and several business offices. The various businesses create at least eight driveways along Route 3A, in addition to three driveways from the developments on the other side of Route 3A. Route 3A in this section has a high number of crashes, most of which involve vehicles turning in and out of the adjacent developments.

2.2.2 Route 3A Middle Section

Figure 3 shows the existing roadway conditions and adjacent developments in the middle section of the study corridor. Route 3A in this section contains one signalized intersection (Route 3A at Pond Street), a few unsignalized intersections connecting to local streets, and a number of driveways (mostly from individual homes and some from businesses abutting Route 3A).

In general, the section is wooded with scattered single-family houses and a few businesses in between. Cohasset School District—located on Pond Street about 1,000 feet from Route 3A—is the major development in this section. The district contains the Town's public middle and high schools and attracts substantial traffic during school opening and closing periods. Although the district itself is not located on Route 3A, traffic at the intersection of Route 3A at Pond Street is affected by some of the school traffic from around 7:00 to 7:30 AM.

Currently, a subdivision containing 41 upscale new homes, called Estate at Cohasset, is under construction on the east side of Route 3A between Mendel Road and Beechwood Street. The development will be accessible mainly from Beechwood Street, with emergency access that connects to Route 3A.

Because this section is less developed, vehicles tend to travel faster here than in other sections of the corridor. While they are speeding up, vehicles encounter the traffic light in the middle of the section. At the signalized intersection, Route 3A has only one lane shared by all movements in both directions. During the green lights, either approach of Route 3A can be blocked by one or two left-turning vehicles, especially in the southbound direction. This

happens frequently when school opens in the morning and evening (PM) peak hours. The intersection is a high crash location. The recent five-year crash data for Route 3A indicate that the majority of reported crashes were rear-end collisions, and more than 25 percent of the crashes caused personal injuries.

2.2.3 Route 3A South Section

Figure 4 shows the existing roadway conditions and adjacent developments in the south section of the study corridor. This section contains mostly business districts and some vacant land.

Route 3A in this section contains a signalized intersection (Route 3A at Beechwood Street), a major unsignalized intersection (Route 3A at Henry Turner Bailey), and a large number of driveways from adjacent businesses. It also contains the only four-lane stretch (about a quarter mile south of Beechwood Street) in the entire study corridor.

In general, the signalized intersection of Route 3A at Beechwood Street operates acceptably during the day. However, according to Cohasset's residents and businesses, it is a dangerous intersection. Crash reports for the past few years show that the intersection had a high number of crashes, with more than a quarter of them causing personal injuries. Many of them are left-turn crashes occurring at the middle of the intersection. This indicates that traffic operations at the intersection may create potential conflicts between left-turning and through traffic on Route 3A.

Under a stop control, drivers on Henry Bailey Turner Road usually have to wait a long time to enter Route 3A during peak traffic hours. According to Scituate residents, this intersection—located in an open wooded area and running downhill from either direction—also is dangerous; and vehicles on Route 3A usually travel fast when approaching the intersection.

The adjacent areas on both sides of Route 3A in this section from Beechwood Street in Cohasset to the Scituate town line are designated as Highway Business Districts in Cohasset. Across the town line, only a portion of the east side of Route 3A is zoned as a Highway Business District in Scituate (see Appendix C: Zoning District Map, Town of Scituate).

Major developments in this section include:

- Cushing Plaza Shopping Center: Shaw's Supermarket, CVS Pharmacy, and several retail stores
- Tedeschi Shopping Center: a number of retail stores and restaurants, including a Starbucks and a pizzeria
- Other existing developments include Cohasset Village Greenery, Aubuchon Hardware, Scituate Racquet & Club (located in Scituate, a

swimming pool recently added), a gas station, a car dealership, and a number of stores, offices, and restaurants south of the two shopping centers

- Recently approved developments include a car-wash center (South Shore Auto Wash) and an office building

There are nearly 30 driveways directly connected to Route 3A from the adjacent developments. Except for the driveway from Cushing Plaza Shopping Center, most of them serve an individual or just a few neighboring developments. MassDOT 2006–10 crash data show a high number of crashes in these business districts and a crash rate higher than the MassDOT District 5 average for urban principal arterials.

2.3 Issues and Concerns

In the scope meeting on March 14, 2013, representatives from the Towns, MassDOT, and MAPC shared their views of the study corridor. Below is a summary of issues and concerns:

- High travel speeds on Route 3A perceived by the area's residents and businesses
- Perceived unsafe travel conditions along the corridor
- Perceived unsafe conditions at intersections in the corridor, especially at Beechwood Street in Cohasset and at Henry Turner Bailey Road in Scituate
- Lack of pedestrian accommodations in the corridor, including access to the MBTA Cohasset Station
- Lack of safe bicycle accommodations in the corridor
- Frequent curb cuts in business districts with high crash occurrences, especially those south of Beechwood Street
- Inconvenient and unsafe access from Route 3A to adjacent developments in the business districts
- Delays at stop-controlled locations, especially at Sohier Street and at King Street

The study advisory members discussed issues and concerns at other specific locations in the corridor, where analyses identified safety and operational problems. These issues and concerns, along with the proposed improvements, are summarized by location in Section 5 of this memorandum.

3 CRASH DATA ANALYSIS

Crash data are an essential source for identifying safety and operational problems in a study area. Analyses of crash locations, collision types, time-of-day, roadway conditions, and other factors also can assist in developing improvement strategies. To obtain sufficient data for analysis, staff collected two sets of data from available resources. The two datasets are:

- 2008–10 MassDOT Registry of Motor Vehicles (RMV)
- 2008–12 crash reports from Cohasset and Scituate Police Departments

Figure 5 shows the crash locations and the crash rates at major intersections and in different sections of the corridor during the five-year period 2008–12.

3.1 Crash Locations

The two datasets identified a total of 321 crashes. As shown in Figure 5, crashes in the study corridor mainly concentrate at intersections and in business districts.

During the five-year period 2008–12, more than 30 crashes occurred in the business district between Sanctuary Pond Road and Sohier Street in the north; and more than 50 crashes occurred in the business district between Beechwood Street and the Cohasset/Scituate town line in the south. In both districts, about 70 percent of the crashes involved a vehicle turning into or out of an adjacent business development.

The concentration of crashes in the business districts is primarily a result of 1) the lack of convenient and safe facilities for vehicles on Route 3A to access the adjacent developments, such as a left-turn-only lane or a two-way left-turn lane, and 2) frequent curb cuts in the business districts, which create multiple potential conflict points on the roadway with short distances in between.

Among the major intersections, those at 1) Route 3A at King Street/Cohasset Plaza Shopping Center, 2) Pond Street, and 3) Beechwood Street had a noticeably greater number of crashes than other locations. Crashes at intersections are complicated; staff further analyzed them using collision diagrams (see Section 3.4).

Figure 5 also shows the locations of a pedestrian crash and a bicycle crash. The pedestrian crash, which occurred in 2010 in the middle section of the south business district, involved a pedestrian crossing Route 3A and a vehicle traveling straight northbound. The bicycle crash occurred in 2009 near the intersection of Route 3A at Sohier Street, and involved a bicycle and a vehicle both traveling straight northbound.

Two fatal crashes occurred in the study corridor during the five-year period. One accident happened in 2010 in the north section of Route 3A near Sanctuary Pond Road; a southbound vehicle crossed the center line (reason unknown) and collided head on with a northbound vehicle. The other crash took place in 2008 in a curved area of the middle section just north of Beechwood Street; a single out-of-control vehicle crashed into a roadside embankment around midnight.

Analyses also showed that during the five-year period nearly 20 crashes at various locations in the corridor involved a deer crossing Route 3A and a vehicle traveling straight. Most noticeably, there were eight such crashes in 2012.

3.2 Corridor Crash Rates

Crash rates are an effective metric for examining the relative safety of a particular location. The crash rate of a roadway segment is measured in terms of crashes per million miles traveled. Based on the crash datasets and the recently collected traffic volume data, staff estimated crash rates for the study area according to its three sections and their various land use characteristics, as well as for the corridor as a whole.

- North Section (Route 3A from the MBTA Cohasset Station to the Cohasset Plaza Shopping Center): 3.29 crashes per million vehicles miles traveled
- Middle Section (Route 3A from south of the Cohasset Plaza to north of Beechwood Street): 1.68 crashes per million vehicles miles traveled)
- South Section (Route 3A from Beechwood Street to Henry Turner Bailey Road): 4.89 crashes per million vehicles miles traveled
- Study Corridor (Route3 A from the MBTA Cohasset Station to Henry Turner Bailey Road): 3.14 crashes per million vehicles miles traveled

Based on a MassDOT official estimate (updated January 23, 2013), the 2010 State average crash rate for principal arterials in urban areas is 3.23 crashes per million vehicles miles traveled. The crash rate for the north section is slightly higher than the state average, and the crash rate for the south section is much higher than the state average. Detailed calculations of the crash rates for the three sections and for the corridor are included in Appendix D.

3.3 Intersection Crash Rates

Crashes at intersections are measured in terms of crashes per million entering vehicles. The crash rates for four signalized intersections in the study corridor are estimated as follows:

- Route 3A at the MBTA Cohasset Station Driveway: 0.45 crashes per million entering vehicles
- Route 3A at King Street/Cohasset Plaza Driveway: 0.97 crashes per million entering vehicles
- Route 3A at Pond Street: 0.98 crashes per million entering vehicles
- Route 3A at Beechwood Street: 1.53 crashes per million entering vehicles

Based on a MassDOT official estimate, the 2010 average crash rate for signalized intersections in MassDOT District 5 is 0.77 crashes per million entering vehicles. Except for the MBTA driveway intersection, the crash rates of the other three signalized intersections are all higher than the District 5 average. The crash rate of the intersection of Route 3A at Beechwood Street is about double the District 5 average.

Crash rates for the three major unsignalized intersections in the study corridor are estimated as follows:

- Route 3A at King Street: 0.43 crashes per million entering vehicles
- Route 3A at Sohier Street: 0.43 crashes per million entering vehicles
- Route 3A at Henry Turner Bailey Road: 0.60 crashes per million entering vehicles

The 2010 average crash rate for unsignalized intersections in MassDOT District 5 is estimated as 0.58 crashes per million entering vehicles. The crash rate for the intersection of Route 3A at Henry Turner Bailey Road is higher than the District 5 average. The crash rate calculations for the study intersections, in order of north to south, are included in Appendix E.

3.4 Intersection Crash Analyses

To further investigate safety and operational problems, staff summarized the crash data at the study intersections according to crash severity (property damage only, non-fatal injury, fatality, unknown), collision type (single-vehicle, rear-end, angle, sideswipe, head-on, rear-to-rear, unknown), pedestrian or bicycle involvement, time of day, pavement conditions, and light conditions. Crash statistics for the intersections, in order of north to south, are included in Appendix F. Data in both datasets (2008–10 MassDOT crash data and 2008–12 Cohasset/Scituate Police Department crash reports) were used in this analysis.

Staff also constructed collision diagrams for the study intersections based on the recent five-year crash reports provided by Cohasset and Scituate Police Departments. The collision diagrams for the intersections, in order of north to south, are included in Appendix G. Note that the number of crashes shown in

the collision diagrams generally differs from the number cited in the crash statistics. This is because staff used only the police crash reports dataset—which contains detailed information about how and where the crashes occurred—to create the collision diagrams.

Major findings from the crash statistics and the collision diagrams for each of the study intersections are summarized below:

Route 3A at MBTA Cohasset Station Driveway

- About three or less crashes every year
- High proportion of single-vehicle collisions (about 50 percent)
- Noticeable number of crashes of a northbound vehicle colliding with the right-turn channelized island or the median island of MBTA Driveway (Figure G-1 in Appendix G)

Route 3A at King Street

- About three or more crashes every year
- High proportion of angle collisions (about 45 percent)
- High proportion of crashes (about 35 percent) involving a left-turn vehicle from King Street colliding with a northbound vehicle on Route 3A (Figure G-2 in Appendix G)

Route 3A at Sohier Street

- About two crashes every year
- High proportion of angle collisions (nearly 70 percent)
- Residents are concerned about the lack of visibility of the overhead beacon, and insufficient sight distances from Sohier Street. But the collision diagram based on recent crash reports does not show distinctive patterns associated with these concerns (Figure G-3 in Appendix G).
- Crash data for this intersection should be continuously monitored

Route 3A at King Street/Cohasset Plaza Shopping Center

- About seven or more crashes every year
- Relatively high proportion of crashes causing injuries (about 35 percent)
- Number of crashes decreasing since 2012 (Table F-4 in Appendix F)
- No distinctive patterns of crashes (Figure G-4 in Appendix G)

Route 3A at Pond Street

- Nearly seven crashes every year

- Relatively high proportion of crashes causing injuries (about 25 percent)
- Number of crashes increasing since 2012 (Table F-5 in Appendix F)
- High proportion of rear-end collisions (about 85 percent)
- High number of rear-end crashes occurred on Route 3A, with more on southbound approach (Figure G-5 in Appendix G)
- The high number of crashes is mainly a result of the intersection lacking an exclusive left-turn lane on both approaches of Route 3A, compounded by high travel speeds, and poor visibility of traffic signals

Route 3A at Beechwood Street

- High number of crashes (about ten or more crashes every year)
- High crash rate (almost twice the MassDOT District 5 average)
- Relatively high proportion of crashes causing injuries (about 25 percent)
- High proportion of angle collisions (more than 60 percent)
- Number of crashes increasing since 2011 (Table F-6 in Appendix F)
- Noticeable number of crashes involving a left-turn vehicle and a through vehicle on Route 3A (Figure G-6 in Appendix G)[5]
- High number of left-turn crashes likely caused by a number of factors related to layout of Route 3A and its associated signal operations:
    - Left turns share the inside lane with through movements and frequently block the lane during peak traffic conditions.
    - Left turns on Route 3A operate under a protected/permissive mode, with a leading protected phase northbound and a lagging protected phase southbound. However, the protected left-turn phases frequently are not triggered by left-turning vehicles.[6]

[5] Twenty-nine crashes occurred in the middle of the intersection. Ten of them involved a southbound left-turning vehicle and a northbound through vehicle, and seven of them involved a northbound vehicle and a southbound through vehicle.

[6] Currently the left turners are detected by a single six-by six-foot loop covering only a small area on the stop line. If a left-turning vehicle stops beyond the stop line or too far from the stop, it will not be detected by the detector loop. Especially in the southbound section, vehicles tend to move beyond the stop line when they are seeking the scarce gaps under heavy traffic conditions.

- The left-turn lead/lag operation at times creates "yellow trap" situations for turning vehicles.[7]
- Two through lanes on Route 3A (though one of them is a left-turn shared lane) allow vehicles to travel fast through the intersection.
- Drivers' views can be obstructed by stopping left-turn vehicles because of the offset of the inside lanes from both directions.[8]
- Some of the crashes are related to vehicles entering and departing the adjacent gas station.[9]

Route 3A at Henry Turner Bailey Road

- About four crashes every year
- Crash rate slightly higher than the MassDOT District 5 average
- About 20 percent crashes causing injuries
- Crashes consist of 43 percent rear-end, 38 percent angle, 14 percent single-vehicle, and 5 percent side-swipe collisions (Figure F-7 in Appendix F)
- The three identified injury crashes all involved a left-turning vehicle from Henry Turner Bailey Road colliding with a through vehicle on Route 3A (Figure G-7 in Appendix G)
- Relatively high number of rear-end crashes on Henry Turner Bailey Road indicates that approaching vehicles had a difficult time entering the intersection when Route 3A traffic was fast and continuous

4 ROADWAY OPERATIONS ANALYSIS

To address the major issues and concerns related to roadway operations, this section examines the existing speed controls and prevailing travel speeds, traffic volumes and flow patterns, delays at major intersections, roadway cross-

[7] The "trap" can happen when the left turners use the yellow change interval but fail to pass out of the intersection before the opposite through traffic arrives or when they are confused about the green ball and fail to yield to the opposite through traffic.

[8] Under the configuration, a left-turn driver's view of the through traffic on the opposite outside lane can be obstructed by left-turning vehicles on the other approaches of Route 3A. A driver on the outside lane can be prevented from seeing the opposite left-turning traffic by vehicles stopping on the adjacent inside lane.

[9] Fifteen crashes involved a through vehicle on Route 3A and a vehicle-turning vehicle in or out of the gas station.

sections' accommodation of pedestrians and bicycles, and the potential for improving access to and from adjacent developments in the corridor.

4.1 Speed Controls and Travel Speeds

Figure 6 shows the existing speed controls and observed 85th percentile travel speeds in the study corridor. Speed limits in the corridor are regulated in three ranges: 35-, 45-, and 50-mph. Most sections of the corridor are designated as 45- or 50-mph zones, except for the business district between Beechwood Street and the Cohasset/Scituate town line, which is a 35-mph zone.

The 85th percentile speed of vehicles passing a given point is the speed at or below which 85 percent of the vehicles passing the point are traveling. It is the principle value used for establishing speed controls. The 85th percentile speeds at eight selected locations in the corridor were derived from spot speed studies performed by MassDOT for this study in spring 2013.

MassDOT procedures for speed zoning require that at speed observation locations, the established safe speed shall not be more than 7 mph below the 85th percentile speed, and not higher than the 95th percentile speed.[10]

As shown in Figure 6, the observed 85th percentile speeds generally conform to the safe speed requirement. The only location clearly outside the 85 percentile speed safe range is Route 3A southbound just past King Street, where the estimated 85th percentile speed is about 15 mph lower than the posted speed limit.[11] The approach is slightly uphill and in a horizontal curve formation. Traffic in the section also includes some vehicles just turning onto Route 3A from King Street and thus at a lower speed.

The observed 95th percentile speeds are all within the safe speed range, as they are generally higher than 50 mph in the 45- and 50-mph zones, and at nearly 40 mph northbound and nearly 50 mph southbound in the 35 mph zone.

Overall, the 85th and 95th percentile speeds are within the required safe speed range. However, speed zone transitions in the southern half of the corridor are somewhat abrupt. There are transitions from 50 to 35 mph on Route 3A southbound just before Beechwood Street and on Route 3 northbound just past the Cohasset/Scituate town line.

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10 *Procedures for Speed Zoning on State and Municipal Roadways*, MassDOT Highway Division, May 2012.

11 Note that the 85th percentile speeds for this planning study were derived from spot speed data collected from automatic traffic reorders. To establish or modify speed controls, MassDOT requires speed data collected by using radar gun or laser gun at critical locations not to exceed 0.25 miles, in addition to vehicle trial runs in the study area.

The transition of 35 to 50 mph just north of Beechwood Street appears to be undesirable because of a horizontal curve and a signalized intersection located about 1,000 and 1,500 feet, respectively, ahead of the transition point.[12]

It appears that the 50-mph zone in the middle of the corridor could be modified to a 45-mph zone. This modification not only would smooth the speed transition but also would improve safety at the intersection of Route 3A and Pond Street (a high-crash location).

For similar reasons, MassDOT may consider further study to reduce the speed limit from 50 to 45 mph from the Cohasset/Scituate town line to Henry Turner Bailey Road.[13]

In addition, the speed limit around the intersection of Route 3A at King Street could be reduced from 50 to 45 mph. This modification would stipulate a travel speed that is within the safe speed range of the observed 85th percentile speed in both directions.[14]

Together, these modifications would bring most sections of the corridor to within a consistent 45-mph speed control, and maintain a smoother transition to or from 35 mph in the south business districts.

Note that speed regulations are complicated and require careful consideration supported by thorough engineering analyses. The proposed speed modifications should be further examined and validated according to the procedures required by MassDOT.

4.2 Traffic Volumes, Heavy Vehicles, Bicyclists, and Pedestrians

Figure 7 shows traffic volumes along Route 3A and at major intersections in the study corridor. The volumes represent recently observed traffic flows in the

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[12] Although crashes in this section of 50-mph zone are not as numerous as those in business districts, they are generally more severe and likely would cause personal injuries. There was a fatal crash in this section in 2008.

[13] Although officially the section is regulated as a 50-mph zone, there is no speed limit sign on Route 3A southbound at the town line to indicate the speed limit change. Without the sign, drivers on the approach may assume that they still are under a 35-mph speed control. This reflects in the observed 85th percentile speed, which is much lower than 50 mph in a relatively straight section. It is actually favorable to maintain this low speed in the section, as vehicles travel downhill toward the Henry Turner Bailey Road intersection where other vehicles may enter Route 3A unexpectedly.

[14] Although officially the section is regulated as a 50-mph zone, there is no speed limit sign on Route 3A northbound before the intersection to indicate the speed limit change. Without the sign, drivers on the approach may assume that they still are under a 45-mph speed control. It is actually helpful to maintain a low speed in this section, as drivers are in a curve and slightly downhill approaching the King Street intersection where their sight distances are limited.

morning and evening peak hours of a typical weekday. As a reference, average daily traffic (ADT) volumes at eight locations in the corridor also are cited in Figure 7.

Based on traffic counts collected by MassDOT for this study, the corridor carried about 15,500 to nearly 21,500 vehicles per average weekday in spring 2013. Traffic volumes increase gradually from the south to the north section of the corridor. The variation in traffic volumes indicates that in the morning, traffic gradually feeds into the corridor from mainly Henry Turner Bailey Road, Pond Street, and King Street (the southern segment); most traffic continues on Route 3A, and some leaves the corridor at King Street (the northern leg). In the evening, the corridor has a reverse traffic pattern of a somewhat smaller magnitude.

Turning movements at major intersections in the corridor also were collected for the study; in 15-minute intervals between 7:00 to 9:00 AM and 4:00 to 6:00 PM. Traffic movements in the morning or evening peak hours were then identified and summarized for operational analyses. In general, these intersections carry a total entry traffic volume ranging from 1,550 to 1,950 vehicles per peak hour.[15]

It is essential to examine the proportion of heavy-vehicle traffic in a corridor, as an unusually high share of heavy vehicles (trucks and buses) may seriously affect roadway and intersection operations. Overall, the study corridor carries a normal percentage of heavy-vehicle traffic, and no concerns were expressed at meetings related to this use of the corridor.

According to the recent turning movement counts at three intersections in the corridor, heavy vehicles accounted for about 2.5-to-4.0 percent of total Route 3A traffic in the AM peak period, and 1.5-to-2.0 percent of total Route 3A traffic in the PM peak period. These heavy-vehicle percentages are considered normal, or even slightly less than average, for urban arterials in the region and would not seriously affect roadway operations.

The intersection turning movement counts also include bicycle counts and pedestrian crossings. Recent turning movement counts indicate that about two-to-five bicycles traveled on Route 3A in each of the morning and evening two-hour periods. Bicycles also were observed on Route 3A on weekends, as the roadway is adjacent to coastal and nature areas. Cohasset has designated North/South Main Street as a bike route. Depending upon their origins and destinations, some bicyclists still use Route 3A in this area.

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[15] Turning movement counts at the intersection of Route 3A at the driveway of the MBTA Cohasset Station were not collected, as the location generally operates desirably without noticeable delays.

The turning movement counts do not show large numbers of pedestrian crossings at the major intersections in the corridor. In general, about zero- to one-or-two pedestrians were observed during the morning or evening peak period. The scarce pedestrian activity may be a result of the lack of sidewalks and safe crossing facilities in the study corridor.[16] According to the Cohasset town officers, pedestrian crossings on Route 3A, especially in business districts, were observed from time to time.

4.3 Intersection Capacity Analyses

Figure 8 shows the estimated levels of service (LOS) and delays at major intersections in the corridor based on recent turning movement counts. These were analyzed for all approaches, and for the average of a study intersection in the AM and PM peak hours. Staff performed the analyses using Synchro computer software.[17] Figure 8 also cites definitions of the different LOS, based on estimated average delays per vehicle, for signalized and unsignalized intersections.

In general, the signalized intersections in the study area operate at desirable or acceptable LOS. In the off-peak direction, i.e., southbound in the morning and northbound in the evening peak hour, Route 3A approaches generally operate at desirable LOS ranges (LOS A or LOS B). In the peak direction, i.e., northbound in the morning or southbound in the evening peak hours, Route 3A approaches generally operate acceptably (LOS C or LOS D), except for the northbound approach at Pond Street. This approach, which contains a single travel lane for all movements, operates at LOS E in the morning peak hour.

In general, the side streets of the signalized intersections operate acceptably. The analyses indicate that two locations endure slightly more delays than other locations in the AM peak hour: the northbound approach of King Street at the Cohasset Plaza Shopping Center and the southbound approach of Pond Street at Route 3A. The northbound movement on King Street carries heavy commuter traffic in the morning, and the southbound on Pond Street is especially congested between 7:00-to-7:30 AM when school opens.

The capacity analyses for the unsignalized intersections indicate that the side streets of these intersections generally operate at undesirable LOS E or LOS F

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[16] In the corridor, crosswalks exist only at the intersections of Route 3A at Sohier Street, Pond Street, and Beechwood Street. Pedestrian push buttons exist only at the intersections of Route 3A at Pond Street and Beechwood Street.

[17] Synchro Version 8 is developed and distributed by Trafficware Ltd. The software can perform capacity analysis and traffic simulation (when combined with SimTraffic) for an individual intersection or a series of intersections.

with extensive delays. These analyses confirm residents' concern about delays at the three major unsignalized intersections in the corridor.

In addition, staff performed a preliminary traffic signal warrant analysis for each of the three unsignalized intersections, which is a basic requirement to justify installing a traffic signal at an unsignalized intersection.

The warrant analyses indicate that all three unsignalized intersections are suitable for installation of a traffic signal. Summaries of the analyses of applicable warrants are shown in Appendix H. Note that these are preliminary analyses based on the available traffic counts and crash data, and further engineering studies based on more detailed and updated data are needed in order to justify the signal installation.

4.4 Roadway Cross-Sections Analysis

Figure 9 shows typical roadway cross-sections in different segments of the study corridor, presenting street views looking south by a southbound driver. The two-lane roadway sections generally contain a 12-foot travel lane in each direction with a 2-foot shoulder.[18] The four-lane section, referring to the section of about a quarter mile south of Beechwood Street, contains two 12-foot travel lanes in each direction with a 2-foot shoulder.

The fact that there are no sidewalks in the entire study corridor also can be seen in Figure 9. Even in the business districts, pedestrians need to walk on the edge of parking lots adjacent to Route 3A; and customers usually need to drive in order to move from one shopping plaza to another. Crossing Route 3A is challenging to pedestrians as well. In the corridor, crosswalks exit at three locations only: Route 3A at Sohier Street, Pond Street, and Beechwood Street.

The corridor does not contain a separate lane or sufficient shoulder for bicycle travel. Although no pavement markings or traffic signs clearly indicate the corridor as a shared roadway, it is regarded as one since bicycles are not prohibited in of any sections in the corridor.[19] However, such a shared roadway usually is perceived as unsafe because the prevailing traffic speed is greater than 45 mph.

In the business districts under either the two- or four-lane configuration, there is no exclusive space, such as a left-turn-only lane or a two-way left-turn lane, for

[18] Some sections in the residential districts contain shoulders less than two feet wide.

[19] As bicyclists are legally able to use nearly all roadways, most of them can be technically classified as shared roadways. The exception for shared roadways are where bicycling has been expressly prohibited by an ordinance or law, such as in city streets or access-controlled freeways in some states. However, many of these shared roadways have no provisions for bicycle travel and are perceived by bicyclists to be unsafe or at least uninviting.

vehicles traveling on Route 3A to access adjacent developments. In the two-lane sections, left-turning vehicles usually block the entire roadway if the opposite traffic is heavy. In the four-lane sections, left-turning vehicles need to cross two lanes of traffic that often obstruct the other's view.

In addition, frequent curb cuts in the business districts create multiple conflict points on the roadway with short distances in between. Some of the driveways in the business districts have the potential for consolidation, which to be effected would require collaborative efforts from adjacent businesses, the Towns, and MassDOT.

The crash data analyses in Section 3 indicate that the business sections of the corridor have a high number of crashes and a higher-than-State-average crash rate, especially in the four-lane business section. Improvements to the access to adjacent business from Route 3A would make the roadway safer for all users.

4.5 Opportunities for Complete-Street Applications and Development Access Improvements

A directive of MassDOT is that urban arterials should be designed to serve all individual roadway users, including pedestrians, cyclists, and transit riders, under either separate or shared accommodations.[20] This section explores opportunities for "complete-street" applications to address the lack of pedestrian and bicycle accommodations in the study corridor. It also examines whether access to and from adjacent businesses on Route 3A could be improved by modifying the existing roadway configuration.

The corridor has a right-of-way ranging from 40 to 70 feet. The majority (nearly 70 percent) of the corridor has a 50-foot right-of-way, consisting of the area from the MBTA Cohasset Station to King Street (northern segment) and the Cohasset Plaza Shopping Center to the Cohasset/Scituate town line. The section from King Street to the Cohasset Plaza has a right-of-way of 40 feet. The section from the town line to Henry Turner Bailey Road has a right-of-way of 70 feet. These dimensions are ample enough to potentially install sidewalks, widen shoulders, and add traffic medians or left-turn lanes at suitable locations.[21]

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[20] *MassDOT Project Development and Design Guide*, January 2006, Massachusetts Department of Transportation.

[21] These approximate right-of-way data were obtained from the MassDOT Roadway Inventory File for this planning study. Further review of the assessor's plots should be conducted at the functional stage.

Figure 10 shows the proposed roadway cross-sections in the residential and business districts of the corridor. These contain three major components over the existing roadway configurations:

- Continuous 5-foot sidewalks on east side of Route 3A from MBTA Cohasset Station to south business district
- Continuous 5-foot shoulders on both sides of Route 3A from MBTA Cohasset Station to Henry Turner Bailey Road
- A central turning lane for vehicles to access adjacent developments in the business districts

The sidewalks would provide non-motorized accesses to the businesses, conservation areas, and the MBTA Cohasset commuter rail station. In the business districts, sidewalks can be considered on both sides of the roadway.

The 5-foot shoulders would provide accommodation for bicycles and a sufficient buffer between traffic and pedestrians. On the west side of the roadway, they also could offer occasional access for pedestrians, although most houses are located on the roadway's east side. Preferably, these 5-foot wide shoulders could be extended beyond the study corridor to connect major destinations in the area.[22]

The central lane on Route 3A would provide access to the adjacent developments and maintain a safe traffic flow on Route 3A. Depending on the adjacent development needs, the central lane could be a combination of left-turn only, two-way left-turn, or traffic median. This roadway design is suitable for urban arterials with various types of adjacent developments. In the study corridor, the central lane could be appropriated by adding a lane in the two-lane sections and reducing a lane in the four-lane sections.

It would require a right-of-way of about 50 feet to accommodate the three major modifications. Most sections of the corridor should be able to accommodate the modifications, except for the 40-foot right-of-way business section between Sanctuary Pond Road and the Cohasset Plaza Shopping Center. Currently, both sides of this section are composed of lawns, with no major fixed structures. The potential land takings of about 5 feet on each side of the roadway would not affect existing building and parking layouts.

[22] Based on the MassDOT Project Development and Design Guide, five feet is the minimal width requirement to accommodate bicycle travel. If right-of-way is available, six feet would be preferable.

5 PROPOSED IMPROVEMENTS

Based on the preceding analyses, staff developed short-, medium-, and long-term suggested improvements for the study corridor. Their implementation horizons are defined as:

- Short-term: less than two years
- Medium-term: two-to-five years
- Long-term: more than five years

The short-term improvements may be implementable in a brief timeframe with relatively low costs. The medium-term improvements are options that require further engineering analyses and designs, and likely would involve more time and resources than the short-term improvements. The long-term improvements generally are more complicated and cover a large area, which would require intensive planning and design efforts and funding resources.

5.1 Route 3A North Section

Table 1 summarizes the proposed short-, medium-, and long-term improvements for the north section of the study corridor, with issues and concerns listed for reference. They are arranged according to the roadway section in general, and by specific location, from north to south.

Figures 11 and 12 show the locations and layouts of the proposed long-term improvements in two parts of a conceptual plan for the north section of the study corridor. The conceptual plan was not created to scale, but in approximate proportion, in order to show how the proposed improvements would relate to their surroundings.

For the north section in general, three major long-term improvements are proposed:

- Install 5-foot sidewalk on east side of Route 3A
- Install 5-foot shoulder on both sides of Route 3A
- Install a 12-foot center lane to be used as a median, left-turn only, or a two-way left-turn lane between King Street and Sohier Street

The proposed three-lane Route 3A section would provide safe access to adjacent developments and maintain continuous traffic flow.

Note that the section of Route 3A between the MBTA Cohasset Station and King Street is not explicitly shown in the conceptual plan, as the adjacent areas potentially would contain future redevelopments and the layouts are unknown. The areas, currently zoned as Technology Business District and Light Industrial District, house a number of older developments and vacant lands; hence have the potential to be combined and redeveloped. However, the concepts and

layouts of the proposed improvements for the section between Sanctuary Pond Road and Sohier Street (Figure 11) also could be applied to this area.

Residents at the Avalon Cohasset raised the concern that there is no crosswalk to access businesses on the other side of Route 3A. The current traffic and pedestrian crossing conditions probably do not meet the warrants for installing a traffic signal specifically for pedestrian crossings; but the location may be suitable for installing a crosswalk with pedestrian hybrid beacons. However, a detailed engineering study with more detailed and updated data should be performed to examine the feasibility of such an installation. Information and guidelines for the installation of pedestrian hybrid beacons are included in Appendix I.[23]

5.2 Route 3A Middle Section

Table 2 summarizes the proposed short-, medium-, and long-term improvements for the middle section of the study corridor, with issues and concerns listed for references.

The middle section mainly consists of residential districts and vacant woodlands. For the section in general, two major long-term improvements are proposed:

- Install 5-foot sidewalk on east side of Route 3A
- Install 5-foot shoulder on both sides of Route 3A

In addition, a major reconstruction of the intersection of Route 3A at Pond Street is proposed in order to address safety and operational problems at the location.

Figure 13 shows the conceptual plan for the proposed long-term improvements in the vicinity of this intersection.

[23] The pedestrian hybrid beacon is a pedestrian-activated warning device located on the roadside or on mast arms over midblock pedestrian crossings. The beacon head consists of two red lenses above a single yellow lens. The beacon head is “dark” until the pedestrian desires to cross the street. At this point, the pedestrian will push an easy-to-reach button that activates the beacon. After displaying brief flashing and steady yellow intervals, the device displays a steady red indication to drivers and a WALK indication to pedestrians, allowing them to cross a major roadway while traffic is stopped. After the pedestrian phase ends, the WALK indication changes to a flashing orange hand to notify pedestrians that their clearance time is ending. The hybrid beacon displays alternating flashing red lights to drivers while pedestrians finish crossing before going dark once again at the conclusion of the cycle.

5.3 Route 3A South Section

Table 3 summarizes the proposed short-, medium-, and long-term improvements for the south section in the study corridor, with issues and concerns listed for references.

For the section in general, three major long-term improvements are proposed:

- Install 5-foot sidewalk on east side of Route 3A
- Install 5-foot shoulder on both sides of Route 3A
- Reconstruct entire section into a three-lane roadway

The center lane of the three-lane roadway would be configured as a traffic median, a left-turn-only lane, or a two-way left-turn lane depending on the adjacent business settings. The proposed improvements would provide safe access to adjacent developments and maintain continuous traffic flow on Route 3A. However, some consolidations or modifications of adjacent driveways could be required for the center lane to function safely and efficiently.[24]

In addition, a major reconstruction of the intersection of Route 3A at Beechwood Street is proposed in order to address safety and operational problems at the location.

Figure 14 shows the proposed medium-term improvements for the Beechwood Street intersection and the section south of Beechwood Street. Figures 15, 16, and 17 show the proposed long-term improvements for the all the business districts in four parts of a conceptual plan for the south section.

Sidewalks also should be considered on the west side of Route 3A if the right-of-way on that side is available for the business districts south of the Cushing Plaza Shopping Center. At the roadway functional design stage, potential crosswalk locations should be examined for the purpose of connecting the businesses on both sides of Route 3A.

In summary, with the proposed long-term improvements in the north, middle, and south sections of the study corridor, all intersections are expected to operate at a desirable or acceptable LOS under the projected 2020 traffic conditions (Figure 18). Analysis of the Beechwood Street intersection indicates that conversion of the four-lane section into a three-lane roadway would not seriously affect traffic operations on Route 3A. [25]

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[24] The center lane is intended for turning movements only, not for continuous vehicle travel. It should be designed in concert with the adjacent parking and driveway settings by carefully applying it as a traffic median, left-turn-only, or two-way left-turn lane in appropriate lengths.

[25] One percent traffic growth per year was assumed for 2020 traffic conditions at the study intersections.

6 SUMMARY AND RECOMMENDATIONS

This study performed a series of safety and operations analyses, identified safety and operational problems, and proposed a number of short-, medium-, and long-term improvements to address the identified problems in the study corridor. Altogether, the long-term improvement conceptual plans provide a vision that would accommodate all users and significantly enhance safety, mobility, and access in the corridor.

Below is a summary of major benefits expected from the proposed improvements:

- Speed limit reduction from 50 to 45 mph would make travel speeds more consistent and smooth speed transitions, thus improving safety for all.
- Sidewalk addition and shoulder expansion would accommodate pedestrian and bicycle travel in the corridor.
- Center lane addition/conversion in the business districts would improve safety, mobility, and access for traffic to and from the businesses and maintain a safe traffic flow on Route 3A.
- Long-term improvements at the major intersections, especially at Beechwood Street and Pond Street, would improve traffic operations, thus enhancing safety, mobility, and access for all users.

Implementing the proposed improvements would require sufficient resources and cooperation. The staff proposes the following implementation priorities for consideration:

- Discussions between Towns and business owners about merits of recommendations, including promoting the notion that driveway consolidations would be required to implement eventual design
- Further MassDOT engineering studies to validate and implement proposed speed limit modifications
- Short-term improvements, especially those that can be executed by MassDOT District 5 as part of routine maintenance programs
- Design and reconstruction of Beechwood intersection and the Route 3A four-lane section, including signal upgrade at the intersection (medium-term improvements in the south business districts)
- Further feasibility study and design of the expansion of Pond Street intersection, including signal system upgrade
- Design and signalization of H. T. Bailey Road intersection
- Design and signalization of King Street intersection, when commercial development resumes construction

- Design and reconstruction of the north section of Route 3A, including sidewalks, shoulders, and signalization of Sohier intersection
- Design and reconstruction of south section of Route 3A
- Design and reconstruction of middle section of Route 3A

After the second advisory meeting, the Cohasset Planning Board met with Town residents and business owners to discuss the issues and solutions for the corridor based on preliminary findings and proposed improvements. Comments from residents and business owners are included in Appendix J.

In conclusion, the corridor would benefit from a consensus vision for long-term improvements and a comprehensive access management program. This would require a collaborative effort from adjacent developments, the Towns, and MassDOT to ensure that the corridor operates safely, efficiently, and sufficiently for all users in all transportation modes.

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TABLE 1
Proposed Improvements in North Section

Route 3A from MBTA Cohasset Station to Cohasset Plaza Shopping Center

Location	Issues/Concerns	Short- and Medium-Term Improvements*	Long-Term Improvements
The section in general	• No pedestrian connection to MBTA Station • No bicycle accommodation • High travel speed in curve section between King Street (northern segment) and Sanctuary Pond Road • High number of crashes with deer (nine crashes in past-five years) • Frequent curb cuts in business district between Sanctuary Pond Road and Sohier Street, creating potential traffic conflict points on Route 3A • High crash rate and high proportion of crashes (more than 60%) because of traffic entering and exiting adjacent developments • Lack of crosswalk between Avalon Cohasset and business district on the east side of Route 3A	• Consider changing speed limit from 50 to 45 mph in curve section, with further engineering study • Install Deer Crossing warning signs (W11-3, MUTCD) before Crocker Lane on Route 3A southbound and before Sohier Street on Route 3A northbound	• Install 5-foot wide sidewalks on east side of Route 3A • Install 5-foot wide shoulder on both sides of Route 3A • Install 12-foot center lane to be used as median, left-turn only, or TWLTL between King Street and Sohier Street. (The proposed consistent three-lane section would provide safe accesses to adjacent developments and maintain continuous traffic flow.) • Perform engineering study to investigate feasibility of installing crosswalk with pedestrian hybrid beacons between Avalon Cohasset and Dunkin' Donuts on east side of Route 3A
Intersection: Route 3A at MBTA Cohasset Station	• Noticeable number of crashes by northbound vehicles colliding with right-turn channelized island on Route 3A, and with median island on MBTA Station driveway	• Relocate Right-Lane Must-Turn Right sign (R3-7, MUTCD) to about 150 feet further south from existing location • Add two more Right-Turn-Only and arrow-pavement markings to existing markings on curb lane of Route 3A northbound • Install lane-designation sign at about 500 feet before intersection	• Realign northbound right-turn-only lane and modify traffic island with advance pavement markings/ hatch yellow lines to alert drivers traffic island ahead (part of the section reconstruction for adding sidewalks and expanding shoulders)
Intersection: Route 3A at King Street	• Drivers on King Street experience delays because of lack of gaps in peak-hour traffic	• Medium-term: Install traffic signal when adjacent business development resumes construction (could be considered a mitigation requirement)	• Install traffic signal (if not realized in medium term)
Intersection: Route 3A at Sohier Street	• Limited sight distance for drivers on Sohier Street • Drivers on Sohier Street experience delays because of lack of gaps in peak-hour traffic • Existing post-mounted flashing beacons hard to see by drivers • Potential traffic increases because of new Stop&Shop gas station	• Clear vegetation on both sides of Route 3A adjacent to intersection • Consider installing mast arm for flashing beacons	• Town coordinating with shopping center to provide additional driveway on Sohier Street in order to reduce traffic on Route 3A • Modify intersection geometry to tighten intersection in order to provide sufficient sight distances for drivers, slow traffic, and to reduce pedestrian crossing distances • Install traffic signal and coordinate it with traffic signal at adjacent intersection at Cohasset Plaza Shopping Center
Intersection: Route 3A at King Street/Cohasset Plaza Shopping Center	• No crosswalks; no pedestrian signals/ phases for pedestrian crossings	NA	• Install crosswalk connecting future sidewalks on east side of Route 3A • Install pedestrian signals with of crosswalk

Mph Miles per hour. N/A Not available or applicable. TWLTL two-way left-turn lane.
* Unless noted as “medium-term,” the proposed items are considered to be short-term.

TABLE 2
Proposed Improvements in Middle Section

Route 3A from South of Cohasset Plaza Shopping Center to North of Beechwood Street

Location	Issues/Concerns	Short- and Medium-Term Improvements*	Long-Term Improvements
The section in general	• No pedestrian accommodation • No bicycle accommodation • High travel speed • High number of crashes with deer (ten crashes in past-five years)	• Consider changing speed limit from 50 to 45 mph in the section between north of Pond Street and north of Beechwood Street, with a further engineering study • Install Deer Crossing warning signs (W11-3, MUTCD) after King Street/Cohasset Plaza southbound, and after Beechwood Street northbound	• Install 5-foot wide sidewalk on east side of Route 3A • Install 5-foot wide shoulder on both sides of Route 3A
Intersection: Route 3A at Pond Street	• High number of crashes (33 in past-five years); 25% of them causing injuries • High concentration of rear-end collisions on Route 3A southbound before the intersection • Traffic frequently backs up on Route 3A in peak hours because of lack of left-turn storage space in both directions, especially southbound	• N/A	• Install left-turn storage lane in both directions of Route 3A (southbound 125 feet, and northbound 75 feet, plus a taper); and upgrade existing traffic signal equipment (including new mast arms and 5-section signal head for left turns) to accommodate left-turn protected/ permissive phase on Route 3A

Mph Miles per hour. N/A Not available or applicable. TWLTL two-way left-turn lane.
* Unless noted as “medium-term,” the proposed items are considered to be short-term.

TABLE 3
Proposed Improvements in South Section

Route 3A from Beechwood Street in Cohasset to Henry Turner Bailey Road in Scituate

Location	Issues/Concerns	Short- and Medium-Term Improvements*	Long-Term Improvements
The section in general	• No pedestrian accommodation • No bicycle accommodation • Frequent curb cuts create potential traffic conflicts in majority of section • Very high crash rate (4.89 versus 3.12 (State average for same functional class corridors)); high proportion (about 70%) of total crashes caused by traffic entering/ exiting adjacent developments	• Medium-Term: Reconfigure existing four-lane (two lanes in each direction) section into three-lane (one lane in each direction plus center lane) roadway with 5-foot wide shoulders on both sides. Center lane would be used as median and for left-turn only at appropriate locations.	• Install 5-foot wide sidewalk on east side of Route 3A • Install 5-foot wide shoulder on both sides of Route 3A • Reconstruct entire section into three-lane roadway. Center lane would be configured as traffic median, left-turn-only lane, or a TWTLT lane depending on adjacent business settings. The proposed consistent three-lane section would provide safe access to adjacent developments and maintain continuous traffic flow
Intersection: Route 3A at Beechwood Street	• Very high number of crashes (57 in the past-five years); 25% of them causing injuries • High proportion (nearly 30%) of crashes involving a left-turn and through vehicle on Route 3A in both directions • Vehicles do not stop on detector loops (a 6'x6' signal on stop line in each direction) to trigger protected left-turn phases on Route 3A • Lead/ lag left-turn operation creating “yellow trap” situations for turning vehicles	• Medium-Term: Reconfigure Route 3A approaches to provide exclusive left-turn lane in both directions by 1) obtaining northbound left-turn only lane from center lane of restriped three-lane section, and 2) converting southbound left-turn/ through shared lane into southbound left-turn only. Restripe Beechwood Street eastbound approach to provide two-car storage left-turn bay. Upgrade signal equipment (including adjusting signal head positions and modifying loop detectors) to provide leading left-turn protected/ permissive phase in both directions on Route 3A.	• Reconstruct intersection (as a part of entire section reconstruction) to provide exclusive left-turn lane in both directions on Route 3A, and a 2-car storage for left turns on Beechwood Street by slightly flaring its approaches. Provide leading left-turn protected/ permissive phase in both directions on Route 3A with upgrade of signal equipment.
Intersection: Route 3A at Henry Turn Bailey Road	• High travel speed in vicinity of intersection • Drivers' sight distances sometimes limited by overgrown vegetation • Drivers on Henry Turn Bailey Road experience delays because of lack of gaps on Route 3A during peak traffic conditions	• Consider changing speed limit from 50 to 45 mph in section from south of Cohasset/ Scituate border to about 1,500 feet south of intersection, with further engineering study • Clear vegetation on both sides of Route 3A adjacent to intersection	• Install traffic signal at the intersection (potentially no major layout modifications would be necessary)

Mph Miles per hour. N/A Not available or applicable. TWLTL two-way left-turn lane.
* Unless noted as “medium-term,” the proposed items are considered to be short-term.

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FIGURE 1
Study Corridor and Adjacent Major Transportation Facilities
Route 3A in Cohasset and Scituate

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

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FIGURE 2
Existing Roadway Conditions and Adjacent Developments
Route 3A North Section

Addressing Safety, Mobility, and Access on Subregional Priority Roadways

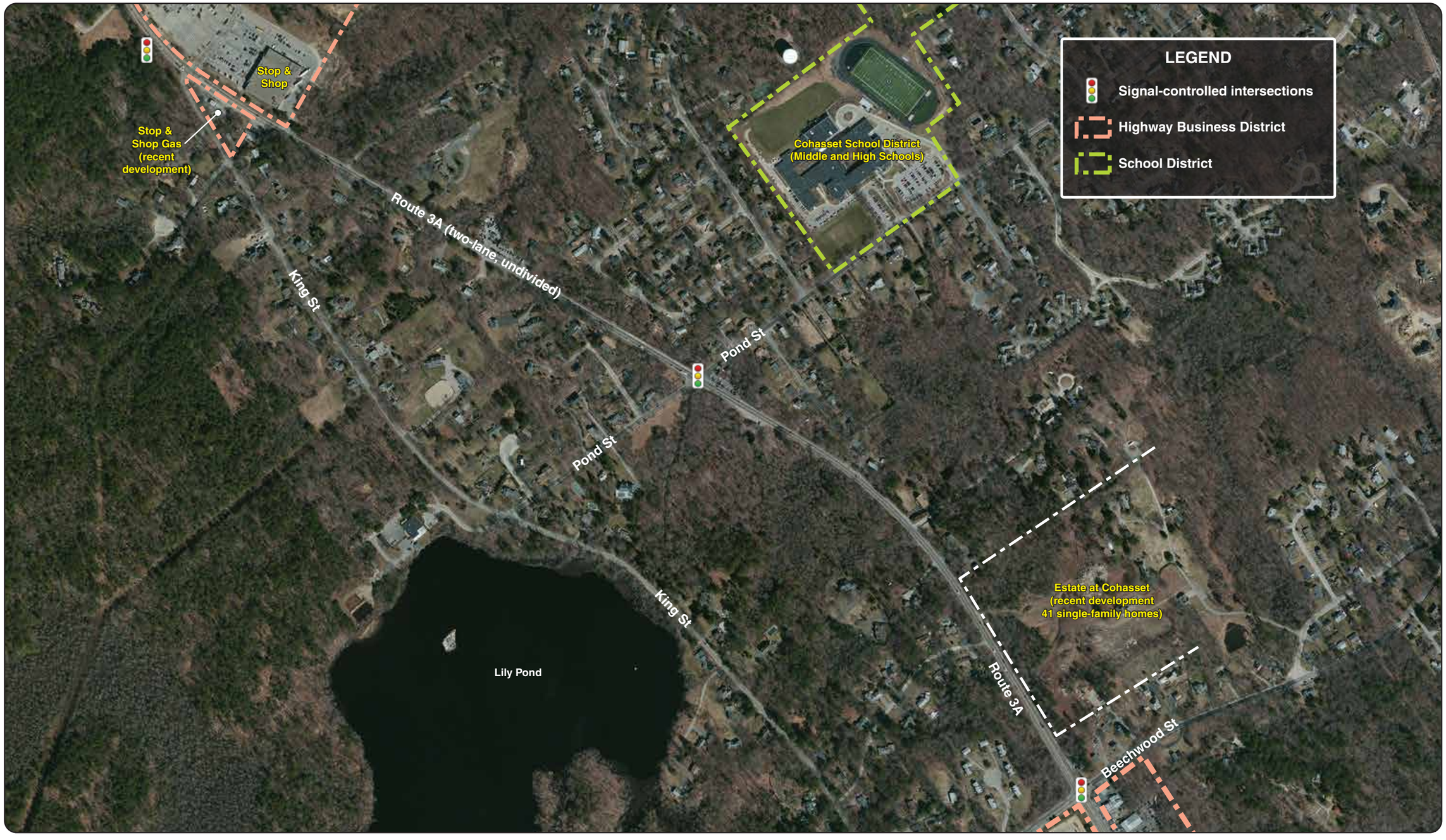

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FIGURE 3
Existing Roadway Conditions and Adjacent Developments
Route 3A Middle Section

Addressing Safety, Mobility, and Access on Subregional Priority Roadways

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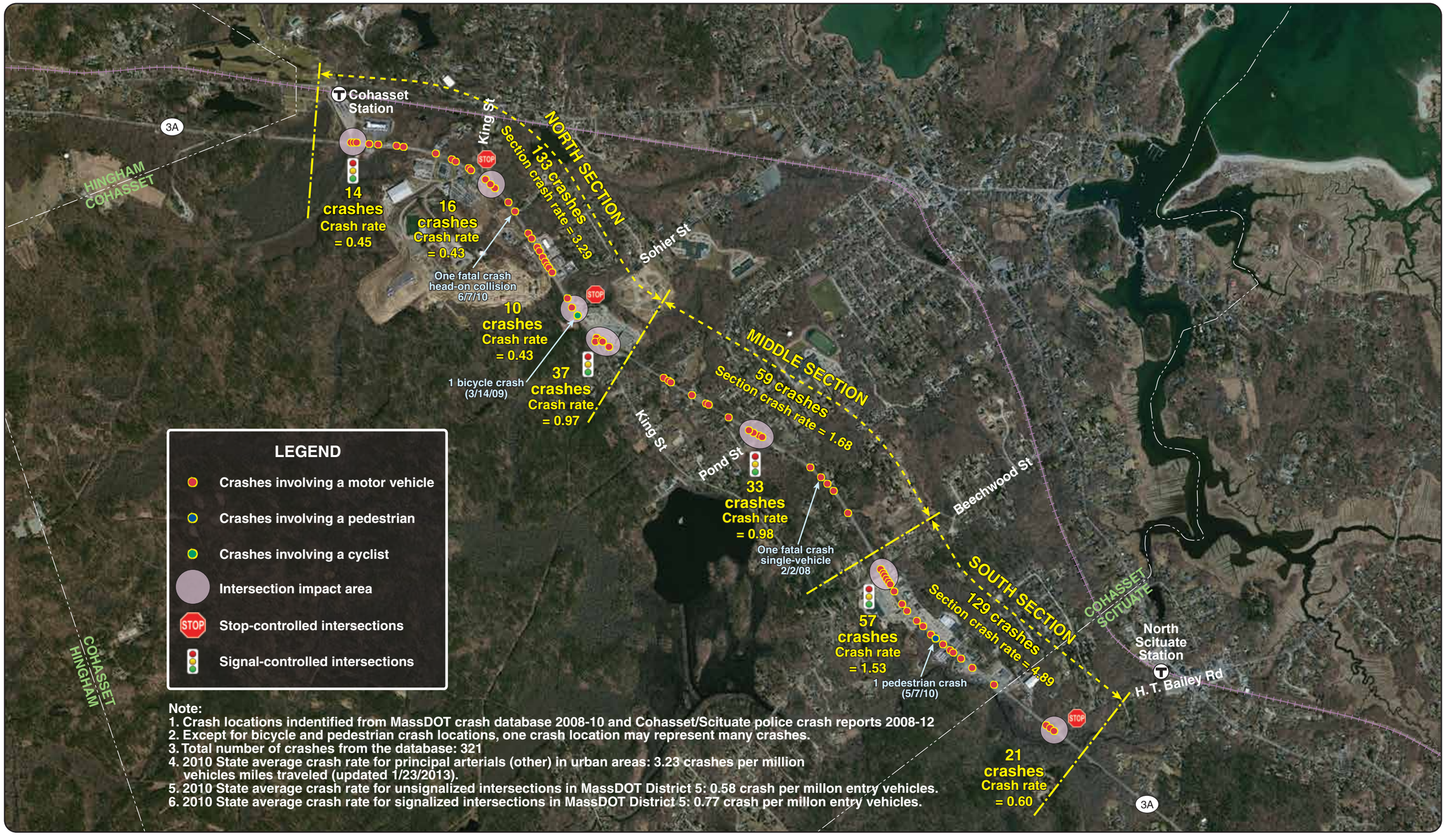
FIGURE 4
Existing Roadway Conditions and Adjacent Developments
Route 3A South Section

Addressing Safety, Mobility, and Access on Subregional Priority Roadways



Note:
1. Crash locations indentified from MassDOT crash database 2008-10 and Cohasset/Scituate police crash reports 2008-12
2. Except for bicycle and pedestrian crash locations, one crash location may represent many crashes.
3. Total number of crashes from the database: 321
4. 2010 State average crash rate for principal arterials (other) in urban areas: 3.23 crashes per million vehicles miles traveled (updated 1/23/2013).
5. 2010 State average crash rate for unsignalized intersections in MassDOT District 5: 0.58 crash per millon entry vehicles.
6. 2010 State average crash rate for signalized intersections in MassDOT District 5: 0.77 crash per millon entry vehicles.

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FIGURE 5
Crash Locations and Crash Statistics 2008-12
Route 3A in Cohasset and Scituate

Addressing Safety, Mobility, and Access on Subregional Priority Roadways

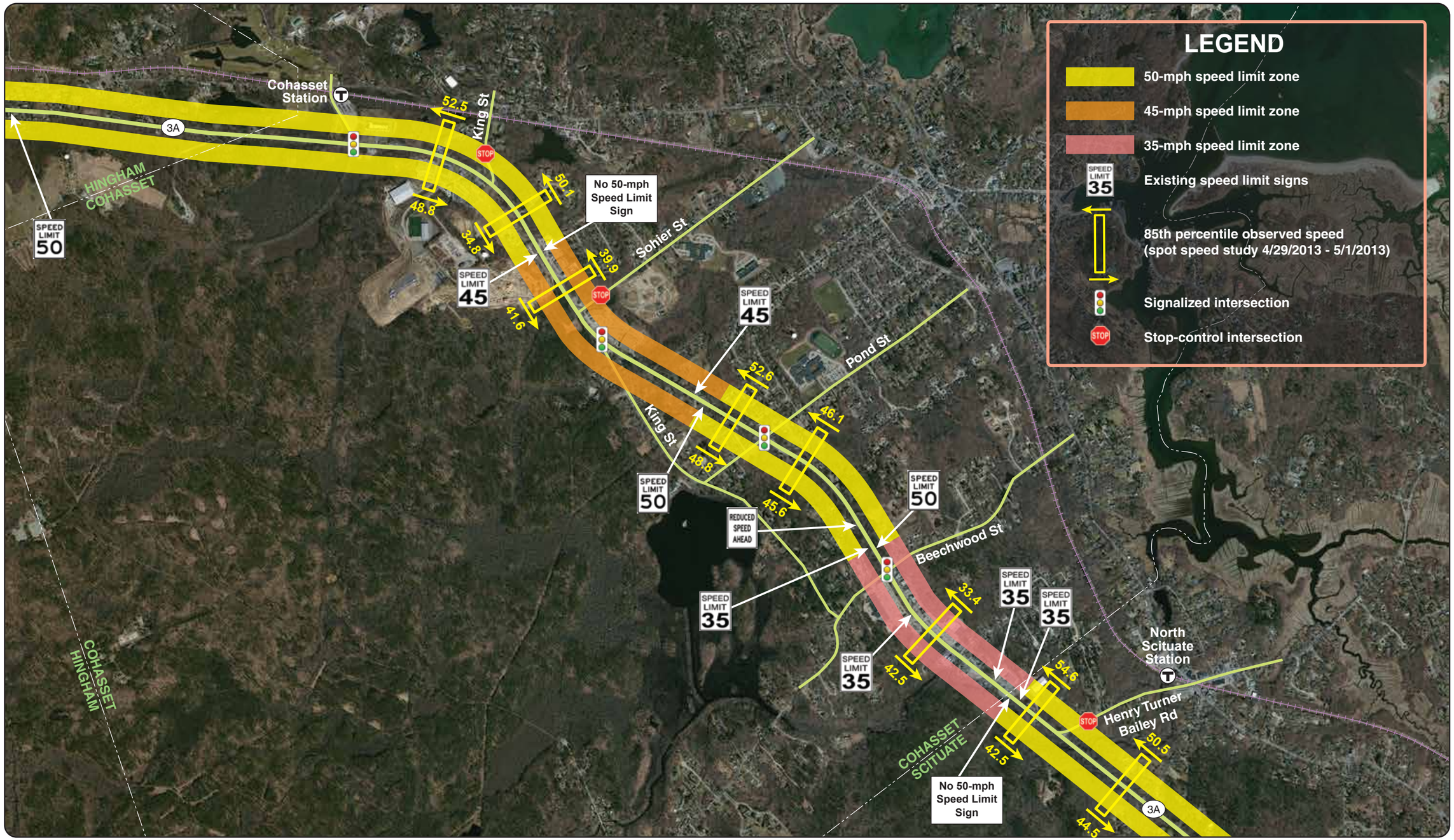

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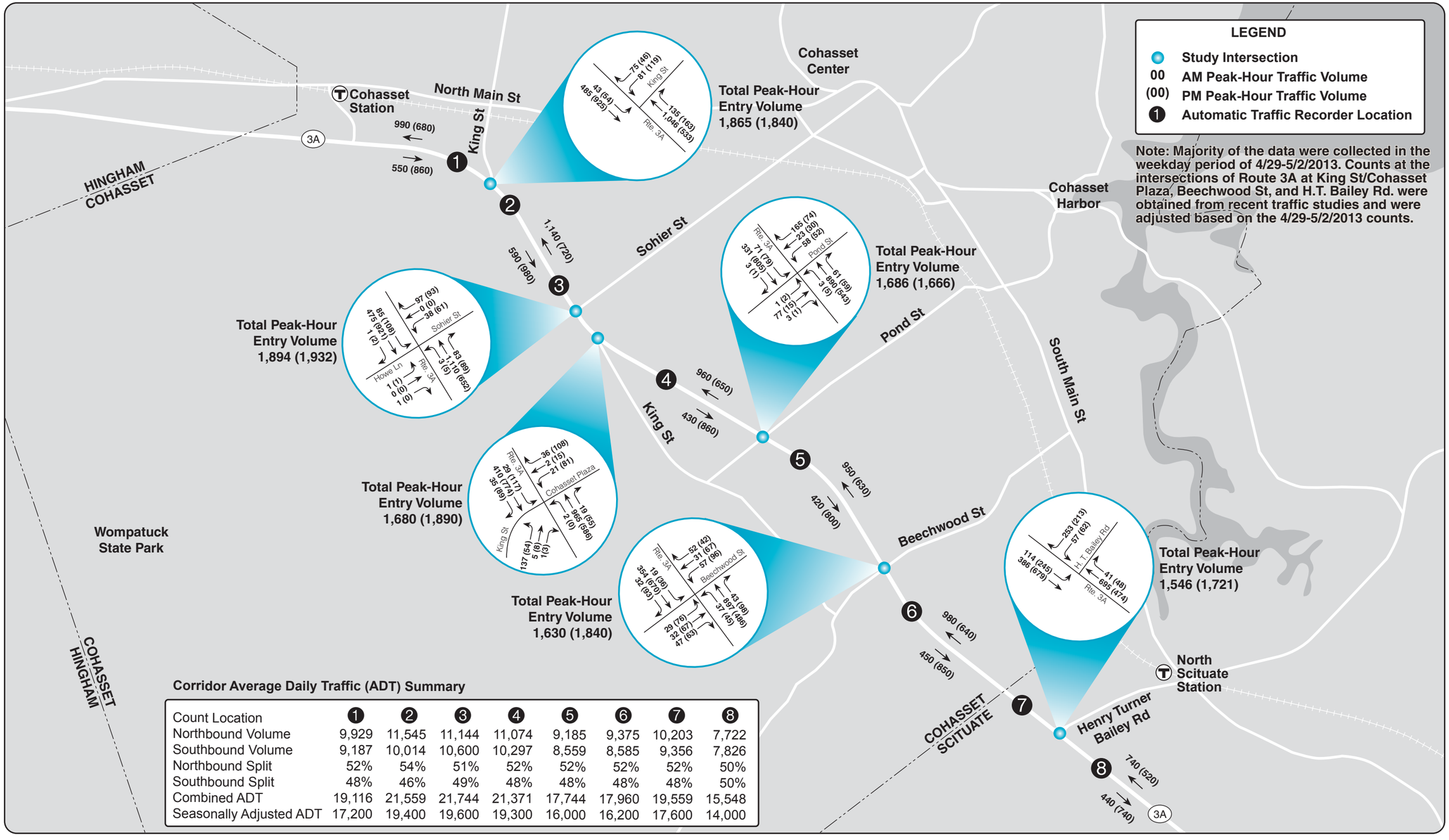
FIGURE 6
Existing Speed Controls and Observed 85th-Percentile Speeds
Route 3A in Cohasset and Scituate

Addressing Safety, Mobility, and Access on Subregional Priority Roadways



Corridor Average Daily Traffic (ADT) Summary

Count Location	1	2	3	4	5	6	7	8
Northbound Volume	9,929	11,545	11,144	11,074	9,185	9,375	10,203	7,722
Southbound Volume	9,187	10,014	10,600	10,297	8,559	8,585	9,356	7,826
Northbound Split	52%	54%	51%	52%	52%	52%	52%	50%
Southbound Split	48%	46%	49%	48%	48%	48%	48%	50%
Combined ADT	19,116	21,559	21,744	21,371	17,744	17,960	19,559	15,548
Seasonally Adjusted ADT	17,200	19,400	19,600	19,300	16,000	16,200	17,600	14,000

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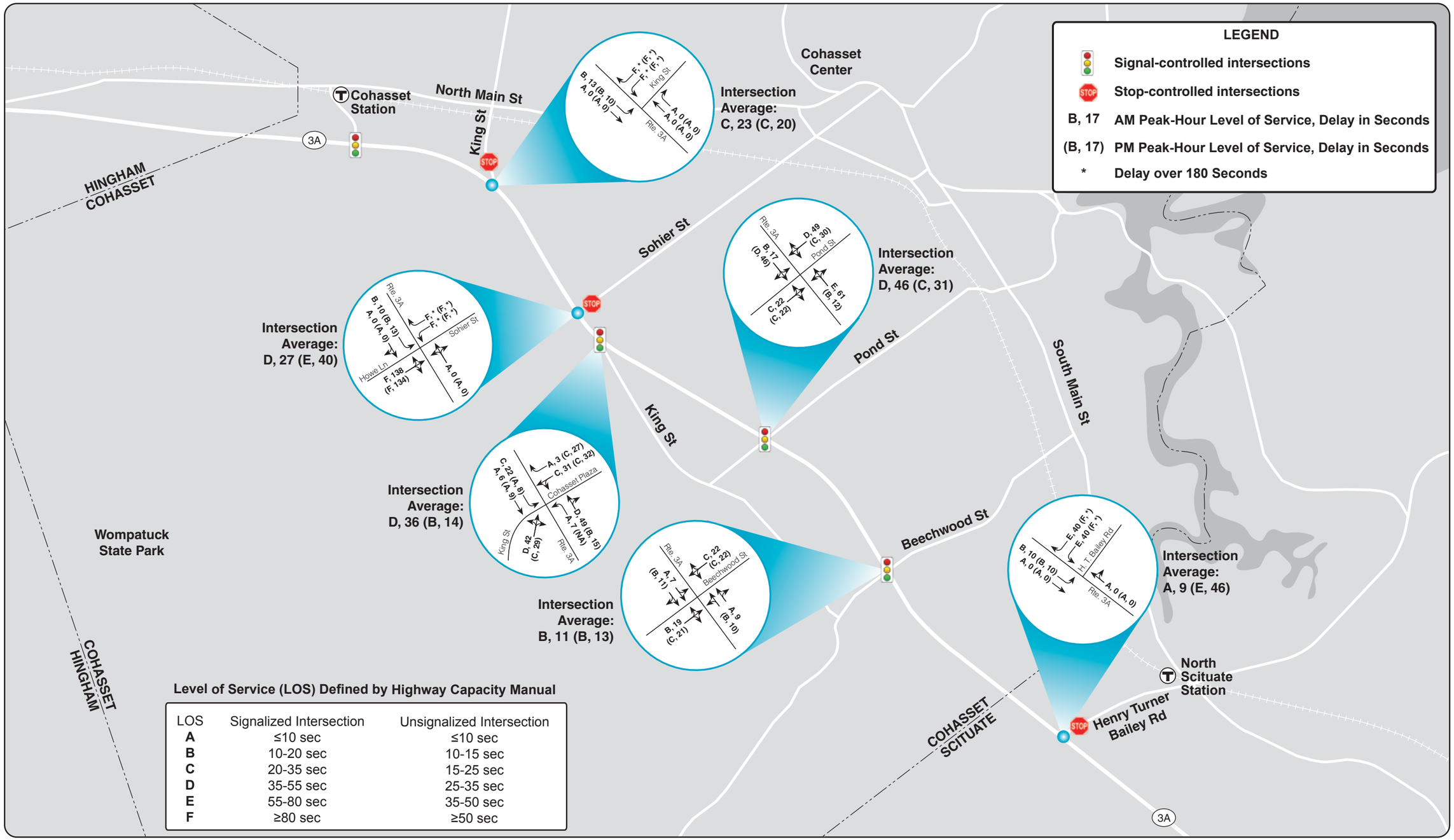
FIGURE 7
Traffic Volumes along the Corridor at Major Intersections
Route 3A in Cohasset and Scituate

Addressing Safety, Mobility, and Access on Subregional Priority Roadways



Level of Service (LOS) Defined by Highway Capacity Manual

LOS	Signalized Intersection	Unsignalized Intersection
A	≤10 sec	≤10 sec
B	10-20 sec	10-15 sec
C	20-35 sec	15-25 sec
D	35-55 sec	25-35 sec
E	55-80 sec	35-50 sec
F	≥80 sec	≥50 sec

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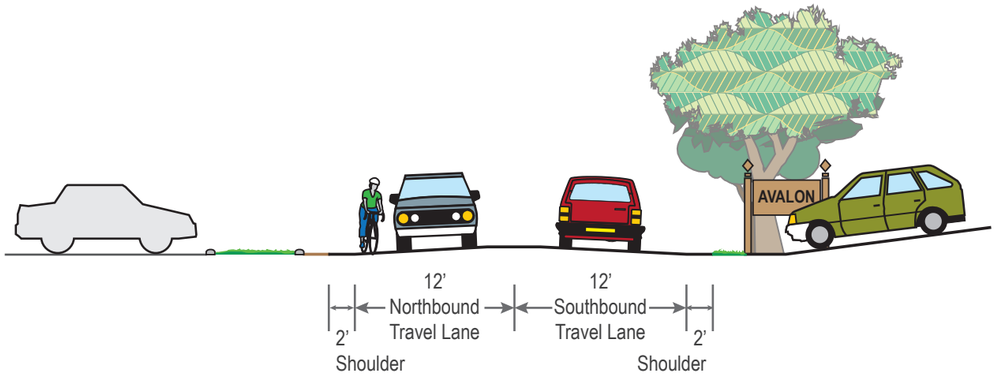
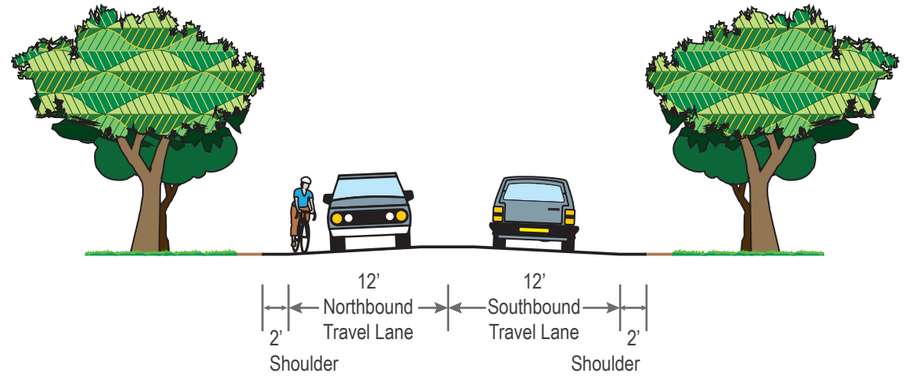
FIGURE 8
Intersection Capacity Analyses: Existing Conditions (2013)
Route 3A in Cohasset and Scituate

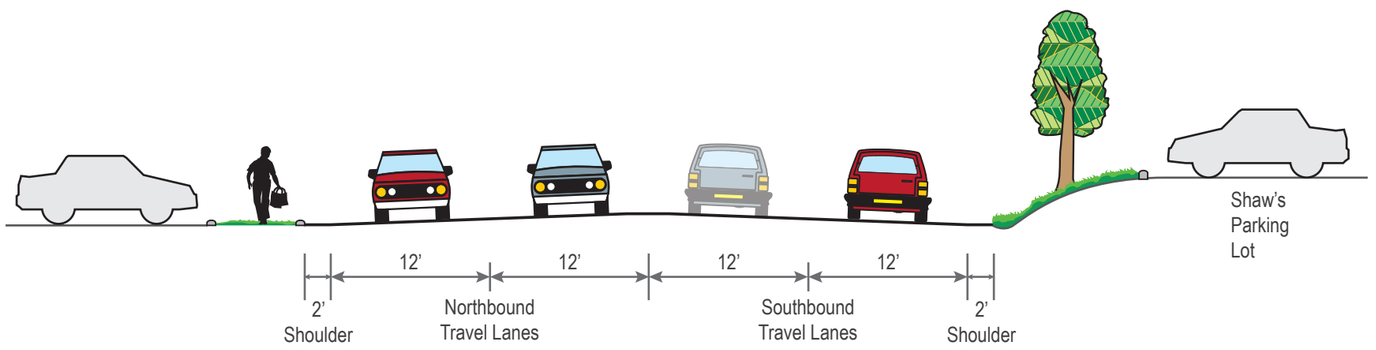
Addressing Safety, Mobility, and Access on Subregional Priority Roadways



Two-Lane Cross-Section in North Business District



Two-Lane Cross-Section in Residential District



Four-Lane Cross-Section in South Business District

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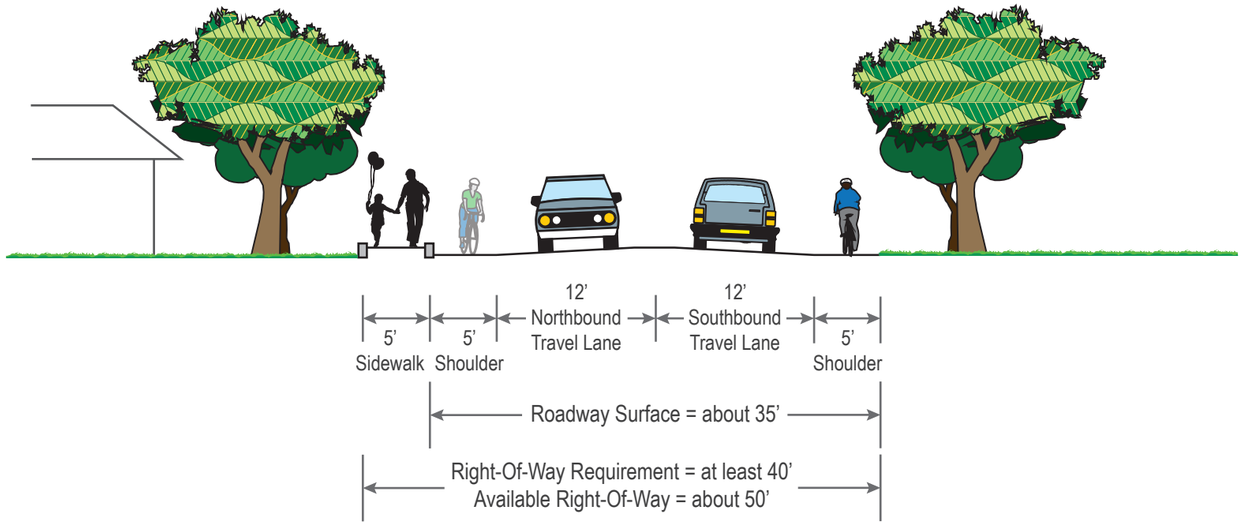
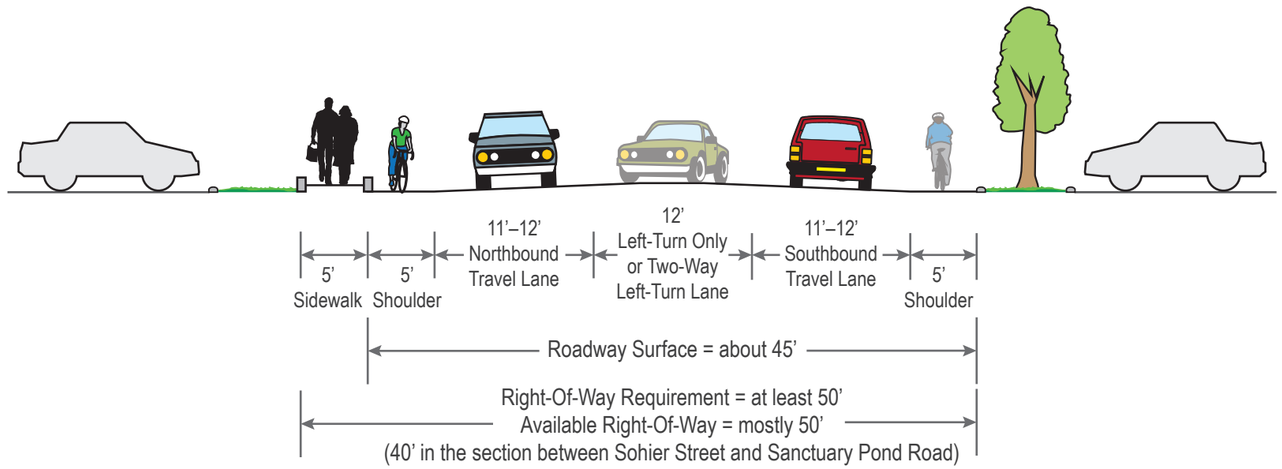
FIGURE 9
Existing Street Cross-Sections
Route 3A in Cohasset and Scituate

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways



Proposed Cross-Section in Residential District



Proposed Cross-Section in Business Districts

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FIGURE 10
Proposed Roadway Cross-Sections for Long-Term Improvements
Route 3A in Cohasset and Scituate

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

BOSTON
REGION
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FIGURE 11
Proposed Long-Term Improvements Conceptual Plan
Route 3A North Section (1)

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

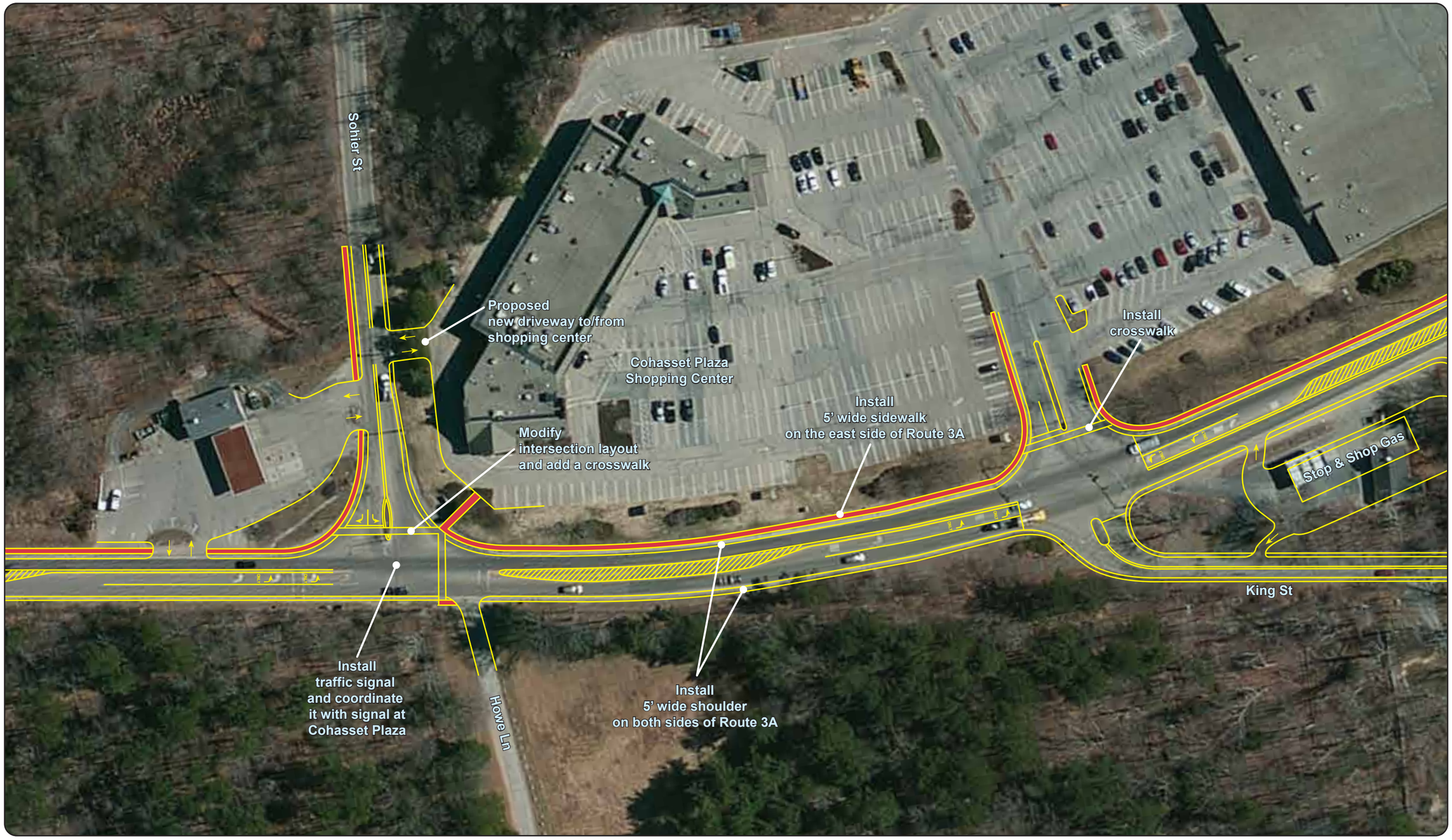

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FIGURE 12
Proposed Long-Term Improvements Conceptual Plan
Route 3A North Section (2)

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

BOSTON
REGION
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FIGURE 13
Proposed Long-Term Improvements Conceptual Plan
Route 3A Middle Section

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

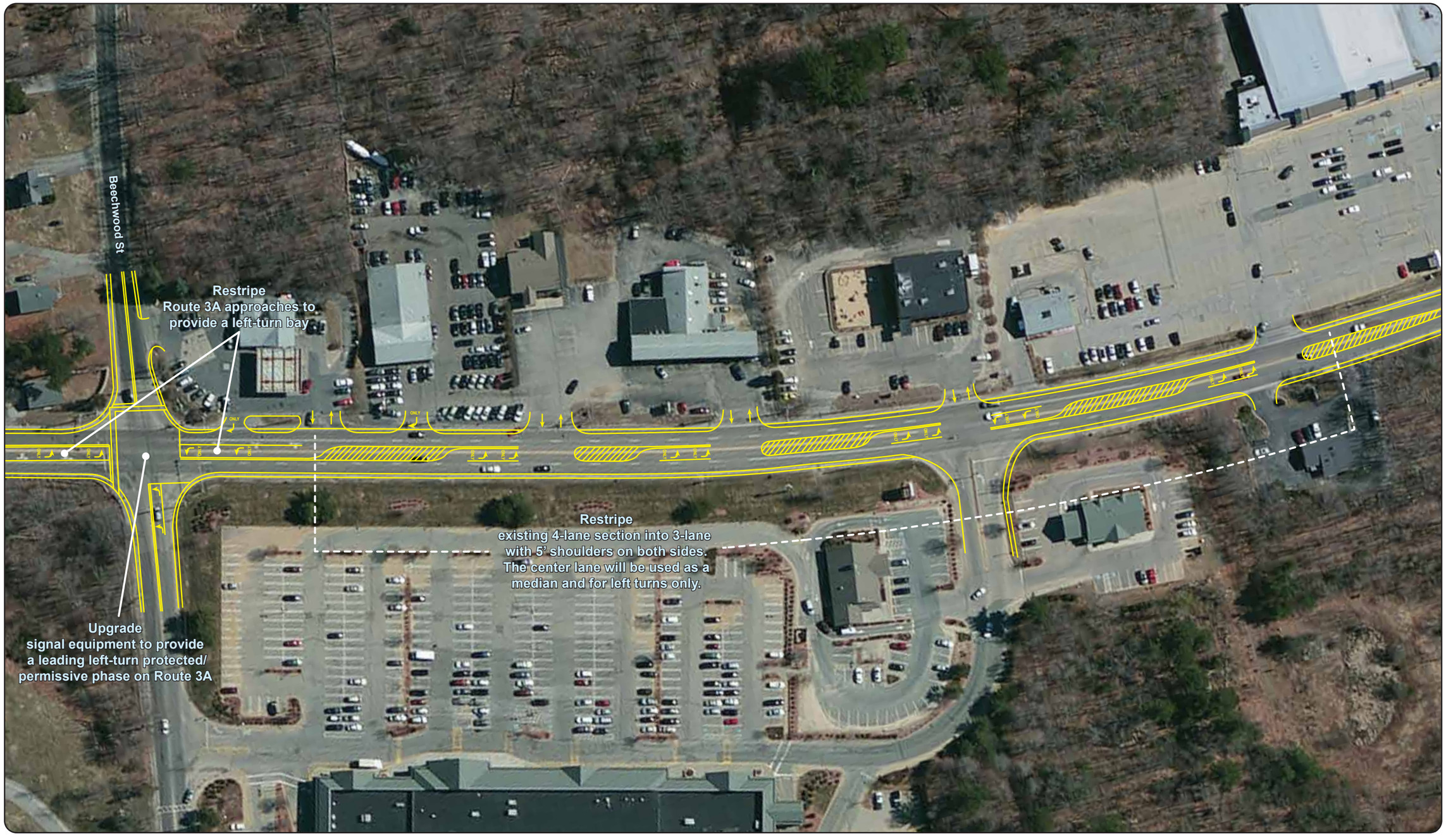

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FIGURE 14
Proposed Short- and Median-Term Improvements Conceptual Plan
Route 3A South Section

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

BOSTON
REGION
MPO

FIGURE 15
Proposed Long-Term Improvements Conceptual Plan
Route 3A South Section (1)

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

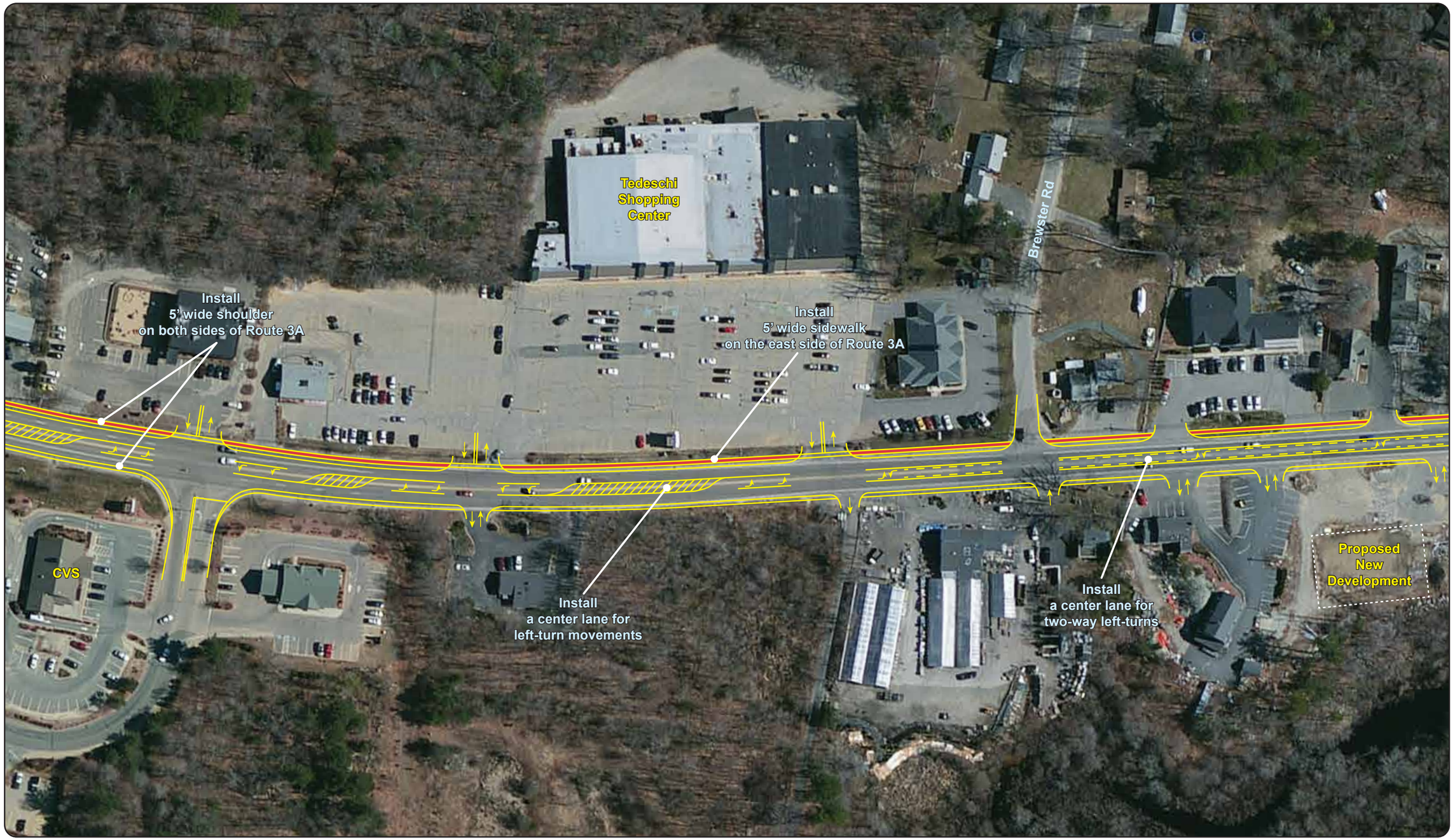

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FIGURE 16
Proposed Long-Term Improvements Conceptual Plan
Route 3A South Section (2)

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

BOSTON
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FIGURE 17
Proposed Long-Term Improvements Conceptual Plan
Route 3A South Section (3)

Addressing Safety,
Mobility, and Access on
Subregional Priority Roadways

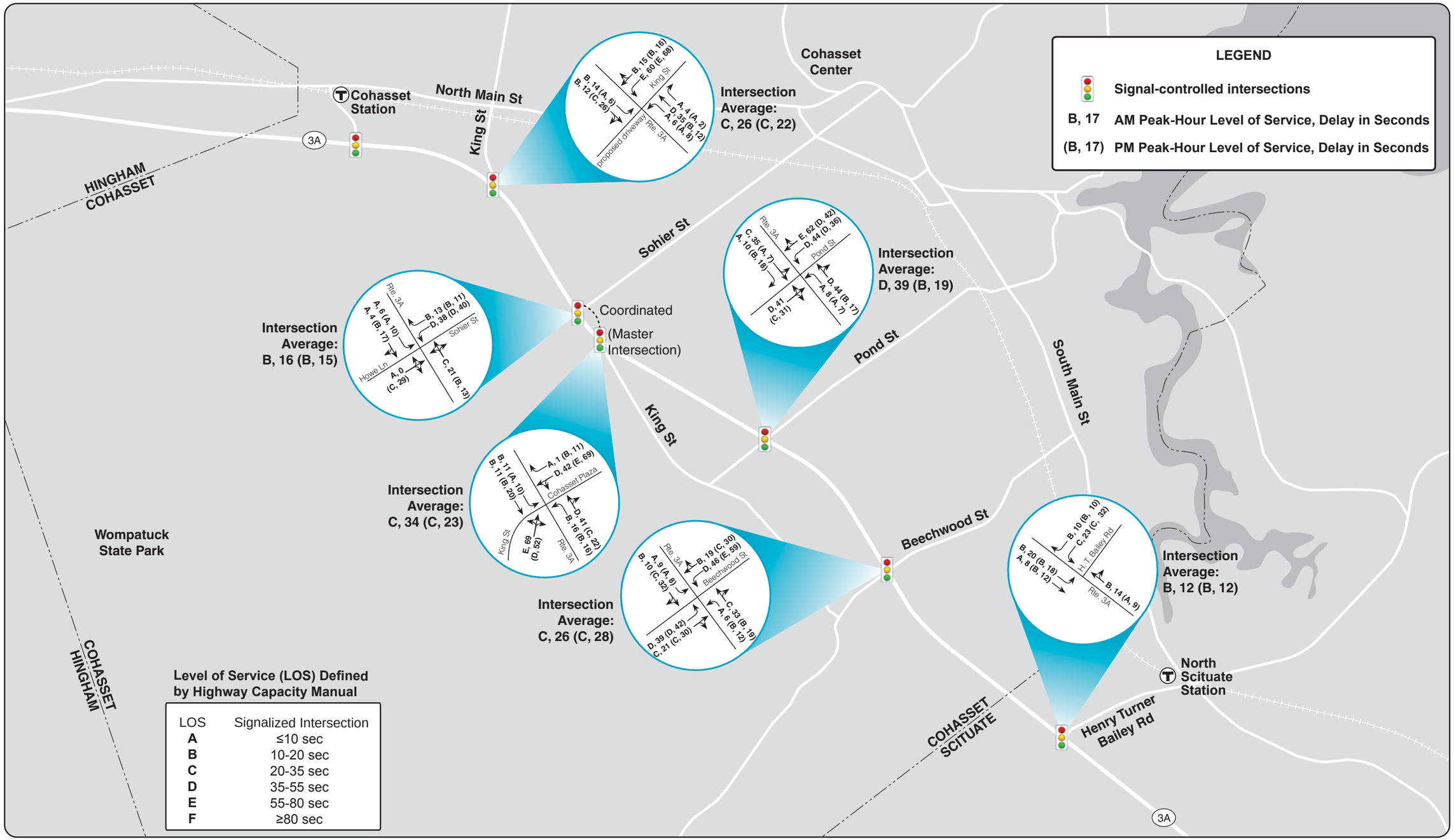

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FIGURE 18
Intersection Capacity Analyses: Future Year (2020) Conditions with Proposed Long-Term Improvements
Route 3A in Cohasset and Scituate

Addressing Safety, Mobility, and Access on Subregional Priority Roadways

APPENDIX A

List of Participants
Study Advisory Meetings
March 14, 2013
September 5, 2013

Study Adisory Meetings

Subarea Priority Roadways Study: Route 3A in Choasset and Scituate

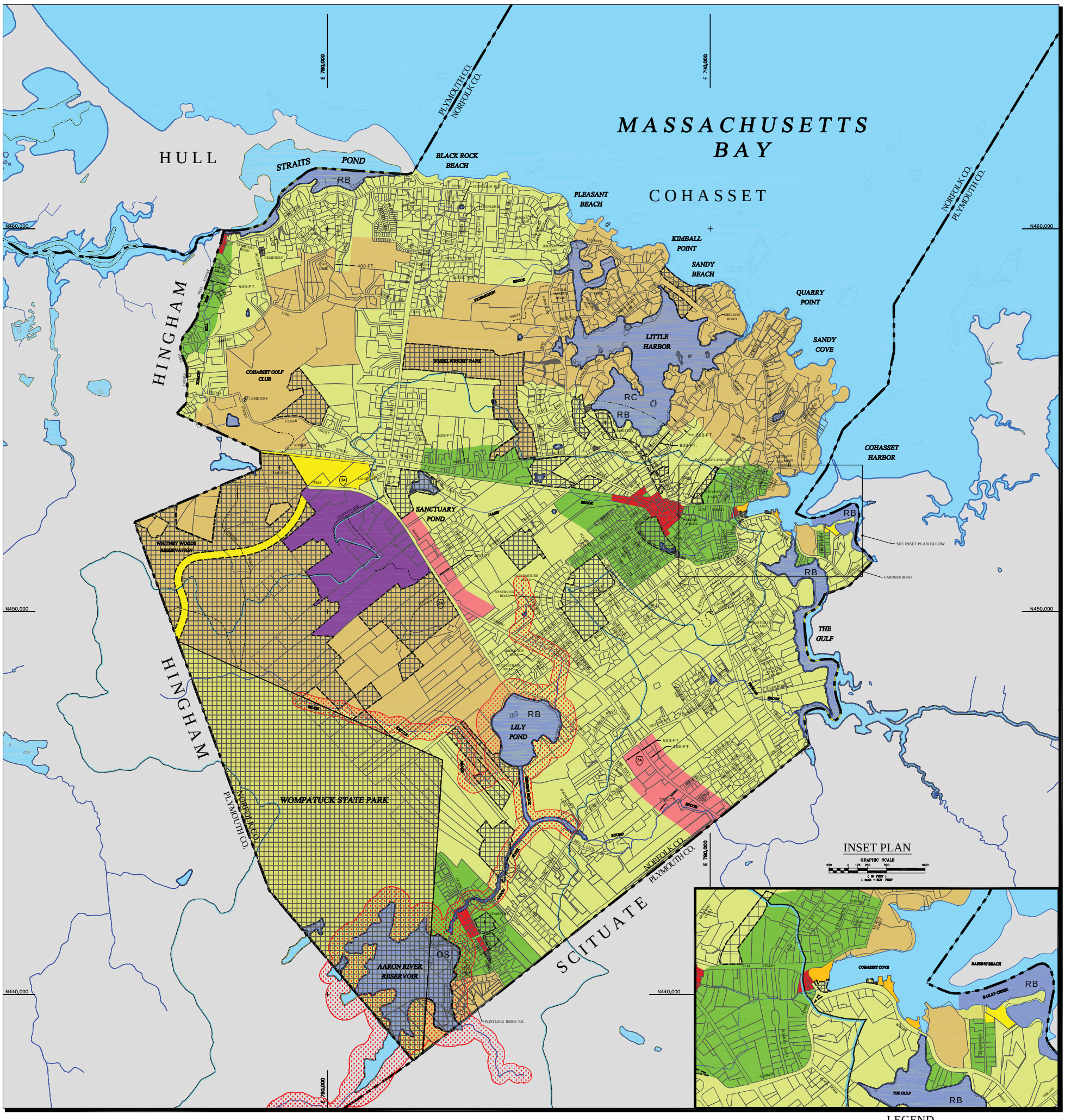
Name	Affliation	E-mail Address	3/14/2013	9/5/2013
Michael Milanoski	Cohasset Town Manager	mmilanoski@townofcohasset.org	√	√
Brian Joyce	Cohasset Project Management/Planning	bjoyce@cohassetma.org	√	√
Stuart Ivimey	Cohasset Planning Board	stuart.Ivimey@verizon.net		√
Clark Brewer	Cohasset Planning Board	clarkbrewer@comcast.net	√	√
Dave Drinan	Cohasset Planning Board	dhdrinan@aol.com		√
Brian Frazier	Cohasset Planning Board	brianfrazierdesign@gmail.com		√
Jo-Ann Pilczak	Cohasset Planning Board Adminstrator	jpilczak@cohassetma.org	√	√
Bob Egan	Cohasset Building Commisioner	regan@cohassetma.org		√
Ian Lyster	Cohasset Planning	ilyster@cohassetma.org		√
Robert Silvia	Cohasset Fire Chief	chief@cohassetfire.org	√	√
John Dockray	Cohasset Fire Department	jdockray@cohassetfire.org		√
Jeff Treanor	Cohasset Police Department	jtreanor@cohassetpolice.com	√	√
Laura Harbottle	Scituate Town Planner	lharbottle@town.scituate.ma.us	√	√
Mark Thompson	Scituate Police Department	mthompson@scituatepolice.org	√	√
Brian Stewart	Scituate Police Department	bstewart@scituatepolice.org	√	
Kerri-Anne Hollingshead	MA Rep. Bradley's office	kerrianne.hollingshead@mahouse.gov		√
Gabe Crocker	Coler & Colantonio Inc.	gcrocker@col-col.com	√	
John Morgan	Coler & Colantonio Inc.	jmorgan@col-col.com	√	√
Pamela Haznar	MassDOT District 5 Traffic	pamela.haznar@state.ma.us		√
Edward Feeney	MassDOT District 5 Traffic	edward.feeney@state.ma.us	√	√
Barbara Lachance	MassDOT District 5 Traffic	Barbara.Lachance@dot.state.ma.us	√	
James Greene	MassDOT District 5 Maintenance	james.greene@state.ma.us	√	
Timothy Kocahn	MassDOT District 5 Bike & Ped. Coord.	timothy.kochan@state.ma.us	√	
Erin Reed	MassDOT Safe Routes to School	erin.reed@state.ma.us	√	√
Barry Keppard	MAPC SSC Coordinator	bkeppard@MAPC.ORG	√	
Scott Peterson	CTPS Technical Director	speterson@ctps.org		√
Efi Pagitsas	CTPS Traffic Analysis & Design	epagitsas@ctps.org	√	√
Chen-Yuan Wang	CTPS Traffic Analysis & Design	cwang@ctps.org	√	√

APPENDIX B

Zoning District Map
Town of Cohasset

TOWN OF COHASSET
MASSACHUSETTS
ZONING DISTRICT MAP

MARCH 2002



NOTES:

1. MAP PROJECTION IS NAD 83, MASSACHUSETTS STATE PLANES, MAINLAND ZONE, US FOOT.

2. CORPORATE BOUNDARIES AND HYDROGRAPHY DOWNLOADED FROM FROM MASS GIS. PLEASE NOTE ONLY MAJOR HYDROGRAPHIC FEATURES ARE SHOWN.

3. PARCEL & RIGHT-OF-WAY DATA CREATED IN 1995 & PROVIDED BY TOWN OF COHASSET. INFORMATION IS SHOWN FOR REFERENCE PURPOSES ONLY.

4. STREET NAMES ARE FOR REFERENCE PURPOSES ONLY AND DO NOT REPRESENT AN OFFICIAL MAP FOR DETERMINING THE STATUS OF PUBLIC AND PRIVATE WAYS.

5. ZONING INFORMATION TAKEN FROM PLAN ENTITLED ZONING DISTRICT MAP OF THE TOWN OF COHASSET, MASSACHUSETTS, DATED OCTOBER 1, 1969 WITH LATEST REVISION IN 1985. PREPARED BY EDWIN A. YOUNG, P.E.

6. THE WATER RESOURCE DISTRICT, ESTABLISHED AS THE OVERLAY DISTRICT SHOWN ON THIS ZONING MAP, IS BASED ON THE PRIOR OFFICIAL WATER RESOURCE DISTRICT MAP DATED MARCH 2001, WITH MINOR MODIFICATIONS TO THE DISTRICT LINE BY NORFOLK RAM GROUP, LLC ENVIRONMENTAL ENGINEERS OF PLYMOUTH, MA, TO ADJUST PORTIONS OF THE DISTRICT LINE THAT DEFINE THE LILY POND AND AARON RIVER RESERVOIR WATERSHEDS SO AS TO BE CONSISTENT WITH THE THREE METER TOPOGRAPHIC MAPS PUBLISHED BY THE UNITED STATES GEOLOGICAL SURVEY IN 1984.

7. FOR ADDITIONAL INFORMATION REGARDING ZONE BOUNDARIES THAT DO NOT FOLLOW PHYSICAL FEATURES SUCH AS HYDROGRAPHY OR PROPERTY LINES, PLEASE REFER TO NOTES ON FILE WITH THE TOWN CLERKS OFFICE.

GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)

1 inch = 1000 FEET

AMORY ENGINEERS, P.C.

DUXBURY, MASSACHUSETTS

LEGEND

- HIGHWAY BUSINESS DISTRICT - 10,000 s.f. Minimum Lot Size
- RESIDENCE A DISTRICT - 18,000 s.f. Minimum Lot Size
- RESIDENCE B DISTRICT - 35,000 s.f. Minimum Lot Size
- RESIDENCE C DISTRICT - 60,000 s.f. Minimum Lot Size
- DOWNTOWN BUSINESS DISTRICT - 5,000 s.f. Minimum Lot Size
- LIGHT INDUSTRY DISTRICT - 80,000 s.f. Minimum Lot Size
- WATERFRONT BUSINESS DISTRICT - N/A
- TECHNOLOGY BUSINESS DISTRICT - 80,000 s.f. Minimum Lot Size
- OPEN SPACE DISTRICT
- WATER BODIES (UN-ZONED INLAND AND/OR COASTAL WATER BODIES)
- WATER BODIES (ZONED INLAND AND/OR TIDAL WATER BODIES)
- STATE, MUNICIPAL & RESERVATION LAND
- LIMIT OF HYDROGRAPHIC FEATURE
- WATER RESOURCE DISTRICT
- ZONE A - SURFACE WATER PROTECTION AREA

APPENDIX C

Zoning District Map
Town of Scituate

TOWN OF SCITUATE
MASSACHUSETTS
ZONING DISTRICT MAP

OCTOBER 25, 2011

LEGEND

ZONING DISTRICTS		MINIMUM DIMENSIONAL REQUIREMENTS					
		LOT AREA (UPLAND) (SQ. FT.)	FRONTAGE[2] (FT.)	SETBACKS[1] FRONT[3] (FT.)	SIDE (FT.)	REAR (FT.)	LOT WIDTH (FT.)
R-1	RESIDENCE R-1	40,000	100	30	15	30	175
R-2	RESIDENCE R-2	20,000	100	30	15	30	125
R-3	RESIDENCE R-3	10,000	100	30	8	20	100
B	BUSINESS[4]	---	60	30	8[5]	8	--
C	COMMERCIAL[4]	---	60	30	8[5]	8	--
D	SALTMARSH & TIDELAND CONSERVATION DISTRICT						

OVERLAY DISTRICTS

- FLOOD PLAIN & WATERSHED PROTECTION DISTRICT
- HUMAROCK VILLAGE RESIDENTIAL OVERLAY DISTRICT
- PLANNED DEVELOPMENT DISTRICT (See Zoning Bylaw for information on subdistricts)
- RESIDENTIAL CLUSTER DISTRICT
- VILLAGE BUSINESS OVERLAY DISTRICT
- WATER RESOURCE PROTECTION DISTRICT
- WIRELESS COMMUNICATION OVERLAY DISTRICT
- SCENIC ROAD (Parts of the Driftway were designated as a Scenic Road by Article 23 of the 1985 Annual Town Meeting. All other Scenic Roads were designated by Article 53 of the 1974 Annual Town Meeting.)

GRAPHIC SCALE

1000 0 500 1000 2000 4000

(IN FEET)
1 inch = 1000 FEET

AMORY ENGINEERS, P.C.
DUXBURY, MASSACHUSETTS

NOTES:

1. SEE ZONING BYLAW SECTION 510.5, NON-DISTURBANCE BUFFER ZONE, FOR REQUIRED SETBACK WITHIN WRPD FROM THE HIGH WATER MARK OF TACK FACTORY POND RESERVOIR AND TRIBUTARIES IN THE RESERVOIR WATERSHED.
2. SEE ZONING BYLAW SECTION 610.2, LOT FRONTAGE REQUIREMENTS, FOR ADDITIONAL INFORMATION.
3. SEE ZONING BYLAW SECTION 620.3, SETBACK AND YARD REQUIREMENTS, FOR REQUIRED SETBACKS FROM CHIEF JUSTICE CUSHING HIGHWAY, THE NEW DRIFTWAY, THE DRIFTWAY AND NEW KENT STREET.
4. SEE ZONING BYLAW SECTIONS 610.1, LOT AREA AND WIDTH REQUIREMENTS AND 620.3, SETBACK AND YARD REQUIREMENTS, FOR THE REQUIRED AREA, FRONTAGE, LOT WIDTH AND SETBACKS FOR DWELLINGS IN THE BUSINESS AND COMMERCIAL ZONING DISTRICTS.
5. UNLESS HAVING A PARTY WALL ON THE SAME LOT LINE, PER ZONING BYLAW SECTION 620.3, SETBACKS AND YARD REQUIREMENTS.

APPENDIX D

Segment Crash Rate Worksheets

Worksheet D-1
Route 3A North Section:
MBTA Cohasset Station to Cohasset Plaza Shopping Center

Worksheet D-2
Route 3A Middle Section:
Cohasset Plaza Shopping Center to Beechwood Street

Worksheet D-3
Route 3A South Section:
Beechwood Street to Henry Turner Bailey Road

Worksheet D-4
Route 3A Corridor:
MBTA Cohasset Station to Henry Turner Bailey Road

SEGMENT CRASH RATE WORKSHEET D-1

CITY/TOWN : Cohasset

COUNT DATE : 4/29-5/1/2013

DISTRICT : 5

~ SEGMENT DATA ~

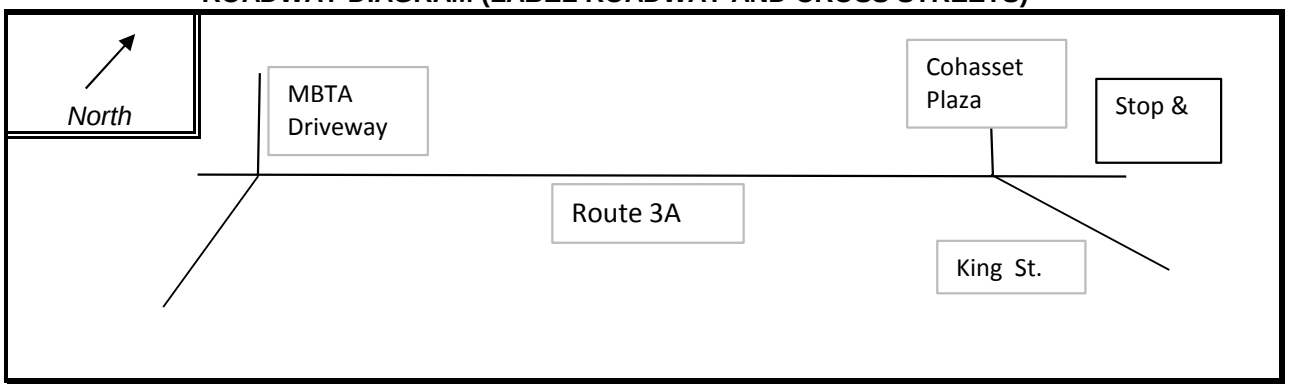
ROADWAY NAME: Route 3A

START POINT: MBTA Station in Cohasset

END POINT: South of Stop&Shop Supermarket

FUNCTIONAL CLASSIFICATION OF ROADWAY: Principal Arterial (Other)

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (**L**):	**1.14**
AVERAGE DAILY TRAFFIC VOLUME (**V**):	19,500

TOTAL # OF CRASHES:	133	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**26.60**

CRASH RATE CALCULATION : **3.29**

RATE = (A * 1,000,000) / (L * V * 365)

Comments : 2010 State Average Crash Rate (updated 1/23/2013) for the functional class of Principal Arterial (Other) for urban areas = 3.23 crashes per million vehicle miles traveled

Project: Address Safety, Mobility, and Accessibility for Route 3A in Cohasset and Scituate

SEGMENT CRASH RATE WORKSHEET D-2

CITY/TOWN : Cohasset

COUNT DATE : 4/29-5/1/2013

DISTRICT : 5

~ SEGMENT DATA ~

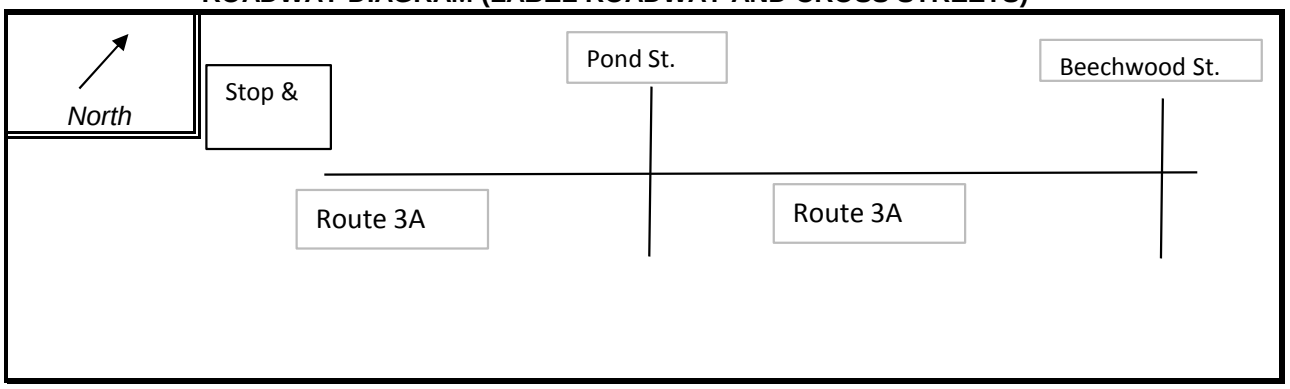
ROADWAY NAME: Route 3A

START POINT: South of Stop&Shop Supermarket

END POINT: North of Beechwood Street

FUNCTIONAL CLASSIFICATION OF ROADWAY: Principal Arterial (Other)

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (**L**):	**1.04**
AVERAGE DAILY TRAFFIC VOLUME (**V**):	18,500

TOTAL # OF CRASHES:	59	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**11.80**

CRASH RATE CALCULATION : **1.68**

RATE = (A * 1,000,000) / (L * V * 365)

Comments : 2010 State Average Crash Rate (updated 1/23/2013) for the functional class of Principal Arterial (Other) for urban areas = 3.23 crashes per million vehicle miles traveled

Project: Address Safety, Mobility, and Accessibility for Route 3A in Cohasset and Scituate

SEGMENT CRASH RATE WORKSHEET D-3

CITY/TOWN : Cohasset

COUNT DATE : 4/29-5/1/2013

DISTRICT : 5

~ SEGMENT DATA ~

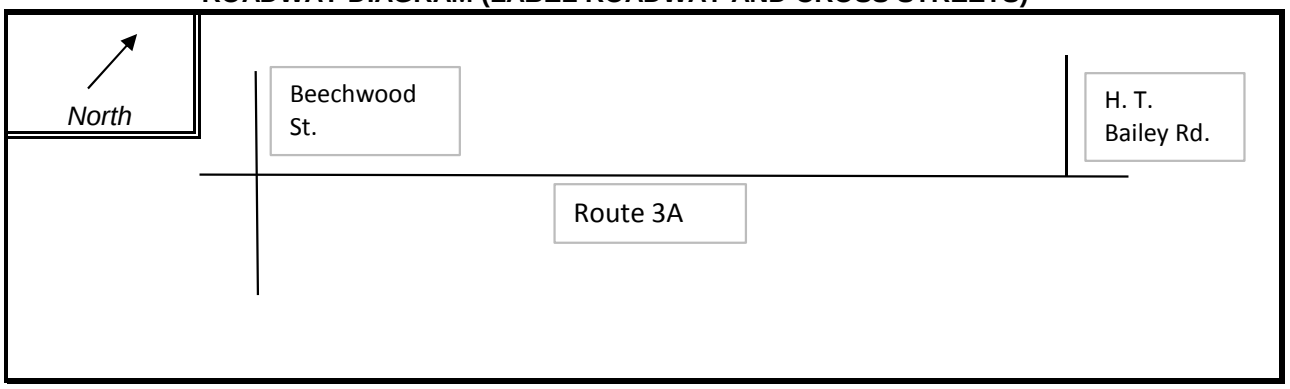
ROADWAY NAME: Route 3A

START POINT: Beechwood Street

END POINT: H. T. Bailey Road in Scituate

FUNCTIONAL CLASSIFICATION OF ROADWAY: Principal Arterial (Other)

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (**L**):	**0.85**
AVERAGE DAILY TRAFFIC VOLUME (**V**):	17,500

TOTAL # OF CRASHES:	133	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**26.60**

CRASH RATE CALCULATION : **4.89**

RATE = (A * 1,000,000) / (L * V * 365)

Comments : 2010 State Average Crash Rate (updated 1/23/2013) for the functional class of Principal Arterial (Other) for urban areas = 3.23 crashes per million vehicle miles traveled

Project: Address Safety, Mobility, and Accessibility for Route 3A in Cohasset and Scituate

SEGMENT CRASH RATE WORKSHEET D-4

CITY/TOWN : Cohasset

COUNT DATE : 4/29-5/1/2013

DISTRICT : 5

~ SEGMENT DATA ~

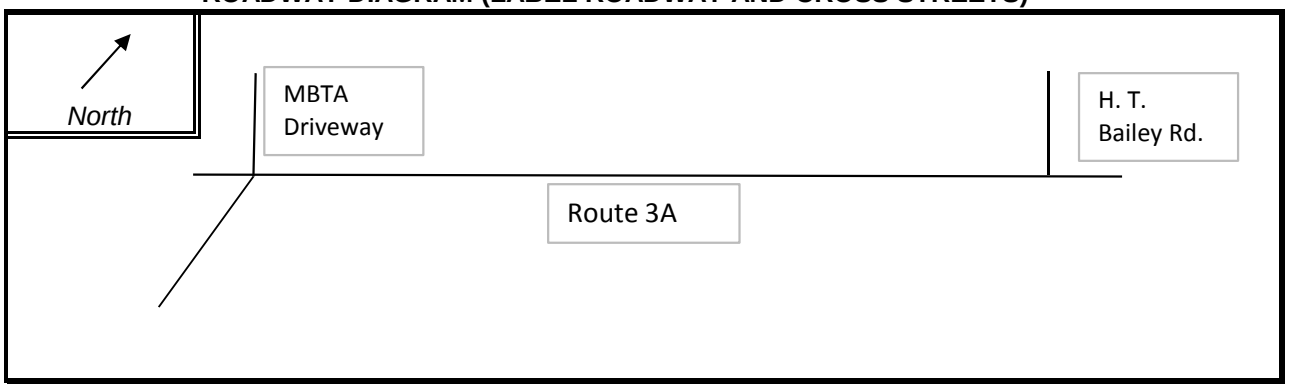
ROADWAY NAME: Route 3A

START POINT: MBTA Station in Cohasset

END POINT: H. T. Bailey Road in Scituate

FUNCTIONAL CLASSIFICATION OF ROADWAY: Principal Arterial (Other)

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (**L**):	**3.03**
AVERAGE DAILY TRAFFIC VOLUME (**V**):	18,500

TOTAL # OF CRASHES:	321	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**64.20**

CRASH RATE CALCULATION : **3.14**

RATE = (A * 1,000,000) / (L * V * 365)

Comments : 2010 State Average Crash Rate (updated 1/23/2013) for the functional class of Principal Arterial (Other) for urban areas = 3.23 crashes per million vehicle miles traveled

Project: Address Safety, Mobility, and Accessibility for Route 3A in Cohasset and Scituate

APPENDIX E

Intersection Crash Rate Worksheets

Worksheet E-1
Route 3A at MBTA Station Driveway, Cohasset

Worksheet E -2
Route 3A at King Street, Cohasset

Worksheet E -3
Route 3A at Sohier Street, Cohasset

Worksheet E -4
Route 3A at King Street/Cohasset Plaza, Cohasset

Worksheet E -5
Route 3A at Pond Street, Cohasset

Worksheet E -6
Route 3A at Beechwood Street, Cohasset

Worksheet E -7
Route 3A at Henry Turner Bailey Road, Scituate

INTERSECTION CRASH RATE WORKSHEET E-1

CITY/TOWN : Cohasset COUNT DATE : 4/30/2013

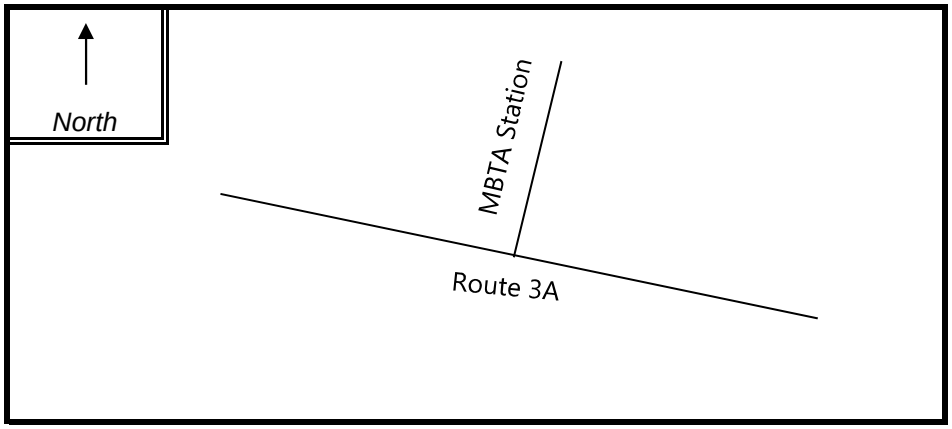
DISTRICT : 5 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Route 3A

MINOR STREET(S) : MBTA Station Driveway

INTERSECTION DIAGRAM



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	WB			
PEAK HOURLY VOLUMES (AM/**PM**) :	950	550	50			**1,550**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **17,222**

TOTAL # OF CRASHES : 14 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **2.80**

CRASH RATE CALCULATION : **0.445** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 5 Average Rate = 0.58 (2010 data, updated January 23, 2013)

Project Title & Date: Route 3A Subregional Priority Roadway Improvements Study

INTERSECTION CRASH RATE WORKSHEET E-2

CITY/TOWN : Cohasset COUNT DATE : 4/30/2013

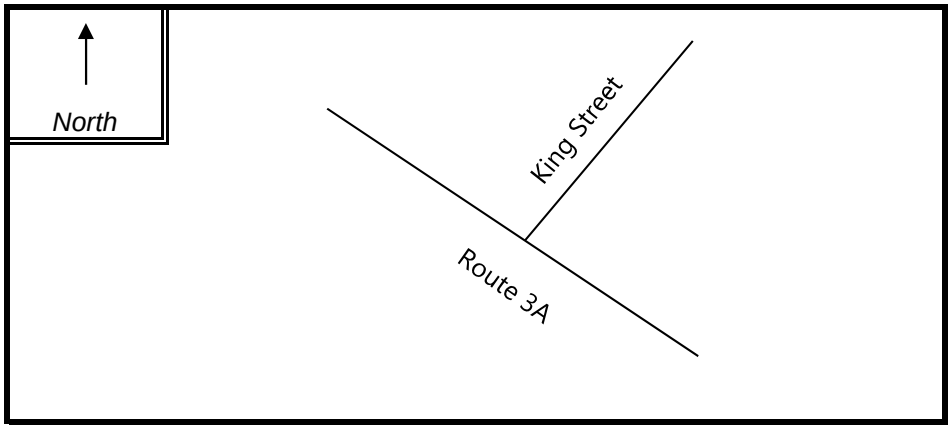
DISTRICT : 5 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Route 3A

MINOR STREET(S) : King Steet

INTERSECTION DIAGRAM



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	WB			
PEAK HOURLY VOLUMES (AM/**PM**) :	696	979	165			**1,840**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **20,444**

TOTAL # OF CRASHES : 16 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **3.20**

CRASH RATE CALCULATION : **0.429** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 5 Average Rate = 0.58 (2010 data, updated January 23, 2013)

Project Title & Date: Route 3A Subregional Priority Roadway Improvements Study

INTERSECTION CRASH RATE WORKSHEET E-3

CITY/TOWN : Cohasset COUNT DATE : 4/30/2013

DISTRICT : 5 UNSIGNALIZED : X SIGNALIZED :

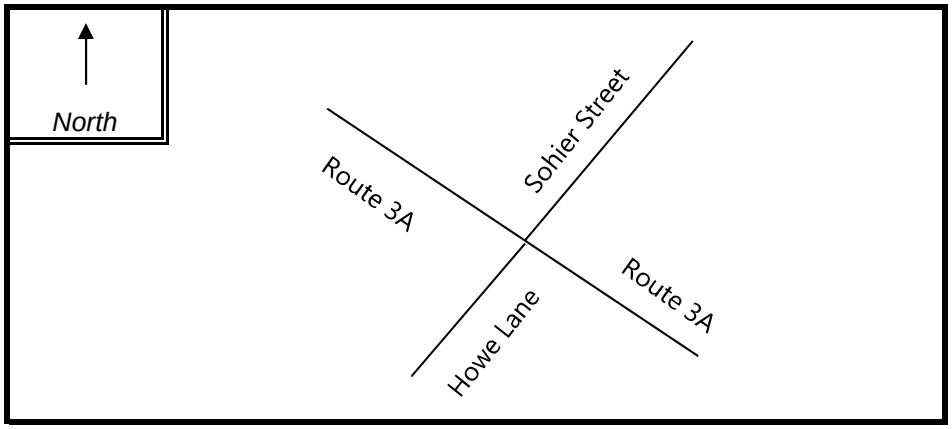
~ INTERSECTION DATA ~

MAJOR STREET : Route 3A

MINOR STREET(S) : Sohier Steet

Howe Lane

INTERSECTION DIAGRAM



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM/PM) :	746	1,031	1	154		**1,932**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **21,467**

TOTAL # OF CRASHES : 10 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **3.33**

CRASH RATE CALCULATION : **0.425** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 5 Average Rate = 0.58 (2010 data, updated January 23, 2013)

Project Title & Date: Route 3A Subregional Priority Roadway Improvements Study

INTERSECTION CRASH RATE WORKSHEET E-4

CITY/TOWN : Cohasset COUNT DATE : 5/3/2011 (Adj. April 2013)

DISTRICT : 5 UNSIGNALIZED : SIGNALIZED : X

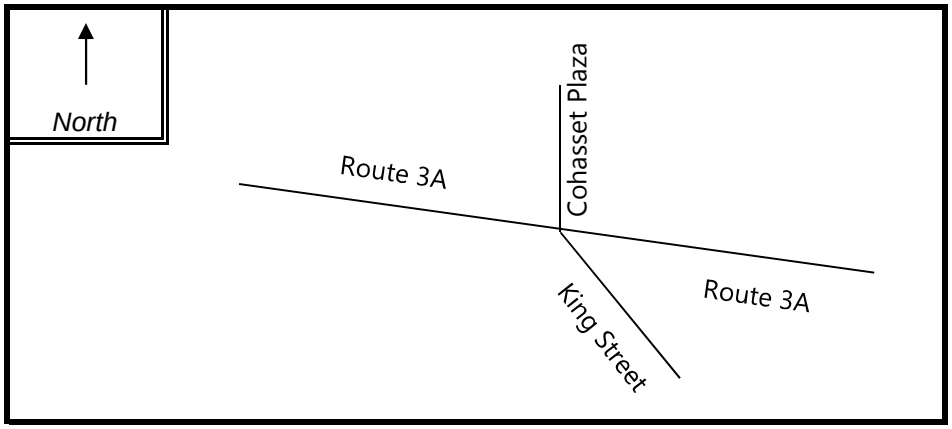
~ INTERSECTION DATA ~

MAJOR STREET : Route 3A

MINOR STREET(S) : King Street

Cohasset Plaza Shopping Center Driveway

INTERSECTION DIAGRAM



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM/PM) :	641	980	65	204		**1,890**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **21,000**

TOTAL # OF CRASHES : 37 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **7.40**

CRASH RATE CALCULATION : **0.965** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 5 Average Rate = 0.77 (2010 data, updated January 23, 2013)

Project Title & Date: Route 3A Subregional Priority Roadway Improvements Study

INTERSECTION CRASH RATE WORKSHEET E-5

CITY/TOWN : Cohasset COUNT DATE : 4/30/2013

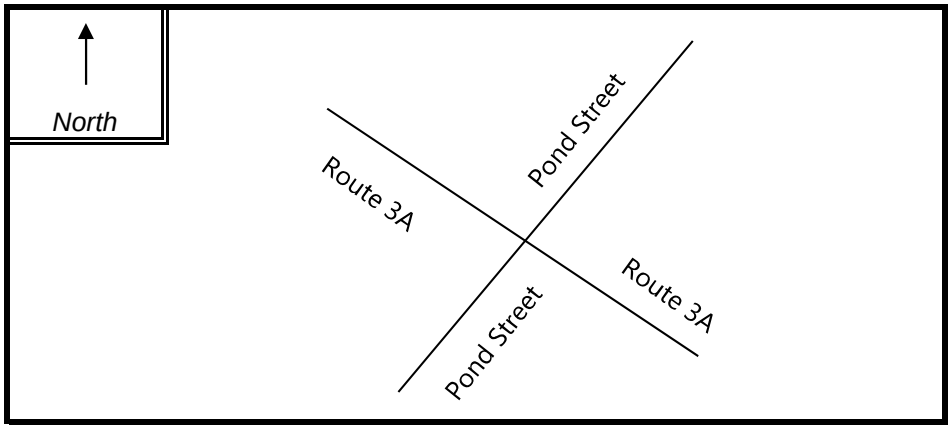
DISTRICT : 5 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Route 3A

MINOR STREET(S) : Pond Steet

INTERSECTION DIAGRAM



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM/PM) :	607	885	18	156		**1,666**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **18,511**

TOTAL # OF CRASHES : 33 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **6.60**

CRASH RATE CALCULATION : **0.977** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 5 Average Rate = 0.77 (2010 data, updated January 23, 2013)

Project Title & Date: Route 3A Subregional Priority Roadway Improvements Study

INTERSECTION CRASH RATE WORKSHEET E-6

CITY/TOWN : Cohasset COUNT DATE : 1/10/2012, Adj. April 2013

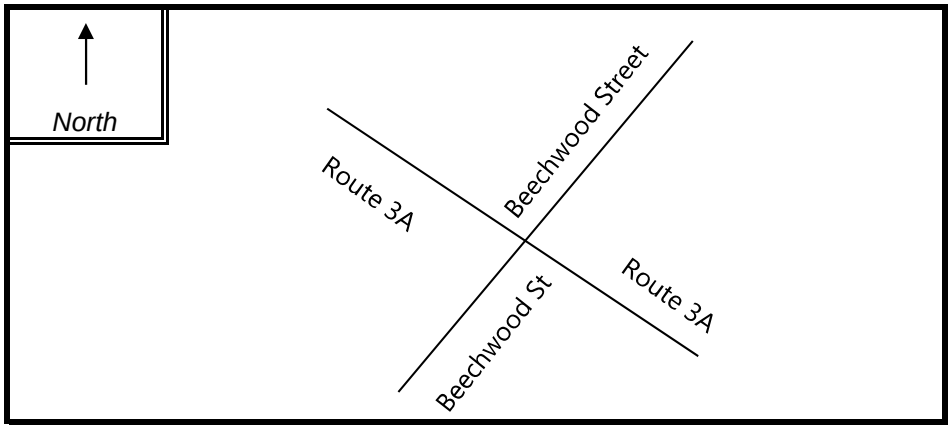
DISTRICT : 5 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Route 3A

MINOR STREET(S) : Beechwood Steet

INTERSECTION DIAGRAM



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM/PM) :	629	800	206	205		**1,840**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **20,444**

TOTAL # OF CRASHES : 57 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **11.40**

CRASH RATE CALCULATION : **1.528** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 5 Average Rate = 0.77 (2010 data, updated January 23, 2013)

Project Title & Date: Route 3A Subregional Priority Roadway Improvements Study

INTERSECTION CRASH RATE WORKSHEET E-7

CITY/TOWN : Scituate COUNT DATE : 7/13/2011 (Adj. April 2013)

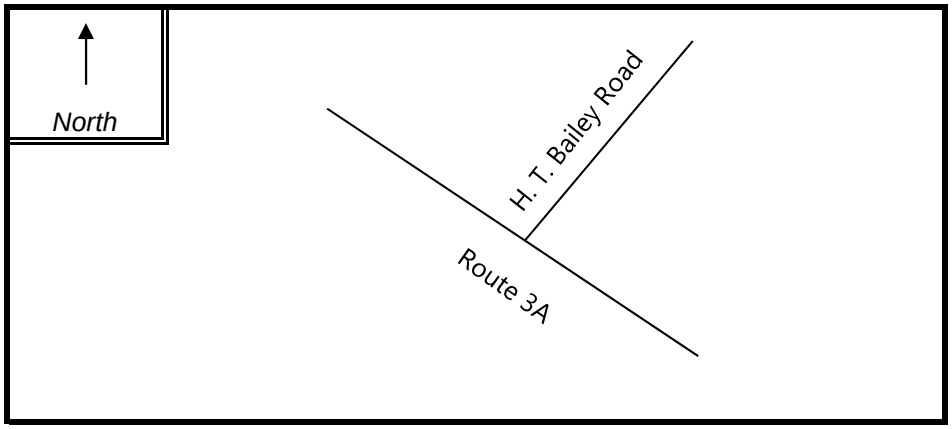
DISTRICT : 5 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Route 3A

MINOR STREET(S) : Henry Turner Bailey Road

INTERSECTION DIAGRAM



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	WB			
PEAK HOURLY VOLUMES (AM/**PM**) :	522	924	275			**1,721**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **19,122**

TOTAL # OF CRASHES : 21 # OF YEARS : 5 AVERAGE # OF CRASHES PER YEAR (**A**) : **4.20**

CRASH RATE CALCULATION : **0.602** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 5 Average Rate = 0.58 (2010 data, updated January 23, 2013)

Project Title & Date: Route 3A Subregional Priority Roadway Improvements Study

APPENDIX F

Intersection Crash Statistics

Table F-1
Route 3A at MBTA Station Driveway, Cohasset

Table F-2
Route 3A at King Street, Cohasset

Table F-3
Route 3A at Sohier Street, Cohasset

Table F-4
Route 3A at King Street/Cohasset Plaza, Cohasset

Table F-5
Route 3A at Pond Street, Cohasset

Table F-6
Route 3A at Beechwood Street, Cohasset

Table F-7
Route 3A at Henry Turner Bailey Road, Scituate

TABLE F-1
Route 3A at MBTA Station Driveway, Cohasset
MassDOT Crash Data 2008–10 and Cohasset Police Crash Reports 2010–12

Statistics Period		2008	2009	2010	2011	2012	2008–12 Total	Annual Avg.
Total number of crashes		3	2	4	1	4	14	2.8
Severity	Property damage only	3	1	2	1	4	11	2.2
	Non-fatal injury	0	1	2	0	0	3	0.6
	Fatality	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Collision type	Single vehicle	2	0	4	0	1	7	1.4
	Rear-end	0	1	0	0	3	4	0.8
	Angle	1	1	0	0	0	2	0.4
	Sideswipe, same direction	0	0	0	0	0	0	0.0
	Sideswipe, opposite direction	0	0	0	0	0	0	0.0
	Head-on	0	0	0	0	0	0	0.0
	Rear-to-rear	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Involved pedestrian(s)		0	0	0	0	0	0	0.0
Involved cyclist(s)		0	0	0	0	0	0	0.0
Occurred during weekday peak periods*		1	1	0	1	1	4	0.8
Wet or icy pavement conditions		1	0	1	0	1	3	0.6
Dark conditions (lit or unlit)		1	0	3	0	0	4	0.8

* Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

TABLE F-2
Route 3A at King Street, Cohasset
MassDOT Crash Data 2008–10 and Cohasset Police Crash Reports 2010–12

Statistics Period		2008	2009	2010	2011	2012	2008–12 Total	Annual Avg.
Total number of crashes		4	2	5	2	3	16	3.2
Severity	Property damage only	3	2	3	1	2	11	2.2
	Non-fatal injury	1	0	1	1	0	3	0.6
	Fatality	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	1	0	0	1	0.2
Collision type	Single vehicle	1	1	1	0	0	3	0.6
	Rear-end	2	1	1	1	0	5	1.0
	Angle	0	0	3	1	3	7	1.4
	Sideswipe, same direction	0	0	0	0	0	0	0.0
	Sideswipe, opposite direction	0	0	0	0	0	0	0.0
	Head-on	1	0	0	0	0	1	0.2
	Rear-to-rear	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Involved pedestrian(s)		0	0	0	0	0	0	0.0
Involved cyclist(s)		0	0	0	0	0	0	0.0
Occurred during weekday peak periods*		0	1	3	1	1	6	1.2
Wet or icy pavement conditions		1	1	1	0	0	3	0.6
Dark conditions (lit or unlit)		2	0	1	0	0	3	0.6

* Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

TABLE F-3
Route 3A at Sohier Street, Cohasset
MassDOT Crash Data 2008–10 and Cohasset Police Crash Reports 2010–12

Statistics Period		2008	2009	2010	2011	2012	2008–12 Total	Annual Avg.
Total number of crashes		2	5	2	0	1	10	2.0
Severity	Property damage only	1	5	2	0	0	8	1.6
	Non-fatal injury	1	0	0	0	1	2	0.4
	Fatality	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Collision type	Single vehicle	0	1	1	0	0	2	0.4
	Rear-end	1	0	0	0	0	1	0.2
	Angle	1	4	1	0	1	7	1.4
	Sideswipe, same direction	0	0	0	0	0	0	0.0
	Sideswipe, opposite direction	0	0	0	0	0	0	0.0
	Head-on	0	0	0	0	0	0	0.0
	Rear-to-rear	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Involved pedestrian(s)		0	0	0	0	0	0	0.0
Involved cyclist(s)		0	1	0	0	0	1	0.2
Occurred during weekday peak periods*		1	1	0	0	0	2	0.4
Wet or icy pavement conditions		0	2	1	0	0	3	0.6
Dark conditions (lit or unlit)		1	1	2	0	0	4	0.8

* Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

TABLE F-4
Route 3A at King Street/Cohasset Plaza Driveway, Cohasset
MassDOT Crash Data 2008–10 and Cohasset Police Crash Reports 2010–12

Statistics Period		2008	2009	2010	2011	2012	2008–12 Total	Annual Avg.
Total number of crashes		10	6	11	7	3	37	7.4
Severity	Property damage only	6	5	8	4	1	24	4.8
	Non-fatal injury	4	1	3	3	2	13	2.6
	Fatality	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Collision type	Single vehicle	2	2	1	0	0	5	1.0
	Rear-end	5	2	4	3	0	14	2.8
	Angle	2	2	5	3	1	13	2.6
	Sideswipe, same direction	0	0	1	0	0	1	0.2
	Sideswipe, opposite direction	0	0	0	1	1	2	0.4
	Head-on	1	0	0	0	1	2	0.4
	Rear-to-rear	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Involved pedestrian(s)		0	0	0	0	0	0	0.0
Involved cyclist(s)		0	0	0	0	0	0	0.0
Occurred during weekday peak periods*		4	1	3	2	2	12	2.4
Wet or icy pavement conditions		2	3	2	2	2	11	2.2
Dark conditions (lit or unlit)		4	0	1	1	1	7	1.4

* Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

TABLE F-5
Route 3A at Pond Street, Cohasset
MassDOT Crash Data 2008–10 and Cohasset Police Crash Reports 2010–12

Statistics Period		2008	2009	2010	2011	2012	2008–12 Total	Annual Avg.
Total number of crashes		6	7	7	4	9	33	6.6
Severity	Property damage only	5	6	4	3	6	24	4.8
	Non-fatal injury	1	1	2	1	3	8	1.6
	Fatality	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	1	0	0	1	0.2
Collision type	Single vehicle	0	1	1	0	1	3	0.6
	Rear-end	6	6	5	4	7	28	5.6
	Angle	0	0	1	0	1	2	0.4
	Sideswipe, same direction	0	0	0	0	0	0	0.0
	Sideswipe, opposite direction	0	0	0	0	0	0	0.0
	Head-on	0	0	0	0	0	0	0.0
	Rear-to-rear	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Involved pedestrian(s)		0	0	0	0	0	0	0.0
Involved cyclist(s)		0	0	0	0	0	0	0.0
Occurred during weekday peak periods*		3	5	2	2	2	14	2.8
Wet or icy pavement conditions		1	3	3	2	3	12	2.4
Dark conditions (lit or unlit)		1	0	2	1	1	5	1.0

* Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

TABLE F-6
Route 3A at Beechwood Street, Cohasset
MassDOT Crash Data 2008–10 and Cohasset Police Crash Reports 2010–12

Statistics Period		2008	2009	2010	2011	2012	5-Yr. Total	Annual Avg.
Total number of crashes		11	10	9	14	13	57	11.4
Severity	Property damage only	10	5	7	9	10	41	8.2
	Non-fatal injury	0	4	2	5	3	14	2.8
	Fatality	0	0	0	0	0	0	0.0
	Not reported/unknown	1	1	0	0	0	2	0.4
Collision type	Single vehicle	0	1	1	1	1	4	0.8
	Rear-end	2	1	2	1	2	8	1.6
	Angle	7	8	3	9	8	35	7.0
	Sideswipe, same direction	1	0	0	1	1	3	0.6
	Sideswipe, opposite direction	0	0	1	0	0	1	0.2
	Head-on	1	0	1	1	0	3	0.6
	Rear-to-rear	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	1	1	1	3	0.6
Involved pedestrian(s)		0	0	0	0	0	0	0.0
Involved cyclist(s)		0	0	0	0	0	0	0.0
Occurred during weekday peak periods*		4	5	2	6	1	18	3.6
Wet or icy pavement conditions		2	4	3	5	4	18	3.6
Dark conditions (lit or unlit)		0	0	2	0	2	4	0.8

* Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

TABLE F-7
Route 3A at Henry Turner Bailey Road, Scituate
MassDOT Crash Data 2008–10 and Cohasset Police Crash Reports 2010–12

Statistics Period		2008	2009	2010	2011	2012	2008–12 Total	Annual Avg.
Total number of crashes		7	6	2	2	4	21	4.2
Severity	Property damage only	6	4	2	1	4	17	3.4
	Non-fatal injury	1	2	0	1	0	4	0.8
	Fatality	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Collision type	Single vehicle	0	2	0	0	1	3	0.6
	Rear-end	5	0	1	1	2	9	1.8
	Angle	2	4	0	1	1	8	1.6
	Sideswipe, same direction	0	0	0	0	0	0	0.0
	Sideswipe, opposite direction	0	0	1	0	0	1	0.2
	Head-on	0	0	0	0	0	0	0.0
	Rear-to-rear	0	0	0	0	0	0	0.0
	Not reported/unknown	0	0	0	0	0	0	0.0
Involved pedestrian(s)		0	0	0	0	0	0	0.0
Involved cyclist(s)		0	0	0	0	0	0	0.0
Occurred during weekday peak periods*		4	2	1	1	1	9	1.8
Wet or icy pavement conditions		0	1	0	0	1	2	0.4
Dark conditions (lit or unlit)		0	2	0	0	0	2	0.4

* Peak periods are defined as 7:00–10:00 AM and 3:30–6:30 PM.

APPENDIX G

Intersection Collision Diagrams

Figure G-1
Route 3A at MBTA Station Driveway, Cohasset

Figure G-2
Route 3A at King Street, Cohasset

Figure G-3
Route 3A at Sohier Street, Cohasset

Figure G-4
Route 3A at King Street/Cohasset Plaza, Cohasset

Figure G-5
Route 3A at Pond Street, Cohasset

Figure G-6
Route 3A at Beechwood Street, Cohasset

Figure G-7
Route 3A at Henry Turner Bailey Road, Scituate

Figure G-1
Collision Diagram, Cohasset Police Reports 1/1/2008–3/31/2013
Route 3A @ MBTA Station Driveway, Cohasset

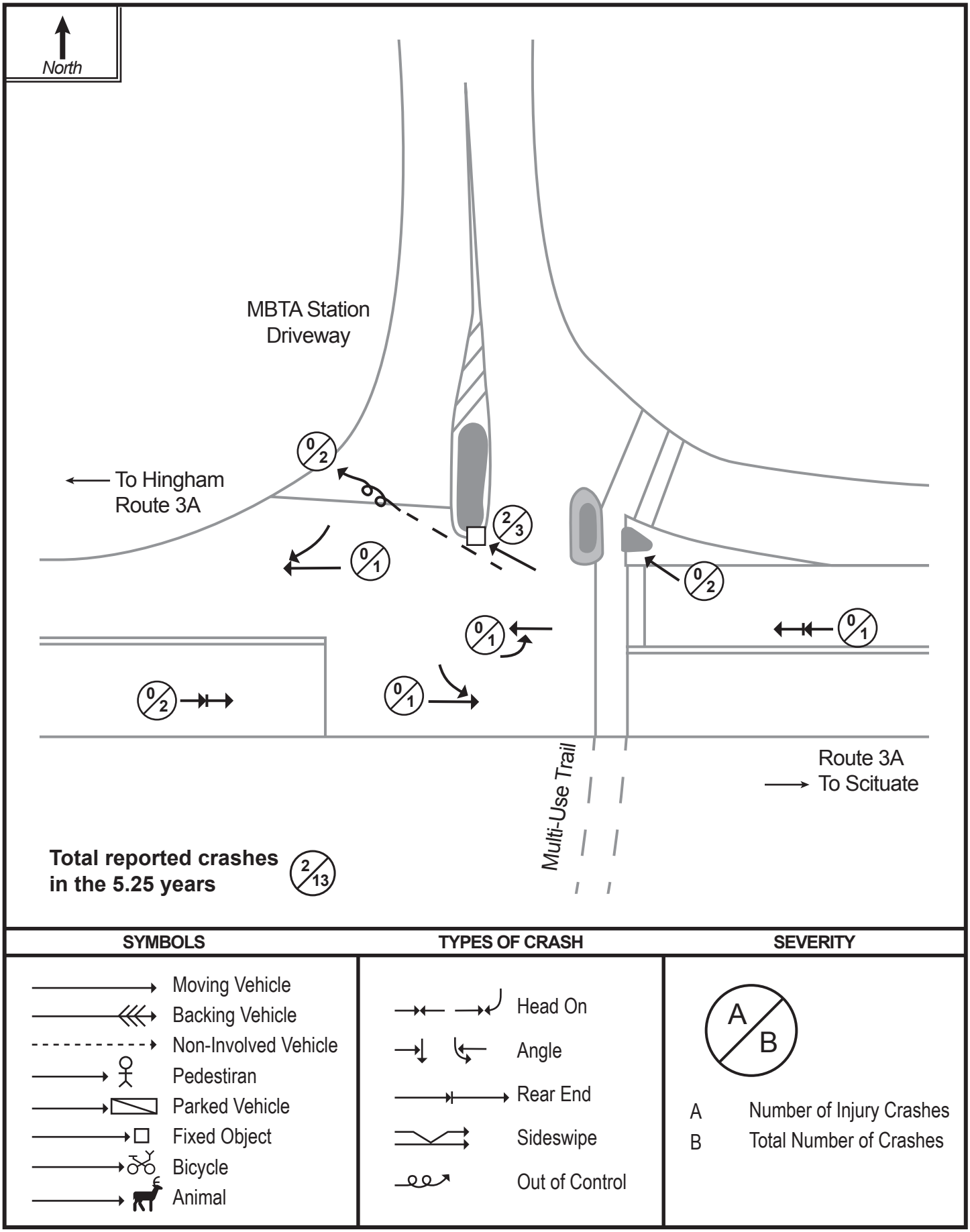


Figure G-2
Collision Diagram, Cohasset Police Reports 1/1/2008–3/31/2013
Route 3A @ King Street, Cohasset

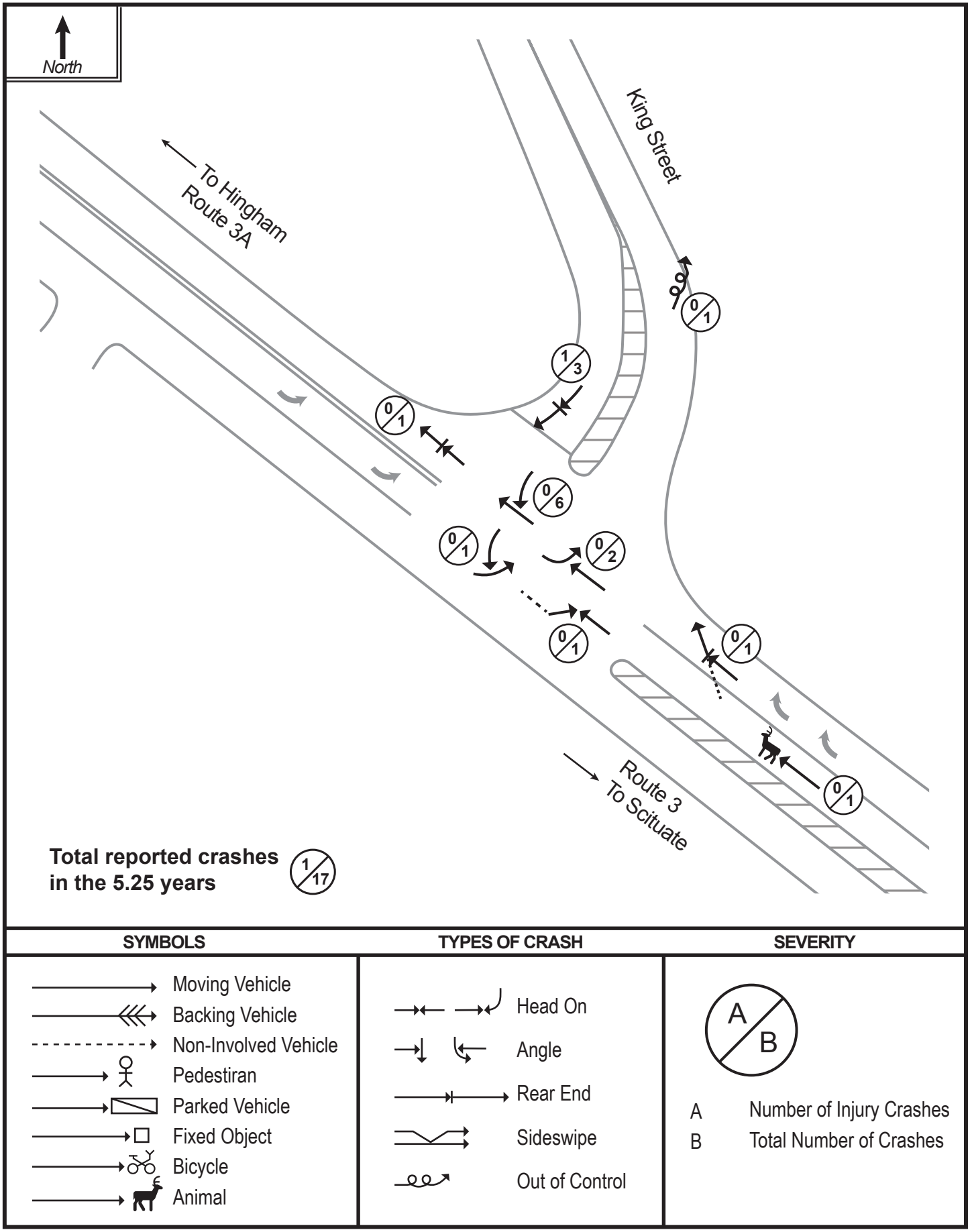
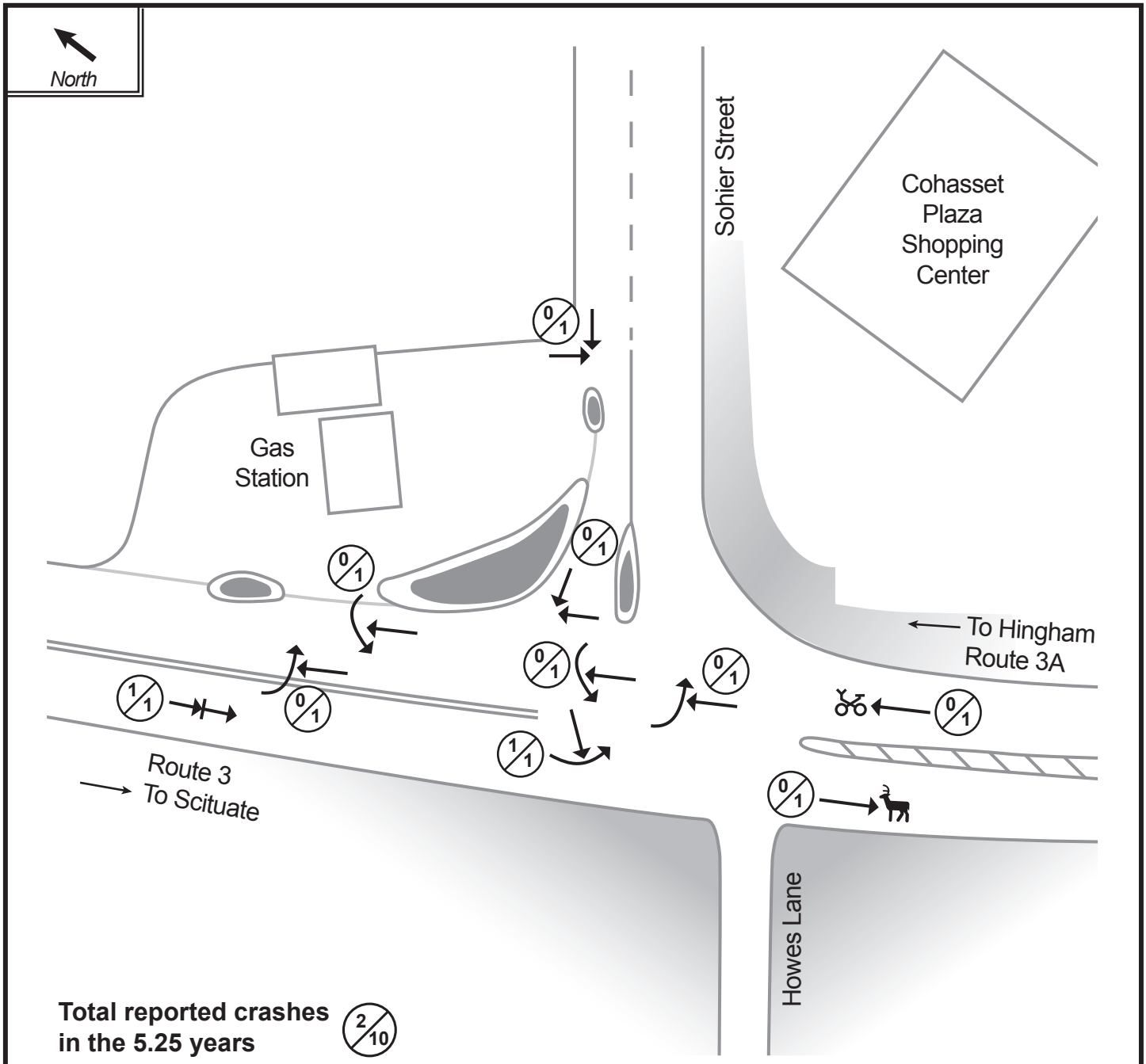
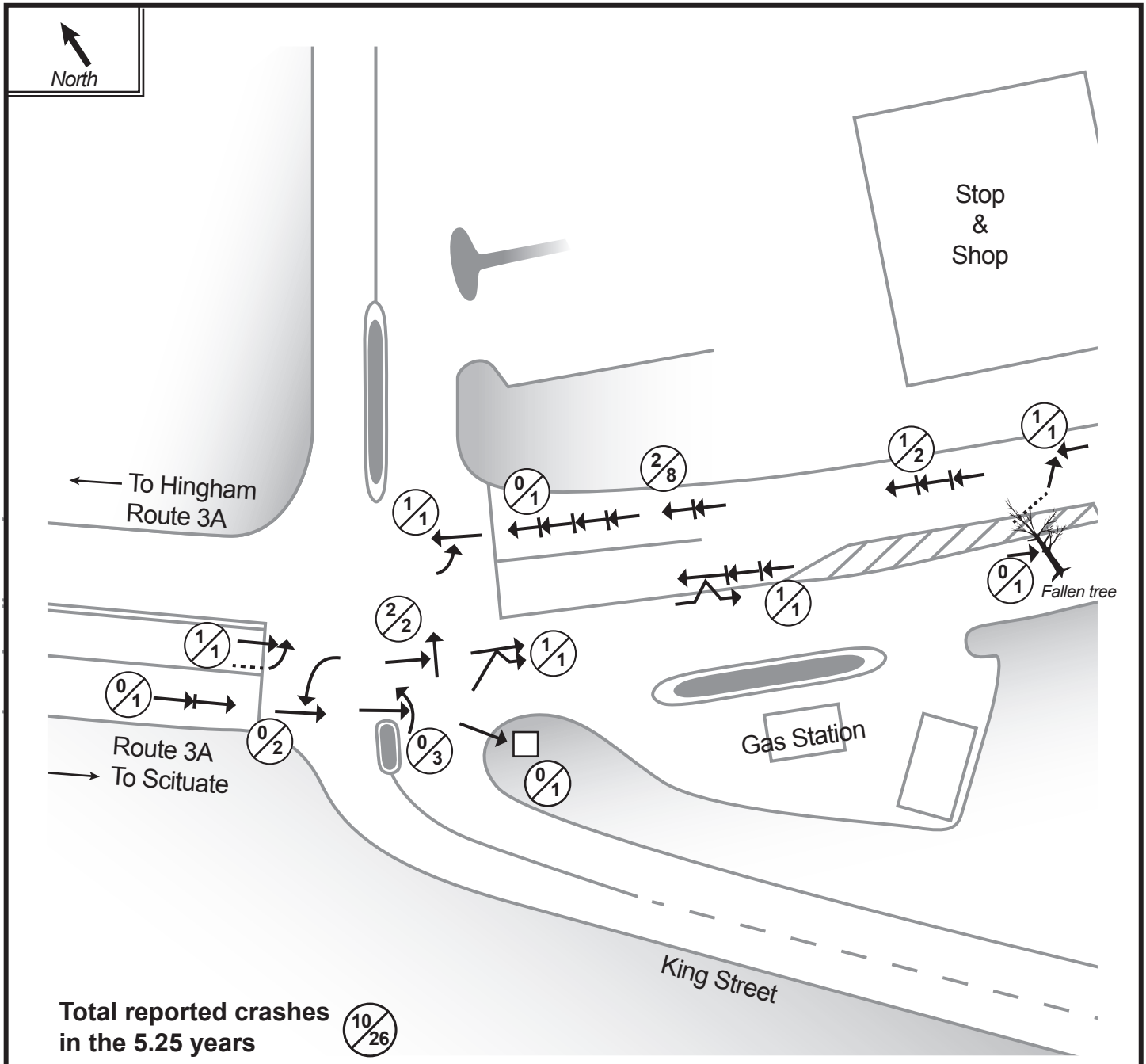


Figure -3
Collision Diagram, Cohasset Police Reports 1/1/2008–3/31/2013
Route 3A @ Sohier Street, Cohasset



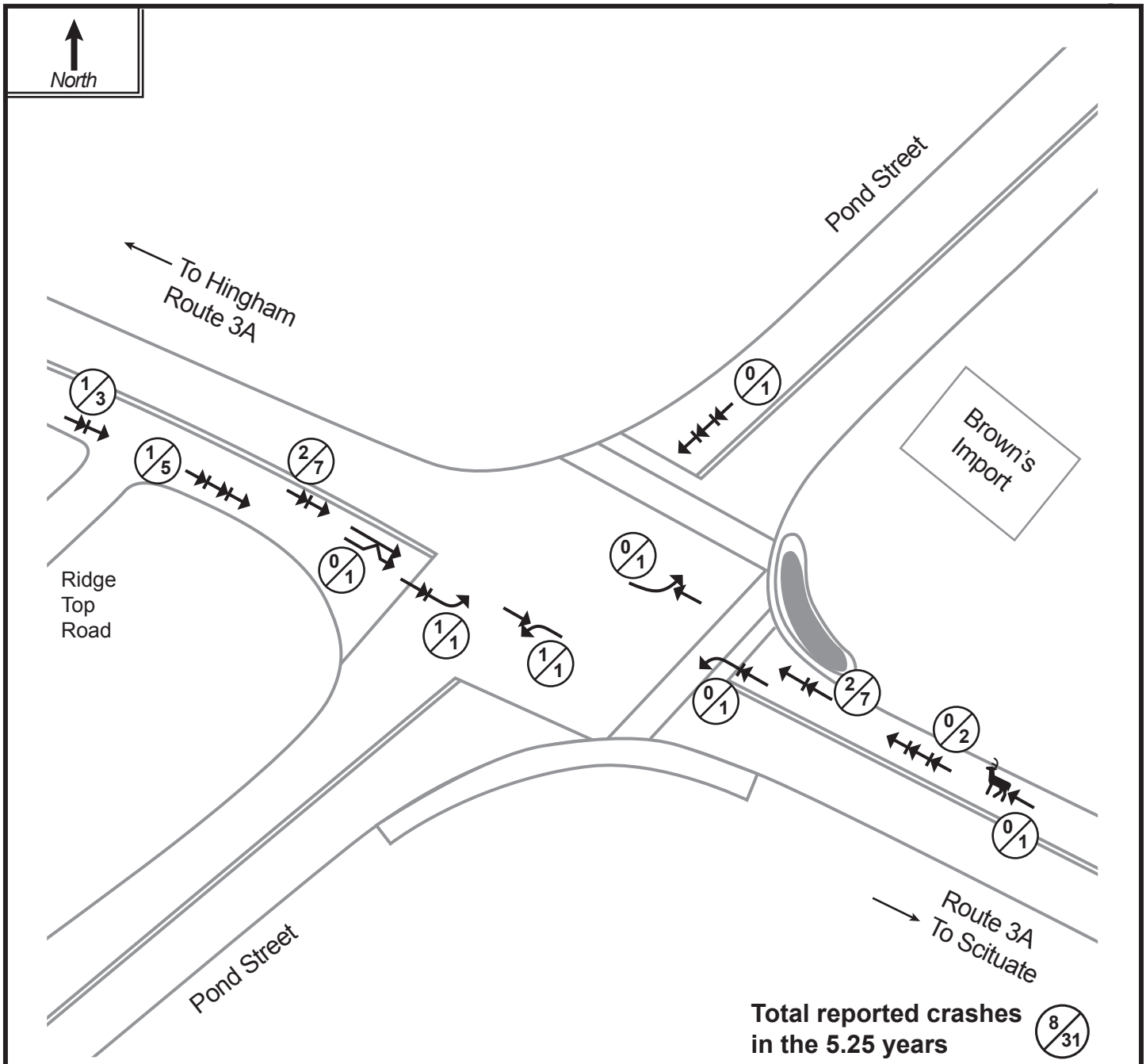
SYMBOLS	TYPES OF CRASH	SEVERITY
Moving Vehicle	Head On	A/B
Backing Vehicle	Angle	A Number of Injury Crashes
Non-Involved Vehicle	Rear End	B Total Number of Crashes
Pedestiran	Sideswipe	
Parked Vehicle	Out of Control	
Fixed Object		
Bicycle		
Animal		

Figure G-4
Collision Diagram, Cohasset Police Reports 1/1/2008–3/31/2013
Route 3A @ Stop & Shop Driveway/King Street, Cohasset



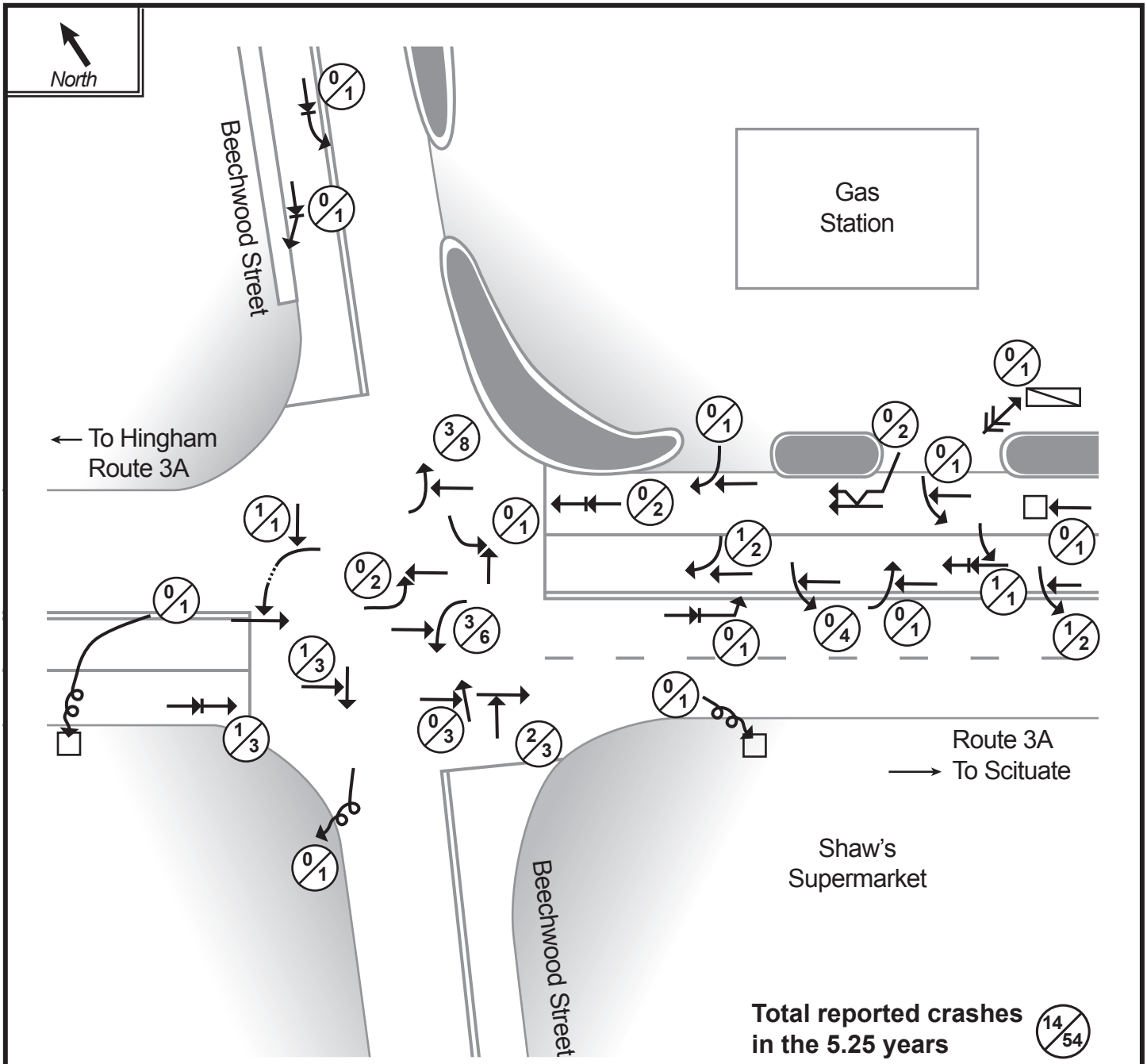
SYMBOLS	TYPES OF CRASH	SEVERITY
Moving Vehicle	Head On	A/B
Backing Vehicle	Angle	A Number of Injury Crashes
Non-Involved Vehicle	Rear End	B Total Number of Crashes
Pedestiran	Sideswipe	
Parked Vehicle	Out of Control	
Fixed Object		
Bicycle		
Animal		

Figure G-5
Collision Diagram, Cohasset Police Reports 1/1/2008–3/31/2013
Route 3A @ Pond Street, Cohasset



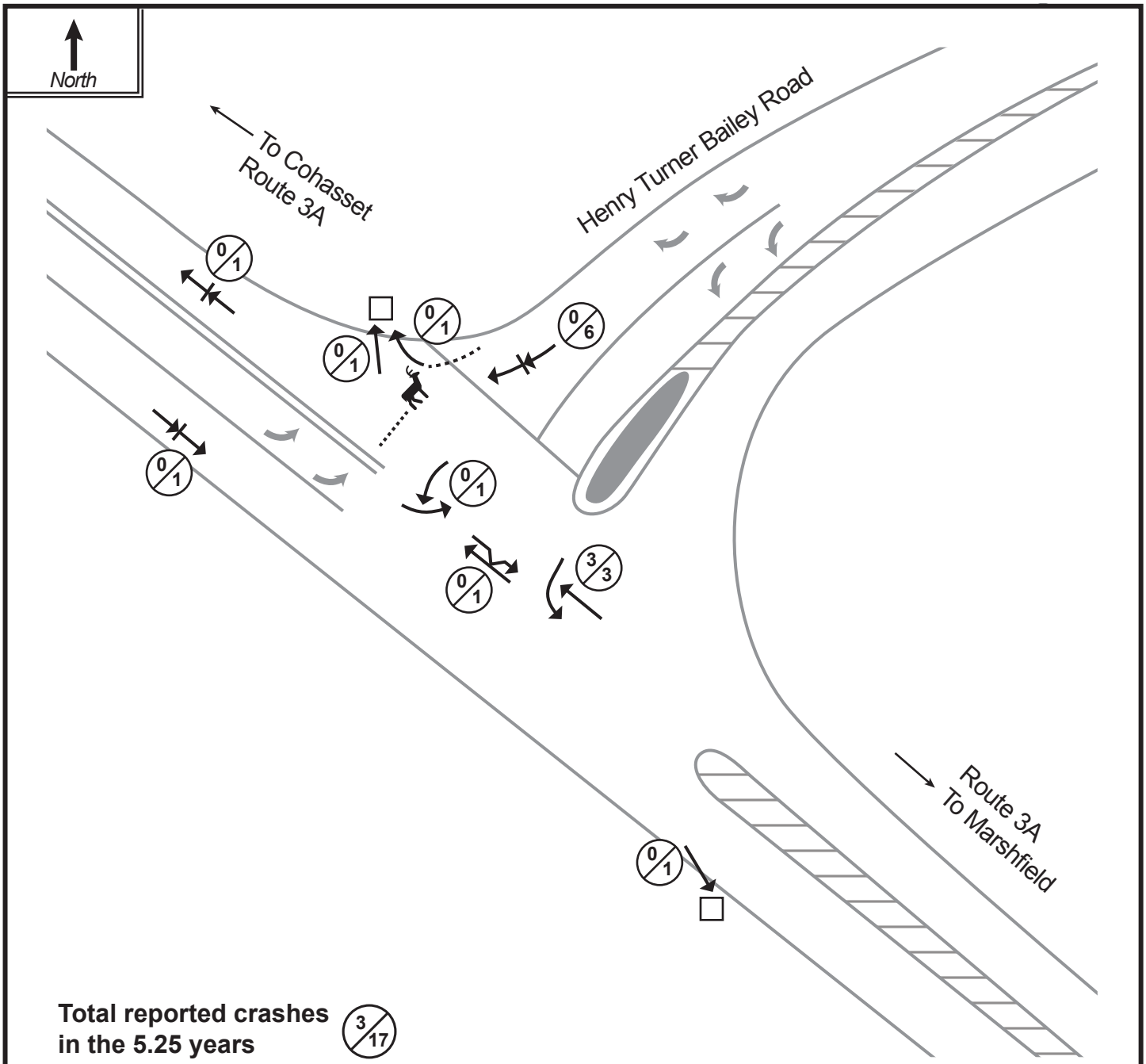
SYMBOLS	TYPES OF CRASH	SEVERITY
Moving Vehicle	Head On	A/B
Backing Vehicle	Angle	A Number of Injury Crashes
Non-Involved Vehicle	Rear End	B Total Number of Crashes
Pedestiran	Sideswipe	
Parked Vehicle	Out of Control	
Fixed Object		
Bicycle		
Animal		

Figure G-6
Collision Diagram, Cohasset Police Reports 1/1/2008–3/31/2013
Route 3A @ Beechwood Street, Cohasset



SYMBOLS	TYPES OF CRASH	SEVERITY
Moving Vehicle	Head On	A/B
Backing Vehicle	Angle	A Number of Injury Crashes
Non-Involved Vehicle	Rear End	B Total Number of Crashes
Pedestiran	Sideswipe	
Parked Vehicle	Out of Control	
Fixed Object		
Bicycle		
Animal		

Figure G-7
Collision Diagram, Scituate Police Reports 1/1/2008–3/31/2013
Route 3A @ Henry Turner Bailey Road, Scituate



SYMBOLS	TYPES OF CRASH	SEVERITY
Moving Vehicle	Head On	A/B
Backing Vehicle	Angle	A Number of Injury Crashes
Non-Involved Vehicle	Rear End	B Total Number of Crashes
Pedestiran	Sideswipe	
Parked Vehicle	Out of Control	
Fixed Object		
Bicycle		
Animal		

APPENDIX H

Preliminary Traffic Signal Warrants Analyses

Table H-1
Route 3A at King Street, Cohasset

Table H-2
Route 3A at Sohier Street, Cohasset

Table H-3
Route 3A at Henry Turner Bailey Road, Scituate

Table H-1
Summary of Hourly Volumes and Warrant Analyses
Route 3A at King Street, Cohasset

Hourly period starting	Route 3A (main street)		King Street (minor street)		Sum of main street*	Max. of minor street*	Volumes above the required minimum on main/minor street		
	NB	SB	EB	WB			Warrant 1	Warrant 2	Warrant 7
6:00	787	226	0	92	913	83	√		√
7:00	1171	449	0	168	1461	151	√	√	√
8:00	1047	548	0	175	1438	158	√	√	√
9:00	821	506	0	163	1196	147	√	√	√
10:00	657	528	0	161	1068	145	√	√	√
11:00	689	567	0	144	1132	130	√	√	√
12:00	673	558	0	154	1110	139	√	√	√
13:00	821	585	0	162	1268	146	√	√	√
14:00	723	636	0	193	1225	174	√	√	√
15:00	821	744	0	184	1411	166	√	√	√
16:00	723	808	0	170	1380	153	√	√	√
17:00	713	741	0	151	1311	136	√	√	√
18:00	542	765	0	131	1178	118	√	√	√
19:00	431	569	0	89	902	80	√		√

* Based on 4/30-5/1/2013 MassDOT ATR counts and adjusted by seasonal factor 0.92 and trend factor 0.98

Warrant 1 (8-Hour Volume) is fulfilled. It requires that the traffic conditions (observed vehicular volumes higher than the specified minimum volumes) exist for each of any 8 hours of an average day. Conditions B was applied in this case.

Warrant 2 (4-Hour Volume) is fulfilled. It requires that the traffic conditions (main street combined/minor street miximun volume falling above an applicable curve) exist for each of any 4 hours of an average day.

Warrant 7 (Crash Experience) is not fulfilled. The traffic conditions meets the volume requirement (higher than 80% of the volumes specified in Warrant 1), but does not meet the crash requirement: five or more correctable crashes in the recent 12-month period.

Table H-2
Summary of Hourly Volumes and Warrant Analyses
Route 3A at Sohier Street, Cohasset

Hourly period starting	Route 3A (main street)		Sohier Street (minor street)		Sum of main street*	Max. of minor street*	Volumes above the required minimum on main/minor street		
	NB	SB	EB	WB			Warrant 1	Warrant 2	Warrant 7
6:00	643	246	0	63	802	57			
7:00	744	510	0	132	1131	119	√	√	√
8:00	779	590	0	152	1234	137	√	√	√
9:00	637	553	0	183	1073	165	√	√	√
10:00	557	602	0	132	1045	119	√	√	√
11:00	605	667	0	170	1147	153	√	√	√
12:00	577	668	0	158	1122	142	√	√	√
13:00	556	667	0	133	1103	120	√	√	√
14:00	622	737	0	185	1225	167	√	√	√
15:00	643	844	0	226	1341	204	√	√	√
16:00	631	947	0	161	1423	145	√	√	√
17:00	593	974	0	148	1413	133	√	√	√
18:00	457	921	0	99	1242	89	√	√	√
19:00	305	634	0	118	847	106	√		√

* Based on 4/30-5/1/2013 MassDOT ATR counts and adjusted by seasonal factor 0.92 and trend factor 0.98

Warrant 1 (8-Hour Volume) is fulfilled. It requires that the traffic conditions (observed vehicular volumes higher than the specified minimum volumes) exist for each of any 8 hours of an average day. Conditions B was applied in this case.

Warrant 2 (4-Hour Volume) is fulfilled. It requires that the traffic conditions (main street combined/minor street miximun volume falling above an applicable curve) exist for each of any 4 hours of an average day.

Warrant 7 (Crash Experience) is not fulfilled. The traffic conditions meets the volume requirement (higher than 80% of the volumes specified in Warrant 1), but does not meet the crash requirement: five or more correctable crashes in the recent 12-month period.

Table H-3
Summary of Hourly Volumes and Warrant Analyses
Route 3A at Henry Turner Bailey Road, Scituate

Hourly period starting	Route 3A (main street)		H. T. Bailey Road (minor street)		Sum of main street*	Max. of minor street*	Volumes above the required minimum on main/minor street		
	NB	SB	EB	WB			Warrant 1	Warrant 2	Warrant 7
6:00	481	167	0	216	584	195			
7:00	736	373	0	277	1000	250	√	√	√
8:00	689	481	0	297	1055	268	√	√	√
9:00	530	474	0	256	905	231	√	√	√
10:00	454	539	0	227	895	205	√	√	√
11:00	494	617	0	232	1002	209	√	√	√
12:00	448	619	0	256	962	231	√	√	√
13:00	443	594	0	246	935	222	√	√	√
14:00	526	686	0	238	1093	215	√	√	√
15:00	569	789	0	274	1224	247	√	√	√
16:00	522	864	0	275	1250	248	√	√	√
17:00	519	912	0	212	1290	191	√	√	√
18:00	387	809	0	175	1078	158	√	√	√
19:00	279	576	0	130	771	117			√

* Based on 4/30-5/1/2013 MassDOT ATR counts and adjusted by seasonal factor 0.92 and trend factor 0.98

Warrant 1 (8-Hour Volume) is fulfilled. It requires that the traffic conditions (observed vehicular volumes higher than the specified minimum volumes) exist for each of any 8 hours of an average day. Conditions B was applied in this case.

Warrant 2 (4-Hour Volume) is fulfilled. It requires that the traffic conditions (main street combined/minor street miximun volume falling above an applicable curve) exist for each of any 4 hours of an average day.

Warrant 7 (Crash Experience) is not fulfilled. The traffic conditions meets the volume requirement (higher than 80% of the volumes specified in Warrant 1), but does not meet the crash requirement: five or more correctable crashes in the recent 12-month period.

APPENDIX I

Information and Guidelines: Pedestrian Hybrid Beacon

Baystate Roads Program
Local Technical Assistance Program (LTAP)
TECH notes

#65-PEDESTRIAN HYBRID BEACON

Pedestrian Hybrid Beacon:
A FHWA Proven Safety Countermeasure

The pedestrian hybrid beacon (also known as the High intensity Activated crossWalK or HAWK) is a pedestrian-activated warning device located on the roadside or on mast arms over midblock pedestrian crossings. The beacon head consists of two red lenses above a single yellow lens.

The beacon head is "dark" until the pedestrian desires to cross the street. At this point, the pedestrian will push an easy-to-reach button that activates the beacon. After displaying brief flashing and steady yellow intervals, the device displays a steady red indication to drivers and a "WALK" indication to pedestrians, allowing them to cross a major roadway while traffic is stopped. After the pedestrian phase ends, the "WALK" indication changes to a flashing orange hand to notify pedestrians that their clearance time is ending. The hybrid beacon displays alternating flashing red lights to drivers while pedestrians finish their crossings before, once again, going dark at the conclusion of the cycle.

Background

Midblock locations account for more than 70 percent of pedestrian fatalities. Vehicle travel speeds are usually higher at midblock locations, contributing to the higher injury and fatality rates at these locations. More than 80 percent of pedestrians die when hit by vehicles traveling at 40 mph or faster while less than 10 percent die when hit at 20 mph or less.

The pedestrian hybrid beacon is a great intermediate option between the operational requirements and effects of a rectangular rapid flash beacon and a full pedestrian signal because it provides a positive stop control in areas without the high pedestrian traffic volumes that typically warrant the installation of a signal. In addition, the alternating red signal heads allow vehicles to proceed once the pedestrian has cleared their side of the travel lane, thus improving vehicle traffic flow.

Installation of the pedestrian hybrid beacon has been shown to provide the following safety benefits:

- Up to a 69 percent reduction in pedestrian crashes; and
- Up to a 29 percent reduction in total roadway crashes.

Guidance

Pedestrian hybrid beacons should only be used in conjunction with a marked crosswalk. In general, they should be used if gaps in traffic are not adequate to permit pedestrians to cross, if vehicle speeds on the major street are too high to permit pedestrians to cross, or if pedestrian delay is excessive. Transit and school locations may be good places to consider using the pedestrian hybrid beacon. Chapter 4F of the Manual on Traffic Control Devices (MUTCD) contains a chapter on the pedestrian hybrid beacon and when and where it should be installed. Practitioners should follow the MUTCD guidelines, which are referenced below. Since the pedestrian hybrid beacon is a traffic control device many people are not yet familiar with, effort should be made to perform outreach to the public before implementation so there is no confusion about how the beacon operates and what drivers and pedestrians should do when encountering it.

MUTCD requirements for Pedestrian Hybrid Beacons

The following text is from Section 4F, December 2009. MUTCD 2009 Edition

Section 4F.01 Application of Pedestrian Hybrid Beacons

Support:

01 A pedestrian hybrid beacon is a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.

Option:

02 A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C), or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal.

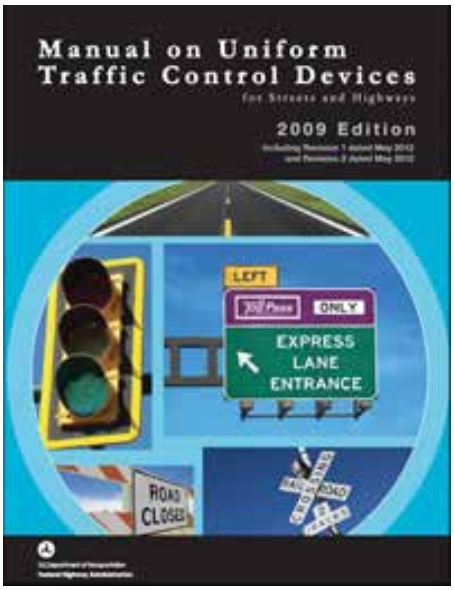
Standard:

03 **If used, pedestrian hybrid beacons shall be used in conjunction with signs and pavement markings to warn and control traffic at locations where pedestrians enter or cross a street or highway. A pedestrian hybrid beacon shall only be installed at a marked crosswalk.**

Guidance:

04 If one of the signal warrants of Chapter 4C is met and a traffic control signal is justified by an engineering study, and if a decision is made to install a traffic control signal, it should be installed based upon the provisions of Chapters 4D and 4E.

05 If a traffic control signal is not justified under the signal warrants of Chapter 4C and if gaps in traffic are not adequate to permit pedestrians to cross, or if the speed for vehicles approaching on the major street is too high to permit pedestrians to cross, or if pedestrian delay is excessive, the need for a pedestrian hybrid beacon should be considered on the basis of an engineering study that considers major-street volumes, speeds, widths, and gaps in conjunction with pedestrian volumes, walking speeds, and delay.



06 For a major street where the posted or statutory speed limit or the 85th-percentile speed is 35 mph or less, the need for a pedestrian hybrid beacon should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-1 for the length of the crosswalk.

07 For a major street where the posted or statutory speed limit or the 85th-percentile speed exceeds 35 mph, the need for a pedestrian hybrid beacon should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-2 for the length of the crosswalk.

08 For crosswalks that have lengths other than the four that are specifically shown in Figures 4F-1 and 4F-2, the values should be interpolated between the curves.

Section 4F.02 Design of Pedestrian Hybrid Beacons

Standard:

01 **Except as otherwise provided in this Section, a pedestrian hybrid beacon shall meet the provisions of Chapters 4D and 4E.**

02 **A pedestrian hybrid beacon face shall consist of three signal sections, with a CIRCULAR YELLOW signal indication centered below two horizontally aligned CIRCULAR RED signal indications (see Figure 4F-3 on page 11).**

03 **When an engineering study finds that installation of a pedestrian hybrid beacon is justified, then:**

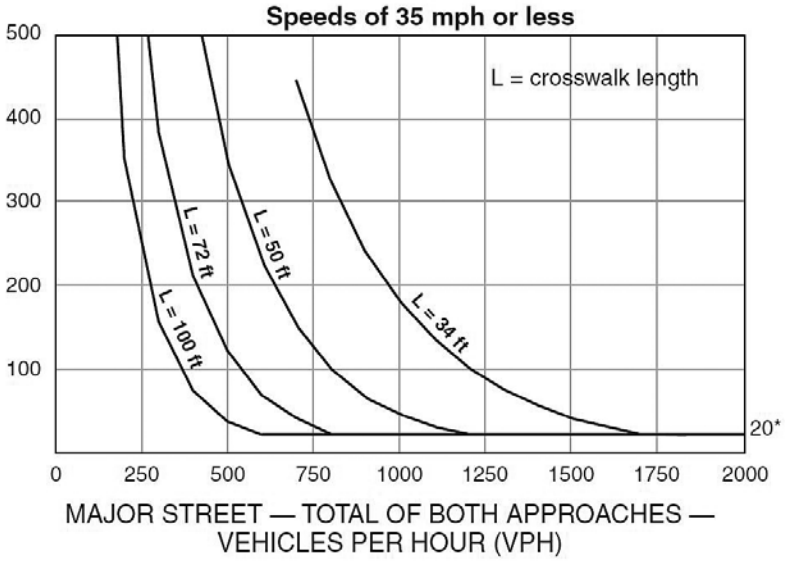
- **At least two pedestrian hybrid beacon faces shall be installed for each approach of the major street,**
- **A stop line shall be installed for each approach to the crosswalk,**
- **A pedestrian signal head conforming to the provisions set forth in Chapter 4E shall be installed at each end of the marked crosswalk, and**
- **The pedestrian hybrid beacon shall be pedestrian actuated.**

Guidance:

04 When an engineering study finds that installation of a pedestrian hybrid beacon is justified, then:

- The pedestrian hybrid beacon should be installed at least 100 feet from side streets or driveways that are controlled by

Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways



This figure shows a graph depicting numerical values for guidelines for the installation of pedestrian hybrid beacons on low-speed roadways at speeds of 35 mph or less. The figure displays four curves for different crosswalk lengths: 34 ft, 50 ft, 72 ft, and 100 ft.

* Note: 20 pph applies as the lower threshold volume

The table below shows the approximate vehicles per hour (VPH) on the major street and corresponding pedestrians per hour (PPH) for the total of all pedestrians crossing the major street.

Table for Figure 4F-1

Crosswalk length = 34 ft		Crosswalk length = 50 ft		Crosswalk length = 72 ft		Crosswalk length = 100 ft	
VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street	VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street	VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street	VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street
2000	20*	2000	20*	2000	20*	2000	20*
1750	20*	1750	20*	1750	20*	1750	20*
1500	40	1500	20*	1500	20*	1500	20*
1250	90	1250	20*	1250	20*	1250	20*
1000	190	1000	50	1000	20*	1000	20*
750	40	750	125	750	25	750	20*
500	—	500	350	500	120	500	30
250	—	250	—	250	500	250	250
225	—	225	—	225	—	225	500

* Note: 20 pph applies as the lower threshold volume.

STOP or YIELD signs,

- Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk, or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance,
- The installation should include suitable standard signs and pavement markings, and
- If installed within a signal system, the pedestrian hybrid beacon should be coordinated.

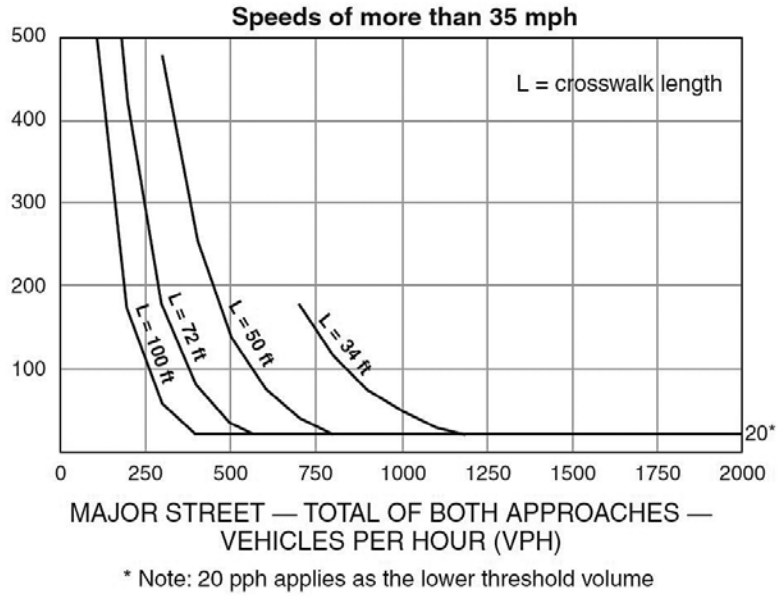
05 On approaches having posted or statutory speed limits or 85th-percentile speeds in excess of 35 mph and on approaches having traffic or operating conditions that would tend to obscure visibility of roadside hybrid beacon face locations, both of the minimum of two pedestrian hybrid beacon faces should be installed over the roadway.

06 On multi-lane approaches having a posted or statutory speed limits or 85th-percentile speeds of 35 mph or less, either a pedestrian hybrid beacon face should be installed on each side of the approach (if a median of sufficient width exists) or at least one of the pedestrian hybrid beacon faces should be installed over the roadway.

07 A pedestrian hybrid beacon should

Continued on next page

Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways



This figure shows a graph depicting guidelines for the installation of pedestrian hybrid beacons on high-speed roadways at speeds of more than 35 mph. The figure displays four curves for different crosswalk lengths: 34 ft, 50 ft, 72 ft, and 100 ft.

The table below shows the approximate vehicles per hour (VPH) on the major street and corresponding pedestrians per hour (PPH) for the total of all pedestrians crossing the major street.

Table for Figure 4F-2

Crosswalk length = 34 ft		Crosswalk length = 50 ft		Crosswalk length = 72 ft		Crosswalk length = 100 ft	
VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street	VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street	VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street	VPH on the major street (Total of both approaches)	PPH for total of all pedestrians crossing the major street
2000	20*	2000	20*	2000	20*	2000	20*
1750	20*	1750	20*	1750	20*	1750	20*
1500	20*	1500	20*	1500	20*	1500	20*
1250	20*	1250	20*	1250	20*	1250	20*
1000	50	1000	20*	1000	20*	1000	20*
750	150	750	25	750	20*	750	20*
500	—	500	150	500	25	500	20*
250	—	250	—	250	300	250	100
225	—	225	—	225	—	225	500

* Note: 20 pph applies as the lower threshold volume.

comply with the signal face location provisions described in Sections 4D.11 through 4D.16.

Standard:

08 **A CROSSWALK STOP ON RED (symbolic circular red) (R10-23) sign (see Section 2B.53) shall be mounted adjacent to a pedestrian hybrid beacon face on each major street approach. If an overhead pedestrian hybrid beacon face is provided, the sign shall be mounted adjacent to the overhead signal face.**

Option:

09 A Pedestrian (W11-2) warning sign (see Section 2C.50) with an AHEAD (W16-9P) supplemental plaque may be placed in advance of a pedestrian hybrid beacon. A warning beacon may be installed to supplement the W11-2 sign.

Guidance:

10 If a warning beacon supplements a W11-2 sign in advance of a pedestrian hybrid beacon, it should be programmed to flash only when the pedestrian hybrid beacon is not in the dark mode.

Standard:

11 **If a warning beacon is installed to supplement the W11-2 sign, the design and location of the warning beacon shall comply with the provisions of Sections 4L.01 and 4L.03.**

Section 4F.03 Operation of Pedestrian Hybrid Beacons

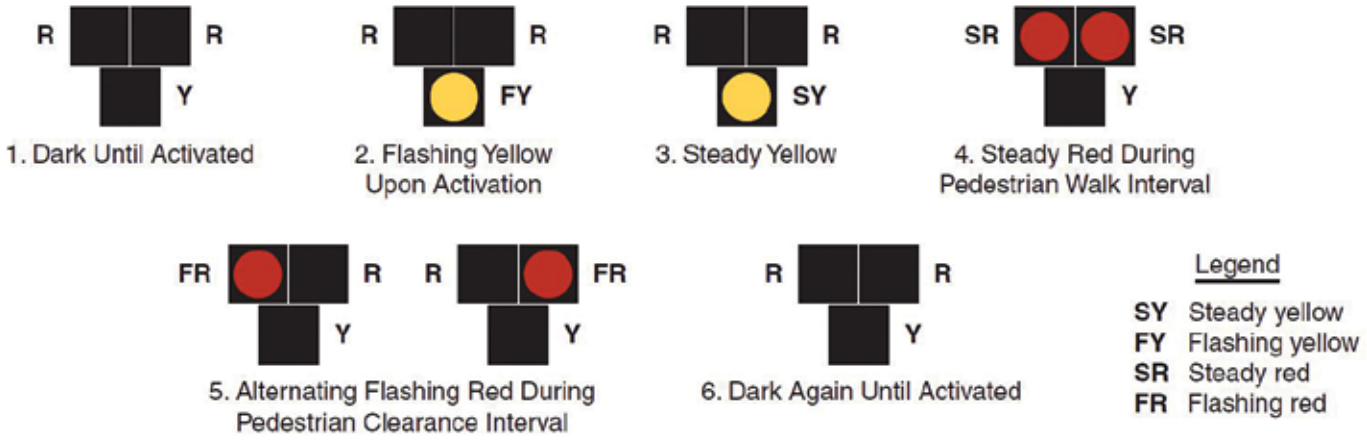
Standard:

01 **Pedestrian hybrid beacon indications shall be dark (not illuminated) during periods between actuations.**

02 **Upon actuation by a pedestrian, a pedestrian hybrid beacon face shall display a flashing CIRCULAR yellow signal**

Please see MUTCD on page 10

Figure 4F-3. Sequence for a Pedestrian Hybrid Beacon



Each interval is shown as a signal face having three lenses: two horizontally aligned with a third centered under them.

- **The first interval is labeled "1. Dark Until Activated." It shows black squares for a circular red signal (not shown) to the left of a circular red signal (not shown) above a black square for a circular yellow signal (not shown).**
- **The second interval is labeled "2. Flashing Yellow Upon Activation." It shows black squares for a circular red signal (not shown) to the left of a circular red signal (not shown) above a circular yellow signal labeled "flashing yellow."**
- **The third interval is labeled "3. Steady Yellow." It shows black squares for a circular red signal (not shown) to the left of a circular red signal (not shown) above a circular yellow signal labeled "steady yellow."**
- **The fourth interval is labeled "4. Steady Red During Pedestrian Walk Interval." It shows a circular red signal to the left of a circular red signal, both labeled "steady red" above a black square for a circular yellow signal (not shown).**
- **The fifth interval is labeled "5. Alternating Flashing Red During Pedestrian Clearance Interval." It shows a circular red signal labeled "flashing red" to the left of a black square for a circular red signal (not shown) above a black square for a circular yellow signal (not shown). To the right, the same arrangement is shown, except the circular red signal labeled "flashing red" is shown at the top right instead of the top left.**
- **The sixth interval is labeled "6. Dark Again Until Activated." It shows black squares for a circular red signal (not shown) to the left of a circular red signal (not shown) above a black square for a circular yellow signal (not shown).**

MUTCD

Continued from page 11

indication, followed by a steady CIRCULAR yellow signal indication, followed by both steady CIRCULAR RED signal indications during the pedestrian walk interval, followed by alternating flashing CIRCULAR RED signal indications during the pedestrian clearance interval (see Figure 4F-3 on page 11). Upon termination of the pedestrian clearance interval, the pedestrian hybrid beacon faces shall revert to a dark (not illuminated) condition.

03 **Except as provided in Paragraph 4, the pedestrian signal heads shall continue to display a steady UPRAISED HAND (symbolizing DON'T WALK) signal indication when the pedestrian hybrid beacon faces are either dark or displaying flashing or steady CIRCULAR yellow signal indications. The pedestrian signal heads shall display a WALKING PERSON (symbolizing WALK) signal indication when the pedestrian hybrid beacon faces are displaying steady CIRCULAR RED signal indications. The pedestrian signal heads shall display a flashing UPRAISED HAND (symbolizing DON'T WALK) signal indication when the pedestrian hybrid beacon faces are displaying alternating flashing CIRCULAR RED signal indications. Upon termination of the pedestrian clearance interval, the pedestrian signal heads shall revert to a steady UPRAISED HAND (symbolizing DON'T WALK) signal indication.**

Option:

04 Where the pedestrian hybrid beacon is installed adjacent to a roundabout to facilitate crossings by pedestrians with visual disabilities and an engineering study determines that pedestrians without visual disabilities can be allowed to cross the roadway without actuating the pedestrian hybrid beacon, the pedestrian signal heads may be dark (not illuminated) when the pedestrian hybrid beacon faces are dark.

Guidance:

05 The duration of the flashing yellow interval should be determined by engineering judgment.

Standard:

06 **The duration of the steady yellow change interval shall be determined using engineering practices.**

Guidance:

07 The steady yellow interval should have a minimum duration of 3 seconds and a maximum duration of 6 seconds (see Section 4D.26). The longer intervals should be reserved for use on approaches with higher speeds.

References

The Manual on Uniform Traffic Control Devices(MUTCD)
Published by the FHWA, the MUTCD defines the standards used by transportation professionals nationwide to install and maintain traffic control devices on all streets and highways. The most recent version (2009) can be found at http://mutcd.fhwa.dot.gov/index.htm

Proven Safety Countermeasures, Pedestrian Hybrid Beacon
U.S. Department of Transportation Federal Highway Administration. FHWA-SA-12-012
http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_012.htm

The Baystate Roads Program *is a cooperative effort of the Federal Highway Administration, Massachusetts Department of Transportation (MassDOT), and the University of Massachusetts. Program Director, Dr. John Collura, and Program Manager, Dr. Christopher J. Ahmadjian, provide technology transfer assistance to all communities in the Commonwealth. Our purpose is to provide information and training on transportation and related topics, to answer the needs and problems of local agencies, to identify and transfer new technologies and innovations into a usable format, and to operate as a link between transportation research and practicing highway personnel.* ***www.baystateroads.org.***

APPENDIX J

Route 3A Study Comments
Collected by Cohasset Project Management and Planning Department
11/5/2013

#	Location/ Intersection	Comments
1	**General Comments & Speed Limits**	Agrees with the long term recommendations to install a sidewalk for pedestrians and a wide shoulder for bicycles in all sections of the corridor
2		Recommends that the speed limit between Pond St. and Beechwood St. be reduced from 50 mph to 45 mph
3		Recommends that the speed limit between King St. and Sanctuary Pond Rd. be reduced from 50 mph to 45 mph
4		Many vehicles do not reduce their speed to 35 mph in marked areas
5		Disagrees in raising the speed limit from 45 mph to 50 mph in proposed segments, especially when the speed limit is going to be reduced to 35 mph
6		Recommends that there needs to be definitive left turn lanes with left turn arrows on 3A
7		Recommends that the speed limit between Stop and Shop and Beechwood St. be reduced from 45 mph to 40 mph; the 35 mph zone is appropriate
8		Suggests that the speed limit from the Hingham town line to the train station lights be reduced to 40 mph; also the speed limit should be reduced from the train station lights all the way to the Scituate town line to 35 mph
9		Recommends drastically lowering the speed limit the lower part 3A to allow for easier access to the surrounding businesses (dunkin' donuts, marylou's, Avalon, etc)
10		It seems to me that the major intersections of Beechwood and Pond are dangerous less from a structural issue and more from a lack of enforcement of the speed limit and cars running yellow/red lights. Much improvement could be attained immediately from such enforcement. Additionally, lowering the speed limit and making it consistent from the Scituate-Cohasst border to the train station would improve matters greatly.
11	**Henery Turner Baily Road / RT 3A**	Agrees with the short, medium, and long-term recommendations at the intersection of Henry Turner Bailey Road
12		Supports improvements of reducing curb cuts at his other property (Aubuchon hardware) but would like to adjust their proposed location
13	**Beechwood St. / RT 3A**	Agrees in principal with the medium-term recommendations at the Beechwood St. intersection; it should be noted that the medium-term solution may require installation of new mast arms to properly provide for left turn lane signals
14		Agrees with the recommendation to reconfigure the 4-lane section to a 3-lane section with a center left turn lane/median; this will allow for wider shoulders for bicycles. Also recommendeds that this improvement be considered as part of MassDOT's next pavement maintenance program
15		Beechwood Street lights - look at the queue on Beechwood Street - Need to time the light better to allow for the vehicles in the max queue to pass onto 3A
16		Beechwood Street lights- Need to include a delay from the red to green in both direction to avoid accidents from those running the red light and those jumping on the green light
17		Nissan Dealership doe not have a shared access with the adjacent property - need a separate left/right turn curb cut
18		Beechwood Street lights - 3A northbound -Shorten the left turn bay lane onto Beechwood, and install center left turn lane into gas station and Nissan Dealership
19		Concerned that 41+ new homes will increase traffic on both 3A and Beechwood St.
20		Concerned about the potentially dangerous left hand turn when headed South on 3A turning onto Beechwood St.; If two cars, one headed South and the other North, make left turns simultaneously at this intersection often the right lane is obscured from view which can result in increased accidents.
21		Concerned about the "delayed green light" when attempting to make a left turn off of 3A; this delayed green light is rarely received
22		The intersection at 3A and Beechwood needs to have dedicated left-turn lanes with left-turn arrows
23		Recommends that the current Beechwood intersection be re-thought due to high traffic and accident rates

#	Location/ Intersection	Comments
24		Recommends that a rotary be installed at the intersection of 3A and Beechwood St.; This would keep traffic moving while ensuring people slow down when approaching the intersection ideally reducing accidents
25	**Pond St. / RT 3A**	Agrees with long-term recommendation to install left turn lanes at the intersection of Route 3A and Pond St.
26		Recommends that there be a light installed with a left turn arrow at the bottom of pond street where it meets 3A, concerned about the amount of traffic build up especially for school drop off and pick up in the morning and afternoon. If the light can't be installed then the speed limit should be reduced to make turning off of 3A more managable
27	**King St. / RT 3A**	Establish a center two-way left turn lane for the King St. Shopping Center as suggested
28	**Sohier St. / RT 3A**	Agrees with short and long term improvements at the intersection of 3A and Sohier St.
29		Recommends that a traffic light be installed at the intersection of Sohier St. and 3A
30		Recommends that there be an enterance at the backside of the Stop and Shop Plaza so people can take a left off of Sohier St into the Plaza without having to turn onto 3A first
31		Boat Yard Storage business - Concerned with turn radius to tow boats on and off the lot with proposed curb cut configuration in study
32		Concerned with reduction of traffic to businesses due to reduction in curb cuts, 2 to 1
33		The safety issues at Sohier Street and lower King Street could benefit immediately from right only turns during rush hour traffic hours and would also require enforcement. Ultimately, traffic lights at these locations might be necessary.
34		Supports all improvements proposed at stop and shop complex including back driveway
35		Recommends that there needs to either be a cross walk or pedestrian crossing light at the bottom of Avalon; concerned that there are hundreds of people who are bound to their cars to leave their homes because of dangerous crossing situation
36	**(Lower) King St. / RT 3A**	Recommends that as a medium-term improvement, a traffic signal should be installed at the intersection of Route 3A and King St. as part of mitigation for development; also what is the status of development in this area and the feasibility of requiring this type of mitigation?
37		The safety issues at Sohier Street and lower King Street could benefit immediately from right only turns during rush hour traffic hours and would also require enforcement. Ultimately, traffic lights at these locations might be necessary.
38		Recommends that there be a traffic light installed at the intersetion of lower King St. and RT 3A
39		Concerned about the intersection of 3A and lower King St. - speed limit should be reduced and better mark a right turn lane
40	**RT 228 / RT 3A**	Concerned about the intersection of 3A and RT 228 - when making a right off of 3A onto 228, heading towards West Corner, you have to turn off before the island with ornamental grass and merge onto 228, however, the height of the grass makes it hard to see oncomming traffic and difficult to merge
41		Recommends that the right and left turn lanes at the intersection of RT 228 and 3A be extended on both sides to reduce traffic build up