

Duxbury Route 3A Corridor Study

February 2017

Prepared Under through the Old Colony Unified Planning Work Program under MassDOT Contract 88826

Prepared By:
Old Colony Planning Council
70 School Street
Brockton, MA. 02301
508-583-1833 www.ocpcrpa.org

Notice of Nondiscrimination Rights and Protections to Beneficiaries

Federal "Title VI/Nondiscrimination" Protections

The Old Colony Metropolitan Planning Organization (MPO) operates its programs, services, and activities in compliance with federal nondiscrimination laws including Title VI of the Civil Rights Act of 1964 (Title VI), the Civil Rights Restoration Act of 1987, and related statutes and regulations. Title VI prohibits discrimination in federally assisted programs and requires that no person in the United States of America shall, on the grounds of **race, color, or national origin** (including **limited English proficiency**), be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving federal assistance. Related federal nondiscrimination laws administered by the Federal Highway Administration, the Federal Transit Administration, or both prohibit discrimination on the basis of **age, sex, and disability**. These protected categories are contemplated within the Old Colony MPO's Title VI Programs consistent with federal interpretation and administration. Additionally, the Old Colony MPO provides meaningful access to its programs, services, and activities to individuals with limited English proficiency, in compliance with US Department of Transportation policy and guidance on federal Executive Order 13166.

State Nondiscrimination Protections

The Old Colony MPO also complies with the Massachusetts Public Accommodation Law, M.G.L. c 272 §§ 92a, 98, 98a, prohibiting making any distinction, discrimination, or restriction in admission to or treatment in a place of public accommodation based on **race, color, religious creed, national origin, sex, sexual orientation, disability, or ancestry**. Likewise, the Old Colony MPO complies with the Governor's Executive Order 526, section 4 requiring all programs, activities, and services provided, performed, licensed, chartered, funded, regulated, or contracted for by the state shall be conducted without unlawful discrimination based on **race, color, age, gender, ethnicity, sexual orientation, gender identity or expression, religion, creed, ancestry, national origin, disability, veteran's status** (including Vietnam-era veterans), or **background**.

Additional Information

To request additional information regarding Title VI and related federal and state nondiscrimination obligations, please contact:

Old Colony Planning Council
Title VI/ Nondiscrimination Coordinator
Pat Ciaramella
70 School Street
Brockton, MA 02301
508-583-1833 Extension 202
pciaramella@ocpcrpa.org

Title VI Specialist
MassDOT, Office of Diversity and Civil Rights
10 Park Plaza
Boston, MA 02116
857-368-8580
TTY: 857-368-0603
MASSDOT.CivilRights@state.ma.us

Complaint Filing

To file a complaint alleging a violation of Title VI or related federal nondiscrimination law, contact the Title VI Specialist (above) within 180 days of the alleged discriminatory conduct.

To file a complaint alleging a violation of the state's Public Accommodation Law, contact the Massachusetts Commission Against Discrimination within 300 days of the alleged discriminatory conduct at:

Massachusetts Commission Against Discrimination (MCAD)
One Ashburton Place, 6th Floor
Boston, MA 02109
617-994-6000
TTY: 617-994-6196

Translation

English

If this information is needed in another language, please contact the MPO Title VI Coordinator at 508-583-1833 ext. 202.

Spanish

Si necesita esta información en otro idioma, por favor contacte al coordinador de MPO del Título VI al 508-583-1833 ext. 202.

Portuguese

Caso estas informações sejam necessárias em outro idioma, por favor, contate o Coordenador de Título VI da MPO pelo telefone 508-583-1833, Ramal 202

Chinese Simple

如果需要使用其它语言了解信息，请联系Old Colony大都会规划组织（MPO）《民权法案》第六章协调员，电话508- 583-1833，转202。

Chinese Traditional

如果需要使用其他語言瞭解資訊，請聯繫Old Colony大都會規劃組織（MPO）《民權法案》第六章協調員，電話508- 583-1833，轉202。

Vietnamese

Nếu quý vị cần thông tin này bằng tiếng khác, vui lòng liên hệ Điều phối viên Luật VI của MPO theo số điện thoại 508- 583-1833, số máy nhánh 202.

Haitian Creole

Si yon moun bezwen enfòmasyon sa a nan yon lòt lang, tanpri kontakte Koòdonatè a Title VI MPO nan 508-583-1833 ext. 202.

French Creole

Si yon moun vle genyen enfòmasyon sa yo nan yon lòt lang, tanpri kontakte Kowòdinatè MPO Title VI la nan nimewo 508-583-1833, ekstansyon 202.

Russian

Если Вам необходима данная информация на любом другом языке, пожалуйста, свяжитесь с Координатором Титула VI в МРО по тел: 508-583-1833, добавочный 202.

French

Si vous avez besoin d'obtenir une copie de la présente dans une autre langue, veuillez contacter le coordinateur du Titre VI de MPO en composant le 508-583-1833, poste 202.

Italian

Se ha bisogno di ricevere queste informazioni in un'altra lingua si prega di contattare il coordinatore MPO del Titolo VI al 508- 583-1833 interno 202

Mon-Khmer, Cambodian

ប្រសិនបើលោក-អ្នកត្រូវការបកប្រែពីភាសានេះ សូមទាក់ទងអ្នកសម្របសម្រួលជំពូកទី**6** របស់ **MPO** តាមរយៈលេខទូរស័ព្ទ **508-583-1833** រួចភ្ជាប់ទៅលេខ **202**។

Arabic

إذا كنت بحاجة إلى هذه المعلومات بلغة أخرى، يُرجى الاتصال بمنسق الفقرة السادسة لمنظمة التخطيط الحضري على الهاتف: 508- 583-1833 و ثم اضغط الأرقام 202.

Updated April 2015

Old Colony Planning Council

Old Colony Metropolitan Planning Organization (MPO)

The Honorable William Carpenter	Mayor, City of Brockton
Kenneth Tavares	Chairman, Board of Selectmen, Town of Plymouth
Eldon Moreira	Vice Chairman, Board of Selectmen, Town of West Bridgewater
Daniel Salvucci	Vice Chairman, Board of Selectmen, Town of Whitman
Stephanie Pollack	Secretary and CEO, Massachusetts Department of Transportation (MassDOT)
Jonathan Gulliver	Highway Administrator, Massachusetts Department of Transportation (MassDOT)
Reinald Ledoux, Jr.	Administrator, Brockton Area Transit Authority (BAT)
Frank Staffier	President, Old Colony Planning Council (OCPC)

Joint Transportation Committee (JTC)

JTC Officers

JTC Chairman	Noreen O'Toole
JTC Vice Chairman	Sid Kashi, P.E.

COMMUNITY	DELEGATE / ALTERNATE
Abington - Delegate	John Stone
Abington - Alternate	Bruce Hughes
Avon - Delegate	William Fitzgerald
Bridgewater - Delegate	Robert Wood
Brockton - Delegate	Lawrence Rowley
Duxbury - Delegate	Peter Buttkus
East Bridgewater - Delegate	John Haines
Easton - Delegate	David Field, P.E.
Easton - Alternate	Greg Swan, P.E.
Halifax - Delegate	R. Steven Hayward
Hanson - Delegate	Donald Howard
Hanover - Delegate	Victor Diniak
Kingston - Delegate	Paul Basler
Pembroke - Delegate	Gene Fulmine
Plymouth - Delegate	Sid Kashi, P.E.
Plymouth - Alternate	James Downey
Plympton - Delegate	Jim Mulcahy
Stoughton - Delegate	Noreen O'Toole
Stoughton - Alternate	Marc Tisdelle
West Bridgewater - Delegate	Chris Iannitelli
Whitman - Delegate	Daniel Salvucci
Delegate-at-Large	Troy E. Garron

Agency Representation

MassDOT	David Mohler, AICP
MassDOT	Derek Krevat
MassDOT District 5	Mary-Joe Perry
MassDOT District 5	Pamela Haznar, P.E.
MassDOT District 5	Timothy Kochan
BAT	Reinald Ledoux, Jr.
BAT	Kathy Riddell
BAT	Glenn Ann Geiler
FHWA	Jeff McEwen
FHWA	Kenneth Miller
FHWA	Nelson Hoffman
FTA	Mary Beth Mello
FTA	Peter Butler
FTA	Leah Sirmin
FTA	Kristin Wood
Brockton Traffic Commission	Captain John Hallisey

OCPC Transportation Staff

Charles Kilmer, AICP	Assistant Director/ Transportation Program Manager
Shawn Bailey	Transportation Planner
Paul Chenard	Senior Transportation Planner
Raymond Guarino	Senior Transportation Planner
William McNulty	Senior Transportation Planner
Kyle Mowatt	Transportation Planner
Jimmy Pereira	Community/ Transportation Planner
Andrew Vidal	GIS Manager/ Communications and IT Specialist

Old Colony Planning Council (OCPC)

OCPC Officers

President	Frank P. Staffier
Treasurer	Christine Joy
Secretary	Fred Gilmetti

COMMUNITY	DELEGATE	ALTERNATE
Abington	David Klein	Christopher Aiello
Avon	Frank Staffier	Charles Marinelli
Bridgewater	Sandra Wright	
Brockton	Robert Moran, Jr.	Preston Huckabee, P.E.
Duxbury	Valerie Massard, AICP	George Wadsworth
East Bridgewater		
Easton	Jeanmarie Kent Joyce	
Halifax	John Mather	
Hanson	Robert Overholtzer	Phillip Lindquist
Hanover	Michaela Shoemaker	
Kingston	Robert Downey	Paul Basler
Pembroke	Daniel Trabucco	Daniel Taylor
Plymouth	Lee Hartmann, AICP	
Plympton	Christine Joy	James Mulcahy
Stoughton	Robert Kuver	Forrest Lindwall
West Bridgewater	Eldon Moreira	
Whitman	Fred Gilmetti	Daniel Salvucci
Delegate-at-Large	Troy Garron	

OCPC Staff

Pasquale Ciaramella	Executive Director
Janet McGinty	Fiscal Officer
Brenda Robinson	Fiscal Officer
Patrick Hamilton	AAA Administrator
Lila Burgess	Ombudsman Program Director
Jane Selig	Ombudsman Program Assistant
Laurie Muncy	Principal Comprehensive Planner
Lisa Sullivan	Senior Planner
Jimmy Pereira	Community/ Transportation Planner
Bruce Hughes	Economic Development/ Community Planner
Andrew Vidal	GIS Manager/ Communications and IT Specialist
Charles Kilmer, AICP	Assistant Director/ Transportation Program Manager
Paul Chenard	Senior Transportation Planner
Raymond Guarino	Senior Transportation Planner
William McNulty	Senior Transportation Planner
Kyle Mowatt	Transportation Planner
Shawn Bailey	Transportation Planner

Contents

Introduction	1
Study Purpose and Scope.....	1
Community Profile, Environmental Justice, and Title VI	1
Public Outreach.....	1
Public Survey.....	2
Outreach to Greater Attleboro Taunton Regional Transit Authority (GATRA)	11
Outreach to Highway Safety Committee	11
Previous Studies and Planned Development.....	12
Existing Conditions.....	12
Mainline Conditions	13
Average Daily Traffic, Prevailing Speeds, and Heavy Vehicles	13
Crash History.....	15
Pavement Conditions.....	17
Pedestrian and Bicycle Accommodations.....	21
Intersection Conditions (Level of Service and Crash History).....	21
Enterprise Street / Tremont Street / Enterprise Street (Route 3A) at Tremont Street and Church Street (Route 139)	21
Tremont Street (Route 3A) at St. George Street / West Street (Route 14).....	22
Tremont Street (Route 3A) at Alden Street.....	24
Tremont Street (Route 3A) at Harrison Street	25
Tremont Street (Route 3A) at Depot Street	27
Tremont Street (Route 3A) at Mayflower Street.....	28
Tremont Street (Route 3A) at Tobey Garden Street / Chestnut Street.....	29
Tremont Street (Route 3A) at Soule Avenue / Elm Street.....	31
Tremont Street (Route 3A) at Parks Street / Oak Street	33
Tremont Street (Route 3A) at Route 3 Northbound Ramps.....	34
Tremont Street (Route 3A) at Route 3 Southbound Ramps.....	36
Environmental Issues and Constraints.....	38

Future Conditions and Operations	38
Planned Improvements.....	38
Sustainability and Livability	38
Community Health	39
Conclusions and Recommendations.....	40
Complete Streets and Pedestrian Improvements	40
Resurfacing and Drainage Improvements	41
Intersection of Route 3A at Church Street and Enterprise Street (Route 139)	41
Intersection of Route 3A at West Street (Route 14) and Saint George Street	42
Intersection of Route 3A at Chestnut Street and Tobey Garden Street.....	42
Route 3A at Route 3 Exit 10 Ramps	43

Introduction

Study Purpose and Scope

This Route 3A Corridor Study is a comprehensive traffic study of the entire length of Route 3A and its intersections in the town of Duxbury, from the Marshfield Town Line on the northern terminus of the study area to the Kingston Town Line on the southern terminus. The primary purpose of this study is to present an assessment of efficiency (congestion), safety, and mobility along the Route 3A Corridor in Duxbury for all roadway users, including motorists, pedestrians, bicyclists, and transit users, as well as identify potential projects for mitigating deficiencies as they relate to all modes on this highway.

Community Profile, Environmental Justice, and Title VI

The 2010 Census population for Duxbury was 15,059. Based on the 2010 Census data, there are no Environmental Justice area or Title VI populations of significance within or abutting the study area. Duxbury is a (relative to the region) affluent community of a predominantly white population, with a 2010 median household income of \$120,253 and 97.3 percent of the population identifying themselves as “White” in the Census.

According to analysis performed using the Census Bureau’s *Longitudinal Employment Household Dynamic (LEHD)* tool, most of the jobs based in Duxbury are located in areas along and to the east of the Route 3A corridor. Specifically, the Island Creek development area located on the southern end of the Route 3A corridor, Halls Corner to the east of Route 3A on Chestnut Street and Depot Street, and the school and library area on St. George Street are significant employment areas in the town. Duxbury, like many towns on the South Shore, is a typical “bedroom community” with a disproportionate number of residents commuting out of Duxbury for employment than commuters coming into Duxbury. Based on 2014 Labor Department data, 5,599 workers living in Duxbury travel out of town for employment (mostly to the northwest to Boston and locations along the Route 3 corridor), while 436 live and work within the Town. There was a total of 1,529 commuters coming into Duxbury for employment from outside communities.

Public Outreach

Public opinion on the Route 3A Corridor in Duxbury was largely achieved through the use of a public survey, which was publically advertised in local print and social media, and discussed on WATD-FM (99.5), a radio station with a news department covering Duxbury and the entire South Shore. Interviews with stakeholders were also conducted to gather input on the needs of those in the community along with those utilizing Route 3A on a regular basis.

Public Survey

A survey was utilized to gather public input and insight from those who use the Route 3A corridor or are otherwise familiar with the roadway. It was launched on April 1, 2016, and was publically available in print format at places of convenience in Duxbury for 3 weeks, through April 22nd. The online version continued to be advertised on websites and social media through May 13th (6 weeks) for anyone who missed the opportunity to pick up a printed copy in Duxbury. Printed hardcopies of the survey were available at the following locations in Duxbury:

- Duxbury Senior Center / Council on Aging
- Duxbury Free Library
- Duxbury Town Hall

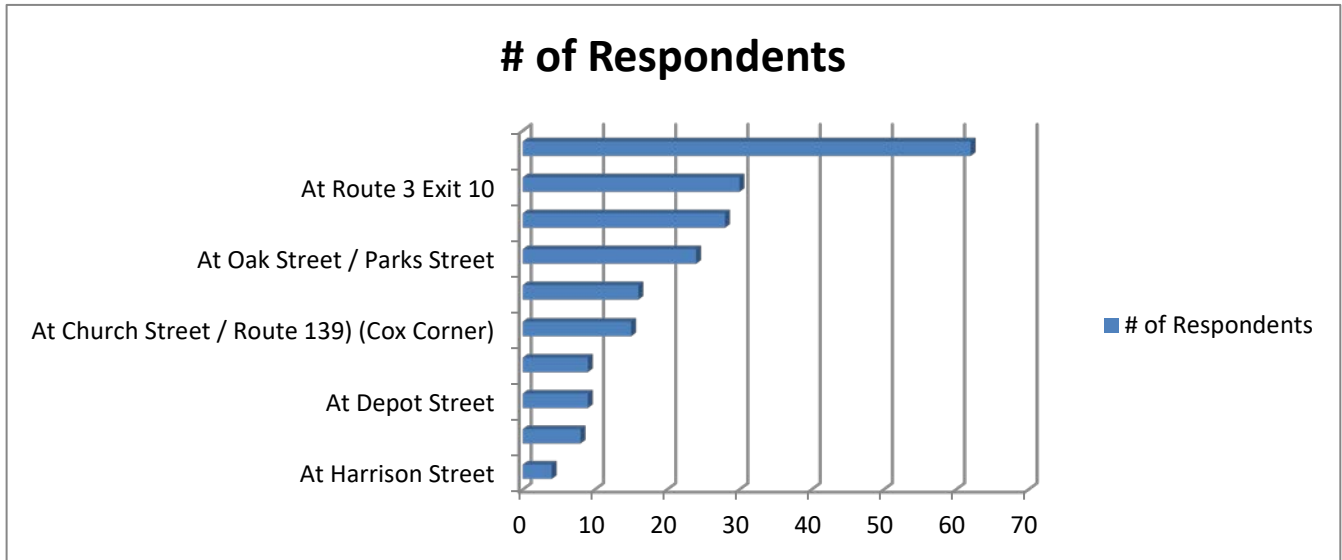
Those participating in the survey using the printed version were invited to either mail the survey directly to Old Colony Planning Council, or leave the survey with either the Duxbury Senior Center or the Duxbury Planning Department at Duxbury Town Hall.

In total, 127 participants (112 online, 15 on printed hard copies) had responded to the survey in the 6 week period from April 1, 2016 to May 13, 2016.

Question 1: At what intersection(s) or location(s) do you typically experience congestion or delays within the Route 3A Corridor in Duxbury?

Out of 127 survey participants, 117 (92 percent) chose to answer the question and provided at least one location along Route 3A where they typically experience delay. Participants were allowed to provide as many locations as they chose, and many provided more than one location. Figure 1 graphically depicts how respondents answered.

Figure 1: Responses to Question 1



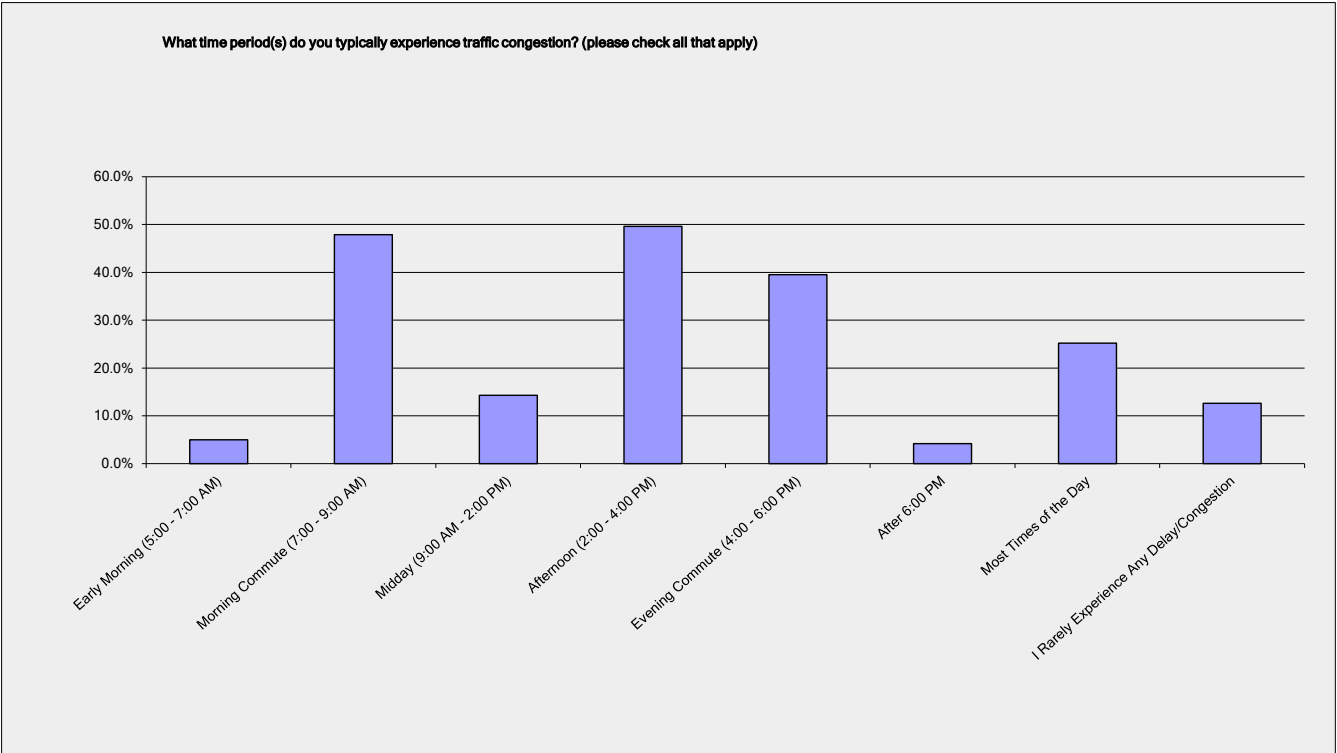
Overwhelmingly, the most popular answer to Question 1 was the intersection of Route 3A at Chestnut Street and Tobey Garden Street. This is consistent with consultation with town staff and conversation with residents, most of whom also mentioned this intersection as being an issue in regard to both congestion and safety. The interchange of Route 3A at Route 3 Exit 10, and the intersections of Route 3A and Alden Street and Route 3A at Oak Street and Parks Street were also popular answers.

Question 2: What time period(s) do you typically experience traffic congestion (check all that apply)

Figure 2 displays how respondents answered the 2nd question in the survey: which time period(s) do they typically experience traffic congestion. The responses to both this question and Question 1 reveal that school-based trips have a major impact on the traffic pattern on the Route 3A corridor, with the most popular answer for when congestion occurs being during the early afternoon when schools are being dismissed. Many in Question 1 indicated that heavy queues often form at the Alden Street and St. George Street intersections during this time frame.

The morning and afternoon commute periods were also popular answers for when drivers are experience traffic congestion. It should be noted that 1.13 percent of respondents answered that they rarely experience any traffic congestion.

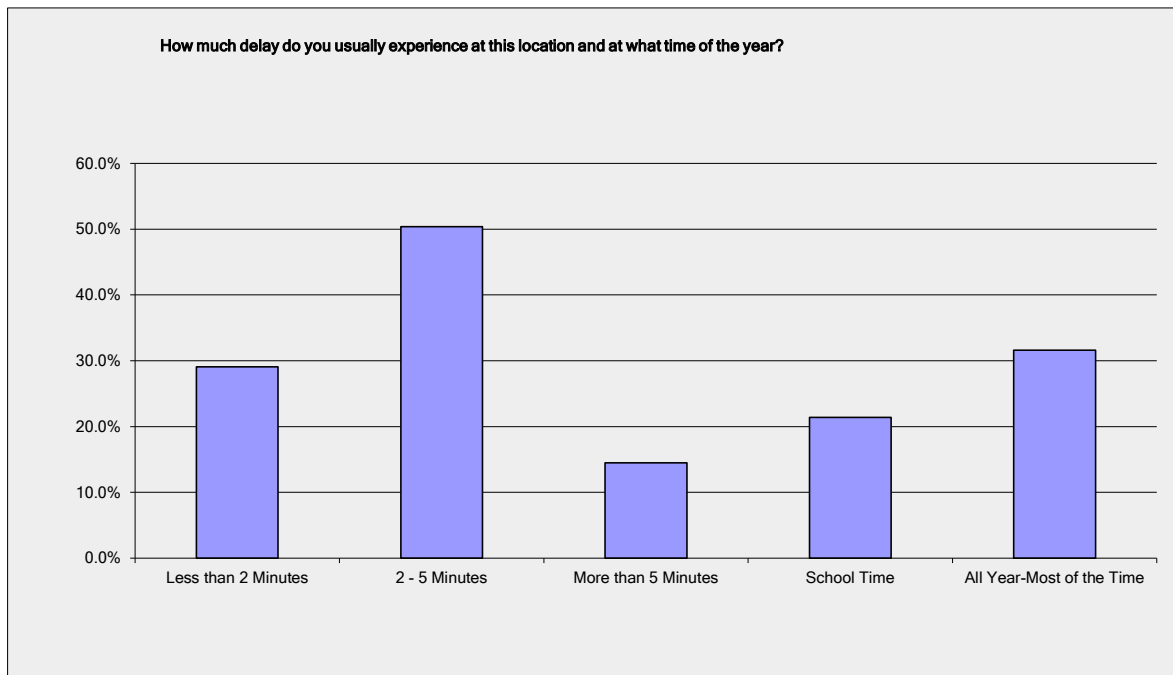
Figure 2: Responses to Question 2



Question 3: How much delay do you usually experience at this location and at what time of the year?

Question 3 followed up on the first two questions about locations and time of day of congestion, asking respondents how much delay do the typically experience. Figure 3 displays the results of this question.

Figure 3: Responses to Question 3

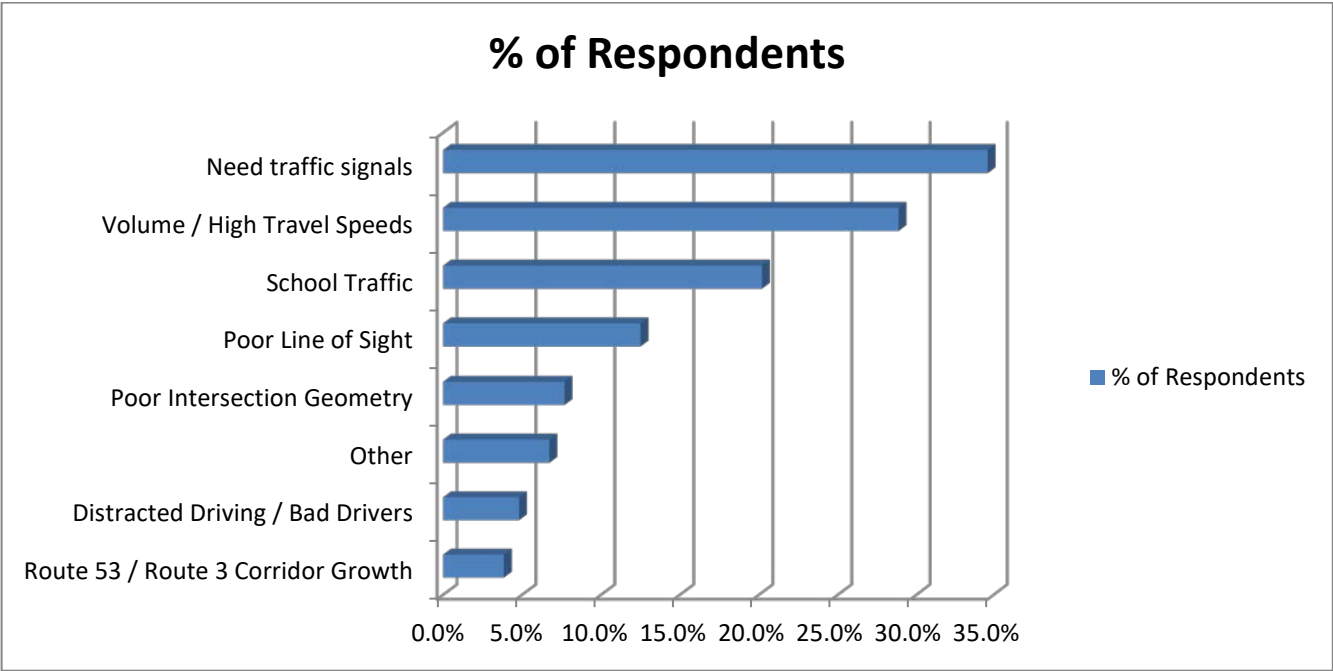


Question 4: What do you believe to be the root cause of congestion and delay at this location?

Question 4 was an open-ended question, following up on the previous questions about congestion and delay. Figure 4 shows how respondents answered when asked what they believe to be the root cause of the congestion at the locations they indicated in the previous questions. While the most popular answer was that the location had inadequate traffic control (“no traffic signals”, “needs traffic signals”), the following were also common themes among the answers given by survey respondents:

- Parents dropping off – picking up students from school (instead of having kids take the bus, or carpooling). This issue to particularly specific to congestion on Alden Street.
- Poor alignment at the intersection of Route 3A at Chestnut Street and Tobey Garden Street. Also, poor intersection design at Route 3A at Route 139 and Route 3A at Depot Street was also mentioned.
- Poor lines of sight due to roadway curvature, or physical obstructions (such as vehicles parked in front of garage on corner of Route 3A and Parks Street.
- Speeding on Route 3A was mentioned as a concern by many respondents.

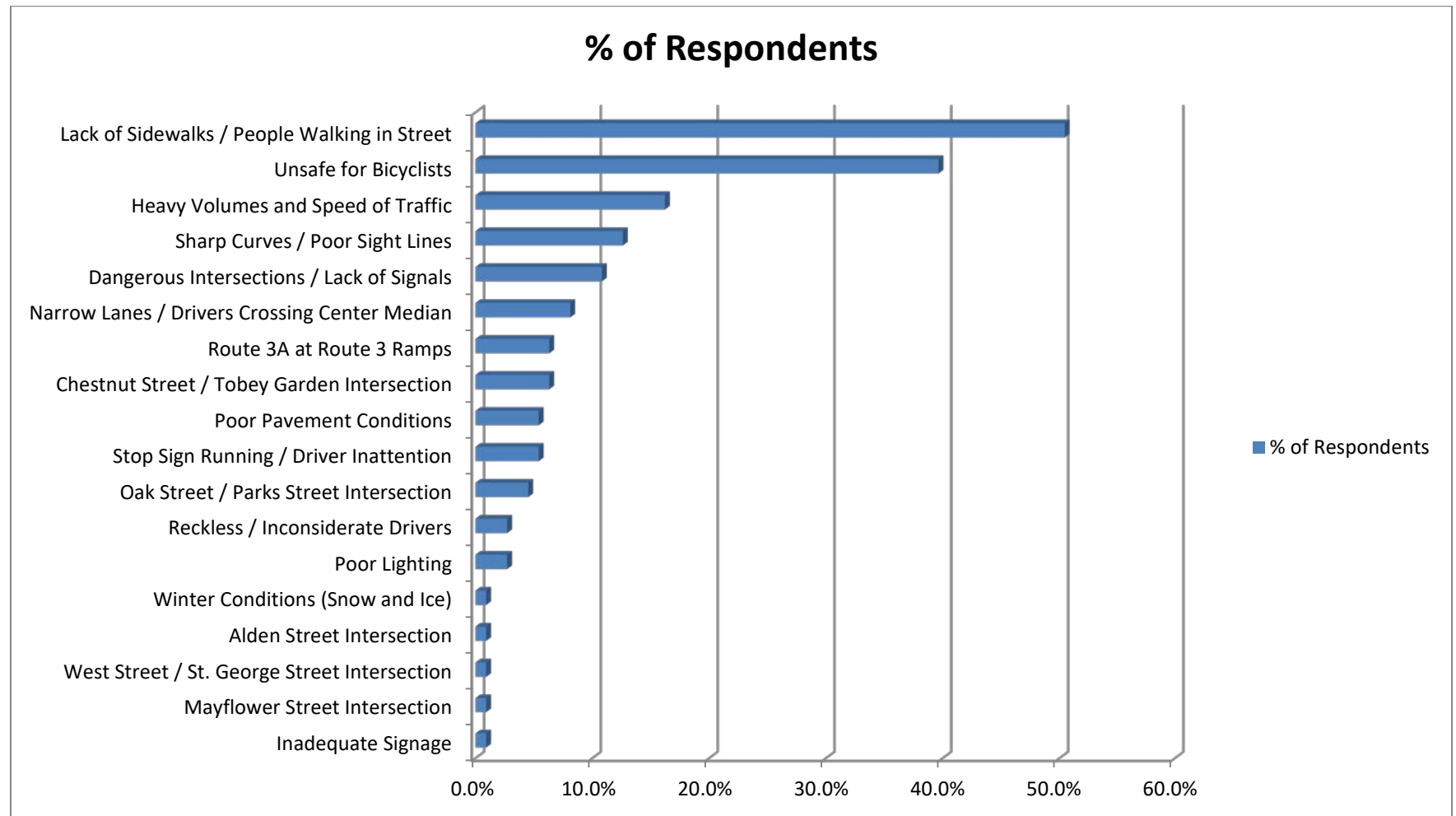
Figure 4: Responses to Question 4



Question 5: What are the most important safety issue(s) on Route 3A (for drivers, pedestrians, bicyclists, or other), and what do you think are the best solutions to address them?

Question 5 was an open-ended question allowing survey participants to express in their own words what they felt were the most important safety issues associates with the Route 3A corridor. Safety for pedestrians and bicyclists was a prominent concern among survey participants, with half of all respondents indicating the lack of sidewalks was an issue, and nearly 40 percent stating the roadway was unsafe for bicyclists.

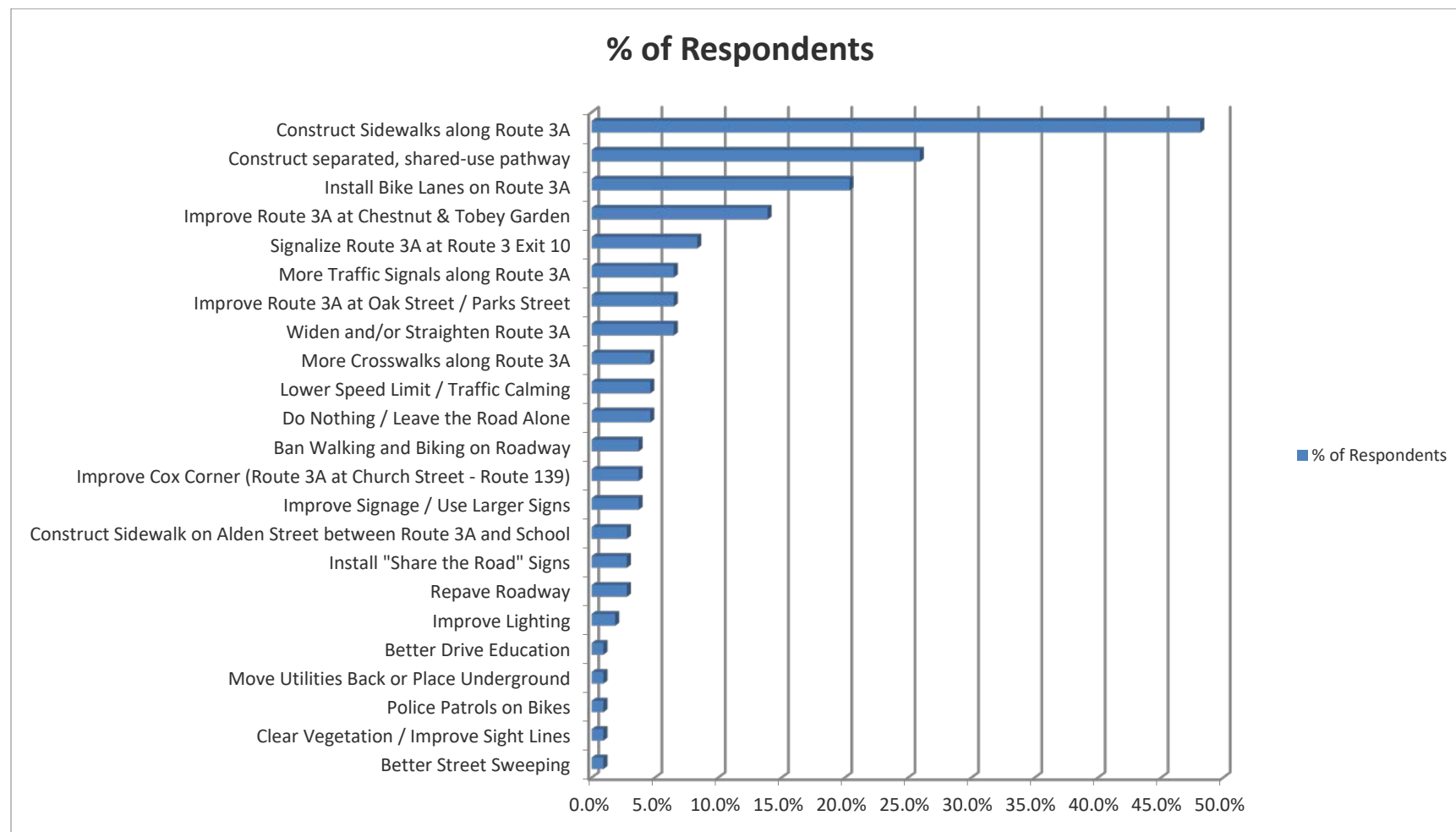
Figure 5: Responses to Question 5



Question 6: What improvements for safety and convenience do you believe should be made to the study area to for better walking and cycling conditions?

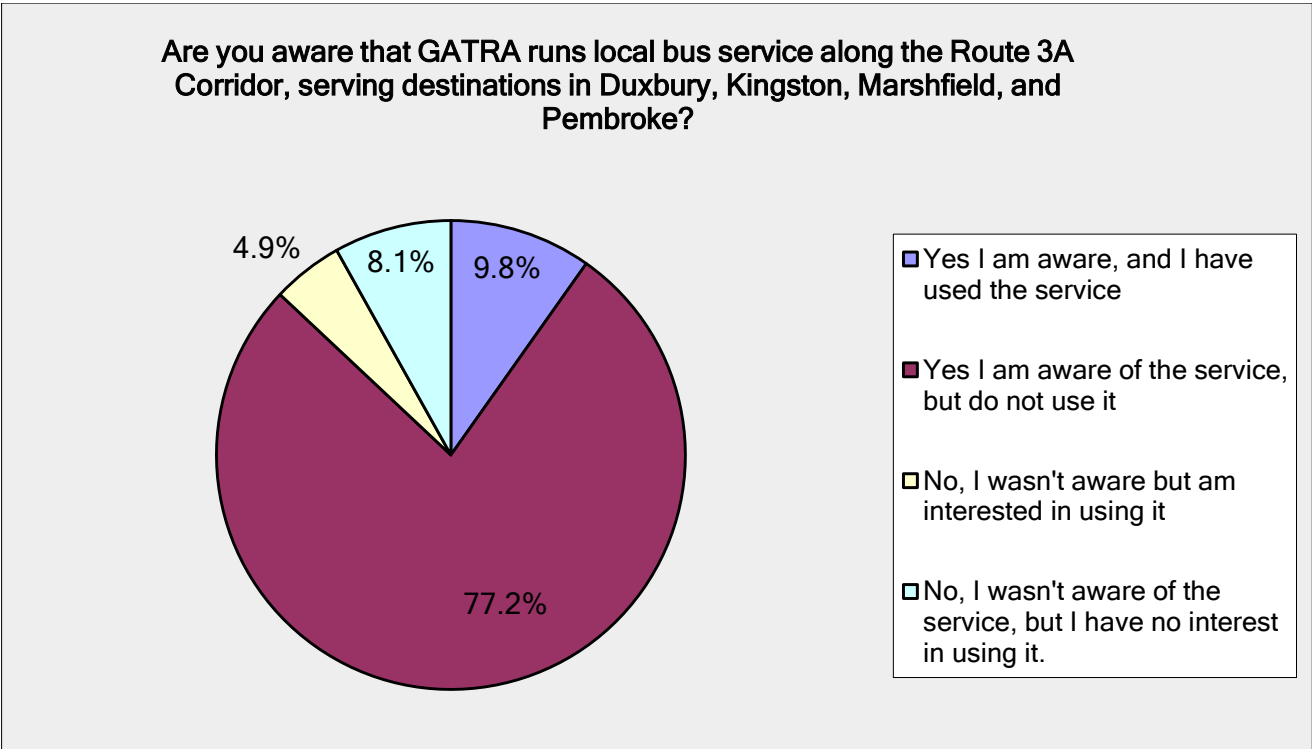
While this question was worded specifically to solicit the public's opinion on pedestrian and bicycle safety on Route 3A, it appears that based on the answers many survey participants saw this question as a continuation of Question 5. In many cases, survey participants identified safety improvements they would like to see that are not specific to bicycle and pedestrian safety.

Figure 6: Responses to Question 6



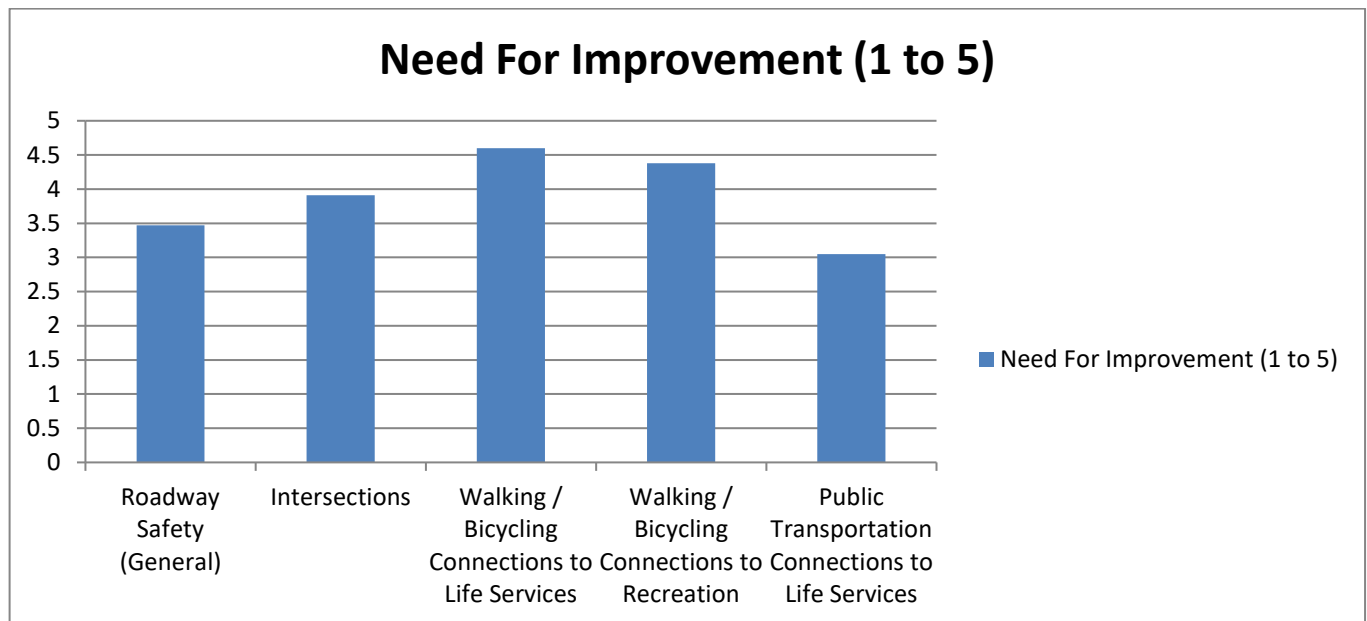
Question 7: Are you aware that GATRA runs local bus service along the Route 3A Corridor, serving destinations in Duxbury, Kingston, Marshfield, and Pembroke?

Figure 7: Responses to Question 7



Question 8: Recent research has demonstrated a connection between the transportation environment and public health. On a scale of 1 (Needs Little Improvement) to-5 (Needs Much Improvement), please rank existing conditions on the following factors related to public health in Duxbury.

Figure 8: Responses to Question 8



Outreach to Greater Attleboro Taunton Regional Transit Authority (GATRA)

The Greater Attleboro Taunton Regional Transit Authority (GATRA) provides fixed route and demand response (paratransit) service in Duxbury. The Seaside Area Inter-Link (SAIL) route provides service to locations along and to the east of the Route 3A corridor, including: the Island Creek development, the Duxbury Senior Center, the Duxbury Housing Authority development on Chestnut Street, Hall's Corner, Duxbury Town Hall, the Duxbury Free Library, and Cox Corner.

Conditions along Route 3A largely prevent the fixed route fleet from allowing for flag stops along the route. The lack of shoulders along Route 3A, along with limited stopping sight distances in many locations due to the hilly and curvy nature of Route 3A, does not allow for safe areas for the fixed route fleet to stop. Additionally, the lack of sidewalks does not allow for the safe waiting, boarding, and alighting of passengers. Service is provided to the corridor by designated stops like those listed above. Demand response (paratransit) service is along the corridor, as in most cases the demand response vehicles are able to utilize passenger driveways.

GATRA reportedly experiences some traffic congestion at peak times during the summer months due to seasonal beach and vacation traffic, although overall impact on operations is minimal. Very little congestion or delay is experienced outside of peak summer conditions.

Outreach to Highway Safety Committee

Old Colony Planning Council staff met with the Duxbury Highway Safety Committee at their April 7, 2016 meeting. The Committee made the following comments:

- The data collection during the summer months may have missed school-based traffic congestion. Some area roadways become very congested at school drop-off and again immediately after school dismissal, particularly the Alden Street and Harrison Street approaches into Route 3A where long queues can form.
- The Committee expressed some surprise at the low number of crashes at some locations, particularly at the Route 3 Ramps, the intersection of Route 3A at Oak Street and Parks Street, and the intersection of Route 3A at Chestnut Street and Tobey Garden Street. (Note: Since meeting with the Highway Safety Committee, crash data for 2014 was made available and incorporated into analysis. With the revised analysis period of 2012 through 2014, crash figures for the Route 3 ramps and the Chestnut Street and Tobey Garden Street intersection increased).
- The Department of Public Works stated that the roadway is in need of repairs and resurfacing in many areas, as the roadway surface has become quite deteriorated. Drainage / runoff improvements also needed in some areas.
- Limited sight lines is the main issue at many intersections.

Previous Studies and Planned Development

The Old Colony Planning council prepared the Halls Corner Economic Development and Transportation Study for the Town of Duxbury in 2014. The Study noted that Halls Corner, located to the east of Route 3A with access via Chestnut Street and Depot Street, is the main commercial center for the town and draws a consumer base that largely uses Route 3A for transportation access.

In 2009, the project proponent for the Island Creek Village Project prepared a Traffic Impact and Access Study (TIAS) that looked at transportation access for that project, located on the southern end of the Route 3A corridor near the Kingston Town Line. That TIAS found the Route 3 Exit 10 at Tremont Street (Route 3A) interchange to be congested along with high crash rates under existing (pre-build) conditions. A full signalization of the ramp system was recommended, with Old Colony Planning Council submitting a comment letter stating the developer should work with MassDOT (formerly MassHighway) and the Towns of Duxbury and Kingston to address improvements at this location.

No planned developments of significance that would affect the Route 3A Corridor were identified at the time of development of this Study.

Existing Conditions

A combination of Automatic Traffic Recorder (ATR) equipment, manual turning movement counts, and field observation was used to collect and assess existing conditions along the Corridor.

Mainline Conditions

Average Daily Traffic, Prevailing Speeds, and Heavy Vehicles

Table 1 summarizes traffic conditions along the Route 3A Corridor in Duxbury, including average weekday volume, travel speeds, and the percentage of heavy vehicle traffic as recorded with automated traffic recorders at several locations along the corridor. The volume of traffic increases dramatically from the northern end of the corridor to the southern end, while speeds remain fairly constant with an 85th percentile speed that ranges from 36 to 43 miles per hour.

The percentage of heavy vehicle traffic along Route 3A, based on the data recorded by the automatic traffic recorders, varied by location but generally ranged between 4 and 8 percent along the corridor, with a couple of outliers. Route 3A is a significant regional highway for the South Shore, and is expected to carry a significant amount of motor freight service to communities along the corridor.

The map in Figure 9 graphically displays the data summarized in Table 1.

Figure 9: Traffic Volumes, Speeds, and Heavy Vehicle Traffic on Route 3A in Duxbury

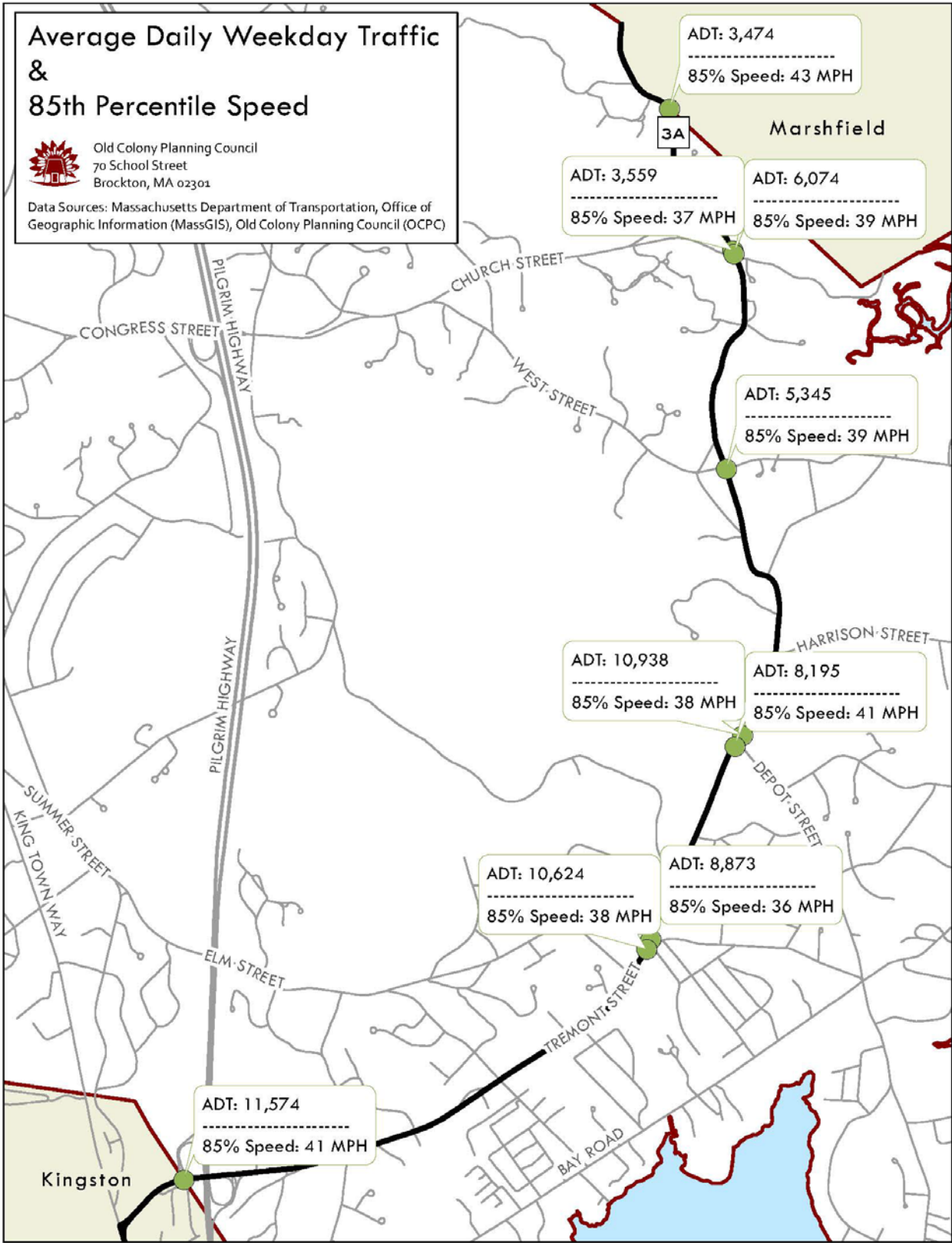


Table 1: Traffic Volumes, Speeds, and Heavy Vehicle Traffic on Route 3A in Duxbury

Intersection	Average Weekday Daily Traffic	Travel Speeds		% Heavy Vehicle Traffic
		85th Percentile	10 MPH Pace Speed	
Enterprise Street (Route 3A) at Marshfield Town Line	3,474	43 MPH	34 - 43 MPH	14.5%
Enterprise Street (Route 3A), north of Church Street (Route 139)	3,559	37 MPH	30 - 39 MPH	5.4%
Tremont Street (Route 3A), south of Church Street (Route 139)	6,074	39 MPH	31 - 40 MPH	7.2%
Tremont Street (Route 3A), south of West Street (Route 14)	5,345	39 MPH	31 - 40 MPH	6.7%
Tremont Street (Route 3A), north of Depot Street	10,938	38 MPH	30 - 39 MPH	5.6%
Tremont Street (Route 3A), south of Depot Street	8,195	41 MPH	34 - 43 MPH	3.9%
Tremont Street (Route 3A), north of Tobey Garden Street	8,873	36 MPH	18 - 27 MPH	5.6%
Tremont Street (Route 3A), south of Tobey Garden Street	10,624	38 MPH	30 - 39 MPH	6.3%
Tremont Street (Route 3A), east of Oak Street	11,143	39 MPH	30 - 39 MPH	8.7%
Tremont Street (Route 3A), west of Oak Street	13,263	36 MPH	17 - 26 MPH	6.6%
Tremont Street (Route 3A), at Kingston Town Line	11,574	41 MPH	34 - 43 MPH	4.0%

Crash History

Crash data from the Massachusetts Department of Transportation was obtained for the years 2012 through 2014 (the three most recent years of data available) to assess crash history and intersection crash rates along the Route 3A Corridor. Based on the data obtained, there were a total of 110 reported crashes along the Route 3A Corridor from January 1, 2012 through December 31, 2014. Of these 100 crashes, 76 were determined to have occurred either at or immediately adjacent to an intersection, while 34 occurred on Route 3A away from any identified intersection.

Table 2 summaries non-intersection related crashes along Route 3A. Rear end collisions, angled collisions, and single vehicle crashes were the most common types of crashes occurring on Route 3A away from intersections. Many of the single vehicle crashes were determined to be roadway departure crashes, where the vehicle struck a roadside object such as a guardrail, utility pole, or tree. Due to the absence of shoulders, fog lines, and curbs along with sharp curvature in places along Route 3A, there is an elevated opportunity for roadway departure crashes along the entire stretch of Route 3A from the Kingston town line to the Marshfield town line.

Table 2: Summary of Non-Intersection Related Crashes along Route 3A, 2012 - 2014

Total # Crashes: 34			Crash Average (Crashes Per Year): 11.33		
Type of Collision	3-Year Total	% of Total	Time Of Crash	3-Year Total	% of Total
Rear-End Collisions	10	29.41%	12:00-6:00 AM	1	2.94%
Angled Collisions	9	26.47%	6:00 AM-12:00 PM	9	26.47%
Single Vehicle Crash	8	23.53%	12:00-6:00 PM	20	58.82%
Sideswipe, Same Direction	3	8.82%	6:00 PM-12:00 AM	4	11.76%
Sideswipe, Opposite Direction	2	5.88%			
Head-On Collisions	1	2.94%			
Unknown	1	2.94%			
Involving Injury	9	26.47%	Morning Peak (7:00 - 9:00)	4	11.76%
Involving Fatality	0	0.00%	Afternoon Peak (4:00 - 6:00)	4	11.76%

Table 3 summarizes crash data for reported crashes that occurred either at or immediately adjacent to intersections studied in this study. The table lists the number of reported crashes identified at each intersection, the number of those crashes that resulted in personal injury, and the associated intersection crash rate. An intersection's crash rate is calculated as the number of crashes over a three year period per million entering vehicles (MEV) into the intersection. Throughout the MassDOT District Five region, which covers southeastern Massachusetts including Duxbury, the average crash rate is 0.58/MEV for un-signalized intersections, and 0.76/MEV for signalized intersections. Four intersections along the Route 3A corridor were observed to have a calculated crash rate that is above the regional average for MassDOT District 5. Those intersections are highlighted in Table 3.

Table 3: Route 3A Intersection Crash History, 2012 – 2014

Intersection	Level of Service		Crash History (2012-2014)			Signals Warranted?
	AM Peak	PM Peak	# Crashes	Crashes w/ Injury	Crash Rate	
Enterprise Street (Route 3A) at Tremont Street and Church Street (Route 139)	D	D	17	7	1.49	No
Tremont Street (Route 3A) at West Street and St. George Street (Route 14)	B	A	9	5	0.98	Signalized
Tremont Street (Route 3A) at Alden Street	C	D	1	0	0.09	No
Tremont Street (Route 3A) at Harrison Street	C	C	2	0	0.20	No
Tremont Street (Route 3A) at Depot Street	B	B	4	2	0.38	Yes
Tremont Street (Route 3A) at Mayflower Street	B	B	1	1	0.07	No
Tremont Street (Route 3A) at Tobey Garden Street and Chestnut Street	F	F	9	2	0.65	Yes
Tremont Street (Route 3A) at Elm Street and Soule Avenue	C	C	4	2	0.39	No
Tremont Street (Route 3A) at Oak Street and Parks Street	F	F	5	0	0.37	No
Route 3A at Route 3 Northbound Ramps	F	F	7	4	0.32	Yes
Route 3A at Route 3 Southbound Ramps	F	F	17	6	0.68	Yes
Regional Average Crash Rate: 0.58 (0.76 for signalized intersections). Highlighted locations indicate where crash rate is above average						

Pavement Conditions

OCPC utilizes pavement management software (PMS) to maintain a region-wide data base of pavement surface conditions for federal aid roads. The PMS includes a data base that documents the severity and extent of pavement deterioration and the implications for cost of maintenance and repair. The severity and extent of pavement surface deterioration is obtained via a windshield survey of roads and then entered into the PMS. The software calculates Pavement Condition Index (PCI) scores for the surveyed road segments. The field survey evaluations are based on the severity and extent of specific surface condition criteria including: potholes and patching, alligator cracking, distortion, rutting, weathering and block cracking, transverse and longitudinal cracking, bleeding and polished aggregate, surface wear and raveling, corrugations, shoving, and slippage. The PMS software calculates Pavement Condition Index (PCI) scores for the surveyed road segments, as a deduction is assigned for each distress as well as the extent of the distress. Each road or road segment is placed in a condition category based on the calculated PCI. These categories include “POOR” (PCI = 0 to 60), “DEFICIENT” (PCI = 61 to 72), “FAIR” (PCI = 73 to 85), “GOOD” (PCI = 86 to 92), and “EXCELLENT” (PCI = 93 to 100). The software recommends a repair and associated cost for each road and/or road segment. The PMS repair and maintenance strategies fall under five general default strategies.

These repairs include:

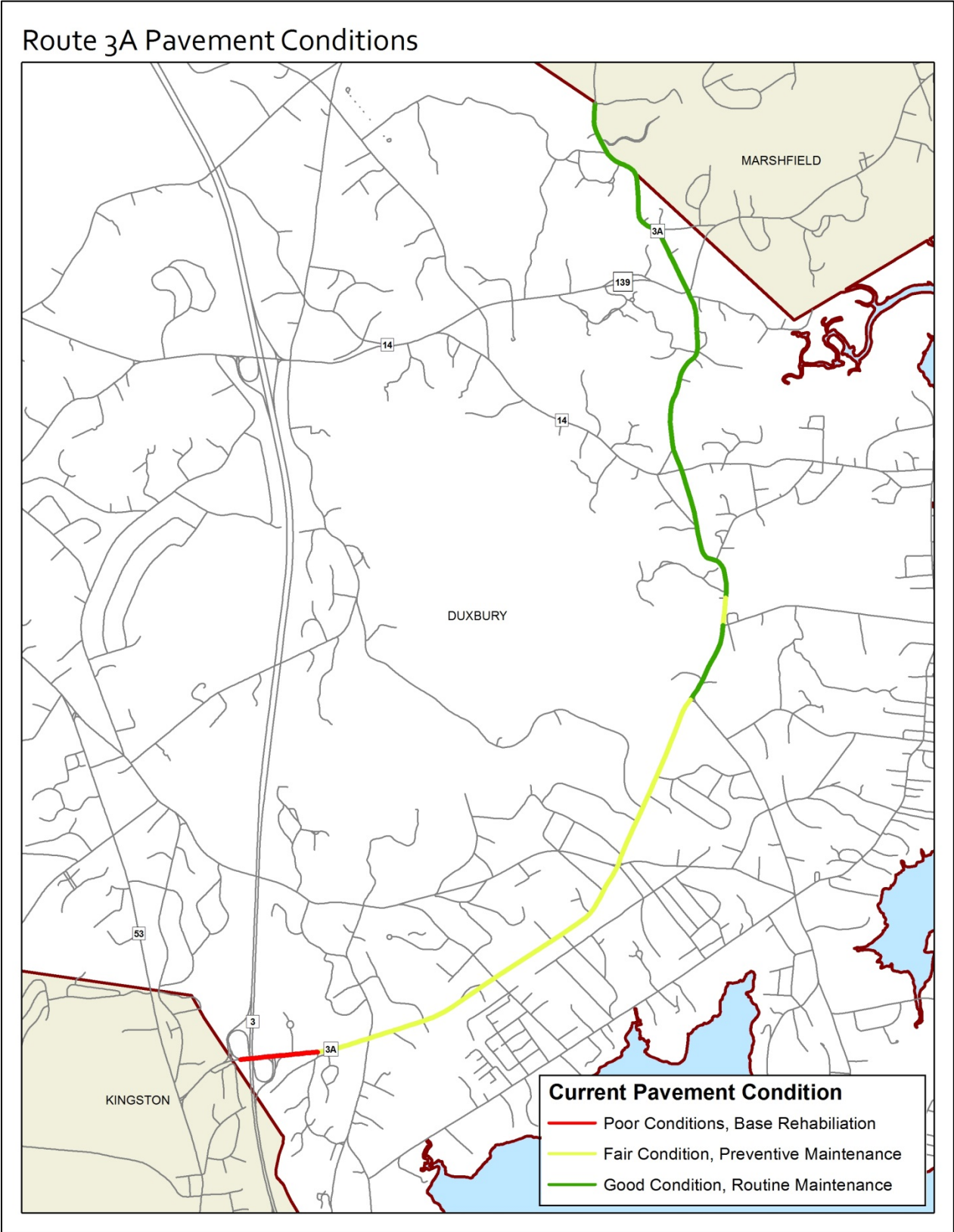
1. Base Rehabilitation – This is recommended for road segments with a PCI between 0 and 60. This is recommended for roads in need of base improvement. Typical repairs include full depth reconstruction and reclamation.
2. Structural Improvement – This is recommended for road segments with a PCI between 61 and 72. This is recommended when the pavement surface structure is in need of added strength for existing traffic. Typical repairs may include overlay with or without milling.
3. Preventive Maintenance – This is recommended for road segments with a PCI between 73 and 85. The pavement surface may be in need of surface sealing, full depth patch and/or crack sealing. This could include minor leveling, as well as surface treatments such as chip seals, micro-surfacing, and thin overlays.
4. Routine Maintenance – This is recommended for road segments with a PCI between 86 and 92. This is recommended when the surface may be in need of crack sealing or minor localized repair. This work may include crack sealing and pothole and full depth patching.
5. No Immediate Maintenance or Repair – This category is for road segments with a PCI between 93 and 100, and the surface is considered in excellent condition.

OCPC conducted a windshield survey of the Route 3A corridor in Duxbury. Route 3A is a part of the OCPC's region-wide pavement management system. Table 4 summarizes the results of the Route 3A pavement management analysis in Duxbury. Table 4 shows that the Pavement Condition Index (PCI), (which characterizes the surface condition); on most of the corridor road sections falls within 73 to 85 range, which puts it in the "Fair" category. Some sections have a PCI of 86, which put those sections in the "Good" category. One section, from Woodbridge Road to the Kingston Line (Route 3A at the Route 3 on and off ramps) is in the "Poor" category, with a PCI below 60. Most of Route 3A requires Routine or Preventive Maintenance, except for the Route 3A section from Woodbridge Street south to the Kingston Line, which requires Base Rehabilitation. Figure 10 shows the existing pavement conditions and recommendations for the Route 3A corridor.

Table 4: Route 3A Pavement Conditions and Recommendations

Route 3A Section	From	To	Length (miles)	Pavement Conditions	Current PCI	Recommend Repair	Estimated Cost
ENTERPRISE STREET	Marshfield Line	Church Street (Route 139)	0.913	Good	86	Routine Maintenance	\$11,373.57
TREMONT STREET	Church Street (Route 139)	174 feet south of the Marshes	0.272	Fair	85	Prevent Maintenance	\$16,957.58
TREMONT STREET	174 feet south of the Marshes	West Street	0.490	Good	86	Routine Maintenance	\$6,107.61
TREMONT STREET	West Street	290 feet north of Depot Street	0.950	Fair	83 to 85	Prevent Maintenance	\$59,185.02
TREMONT STREET	290 feet north of Depot Street	Depot Street	0.055	Good	86	Routine Maintenance	\$683.99
TREMONT STREET	Depot Street	Woodridge Road	2.000	Fair	74 to 84	Prevent Maintenance	\$141,158.73
TREMONT STREET	Woodridge Road	Kingston Line	0.316	Poor	58 to 59	Base Rehabilitation	\$354,375.83

Figure 10: Route 3A Pavement Conditions



Pedestrian and Bicycle Accommodations

Due to the lack of sidewalks, shoulders, and bicycle lanes along Route 3A, pedestrian and bicycle access and mobility is highly challenged and hazardous along the entire stretch of Route 3A in Duxbury. Although there are no sidewalks, there are three crosswalks across Route 3A.

Intersection Conditions (Level of Service and Crash History)

Enterprise Street / Tremont Street / Enterprise Street (Route 3A) at Tremont Street and Church Street (Route 139)

The intersection of Tremont Street and Enterprise Street (Route 3A) at Tremont Street and Church Street (Route 139) is a 4-way intersection, controlled by STOP signs on the side-street approaches of Tremont Street and Church Street. All four roads are two-lane roadways, with single lane approaches to the intersection. Both approaches of Route 139 curve significantly coming into the intersection. Figure 11 contains an aerial image of the intersection.

Figure 11: Aerial Photo of Route 3A at St. Tremont Street and Church Street (Route 139)



Crash History and Crash Rate: According to MassDOT crash records; there were seventeen crashes on record at the intersection from 2012 through 2014. The crash rate based on this data set is 1.49 crashes per million entering vehicles, which is above the MassDOT District 5 average of 0.58/MEV for unsignalized intersections.

Level of Service: The intersection operates with moderate queues on the side-street approaches and delay to drivers during the peak demand hours, especially on the Tremont Street (Route 139) approach from the northeast. Table 5 summarizes existing level of service, forecasted level of service though 2020 with a no-build scenario, and an improvement scenario that includes constructing a roundabout at the intersection. Delays at the intersection are expected to slowly worsen without infrastructure improvements.

Table 5: Existing and Projected LOS at Route 3A and St. George Street and West Street (Route 14)

Location	Approach	2015 Existing		2020 No-Build		2020 Roundabout Build	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Church Street and Tremont Street (Route 139)	Church Street EB	B	D	C	E	A	A
	Tremont Street WB	D	D	D	E		

Operational and Safety Summary: The intersection has a poor safety record, with a very high crash rate, and 41 percent (7 out of 17) of crashes resulting in personal injury. The combination of poor intersection geometry and alignment (sharp curvature of Route 139 and Route 3A northwest-southeast orientation) and heavy vegetation and fixed roadside objects, particularly on the northwest corner, creates significant obstructions to sight lines. Travel speeds on Route 3A through this intersection are also relatively high, creating additional hazard and difficulty for drivers.

Tremont Street (Route 3A) at St. George Street / West Street (Route 14)

The intersection of Tremont Street (Route 3A) at St. George Street and West Street (Route 14) is a 4-way intersection, controlled by a traffic signal system. Tremont Street, St. George Street, and West Street (Route 14) are two-lane roadways with single lane approaches to the intersection. There is a channelized right turn lane from Tremont Street northbound onto St. George Street. Figure 12 contains an aerial image of the intersection.

Figure 12: Aerial Photo of Route 3A at St. George Street and West Street (Route 14)



Crash History and Crash Rate: According to MassDOT crash records; there were nine crashes on record occurring at the intersection from 2012 through 2014. The crash rate based on this data set is 0.98 crashes per million entering vehicles, which is above the MassDOT District 5 average of 0.76/MEV for signalized intersections.

Level of Service: The intersection operates well, with generally only minimal delays to drivers. It has level of service ratings of 'B' and 'A' during the morning and afternoon peak hours. A surge in traffic flow has been observed after school dismissal, which results in short term moderate delays and queues at the traffic signal. Table 6 summarizes existing level of service, and forecasted level of service though 2020 with no-build.

Table 6: Existing and Projected LOS at Route 3A and St. George Street and West Street (Route 14)

Location	2015 Existing		2020 No-Build	
	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at St. George Street and West Street (Route 14)	B	A	B	B

Operational and Safety Summary: While the intersection generally operates efficiently with minimal delay to drivers, the intersection’s crash rate and rate of injury (5 out of 9 crashes resulted impersonal injury) are high are warrant further, more detailed study.

Tremont Street (Route 3A) at Alden Street

The intersection of Tremont Street (Route 3A) at Alden Street is a 3-way “T” intersection, with Alden Street approaching from the northeast. Tremont Street and Alden Street are two-lane roadways, with single lane approaches to the intersection. Alden Street is controlled by a STOP sign. The intersection is located within an “S” curve of Tremont Street, creating limited sight lines to and from the intersection. Figure 13 contains an aerial image of the intersection.

Figure 13: Aerial Photo of Route 3A at Alden Street



Crash History and Crash Rate: According to MassDOT crash records; there was one crash on record occurring at the intersection from 2012 through 2014. The crash rate based on this data set is 0.09 crashes per million entering vehicles, which is below the MassDOT District 5 average of 0.58/MEV for un-signalized intersections.

Level of Service: Drivers experience moderate to occasional significant delays at this intersection during the peak hours, with level of service ratings of ‘C’ and ‘D’ during the morning and afternoon peak demand hours, respectively. Several respondents in the survey for this traffic study noted that

this intersection becomes very congested following the release of school in the afternoon. Alden Street provides a connection between Route 3A and the public school and library complex (Alden Elementary School, Duxbury High School, and Duxbury Free Library). Table 7 summarizes the existing level of service, and forecasted level of service through 2020 with no-build.

Table 7: Existing and Projected LOS at Route 3A and Alden Street

Location	2015 Existing		2020 No-Build	
	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Alden Street	C	D	C	D

Operational and Safety Summary: The intersection experiences moments of significant congestion, particularly following the release of school in the afternoon and again during the evening commute. The curvature of Route 3A and heavy roadside vegetation create severely limited lines of sight to and from the intersection. There are no advance warning signs on either Route 3A approach to the intersection.

Tremont Street (Route 3A) at Harrison Street

The intersection of Tremont Street (Route 3A) at Harrison Street is a 3-way “T” intersection, with Harrison Street approaching from the east. Tremont Street and Harrison Street are two-lane roadways, with single lane approaches to the intersection. Harrison Street is controlled by a STOP sign. Figure 14 contains an aerial image of the intersection.

Figure 14: Aerial Photo of Route 3A at Harrison Street



Crash History and Crash Rate: According to MassDOT crash records; there were two crashes on record occurring at the intersection from 2012 through 2014. The crash rate based on this data set is 0.20 crashes per million entering vehicles, which is below the MassDOT District 5 average of 0.58/MEV for un-signalized intersections.

Level of Service: Drivers experience moderate delay at this intersection during the peak hours, with a level of service ratings of 'C' during the morning and afternoon peak demand hours. Level of service could deteriorate to a rating of 'D' by 2020 based on forecast background traffic growth. Table 8 summarizes existing level of service, and forecasted level of service through 2020 with no-build.

Table 8: Existing and Projected LOS at Route 3A and Harrison Street

Location	2015 Existing		2020 No-Build	
	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Harrison Street	C	C	D	D

Operational and Safety Summary: Level of service analysis indicates that drivers experience moderate levels of delay during peak times, however some respondents in the study survey indicated that delays and traffic queues can be lengthy at certain times, particularly following the dismissal of school. Heavy

roadside vegetation and roadway curvature (horizontal and vertical) create some obstruction to sight lines at this location, which could be a potential hazard for drivers and increase the level of difficulty in evaluating the available gaps in the Route 3A traffic stream.

Tremont Street (Route 3A) at Depot Street

The intersection of Tremont Street (Route 3A) at Depot Street is a modified 3-way “T” intersection, with Depot Street approaching from the east. Depot Street flares out at the intersection, with two separate channels of traffic separated by a vegetated triangular island. Tremont Street and Depot Street are two-lane roadways, with single lane approaches to the intersection. Both channels of Depot Street are controlled by STOP signs. Figure 15 contains an aerial image of the intersection.

Figure 15: Aerial Photo of Route 3A at Depot Street



Crash History and Crash Rate: According to MassDOT crash records, there were four crashes on record occurring at the intersection from 2012 through 2014. The crash rate based on this data set is 0.38 crashes per million entering vehicles, which is below the MassDOT District 5 average of 0.58/MEV for un-signalized intersections.

Level of Service: The intersection operates well during both the morning and afternoon peak demand hours with a level of service rating of ‘B’. Table 9 summarizes existing level of service, and forecasted level of service through 2020 with no-build.

Table 9: Existing and Projected LOS at Route 3A and Depot Street

Location	2015 Existing		2020 No-Build	
	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Depot Street	B	B	B	B

Operational and Safety Summary: The intersection operates well, with very little delay and no observed safety issues.

Tremont Street (Route 3A) at Mayflower Street

The intersection of Tremont Street (Route 3A) at Mayflower Street is a 3-way “T” intersection, with Mayflower Street approaching from the west. Tremont Street and Mayflower Street are two-lane roadways, with single lane approaches to the intersection. Mayflower Street is controlled by a STOP sign. Figure 16 contains an aerial image of the intersection.

Figure 16: Aerial Photo of Route 3A at Mayflower Street



Crash History and Crash Rate: According to MassDOT crash records; there is only a single crash on record occurring at the intersection from 2009 through 2014. The crash rate based on this data set is 0.07 crashes per million entering vehicles, which is below the MassDOT District 5 average of 0.58/MEV for un-signalized intersections.

Level of Service: The intersection operates well during both the morning and afternoon peak demand hours with a level of service rating of 'B'. Table 10 summarizes existing level of service, and forecasted level of service through 2020 with no-build.

Table 10: Existing and Projected LOS at Route 3A and Mayflower Street

Location	2015 Existing		2020 No-Build	
	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Mayflower Street	B	B	C	B

Operational and Safety Summary: The intersection operates well, with very little delay and no observed safety issues.

Tremont Street (Route 3A) at Tobey Garden Street / Chestnut Street

The intersection of Tremont Street (Route 3A) at Tobey Garden Street and Chestnut Street is a 4-way intersection, with Tobey Garden Street approaching from the west and Chestnut Street from the east. The intersection has a slightly skewed geometry, as Chestnut Street comes into the intersection slightly north of Tobey Garden Street. A fifth roadway, Pinewood Lane, enters into Chestnut Street immediately adjacent to the intersection. Tremont Street, Chestnut Street, and Tobey Garden Street are all two-lane roadways, with single lane approaches to the intersection. Chestnut Street and Tobey Garden Street are controlled by STOP signs. Figure 17 contains an aerial image of the intersection.

Figure 17: Aerial Photo of Route 3A at Tobey Garden Street and Chestnut Street



Crash History and Crash Rate: According to MassDOT crash records, there were 9 reported crashes at the intersection of Route 3A at Tobey Garden Street and Chestnut Street from 2012 through 2014. The crash rate based on this data set is 0.65 crashes per million entering vehicles, which is above the MassDOT District 5 average of 0.58/MEV for un-signalized intersections.

Level of Service: The existing level of service at the intersection is “F” during both the morning and afternoon peak demand hours for the Chestnut Street approach (the heavier traveled approach of the two side streets), with drivers experiencing significant delay attempting to turn left onto Route 3A from the side streets. Without capacity improvements, the intersection is expected to operate at level of service “F” through 2020. Table 11 summarizes existing level of service, and forecasted level of service though 2020 with no-build, conceptual traffic signal build, and conceptual roundabout build scenarios.

Table 11: Existing and Projected LOS at Route 3A and Tobey Garden Street and Chestnut Street

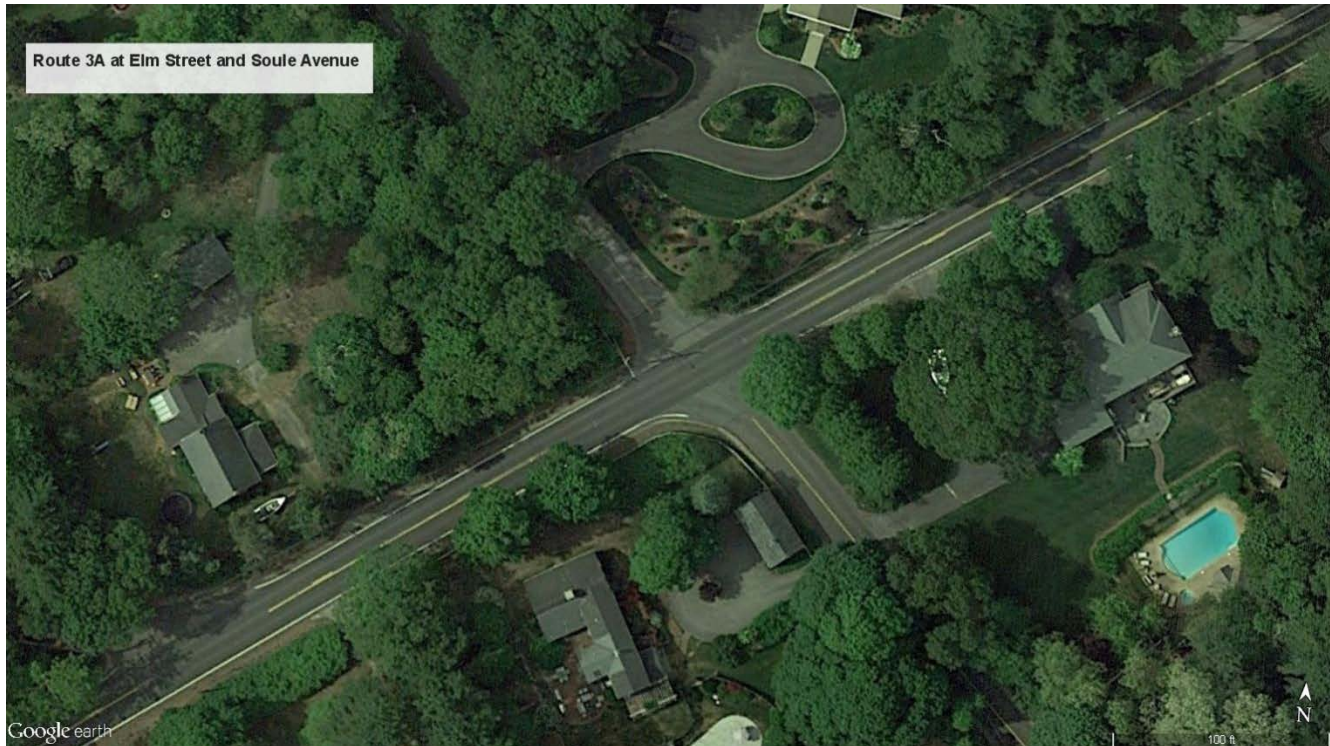
Location	Approach	2015 Existing		2020 No-Build		2020 Traffic Signal Build		2020 Roundabout Build	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Tobey Garden Street and Chestnut Street	Tobey Garden Street EB	D	E	E	F	B	B	B	B
	Chestnut Street WB	F	F	F	F				

Operational and Safety Summary: Analysis of collected data, field observation, and reports from drivers who took the survey all verify that this intersection experiences significant congestion and delay during peak hours and has a demonstrated above average crash history. Over half of the survey respondents specifically mentioned the intersection of Route 3A at Tobey Garden Street and Chestnut Street as a “problem area” on the Route 3A corridor. In addition to delays, survey respondents also mentioned that traffic queues on Chestnut Street can extend past Bayridge Lane, making it difficult for drivers to maneuver that intersection.

Tremont Street (Route 3A) at Soule Avenue / Elm Street

The intersection of Tremont Street (Route 3A) at Elm Street and Soule Avenue is a 4-way intersection, with Elm Street approaching from the northwest and Soule Avenue from the southeast. Tremont Street, Elm Street, and Soule Avenue are all two-lane roadways, with single lane approaches to the intersection. Elm Street and Soule Avenue are controlled by STOP signs. Figure 18 contains an aerial image of the intersection.

Figure 18: Aerial Photo of Route 3A at Elm Street and Soule Avenue



Crash History and Crash Rate: According to MassDOT crash records, there were 4 reported crashes at the intersection of Route 3A at Elm Street and Soule Avenue from 2012 through 2014. The crash rate based on this data set is 0.39 crashes per million entering vehicles, which is below the MassDOT District 5 average of 0.58/MEV.

Level of Service: The intersection operates efficiently, with level of service ratings of 'B' and 'C' during the weekday morning and afternoon peak commute hours, respectively. The intersection is forecast to continue to operate with acceptable levels of service ratings of 'C' through 2020. Table 12 summarizes existing level of service, and forecasted level of service through 2020.

Table 12: Existing and Projected LOS at Route 3A and Elm Street and Soule Avenue

Location	Approach	2015 Existing		2020 No-Build	
		AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Elm Street and Soule Avenue	Elm Street Southbound	B	C	B	C
	Soule Avenue Northbound	C	C	C	C

Operational and Safety Summary: While both field observation and reports from drivers revealed that there are some issues with sight lines at this intersection due to vertical curves, vegetation, and sun glare, the intersection operates well, with only minimal delays occurring during peak demand

moments. Similarly, the intersection has a good safety record with a crash rate that is well below the regional average for un-signalized intersections.

Tremont Street (Route 3A) at Parks Street / Oak Street

The intersection of Tremont Street (Route 3A) at Oak Street and Parks Street is a 4-way intersection, with Oak Street approaching from the north and Parks Street from the South. Tremont Street, Oak Street, and Parks Street are all two-lane roadways, with single lane approaches to the intersection. Oak Street and Parks Street are controlled by STOP signs. Figure 19 contains an aerial image of the intersection.

Figure 19: Aerial Photo of Route 3A at Oak Street and Parks Street



Crash History and Crash Rate: According to MassDOT crash records, there were 5 reported crashes at the intersection of Route 3A at Oak Street and Parks Street from 2012 through 2014. The crash rate based on this data set is 0.37 crashes per million entering vehicles, which is below the MassDOT District 5 average of 0.58/MEV.

Level of Service: Parks Street is the busier of the side-street approaches at this intersection, and experiences backups and delay to drivers during the peak demand hours. Parks Street has a level of service rating of 'F' during both peak weekday commutes, while traffic demand on Oak Street is much lighter and has corresponding levels of service of 'B' and 'C' during the morning and afternoon

commutes, respectively. Without capacity improvements, the Parks Street approach is expected to operate at level of service “F” through 2020. Table 13 summarizes existing level of service, and forecasted level of service through 2020.

Table 13: Existing and Projected LOS at Route 3A and Oak Street and Parks Street

Location	Approach	2015 Existing		2020 No-Build	
		AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Oak Street and Parks Street	Oak Street Southbound	B	C	C	C
	Parks Street Northbound	F	F	F	F

Identified Issues: Several respondents to the survey identified congestion and safety concerns with this intersection, particularly on the Parks Street approach. Level of service and queue analysis supported claims of delay to drivers and difficulty entering Tremont Street from Parks Street. Several participants in the survey mentioned that vehicles parked at the automotive business on the southwest corner obstructs line of sight between Tremont Street and Parks Street, increasing the difficulty for drivers to maneuver in this intersection.

Tremont Street (Route 3A) at Route 3 Northbound Ramps

The off-ramp from Exit 10 on Route 3 northbound meets Route 3A at a STOP sign controlled intersection, with a left turn lane and channelized right turn lane coming off of Route 3. Channelized right turn lanes are included for both the right turn from the off-ramp onto Route 3A eastbound, and for Route 3A eastbound onto Route 3 northbound. The left turn lane from the off-ramp is controlled by a STOP sign and painted stop line. The channelized right turns are controlled by YIELD signs and pavement markings. Route 3A in this section is a four-lane cross section, with two shared movement lanes of travel in each direction. Figure 20 contains an aerial image of the ramp.

Figure 20: Aerial Photo of Route 3A at Route 3 Exit 10 Northbound



Crash History and Crash Rate: According to MassDOT crash records, there were 7 reported crashes at the intersection of Route 3A at the Route 3 Northbound Ramps from 2012 through 2014. The crash rate based on this data set is 0.32 crashes per million entering vehicles, which is below the MassDOT District 5 average of 0.58/MEV.

Level of Service: The existing level of service at the ramp is “F” during both the morning and afternoon peak demand hours, with drivers experiencing significant delay attempting to turn left from the off-ramp onto Route 3A westbound. Without capacity improvements, the ramp is expected to operate at level of service “F” through 2020. Table 14 summarizes existing level of service, and forecasted level of service through 2020 with both no-build and conceptual traffic signal build scenarios.

Table 14: Existing and Projected LOS at Route 3A and Route 3 Exit 10 Northbound

Location	2015 Existing		2020 No-Build		2020 Traffic Signal Build	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Route 3 Exit 10 Northbound Ramps	F	F	F	F	B	B

Identified Deficiencies: When asked where they experience congestion and where they perceive to be safety issues on the Route 3A Corridor, both ramps at Route 3A Exit 10 were a common answer for both. In particular regard to the southbound ramps, survey respondents indicated that making left turns from Route 3A westbound onto the on-ramp is challenging due to the volume and speed of cross traffic on Route 3A. Data from automated traffic recorders indicate the 85th percentile speed of oncoming traffic at this location is 41 miles per hour. This speed, combined with two opposing lanes of travel, may be a contributing factor in difficulty for drivers entering the on-ramp from the westbound (coming from Duxbury) direction.

Tremont Street (Route 3A) at Route 3 Southbound Ramps

The off-ramp from Exit 10 on Route 3 southbound meets Route 3A at a STOP sign controlled intersection, with a left turn lane and channelized right turn lane coming off of Route 3. Channelized right turn lanes are included for both the right turn from the off-ramp onto Route 3A westbound, and for Route 3A westbound onto Route 3 southbound. The left turn lane from the off-ramp is controlled by a STOP sign and painted stop line. The channelized right turns are controlled by YIELD signs and pavement markings. Route 3A in this section is a four-lane cross section, with two shared movement lanes of travel in each direction. Figure 21 contains an aerial image of the ramp.

Figure 21 Aerial Photo of Route 3A at Route 3 Exit 10 Southbound



Crash History and Crash Rate: According to MassDOT crash records, there were 17 reported crashes at the intersection of Route 3A at the Route 3 Southbound Ramps from 2012 through 2014. The crash rate based on this data set is 0.68 crashes per million entering vehicles, which is above the MassDOT District 5 average of 0.58/MEV.

Level of Service: The existing level of service at the ramp is “F” during both the morning and afternoon peak demand hours, with drivers experiencing significant delay attempting to turn left from the off-ramp onto Route 3A eastbound. Without capacity improvements, the ramp is expected to operate at level of service “F” through 2020. Table 15 summarizes existing level of service, and forecasted level of service through 2020 with both no-build and conceptual traffic signal build scenarios.

Table 15: Existing and Projected LOS at Route 3A and Route 3 Exit 10 Southbound

Location	2015 Existing		2020 No-Build		2020 Traffic Signal Build	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Route 3A at Route 3 Exit 10 Southbound Ramps	F	F	F	F	B	B

Identified Deficiencies: When residents were asked where they experience congestion and where they perceive safety issues are located on the Route 3A Corridor, both ramps at Route 3A Exit 10 were a common answer for both. In particular, survey respondents indicated that making left turns from the Route 3 southbound off-ramp onto Route 3A into Duxbury is challenging due to the volume and speed of cross traffic on Route 3A. Analysis of available data supports these responses, indicating the intersection has a crash rate that is above the MassDOT District 5 average for un-signalized intersections, and has significant delays during the peak demand hours.

Environmental Issues and Constraints

The Route 3A Corridor in Duxbury either directly abuts or is located in close proximity to several ponds, streams, and natural areas; all of which present significant challenges to both land development and transportation capacity expansion.

Future Conditions and Operations

Planned Improvements

There were no identified planned transportation improvements along the Route 3A corridor in Duxbury at the time of the development of this Study.

Sustainability and Livability

The Old Colony Regional Transportation Plan includes goals to incorporate livability principles and sustainable practices into transportation plans and programs for maximizing the efficiency of existing transportation investments, providing better access within and between activity centers, reinvesting in aging suburban corridors, restoring complete streets and networks, and maintaining a transportation system that provides reliable, safe access to jobs, education, health care, and goods and services.

Sustainability encourages healthy, non-motorized modes to conserve energy and reduce reliance on fossil fuels. Principles for creating more sustainable neighborhoods include designing streets and the rights-of-way to encourage shared pedestrian, bicycle, and vehicular use. A new design strategy, often referred to as “Complete Streets”, enables safe road access and operation for all users including pedestrians, bicyclists, motorists, and public transportation users of all ages and abilities. Complete

Streets make it easy to cross the street, walk, and bicycle to and from destinations (shops, work, school, etc.) by integrating safety for non-motorized travel in the design and construction of roads.

The Federal Highway Administration (FHWA) defines Livability in the following way: “Livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, high quality schools, and safe streets. This includes addressing safety and capacity issues on all roads through better planning and design.”

The recommendations presented in this transportation corridor study are consistent with the sustainability and livability principles outlined in the Old Colony Regional Transportation Plan, and with state plans and directives such as the MassDOT Healthy Transportation Policy Directive.

Community Health

According to the National Academy of Arts and Sciences, a Health Impact Assessment (HIA) supports the decision-making process with information that is used to shape improvements and recommendations so that adverse effects to public health are minimized and beneficial ones are optimized.¹ The components of the HIA include:

- Screening - This establishes the need for and value of conducting an HIA.
- Scoping - Identifies the populations that might be affected, determines the health effects evaluated, identifies research questions and plans to address them, identifies the data and methods to be used and alternatives to be assessed, and establishes the HIA team and a plan for stakeholder participation throughout the HIA process.
- Assessment - Involves describing the baseline health status of affected populations and characterizing the expected effects on health (and its determinants) of the proposed improvements and alternatives under consideration.
- Recommendations - Identify alternatives to the proposal or specific actions that could be taken to avoid, minimize, or mitigate adverse effects or to take advantage of opportunities for a proposal to improve health.
- Reporting - This is the communication of findings and recommendations to decision- makers, the public, and other stakeholders.
- Monitoring - This consists of tracking the adoption and implementation of recommendations.

This section of this report will follow the guidelines of the HIA; however, its scope will not be as broad as a full HIA report.

Public health improvement focuses on the promotion of good health and the prevention of accident and disease through changes in the built environment as well as through education and awareness

¹ Improving Health in the U.S.; The Role of Health Impact Assessment, National Academy of Arts and Sciences, Page 5.

training for at-risk populations. The improvement of the public health in a community or neighborhood requires that resources be focused on specific populations as opposed to health care treatment, which focuses mainly on the health of an individual. Improvements to the public health impact life expectancy as well as the quality of life as both behavior and the environment (and how people interact with the environment), influence health outcomes. Studies show that social, environmental, and behavioral factors make up 60 percent of the determinants of health, with genetics making up 20 percent, and access to healthcare making up 20 percent. Transportation facilities and systems (such as sidewalks, access to transit, safe bicycle paths, and safe street crossings) can influence the social, environmental, and behavioral factors that determine the quality of health.

Route 3A is a state numbered route, and therefore a significant commuting and trucking route through the South Shore. The traffic volumes and high percentages of heavy commercial vehicle traffic (generally ranging between 5 and 10 percent along the corridor in Duxbury) may result in a disproportional amount of air pollution and particulates, resulting in higher rates of asthma in adjacent neighborhoods.

The suburban nature of Duxbury with large residential plot sizes, combined with the absence of sidewalks and bicycle accommodating, makes the community highly dependent on use of personal automobiles for nearly all daily trips. Dependence on the personal automobile can be a major contributing factor to a sedentary lifestyle, which can lead to obesity and serious associated disease. An inclusive transportation network that accommodates healthy transportation modes such as walking and cycling can mitigate these factors by providing more choice to residents.

The findings, conclusions, and potential recommended improvements of this study will be described in more detail in subsequent sections. However, the provision of pedestrian and bicycle accommodations is a consistent long term recommendation for all points along the corridor, with connections to common pedestrian trip generators such as schools, the library, and Halls Corner. Providing such infrastructure can mitigate negative transportation-based health impacts, and reduce the threat of injury to those who currently choose to walk or bike on the existing system with little protection.

Conclusions and Recommendations

Complete Streets and Pedestrian Improvements

Identified Deficiencies: As currently designed, Route 3A provides little to no accommodation for the safe access and mobility for pedestrians, bicyclists, and users of other non-motorized modes of transportation. The corridor does not have any sidewalks, nor are there any bicycle lanes or bicycle accommodating shoulders. In the survey of the general public that was prepared for this study, the needs of pedestrians and bicyclists weighed heavily in the responses, with many stating the desire for sidewalks and bicycle facilities.

Recommended Short-Term Improvements: The installation of “Share the Road” signage along the Route 3A corridor may be considered to alert drivers to the presence of bicyclists along the corridor. Despite the lack of accommodating infrastructure, there has been observed bicycle activity along Route 3A, particularly during the spring and summer months. Narrow lanes and the lack of shoulders create a high degree of conflict between motorists and cyclists. Furthermore, the Old Colony Planning Council will continue to work with the Town of Duxbury to identify alternative on-road and off-road connections to provide town-wide mobility while limiting exposure for bicyclists and pedestrians along Route 3A.

Recommended Short-Term Improvements: In accordance with Massachusetts Complete Streets policies, future improvements to Route 3A should include the addition of sidewalks and bicycle lanes or bicycle accommodating shoulders to the corridor. Such improvements would likely require significant planning and capital investment. Although it may not be feasible due to right of way constraints, several respondents in the survey express the desire for a separated shared-use pathway running parallel to Route 3A, similar to designs other towns on the South Shore such as Norwell and Hingham have.

Resurfacing and Drainage Improvements

Identified Deficiencies: Pavement conditions along the entire Route 3A corridor are rated mostly as “Fair” (pavement condition categories are “Excellent”, “Good”, “Fair”, “Deficient” and “Poor”), with significant surface wear evident, along with potholes and cracking. The section in the vicinity of the Route 3A interchange, from Woodbridge Street south to the Kingston Line, is rated as “Poor”. Ponding along the roadway edges has also been observed during rain events. Routine and Preventive Maintenance are recommended for Route 3A, except for the section from Woodbridge Street south to the Kingston Line. Base Rehabilitation is recommended for this section.

Recommended Short-Term Improvements: All potholes and cracking in the surface should be immediately repaired and sealed for improve ride-ability and safety, and prevent further deterioration of the surface.

Recommended Long-Term Improvements: The entire roadway should be resurfaced to sustain long term reliability and preservation of the pavement. Drainage improvements should be implemented in problem areas where water chronically collects and ponds during significant precipitation events.

Intersection of Route 3A at Church Street and Enterprise Street (Route 139)

Identified Deficiencies: The intersection has a very high crash rate of 1.49 crashes per million entering vehicles, which is more than double the regional MassDOT District Five average of 0.58/MEV for unsignalized intersections. The intersection also experiences significant delay during the peak demand hours, particularly on the Church Street eastbound approach into the intersection.

Recommended Short-Term Improvements: Vegetation within the right-of-way on the northwest corner of the intersection should be cleared to improve sight lines. Furthermore, MassDOT and the Town of Duxbury should work with property owners to mitigate sight line obstructions that may be located on private property. The installation of a flashing beacon (RED signals towards Church Street and Tremont Street (Route 139), and AMBER signals towards Route 3A) should be considered to further enhance existing signage.

Recommended Long-Term Improvements: The installation of a roundabout (or traffic signal, if warranted) should be considered if safety isn't improved with short-term, lower-cost alternatives.

Intersection of Route 3A at West Street (Route 14) and Saint George Street

Identified Deficiencies: The intersection is controlled by an older traffic signal system, with most of the traffic signal heads post-mounted, although a mast arm with a single signal head hangs over the intersection, controlling traffic in the northbound and southbound directions. There are posted "No Turn on Red" signs in the northbound, eastbound, and westbound directions; but not in the southbound direction. While the northbound direction does have a "No Turn on Red" sign posted, there is also a channelized right turn lane absent of any posted or painted traffic controls. None of the approaches have turn lanes, with the exception of the channelized right turn lane from Tremont Street northbound onto St. George Street.

Recommended Short-Term Improvements: Monitoring of safety performance at this location through the Old Colony Safety Management System is recommended to determine trends in crash rate and severity. The Town of Duxbury may opt to request a traffic study of this specific intersection be performed through the Old Colony MPO's Local Highway Technical Assistance (LTA) Program. Traffic studies conducted through the LTA program provide a greater level of analysis that this corridor study can offer, and may provide insight into specific factors contributing to crashes occurring at this intersection. A YIELD sign accompanied by painted YIELD "shark teeth" on the pavement should be installed on the right turn lane from Tremont Street onto St. George Street. Backplates with reflective borders should be installed on the traffic signal heads to further enhance visibility and safety.

Recommended Long-Term Improvements: The existing post-mounted traffic signal design is outdated, and should be replaced with a modern, overhead mast or guide wire mounted system.

Intersection of Route 3A at Chestnut Street and Tobey Garden Street

Identified Deficiencies: The intersection has an elevated crash rate that is above the MassDOT District Five regional average for un-signalized intersections. The combination of a busy, swift moving through traffic flow on Tremont Street and the skewed approaches of Tobey Garden Street and Chestnut Street creates a challenge for drivers entering the intersection from the side streets. Lengthy queues and delays are common on Chestnut Street and Tobey Garden Street, particularly

during peak demand hours. Roadside vegetation and fixed objects, along with the skewed geometry, also create some impediments to clear sight lines.

Recommended Short-Term Improvements: The following short-term, lower-cost improvements may yield an improvement in safety at the intersection:

- Improved intersection warning signs on both Tremont Street approaches, with side street name plaques below the warning sign.
- Clearing of roadside vegetation and tree canopies to improve visibility of oncoming traffic from the side streets.
- Consider replacing post-mounted flashing warning beacons with overhead wire or mast-arm mounted signals to remove impediments to sight lines created by utilizing post-mounted beacons.
- Consider possibility of making nearby Bayridge Lane (entering Chestnut Street immediately east of Tremont Street) “right turn in – right turn out only” to reduce number of conflicting moves around intersection.

Recommended Long-Term Improvements: The installation of a roundabout (or traffic signal, if warranted) should be considered if safety isn’t improved with short-term, lower-cost alternatives.

Route 3A at Route 3 Exit 10 Ramps

Identified Deficiencies: The interchange of Route 3 Exit 10 and Tremont Street (Route 3A) has become a significant regional transportation connection due to residential and commercial growth in the area. The absence of traffic signals and the four-lane cross section of Route 3A through this interchange contributes to delays and an increased hazard factor for vehicles both entering and exiting Route 3.

Recommended Long-Term Improvements: The interchange of Route 3 Exit 10 and Tremont Street (Route 3A) should be signalized. This improvement is a priority of both the Towns of Duxbury and Kingston, and has been identified as a regional transportation priority in the Old Colony MPO’s Long Range Regional Transportation Plan.