



CAPE COD
COMMISSION

Brewster

Road Safety Audit

Route 124 (Harwich Road)
and Tubman Road Intersection

September 2011





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Prepared by the Cape Cod Commission
In cooperation with
The Town of Brewster
And
MassDOT Highway Division

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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

The Town of Brewster has grown over the last couple of decades but remains fairly rural and historic in character. As with most Cape Cod towns, there are visitors in town adding to the numbers of people moving around for various activities.

Cape Cod’s scenic byway state Route 6A winds through the Town of Brewster and is also the major vehicular access for residential, business, governmental, and visitor activities in the Town. With congestion increasing at times on that main route, other roadways are experiencing increased through traffic. One of



these roadways is Tubman Road, and where it crosses Route 124, or Harwich Road, it has become a high crash location in the region.

The Route 124 - Harwich Road at Tubman Road intersection based on Equivalent Property Damage Only (EPDO) rate¹ is the 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 Brewster for this Road Safety Audit. The crash data were reviewed with a resulting crash diagram and summary developed. A turning movement count (TMC) to review intersection traffic volumes was not available at the RSA meeting, but was performed by CCC staff the following week. The crash diagram, summary data, and the TMC data are included in the appendices.

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

Project Data

The Road Safety Audit meeting was held on Friday, September 16, 2011, beginning around 1:30 p.m., at the Brewster Police Station. The multidisciplinary team also visited the site: Route 124 (Harwich Road) at Tubman Road intersection, at this time.

Table 1. Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Jillian Douglas	Brewster Assistant Administrator
John Fallendar	MassBike Cape and Islands
Robert Bersin, P.E.	Brewster Department of Public Works
George A. Bausch, Lt.	Brewster Police Department
Robert Moran, Chief	Brewster Fire Department
Sue Leven	Brewster Town Planner
Lisa Schletzbaum	MassDOT – Safety Division
Glenn Cannon, P.E.	Technical Services Director, Cape Cod Commission
Priscilla N. Leclerc	Senior Transportation Planner, Cape Cod Commission



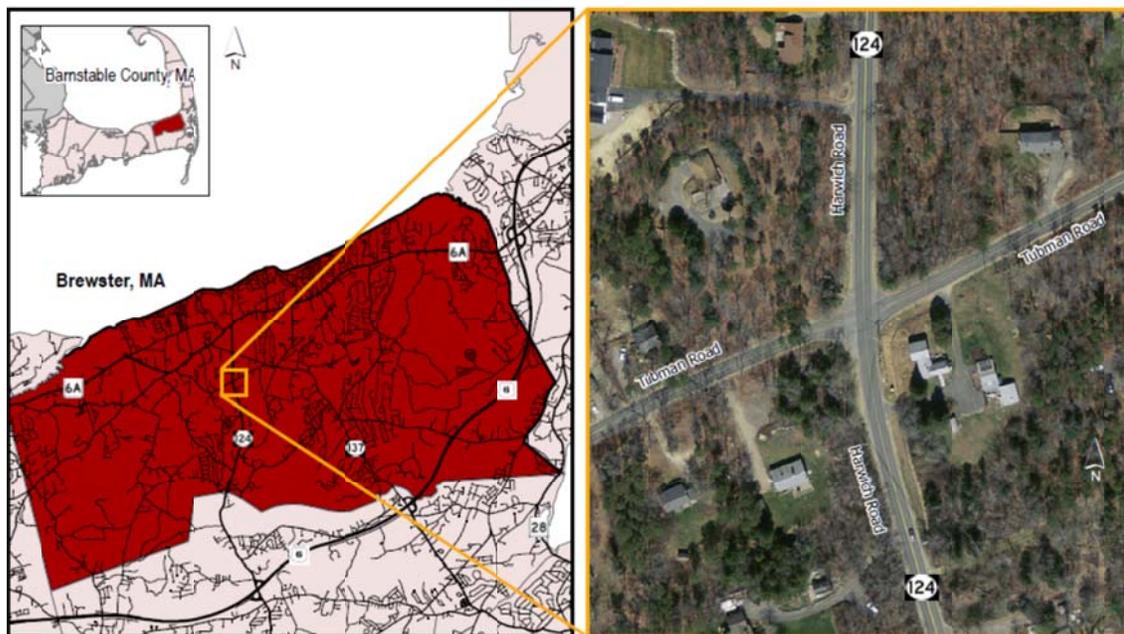
Project Location and Description

Route 124 (Harwich Road) in the Town of Brewster is a two-lane roadway that extends in a north-south direction between state Route 6A and the Harwich Town Line.

Tubman Road, also a two-lane roadway, runs from state Route 6A southeasterly, crosses Route 124 (Harwich Road), and continues to intersect with Route 137 (Long Pond Road).

Both of the intersecting roadways are federal aid eligible. Route 124 (Harwich Road) is functionally classified as an urban extension of a rural minor arterial, and runs in a north/south direction. Tubman Road is classified as an urban collector, and also as a scenic road in the Town of Brewster.

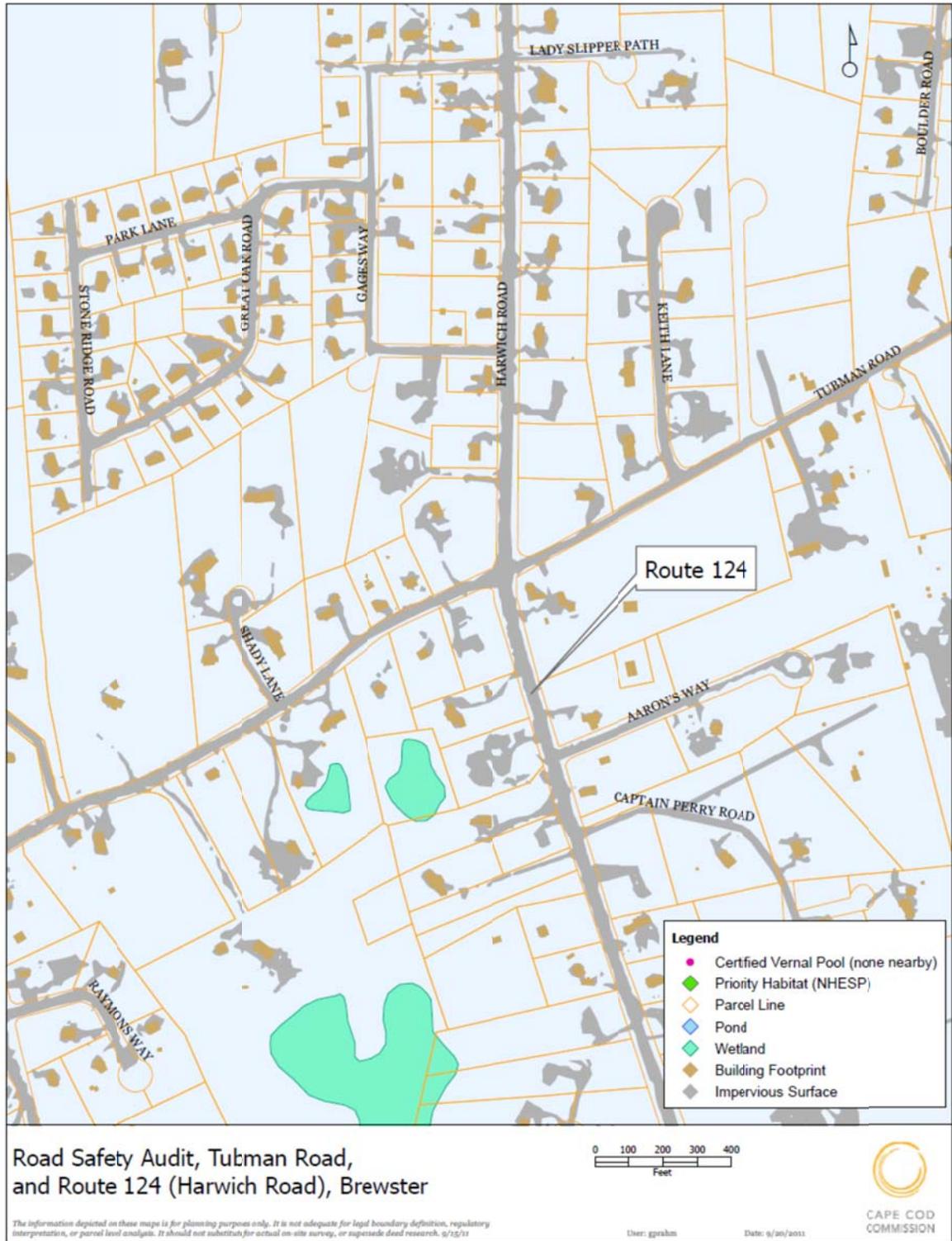
Figure 1. Locus Map





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Figure 2. Land Use and Environmental Map





Road Safety Audit: Route 124 at Tubman Road

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

The Route 124 at Tubman Road intersection totaled 19 crashes from 2008-2010, with one fatal crash and three injury crashes. The crash experience has been a concern of the Town for some time; the intersection geometry was reviewed and improvements on one corner to improve sight distance have been completed fairly recently (2008/2009).

The Town of Brewster does have regulations for maintenance of sight distance. Typically an owner is sent a letter to trim back obstructing vegetation when it is noted, and if it is not cut back by the owner within six months, then the Town will go out and cut it back.

Traffic volumes were noted as being similar for Route 124 (Harwich Road) and Tubman Road. A Turning Movement Count (TMC) had not been performed by the time of the Road Safety Audit meeting, but was performed on Monday, September 19, 2011. The TMC data is included in the Appendices.

The regulatory speed limit for Route 124 (Harwich Road) varies from 25 to 40 miles per hour in both directions, but is 40 miles per hour (mph) through this section. This section is posted at 40 mph with a 30 mph advisory speed sign prior to the intersection with Tubman Road in both directions. For Tubman Road, the regulatory speed is 35 mph, and it is posted at 35 mph.

Audit Observations and Potential Safety Enhancements

SAFETY ISSUE #1. SIGNAGE

Observation: Signs in the vicinity of the intersection of Route 124 (Harwich Road) and Tubman Road were reviewed while considering crash experience, driver expectations, and potential enhancement for increased driver awareness.

Intersection warning signs and speed limit signs were located. STOP signs were on one side on each of the Tubman Road legs; however, these were not located directly adjacent to the painted STOP line.

Chevron signs were located on Tubman Road on the western approach to this intersection with Route 124, and it was mentioned that it could be confusing for drivers; simple reflectors were suggested instead.

Enhancement:

Increase the size of the STOP signs to 36" signs, and install on both sides of the intersection in line with the STOP line.

Replace the chevron signs with reflectors.



Rte. 124 view southerly toward Tubman Road



Tubman Road view easterly toward Rte. 124



Tubman Road view easterly approaching Rte. 124



SAFETY ISSUE #2. SPEED

Observation: During the RSA Team meeting discussion, the police mentioned that there have been assessments of vehicular speeds, and reported that speeding is not a problem in the vicinity of the intersection.

Warning speed signs at 30 miles per hour (mph) are posted with the intersection warning signs on both approaches of Route 124 (Harwich Road).

In the field, there was a comment that vehicles southbound on Route 124 seemed to be traveling too fast, and likely over the 30 mph posted on the warning sign.

Enhancement: Continue police monitoring of traveling speeds in the vicinity of the intersection to ensure compliance for improved safety.



Intersection and speed warning signs on Route 124

SAFETY ISSUE #3. CORRIDOR CONSISTENCY

Observation: It was mentioned that the nearby intersection of Route 124 (Harwich Road) with Route 137 (Long Pond Road) has a four-way STOP with blinking traffic lights. It was noted that in some of the Route 124/Tubman Rd. crash reports drivers expected the Route 124 traffic to stop as if this intersection was also a four-way STOP controlled intersection.

Enhancement: Consider a four-way STOP controlled treatment at this intersection.



Tubman Rd. looking westerly toward Rte. 124



SAFETY ISSUE #4. CONFLICTING VOLUMES

Observation:

A statement was made that the traffic volumes on Route 124 (Harwich Road) and on Tubman Road have increased and are about even. This creates many conflicts due to the turning and crossing traffic volumes. The angle crashes account for 74% of all crashes in the years 2008-2010, and included one fatal crash. Increasing awareness of the intersection through signage and sight distance improvements are mentioned under other safety issues.



*Tubman Road westerly approach
with a view toward Rte. 124 northbound*

Enhancement:

A roundabout concept was mentioned as a possible long-term improvement to reduce conflicts at the intersection. A roundabout intersection is designed to slow traffic and eliminate all left turns from the intersection movements.



Tubman Road view easterly toward Rte. 124

However, the Town staff was not comfortable with the roundabout concept and thought that a 4-way STOP would be more in keeping with local character. An engineering review of the intersection should be conducted to determine the most appropriate and safest form of control.



SAFETY ISSUE #5. PAVEMENT LEVEL AND MARKINGS

Observation: From the northern approach (southbound travel) on Route 124 to the intersection, it was noted that the location of the STOP line and the STOP sign for Tubman Road western approach (eastbound travel), and therefore vehicles stopped, were not visible to drivers travelling southbound on Route 124 toward the intersection.



Rte. 124 southbound toward Tubman Rd.

The undulating rural roadway has slight changes in elevation at some points that may complicate driver perceptions and/or reduce sight distance. At the Tubman Road STOP lines, the pavement level is lower than the elevation crown of Route 124 (Harwich Road). The crest in the Route 124 SB approaching vehicles may hide these vehicles from drivers stopped EB on Tubman Road.



Tubman Rd. WB at STOP line looking SB Rte. 124

Enhancement: Align the stop bar pavement marking at Tubman Road four feet from Rte. 124 edge line.

Consider regrading to move toward consistent approach elevations, possibly with design of a roundabout.



Tubman Rd. looking easterly toward Rte. 124



*Tubman Road EB at the STOP line
looking NB on Route 124*



*Tubman Road EB at the STOP line
Looking SB on Route 124*



SAFETY ISSUE #6. SIGHT DISTANCE

Observation: Discussion by the multidisciplinary team included review of sight distance from the intersection approaches. The utility pole and brush on the northeast corner was perceived to be partially obstructing northward views from the STOP at Tubman Road westbound. Recent Town improvements on the southeast corner had removed vegetation and installed a stone wall. A couple of locations were noted to be in need of brush trimming.

Enhancement: Relocate the utility pole on the northeast corner of the Route 124 at Tubman Road intersection.

Trimming or cutting back brush to improve visibility where necessary.

Install larger STOP signs, on both sides of each of the Tubman Road legs, and in line with the painted STOP lines.



Tubman Road Westbound at STOP, looking northerly.



Example of sign where minor trimming will improve visibility

SAFETY ISSUE #7. BICYCLE AND PEDESTRIAN ACCOMMODATION

Observation: There are no separate facilities for bicycles or pedestrians along the roadways or at the intersection.

Enhancement: Consider improved bicycle/pedestrian accommodation when reconstruction for Route 124 (Harwich Road) is being considered.



Route 124 (Harwich Road) Brewster



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 Stop sign visibility and alignment Driver confusion	Increase STOP sign size on both sides of each leg of Tubman Road. STOP sign post and STOP line should be horizontally aligned. Removal of Chevron signs and installation of reflectors on westerly approach leg of Tubman Rd.	Low to Medium	Short-term	Low	Town
Speed Continue monitoring	Continue assessment and focused periodic enforcement to encourage compliance with speed limits.	Low	Medium-term	Medium	Town
Corridor consistency / Driver expectations with four-way STOP at the nearby intersection of Route 124 and Route 137	With warrants met, consider four-way STOP control.	Medium	Medium-term	Medium	Town
Conflicting Volumes Left turns in and out of side roads conflicting with Harwich Road volumes	With warrants met, install STOP signs on Route 124 for a four-way STOP control.	Medium	Medium-term	Medium	Town
	Consider a roundabout for this intersection.	High	Long-term	High	Town
Intersection Level and Pavement Markings Vertical crest and sag areas Pavement marking location	Consider regrading of approaches, or a roundabout for this intersection.	High	Long-term	High	Town
	STOP line should be moved closer to Route 124 edge line (to 4' from edge line)	Medium	Short-term	Low	Town
Sight Distance Utility pole Vegetation STOP sign size	Relocated the utility pole on the NE corner of the intersection Trim or cut back brush where necessary The addition of large size STOP signs (36") on both sides of each leg of Tubman Road will provide better visibility.	Low to Medium	Short-term	Low	Town
Bicycle and Pedestrian Accommodation , narrow roadway no separate facilities	Consider improved bicycle/pedestrian accommodation when reconstruction is being considered.	Medium	Long-term	High	Town

Appendix A. RSA Meeting Agenda

3225 MAIN STREET • P.O. BOX 226
BARNSTABLE, MASSACHUSETTS 02630

(508) 362-3828 • Fax (508) 362-3136 • www.capecodcommission.org



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Road Safety Audit Meeting

Brewster, Route 124 (Harwich Road) at Tubman Road

Friday, September 16, 2011

1:30 p.m. – 3:30 p.m.

Location: Brewster Police Station, 631 Harwich Road, Brewster, MA 02631

~~1:30 p.m.~~

~~10:30 a.m.~~ **Welcome and Introductions**

~~10:40 a.m.~~ **Review of Site Specific Material**

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

~~11:30 a.m.~~ **Visit the Site**

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

~~12:00 noon~~ **Post Visit Discussion / Completion of RSA**

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

~~3:30 p.m.~~

~~12:30 p.m.~~ **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

Participating Audit Team Members

Date: September 16, 2011 Location: Brewster Police Station and site visit

Audit Team Members	Agency/Affiliation	Email Address	Phone Number
Jillian Douglas	Brewster Asst. Administrator	jdouglas@town.brewster.ma.us	508-896-3701 x1130
John Fallendar	MassBike Cape and Islands	Jfall118@msn.com	508-255-9893
Robert Bersin, P.E.	Brewster DPW	rbersin@town.brewster.ma.us	508-896-3212
George A. Bausch, Lt.	Brewster Police Dept.	gbausch@town.brewster.ma.us	774-353-7029
Robert Moran, Chief	Brewster Fire Dept.	rmoran@town.brewster.ma.us	508-896-7018
Sue Leven	Brewster Planning Dept.	sleven@town.brewster.ma.us	508-896-3701 x1150
Lisa Schletzbaum	MassDOT – Safety Division	Lisa.schletzbaum@state.ma.us	617-973-7685
Glenn Cannon, P.E.	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

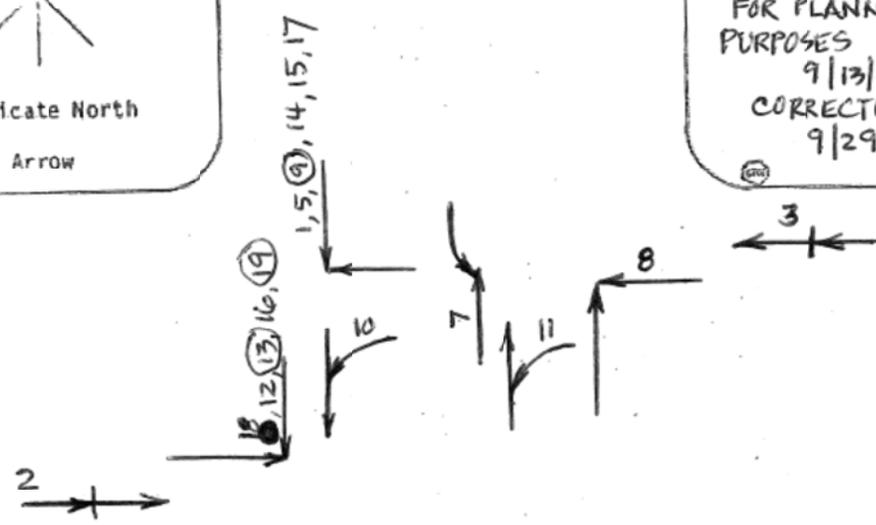


Indicate North
by Arrow

COLLISION DIAGRAM

FOR PLANNING
PURPOSES ONLY

9/13/11
CORRECTED
9/29/11



TUBMAN RD. STOP

Name

RTE 124
HARWICH RD.

Name

SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
<ul style="list-style-type: none"> ← Moving Vehicle ←→ Backing Vehicle --- Non-Involved Vehicle ✕ Pedestrian ▭ Parked Vehicle □ Fixed Object ● Fatal Accident ○ Injury Accident 	<ul style="list-style-type: none"> ← ← Rear-End ← → Head On ← ↔ Side Swipe ← ○○○○ Out of Control ← ↘ Left Turn ← ↙ Right Angle 	<ol style="list-style-type: none"> 1. Approximate location of accident 2. Type of collision and vehicles involved. 3. Time, Day, Date 4. Any other pertinent factors mentioned on the report (i.e. presence of oil on road, ruts, etc.)

INTERSECTION RTE 124 (HARWICH ROAD) and TUBMAN RD.

PERIOD FROM: 2008 to 2010

BREWSTER, MA

Source: Brewster Police Department Crash Reports for the location, 2008-2010.

Route 124 / Harwich Road at Tubman Road									
Crash Ref. #	Date	Time	Day	Month	Severity	# Cars	Manner	Description	weather
1	2/4/2008	2:24:00 PM	Mon	Feb	PDO	2	Angle	Veh 2 traveling SB on Rte. 124, Veh 1 pulled out from Tubman WB and struck Veh 2--did not see 124 vehicle when pulling out	clear
2	2/22/2008	2:19:00 PM	Fri	Feb	PDO	2	Rear-end	Veh 1 stopped at stop sign on Tubman EB and struck by Veh 2 who could not stop due to weather. Veh 2 got stuck on the trailer hitch of Veh 1 (damage appeared to be under \$1,000)	unknown
3	3/20/2008	5:26:00 PM	Thu	Mar	PDO	2	Rear-end	Veh 1 hit by Veh 2 while at stop sign WB on Tubman--Veh 2 left scene but noticed by Patrol Officer and charged with leaving the scene of MVA and failure to use care in stopping	rain
4 *	4/2/2008	12:42:00 PM	Wed	Apr	PDO	2	unknown	Narrative only has "Minor mva at the intersection. Parties exchanged information."	unknown
5	4/4/2008	2:46:00 PM	Fri	Apr	PDO	2	Angle	Hit/run --report that Veh 1 travelling SB on Rte. 124 and Veh 2 ran the stop sign at Tubman and hit Veh 1 back end--but Veh 2 never stopped. Veh 1 owner checked her vehicle and found little if any damage. Veh 2 not found.	unknown
6 *	6/17/2008	8:52:00 PM	Tue	Jun	PDO	2	unknown	No damage on vehicles, drivers conversed but exchanged little info -- one driver reported MVA at Rte. 124 and Tubman, but no damage.	unknown
7	7/7/2008	6:30:00 PM	Mon	Jul	PDO	2	unknown	hit/run Veh 1 hit by Veh 2 Rte. 124 SB taking left turn into Tubman	unknown
8	12/19/2008	2:10:00 PM	Fri	Dec	PDO	2	Angle	Veh 1 stopped at stop sign, proceeded to go & did not see 124 NB Veh 2. In path of Veh 2, and Veh 2 struck Veh 1.	snow
9	1/16/2009	11:27:00 AM	Fri	Jan	Injury	2	Angle	Veh 1 WB on Tubman driver ran stop sign and struck driver's side of Veh 2 SB Rte. 124	clear
10	7/15/2009	6:05:00 PM	Wed	Jul	PDO	2	Angle	Veh 1 SB Rte. 124 while Veh 2 WB from Tubman attempts Left Turn into the path of Veh 1 causing the crash.	clear
11	8/1/2009	10:39:00 AM	Sat	Aug	PDO	2	Angle	Veh 1 NB Rte. 124 while Veh 2 WB from Tubman attempts Left Turn into the right rear quarter panel of Veh 1.	clear / unknown

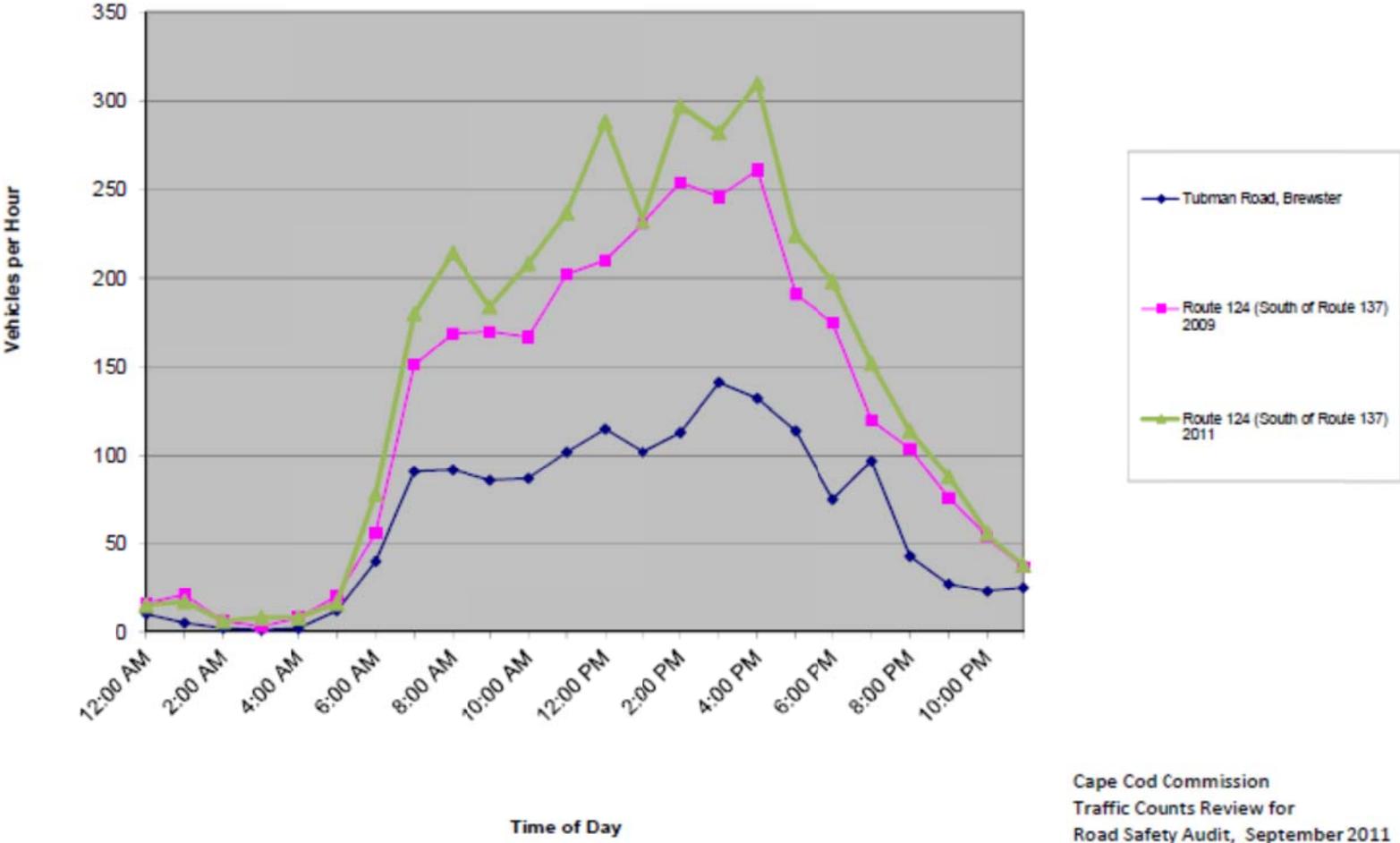
Crash Ref. #	Date	Time	Day	Month	Severity	# Cars	Manner	Description	weather
12	8/21/2009	2:07:00 PM	Fri	Aug	PDO	2	Angle	Veh 1 SB 124 while Veh 2 pulled out of Tubman Road. Veh 2 driver thought it was 4-way stop. Veh 1 hit driver's side doors on Veh 2.	cloudy
13	3/20/2010	11:25:00 AM	Sat	Mar	Injury	2	Angle & rollover	Veh 1 SB 124, and Veh 2 EB on Tubman failed to stop at stop sign. Veh 1 struck Veh 2 on left rear side flipping Veh 2 over. Veh 1 came to rest in the middle of the intersection while Veh 2 on its passenger side. Both operators transported to hospital --by appearance for minor injuries. Both vehicles heavily damaged and towed.	clear
14	4/13/2010	8:24:00 AM	Tue	Apr	PDO	2	Angle	Veh 1 WB on Tubman and proceeded from stop sign before safe to do so, struck by Veh 2 SB Rte. 124.	clear
15	4/28/2010	9:54:00 AM	Wed	Apr	PDO	2	Angle	Veh 1 SB 124 while Veh 2 Tubman Road WB proceeded from stop before safe--Veh 1 struck front bumper of Veh 2.	clear
16	4/28/2010	3:48:00 PM	Wed	Apr	PDO	2	Angle	Veh 1 SB 124, and Veh 2 EB on Tubman stopped and proceeded from stop sign and struck Veh 1.	cloudy
17	11/14/2010	12:41:00 PM	Sun	Nov	PDO	2	Angle	Veh 1 WB on Tubman and proceeded from stop sign before safe to do so, and struck Veh 2 SB Rte. 124.	clear
18	11/28/2010	3:02:00 PM	Sun	Nov	Fatal	2	Angle	Veh 1 EB on Tubman failed to stop at stop sign into path of Veh 2 SB 124. Veh 2 struck Veh 1 on driver's side. Veh 1 driver transported to and later died at CCHospital.	clear
19	11/30/2010	8:17:00 AM	Tue	Nov	Injury	2	Angle	Veh 1 SB 124 while Veh 2 Tubman Road EB proceeded from stop before safe--Veh 1 struck driver's side of Veh 2. Veh 2 then rolled to the side of Tubman Rd.	clear

Source: Brewster Police Department Crash Reports for the location; 2008-2010.

Appendix D. Additional Information

- Hourly Traffic Volumes, Route 124 and Tubman Road, Graph
- Turning Movement Count: Rte. 124 at Tubman Rd., Brewster; 9/19/11

Tubman Road and Route 124 (Harwich Road), Brewster, Hourly Traffic Volumes



Cape Cod Commission
 Traffic Counts Review for
 Road Safety Audit, September 2011

September 19, 2011 TMC CARS

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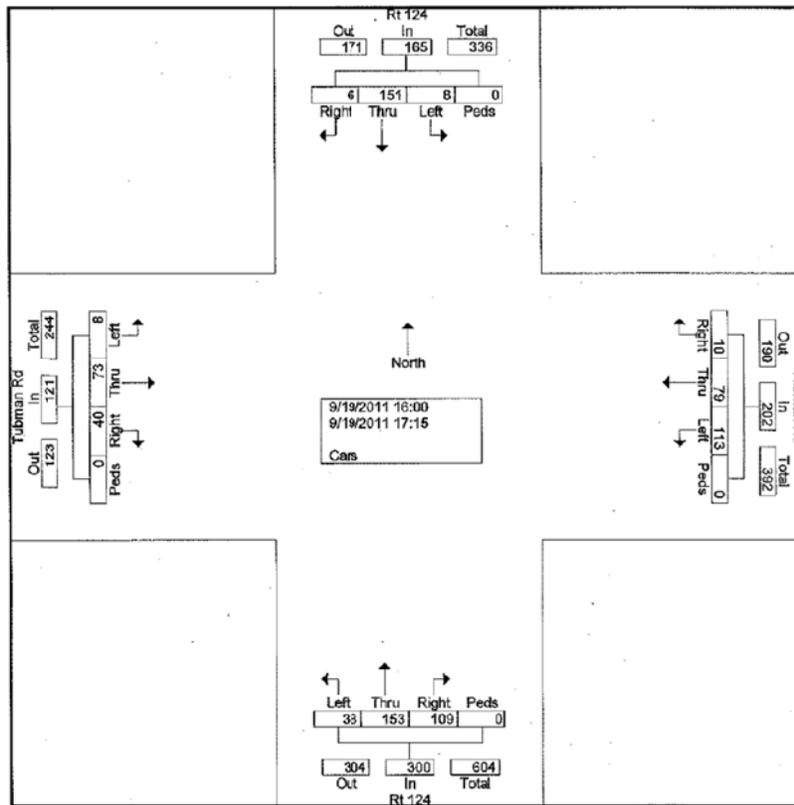
3225 Main Street • P.O. Box 226
 Barnstable, MA 02630
 Tel: 508.362.3828 • Fax: 508.362.3136
 E-Mail: trans@capecodcommission.org

Counter #:4
 Counted By:LAM
 Location:Rt 124 @ Tubman Rd [Brewster]
 Date:09/19/2011

File Name : 3849_09192011
 Site Code : 00003849
 Start Date : 9/19/2011
 Page No : 1

Groups Printed- Cars

Start Time	Rt 124 From North				Tubman Rd From East				Rt 124 From South				Tubman Rd From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	3	33	0	0	26	11	0	0	9	29	21	0	1	12	5	0	150
16:15	2	19	1	0	8	14	3	0	7	31	25	0	0	10	6	0	126
16:30	2	32	1	0	19	13	1	0	5	25	22	0	0	13	7	0	140
16:45	0	19	0	0	19	10	3	0	5	22	9	0	2	12	11	0	112
Total	7	103	2	0	72	48	7	0	26	107	77	0	3	47	29	0	528
17:00	0	24	2	0	20	16	2	0	9	21	18	0	2	10	7	0	131
17:15	1	24	2	0	21	15	1	0	3	25	14	0	3	16	4	0	129
Grand Total	8	151	6	0	113	79	10	0	38	153	109	0	8	73	40	0	788
Apprch%	4.8	91.5	3.6	0	55.9	39.1	5	0	12.7	51	36.3	0	6.6	60.3	33.1	0	
Total%	1	19.2	0.8	0	14.3	10	1.3	0	4.8	19.4	13.8	0	1	9.3	5.1	0	



September 19, 2011 TMC TRUCKS

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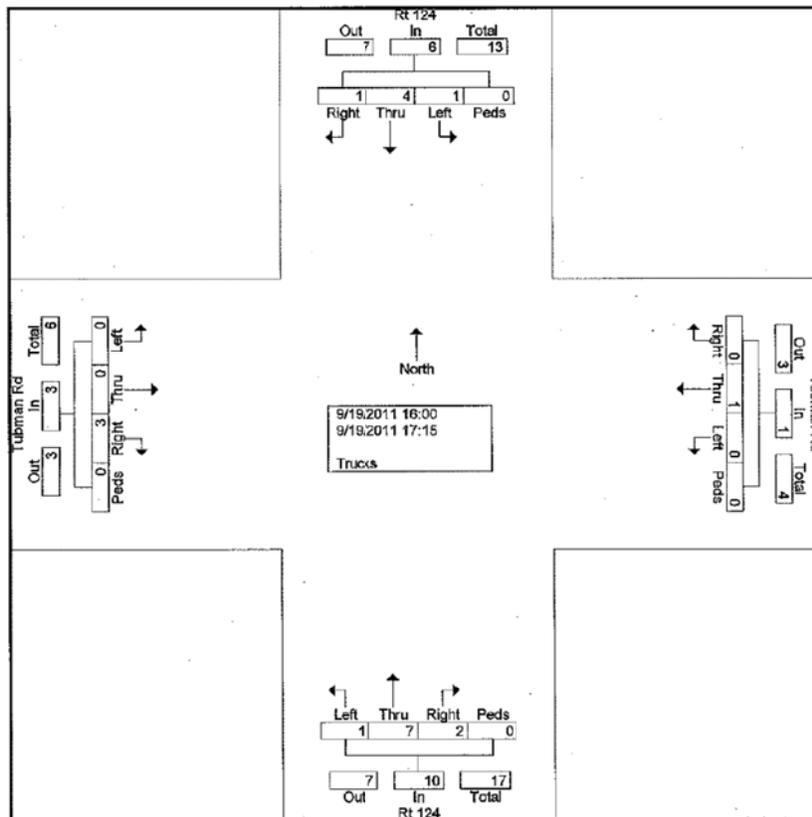
3225 Main Street • P.O. Box 226
 Barnstable, MA 02630
 Tel: 508.362.3828 • Fax: 508.362.3136
 E-Mail: trans@capecodcommission.org

Counter #:4
 Counted By:LAM
 Location:Rt 124 @ Tubman Rd [Brewster]
 Date:09/19/2011

File Name : 3849_09192011
 Site Code : 00003849
 Start Date : 9/19/2011
 Page No : 1

Groups Printed- Trucks

Start Time	Rt 124 From North				Tubman Rd From East				Rt 124 From South				Tubman Rd From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	5
16:15	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	3
16:30	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	3
16:45	0	1	0	0	0	0	0	0	0	2	1	0	0	0	1	0	5
Total	1	2	1	0	0	1	0	0	1	6	1	0	0	0	3	0	16
17:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
17:15	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Grand Total	1	4	1	0	0	1	0	0	1	7	2	0	0	0	3	0	20
Approch %	16.7	66.7	16.7	0	0	100	0	0	10	70	20	0	0	0	100	0	
Total %	5	20	5	0	0	5	0	0	5	35	10	0	0	0	15	0	



September 19, 2011 TMC BIKES

CAPE COD COMMISSION

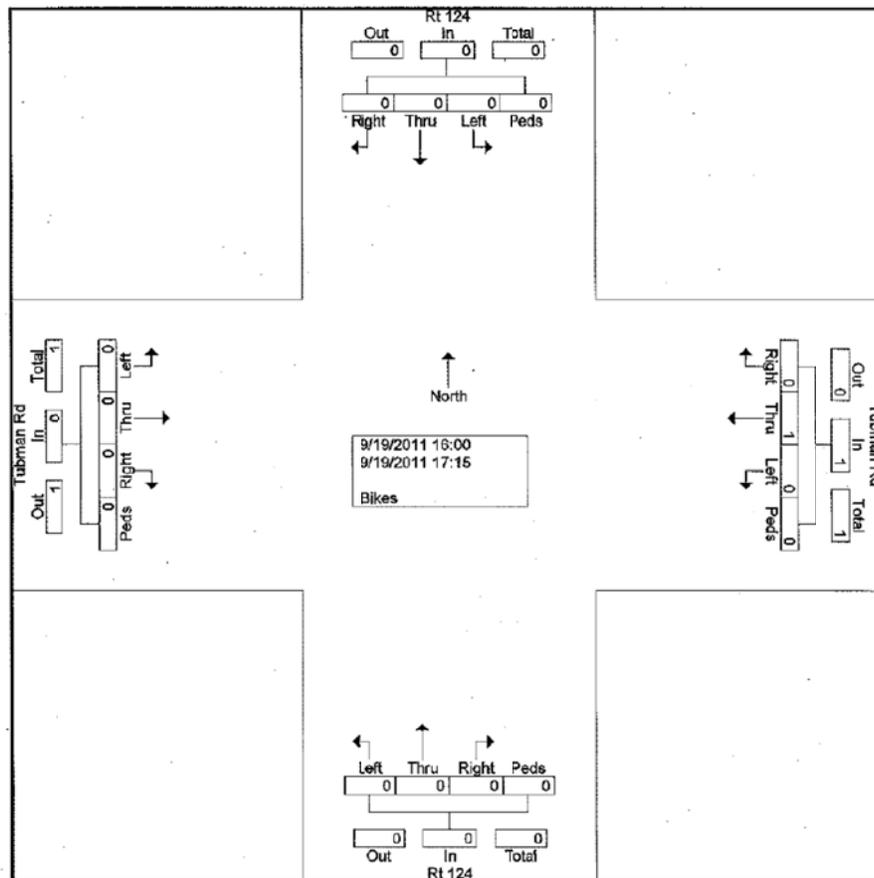
3225 Main Street • P.O. Box 226
 Barnstable, MA 02630
 Tel: 508.362.3828 • Fax: 508.362.3136
 E-Mail: trans@capecodcommission.org

Counter #:4
 Counted By:LAM
 Location:Rt 124 @ Tubman Rd [Brewster]
 Date:09/19/2011

File Name : 3849_09192011
 Site Code : 00003849
 Start Date : 9/19/2011
 Page No : 1

Groups Printed- Bikes

Start Time	Rt 124 From North				Tubman Rd From East				Rt 124 From South				Tubman Rd From West				Int. Total	
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds		
*** BREAK ***																		
16:15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***																		
Total	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***																		
Grand Total	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0
Total %	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0



September 19, 2011 TMC CARS and TRUCKS

CAPE COD COMMISSION

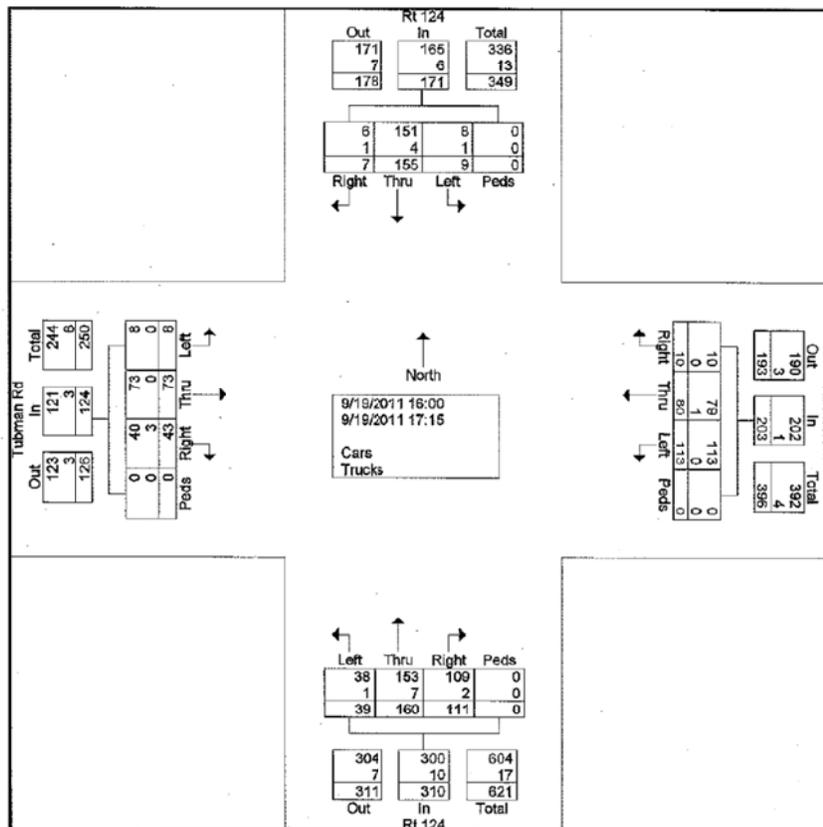
3225 Main Street • P.O. Box 226
 Barnstable, MA 02630
 Tel: 508.362.3828 • Fax: 508.362.3136
 E-Mail: trans@capecodcommission.org

Counter #:4
 Counted By:LAM
 Location:Rt 124 @ Tubman Rd [Brewster]
 Date:09/19/2011

File Name : 3849_0919201
 Site Code : 00003849
 Start Date : 9/19/2011
 Page No : 1

Groups Printed- Cars - Trucks

Start Time	Rt 124 From North				Tubman Rd From East				Rt 124 From South				Tubman Rd From West				Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	
16:00	4	34	1	0	26	11	0	0	9	30	21	0	1	12	6	0	155
16:15	2	19	1	0	8	14	3	0	7	33	25	0	0	10	7	0	129
16:30	2	32	1	0	19	14	1	0	6	26	22	0	0	13	7	0	143
16:45	0	20	0	0	19	10	3	0	5	24	10	0	2	12	12	0	117
→ Total	8	105	3	0	72	49	7	0	27	113	78	0	3	47	32	0	544
17:00	0	26	2	0	20	16	2	0	9	21	18	0	2	10	7	0	133
17:15	1	24	2	0	21	15	1	0	3	26	15	0	3	16	4	0	131
Grand Total	9	155	7	0	113	80	10	0	39	160	111	0	8	73	43	0	808
Approch %	5.3	90.6	4.1	0	55.7	39.4	4.9	0	12.6	51.6	35.8	0	6.5	58.9	34.7	0	
Total %	1.1	19.2	0.9	0	14	9.9	1.2	0	4.8	19.8	13.7	0	1	9	5.3	0	
Cars	8	151	6	0	113	79	10	0	38	153	109	0	8	73	40	0	788
% Cars	88.9	97.4	85.7	0	100	98.8	100	0	97.4	95.6	98.2	0	100	100	93	0	97.5
Trucks	1	4	1	0	0	1	0	0	1	7	2	0	0	0	3	0	20
% Trucks	11.1	2.6	14.3	0	0	1.2	0	0	2.6	4.4	1.8	0	0	0	7	0	2.5



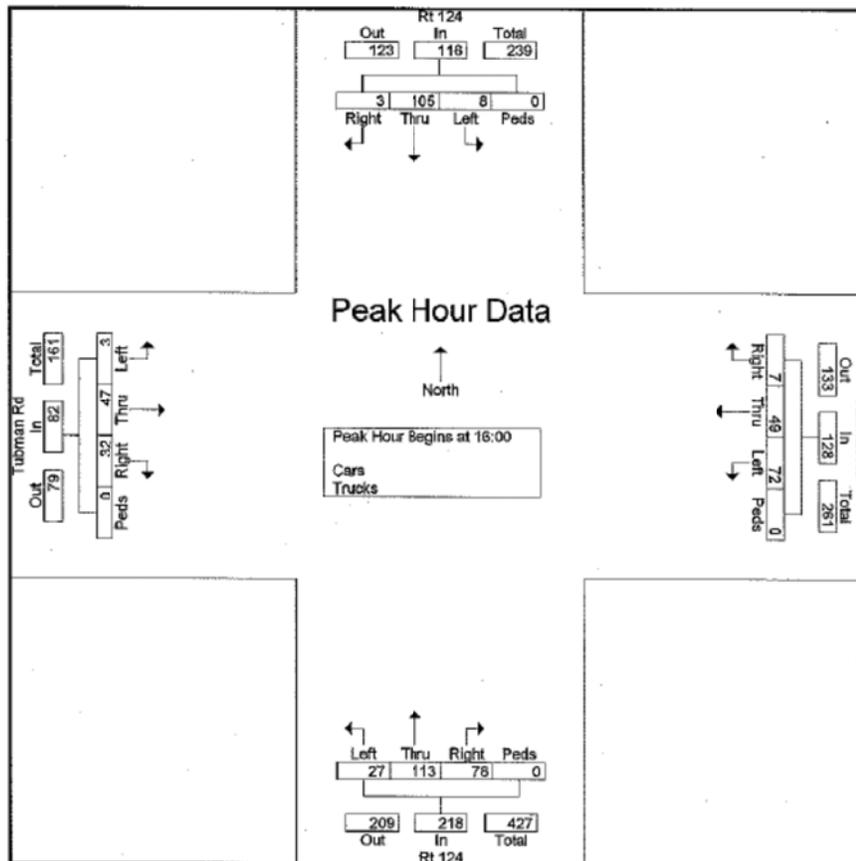
September 19, 2011 TMC PEAK HOUR DATA

CAPE COD COMMISSION
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Counter #:4
 Counted By:LAM
 Location:Rt 124 @ Tubman Rd [Brewster]
 Date:09/19/2011

File Name : 3849_09192011
 Site Code : 00003849
 Start Date : 9/19/2011
 Page No : 2

Start Time	Rt 124 From North					Tubman Rd From East					Rt 124 From South					Tubman Rd 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 16:00																					
16:00	4	34	1	0	39	26	11	0	0	37	9	30	21	0	60	1	12	6	0	19	155
16:15	2	19	1	0	22	8	14	3	0	25	7	33	25	0	65	0	10	7	0	17	129
16:30	2	32	1	0	35	19	14	1	0	34	6	26	22	0	54	0	13	7	0	20	143
16:45	0	20	0	0	20	19	10	3	0	32	5	24	10	0	39	2	12	12	0	26	117
Total Volume	8	105	3	0	116	72	49	7	0	128	27	113	78	0	218	3	47	32	0	82	544
% App. Total	6.9	90.5	2.6	0		56.2	38.3	5.5	0		12.4	51.8	35.8	0		3.7	57.3	39	0		
PHF	.500	.772	.750	.000	.744	.692	.875	.583	.000	.865	.750	.858	.780	.000	.838	.375	.904	.967	.000	.788	.877



Appendix E. Road Safety Audit References

Road Safety Audit References

Massachusetts Traffic Safety Toolbox, Massachusetts Highway Department,
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.

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Road Safety Audit, 2nd 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