

# ROAD SAFETY AUDIT

Route 53 (Washington Street) High Crash Locations  
at Route 139 (Schoosett Street)  
and Route 14 (Congress Street)

Town of Pembroke

April 29, 2016

Prepared For:  
MassDOT Highway Division



Prepared By:  
BETA Group, Inc.



315 Norwood Park South  
2nd Floor  
Norwood, Massachusetts 02062  
781.255.1982  
[www.BETA-Inc.com](http://www.BETA-Inc.com)

# Table of Contents

---

<b>Project Data</b> .....	<b>1</b>
<b>Background</b> .....	<b>2</b>
<b>Project Description</b> .....	<b>2</b>
<b>Audit Observations</b> .....	<b>9</b>
<b>Potential Safety Enhancements</b> .....	<b>12</b>
<b>Summary of Road Safety Audit</b> .....	<b>14</b>

## List of Appendices

Appendix A.	RSA Meeting Agenda
Appendix B.	RSA Audit Team Contact List
Appendix C.	Detailed Crash Data
Appendix D.	Speed Regulations

## List of Figures

Figure 1.	Location Map .....	3
Figure 2.	Location Detail – Route 53 at Route 139 .....	4
Figure 3.	Location Detail – Route 53 at Route 14/Congress Street.....	8

## List of Tables

Table 1.	Participating Audit Team Members .....	1
Table 2.	Estimated Time Frame and Costs Breakdown .....	12
Table 3.	Potential Safety Enhancement Summary .....	15

## Project Data

A Road Safety Audit for High Crash Locations along Route 53 (Washington Street) in the Town of Pembroke was held on March 29, 2016 at Pembroke Town Hall in Pembroke, MA. As indicated in Table 1, the audit team consisted of representatives from State, Regional and Local agencies and included a cross-section of engineering, planning and emergency response expertise.

**Table 1. Participating Audit Team Members**

<b>Audit Team Member</b>	<b>Agency/Affiliation</b>
John Mastera	MassDOT Highway Division – Safety Section
Jason Walters	MassDOT Highway Division – District 5
Gene Fulmine	Pembroke DPW
Scott Glauben	Pembroke DPW
Mike Hill	Pembroke Fire Department (Chief)
Ray Guarino	OCPC
Greg Lucas	BETA Group, Inc.
Justin Curewitz	BETA Group, Inc.
Matt Shute	BETA Group, Inc.

## Background

The Federal Highway Administration defines a Road Safety Audit (RSA) as the formal safety examination of an existing or future road or intersection by an independent, multidisciplinary team. The purpose of an RSA is to identify potential safety issues and possible opportunities for safety improvements considering all roadway users. A Road Safety Audit was scheduled for high crash locations along Route 53 (Washington Street) in Pembroke because the corridor is scheduled for resurfacing (MassDOT File No. 608266). The corridor includes three high crash locations: Route 53 at Route 139 (Schoosett Street), Route 53 at Pleasant Street, and Route 53 at Route 14 (Congress Street). The intersection of Route 53 and Pleasant Street is scheduled for reconstruction in FY 2017 (MassDOT File No. 607337) under Old Colony Metropolitan Planning Organization's Transportation Improvement Plan (TIP); an RSA was held at this intersection in June 2014. This RSA focuses on the remaining two high crash locations along Route 53. The RSA is intended to identify potential short and long term safety improvements that can be made at each intersection, which can then be implemented through general maintenance for short term low cost improvements or incorporated into the future project to the greatest extent practicable.

## Project Description

Route 53 (Washington Street), shown in Figure 1, is an Urban Minor Arterial along the majority of its length within the Town of Pembroke. Route 53 is an Urban Principal Arterial north of its intersection with Schoosett Street, where it runs concurrently with Route 139 and is a National Highway System (NHS) roadway. Route 53 is entirely under State jurisdiction within Pembroke, and follows a north-south alignment, running essentially parallel to Route 3 and serving as a connector from Hanover to the north to Route 3A, Kingston and Plymouth to the south.

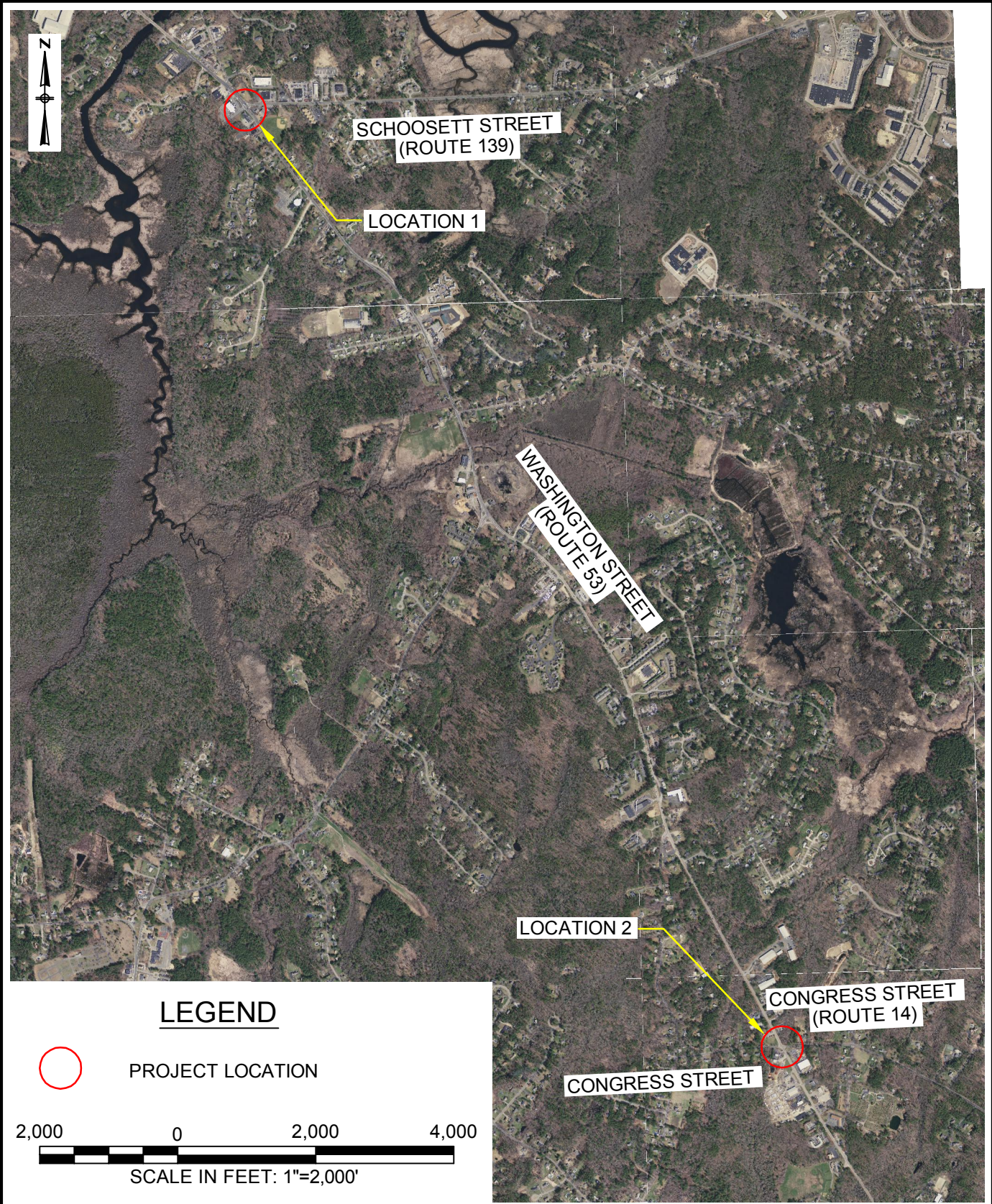
Land use is a mix of residential, commercial and industrial along Route 53. Wooded or tree-lined parcels are common along the corridor.

The two intersections are discussed in detail below.

### **Route 53 (Washington Street) at Route 139 (Schoosett Street)**

Route 53 (Washington Street) and Route 139 (Schoosett Street) form a four-legged intersection under traffic signal control. Route 53 (Washington Street) forms the north and south legs of the intersection, while Route 139 follows Washington Street north of the intersection and Schoosett Street east of the intersection. The entrance to Pointe Plaza forms the fourth leg of the intersection, opposite Schoosett Street. Schoosett Street is under MassDOT jurisdiction, and the signal is owned and maintained by MassDOT. Route 139 (Schoosett Street) is a primary connection to Route 3 and to Marshfield to the east.

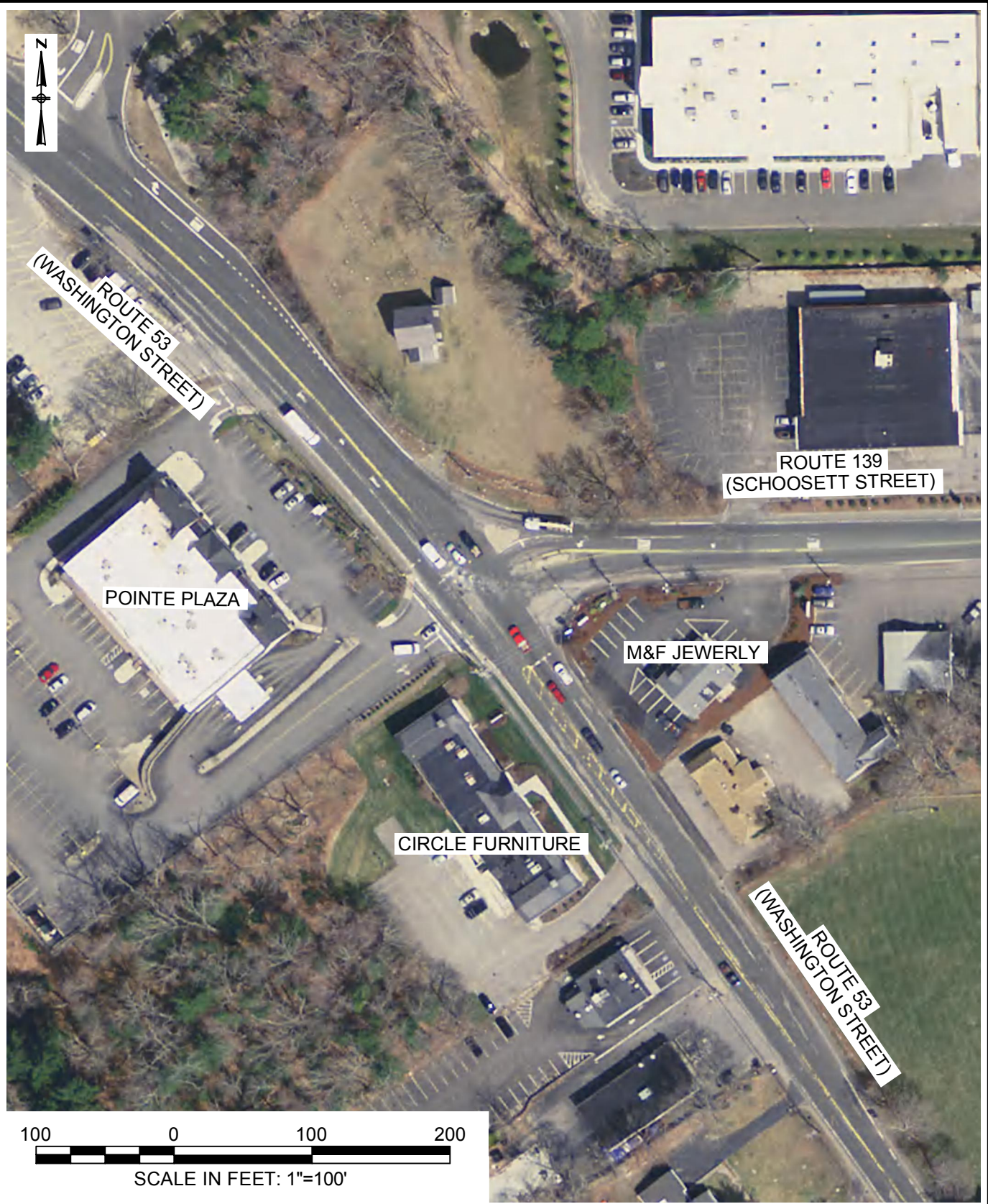
Land use in the area is commercial, with the Pointe Plaza on the northwest corner, Circle Furniture on the southwest corner, and a vacant commercial building on the southeast corner. Land abutting the historical Pembroke Friends Meeting House abuts the northeast corner of the intersection. Figure 2 provides a detailed view of adjacent properties.



Road Safety Audit -  
Route 53  
at Two Locations

Pembroke, MA

**Figure 1**  
Location Map



www.BETA-Inc.com

**Road Safety Audit -  
Route 53  
at Two Locations**

Pembroke, MA

**Figure 2**

Location 1 Detail  
(Route 53 at Route 139)

Route 53 (Washington Street) provides two lanes in each direction at Schoosett Street. The northbound approach provides two through lanes, with turns accommodated from shared lanes.

Observations on the day of the audit revealed that through vehicles generally favor the left lane, with the right lane accommodating right turns to Schoosett Street. The southbound approach provides a left turn lane to Schoosett Street, and a shared lane for through vehicles and for right turns to Pointe Plaza. Schoosett Street westbound provides a left turn lane to Route 53 southbound which is under signal control, and a right turn to Route 53 northbound which is under yield control.



**Route 53 at Route 139 (looking south)**

Through movements to Pointe Plaza from Schoosett Street are allowed from the left lane, although it is marked with arrow and ONLY markings indicating it is a left turn lane only. The Pointe Plaza approach provides two lanes, a left turn lane and a shared lane for through vehicles and right turns.

The traffic signal provides three phase operation, with southbound left turns operating under protected/permissive operation. The intersection was recently retrofitted with a flashing yellow arrow for this movement as part of a statewide initiative at state-owned intersections. A green arrow is provided for southbound left turns in conjunction with a green ball for southbound through vehicles, followed by the flashing yellow arrow for the permissive southbound left turn movement in conjunction with green indications for Route 53 in both directions. Finally, a phase is provided for Schoosett Street and Pointe Plaza.

No pedestrian signals are provided at the intersection. Sidewalks are provided along the frontage of Circle Furniture and Pointe Plaza on the west side of Route 53, but do not extend for any significant length along Route 53 beyond the intersection. A crosswalk is provided across the Pointe Plaza approach. Sidewalk was recently constructed along the east side of Route 53 south of the intersection, and around the southeast corner of the intersection. It was noted by audit participants that no crosswalk is provided across Route 53, despite the presence of sidewalk on both sides of the roadway on the southern leg of the intersection.

Pavement markings are faded at the intersection. As previously noted, arrow and only markings in the left lane of the Schoosett Street approach appear to prohibit through movements to Pointe Plaza, although they are accommodated from within this lane. A solid white edge line is provided to delineate a shoulder, but widths are not sufficient to safely accommodate bicycles.

Crash data provided by the Pembroke Police Department show 26 crashes occurred at the intersection for the three year period from 2013 through 2015. A crash data summary and a collision diagram are included in the Appendix. The most prevalent crash type were angle crashes, comprising 46% of all crashes. Angle

crashes were most prevalent between a southbound left-turning vehicle and a northbound through vehicle. It is assumed that the majority of these crashes occurred during the permissive phase and are the result of drivers taking chances on unacceptable gaps. Town personnel estimated that the flashing yellow arrow for the southbound left turn movement was installed within the last few months, and it should be noted that all crashes occurred prior to that installation. Of note are two angle crashes north of the intersection involving northbound left turning vehicles; one was turning into a paint store north of the Pointe Plaza, while the other was erroneously turning into a one-way exit from the plaza.

Eleven of the 26 crashes (42%) were rear-end crashes. Nine of these eleven crashes occurred in the westbound yield-controlled channelized right turn lane to Route 53 northbound. Rear-end crashes occur on yield-controlled channelized right turn because a driver must turn their head sharply to the left to determine if an acceptable gap exists, and may use different judgement than the driver in front of or behind them. This difference in judgement can lead to a collision when the trailing driver determines there is adequate room for both vehicles to go, and starts to go before turning back to look in front, not realizing that the leading driver did not make the same judgement.

Speed regulations included in the Appendix establish a 35 mph regulatory speed limit for Route 53 in the vicinity of Schoosett Street. This regulatory limit is posted northbound in advance of Schoosett Street. No signs are provided southbound between the Hanover/Pembroke town line and Schoosett Street.

#### **Route 53 (Washington Street) at Route 14 (Congress Street)**

Route 53 (Washington Street) and Route 14 (Congress Street) form a 4-way intersection under 2-way STOP control. Congress Street is under STOP control in both directions, while Washington Street is uncontrolled. A mast-arm mounted overhead 4-way flashing beacon supports the intended control, with yellow flashing indications for Route 53 and red flashing indications for Congress Street.

Both intersecting roadways provide single lane approaches at the intersection. Route 53 (Washington Street) forms the north and south legs of the intersection. Route 14 follows Washington Street north of the intersection and Congress Street east of the intersection. Route 14 is concurrent with Route 53 along Washington Street for approximately 1.7 miles north of Congress Street, and then continues to the west towards Pembroke's town center. Route 14 to the east provides access to Route 3 and to Duxbury.



**Route 53 at Congress Street (looking north)**



Congress Street is an Urban Collector under Town of Pembroke jurisdiction. The intersection of Route 53 and Congress Street is under MassDOT jurisdiction.

Land use in the area is a mix of commercial, industrial and residential. A Marylou's coffee shop on the southwest corner of the intersection is the only corner property with driveway access directly abutting the intersection. A trailer supply company on the southeast corner has a wide driveway over 200' south of Congress Street, while an auto shop on the northwest corner has a driveway approximately 180' north of Congress Street. The northeast corner of the intersection is wooded. Figure 3 provides a detailed view of the intersection and adjacent commercial properties.

No sidewalks are provided in the immediate vicinity of the intersection. Painted stop lines and stop markings are provided on the Congress Street approaches. Solid white edge lines delineate the shoulders on Route 53, but are not of a consistent adequate width to safely accommodate bicycles.

Crash data provided by the Pembroke Police Department and MassDOT show twelve crashes occurred at the intersection for the four year period from 2012 through 2015. A crash data summary and a collision diagram are included in the Appendix. A four year study period was chosen because there was a higher occurrence of crashes in 2012 and 2013 (five per year) than in 2014 (zero) and 2015 (two).

The most prevalent crash type were angle crashes, comprising 83% of all crashes. Six angle crashes involved vehicles departing Congress Street westbound; three collided with a northbound vehicle, while three collided with a southbound vehicle. Three additional angle crashes involved an eastbound vehicle and a northbound vehicle. One angle crash involved a northbound turning vehicle and a southbound vehicle. The two non-angle crashes in the study period were a rear-end crash where both vehicles were turning left to Congress Street westbound, and a head-on crash where solar glare was cited as a contributing factor. Seven of the twelve total crashes occurred between 2 PM and 6 PM.

Speed regulations included in the Appendix establish a 50 mph regulatory speed limit for Route 53 in the vicinity of Congress Street. No signs are provided enforcing this regulatory speed limit in the vicinity of the intersection.



www.BETA-Inc.com

**Road Safety Audit -  
Route 53  
at Two Locations**

Pembroke, MA

**Figure 3**

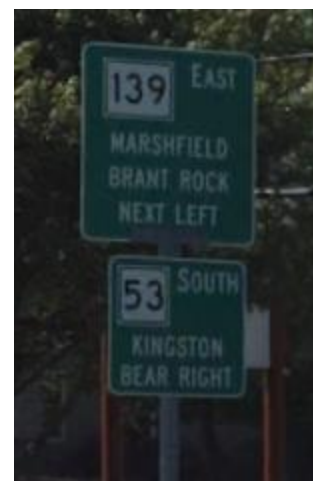
Location 2 Detail  
(Route 53 at Route 14/  
Congress Street)

## Audit Observations

Following a brief introduction to the RSA process and a summary of existing geometry and crash information, the audit participants were asked to discuss safety issues at the intersections of Route 53 with Route 139 (Schoosett Street) and Route 14 (Congress Street). Audit participants then conducted a site visit as a group, at which time they offered observations on safety issues and concerns. A summary of those major safety considerations is as follows:

### Route 53 (Washington Street) at Route 139 (Schoosett Street)

- Lane Configuration – Items related to lane markings and lane configuration were noted by audit participants.
  - The Route 53 southbound approach widens to two lanes in advance of the intersection without warning that the left lane is a left turn only lane to Route 139 (Schoosett Street) eastbound. This creates a trap lane for drivers intending to continue on Route 53 southbound. One sideswipe crash on this approach may be a result of this trap lane condition.
  - The left lane on the Schoosett Street approach has arrow and only markings suggesting it is a left turn only lane, although through movements to Pointe Plaza are accommodated from within this lane
- Pavement Markings – Markings are generally faded at the intersection, including gore areas and yield markings for the channelized westbound right turn carrying the Route 139 westbound through movement. Faded markings reduce adherence and can create confusion over intended lane assignments.
- Guide Signs – Two observations were related to D6/D8 guide signage provided at the intersection.
  - The D8 sign for Route 53 southbound has a direction of “Bear Right” as shown at right, although the Route 53 southbound through movement is aligned as a straight through movement at the intersection.
  - Northbound visibility of the D6/D8 assembly on the southeast corner of the intersection is blocked by a tree in the landscaped island behind the sidewalk.
- Pavement Condition – Pavement is in poor condition at the intersection and along Route 53, including rutting, cracking, edge unraveling and extensive patching.
- Traffic Signal – Two items related to the traffic signal operation and equipment were noted by audit participants.



**Bear Right on  
sign legend**

- Detection for the southbound left turn lane does not appear to be functioning properly. The signal was observed running the protected phase for the southbound left turn movement for long intervals where no vehicle was present, suggesting that the loop detection is not working and/or that the phase is set to max recall. This reduces the efficiency of the signal by devoting green time that could otherwise be allocated based on actual demand.
- Overhead signals for the Route 53 northbound approach are closely spaced on the span wire assembly. This increases the potential for the view of the signal heads to be blocked by a single large vehicle. It was also noted that the northbound approach is the only approach at the intersection without a supplemental ground-mounted signal head.
- Pedestrian Accommodations –Although sidewalks are provided along the west side and on the southeast corner of the intersection, no crosswalk is provided across Route 53 and no pedestrian signal heads or signal phasing is provided.
- Bicycle Accommodation – Accommodation is not provided for bicycles at the intersection. Shoulders, where provided, are of an inadequate width for accommodation.

#### **Route 53 (Washington Street) at Route 14 (Congress Street)**

- Visibility – Overgrown vegetation on the northeast corner restricts visibility for drivers departing Congress Street westbound. This is a likely contributing factor in the three crashes between a westbound vehicle and a southbound vehicle.



**Vegetation growth on northeast corner**

- Marylou's – The drive-thru for the Marylou's coffee shop on the southwest corner of the intersection is located on the west side of the building, but has an order board located in front of the building. The location of the order board and the lack of channelization for drive-thru customers produce limited room for queued vehicles during busy periods. Audit participants noted that a queue of just two vehicles can extend to Congress Street, and that vehicles have been observed backing onto both Congress Street and Route 53. It should be noted that no crashes appear to be attributable to this issue.
- Signage – Several issues related to signage were identified by audit participants.
  - The D6/D8 guide sign on the northwest corner of the intersection is intended for Route 14 westbound traffic, but is angled so that it is visible to both Route 14 westbound and Route 53 northbound. This can create confusion for Route 53 northbound drivers.

- The D6/D8 sign on the southeast corner of the intersection is damaged. It appears that trucks regularly park along the western edge of Route 53 approaching Congress Street, perhaps to walk across the road to Marylou's, and that trucks cut this corner when turning onto Route 14 eastbound.
- Street name signage is small and not clearly visible, and is not in conformance with current standards.
- **Corner Geometry** – Concerns related to corner radii and edge treatments were identified by audit participants.
  - Curbing at the southwest corner of the intersection is depressed. Rutting of soil behind the curb suggests that vehicles routinely drive over the depressed curb when entering Marylou's parking area.
  - The radius on the southeast corner of the intersection is not large enough to accommodate large truck turns, as evidenced by vehicle tracks over the curb, as well as sign damage noted above.
- **Drainage** – Ponding on the northeast and southwest corners suggests drainage deficiencies. Curbing damage on the southwest corner allows runoff to bypass the catch basin and pond within the grass area behind the curb.
- **Speeding** – Speeding is a safety concern at the intersection and along Route 53. Excessive speed can be a contributing factor in angle crashes at the intersection, as it creates variances between expected and actual available gaps for vehicles departing Congress Street. Speed limit signs are not provided along Route 53 to reinforce the regulatory 50 mph speed limit; with the nearest speed limit sign over two miles away in each direction.
- **Pavement Markings** – Audit participants questioned whether the stop line for the Congress Street westbound approach was set too far back from the Route 53 gutter line. The setback exacerbates concerns related to vegetation on the northeast corner. It was suggested that the stop line location may be set to accommodate southbound turning vehicles.
- **Bicycle Accommodation** – Accommodation is not provided for bicycles at the intersection. Shoulders, where provided, are of an inadequate width for accommodation.
- **Passing Zones** – Marked passing zones exist just north and south of Congress Street on Route 53. The proximity of passing zones to the intersection can impact speed, and can be a safety concern if vehicles cannot pass and re-enter the travel lane before passing through the intersection.
- **Pedestrian Accommodation** – No pedestrian facilities are provided at the intersection. Audit participants noted that there is not a notable pedestrian presence at the intersection.



**Bent sign corner**

## Potential Safety Enhancements

Following review of available materials and a discussion of existing safety issues, audit participants were asked to consider improvements. Audit participants were encouraged to consider both short and long term improvements for each issue. Each improvement considered has been categorized as short-term, mid-term, or long-term based on the definitions shown in Table 2. Additionally, a cost category has been assigned to each improvement based on the parameters set forth in Table 2.

**Table 2. Estimated Time Frame and Costs Breakdown**

Time Frame		Costs	
Short-term	<1 year	Low	<\$10,000
Mid-term	1–3 years	Medium	\$10,000–\$50,000
Long-term	>3 years	High	>\$50,000

### **Route 53 (Washington Street) at Route 139 (Schoosett Street)**

- Update pavement markings, including dotted guide lines to clearly delineate the beginning of turn lanes. The addition of dotted guide lines will alert drivers that they are entering a turn lane, providing improved warning of the existing trap lane condition on Route 53 southbound. Gore markings and yield markings should be included in reapplication of existing markings. This is a short-term, low cost improvement.
- Provide lane designation signage for all approaches. This short-term, low cost improvement will help clearly identify the lane assignments on the intersection approaches.
- Remove left arrow and only markings on the Schoosett Street approach, and replace with a left-through arrow. This short-term, low cost improvement will eliminate potential confusion for drivers intending to travel straight across the intersection to enter Pointe Plaza.
- Consider geometric changes to the angle for the channelized right turn from Schoosett Street to Route 53 northbound. This can include increasing the angle so that it is closer to a typical right turn, and may require bringing this movement under traffic signal control. This is a mid-term, potentially medium cost improvement.
- Remove tree on southeast corner blocking D6/D8 guide sign, or work with property owner to relocate. If the tree is contained within the State Highway layout (SHLO), it can be removed by MassDOT forces as a short-term, low cost improvement. If it is on the owner’s property, it will require coordination with the property owner to allow removal of the tree, or consider relocation of the sign to improve visibility.
- Replace D8 sign for Route 53 southbound to incorporate an up arrow, indicating a straight through movement. Discussion at the RSA suggested replacing the misleading “BEAR RIGHT” legend, but revision to maintain conformance with MassDOT standards for a through movement would require

revising the sign legend and layout, suggesting the need for replacement. This is a short-term, low cost improvement.

- Rehabilitate pavement. Pavement will be rehabilitated along Route 53 as part of planned improvements. The appropriate method of pavement rehabilitation should be determined based on the results of subsurface exploration. This is a mid-term, high cost improvement.
- Restore detection for the Route 53 southbound left turn to Schoosett Street. The signal was observed serving the protected phase for this movement when no demand was present, suggesting broken detection or max recall. Recall settings should be confirmed and the detector should be replaced to restore intended operations. This is a short-term, potentially medium cost improvement.
- Increase spacing of overhead signals and add a supplemental ground-mounted signal head for Route 53 northbound. This is a short-term, low cost improvement that would improve signal visibility for this approach.
- Consider adding a crosswalk across the south leg of Route 53, and add pedestrian signals at the intersection. This is a long-term, medium cost improvement that should be studied to determine the operational impact.
- Revise shoulder widths to provide bicycle accommodation, where feasible. Minimum 5-foot shoulders would meet bicycle accommodation requirements set forth in MassDOT's Healthy Transportation Policy. This is a mid-term, potentially high cost improvement.
- Study potential lane configuration modifications at the intersection. It was noted at the audit that northbound traffic favors the left lane, although two northbound through lanes are provided. If the northbound approach could accommodate a single through lane and a right turn lane, the Schoosett Street approach could in turn be modified to allow the channelized right turn to enter a dedicated receiving lane, eliminating the need for yield control. This improvement would require a detailed study to determine the feasibility of suggested modifications. Study is a short-term, medium cost improvement, while intersection modifications would be a long-term, high cost improvement.

#### **Route 53 (Washington Street) at Route 14 (Congress Street)**

- Trim vegetation and remove overgrowth on the northeast corner of the intersection. Audit participants suggested that this can be done within the SHLO. This is a short-term, low cost improvement.
- Coordinate with Marylou's owner to mark and provide internal queuing area for drive-thru patrons. Improving drive-thru queue storage would reduce the potential for vehicles to back up onto Congress Street or Route 53. This is a short-term, low cost improvement.
- Provide speed limit signs along Route 53. Signs should reflect state regulatory speed limits established for the roadway. This is a short-term, low cost improvement.
- Rotate the D6/D8 guide sign on the northwest corner of the intersection to avoid potential confusion for Route 53 northbound drivers. This is a short-term, low cost improvement.

- Replace or repair the D6 guide sign on the southeast corner of the intersection. This is a short-term, low cost improvement.
- Update street name signs at the intersection. Street name signs should be provided on opposite corners, with signs for both Washington Street and Congress Street. Signs should meet current MassDOT and MUTCD mixed case requirements. This is a short-term, low cost improvement.
- Install raised curbing on the southwest corner of the intersection with adequate reveal. Existing berm is depressed and damaged, allowing vehicles to easily traverse the curb and damage the unpaved area directly behind the curb. This will confine turning movements to the Marylou’s driveway, and allow restoration of grass and/or planted area. This is a short-term, low cost improvement.
- Widen the curb radius on the southeast corner of the intersection. Large vehicle tracks are present behind the curb, suggesting that turning vehicles regularly encroach upon this area. The proper radius should be determined using turning templates and/or software. This is a short-term, low cost improvement.
- Clean out drainage structures at the intersection. Ponding suggests that existing structures are not operating as intended. This is a short-term, low cost improvement.
- Continue to enforce speeding in the vicinity of the intersection. Enforcement is a short-term and ongoing improvement, the cost of which is reduced enforcement elsewhere in Town.
- Review stop line location for Congress Street westbound approach. It was suggested that the stop line could be moved forward, allowing increased visibility. The southbound left turning path should be reviewed to ensure that a vehicle will not encroach on the westbound stop line. This is a short-term, low cost improvement.
- Revise shoulder widths to provide bicycle accommodation, where feasible. Minimum 5-foot shoulders would meet bicycle accommodation requirements set forth in MassDOT’s Healthy Transportation Policy. This is a mid-term, potentially high cost improvement.
- Verify adequacy of passing zones. Marked passing zones north and south of Congress Street should be evaluated to ensure that a vehicle can adequately pass and re-enter the travel lane prior to entering the intersection.

## Summary of Road Safety Audit

Table 3 summarizes potential recommendations discussed by the audit team. The recommendations are categorized based on the potential safety payoff, as well as by time frame and cost. The safety payoff is a qualitative judgment of the effectiveness of the potential safety improvements. Each recommendation has a responsibility assigned to it stating whether MassDOT or the Town of Pembroke would be responsible for implementing the recommended improvement.



**Table 3. Potential Safety Enhancement Summary**

Safety Issue	Safety Enhancement	Responsibility	Safety Payoff	Time Frame	Cost
<b>Route 53 (Washington Street) at Route 139 (Schoosett Street)</b>					
Lane Configuration, Pavement Markings	Update pavement markings, including dotted guide lines to clearly delineate the beginning of turn lanes. Gore markings and yield markings should be included in reapplication of existing markings.	MassDOT	Medium	Short-term	\$10,000
Lane Configuration	Provide lane designation signage for all approaches.	MassDOT	Medium	Short-term	\$2,000
Lane Configuration, Pavement Markings	Remove left arrow and only markings on the Schoosett Street approach, and replace with a left-through arrow.	MassDOT	Low	Short-term	\$2,500
Lane Configuration	Consider geometric changes to the angle for the channelized right turn from Schoosett Street to Route 53 northbound.	MassDOT	High	Mid-term	TBD (Medium)
Guide Signs	Remove tree on southeast corner blocking D6/D8 guide sign, or work with property owner to relocate.	MassDOT/ Property Owner	Medium	Short-term	\$1,000
Guide Signs	Replace D8 sign for Route 53 southbound to incorporate an up arrow, indicating a straight through movement.	MassDOT	Low	Short-term	\$2,500
Pavement Condition	Rehabilitate pavement.	MassDOT	Medium	Mid-term	High
Traffic Signal	Restore detection for the Route 53 southbound left turn to Schoosett Street.	MassDOT	High	Short-term	\$15,000
Traffic Signal	Increase spacing of overhead signals and add a supplemental ground-mounted signal head for Route 53 northbound.	MassDOT	Medium	Short-term	\$7,500
Pedestrian Accommodations	Consider adding a crosswalk across the south leg of Route 53, and add pedestrian signals at the intersection.	MassDOT	High	Long-term	Medium
Bicycle Accommodation	Revise shoulder widths to provide bicycle accommodation, where feasible.	MassDOT	Medium	Mid-term	TBD (High)
Lane Configuration	Study potential lane configuration modifications at the intersection.	MassDOT	TBD	Short-term	TBD

Table 3. Potential Safety Enhancement Summary

Safety Issue	Safety Enhancement	Responsibility	Safety Payoff	Time Frame	Cost
<b>Route 53 (Washington Street) at Route 14 (Congress Street)</b>					
Visibility	Trim vegetation and remove overgrowth on the northeast corner of the intersection.	MassDOT	High	Short-term	\$2,500
Marylou's	Coordinate with Marylou's owner to mark and provide internal queuing area for drive-thru patrons.	MassDOT/ Property Owner	Medium	Short-term	TBD
Signage	Provide speed limit signs along Route 53. Signs should reflect regulatory limits.	MassDOT	Medium	Short-term	\$1,000
Signage	Rotate the D6/D8 guide sign on the northwest corner of the intersection to avoid potential confusion for Route 53 northbound drivers.	MassDOT	Low	Short-term	\$1,000
Signage	Replace or repair to D6 guide sign on the southeast corner of the intersection.	MassDOT	Low	Short-term	\$2,500
Signage	Update street name signs at the intersection.	MassDOT	Medium	Short-term	\$1,000
Corner Geometry	Install raised curbing on the southwest corner of the intersection with adequate reveal.	MassDOT	Low	Short-term	\$5,000
Corner Geometry	Widen the curb radius on the southeast corner of the intersection.	MassDOT	Medium	Short-term	\$5,000
Drainage	Clean out drainage structures at the intersection.	MassDOT	Low	Short-term	\$3,000
Speeding	Continue to enforce speeding in the vicinity of the intersection.	Town	High	Short-term	\$0 (Reduced enforcement elsewhere)
Pavement Markings	Review stop line location for Congress Street westbound approach.	MassDOT	Medium	Short-term	TBD
Bicycle Accommodation	Revise shoulder widths to provide bicycle accommodation, where feasible.	MassDOT	Medium	Mid-term	TBD (High)
Passing Zones	Verify adequacy of passing zones. Ensure that a vehicle can adequately pass and re-enter the travel lane prior to entering the intersection.	MassDOT	Medium	Short-term	Low

## Appendix A. RSA Meeting Agenda

---

# Agenda

## Road Safety Audit

Pembroke, MA

Route 53 at Route 139 (Schooset St)

Route 53 at Route 14 (Congress St)

Meeting Location: Pembroke Town Hall

Veterans Hall (Room #6)

100 Center Street, Pembroke, MA

Tuesday, March 29, 2016

1:00 PM – 3:00 PM

**Type of meeting:** High Crash Location – Road Safety Audit  
**Attendees:** Invited Participants to Comprise a Multidisciplinary Team  
**Please bring:** Thoughts and Enthusiasm!!

**1:00 PM** Welcome and Introductions

**1:15 PM** Discussion of Safety Issues

- Crash history, Speed Regulations – provided in advance
- Existing Geometries and Conditions

**1:45 PM** Site Visit

- Drive to the intersections of Route 53/Route 139 and Route 53/Route 14
- As a group, identify areas for improvement

**2:15 PM** Discussion of Potential Improvements

- Discuss observations and finalize safety issue areas
- Discuss potential improvements and finalize recommendations

**3:00 PM** Adjourn for the Day – but the RSA has not ended

### Instructions for Participants:

- Before attending the RSA on March 29<sup>th</sup>, participants are encouraged to drive/walk through the intersection and complete/consider elements on the RSA Prompt List with a focus on safety.
- All participants will be actively involved in the process throughout. Participants are encouraged to come with thoughts and ideas, but are reminded that the synergy that develops and respect for others' opinions are key elements to the success of the overall RSA process.
- After the RSA meeting, participants will be asked to comment and respond to the document materials to assure it is reflective of the RSA completed by the multidisciplinary team.

## Appendix B. RSA Audit Team Contact List

---

## Participating Audit Team Members

Date: March 29, 2016

Location: Pembroke – Route 53 at Route 139 (Schooset St) and Route 14 (Congress St)

<b>Audit Team Member</b>	<b>Agency/Affiliation</b>	<b>Email Address</b>	<b>Phone Number</b>
Greg Lucas	BETA	GLucas@BETA-Inc.com	781-255-1982
Justin Curewitz	BETA	JCurewitz@BETA-Inc.com	781-255-1982
John Mastera	MassDOT Highway Safety	John.Mastera@state.ma.us	857-368-9648
Matt Shute	BETA	MShute@BETA-Inc.com	401-333-2382
Jason Walters	MassDOT D5 - Projects	Jason.Walters@state.ma.us	508-884-4370
Gene B. Fulmine Jr.	Pembroke DPW	GFulminejr@townofpembrokemass.org	781-709-1427
Scott Glauben	Pembroke DPW	sglauben@townofpembrokemass.org	781-831-2550
Mike Hill	Pembroke Fire Dept	mhill@pembrokefire.org	
Raymond Guarino	OCPC	rguarino@ocpcrpa.org	508-583-1833 Ext 212

## Appendix C. Detailed Crash Data

---



www.BETA-Inc.com

COLLISION DIAGRAM



POINTE PLAZA

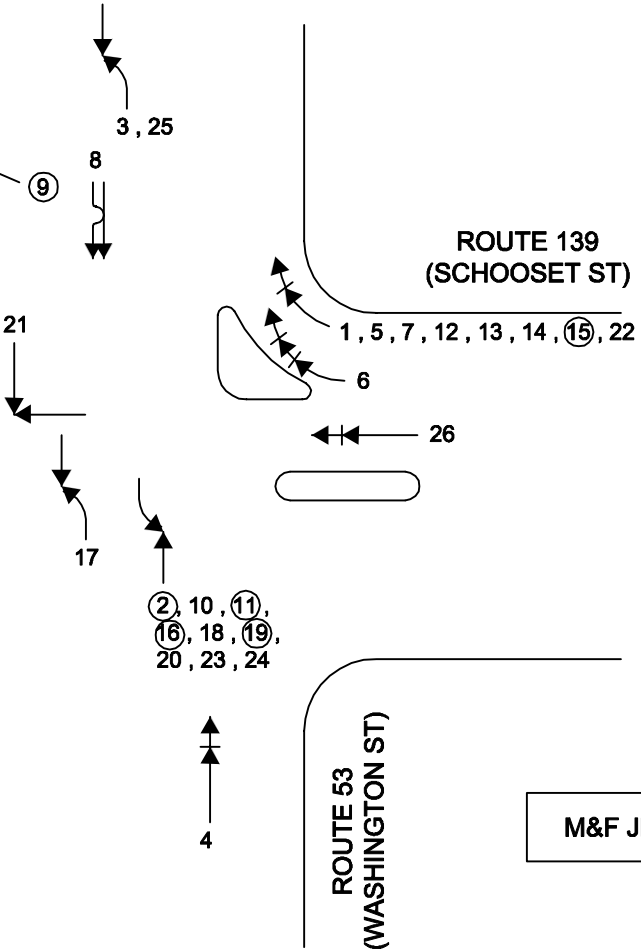
ROUTE 53/139  
(WASHINGTON ST/  
COLUMBIA RD)

ROUTE 139  
(SCHOOSSET ST)

POINTE PLAZA

CIRCLE  
FURNITURE

M&F JEWELRY



SYMBOLS	COLLISION TYPES
← Moving Vehicle	↔ Rear End
← Backing Vehicle	↔ Head On
- - - Non-Involved Vehicle	↔ Side Swipe
↑ Pedestrian	↔ Out of Control
↻ Bicycle	↔ Left Turn
▭ Parked Vehicle	↔ Right Angle
□ Fixed Object	
○ Fatal Accident	
○ Injury Accident	

Intersection: Route 53 (Columbia Rd/Washington St at Route 139 (Schoosset St)

Date Range: January 2013 - December 2015



## Crash Data Summary Table

Route 53 (Washington St/Columbia Rd) at Route 139 (Schooset St), Pembroke, MA

January 2013 - December 2015

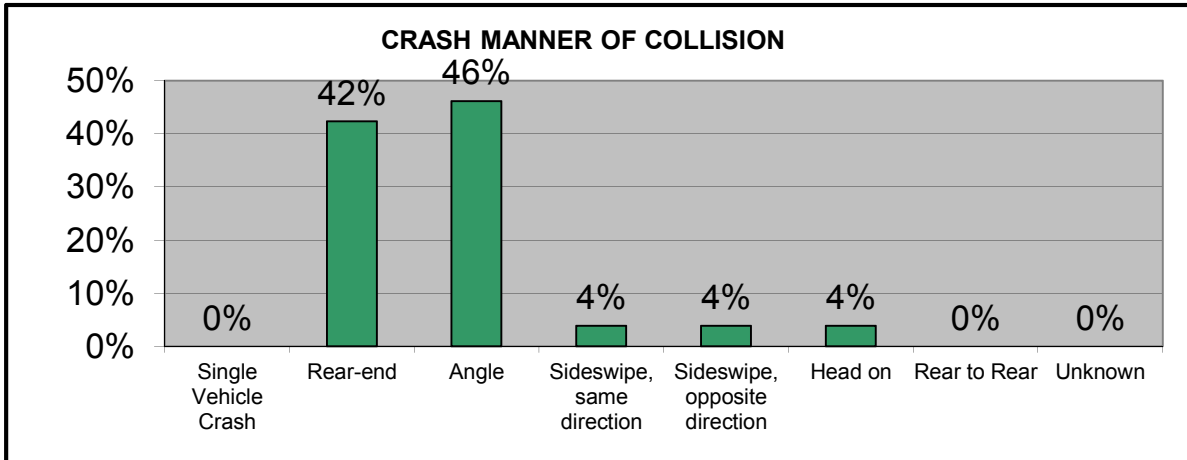
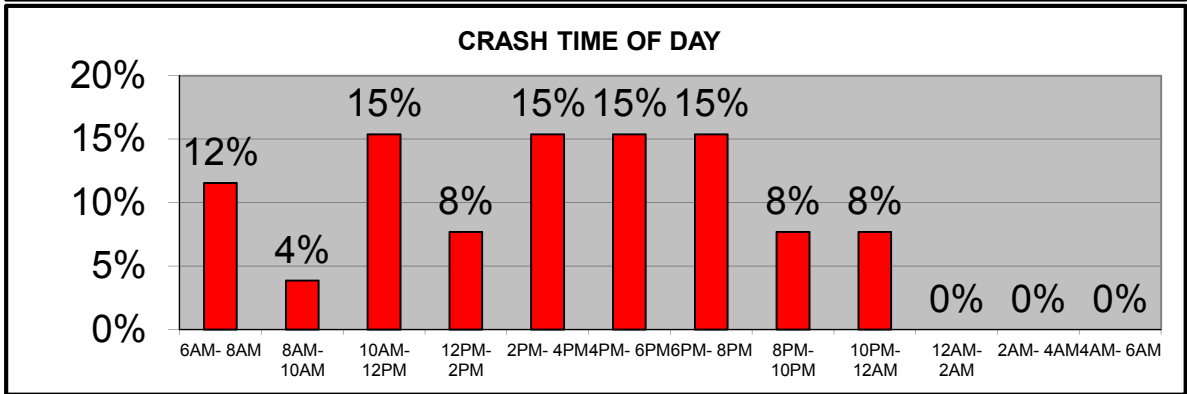
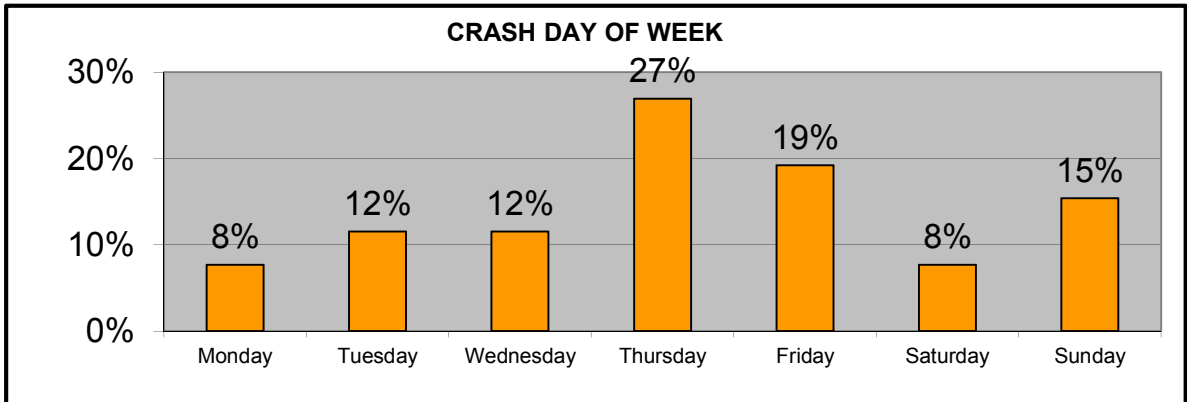
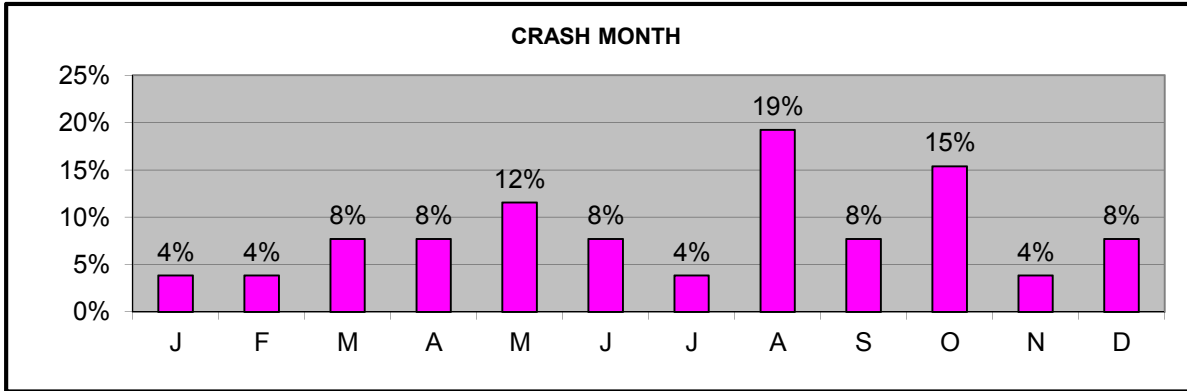
Crash Diagram Ref #	Crash Date <i>m/d/y</i>	Crash Day	Time of Day	Manner of Collision <i>Type</i>	Light Condition <i>Type</i>	Weather Condition <i>Type</i>	Road Surface <i>Type</i>	Driver Contributing Code <i>Type</i>	Ages				Comments
									D1	D2	D3	D4	
1	4/9/13	Tuesday	10:59 AM	Rear-end	Daylight	Clear	Dry	Inattention	30	45			
2	5/12/13	Sunday	9:39 AM	Angle	Daylight	Cloudy	Wet	No Improper Driving	19	54	32		Attempting to turn left to Schooset St and was struck by northbound vehicle pushing them into third vehicle queued eastbound
3	8/1/13	Thursday	4:04 PM	Angle	Daylight	Clear	Dry	Failed to yield right of way	59	18			Factory Paint Entrance
4	8/25/13	Sunday	3:03 PM	Rear-end	Daylight	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	55	52			OUI
5	3/6/14	Thursday	7:47 AM	Rear-end	Daylight	Clear	Dry	Inattention	31	63			
6	3/20/14	Thursday	12:36 PM	Rear-end	Daylight	Clear	Dry	Inattention	26	29	45		
7	5/24/14	Saturday	8:45 PM	Rear-end	Dawn	Clear	Dry	Inattention	44	21			
8	7/21/14	Monday	5:01 PM	Sideswipe, same direction	Daylight	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	30	60	24	20	Sideswiped first vehicle, rear-ended second vehicle and pushed it into fourth vehicle
9	9/5/14	Friday	10:45 PM	Angle	Dark - lighted roadway	Clear	Dry	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	43				Drove straight through intersection and struck Plaza sign, bushes and three other parked vehicles
10	1/9/15	Friday	5:34 PM	Angle	Dark - lighted roadway	Clear	Dry	Inattention	67	19			
11	2/27/15	Friday	8:48 PM	Angle	Dark - lighted roadway	Cloudy	Dry	Failed to yield right of way	48	50			
12	4/19/15	Sunday	3:25 PM	Rear-end	Daylight	Clear	Dry	Inattention	25	54			
13	5/15/15	Friday	12:15 PM	Rear-end	Daylight	Clear	Dry	Inattention	19	47			
14	6/7/15	Sunday	4:05 PM	Rear-end	Daylight	Clear	Dry	Inattention	42	41			
15	6/17/15	Wednesday	10:10 AM	Rear-end	Daylight	Clear	Dry	Inattention	62	43			
16	8/3/15	Monday	11:32 AM	Head on	Daylight	Clear	Dry	Failed to yield right of way	47	29			
17	8/26/15	Wednesday	7:25 PM	Sideswipe, opposite direction	Dusk	Clear	Dry	Failed to yield right of way	42	25			
18	8/28/15	Friday	6:35 AM	Angle	Daylight	Clear	Dry	Failed to yield right of way	47	32			
19	9/17/15	Thursday	7:40 PM	Angle	Dark - lighted roadway	Clear	Dry	No Improper Driving	26	33			Motorcycle
20	10/6/15	Tuesday	6:54 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	44	71			
21	10/8/15	Thursday	10:15 PM	Angle	Dark - lighted roadway	Clear	Dry	Operating defective equipment	27	25			Brakes were not working properly; Rejected inspection sticker for safety
22	10/13/15	Tuesday	7:18 AM	Rear-end	Dawn	Rain	Wet	Followed too closely	56	67			
23	10/15/15	Thursday	2:22 PM	Angle	Daylight	Clear	Dry	Visibility Obstructed	52	21			Visibility was obstructed by truck taking left northbound
24	11/4/15	Wednesday	6:40 PM	Angle	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	18	50			Vehicle went around slowing vehicle at yellow light
25	12/19/15	Saturday	3:55 PM	Angle	Dusk	Clear	Dry	Failed to yield right of way	22	71			Attempted to turn left into an exit only for Pointe Plaza; Courtesy Crash*
26	12/24/15	Thursday	11:01 AM	Rear-end	Daylight	Cloudy	Dry	Followed too closely	43	62			

\*Courtesy Crash - A term used to describe a crash that occurs subsequent to a non-involved mainline driver who gives the right of way, contrary to the rules of the road, to another driver.

Summary based on Crash Reports obtained from the Pembroke Police Department

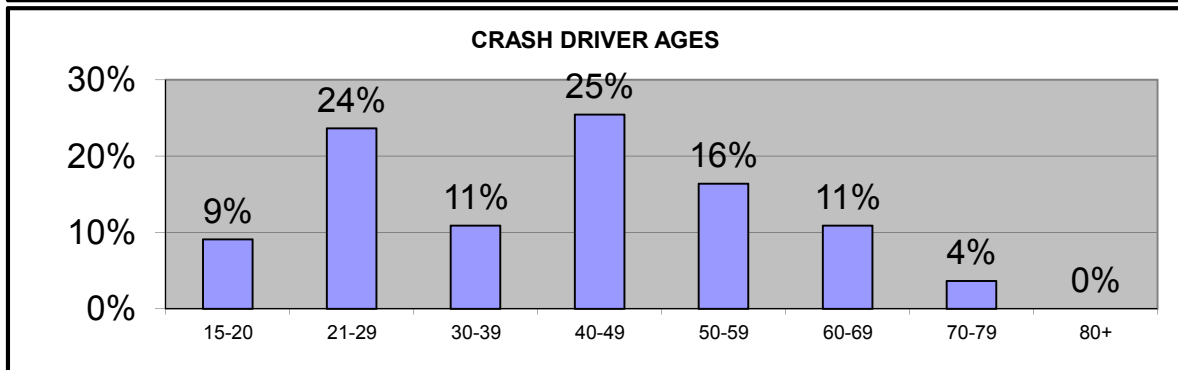
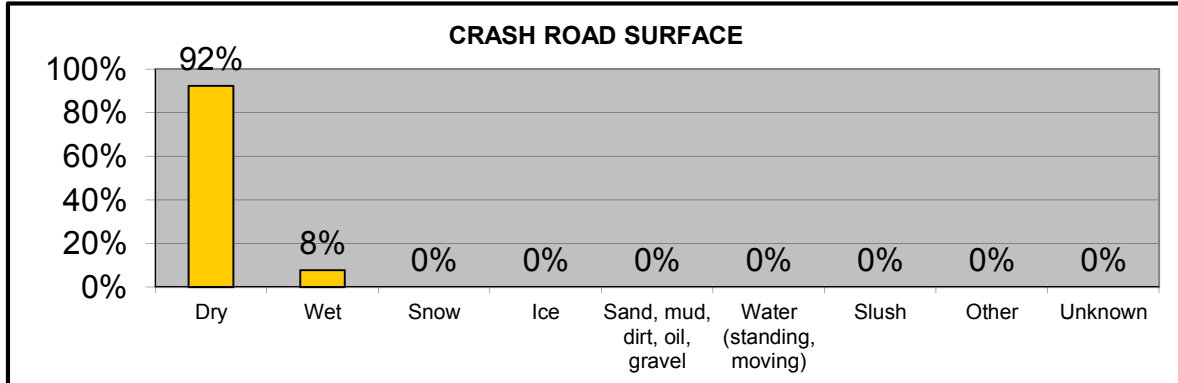
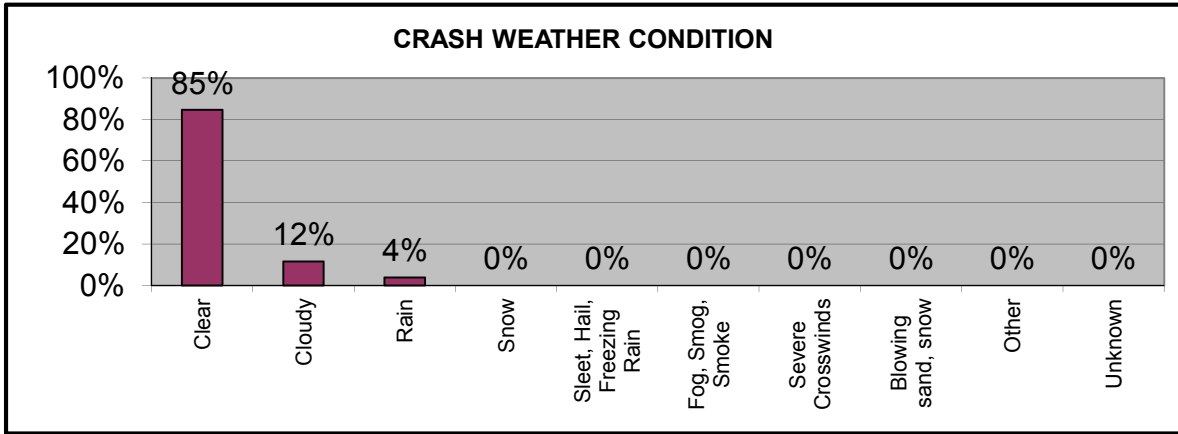
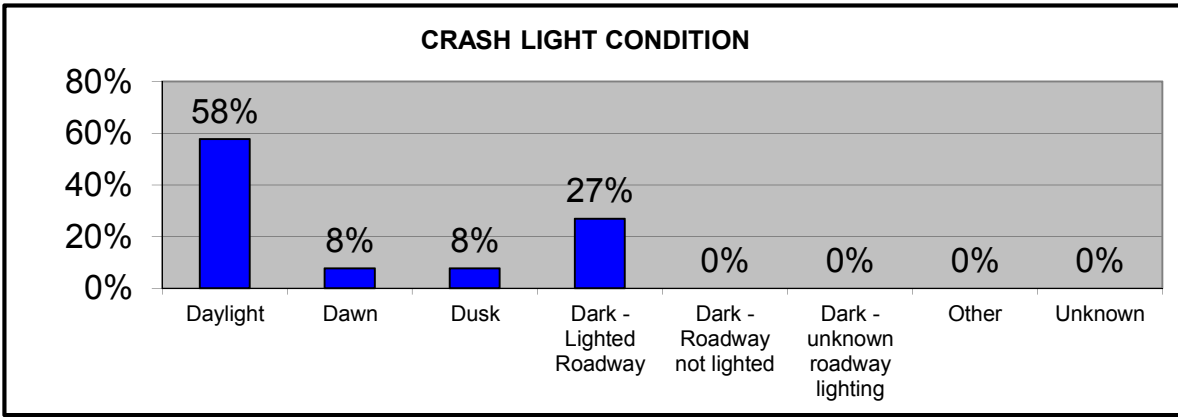
### Crash Data Summary Tables and Charts

Route 53 (Washington St/Columbia Rd) at Route 139 (Schooset St), Pembroke, MA



### Crash Data Summary Tables and Charts

Route 53 (Washington St/Columbia Rd) at Route 139 (Schooset St), Pembroke, MA

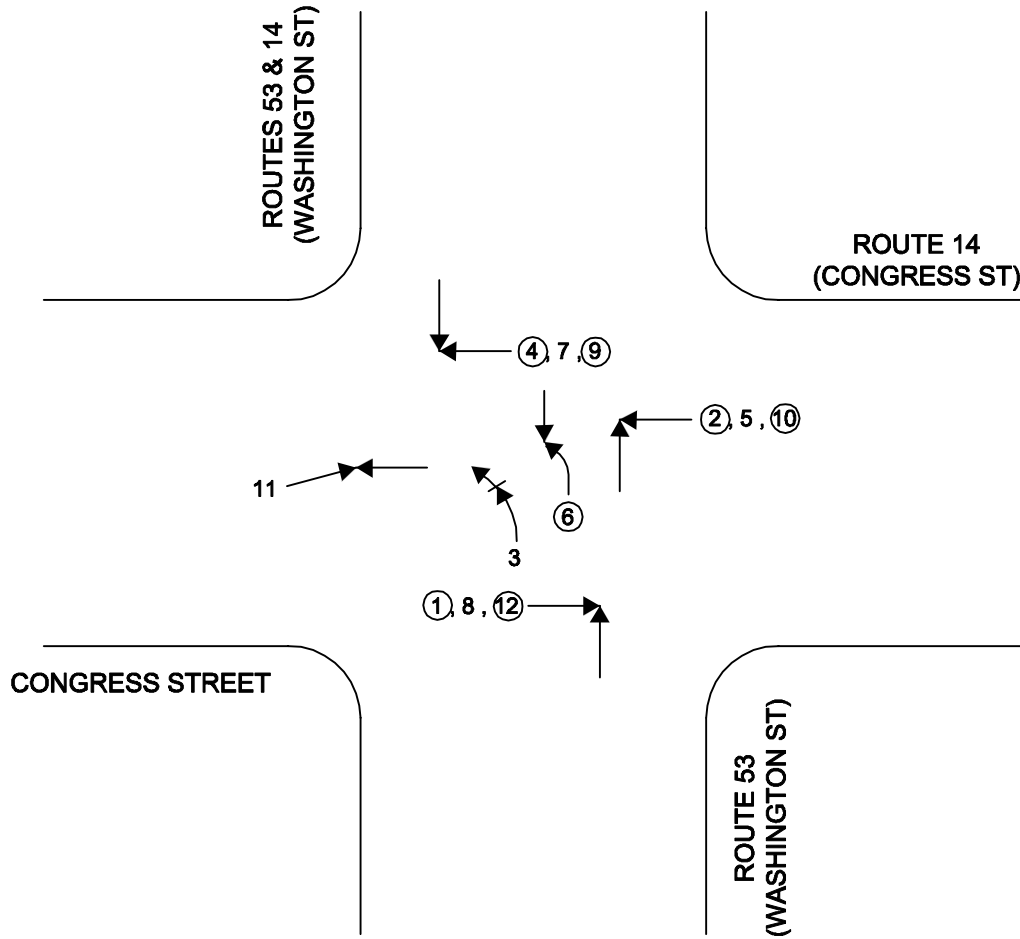




www.BETA-Inc.com



# COLLISION DIAGRAM



Intersection: Route 53 (Washington St) at Route 14 (Congress St)

Date Range: January 2012 - December 2015

SYMBOLS	COLLISION TYPES
← Moving Vehicle	↔ Rear End
←>>>> Backing Vehicle	↔ Head On
- - - Non-Involved Vehicle	↔ Side Swipe
↑ Pedestrian	↔ Out of Control
↻ Bicycle	↔ Left Turn
▣ Parked Vehicle	↔ Right Angle
□ Fixed Object	
● Fatal Accident	
○ Injury Accident	

## Crash Data Summary Table

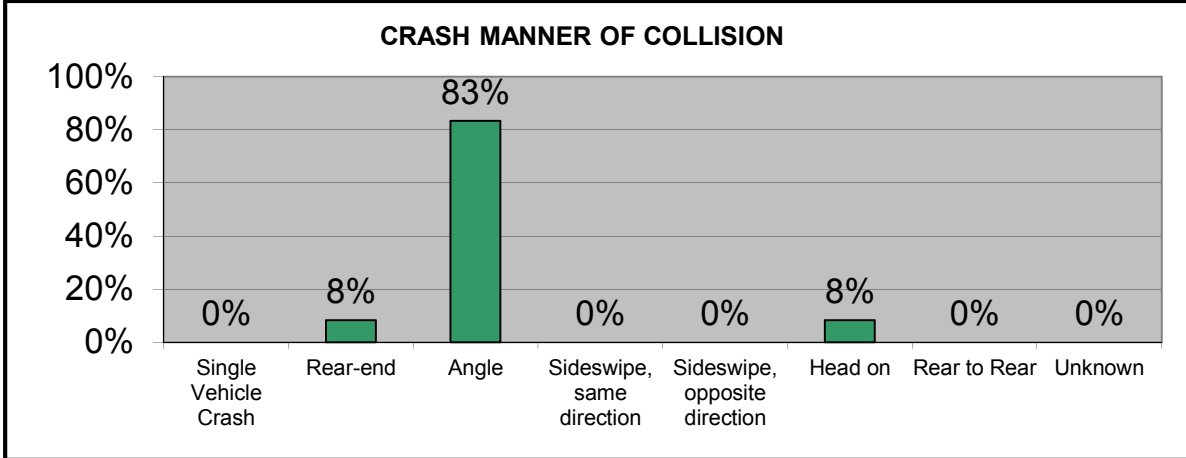
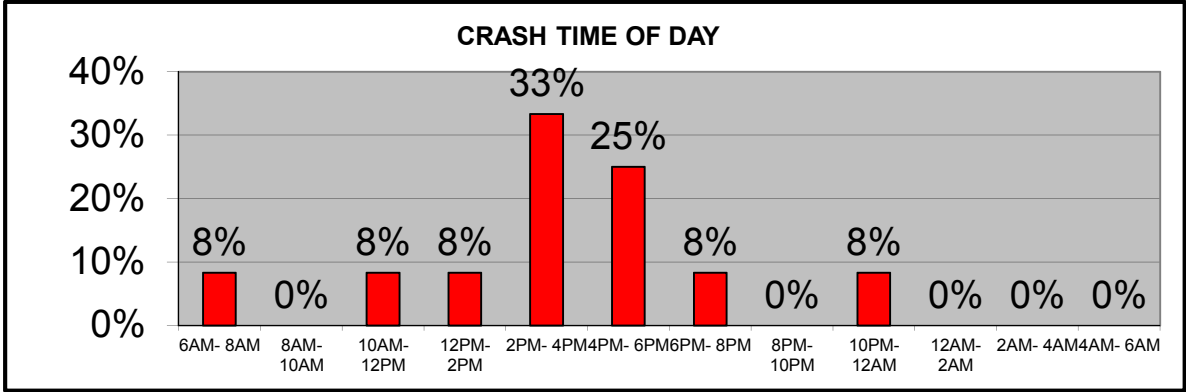
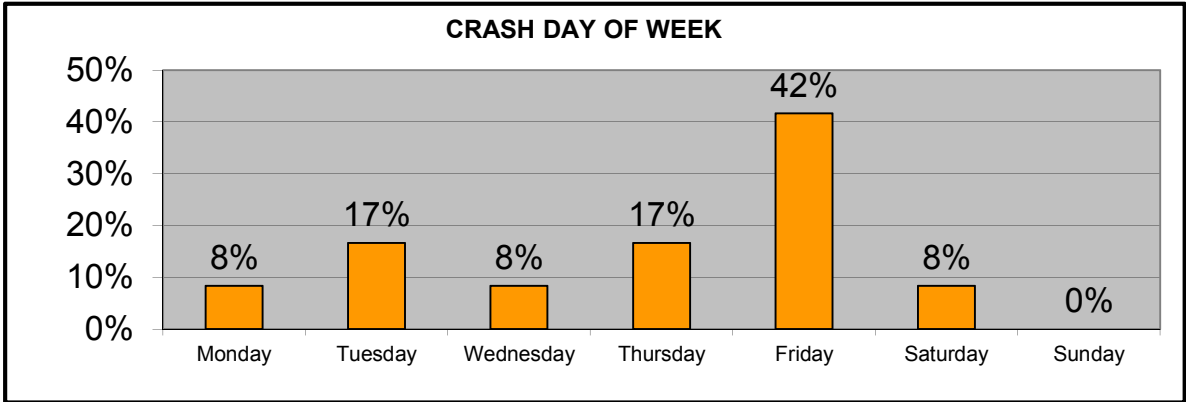
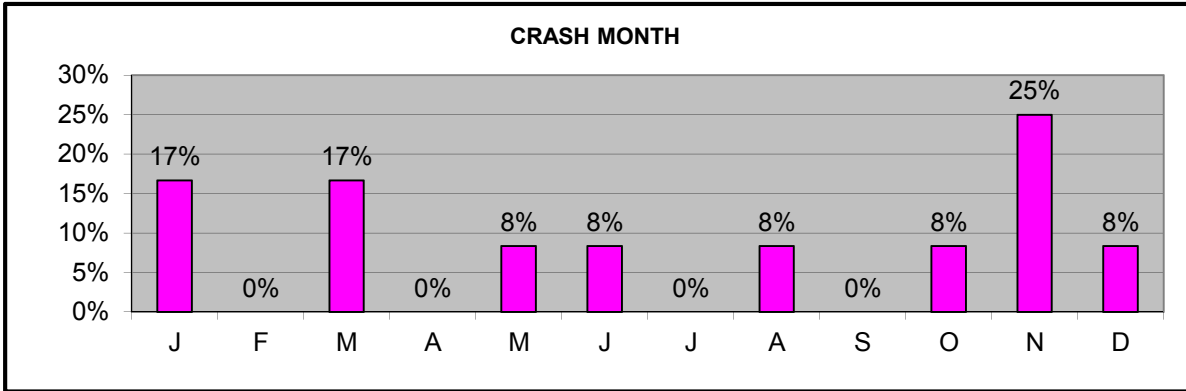
Route 53 (Washington St) at Route 14 (Congress St), Pembroke, MA

January 2012 - December 2015

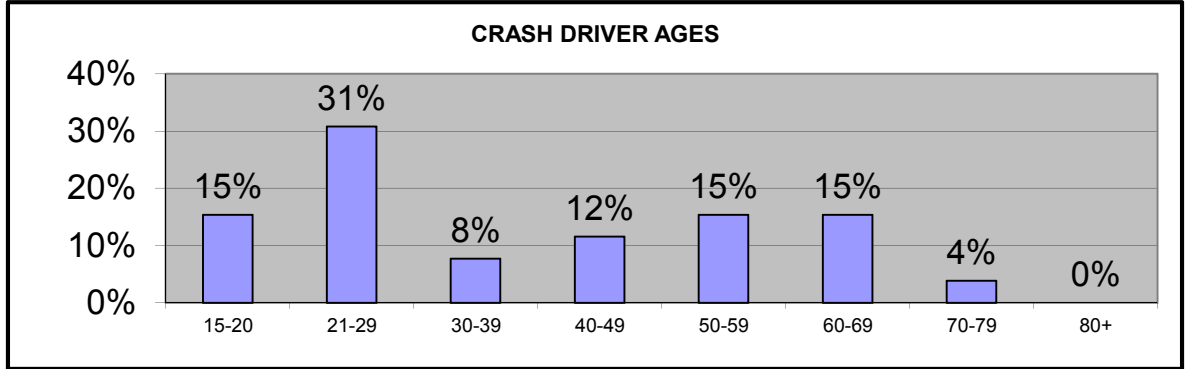
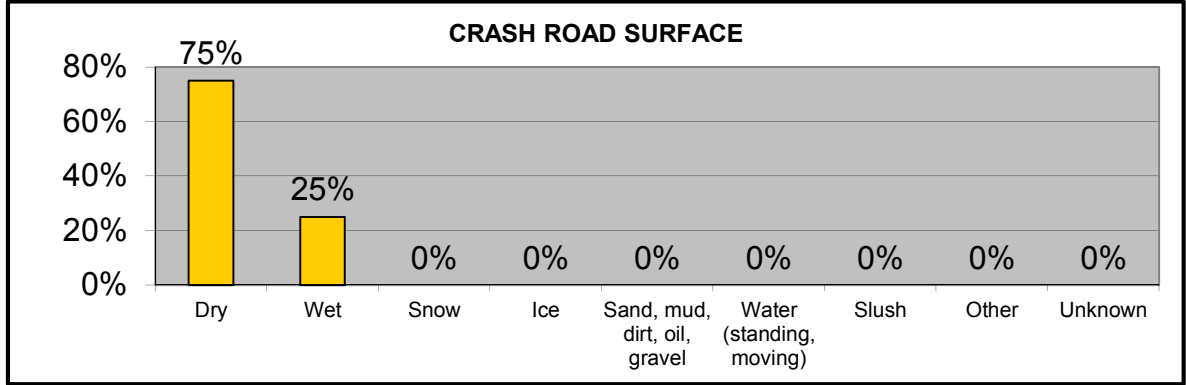
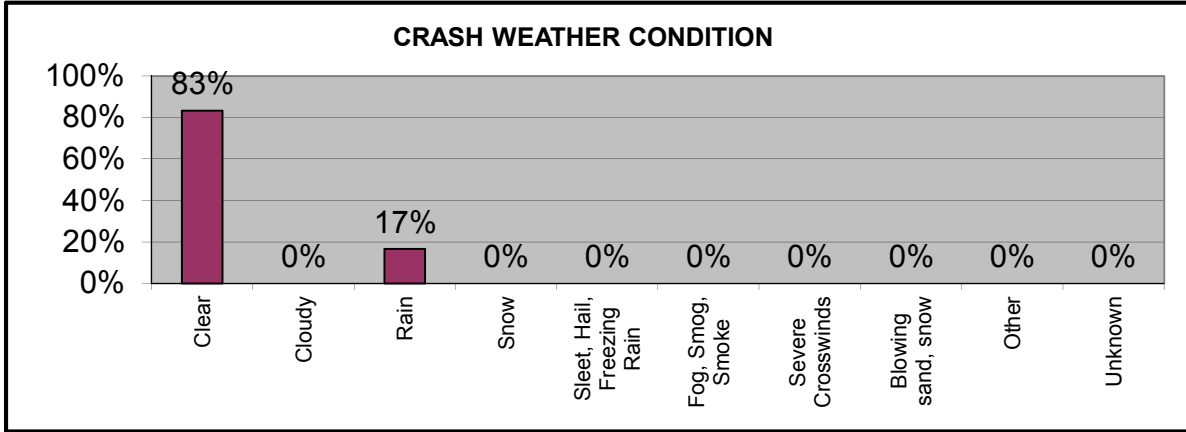
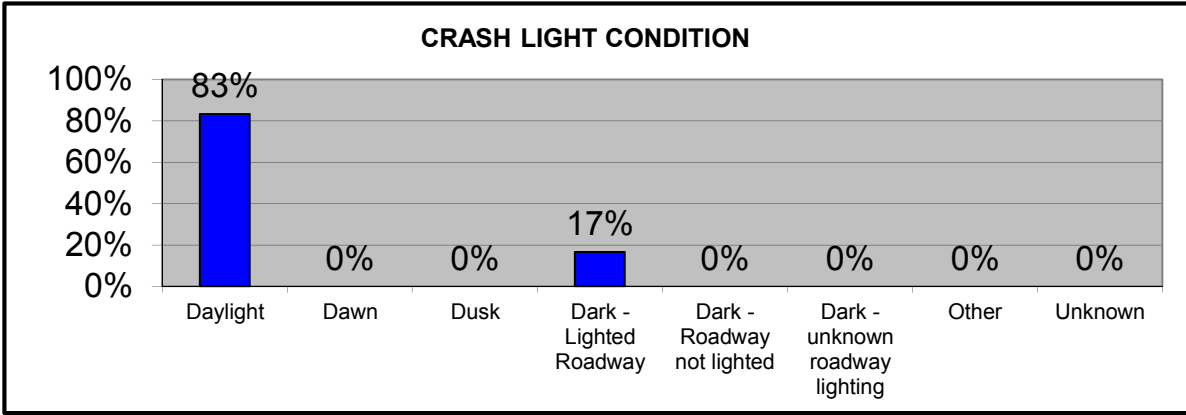
Crash Diagram Ref #	Crash Date <i>m/d/y</i>	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Ages			Comments
				<i>Type</i>	<i>Type</i>	<i>Type</i>	<i>Type</i>	<i>Type</i>	<i>D1</i>	<i>D2</i>	<i>D3</i>	
1	3/14/12	Wednesday	4:22 PM	Angle	Daylight	Clear	Dry	Inattention	57	43	29	Crash pushed vehicle into third vehicle queued at opposite stop sign
2	6/14/12	Thursday	3:03 PM	Angle	Daylight	Clear	Dry	Unknown	45	38		
3	11/3/12	Saturday	2:44 PM	Rear-end	Daylight	Clear	Dry	Other improper action	24	59		Stopped waiting to turn left
4	11/9/12	Friday	2:43 PM	Angle	Daylight	Clear	Dry	Inattention	63	20		Vehicle rolled over and driver (not wearing seat belt) was ejected from vehicle
5	12/7/12	Friday	7:23 PM	Angle	Dark - lighted roadway	Rain	Wet	Inattention	62	27		
6	1/22/13	Tuesday	12:20 PM	Angle	Daylight	Clear	Wet	Disregarded traffic signs, signals, road markings	65	25		
7	3/22/13	Friday	7:54 AM	Angle	Daylight	Clear	Dry	No Improper Driving	77	51		
8	8/16/13	Friday	4:14 PM	Angle	Daylight	Clear	Dry	Inattention	20	20	29	Crash pushed vehicle into third vehicle queued at opposite stop sign
9	10/8/13	Tuesday	4:01 PM	Angle	Daylight	Clear	Dry	Inattention	17	66		
10	11/22/13	Friday	10:15 PM	Angle	Dark - lighted roadway	Rain	Wet	Failed to yield right of way	35	53		Failed to stop at stop sign
11	1/29/15	Thursday	3:25 PM	Head on	Daylight	Clear	Dry	Glare	17	18		Solar glare
12	5/4/15	Monday	11:26 AM	Angle	Daylight	Clear	Dry	Failed to yield right of way	18	47		Failed to stop at stop sign; vehicle waiting to take left turn NB overturned

Summary based on Crash Reports obtained from the Pembroke Police Department

**Crash Data Summary Tables and Charts**  
Route 53 (Washington St) at Route 14 (Congress St), Pembroke, MA



**Crash Data Summary Tables and Charts**  
 Route 53 (Washington St) at Route 14 (Congress St), Pembroke, MA



## Appendix D. Speed Regulations

---



January 14, 1972

THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS

*Mr Sullivan*

SPECIAL SPEED REGULATION NO. 678

Highway Location:

QUINCY, BRAINTREE, WEYMOUTH, HINGHAM,  
NORWELL, HANOVER, PEMBROKE, DUXBURY  
KINGSTON

Authority in Control:

COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS

Name of Highway:

Quincy	Route 53	State Highway		
Braintree	Route 53	State Highway		
Weymouth	"	"	"	"
Hingham	"	"	"	"
Norwell	"	"	"	"
Hanover	"	"	"	"
Pembroke	"	"	"	"
Duxbury	"	"	"	"
Kingston	"	"	"	"

In accordance with the provisions of Section 18 of Chapter 90 of the General Laws (Ter. Ed.) the following Special Speed Regulation is hereby promulgated.

Special Speed Regulations numbered 33C and 33D dated December 1, 1965 and August 8, 1967 are hereby amended by striking out the regulations in their entireties and inserting in place thereof the following revisions and addenda.

The following designated speed limits are established at which motor vehicles may be operated in the areas described.

NORTHBOUND

Beginning in Kingston 77 feet north of the junction of Route 3A, thence northerly in Kingston

0.24 miles	at	40 miles per hour		
0.21	"	"	50	" " " to the Duxbury line,

Thence northerly in Duxbury

0.88 miles	at	50 miles per hour		
0.19	"	"	40	" " "
0.16	"	"	25	" " "
0.25	"	"	40	" " "
<del>1.13</del>	"	"	50	" " "
<del>0.16</del>	"	"	45	" " "
0.94	"	"	50	" " " to the Pembroke line,

*0.76 at 50  
0.53 at 45*

Thence northerly in Pembroke

1.85	miles at	50	miles per hour	
0.44	" "	40	" "	" "
1.01	" "	45	" "	" "
0.20	" "	35	" "	" "
0.23	" "	40	" "	" to the Hanover line,

Thence northerly in Hanover

0.93	miles at	35	miles per hour	
0.36	" "	45	" "	" "
1.72	" "	40	" "	" "
1.33	" "	35	" "	" to the Norwell line,

Thence northerly in Norwell

0.94	miles at	35	miles per hour	
1.10	" "	40	" "	" "
0.10	" "	35	" "	" to the Hingham line,

Thence northerly in Hingham

0.26	miles at	35	miles per hour	
0.51	" "	45	" "	" "
0.43	" "	30	" "	" "
0.96	" "	50	" "	" "
0.08	" "	45	" "	" to the Weymouth line,

Thence northerly in Weymouth

0.47	miles at	45	miles per hour	(Rev. 2-1-73)
0.18	" "	35	" "	" "
0.54	" "	40	" "	" "
1.52	" "	35	" "	" "
0.14	" "	30	" "	" to the End of State Highway

in Weymouth.

Beginning again in Braintree at the beginning of State Highway,

Thence northerly in Braintree

1.11 miles at 35 miles per hour to the Quincy line,

Thence northerly in Quincy

0.30 miles at 30 miles per hour to the end of State Highway, the total distance being 20.87 miles.

#### SOUTHBOUND

Beginning in Quincy at the beginning of State Highway,

Thence southerly

0.27 miles at 30 miles per hour to the Braintree line,

Thence southerly in Braintree

1.11 miles at 35 miles per hour to the end of State Highway in Braintree.

And beginning again in Weymouth at the beginning of State Highway,  
 thence southerly in Weymouth

0.14	miles at	30	miles per hour		
1.52	" "	35	" "	" "	
0.54	" "	40	" "	" "	
0.18	" "	35	" "	" "	
0.47	" "	45	" "	" "	" (Rev 3-9-73) to the Hingham line,

Thence southerly in Hingham

0.08	miles at	45	miles per hour		
0.96	" "	50	" "	" "	
0.43	" "	30	" "	" "	
0.51	" "	45	" "	" "	
0.26	" "	35	" "	" "	" to the Norwell line,

Thence southerly in Norwell

0.10	miles at	35	miles per hour		
1.10	" "	40	" "	" "	
0.94	" "	35	" "	" "	" to the Hanover line,

Thence southerly in Hanover

1.33	miles at	35	miles per hour		
1.72	" "	40	" "	" "	
0.36	" "	45	" "	" "	
0.93	" "	35	" "	" "	" to the Pembroke line,

Thence southerly in Pembroke

0.23	miles at	40	miles per hour		
0.20	" "	35	" "	" "	
1.01	" "	45	" "	" "	
0.44	" "	40	" "	" "	
1.85	" "	50	" "	" "	" to the Duxbury line,

Thence southerly in Duxbury

0.94	miles at	50	miles per hour		
0.16	" "	45	" "	" "	
1.13	" "	50	" "	" "	
0.65	" "	40	" "	" "	
0.82	" "	50	" "	" "	" to the Kingston line,

Thence southerly in Kingston

0.21	miles at	50	miles per hour		
0.25	" "	40	" "	" "	" ending at the junction of

Route 3A; the total distance being 20.84 miles.

Operation of a motor vehicle at a rate of speed in excess of these limits shall be prima facie evidence that such speed is greater than is reasonable and proper.

The provisions of this regulation shall not, however, abrogate in any sense Section 14 of Chapter 90.

The Department of Public Works and the Registrar of Motor Vehicles, acting jointly, do hereby certify in writing that this regulation is consistent with the public interests.

Standard signs must be erected at the beginning of each zone.

FOR THE DEPARTMENT

DATE: January 14, 1972

BY: Bruce Campbell vjc  
BRUCE CAMPBELL  
COMMISSIONER

for Highway Engineering

David J. Lucey  
Registrar of Motor Vehicles

May 21, 1975

678

THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS

SPECIAL SPEED REGULATION NO. 678-B

Highway Location: PEMBROKE  
Authority In Control: COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC WORKS  
Name of Highway: PEMBROKE-STATE HIGHWAY-ROUTE 53

In accordance with the provisions of Section 18 Chapter 90 of the General Laws (Ter. Ed.) the following Special Speed Regulation is hereby promulgated:

Special Speed Regulation number 678 dated January 14, 1972 is hereby amended in Pembroke as follows.

The following designated speed limits are established at which motor vehicles may be operated in the areas described.

PEMBROKE-NORTHBOUND

By striking out the clause reading  
1.01 miles at 45 miles per hour

And inserting in place thereof  
1.01 miles at 40 miles per hour

PEMBROKE-SOUTHBOUND

By striking out the clause reading  
1.01 miles at 45 miles per hour

And inserting in place thereof  
1.01 miles at 40 miles per hour

Operation of a motor vehicle at a rate of speed in excess of these limits shall be prima facie evidence that such speed is greater than is reasonable and proper.

The provisions of this regulation shall not, however, abrogate in any sense, Section 14 of Chapter 90.

The Department of Public Works and the Registrar of Motor Vehicles, acting jointly do hereby certify in writing, that this regulation is consistent with the public interest.

Standard signs must be erected at the beginning of each zone.

DATE: May 21, 1975

FOR THE DEPARTMENT OF PUBLIC WORKS

BY: J. J. Perkins  
Traffic Engineer

Robert A. Panora  
Registrar of Motor Vehicles