



CAPE COD  
COMMISSION

# Falmouth Road Safety Audit

## Sandwich Road: Carriage Shop Road to Hatchville Road

September 2011



Prepared by  
the Cape Cod Commission  
in cooperation with  
the Town of Falmouth and  
Massachusetts Department of Transportation

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## Background

All levels of government— local, regional, state, and federal—have been considering locations where crashes are most severe for many years. Several years ago the national consensus was that there should be goals to reduce crashes, and in the 2005 federal legislation: Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), there was more emphasis on improving highway safety along with a dedicated funding program—the Highway Safety Improvement Program (HSIP).

In an effort to reduce the number of crash-related fatalities and incapacitating injuries, Massachusetts developed a Strategic Highway Safety Plan in 2006. The mission of the Safety Plan is to “Develop, promote, implement, and evaluate data-driven, multidisciplinary strategies to maximize safety for users of the roadway system.” One of the many strategies noted in the Safety Plan is to “conduct Road Safety Audits (RSA) at high-crash locations throughout the Commonwealth.” MassDOT incorporated the RSA as a requirement for securing Federal funding (Highway Safety Improvement Program [HSIP] funds) for safety projects.

The Federal Highway Administration (FHWA) 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 while considering all roadway users.

The Cape Cod Commission, serving as the regional planning agency for the fifteen towns on Cape Cod, has reviewed many transportation locations over the years during various processes, including the Regional Transportation Plan, the Transportation Improvement Program, and Developments of Regional Impact, considering the existing safety issues and potential improvements. In addition, the CCC began looking at specific safety locations annually through safety studies and Road Safety Audits (RSAs). A portion of the federal HSIP funds are allocated for improvements to the region’s highest crash locations.

## Introduction

About 31,000 year round residents inhabit the Town of Falmouth, one of fifteen towns on Cape Cod. As with most Cape Cod towns, there are visitors in town adding to the numbers of people moving around for various activities. Falmouth is a coastal area town or destination for residents and visitors with an historic downtown, scientific institutions, and other attractions.

In Falmouth, there are ports with ferry services to the Islands, intercity bus connections, local bus services provided by the Cape Cod Regional Transit Authority,



and the Shining Sea Bikeway along with the walkable, livable sections of downtown Woods Hole and Falmouth. However, most of the travel in and around town is accomplished by private automobile.

The Sandwich Road section of roadway, between and including the intersections of Carriage Shop Road and Hatchville Road, based on Equivalent Property Damage Only (EPDO) rate<sup>1</sup> is the tenth highest crash location on Cape Cod, and was selected by the Cape Cod Joint Transportation Committee (CCJTC) as a Road Safety Audit location.

In the spring of 2011 CCC staff requested crash reports and information from the Town of Falmouth for this Road Safety Audit. The crash data were reviewed with a resulting crash diagram and summary developed.

The Town of Falmouth was contacted for a list of participants in September 2011, and the Road Safety Audit was scheduled with MassDOT and the Town of Falmouth.

## Project Data

The Road Safety Audit meeting and site visit took place on Friday, September 16, 2011, at 10:00 a.m., at Falmouth Town Hall and on site at the Sandwich Road section and intersections.

Table 1. Participating Audit Team Members

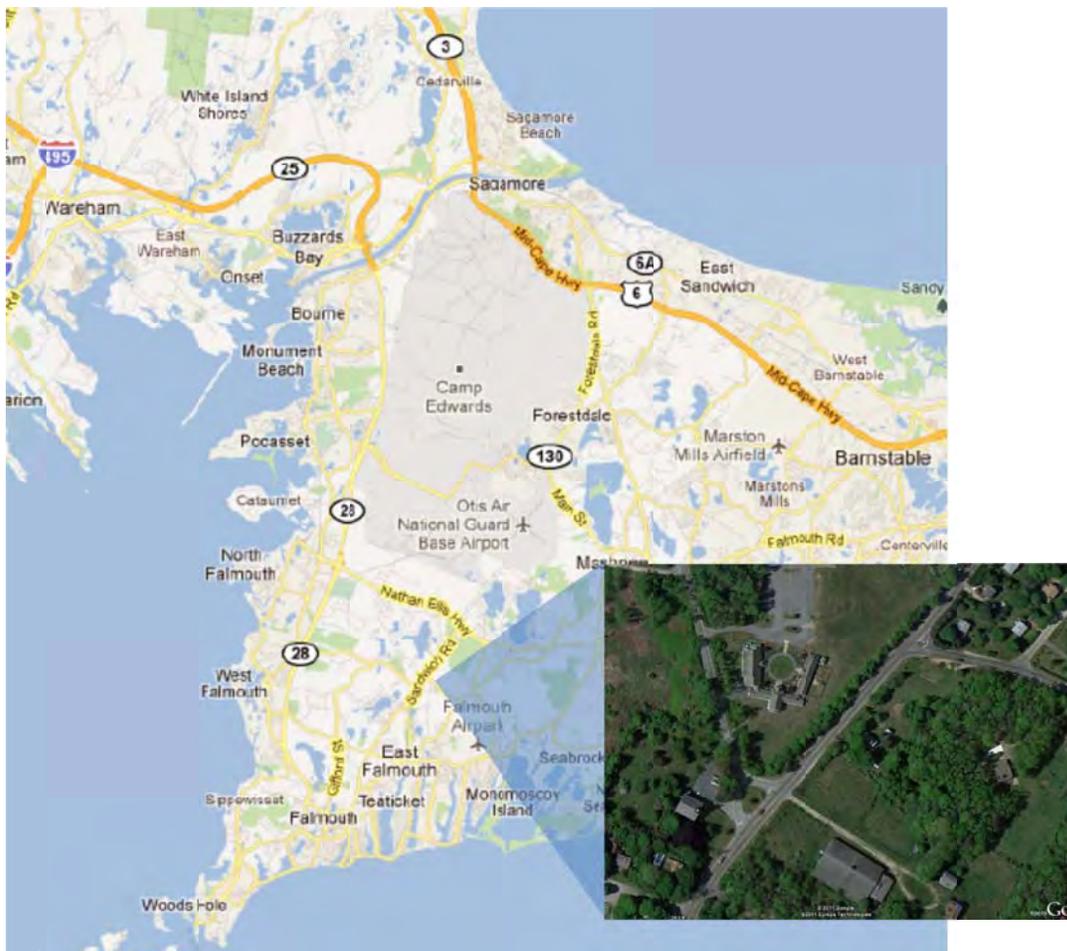
Audit Team Member	Agency/Affiliation
Marlene McCollem	Falmouth Planning Department
Peter McConarty	Falmouth Engineering Division
Bob Williams	Falmouth Engineering Division
Lisa Schletzbaum	MassDOT – Safety Division
Alolade Campbell	MassDOT Highway Division District 5 Projects
Glenn Cannon, P.E.	Technical Services Director, Cape Cod Commission
Priscilla N. Leclerc	Senior Transportation Planner, Cape Cod Commission

## Project Location and Description

Sandwich Road in the Town of Falmouth is a two-lane roadway that extends from approximately the Massachusetts Military Reservation in the Hatchville village, across Nathan Ellis Highway / Route 151, to Route 28 in the Teaticket village area. The section of Sandwich Road reviewed during the Road Safety Audit is about 500 linear feet and included the intersections of Carriage Shop Road and Hatchville Road.

Sandwich Road is functionally classified as an urban extension of a rural minor arterial, and runs in a north/south direction. Carriage Shop Road is classified as an urban minor arterial and Hatchville Road is an urban collector.

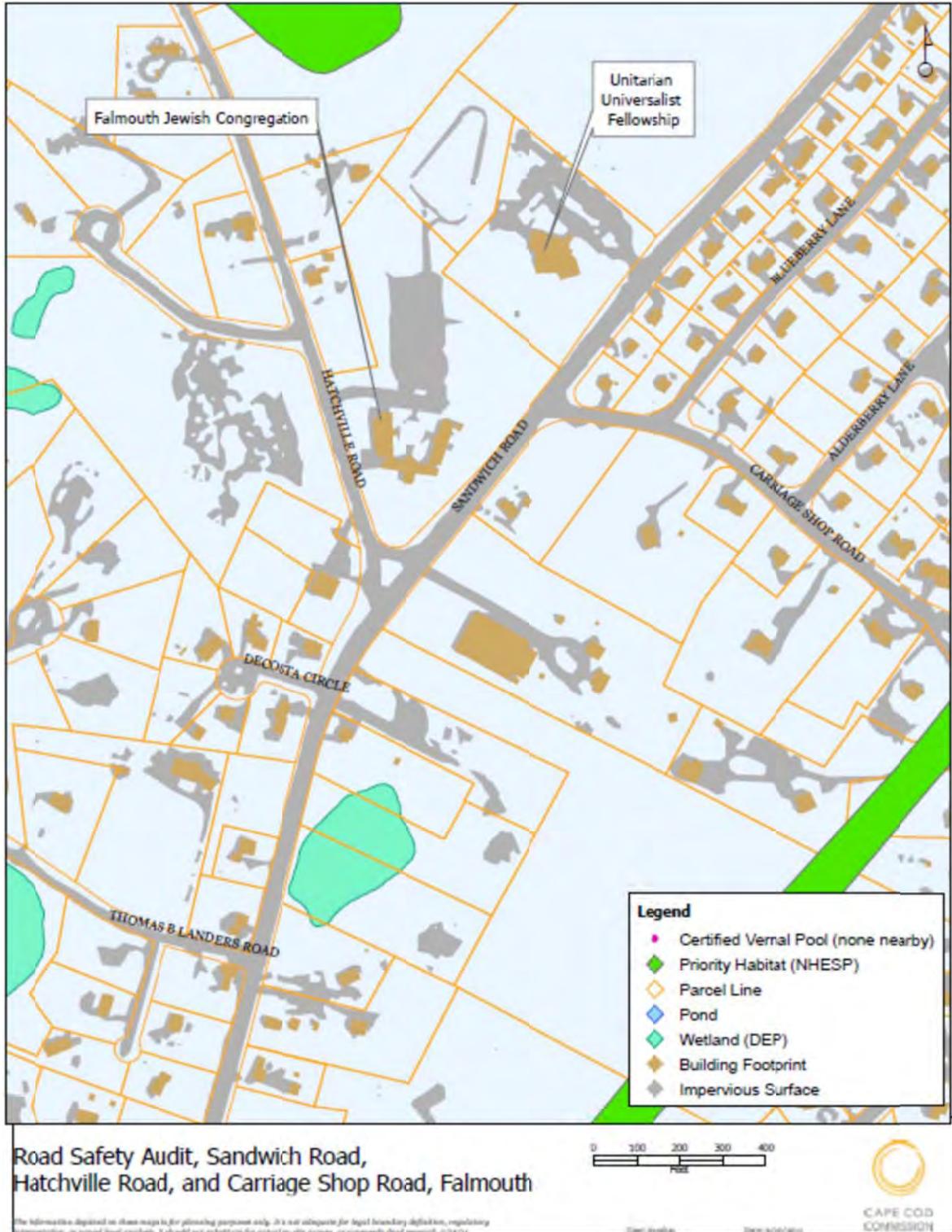
Figure 1. Locus Map





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Figure 1. Land Use and Environmental Map





## Road Safety Audit: Sandwich Road



The RSA Team reviewed the crash diagram, the crash summary, the traffic volumes and turning movement counts, and the speed regulations.

The Sandwich Road crashes from 2008-2010 included eight at the intersection with Carriage Shop Road and two at the intersection with Hatchville Road. Injury crashes accounted for 50% of the crashes at each intersection and overall.

Of the Carriage Shop Road intersection crashes, 62.5% were angle crashes, and the others were rear-end crashes. All of these angle crashes occurred between vehicles turning left from Carriage Shop Road in conflict with vehicles heading northbound on Sandwich Road. The rear-end crashes at this location were between vehicles heading southbound on Sandwich Road that were slowing or waiting to turn left onto Carriage Shop Road and vehicles behind them.

At the Hatchville Road intersection with Sandwich Road two crashes were reported in the 2008-2010 time frame. An injury rear-end crash happened between two vehicles heading northbound on Sandwich Road as the first slowed to turn left into Hatchville Road. One angle crash followed when a northbound vehicle on Sandwich Road



attempting a left turn into Hatchville Road came into conflict with a southbound Sandwich Road vehicle.

The regulatory speed limit for Sandwich Road in the vicinity of Hatchville Road is 35 miles per hour, and this regulatory speed changes about 100 feet northerly toward the Carriage Shop Road intersection.

The posted speed limits reflect these regulatory speeds. On Sandwich Road heading southbound the speed is posted at 40 miles per hour prior to the Carriage Shop Road intersection, and the speed limit sign for 35 miles per hour is on the island at Hatchville Road. Heading northbound on Sandwich Road, the speed is posted at 40 miles per hour about 100 feet south of the Carriage Shop Road intersection.

The regulatory speed for Carriage Shop Road is 35 miles per hour heading westbound to the stop at the intersection with Sandwich Road.

The speed regulations for Sandwich Road and Carriage Shop Road are included in the appendices.



# Audit Observations and Potential Safety Enhancements

## SAFETY ISSUE #1. SIGNAGE

**Observation:** Sandwich Road has intersection warning signs at other intersections, and it was reported that it is advisable to add intersection warning signs to maintain consistency in alerting drivers for the Carriage Shop Road and Hatchville Road intersections.



Another sign note is the curve warning sign on the island at Hatchville Road as fairly close to the other signs on the island, but may need to remain because of distance to the curve.

The Carriage Shop Road street sign is worn and should be replaced for improved visibility.



Local destination and informational signs in rural historic character of the area were observed and it was noted that it may be beneficial to relocate the Falmouth Country Club sign northerly prior to the Carriage Shop Road intersection. It was thought that drivers looking for the location may be stopping too quickly for the traffic behind them to take it in and adjust.

A litter free zone sign should be moved away from the busy Sandwich Road section with the intersections.



**Enhancement:** Add intersection warning signs for both intersections in both directions along Sandwich Road, along with a supplemental tab noting the name of the cross street.

Install a new street sign at Carriage Shop Road and Hatchville Road in larger size (the standard according to the MUTCD).

Move the litter free zone sign to another section beyond the intersections.

Consider relocation of the Falmouth Country Club sign.



## SAFETY ISSUE #2. SPEED

**Observation:** At the Carriage Shop Road intersection, 62.5% of crashes were between vehicles turning left from Carriage Shop Road and vehicles heading northbound on Sandwich Road. It was noted that although the speed limit is 40 miles per hour, vehicles are probably traveling faster along the straight stretch of Sandwich Road.



**Enhancement:** A speed study could be performed to detect traveling speeds and when there may be peaks in violations. The police could then follow-up with targeted enforcement at times to provide a presence and expectation of enforcement in the corridor.

## SAFETY ISSUE #3. CONFLICTING VOLUMES

**Observation:** Sandwich Road southbound traffic turning left at Carriage Shop Road accounts for 21% (112 out of 541 vehicles). At the intersection 37.5% of crashes resulted in rear-ends to Sandwich Road southbound vehicles stopped or slowing to turn left onto Carriage Shop Road.



The northbound through vehicles on Sandwich Road numbered 595 conflicting with 64% or 158 vehicles entering from Carriage Shop Road turning left onto Sandwich Road. At the intersection, 62.5% of crashes were between vehicles turning left from Carriage Shop Road and vehicles heading northbound on Sandwich Road.

**Enhancement:** Installation of intersection warning signs should provide greater awareness of the potential conflicts.

A left turn pocket for the Sandwich Road traffic turning left onto Carriage Shop Road may reduce rear-end crashes at this location. A review of left turn lane warrants can help to determine the need.

## SAFETY ISSUE #4. PAVEMENT MARKINGS

### **Observation:**

Sandwich Road northbound through vehicles and vehicles turning left onto Sandwich Road from Carriage Shop Road account for 62.5% of crashes at the intersection. It was noted that vehicles were driving over the painted narrow median at the end of Carriage Shop Road. Town staff noted that it had been painted earlier this summer, but recently there was a fluid leak and resulting clean-up that dulled the painted median. A raised median may assist in delineation, but it was mentioned that truck traffic needs the wider area for turner. It was thought that rumble strips may be too loud at this spot.



At the Sandwich Road and Hatchville intersection, an island exists with two way traffic on both sides and may be the cause of confusion.

**Enhancement:** Repaint the median.

A possible long term enhancement may be to install a slightly raised median for improved vehicular delineation.



## SAFETY ISSUE #5. ISLAND AT HATCHVILLE ROAD

### Observation:

At the Sandwich Road and Hatchville Road intersection, an island exists with two way traffic on both sides. It was noted that it may be the cause of confusion—drivers that are not familiar with the area may not know which side of the island to use when traveling north on Sandwich Road and turning left at Hatchville Road.

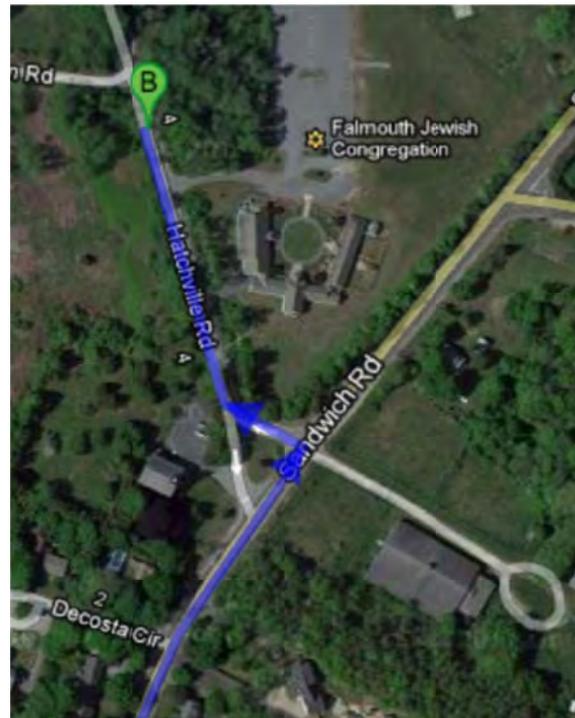


Following the RSA Team meeting, a check for directions that required a left turn from Sandwich Road northbound into Hatchville Road on Google maps, directed drivers to turn left north of the island into Hatchville Road.

### Enhancement:

It may be beneficial to look at traffic flow improvements and/or Global Positioning System (GPS) map directions to determine potential refinements.

A long term consideration may be to eliminate the island and convert the alignment into a right angled traditional intersection, or "T" intersection.



## SAFETY ISSUE #6. BICYCLE AND PEDESTRIAN ACCOMMODATION

### Observation:

Sandwich Road has a small paved shoulder in this section that widens at the Hatchville Road island on the southbound side. A grassy area also exists on both sides of the roadway. There are no separate facilities for bicycles or pedestrians. Town staff reported that funds for capital improvements are limited and that any costly improvements to Sandwich Road are not yet in line.

There is a crosswalk approximately 200 feet from Sandwich Road around the curve on Hatchville Road that is mentioned under the issue for sight distance.



### Enhancement:

Consider improved bicycle/pedestrian accommodation when reconstruction for Sandwich Road is being considered.





## SAFETY ISSUE #7. SIGHT DISTANCE

### Observation:

On the Hatchville Road island there are several low bushes that are high enough to block views to the south at the northerly stop bar. Bushes could be trimmed or relocated to assure visibility.

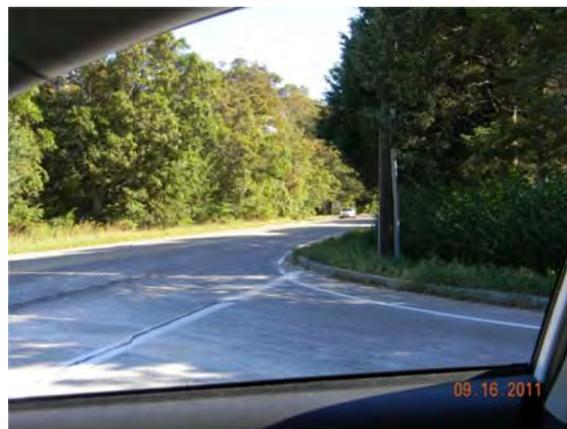


On Hatchville Road approximately 200 feet west of the intersection is a crosswalk and it was noted that it is not visible until one is driving around the corner. It was mentioned that the brush could be cut back on the right side of Hatchville Road on approach to the crosswalk.



At Carriage Shop Road looking northerly onto Sandwich Road, brush on the northeasterly corner of the intersection should be trimmed to allow for vehicles stopped at Carriage Shop Road to have an improved view northbound.

A vehicle stopped on Carriage Shop Road to turn left onto Sandwich Road may have visibility blocked by a vehicle turning right from Carriage Shop Road. Drivers in left turning vehicles may find themselves creeping out into the intersection to see around vehicles stopped in the right lane and may accept a short gap at the last minute to move out of the lane.



### Enhancement:

Trimming or cutting back brush to improve visibility.

After appropriate trimming review sight distance to ensure adequate sight distance for perception and reaction time is achieved.

## Summary of Road Safety Audit

The following summary list of the Road Safety Audit observations and enhancements is provided to assist in the design and/or implementation of potential improvements elicited during the process. It is also recommended that for any more involved geometric changes, the design process include further analysis and public input.

“Safety Payoff” estimates are subjective and may be based on the relative percent of crashes that may be reduced by the enhancement based on known and documented crash reduction factors, if available, or estimated crash reduction based on a stated source. Estimates of crash reduction are categorized as “Low” (<30%), “Medium” (31% to 70%), and “High” (>71%)]. The time frame is categorized as “Short-term” (<1 year), “Medium-term” (1 to 3 years), or “Long-term” (>3 years). The costs are categorized as “Low” (<\$10,000), “Medium” (\$10,001 to \$50,000), or “High” (>\$50,001).

Many of the “Safety Payoff” estimates in this report were based on crash reduction factors in the *Desktop Reference for Crash Reduction Factors*, Report No. FHWA-SA-08-011 by the U.S. Department of Transportation, Federal Highway Administration, September 2008.

**Table 2. Potential Safety Enhancement Summary**

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Signage Intersection warning signs	The addition of intersection warning signs on Sandwich Road will provide advance warning and corridor consistency	Low	Short-term	Low	Town
Signage Street and informational signs	Replacement or adjustment of location to improve visibility	Low	Short-term	Low	Town
Speed	Speed study / document level of violators	Low	Medium-term	Medium	Region/Town
Speed	Short focused periodic enforcement to slow vehicles	Low	Medium-term	Medium	Town
Conflicting Volumes Left turns in and out of side roads conflicting with Sandwich Road volumes	Intersection warning signage (above)  Potential left turn pocket Sandwich Rd. SB at Carriage Shop Rd. to separate vehicles	Low	Long-term	High	Town
Pavement Markings Carriage Shop Rd. painted median	Generally in good condition with the painted median at Carriage Shop Rd. fading and needs repainting.	Low	Short-term	Low	Town
Pavement Markings Carriage Shop Rd. painted median	Median at Carriage Shop Rd. may improve delineation with a slightly raised treatment for the median.	Medium-High	Medium-term	Medium	Town
Island at Hatchville Road Driver confusion / Google map directs Sandwich Rd. NB drivers to turn left northerly of the island.	Review potential traffic flow improvements around the island through striping changes to reduce driver confusion. Google map directs Sandwich Rd. NB drivers to turn left northerly of the island.	Low	Medium-term	Low	Region/Town
Island at Hatchville Road	Eliminate the island for "T" intersection	Medium	Long-term	High	Town
Bicycle and Pedestrian Accommodation, narrow paved shoulder & grass shoulder	Consider improved bicycle/pedestrian accommodation when reconstruction for Sandwich Road is being considered.	Medium	Long-term	High	Town
Sight Distance Trimming brush / bushes	Improved visibility	Low	Short-term	Low-Medium	Town

## Appendix A. RSA Meeting Agenda

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BARNSTABLE, MASSACHUSETTS 02630



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## Road Safety Audit Meeting

### Falmouth, Sandwich Road at Carriage Shop Road and at Hatchville Road

September 16, 2011

10:00 a.m. – 12:00 noon

Location: FALMOUTH TOWN HALL, 59 Town Hall Square, Falmouth, MA 02540

**10:00 a.m.** Welcome and Introductions

**10:15 a.m.** Review of Site Specific Material

- Crash, Speed & Volume Summaries– provided in advance
- Existing Geometries and Conditions

**11:00 a.m.** Visit the Site

- Assemble as a group at the site for observation of conditions
- As a group, identify areas for improvement

**11:30 a.m.** Post Visit Discussion / Completion of RSA

- Discuss observations and finalize findings
- Discuss potential improvements and finalize recommendations

**12:00 noon** Adjourn for the Day

**Next Steps:** After the RSA meeting, participants will be asked to comment and respond to the draft document materials to assure it is reflective of the RSA completed by the multidisciplinary team.

## Appendix B. RSA Audit Team Contact List

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## Participating Audit Team Members

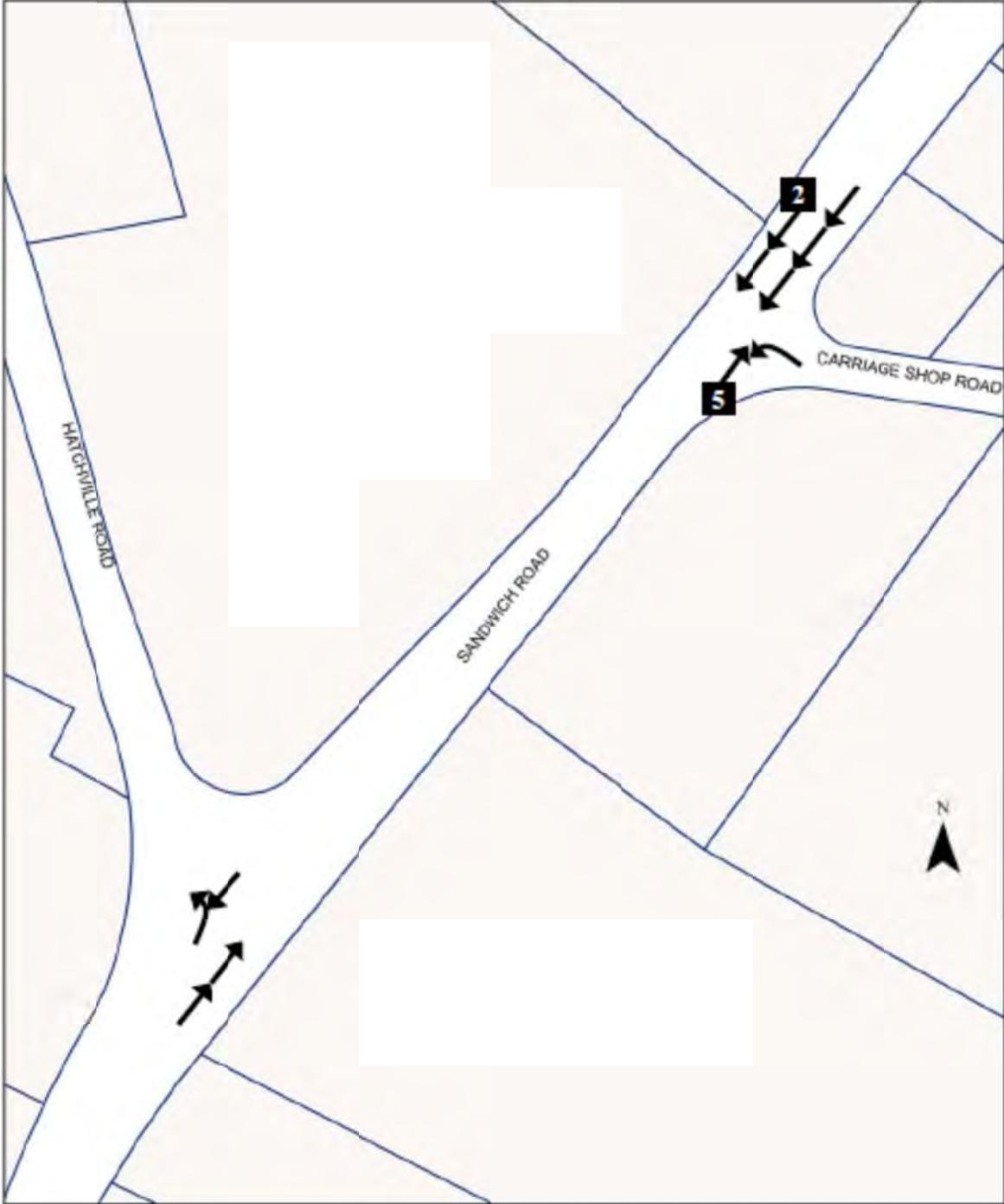
Date: September 16, 2011    Location: Falmouth Town Hall and site visit

Audit Team Members	Agency/Affiliation	Email Address	Phone Number
Marlene McCollem	Falmouth Planning Department	mmccollem@falmouthmass.us	508-495-7440
Peter McConarty	Falmouth Engineering Division	pmcconarty@falmouthmass.us	508-457-2543
Bob Williams	Falmouth Engineering Division		508-457-2543
Lisa Schletzbaum	MassDOT – Safety Division	Lisa.schletzbaum@state.ma.us	617-973-7685
Alolade Campbell	MassDOT Highway Division District 5 Projects	Alolade.Campbell@state.ma.us	508-884-4352
Glenn Cannon	Technical Services Director, Cape Cod Commission	gcannon@capecodcommission.org	508-362-3828
Priscilla N. Leclerc	Senior Transportation Planner, Cape Cod Commission	pleclerc@capecodcommission.org	508-362-3828

## Appendix C. Detailed Crash Data

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**Sandwich Road at Hatchville Road & Carriage Shop Road  
CRASH DIAGRAM**



Source:

Falmouth Police Department Crash Reports for the locations, 2008-2010

Sandwich Road @ Carriage Shop Road								
Date	Time	Day	Severity	# Cars	Manner	Bike/Ped	Weather	Summary
1/21/2008	11:03:00 AM	Mon	PDO	2	Angle	n/a	clear / cloudy	Veh 1 did not use care entering from Carriage Shop Rd turning left onto Sandwich Rd SB and struck Veh 2 --as Veh 2 was heading NB on Sand Rd. No injuries & damage to both vehicles but able to drive away
5/25/2008	4:26:00 PM	Sun	Injury	2	Angle	n/a	clear	Veh 1 NB Sand Rd and hit by Veh 2 failing to yield the ROW when turning L from CS Rd
8/27/2008	8:33:00 PM	Wed	Injury	2	Angle	n/a	clear	Veh 1 NB Sand Rd and hit by Veh 2 failing to yield the ROW when turning L from CS Rd
11/4/2008	1:11:00 PM	Tue	Injury	2	Rear-end	n/a	clear	Veh 1 SB Sand Rd slowing to turn LEFT onto CS Rd and hit by Veh 2 also SB on Sandwich Rd -- reported sun in eyes heading SB did not see Veh 1
11/6/2008	5:25:00 PM	Thu	PDO	2	Rear-end	n/a	rain	Veh 1 SB Sand Rd stopped to turn LEFT onto CS Rd, and hit by Veh 2 also SB on Sandwich Rd unable to stop due to excessive speed under wet road conditions
8/8/2009	7:49:00 PM	Sat	PDO	3	Rear-end	n/a	clear	Veh 1 SB Sand Rd stopped to turn LEFT onto CS Rd, Veh 2 stopped behind waiting for Veh 1 to turn, and Veh 3 also SB on Sandwich Rd hits Veh 2 pushing Veh 2 into Veh 1.
8/12/2010	2:49:00 PM	Thu	PDO	2	Angle	n/a	clear	Veh 1 did not use care entering from Carriage Shop Rd turning left onto Sandwich Rd SB and struck Veh 2 --as Veh 2 was heading NB on Sand Rd. Both vehicles towed.
10/7/2010	3:20:00 PM	Thu	Injury	2	Angle	n/a	clear	Veh 1 did not use care entering from Carriage Shop Rd turning left onto Sandwich Rd SB and struck Veh 2 --as Veh 2 was heading NB on Sand Rd. Injury to passenger of Veh 2.

Sandwich Road @ Hatchville Road								
Date	Time	Day	Severity	# Cars	Manner	Bike/Ped	Weather	Summary
1/31/2008	10:35:00 AM	Thu	PDO	2	Angle	n/a	cloudy / rain	Veh 1 (Sand.Rd NB) attempted LEFT into Hatchville Rd, and hit by Veh 2 SB on Sandwich Rd.
7/11/2009	1:40:00 PM	Sat	Injury	2	Rear-end	n/a	clear	Veh 1 Sand.Rd NB slowing to turn LEFT into Hatchville Rd, and hit by Veh 2 also travelling NB on Sandwich Rd but did not see Veh 1 slowing down.

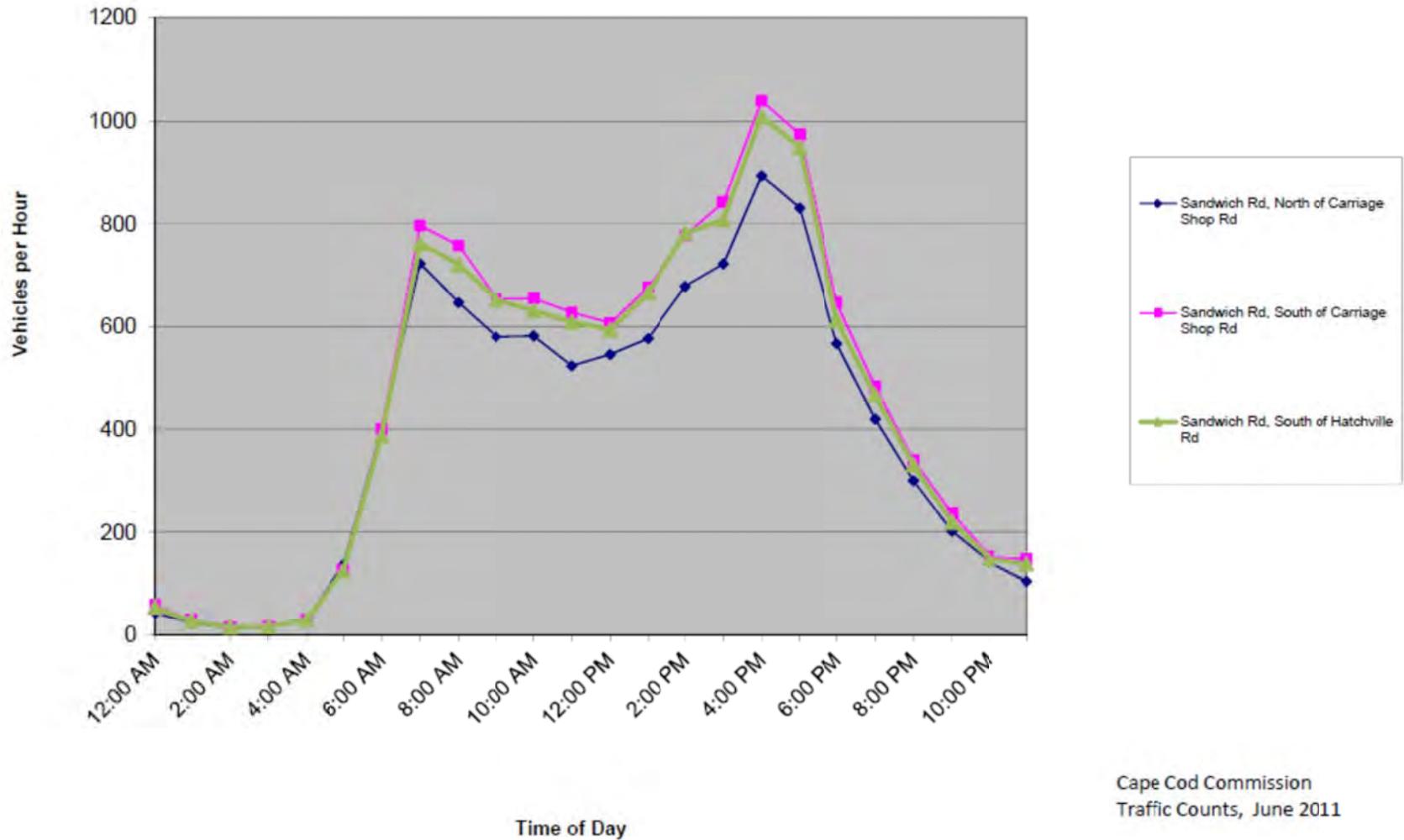
Source: Falmouth Police Department Crash Reports for the locations, 2008-2010

## Appendix D. Additional Information

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- Traffic Volumes
- Turning Movement Counts
  - Carriage Shop Road
  - Hatchville Road
- Speed Regulations
  - Sandwich Road
  - Carriage Shop Road

Sandwich Road, Falmouth, Hourly Traffic Volumes



Cape Cod Commission  
Traffic Counts, June 2011

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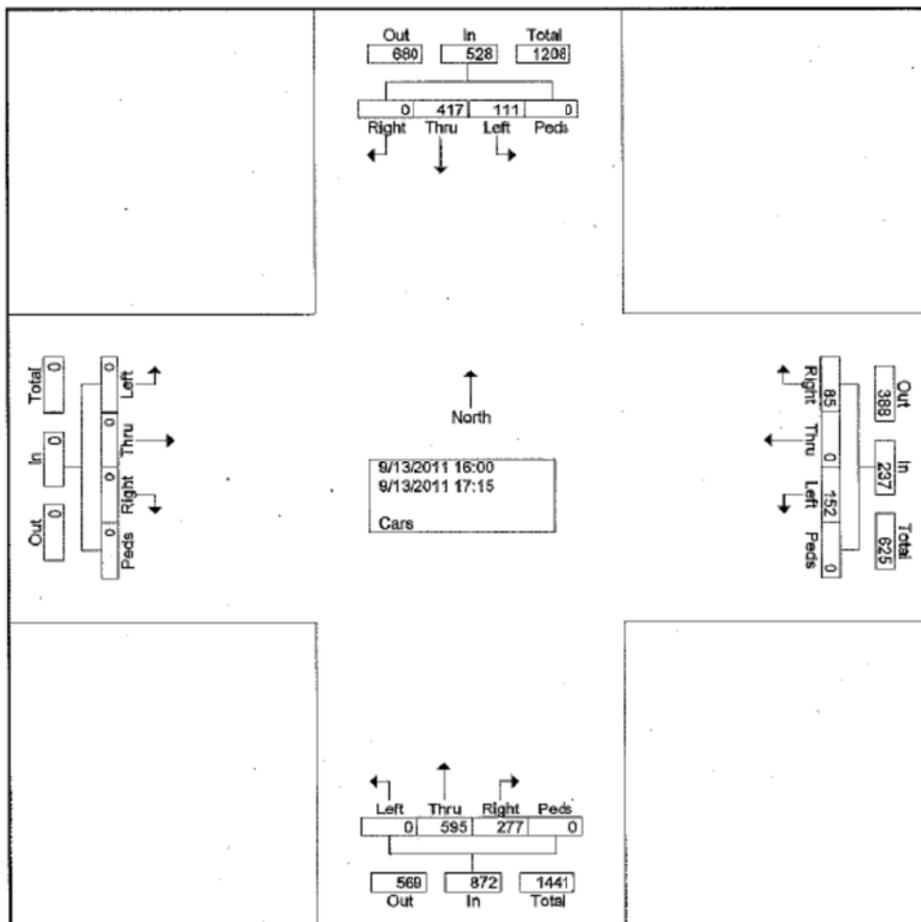
3225 Main Street • P.O. Box 226  
Barnstable, MA 02630  
Tel: 508.362.3828 • Fax: 508.362.3136  
E-Mail: trans@capecodcommission.org

Counter #:5  
Counted By: LAM  
Location: Sandwich Rd @ Carriage Shop Rd  
Date: 9/13/2011

File Name : 3012\_09132011  
Site Code : 00003012  
Start Date : 9/13/2011  
Page No : 1

#### Groups Printed- Cars

Start Time	From North				From East				From South				From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	20	71	0	0	40	0	23	0	0	91	46	0	0	0	0	0	291
16:15	18	82	0	0	26	0	9	0	0	89	39	0	0	0	0	0	263
16:30	23	81	0	0	11	0	11	0	0	89	37	0	0	0	0	0	252
16:45	20	60	0	0	22	0	15	0	0	99	46	0	0	0	0	0	262
<b>Total</b>	<b>81</b>	<b>294</b>	<b>0</b>	<b>0</b>	<b>99</b>	<b>0</b>	<b>58</b>	<b>0</b>	<b>0</b>	<b>368</b>	<b>168</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1068</b>
17:00	17	48	0	0	26	0	11	0	0	109	49	0	0	0	0	0	260
17:15	13	75	0	0	27	0	16	0	0	118	60	0	0	0	0	0	309
<b>Grand Total</b>	<b>111</b>	<b>417</b>	<b>0</b>	<b>0</b>	<b>152</b>	<b>0</b>	<b>85</b>	<b>0</b>	<b>0</b>	<b>595</b>	<b>277</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1637</b>
Apprch %	21	79	0	0	64.1	0	35.9	0	0	68.2	31.8	0	0	0	0	0	
Total %	6.8	25.5	0	0	9.3	0	5.2	0	0	36.3	16.9	0	0	0	0	0	



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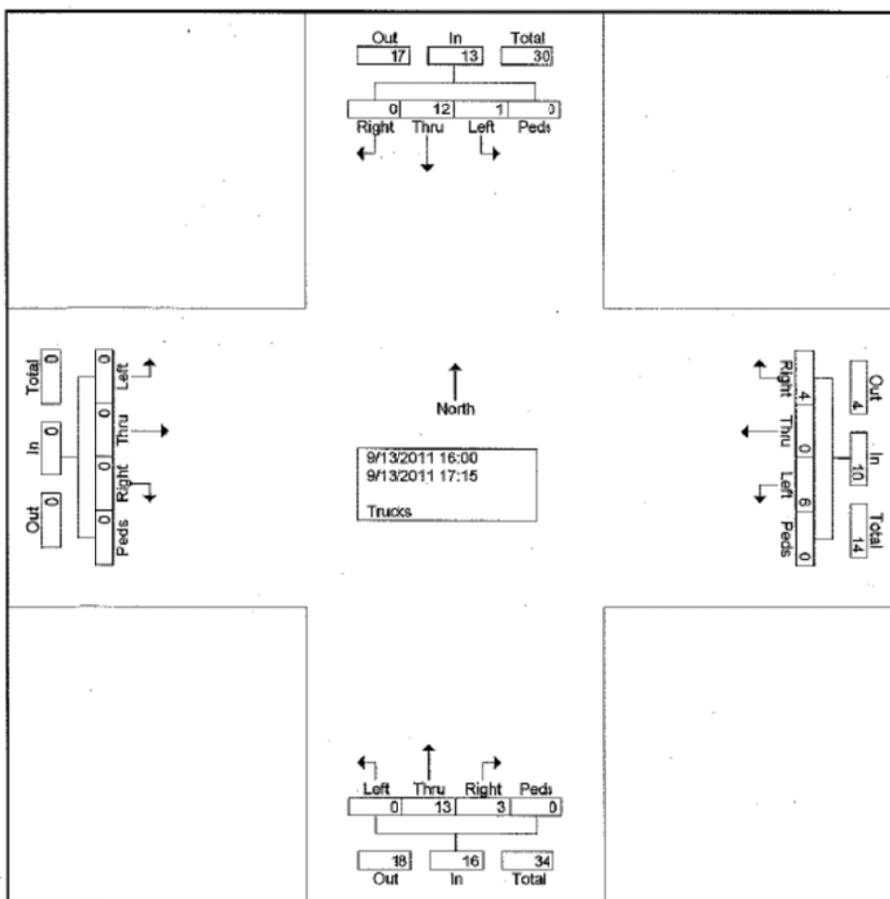
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 Tel: 508.362.3828 • Fax: 508.362.3136  
 E-Mail: trans@capecodcommission.org

Counter #: 5  
 Counted By: LAM  
 Location: Sandwich Rd @ Carriage Shop Rd  
 Date: 9/13/2011

File Name : 3012\_09132011  
 Site Code : 00003012  
 Start Date : 9/13/2011  
 Page No : 1

#### Groups Printed- Trucks

Start Time	From North				From East				From South				From West				Int. Total	
	Left	Thru	Right	Peds	Let	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds		
16:00	0	3	0	0	3	0	1	0	0	2	0	0	0	0	0	0	0	9
16:15	0	5	0	0	3	0	1	0	0	2	1	0	0	0	0	0	0	12
16:30	1	1	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	5
16:45	0	1	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	4
Total	1	10	0	0	6	0	3	0	0	8	2	0	0	0	0	0	0	30
17:00	0	2	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	6
17:15	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	3
Grand Total	1	12	0	0	6	0	4	0	0	13	3	0	0	0	0	0	0	39
Approch %	7.7	92.3	0	0	60	0	40	0	0	81.2	18.8	0	0	0	0	0	0	
Total %	2.6	30.8	0	0	15.4	0	10.3	0	0	33.3	7.7	0	0	0	0	0	0	



### CAPE COD COMMISSION

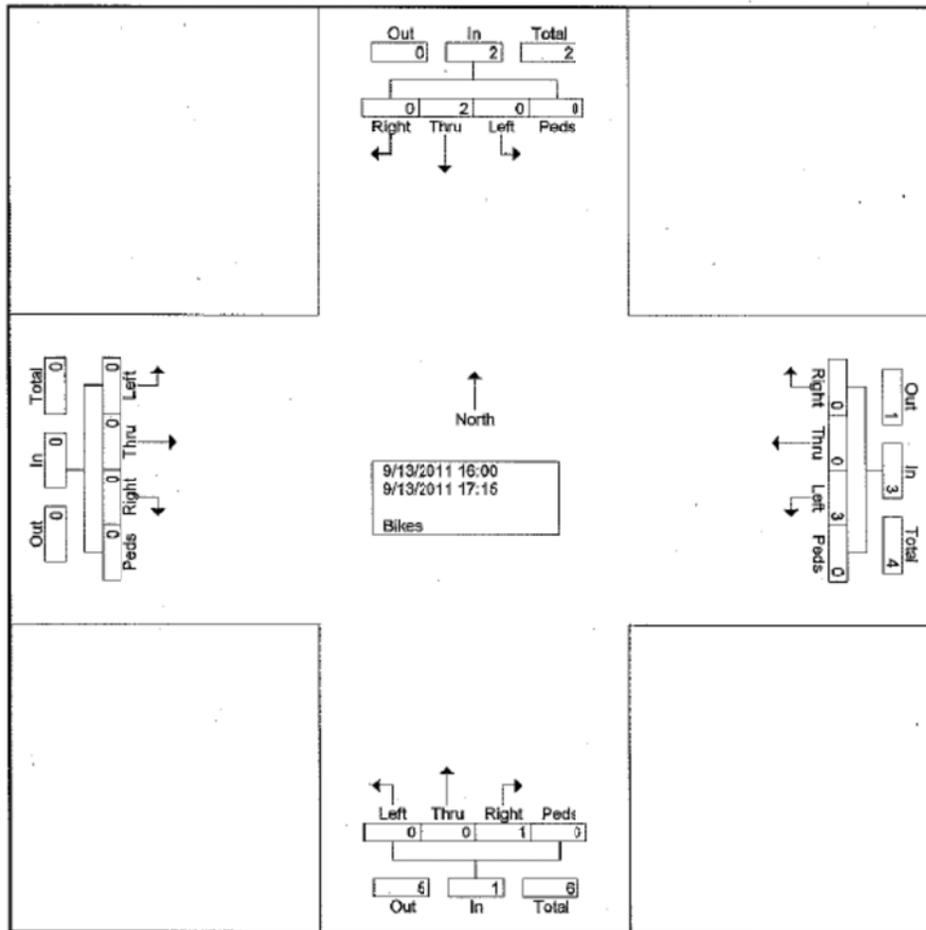
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 E-Mail: trans@capecodcommission.org

Counter #: 5  
 Counted By: LAM  
 Location: Sandwich Rd @ Carriage Shop Rd  
 Date: 9/13/2011

File Name : 3012\_09132011  
 Site Code : 00003012  
 Start Date : 9/13/2011  
 Page No : 1

#### Groups Printed- Bikes

Start Time	From North				From East				From South				From West				Int. Total	
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds		
16:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																		
16:45	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Total	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	4
17:00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
17:15	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	0	2	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	6
Approch %	0	100	0	0	100	0	0	0	0	0	100	0	0	0	0	0	0	
Total %	0	33.3	0	0	50	0	0	0	0	0	16.7	0	0	0	0	0	0	



# CAPE COD COMMISSION

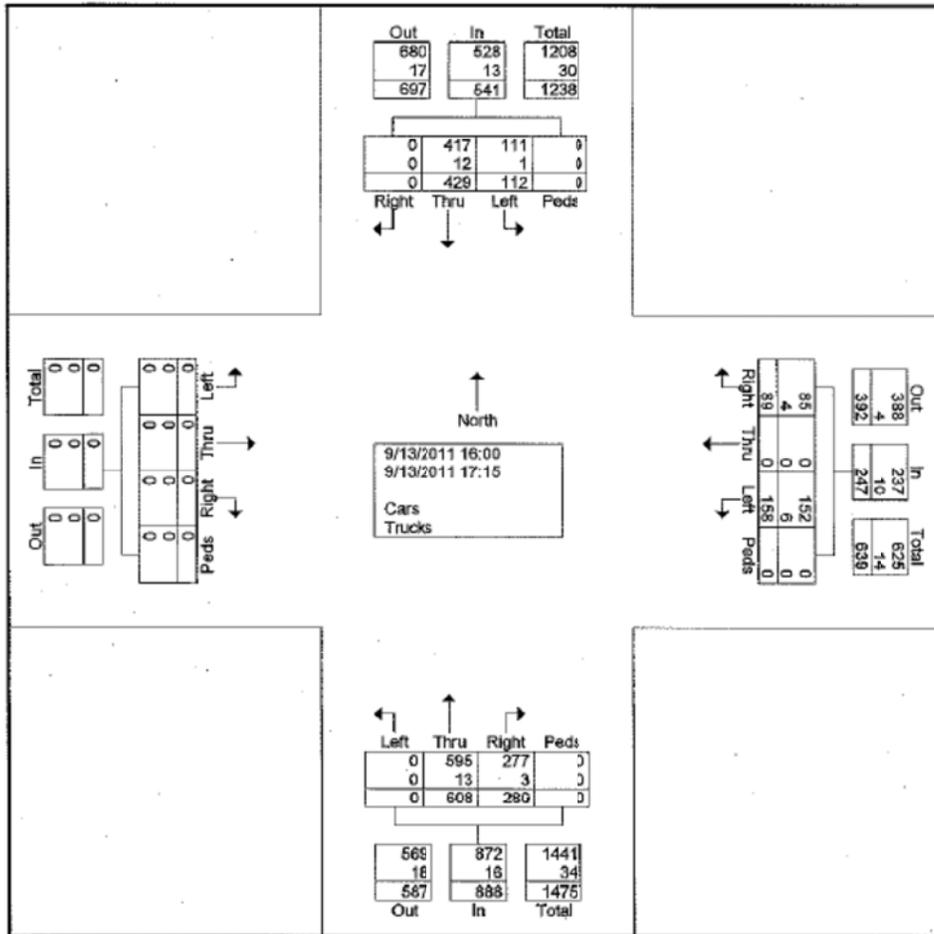
3225 Main Street • P.O. Box 226  
 Barnstable, MA 02630  
 Tel: 508.362.3828 • Fax: 508.362.3136  
 E-Mail: trans@capecodcommission.org

Counter #: 5  
 Counted By: LAM  
 Location: Sandwich Rd @ Carriage Shop Rd  
 Date: 9/13/2011

File Name : 3012\_09132011  
 Site Code : 00003012  
 Start Date : 9/13/2011  
 Page No : 1

### Groups Printed- Cars - Trucks

Start Time	From North				From East				From South				From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	20	74	0	0	43	0	24	0	0	93	46	0	0	0	0	0	300
16:15	18	87	0	0	29	0	10	0	0	91	40	0	0	0	0	0	275
16:30	24	82	0	0	11	0	11	0	0	91	38	0	0	0	0	0	257
16:45	20	61	0	0	22	0	16	0	0	101	46	0	0	0	0	0	266
<b>Total</b>	<b>82</b>	<b>304</b>	<b>0</b>	<b>0</b>	<b>105</b>	<b>0</b>	<b>61</b>	<b>0</b>	<b>0</b>	<b>376</b>	<b>170</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1098</b>
17:00	17	50	0	0	26	0	11	0	0	112	50	0	0	0	0	0	266
17:15	13	75	0	0	27	0	17	0	0	120	60	0	0	0	0	0	312
<b>Grand Total</b>	<b>112</b>	<b>429</b>	<b>0</b>	<b>0</b>	<b>158</b>	<b>0</b>	<b>89</b>	<b>0</b>	<b>0</b>	<b>608</b>	<b>280</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1676</b>
Approch %	20.7	79.3	0	0	64	0	36	0	0	68.5	31.5	0	0	0	0	0	0
Total %	6.7	25.6	0	0	9.4	0	5.3	0	0	36.3	16.7	0	0	0	0	0	0
Cars	111	417	0	0	152	0	85	0	0	595	277	0	0	0	0	0	1637
% Cars	99.1	97.2	0	0	96.2	0	95.5	0	0	97.9	98.9	0	0	0	0	0	97.7
Trucks	1	12	0	0	6	0	4	0	0	13	3	0	0	0	0	0	39
% Trucks	0.9	2.8	0	0	3.8	0	4.5	0	0	2.1	1.1	0	0	0	0	0	2.3



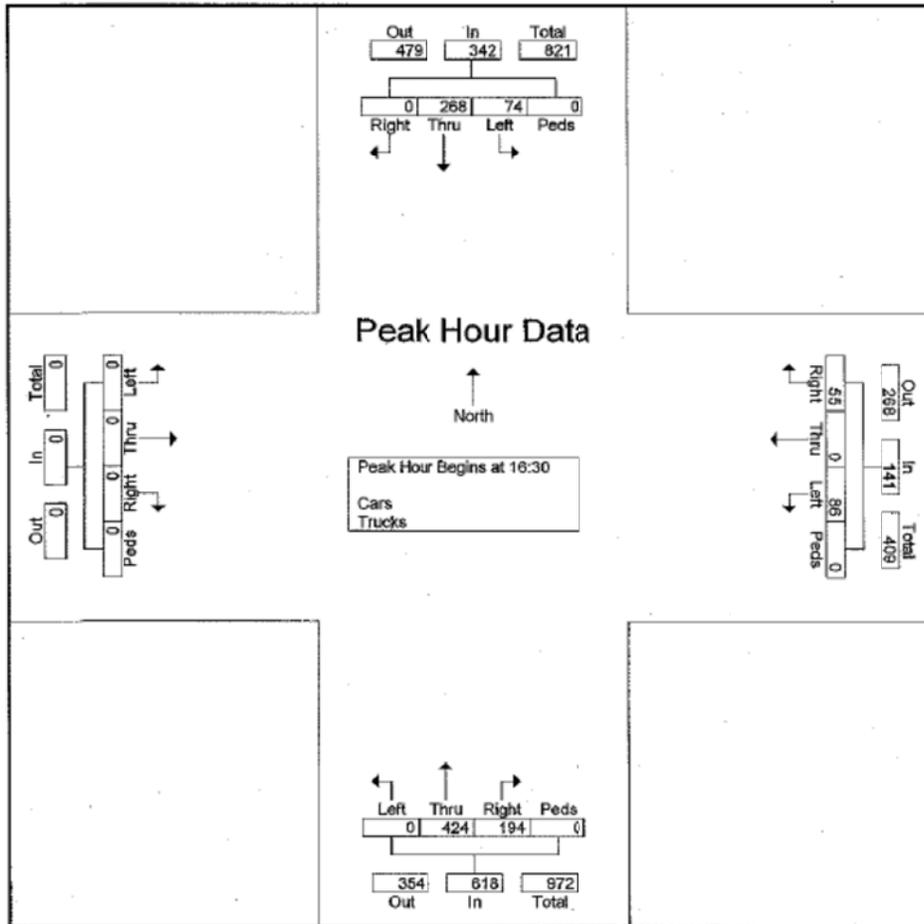
### CAPE COD COMMISSION

3225 Main Street • P.O. Box 226  
 Barnstable, MA 02630  
 Tel: 508.362.3828 • Fax: 508.362.3136  
 E-Mail: trans@capecodcommission.org

Counter #: 5  
 Counted By: LAM  
 Location: Sandwich Rd @ Carriage Shp Rd  
 Date: 9/13/2011

File Name : 3012\_09132011  
 Site Code : 00003012  
 Start Date : 9/13/2011  
 Page No : 2

Start Time	From North					From East					From South					From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 16:00 to 17:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:30																					
16:30	24	82	0	0	106	11	0	11	0	22	0	91	38	0	129	0	0	0	0	0	257
16:45	20	61	0	0	81	22	0	16	0	38	0	101	46	0	147	0	0	0	0	0	266
17:00	17	50	0	0	67	26	0	11	0	37	0	12	50	0	162	0	0	0	0	0	266
17:15	13	75	0	0	88	27	0	17	0	44	0	120	60	0	180	0	0	0	0	0	312
Total Volume	74	268	0	0	342	86	0	55	0	141	0	424	194	0	618	0	0	0	0	0	1101
% App. Total	21.6	78.4	0	0		61	0	39	0		0	82.6	31.4	0		0	0	0	0		
PHF	.771	.817	.000	.000	.807	.796	.000	.809	.000	.801	.000	.883	.808	.000	.858	.000	.000	.000	.000	.000	.882



# CAPE COD COMMISSION

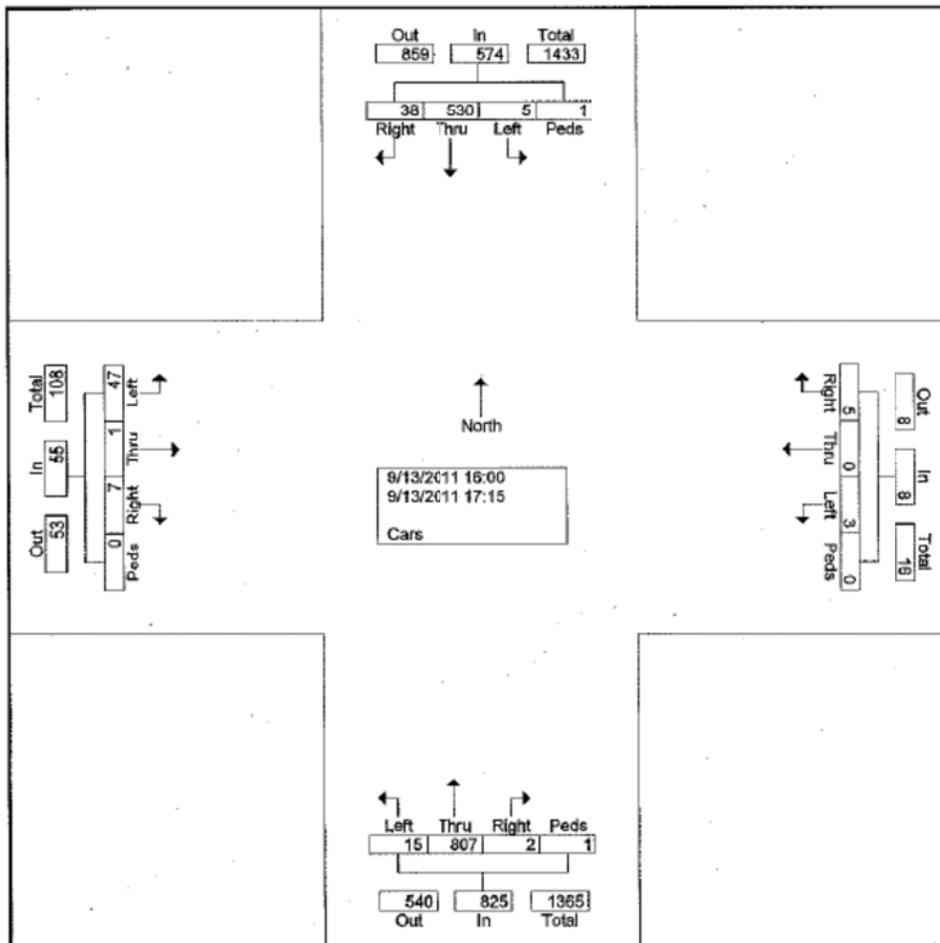
3225 Main Street • P.O. Box 226  
Barnstable, MA 02630  
Tel: 508.362.3828 • Fax: 508.362.3136  
E-Mail: trans@capecodcommission.org

Counter #:4  
Printed By:BCS  
Location:Sandwich Rd @ Hatchville Rd  
Date:9/13/2011

File Name : 3013\_09132011  
Site Code : 00003013  
Start Date : 9/13/2011  
Page No : 1

### Groups Printed- Cars

Start Time	From North				From East				From South				From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	0	108	7	0	0	0	0	0	4	130	0	0	6	0	2	0	257
16:15	1	100	8	0	1	0	1	0	2	119	1	0	2	0	0	0	235
16:30	1	83	10	0	0	0	0	0	1	118	0	1	7	0	4	0	225
16:45	1	80	2	1	1	0	1	0	3	131	0	0	11	0	0	0	231
<b>Total</b>	<b>3</b>	<b>371</b>	<b>27</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>10</b>	<b>498</b>	<b>1</b>	<b>1</b>	<b>26</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>948</b>
17:00	2	64	7	0	1	0	2	0	0	150	0	0	7	1	0	0	234
17:15	0	95	4	0	0	0	1	0	5	159	1	0	14	0	1	0	280
<b>Grand Total</b>	<b>5</b>	<b>530</b>	<b>38</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>15</b>	<b>807</b>	<b>2</b>	<b>1</b>	<b>47</b>	<b>1</b>	<b>7</b>	<b>0</b>	<b>1462</b>
Approch %	0.9	92.3	6.6	0.2	37.5	0	62.5	0	1.8	97.8	0.2	0.1	85.5	1.8	12.7	0	
Total %	0.3	36.3	2.6	0.1	0.2	0	0.3	0	1	55.2	0.1	0.1	3.2	0.1	0.5	0	



### CAPE COD COMMISSION

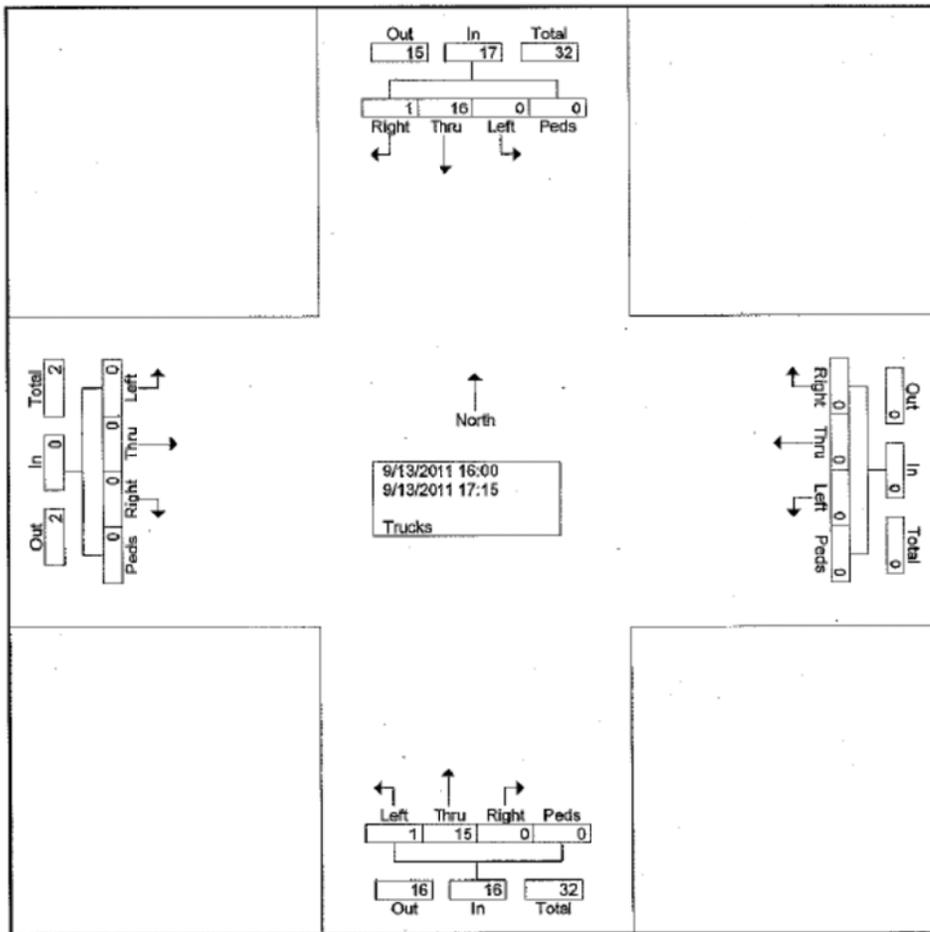
3225 Main Street • P.O. Box 226  
Barnstable, MA 02630  
Tel: 508.362.3828 • Fax: 508.362.3136  
E-Mail: trans@capecodcommission.org

Counter #: 4  
 Counted By: BCS  
 Location: Sandwich Rd @ Hatchville Rd  
 Date: 9/13/2011

File Name : 3013\_09132011  
 Site Code : 00003013  
 Start Date : 9/13/2011  
 Page No : 1

#### Groups Printed- Trucks

Start Time	From North				From East				From South				From West				Int. Total	
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds		
16:00	0	4	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	7
16:15	0	8	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	12
16:30	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4
16:45	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	5
<b>Total</b>	0	15	1	0	0	0	0	0	1	11	0	0	0	0	0	0	0	28
17:00	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4
17:15	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
<b>Grand Total</b>	0	16	1	0	0	0	0	0	1	15	0	0	0	0	0	0	0	33
Approch %	0	94.1	5.9	0	0	0	0	0	6.2	93.8	0	0	0	0	0	0	0	
Total %	0	48.5	3	0	0	0	0	0	3	45.5	0	0	0	0	0	0	0	



# CAPE COD COMMISSION

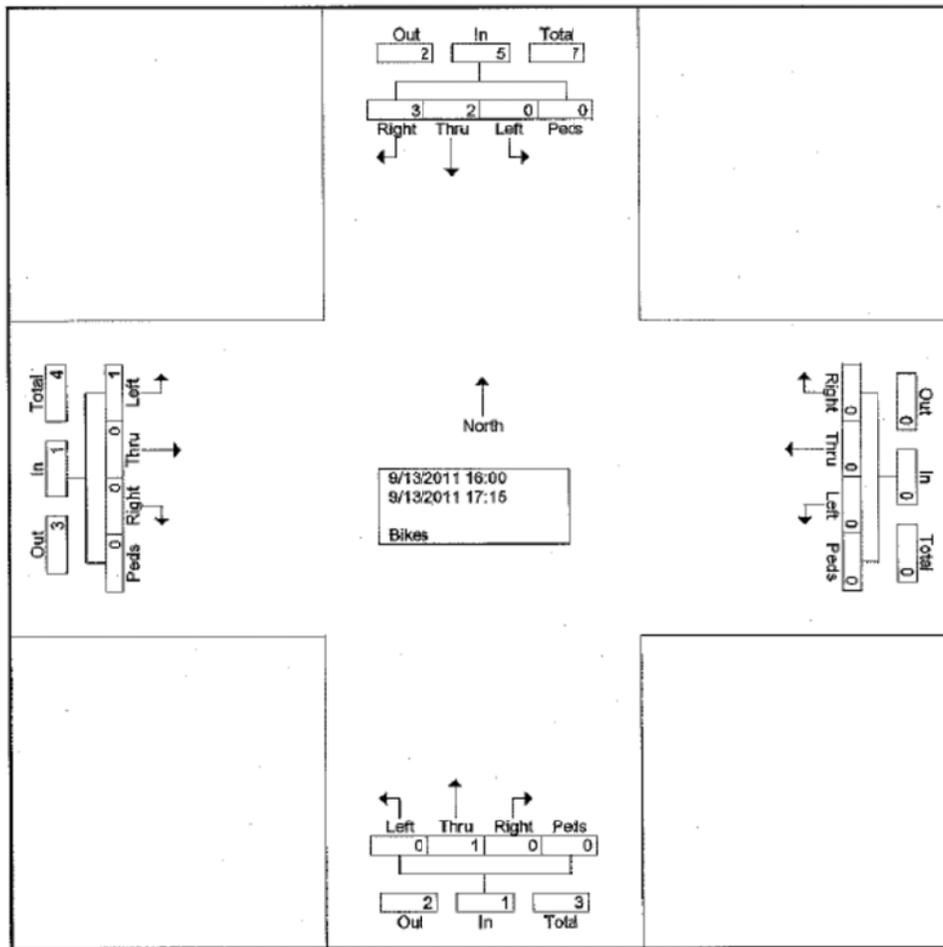
3225 Main Street • P.O. Box 226  
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Tel: 508.362.3828 • Fax: 508.362.3136  
E-Mail: trans@capecodcommission.org

Counter #: 4  
Printed By: BCS  
Location: Sandwich Rd @ Hatchville Rd  
Date: 9/13/2011

File Name : 3013\_09132011  
Site Code : 00003013  
Start Date : 9/13/2011  
Page No : 1

### Groups Printed- Bikes

Start Time	From North				From East				From South				From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
*** BREAK ***																	
16:45	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Total	0	1	3	0	0	0	0	0	0	1	0	0	0	0	0	0	5
17:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
17:15	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	0	2	3	0	0	0	0	0	0	1	0	0	1	0	0	0	7
Approch %	0	40	60	0	0	0	0	0	0	100	0	0	100	0	0	0	
Total %	0	28.6	42.9	0	0	0	0	0	0	14.3	0	0	14.3	0	0	0	



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E-Mail: trans@capecodcommission.org

Counter #: 4

Printed By: BCS

Location: Sandwich Rd @ Hatchville Rd

Date: 9/13/2011

File Name : 3013\_09132011

Site Code : 00003013

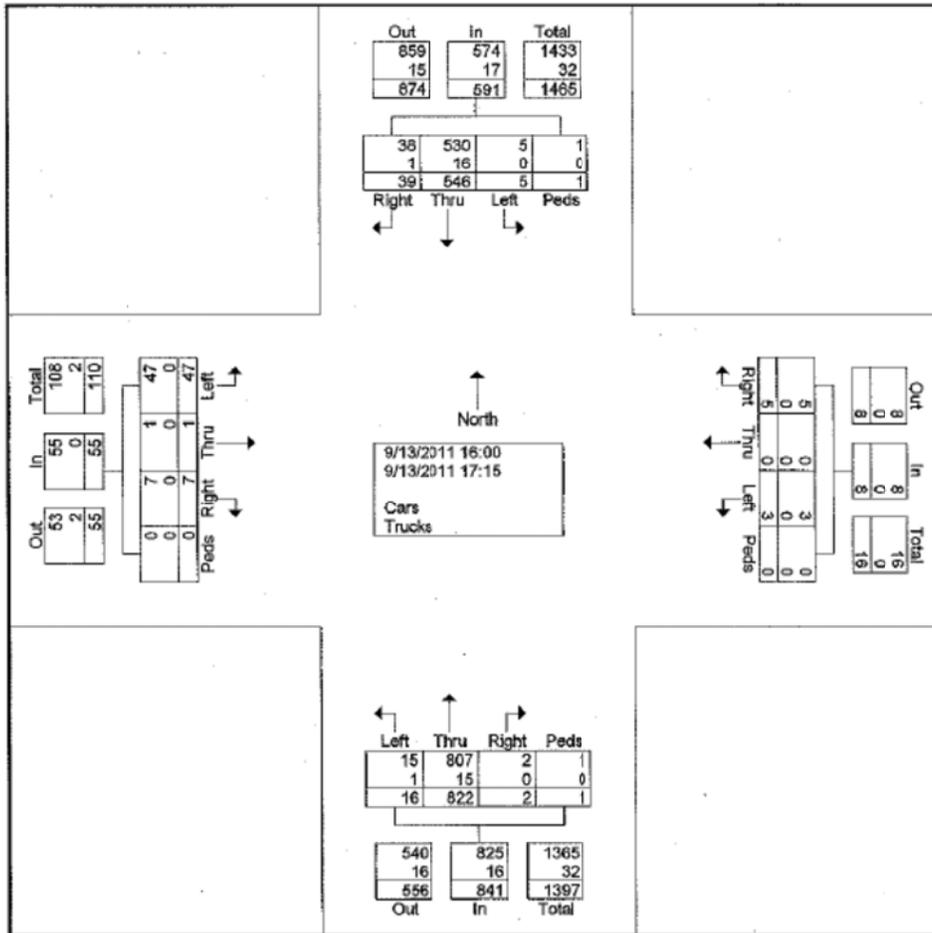
Start Date : 9/13/2011

Page No : 1

### Groups Printed- Cars - Trucks

Start Time	From North				From East				From South				From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	0	112	8	0	0	0	0	0	5	131	0	0	6	0	2	0	264
16:15	1	108	8	0	1	0	1	0	2	123	1	0	2	0	0	0	247
16:30	1	84	10	0	0	0	0	0	1	121	0	1	7	0	4	0	229
16:45	1	82	2	1	1	0	1	0	3	134	0	0	11	0	0	0	236
→ Total	3	386	28	1	2	0	2	0	11	509	1	1	26	0	6	0	976
17:00	2	65	7	0	1	0	2	0	0	153	0	0	7	1	0	0	238
17:15	0	95	4	0	0	0	1	0	5	160	1	0	14	0	1	0	281
Grand Total	5	546	39	1	3	0	5	0	16	822	2	1	47	1	7	0	1495
Approch %	0.8	92.4	6.6	0.2	37.5	0	62.5	0	1.9	97.7	0.2	0.1	85.5	1.8	12.7	0	
Total %	0.3	36.5	2.6	0.1	0.2	0	0.3	0	1.1	55	0.1	0.1	3.1	0.1	0.5	0	
Cars	5	530	38	1	3	0	5	0	15	807	2	1	47	1	7	0	1462
% Cars	100	97.1	97.4	100	100	0	100	0	93.8	98.2	100	100	100	100	100	0	97.8
Trucks	0	16	1	0	0	0	0	0	1	15	0	0	0	0	0	0	33
% Trucks	0	2.9	2.6	0	0	0	0	0	6.2	1.8	0	0	0	0	0	0	2.2

974



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 Barnstable, MA 02630  
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 E-Mail: trans@capecodcommission.org

Counter #:4

Printed By:BCS

Location:Sandwich Rd @ Hatchville Rd

Date:9/13/2011

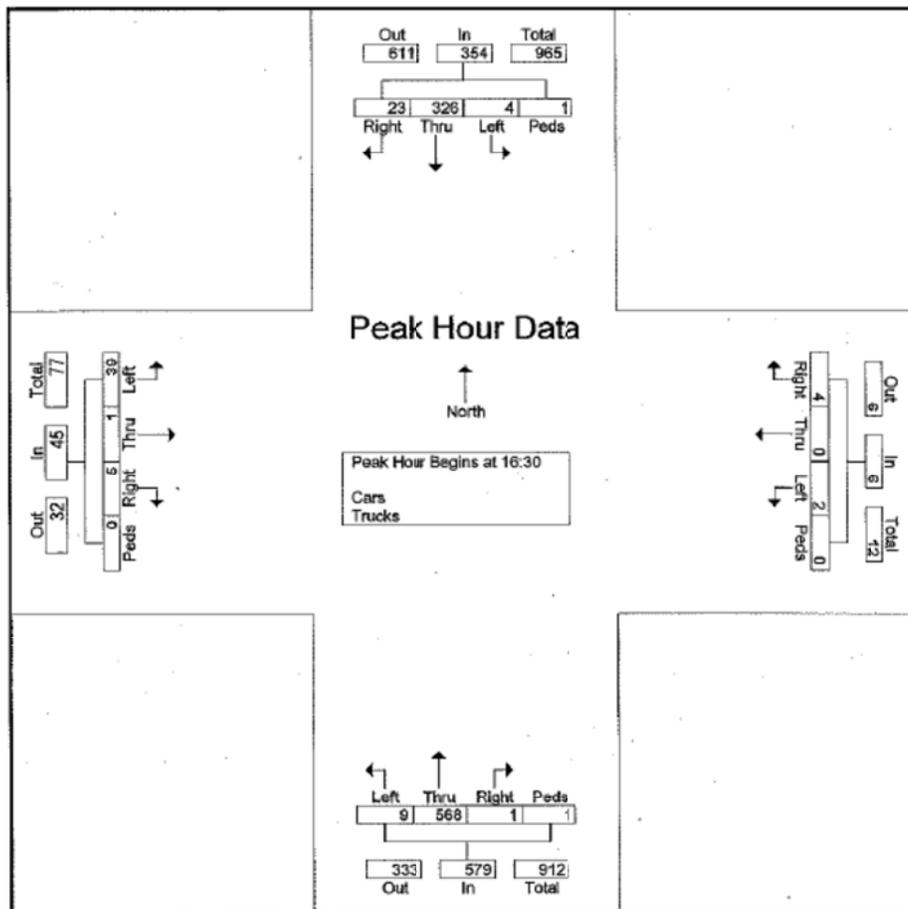
File Name : 3013\_09132011

Site Code : 00003013

Start Date : 9/13/2011

Page No : 2

Start Time	From North					From East					From South					From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 16:00 to 17:15 - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 16:30																					
16:30	1	84	10	0	95	0	0	0	0	0	1	121	0	1	123	7	0	4	0	11	229
16:45	1	82	2	1	86	1	0	1	0	2	3	134	0	0	137	11	0	0	0	11	236
17:00	2	65	7	0	74	1	0	2	0	3	0	153	0	0	153	7	1	0	0	8	238
17:15	0	95	4	0	99	0	0	1	0	1	5	160	1	0	166	14	0	1	0	15	281
Total Volume	4	326	23	1	354	2	0	4	0	6	9	568	1	1	579	39	1	5	0	45	984
% App. Total	1.1	92.1	6.5	0.3		33.3	0	66.7	0		1.6	96.1	0.2	0.2		86.7	2.2	11.1	0		
PHF	.500	.858	.675	.250	.894	.500	.000	.500	.000	.500	.450	.838	.250	.250	.872	.696	.250	.313	.000	.750	.875



THE COMMONWEALTH OF MASSACHUSETTS

Department of Public Works

SPECIAL REGULATION GOVERNING THE SPEED OF MOTOR VEHICLES ON

TOWN WAY, IN THE TOWN OF FALMOUTH

September 10, 1957

SPECIAL SPEED REGULATION NO. 141

Highway Location: FALMOUTH  
 Authority in Control: TOWN OF FALMOUTH  
 Name of Highway: Sandwich Road

In accordance with the provisions of Section 18 of Chapter 90 of the General Laws (Ter. Ed.), as amended by Section 2 of Chapter 564 of the Acts of 1948, the following Special Speed Regulation made by the Board of Selectmen of the Town of Falmouth shall be effective immediately upon compliance with the applicable provisions of the above-referenced Section 2.

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

SOUTHBOUND

Beginning at the town line Mashpee - Falmouth,  
 thence southerly 0.95 miles at 45 miles per hour ending at a point 300 feet north of the intersection of Sandwich Road and Coonamessett Highway.

Then beginning again on the southerly side of the intersection of Sandwich Road and Coonamessett Highway,  
 thence southerly 1.00 miles at 45 miles per hour  
 thence 0.56 " " 40 " " "  
 " 0.17 " " 35 " " "  
 " 1.97 " " 40 " " "  
 " 0.96 " " 35 " " " ending at Route 28; the total distance being 5.61 miles.

NORTHBOUND

Beginning at a point 300 feet north of Route 28,  
 thence northerly 0.96 miles at 35 miles per hour  
 thence 1.97 " " 40 " " "  
 " 0.17 " " 35 " " "  
 " 0.56 " " 40 " " "  
 " 1.00 " " 45 " " " ending at a point 300 feet south of the intersection of Sandwich Road and Coonamessett Highway.

Then beginning again on the northerly side of the intersection of Sandwich Road and Coonamessett Highway,  
 thence northerly 0.98 miles at 45 miles per hour ending at the Mashpee-town line; the total distance being 5.64 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, after a public hearing, that this regulation is consistent with the public interests.

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

DEPARTMENT OF PUBLIC WORKS

Carl A. Sheridan  
Commissioner

Fred B. Dole  
Associate Commissioner

Lewis J. Fritz  
Associate Commissioner

Rudolph F. King  
Registrar of Motor Vehicles

TOWN OF FALMOUTH  
SPECIAL SPEED REGULATION NO. 7206

OCT 24 1983

Highway Location: FALMOUTH  
Authority In Control: TOWN OF FALMOUTH  
Name of Highway(s): CURLEY BOULEVARD, QUAKER ROAD,  
NASHAWENA STREET, GIFFORD STREET,  
FRESH POND ROAD AND CARRIAGE SHOP  
ROAD.

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

hereby Adopted  
by the Board of Selectmen  
of the Town of Falmouth

That the following speed limits are established at which motor vehicles may be operated in the areas described:

CURLEY BOULEVARD, QUAKER ROAD & NASHAWENA STREET-SOUTHBOUND

Beginning at a point 350 feet from Route 28A  
Thence southerly on Curley Boulevard, Quaker Road and Nashawena Street  
0.61 miles at 45 miles per hour  
0.66 miles at 35 " " "  
0.60 " " 30 " " "  
1.06 " " 35 " " "  
0.43 " " 25 " " " ending at Old Dock Road;  
the total distance being 3.36 miles.

NASHAWENA STREET, QUAKER ROAD & CURLEY BOULEVARD-NORTHBOUND

Beginning at Old Dock Road  
Thence northerly on Nashawena Street, Quaker Road and Curley Boulevard  
0.43 miles at 25 miles per hour  
1.06 " " 35 " " "  
0.60 " " 30 " " "  
0.66 " " 35 " " "  
0.58 " " 45 " " "  
0.10 " " 30 " " " ending at Route 28A;  
the total distance being 3.43 miles.

GIFFORD STREET-NORTHBOUND

Beginning at Main Street

Thence northerly on Gifford Street

0.46	miles	at	35	miles	per	hour	
0.28	"	"	25	"	"	"	"
0.43	"	"	35	"	"	"	"
1.18	"	"	45	"	"	"	"
0.05	"	"	30	"	"	"	"

ending at Brick Kiln Road;

the total distance being 2.40 miles.

GIFFORD STREET-SOUTHBOUND

Beginning at Brick Kiln Road

Thence southerly on Gifford Street

1.23	miles	at	45	miles	per	hour	
0.43	"	"	35	"	"	"	"
0.28	"	"	25	"	"	"	"
0.46	"	"	35	"	"	"	"

ending at Main Street;

the total distance being 2.40 miles.

FRESH POND ROAD-NORTHBOUND

Beginning at Route 28

Thence northerly on Fresh Pond Road

0.83 miles at 35 miles per hour ending at Carriage Shop

Road; the total distance being 0.83 miles.

FRESH POND ROAD-SOUTHBOUND

Beginning at Carriage Shop Road

Thence southerly on Fresh Pond Road

0.83 miles at 35 miles per hour ending at Route 28;

the total distance being 0.83 miles.

CARRIAGE SHOP ROAD-EASTBOUND

Beginning at Sandwich Road

Thence easterly on Carriage Shop Road

0.89	miles	at	35	miles	per	hour	
1.61	"	"	30	"	"	"	"
0.34	"	"	25	"	"	"	"
0.39	"	"	30	"	"	"	"

ending at Metoxit Road;

the total distance being 3.23 miles.

CARRIAGE SHOP ROAD-WESTBOUND

Beginning at Route 28,  
 Thence westerly on Carriage Shop Road  
 0.47 miles at 30 miles per hour  
 0.34 " " 25 " " "  
 1.61 " " 30 " " "  
 0.89 " " 35 " " " ending at Sandwich Road;  
 the total distance being 3.31 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 Chapter 90, Section 14, of the General Laws (Ter. Ed).

Date of Passage 10/2/83 Wm. D. [unclear] Dym  
Heather McMurtrie  
Leonard L Costa  
 Board of Selectmen

Attest William [unclear]  
 Town Clerk

COMMONWEALTH OF MASSACHUSETTS  
 DEPARTMENT OF PUBLIC WORKS

SPECIAL SPEED REGULATION NO. 7206

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

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

DATE: **OCT 24 1983**

FOR THE DEPARTMENT OF PUBLIC WORKS

BY: [Signature]  
 Traffic Engineer

[Signature]  
 Chief Deputy Registrar

## Appendix E. Road Safety Audit References

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## Road Safety Audit References

*Massachusetts Traffic Safety Toolbox*, Massachusetts Highway Department,  
[www.mhd.state.ma.us/safetytoolbox](http://www.mhd.state.ma.us/safetytoolbox).

*Road Safety Audits, A Synthesis of Highway Practice*. NCHRP Synthesis 336. Transportation Research Board, National Cooperative Highway Research Program, 2004.

*Road Safety Audits*. Institute of Transportation Engineers and U.S. Department of Transportation, Federal Highway Administration, [www.roadwaysafetyaudits.org](http://www.roadwaysafetyaudits.org).

*FHWA Road Safety Audit Guidelines*. U.S. Department of Transportation, Federal Highway Administration, 2006.

*Road Safety Audit*, 2<sup>nd</sup> edition. Austroads, 2000.

*Road Safety Audits*. ITE Technical Council Committee 4S-7. Institute of Transportation Engineers, February 1995.

*Desktop Reference for Crash Reduction Factors*. Report No. FHWA-SA-08-011. U.S. Department of Transportation, Federal Highway Administration, September 2008