CAPE COD COMMISSION

Town of Barnstable Road Safety Audit

Iyannough Road (Route 132) at Cape Cod Community College/Cape Cod Conservatory Intersection

August 2014

COUNTY OF BARNSTABLE MASSACHUSETTS

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Prepared by the Cape Cod Commission in cooperation with the Town of Barnstable, and
MassDOT Highway Division Traffic Safety and District 5 Offices.

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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). The latest federal legislation: *Moving Ahead for Progress in the 21st Century* (MAP-21), signed into law on July 6, 2012, has consolidated many highway programs while retaining the Highway Safety Improvement Program (HSIP) as one of the five core highway programs.

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.

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Introduction

The Town of Barnstable has 45,193 residents as of the 2010 United States Census of Population, and is the most populous of the fifteen towns on Cape Cod. Although the town lost a little population from the year 2000 to 2010 in the United States Census of Population, it remains the 27th highest community in the state for population. In centerline roadway miles, Barnstable is ranked 5th in the state. While the Town lost a little population, the Barnstable urbanized area (UZA) population did still grow and remains fourth highest in the state, following Boston, Springfield, and Worcester UZA populations.

Barnstable is the home of seven villages. Each is unique with its various attributes: beaches and harbors, golf courses, shopping places, and museums. In addition, all the villages have residential components, and approximately twenty-two public and private schools are located in the town, and one for higher education—Cape Cod Community College. Barnstable is home to regional services and activities, such as the Cape Cod Hospital, the intermodal transportation center, Barnstable Municipal Airport (the third busiest airport in the state), the ferry connections to Nantucket and Martha's Vineyard, and the County government complex. In conclusion, there is a lot of activity in the Town.

In 2014, Town of Barnstable officials approached Cape Cod Commission staff to request a Road Safety Audit (RSA) at the intersection of Iyannough Road (Route 132) and the Cape Cod Community College's southern entrance (this intersection also provides access to the Cape Cod Conservatory of Music & Art and the Kimber Woods housing development).

Project Data

Crash reports were requested from the Town of Barnstable for this Road Safety Audit and were supplied by the Barnstable Police Department. The crash data were reviewed and a crash diagram was developed (see appendix). A review of crashes by manner of collision revealed that there were 50% rear-end, 9% same-direction sideswipe, and 4.5% angle crashes. More than a 6 of the crashes, or 27%, occurred during the hours from 10 a.m. to 2 p.m., while the lowest percentage at 14% were between 2 and 6 p.m. Most of the crashes, or 73%, were in daylight with 91% in clear weather. The lowest driver contributing codes were 18% that failed to yield right of way, and 59% due to driver inattention.

CCC staff also prepared reports of the traffic volume data. Turning Movement Counts (TMCs) were performed for this intersection in early June of 2014 when the Cape Cod Community College was in summer session.

The crash diagram, summary data, and the traffic count data are included in the appendices.

Multidisciplinary Team

The Road Safety Audit was scheduled with representatives of the Massachusetts Department of Transportation (MassDOT), town officials, and representatives of the institutions served by the intersection. The Road Safety Audit meeting was held on June 26, 2014, beginning at 1:00 p.m., at the Cape Cod Community College's Wilkens Library. The multidisciplinary team also visited the site during the RSA meeting, and then reconvened at the Wilken's Library conference room.

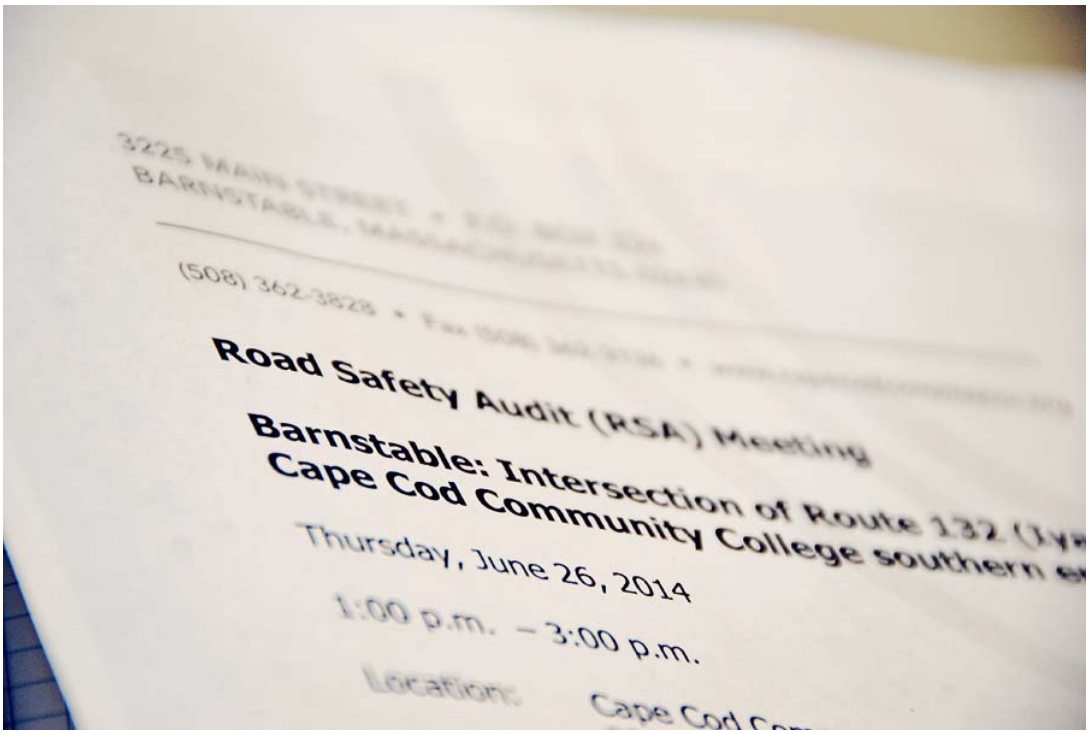

Table 1. Participating Audit Team Members

Audit Team Member	Agency / Affiliation
Ann Canedy	Town Councilor, Barnstable
Steve Seymour	Barnstable DPW
Walter Brooks	Cape Cod Community College
Jeff Marcotte	Cape Cod Community College
Scott McNair	Cape Cod YMCA
Bob Cordeiro	Cape Cod YMCA
Edward Feeney	MassDOT Highway Div.– District 5
Barbara Lachance	MassDOT Highway Div.– District 5
Corey O'Connor	MassDOT Highway Div., Safety
Richard Madsen	MassDOT Highway Div., Project Development
Nithin Krishna Linga Reddy	MassDOT Highway Div.
Hakeem Ottun	MassDOT Highway Div.
Garry Meus	Cape Cod Commission
Lev Malakhoff	Cape Cod Commission

Project Location and Description

The intersection of Route 132 at Cape Cod Community College/Cape Cod Conservatory in the Town of Barnstable is a four-way unsignalized intersection, with the roadways crossing at a right angle. Route 132 is functionally classified in this section as an urban minor arterial and consists of two travel lanes and a sidewalk on the southwest side. Both minor street approaches to the intersection are stop-sign controlled. The Conservatory drive consists of a one-way lane in each direction separated by a median. The College drive includes a single lane entrance lane separated by a median from a two-lane exit.

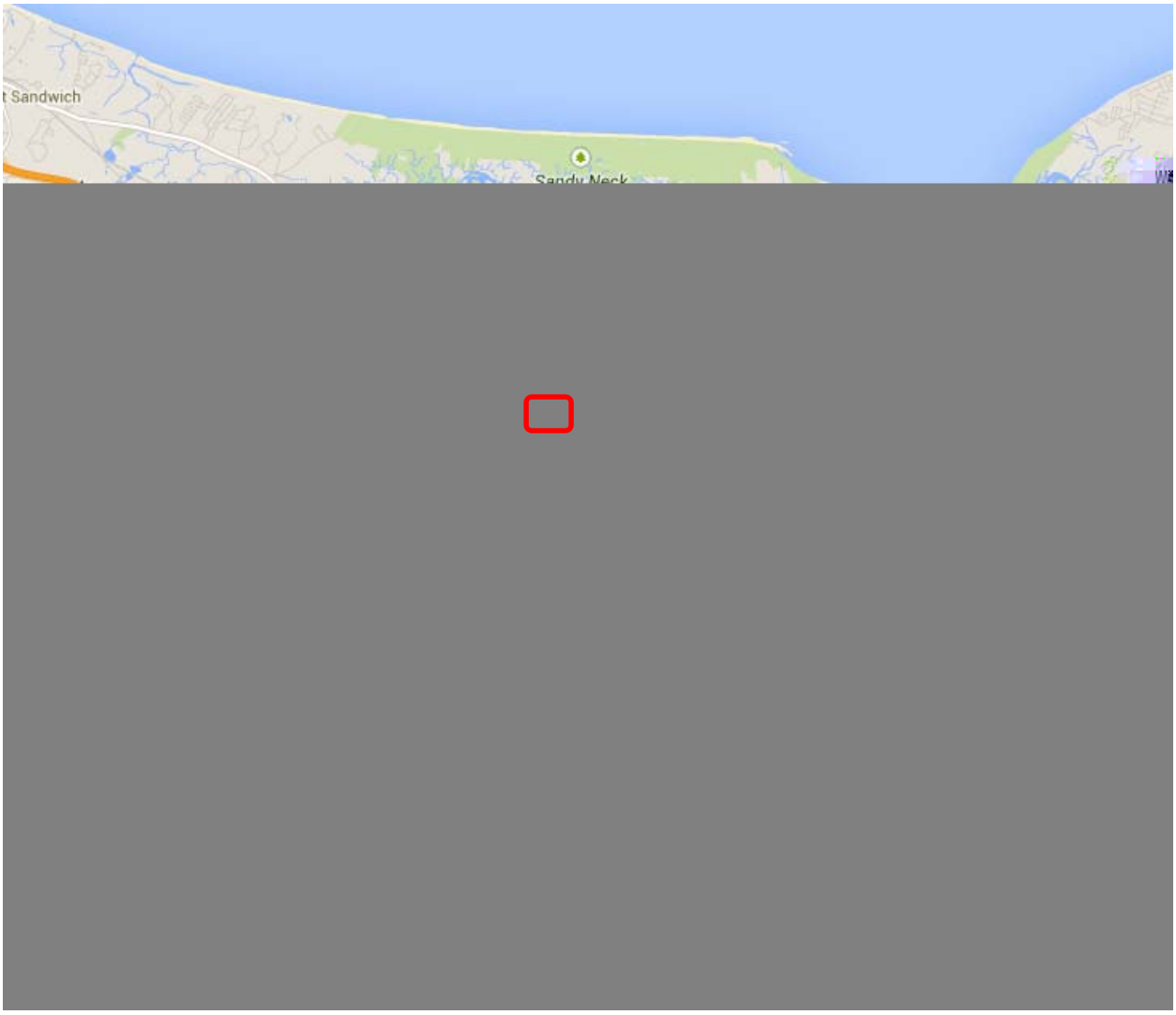

Figure 1 - Locus Map

Figure 2 - Figure 1. Iyannough Road/Route 132 at Cape Cod Community College/Cape Cod Conservatory of Music & Art intersection

The RSA Team met for a discussion of the existing conditions, visited the site for field observations, and returned to discuss the safety issues at the location. The summary crash data, crash diagram, and traffic volume reports were brought to the RSA team meeting, and are included in the Appendices.

The Barnstable Police Department provided local crash reports, and 22 crashes were found to be at the location for the years 2011-2013 with 19 property damage only, 7 injury crashes, and no fatal crashes. The resulting Equivalent Property Damage Only (EPDO) is 46. EPDO is an indicator of overall severity; Property Damage Only crashes are scored with a value of 1, Injury crashes are scored with a value of 5, and Fatality crashes are scored with a value of 10.

Of the 22 crashes from 2011-2013, 50% were rear-end, 9% sideswipe in the same direction crashes, and 4.5% were angle crashes.

Road Safety Audit observations of the safety issues, potential enhancements, and a summary table follow.

Audit Observations and Potential Safety Enhancements

SAFETY ISSUE #1. INTERSECTION GEOMETRY & VEHICLE CONFLICTS

Observations:
The eastern leg approach from the college includes a left-turn marked lane and a right-turn marked lane. There is no consideration given for through traffic traveling across to the destinations on the western side of the intersection. Vehicles in the right-turn lane are guided to a skewed-angle approach, requiring motorists to turn their heads far to the left (while trying to see past vehicles in the left lane waiting to turn left).

The curb radius on the southeastern quadrant is large – allowing northbound Route 132 vehicles to travel at high speed while turning into the college.

Heavy traffic volumes on Route 132, traveling at high speeds make it difficult for vehicles entering the intersection from the minor road approaches, especially for left-turning vehicles. During busy college times, vehicle queues may cause driver frustration – leading to less-experienced motorists (college students) to enter shorter (unsafe) gaps in the traffic stream.

Figure 3 - View of the Cape Cod Community College entrance

Figure 4 - View of Route 132 traveling southbound

Enhancements:
Provide more control and definition at the intersection. This may include a right-turn lane on northbound Route 132. Modify pavement marking to allow for through-traffic exiting the college driveway.

For traffic calming and to reduce vehicle conflicts, consider installation of a modern roundabout.

To reduce left-turning vehicle conflicts, consider installation of a traffic signal.

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SAFETY ISSUE #2. SIGHT DISTANCE AND VEGETATION

Observations:
The team observations on sight distance and vegetation were related, and therefore, the issue categories are combined. Vehicles entering from the eastern leg (college) have difficulties seeing northbound Route 132 vehicles.

Vegetation obscures the view of the college entrance and signage for vehicles traveling north on Route 132

Figure 5 - View of Route 132 northbound toward the entrances to the Cape Cod Community College and the Cape Cod Conservatory of Music & Art

Enhancement:
Trim vegetation to increase available sight distance and signage visibility.

SAFETY ISSUE #3. SIGNAGE AND LIGHTING

Observations:
Signs in the vicinity of the intersection are generally sufficient but do need to be brought up to date with requirements for retro-reflectivity.

It was mentioned that drivers looking for the entrance to the college may have difficulty. Signage on northbound Route 132 near the entrance is obscured by vegetation.

There is no overhead lighting at the intersection. The splitter island on the eastern leg includes an internally illuminated sign for the college.

Figure 6 - View northbound of Route 132 near the Cape Cod Community College entrance

Enhancements:
Upgrade (replace) signs to improve retro-reflectivity.

Add a white on green sign in advance of the intersection with "Cape Cod Community College next right".

Consider installing overhead lighting at the utility pole on the northwest quadrant of the intersection.

SAFETY ISSUE #4. PAVEMENT AND MARKINGS

Observations:
Pavement condition and markings are in poor to fair condition.

There are signs of wear including cracking, potholes, and rutting.

Pavement markings are partly worn through such as the stop bars on the minor leg approaches from the college and conservatory.

Figure 7 - View looking southbound of the pedestrian crosswalk crossing Route 132 depicting no accessible ramp for pedestrians on the opposite side of the street

Enhancement:
With intersection improvements the pavement condition and markings should be improved, as feasible.

SAFETY ISSUE #5. BICYCLE / PEDESTRIAN ACCOMMODATIONS

Observations:

Pedestrian traffic has increased between the Community College and the businesses and bus service at the Exit 6 Park and Ride Lot. A sidewalk exists along the west side of Route 132 connecting Route 6A in the north along the entire length of the roadway to Route 28. Access to the Community College is provided by a crosswalk on the southern leg of the intersection.

There is no crosswalk connecting the sidewalks on either side of the Conservatory driveway on the western leg of the intersection.

There is no accessible ramp from the crosswalk to the Conservatory driveway.

There is no formal bicycle accommodation through the intersection.

Figure 8 - View of sidewalk turning into the Cape Cod Conservatory of Music & Art. This view also depicts the evidence of no crosswalk and no accessible ramps for pedestrians

Figure 9 - View of crosswalk markings across Route 132

Enhancements:

Provide advance warning signage notifying motorists along Route 132 of the upcoming crosswalk.

Install an accessible ramp on the western side of the Route 132 crosswalk.

During intersection improvements, include accommodations for bicyclists such as widened shoulders or bike lanes on Route 132.

Consider creating an accessible and well-lit unpaved path from Route 132 to Community College Parking Lot #2 to shorten walking distances between the college and the Park and Ride Lot; if warranted consider installation of a crosswalk on Route 132 on the northern leg of the Route 6A westbound ramps intersection to provide access to the path.

Summary of Road Safety Audit

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The 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 any design process for more involved geometric changes 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 [for example, 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).

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Table 2. Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Intersection Geometry & Vehicle Conflicts	Provide more control and definition at the intersection. This may include a right-turn lane on northbound Route 132. Modify pavement marking to allow for through-traffic exiting the college driveway. Consider installation of a modern roundabout or traffic signal.	Medium Low High	Medium-term Short-term Long-term	Medium Low High	MassDOT with local input
Sight Distance and Vegetation	Trim vegetation to increase available sight distance and signage visibility.	Low	Short-term	Low	MassDOT
Signage and Lighting	Upgrade (replace) signs to improve retro-reflectivity. Add a white on green sign in advance of the intersection with "Cape Cod Community College next right." Consider installing overhead lighting at the utility pole on the northwest quadrant of the intersection.	Low	Short-term	Low	MassDOT with local input
Pavement and Markings	With intersection improvements the pavement condition and markings should be improved, as feasible.	Low to Medium	Short-term	Medium	MassDOT with local input
Bicycle / Pedestrian Accommodations	Provide advance warning signage notifying motorists along Route 132 of the upcoming crosswalk. Install an accessible ramp on the western side of the Route 132 crosswalk. During intersection improvements, include accommodations for bicyclists such as widened shoulders or bike lanes on Route 132. Consider creating an accessible, well-lit unpaved path from Route 132 to Community College Parking Lot #2 to shorten walking distances between the college and the Park and Ride Lot; if warranted consider installation of a crosswalk on Route 132 on the northern leg of the Route 6A westbound ramps intersection to provide access to the path.	Low Low Medium Medium	Short-term Short-term Medium-term Medium-term	Medium	MassDOT with local input MassDOT & CCCC

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 (RSA) Meeting

Barnstable: Intersection of Route 132 (Iyannough Road) at Cape Cod Community College southern entrance

Thursday, June 26, 2014

1:00 p.m. – 3:00 p.m.

Location: Cape Cod Community College – Wilkens Library Conference Room
2240 Iyannough Road, West Barnstable MA 02668

1:00 p.m. Welcome and Introductions

1:10 p.m. Review of Site-Specific Material
- Crash and Traffic Volume Summaries
- Existing Geometries and Conditions

1:30 p.m. Visit the Site
- Assemble as a group at the site for observation of conditions
- As a group, identify areas for improvement

2:15 p.m. Post-Visit Discussion at Meeting Room / Completion of RSA
- Discuss observations and finalize on-site findings
- Discuss potential improvements and draft recommendations

3:00 p.m. Adjourn

Next Steps: After the RSA meeting, CCC staff will prepare a draft document and circulate it to participants. Participants are asked to comment and respond to the draft document to assure that it is reflective of the RSA completed by the multidisciplinary team. With comments submitted, a final document is then produced; the final document is expected to be available within three weeks of the RSA.

Appendix B. RSA Audit Team Contact List

Participating Audit Team Members

RSA Location: Route 132 – Cape Cod Community College southern entrance/Cape Cod Conservatory intersection

June 26, 2014

Audit Team Member	Agency/Affiliation	Email address
Ann Canedy	Barnstable Town Council	acanedy@comcast.net
Stephen Seymour	Town of Barnstable	Steve.Seymour@town.barnstable.ma.us
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Jeff Marcotte	Cape Cod Community College	jmarcotte@capecod.edu
Scott McNair	Cape Cod YMCA	smcnair@ymcacapecod.org
Bob Cordeiro	Cape Cod YMCA	rcordeiro@ymcacapecod.org
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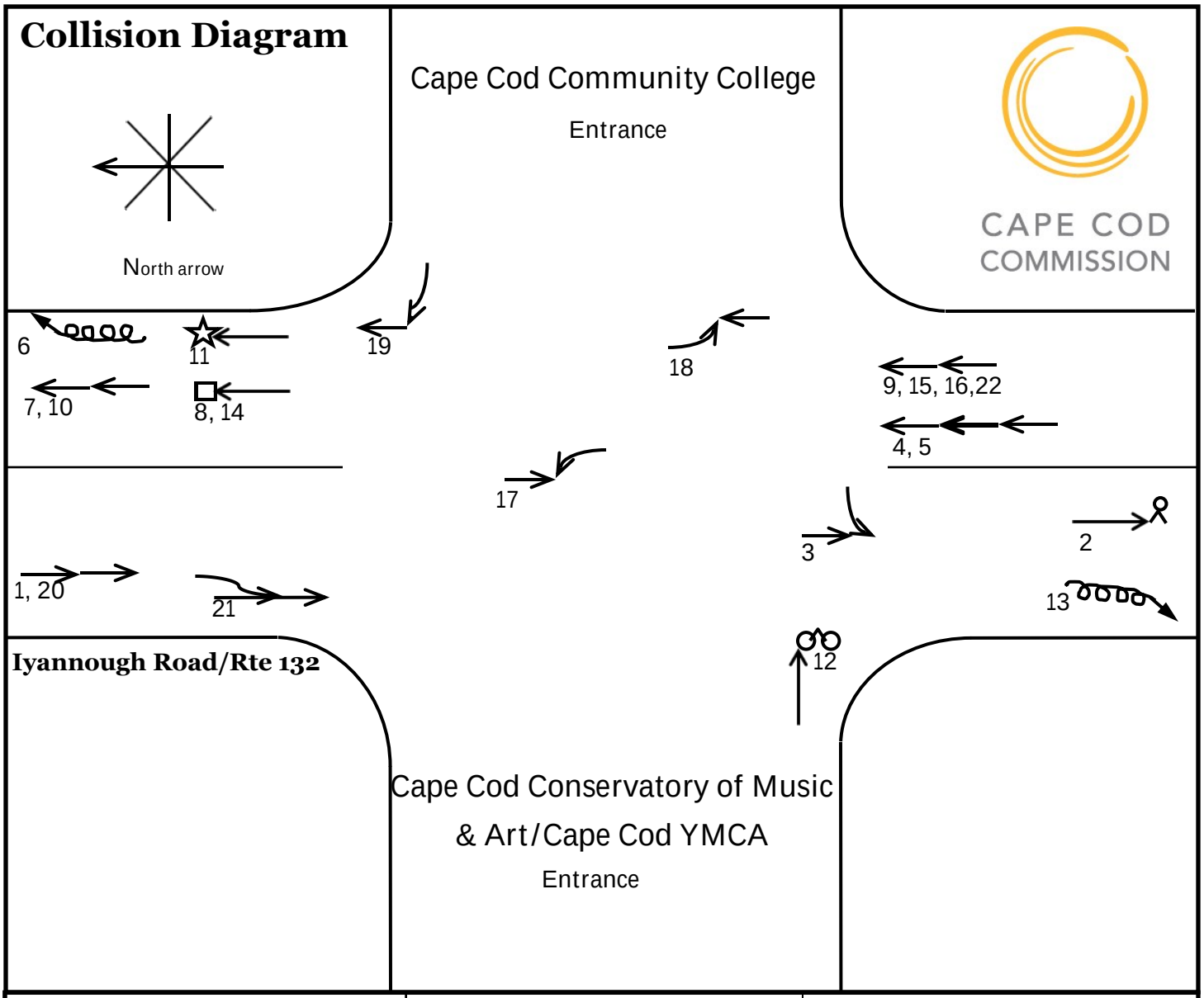
Barbara Lachance	MassDOT Highway Div.– District 5	Barbara.Lachance@state.ma.us
Corey O'Connor	MassDOT Highway Div., Safety	corey.oconnor@state.ma.us
Nithin K. L. Reddy	MassDOT Highway Div., Safety	nithinkrishnalinga.reddy@dot.state.ma.us
Hakeem Ottun	MassDOT Highway Div.– District 5	hakeem.ottun@dot.state.ma.us
Lev Malakhoff	Senior Transportation Engineer, Cape Cod Commission	lmalakhoff@capecodcommission.org
Garry Meus	Regulatory Officer II	garry.meus@capecodcommission.org

Appendix C. Detailed Crash Data

- Crash Diagram
- Crash Records Listing

Collision Diagram



SYMBOLS	TYPES OF COLLISIONS	ACCIDENT INFORMATION
Moving Vehicle	Rear-End	Each crash is numbered and additional information is included on the crash summary.
Backing Vehicle	Head On	
Non-involved Vehicle	Side Swipe	Notes: Equivalent Property Damage Only (EPDO) Index = 46.0
Pedestrian	Out of Control	
Bicyclist/Motorcycle	Turning Movement	
Animal	Right Angle	
Parked Vehicle		
Fixed Object		
Fatal Crash		
Injury Crash		

LOCATION __Along Iyannough Road (Route 132) at the entrances of Cape Cod Conservatory of Music & Art/Cape Cod YMCA and the Cape Cod Community College Campus_____

CRASHES FROM _____04/05/2011_____ TO _____03/07/2014_____

Crash #	Crash Number	Crash Hour	Crash Time	Day of Week	Month	Crash Year	Crash Date	Crash Severity	Maximum Injury Severity Reported	Number of Vehicles	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Age of Driver - Youngest Known	Age of Driver - Oldest Known	Driver Contributing Codes	Road Surface	Ambient Light	Weather Condition	EPDO
1	11-258-AC	09:00AM to 09:59AM	9:21 AM	2	4	2011	4/5/2011	Property damage only	No injury	2	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:S / V2:S	35-44	45-54	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	1.0
2	11-278-AC	01:00PM to 01:59PM	1:04 PM	1	4	2011	4/11/2011	Non-fatal injury	Injury	1	Single vehicle crash	V1: Travelling straight ahead	V1:W	15-24		D1:(No improper driving)	Dry	Daylight	Clear	5.0
3	11-921-AC	02:00PM to 02:59PM	2:36 PM	5	9	2011	9/23/2011	Property damage only	No injury	2	Angle	V1: Travelling straight ahead / V2:Turning while speeding	V1:N / V2: N	15-24	15-24	D1:(Improper driving)	Dry	Daylight	Clear	1.0
4	11-1005-AC	02:00PM to 02:59PM	2:14 PM	5	10	2011	10/21/2011	Non-fatal injury	No injury	3	Rear-end	V1: Travelling straight ahead / V2: Travelling straight ahead / V3: Travelling straight ahead	V1:N / V2: N / V3:N	15-24	25-34	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	-
5	11-1152-AC	09:00AM to 09:59AM	9:07 AM	1	12	2011	12/5/2011	Non-fatal injury	Injury	3	Rear-end	V1: Travelling straight ahead / V2: Travelling straight ahead / V3: Travelling straight ahead	V1:N / V2: N / V3:N			D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	5.0
6	12-124-AC	12:00AM to 12:59AM	12:16 AM	2	2	2012	2/7/2012	Property damage only	No injury	1	Single vehicle crash	V1: Travelling straight ahead	V1:N	25-34		D1:(Improper driving)	Dry	Nightime	Clear	1.0
7	12-1031-AC	08:00AM to 08:59AM	8:25 AM	3	10	2012	10/31/2012	Non-fatal injury	Injury	2	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:N / V2: N	25-34	25-34	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	5.0
8	12-1049-AC	07:00PM to 07:59PM	7:36 PM	3	11	2012	11/7/2012	Property damage only	No injury	1	Single vehicle crash	V1: Travelling straight ahead	V1:W	35-44		D1:(No improper driving)	Wet	Nightime	Rain/Wind Gusts	1.0
9	13-13-AC	06:00AM to 06:59AM	6:37 AM	4	1	2013	1/10/2013	Non-fatal injury	No injury	2	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:N / V2: N	55-64	65-74	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	-
10	13-236-AC	07:00AM to 07:59AM	7:16 AM	4	3	2013	3/21/2013	Non-fatal injury	Injury	2	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:N / V2: N	35-44	65-74	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	5.0
11	13-299-AC	08:00PM to 08:59PM	8:10 PM	2	4	2013	4/16/2013	Non-fatal injury	Injury	1	Single vehicle crash	V1: Travelling straight ahead	V1:W	45-54		D1:(No improper driving)	Dry	Nightime	Clear	5.0
12	13-342-AC	06:00PM to 06:59PM	6:33 PM	3	5	2013	5/1/2013	Non-fatal injury	No injury	2	Sideswipe, same direction	V1: Turning right / V2: Turning right	V1:E / V2: E	35-44	45-54	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	-
13	13-416-AC	05:00PM to 05:59PM	5:23 PM	1	5	2013	5/27/2013	Non-fatal injury	Injury	1	Single vehicle crash	V1: Travelling straight ahead	V1:S	75-84		D1:(Inattention)	Dry	Daylight	Clear	5.0
14	13-425-AC	08:00PM to 08:59PM	8:18 PM	3	5	2013	5/29/2013	Property damage only	No injury	1	Single vehicle crash	V1: Travelling straight ahead	V1:N	25-34		D1:(Improper driving)	Dry	Daylight	Clear	1.0

Crash #	Crash Number	Crash Hour	Crash Time	Day of Week	Month	Crash Year	Crash Date	Crash Severity	Maximum Injury Severity Reported	Number of Vehicles	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Age of Driver - Youngest Known	Age of Driver - Oldest Known	Driver Contributing Codes	Road Surface	Ambient Light	Weather Condition	EPDO
15	13-596-AC	08:00AM to 08:59AM	8:59 AM	1	7	2013	7/8/2013	Non-fatal injury	No injury	2	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:N / V2: N	15-24	25-34	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	-
16	13-634-AC	01:00AM to 01:59AM	1:15 AM	6	7	2013	7/20/2013	Property damage only	No injury	2	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:N / V2: N	15-24		D1:(Improper driving)	Dry	Nightime	Clear	1.0
17	13-910-AC	12:00PM to 12:59PM	12:00 PM	1	9	2013	9/23/2013	Property damage only	No injury	2	Sideswipe, opposite direction	V1: Turning right / V2: Turning left	V1:S / V2: N	15-24	25-34	D1:(Inattention) D2:(Improper driving)	Dry	Daylight	Clear	1.0
18	13-1017-AC	12:00PM to 12:59PM	12:02 PM	3	10	2013	10/30/2013	Property damage only	No injury	2	Head-on	V1: Turning left / V2: Travelling straight ahead	V1:E / V2: S	15-24	35-44	D1:(Loss of Control) D2:(No improper driving)	Wet	Daylight	Cloudy	1.0
19	13-1088-AC	05:00PM to 05:59PM	5:32 PM	2	11	2013	11/26/2013	Unknown	No injury	2	Sideswipe, same direction	V1: Travelling straight ahead / V2: Turning Right	V1:N / V2: N	55-64	85-94	D1:(Inattention) D2:(No improper driving)	Dry	Nightime	Clear	1.0
20	13-1162-AC	07:00AM to 07:59AM	7:59 AM	5	12	2013	12/20/2013	Non-fatal injury	Injury	2	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:S / V2: S	55-64	75-84	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	5.0
21	14-129-AC	06:00PM to 06:59PM	6:10 PM	4	2	2014	2/6/2014	Property damage only	No injury	2	Rear-end	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:N / V2: N	55-64	65-74	D1:(Inattention) D2:(No improper driving)	Dry	Nightime	Clear	1.0
22	14-216-AC	02:00PM to 02:59PM	2:26 PM	5	3	2014	3/7/2014	Property damage only	No injury	2	Rear-end	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:N / V2: N	55-64	65-74	D1:(Inattention) D2:(No improper driving)	Dry	Daylight	Clear	1.0
																				46.0

Appendix D. Traffic Data

- Turning Movement Count Data

Cape Cod Commission

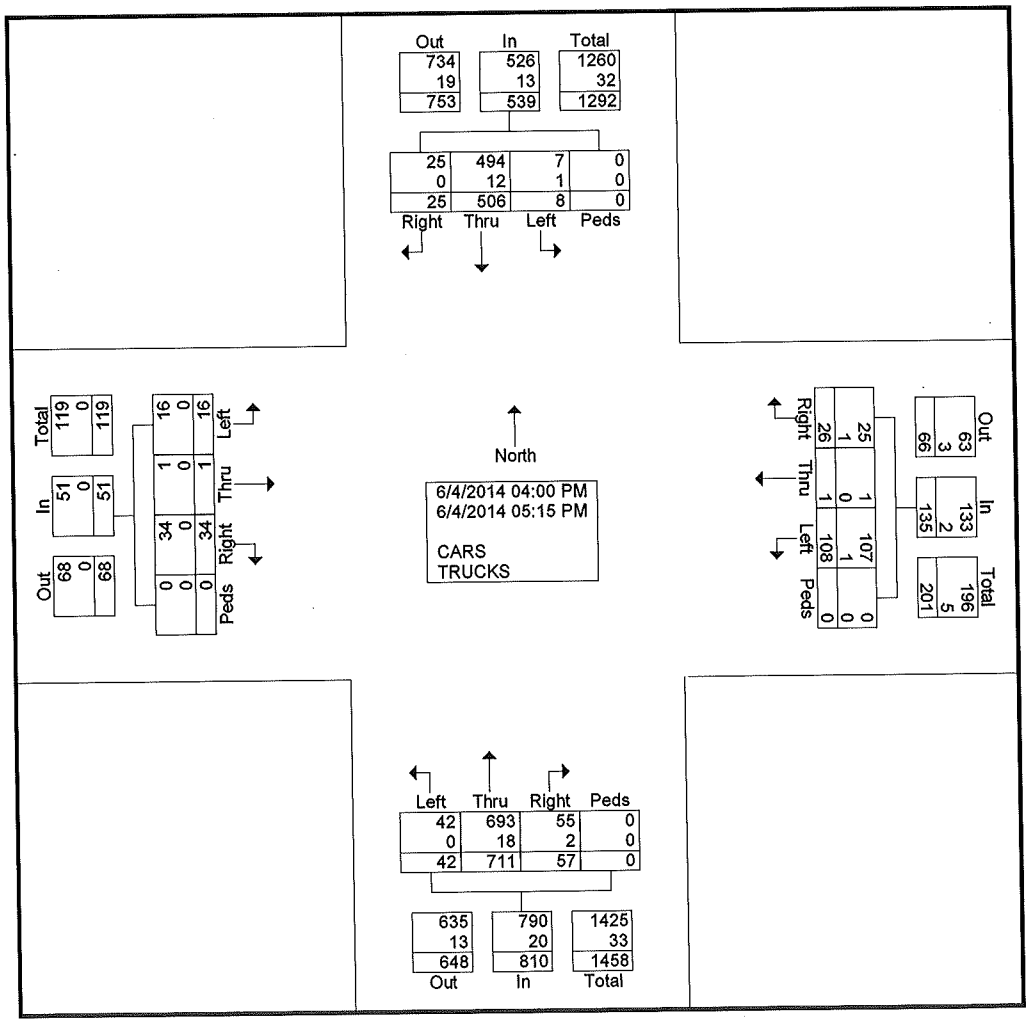
3225 Main Street
Barnstable, MA, 02630
www.capecodcommission.org

:cation: CCCC S Entrance
Town: Barnstable
Counted by: BM
Counted by: 1

File Name : Not Named 2
Site Code : 00001213
Start Date : 6/4/2014
Page No : 1

Groups Printed- CARS - TRUCKS

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	3	105	3	0	111	10	0	39	0	49	20	110	9	0	139	4	0	2	0	6	305
04:15 PM	3	62	0	0	65	3	1	19	0	23	5	127	9	0	141	8	0	3	0	11	240
04:30 PM	3	93	3	0	99	4	0	17	0	21	4	112	9	0	125	5	0	3	0	8	253
04:45 PM	7	78	0	0	85	3	0	16	0	19	9	112	5	0	126	3	0	2	0	5	235
Total	16	338	6	0	360	20	1	91	0	112	38	461	32	0	531	20	0	10	0	30	1033
05:00 PM	5	91	2	0	98	5	0	12	0	17	9	112	4	0	125	12	0	3	0	15	255
05:15 PM	4	77	0	0	81	1	0	5	0	6	10	138	6	0	154	2	1	3	0	6	247
Grand Total	25	506	8	0	539	26	1	108	0	135	57	711	42	0	810	34	1	16	0	51	1535
Apprch %	4.6	93.9	1.5	0		19.3	0.7	80	0		7	87.8	5.2	0		66.7	2	31.4	0		
Total %	1.6	33	0.5	0	35.1	1.7	0.1	7	0	8.8	3.7	46.3	2.7	0	52.8	2.2	0.1	1	0	3.3	
CARS	25	494	7	0	526	25	1	107	0	133	55	693	42	0	790	34	1	16	0	51	1500
% CARS	100	97.6	87.5	0	97.6	96.2	100	99.1	0	98.5	96.5	97.5	100	0	97.5	100	100	100	0	100	97.7
TRUCKS	0	12	1	0	13	1	0	1	0	2	2	18	0	0	20	0	0	0	0	0	35
% TRUCKS	0	2.4	12.5	0	2.4	3.8	0	0.9	0	1.5	3.5	2.5	0	0	2.5	0	0	0	0	0	2.3



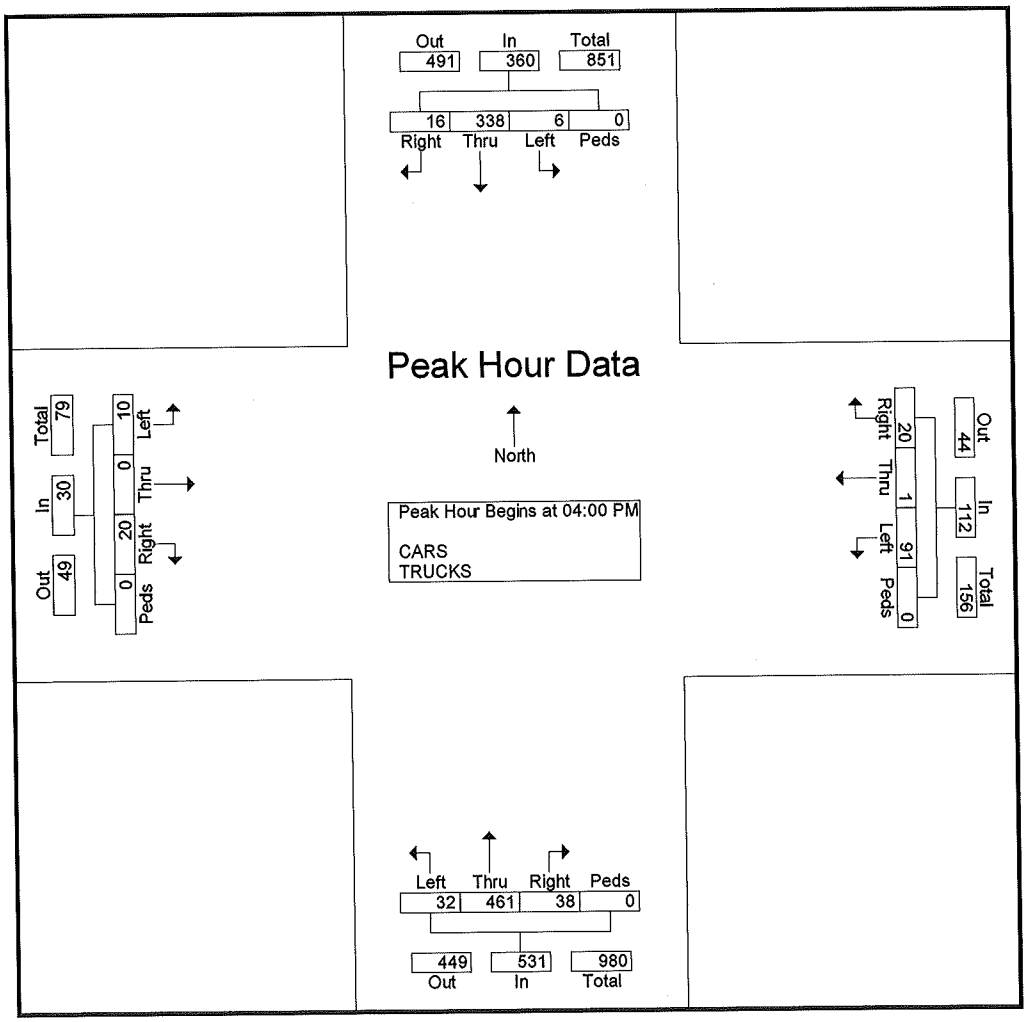
Cape Cod Commission

3225 Main Street
Barnstable, MA, 02630
www.capecodcommission.org

:ation: CCCC S Entrance
'own: Barnstable
Counted by: BM
Counted by: 1

File Name : Not Named 2
Site Code : 00001213
Start Date : 6/4/2014
Page No : 2

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	3	**105**	**3**	0	**111**	**10**	0	**39**	0	**49**	**20**	110	**9**	0	139	4	0	2	0	6	**305**
04:15 PM	3	62	0	0	65	3	**1**	19	0	23	5	**127**	9	0	**141**	**8**	0	**3**	0	**11**	240
04:30 PM	3	93	3	0	99	4	0	17	0	21	4	112	9	0	125	5	0	3	0	8	253
04:45 PM	**7**	78	0	0	85	3	0	16	0	19	9	112	5	0	126	3	0	2	0	5	235
Total Volume	16	338	6	0	360	20	1	91	0	112	38	461	32	0	531	20	0	10	0	30	1033
% App. Total	4.4	93.9	1.7	0		17.9	0.9	81.2	0		7.2	86.8	6	0		66.7	0	33.3	0		
PHF	.571	.805	.500	.000	.811	.500	.250	.583	.000	.571	.475	.907	.889	.000	.941	.625	.000	.833	.000	.682	.847



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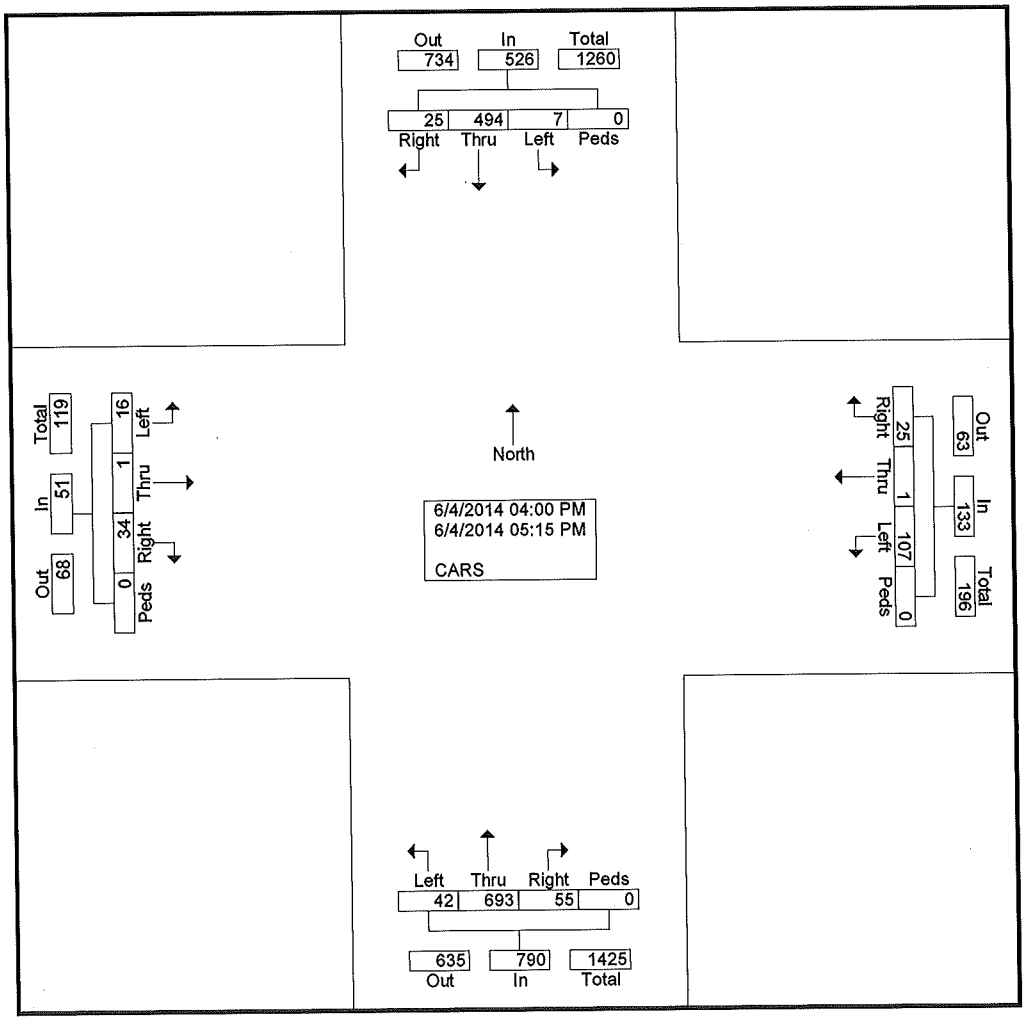
File Name : Not Named 2
Site Code : 00001213
Start Date : 6/4/2014
Page No : 1

Groups Printed- CARS

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	3	101	3	0	107	10	0	39	0	49	19	107	9	0	135	4	0	2	0	6	297
04:15 PM	3	60	0	0	63	3	1	19	0	23	5	122	9	0	136	8	0	3	0	11	233
04:30 PM	3	90	2	0	95	4	0	16	0	20	4	110	9	0	123	5	0	3	0	8	246
04:45 PM	7	78	0	0	85	3	0	16	0	19	9	109	5	0	123	3	0	2	0	5	232
Total	16	329	5	0	350	20	1	90	0	111	37	448	32	0	517	20	0	10	0	30	1008
05:00 PM	5	89	2	0	96	4	0	12	0	16	8	110	4	0	122	12	0	3	0	15	249
05:15 PM	4	76	0	0	80	1	0	5	0	6	10	135	6	0	151	2	1	3	0	6	243
Grand Total	25	494	7	0	526	25	1	107	0	133	55	693	42	0	790	34	1	16	0	51	1500
Apprch %	4.8	93.9	1.3	0		18.8	0.8	80.5	0		7	87.7	5.3	0		66.7	2	31.4	0		
Total %	1.7	32.9	0.5	0	35.1	1.7	0.1	7.1	0	8.9	3.7	46.2	2.8	0	52.7	2.3	0.1	1.1	0	3.4	



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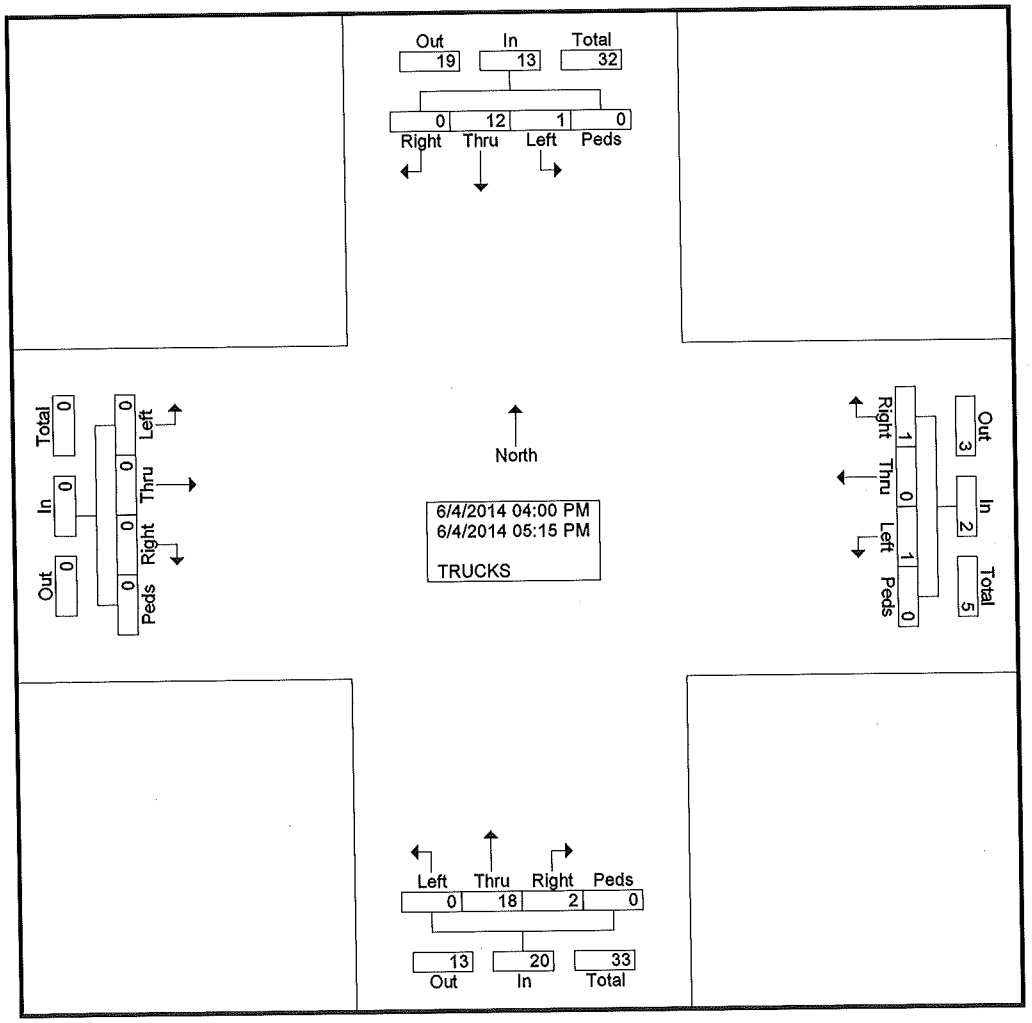
'Town: Barnstable
Counted by: BM
Counted by: 1

File Name : 1213_06042014
Site Code : 00001213
Start Date : 6/4/2014
Page No : 1

Groups Printed- TRUCKS

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	4	0	0	4	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	8
04:15 PM	0	2	0	0	2	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	7
04:30 PM	0	3	1	0	4	0	0	1	0	1	0	2	0	0	2	0	0	0	0	0	7
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	3
Total	0	9	1	0	10	0	0	1	0	1	1	13	0	0	14	0	0	0	0	0	25
05:00 PM	0	2	0	0	2	1	0	0	0	1	1	2	0	0	3	0	0	0	0	0	6
05:15 PM	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	4
Grand Total	0	12	1	0	13	1	0	1	0	2	2	18	0	0	20	0	0	0	0	0	35
Apprch %	0	92.3	7.7	0		50	0	50	0		10	90	0	0		0	0	0	0		
Total %	0	34.3	2.9	0	37.1	2.9	0	2.9	0	5.7	5.7	51.4	0	0	57.1	0	0	0	0	0	



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Town: Barnstable
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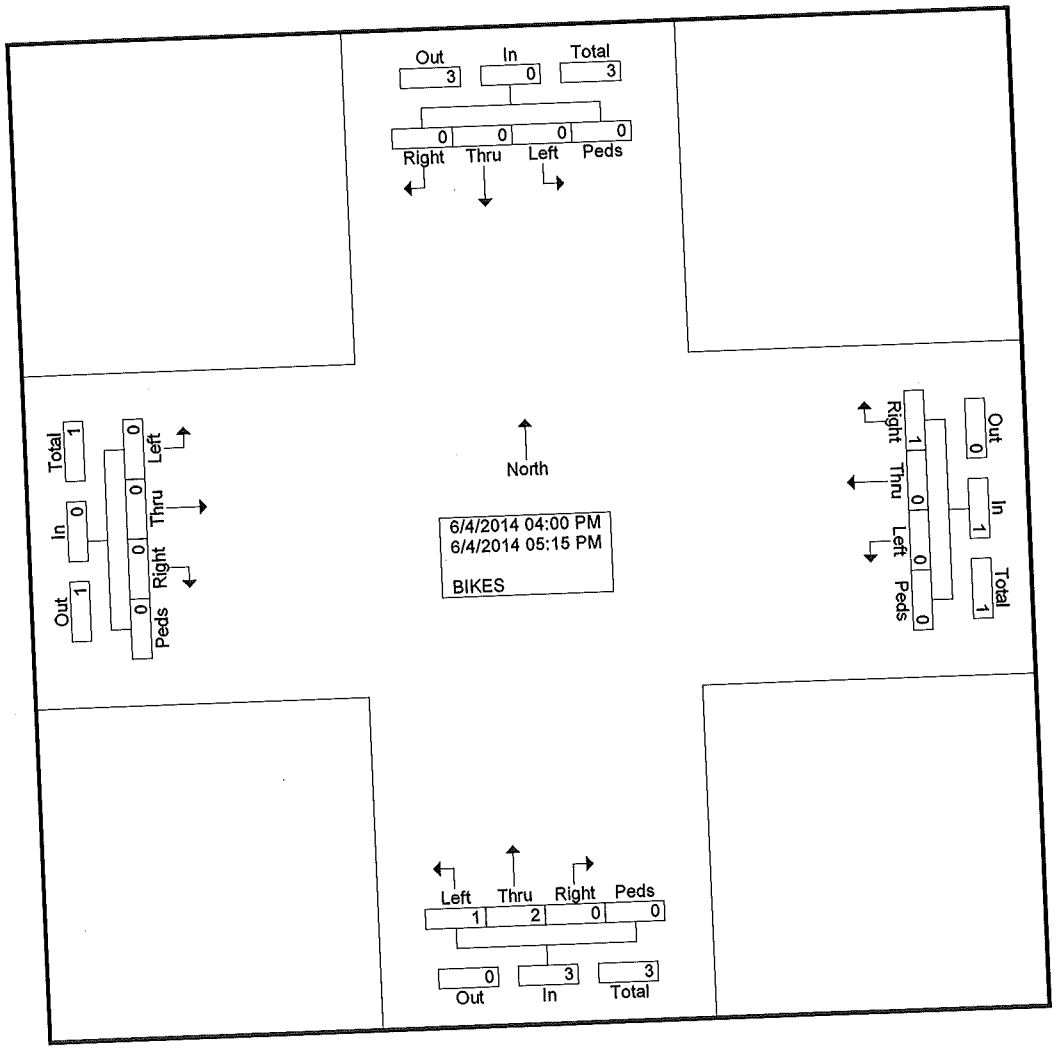
Counted by: 1

File Name : Not Named 2
Site Code : 00001213
Start Date : 6/4/2014
Page No : 1

Groups Printed- BIKES

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
*** BREAK ***																					
04:15 PM	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
*** BREAK ***																					
Total	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	2
Grand Total	0	0	0	0	0	1	0	0	0	1	0	2	1	0	3	0	0	0	0	0	4
Apprch %	0	0	0	0		100	0	0	0		0	66.7	33.3	0		0	0	0	0		
Total %	0	0	0	0	0	25	0	0	0	25	0	50	25	0	75	0	0	0	0	0	



Appendix E. Road Safety Audit References

Road Safety Audit References

Road Safety Audits. Institute of Transportation Engineers and U.S. Department of Transportation, Federal Highway Administration, www.roadwaysafetyaudits.org.

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

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

MassDOT Highway Division Traffic Engineering and Safety resources online, at http://www.mhd.state.ma.us/default.asp?pgid=trafficIndex&sid=level2

U.S. DOT Memorandum from Tony Furst, Acting Associate Administrator for Safety, to Division Administrators, January 12, 2012, Promoting the Implementation of Proven Safety Countermeasures

CAPE COD COMMISSION

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