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Town of Bourne Road Safety Audit

Sandwich Road at Cranberry Highway Intersection

November 2012





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**Prepared by the Cape Cod Commission
In cooperation with The Town of Bourne, 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.

Introduction

The Town of Bourne has 20,384 residents as of the 2010 United States Census of Population, and is the first of the fifteen towns on Cape Cod. Bourne has recreational and visitor attractions—swimming, fishing, whale watches, cruises, pathways on both sides of the Canal, historic sites and villages—along with community centered to service and manufacturing businesses, and the National Marine Life Center.



Bourne has an estimated summer population of about 40,000 residents, and is also traversed by most of the residents and summer visitors traveling into and out of the adjoining fourteen towns. The Town of Bourne is situated on both sides of the Cape Cod Canal with two bridges for vehicular transportation and one for rail crossings. As a result, local traffic needs include crossing the Canal for emergency response, services, schools, recreation, and shopping destinations. The interregional traffic peaks with the additional summer demand adding to the congestion on the Canal bridges, and most of the roadways that provide access toward the bridges.

In March 2012, CCC staff presented a safety update and potential Road Safety Audit (RSA) locations to the Cape Cod Joint Transportation Committee (CCJTC), and the resulting 2012 RSA locations selected by the CCJTC included the Bourne intersection of Sandwich Road and Cranberry Highway with an equivalent property damage only (EPDO) of 58, ranking it as the 22nd highest safety problem intersection in Barnstable County.

Project Data

The crash reports were requested from the Town of Bourne for this Road Safety Audit and were supplied by the Bourne Police Department. The crash data were reviewed and a crash diagram was developed. CCC staff prepared a graph of the traffic volume data. The crash diagram, summary data, and the traffic count data are included in the appendices.

The Road Safety Audit was scheduled with MassDOT and the Town. The Road Safety Audit meeting was held on September 5, 2012, beginning around 10:00 a.m., at the Bourne Town Hall. The multidisciplinary team also visited the site: Bourne, Sandwich Road at Cranberry Highway, during the RSA meeting, and then reconvened at the Town Hall.

Multidisciplinary Team

Table 1. Participating Audit Team Members

Audit Team Member	Agency/Affiliation
Rickie Tellier	Superintendent, Bourne Department of Public Works
Dennis Woodside	Chief, Bourne Police Department
Brandon Esip	Sgt., Bourne Police Department
Martin Greene	Chief, Bourne Fire Department
Lisa Schletzbaum	MassDOT Highway Division – Traffic Safety
Edward Feeney	MassDOT Highway Div.– District 5
Barbara Lachance	MassDOT Highway Div.– District 5
Bill Travers	MassDOT Highway Div.– District 5
Glenn Cannon, P.E.	Technical Services Director, Cape Cod Commission
Priscilla N. Leclerc	Senior Transportation Planner, Cape Cod Commission



Project Location and Description

The intersection of Sandwich Road at Cranberry Highway in the Town of Bourne is an angled connection, and both roadways are functionally classified as urban collectors.

Cranberry Highway connects Route 6 with Sandwich Road, and is also the collector for the surrounding neighborhood. Cranberry Highway has a four-lane undivided cross section. The roadway's two-lane eastbound section narrows in advance of the island located at the intersection with Sandwich Road. The dashed dividing line is dropped eastbound as the roadway narrows, and then the traffic is split. The left turning traffic lane moves to the left of the island to a STOP control, and the right lane, to the right of the island, merges into Sandwich Road with a YIELD.

Sandwich Road is an easterly-westerly two-lane roadway, also known as Route 6A. The special speed regulation number 7604 for Sandwich Road is set at 35 miles per hour, and the posted speed limit is also 35 miles per hour.

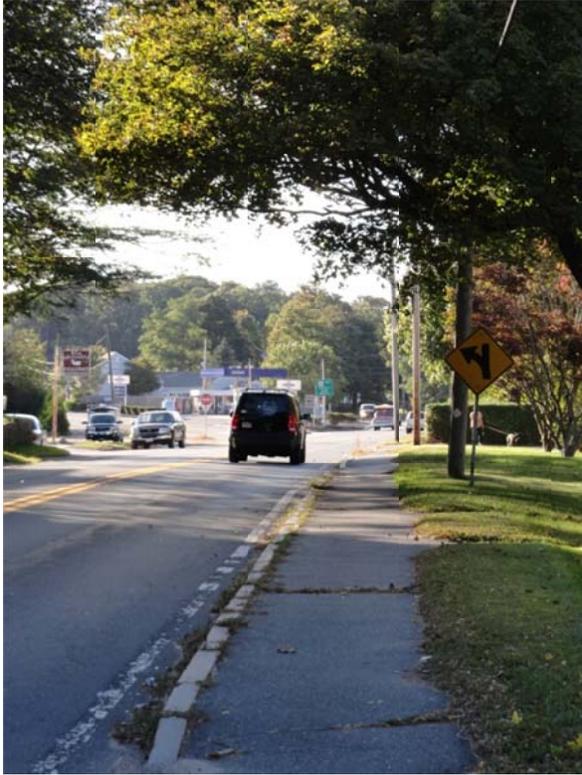
Figure 1. Locus Map showing Sagamore Bridge, Cape Cod Canal, and intersection.



Figure 2. Sandwich Road at Cranberry Highway



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Road Safety Audit:

Sandwich Road, also known as Route 6A, is a regional two-lane roadway, and is often used as an alternate to Route 6 during congested times. Cranberry Highway provides a connection from Route 6A to Route 6 just before the Sagamore Bridge. Many local businesses and residences are situated along both roadways and in the area. The intersection of these two roadways was the focus of the Road Safety Audit (RSA). The RSA Team met for discussion of the existing conditions, visited the site for field observations, and returned to discuss the safety issues at the location.

The RSA Team reviewed the crash diagram, the crash summary, the traffic volumes, and discussed the existing conditions. Due to a crash reporting software glitch in locating State Police crashes reported through the Registry of Motor Vehicles (RMV) system, only local crash reports were used for this RSA. The summary crash data, crash diagram, and traffic volume chart were brought to the RSA team meeting, and are included in the Appendices.

Bourne Police Department provided local crash reports, and after review, 12 crashes were found to be at the location from 2009-2011, with 7 property damage only, 5 injury crashes, and no fatal crashes. The resulting equivalent property damage only (EPDO) for just the local crashes is 32. Of the 12 crashes from 2009-2011, the majority, or 58%, were angle crashes, with 17% each of rear-end and sideswipe crashes, and one head-on crash.

Traffic volumes on the two routes are about even. Sandwich Road totaled 13,945 in Average Daily Traffic (ADT) for both directions, while Cranberry Highway's ADT for both directions totaled 13,013 vehicles. Both of the roadway peak hour volumes were from 4:00-5:00 p.m., with 1,135 vehicles on Sandwich Road and 1,021 vehicles on Cranberry Highway.

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



Audit Observations and Potential Safety Enhancements

SAFETY ISSUE #1. SIGNAGE

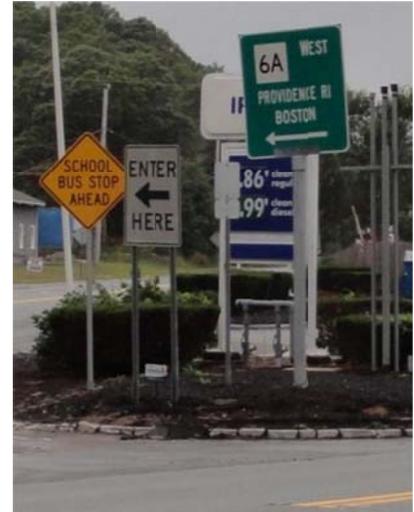
Observation:

The team discussed the existing signs in the vicinity of the intersection. All of the signs need to be upgraded for retro-reflectivity, and in particular, it was mentioned that a couple of signs were faded, such as, the “Enter Here” sign.

It was pointed out that visitors in the area are frequent, and even residents of nearby towns are sometimes looking for certain destinations. Signage in the area in general is confusing, especially if drivers are unfamiliar with the area. The “Market Basket” shop that recently opened is the latest destination that many have stopped to ask directions in order to find it. Although adding a destination sign to the specific retail establishment is not permitted without payment from the Market Basket, there could be a sign directing people to “Factory Outlet Road”.

For drivers navigating along Sandwich Road - Route 6A, it was brought up that both signs “Route 6A West” with the arrow, and “Route 6A West Providence, RI Boston Next Left” are confusing. There should be a sign with the information “To Route 6 / Sagamore Bridge” because that is what motorists in the area may be looking for the connection back to Route 6.

Another sign discussed was the yellow warning sign showing an angled intersection with the arrow on the left fork; this sign was on Sandwich Road westbound approaching the Cranberry Highway intersection, and directs traffic to the Route 6A designated route. Ed Feeney, MassDOT Highway Division District 5 Office reported that Route 6A westbound follows Cranberry Highway from Route 6A and Sandwich Road to Route 6, while Route 6A eastbound follows Sandwich Road from the Mid-Cape Connector. There was surprise by those present, and this was mentioned as being confusing for the traveling public because Sandwich Road is Route 6A in sections, and commonly known as Route 6A.





SIGNAGE (continued)

It was noted that there is no intersection warning sign for this busy intersection.

Electronic map directions were discussed, and a statement was made that Bing maps has Sandwich Road listed as Old Kings Highway. GPS information needs to be accurate and consistent with local signage.

Enhancement:

The directional information should be enhanced through additional or revised signs. Adding the information on the signs "to Route 6 west" and/or "to the Sagamore Bridge" will clarify that Cranberry Highway is the roadway connecting to Route 6 westbound. Many drivers traveling on Sandwich Road may be looking to connect with Route 6. Since the Bourne Bridge is closer to 195 / 495 and connections to Providence, RI

Intersection warning signs should be added to Sandwich Road for improved awareness of the Cranberry Highway intersection. It was suggested that the W2-3L sign, showing the angled intersection, should replace the existing W1-10L sign that includes the arrow turning left.

In addition, it would assist certain motorists to include directional signs to Factory Outlet Road, where redevelopment of that area has added additional shopping attractions.

All signs should be upgraded for retro-reflectivity as the MassDOT District Office maintenance schedule allows.

It was suggested that having street signs with the roadway names may assist in alleviating confusion with the change in Route 6A and the corresponding roadway names.

An effort should be made to contact online map companies to update name and Route numbers. As more people use Global Positioning Systems (GPS), there should be a check to ensure that the street signs and the GPS have the same directional information.



W1-10L



W2-3L



SAFETY ISSUE #2. SIGHT DISTANCE AND VEGETATION

Observation:

It was observed that sight distance from the Cranberry Highway approach to turn left onto Sandwich Road is obscured by bushes that have grown high on the island at the gas station.

With 58% of crash type being angle crashes, improving the sight distance for turning vehicles will contribute to safety.

Vegetation on Sandwich Road westbound was also noted to be growing over the signs.



Enhancement:

Trim or cut back the vegetation for improved visibility on the corner island of the gas station property.

Trim the tree branches back on Sandwich Road and/or relocate the sign for improved prominence.





SAFETY ISSUE #3. SPEED

Observation: It was noted that speed combined with the sight distance and volume of turning movements results in crash experience. 58% of the local intersection crashes from 2009-2011 were angle crashes.

Sandwich Road, also known as Route 6A, is a major east-west regional route where drivers may tend to travel over the speed limit.



Sandwich Road (Route 6A) at Cranberry Highway, Bourne.
Note that second vehicle is pulling over the centerline/cutting the corner to take a left turn. This vehicle may not be visible to Sandwich Road eastbound traffic until it is too late.

Enhancement: Continue periodic police enforcement of traveling speeds along Sandwich Road and in the vicinity of the intersection to encourage compliance for improved safety.

Consider additional measures in the long term, such as a roundabout to reduce speeding and enhance multi-modal safety.



SAFETY ISSUE #4. GEOMETRY

Observation:

The island on Cranberry Highway at the intersection was brought up in discussion, and it was suggested that perhaps bringing the intersection straighter to a "T" may improve operations. Vehicles turning left from Cranberry Highway have a STOP sign, while vehicles turning right merge and then YIELD into eastbound Sandwich Road. There was also a comment that removing the island and having adjacent lanes for right and left turns may cause sight line visibility issues. A vehicle in the right lane, especially a larger sport utility vehicle (SUV) or truck, may block the view of the driver turning left.

It was also noted that drivers on Sandwich Road westbound taking the left onto Cranberry Highway were starting to turn prior to the actual intersection, and this may be contributing to the crashes. Reportedly, this cutting across the centerline early to turn was worse prior to the installation of the island.

A roundabout was suggested as a long-term consideration for this intersection to improve safety, reduce conflicts, slow traffic, and control turning movements.

It was stated that on Sandwich Road the lack of adequate shoulders is a possible contributing factor to crashes.

Enhancement: Consider improving the geometric configuration of the intersection through adjustment of the Cranberry Highway approach and island, or through conversion to a roundabout. Consider shoulder widening on Sandwich Road in the vicinity of the intersection.





SAFETY ISSUE #5. PAVEMENT LEVEL AND MARKINGS

Observation:

It was mentioned that the pavement level on Cranberry Highway for the left turn approach is lower than Sandwich Road. The island is just prior to that leg coming westbound on Sandwich Road. Therefore, drivers coming westbound on Sandwich Road and turning left onto Cranberry Highway may not see the double yellow centerline until they are actually taking the turn. This may add to why drivers are cutting over early to turn left, as mentioned on the previous page.



Cranberry Highway at Sandwich Road, Bourne

Enhancement:

Consider raising the level of the Cranberry Highway approach as part of roadway improvements or maintenance efforts.





SAFETY ISSUE #6. BICYCLE / PEDESTRIAN ACCOMMODATIONS

Observation:

A curbed sidewalk exists on part of the northerly side of Sandwich Road and then ends opposite the Cranberry Highway intersection.

Existing bicycle accommodations are generally lacking through the intersection.



Enhancement:

Provide improved accommodation for pedestrians and bicyclists through roadway improvements or maintenance efforts.



Summary of Road Safety Audit

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), mid-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).

Bourne is home to many residents and also a destination for visitors to Cape Cod. In addition to those traveling to visit Bourne, fourteen towns to the east are accessed through Bourne as gateway to Cape Cod. There is a desire in the town to improve traffic operations and safety for both residents and visitors.



Table 2. Potential Safety Enhancement Summary

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Agency
Signage Confusion / directional Warning Condition Electronic mapping	Add signs to direct travelers to Route 6 and/or Sagamore Bridge from Sandwich Road; Add directional sign "to Factory Outlet Road" Add intersection warning signs on Sandwich Road; remove the sign W1-10L and replace with W2-3L All signs to be Retro reflective Coordinate with online map companies to have improved public directional information that is tied in with local signage	Low to Medium	Short-term	Low	MassDOT with local input
Sight Distance Vegetation	Trim or remove bushes on the gas station island at Cranberry Highway where left turning vehicles line of sight is obscured Trim other vegetation as necessary to allow improved visibility of highway signs along Sandwich Road	Low Low	Short-term Short-term	Low Low	MassDOT with local input
Speed Continue monitoring Consider a roundabout	Continue periodic enforcement of the speed limit. Consider a roundabout or other traffic calming	Medium High	Medium-term Long-term	Medium High	MassDOT with local input
Geometry Consider roundabout Island Shoulders	Consider converting this intersection to a roundabout in the long-term Consider geometric adjustments to provide improved guidance for vehicular movements around the island Consider shoulder improvements on Sandwich Road in the vicinity of the intersection	Medium to High Low	Long-term Long-term	High High	MassDOT with local input
Pavement Level & Markings	Adjust pavement level where lower on the Cranberry Highway approach to turn left onto Sandwich Road to bring up to Sandwich Road level	Low	Medium-term	Medium to High	MassDOT with local input
Bicycle / Pedestrian accommodation	Consider improved accommodation for bicyclists and pedestrians with future improvements or maintenance projects	Medium	Medium to Long-term	Medium to High	MassDOT with local input

Appendix A. RSA Meeting Agenda

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BARNSTABLE, MASSACHUSETTS 02630

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Road Safety Audit (RSA) Meeting

Bourne, Sandwich Road / Route 6A at Cranberry Highway

Wednesday, September 5, 2012

10:00 a.m. – 12:00 p.m.

Location: Bourne Town Hall, 24 Perry Avenue, Bourne, MA 02532

10:00 a.m. Welcome and Introductions

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

- Crash and Traffic Volume Summaries– provided in advance
- Existing Geometries and Conditions

10:45 a.m. Visit the Site

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

11:15 a.m. Post Visit Discussion / Completion of RSA

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

12:00 p.m. Adjourn for the Day

Appendix B. RSA Audit Team Contact List

Participating Audit Team Members

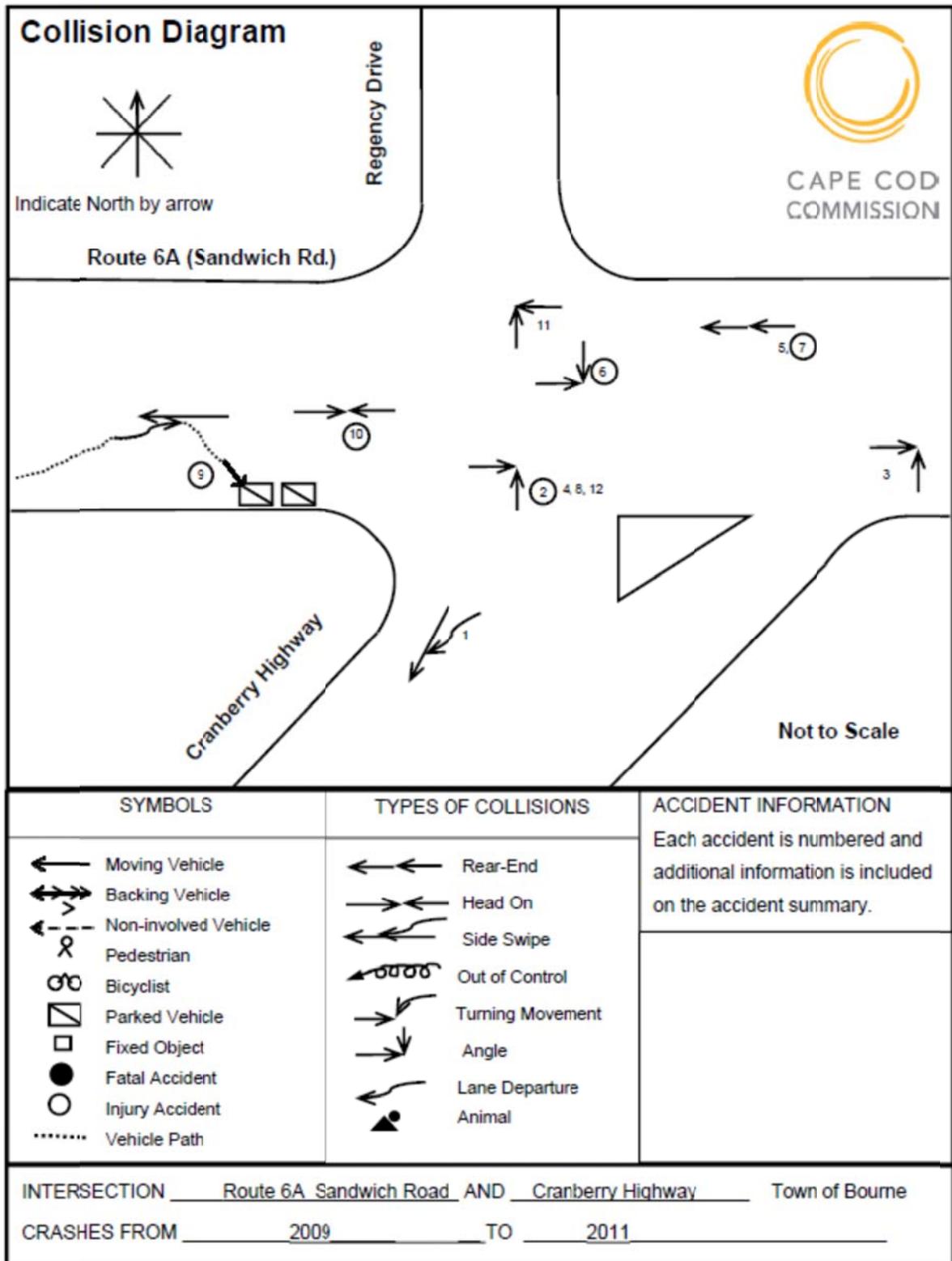
Bourne Town Hall and site visit

RSA Location: Sandwich Road at Cranberry Highway intersection

September 5, 2012

Audit Team Member	Agency/Affiliation
Rickie Tellier	Superintendent, Bourne Department of Public Works
Dennis Woodside	Chief, Bourne Police Department
Brandon Esip	Sgt., Bourne Police Department
Martin Greene	Chief, Bourne Fire Department
Lisa Schletzbaum	MassDOT Highway Division – Traffic Safety
Edward Feeney	MassDOT Highway Div.– District 5
Barbara Lachance	MassDOT Highway Div.– District 5
Bill Travers	MassDOT Highway Div.– District 5
Glenn Cannon, P.E.	Technical Services Director, Cape Cod Commission
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Appendix C. Detailed Crash Data

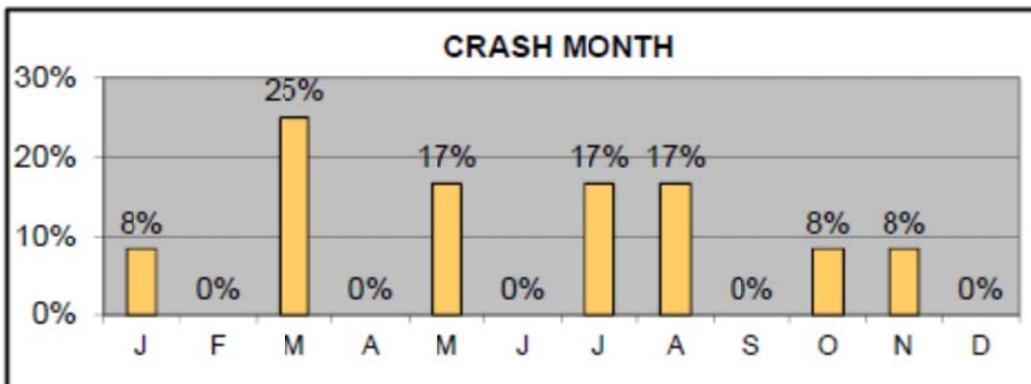
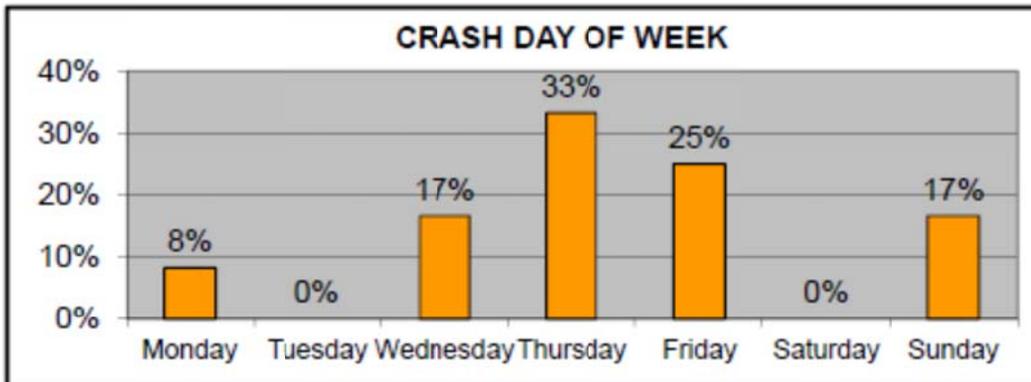
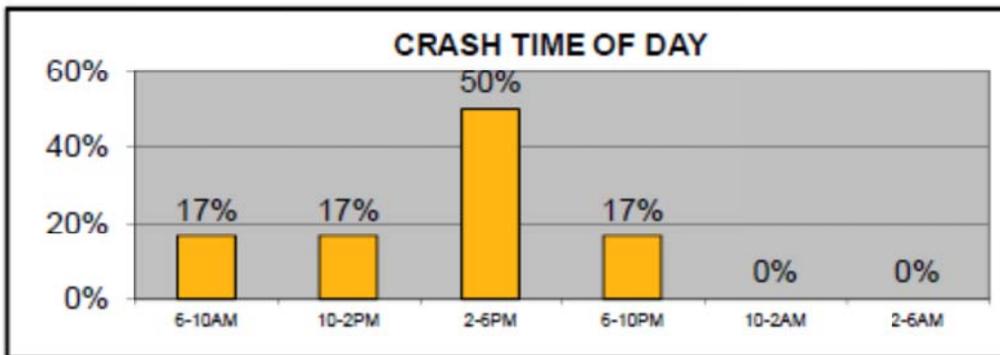
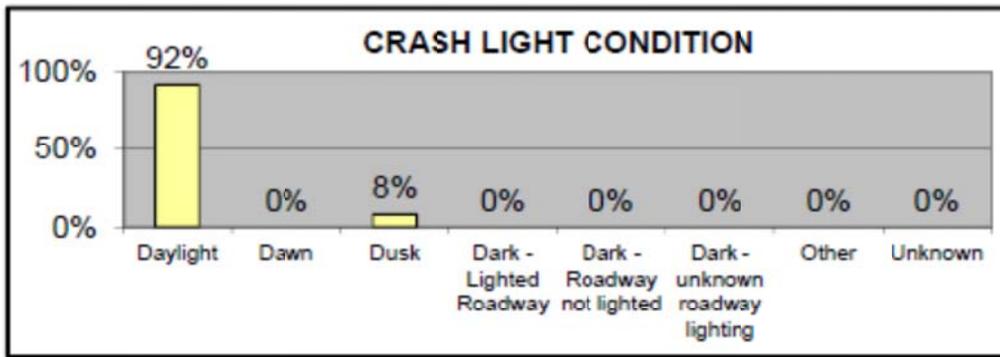


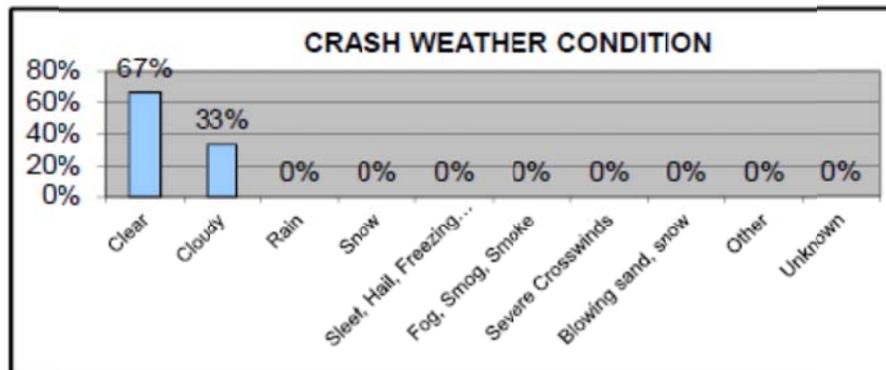
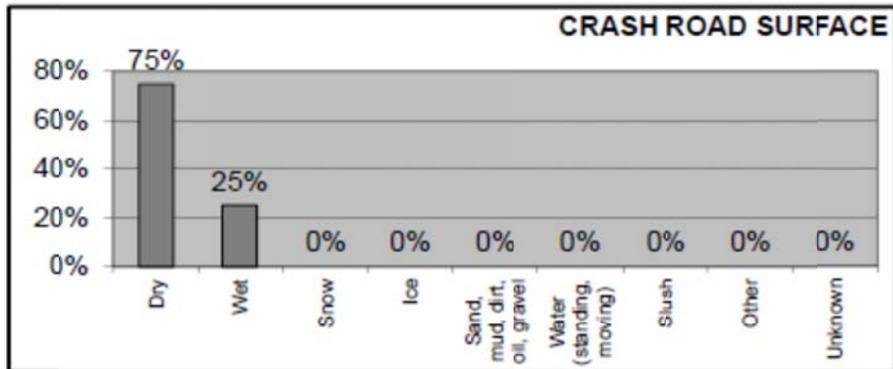
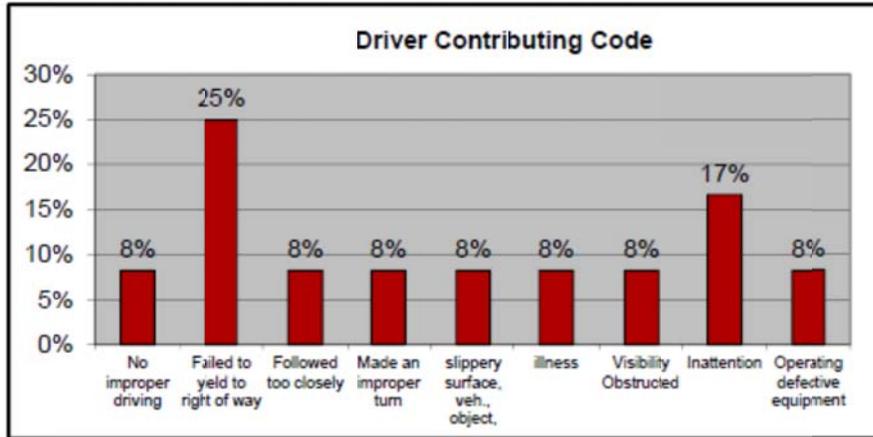
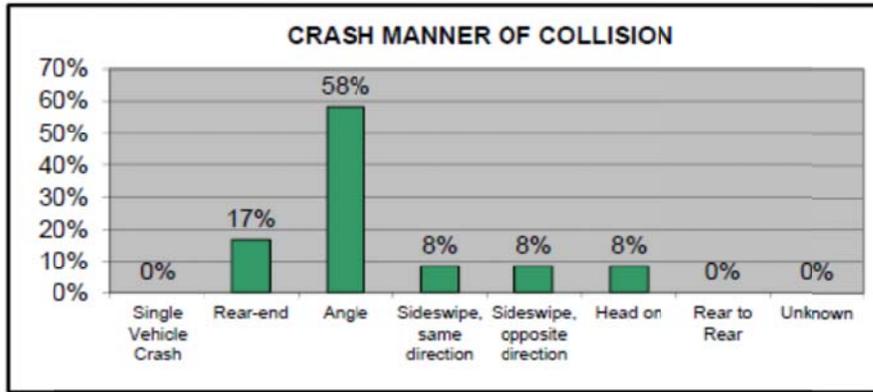
Source: Crash Diagram developed based on 2009-2011 crash reports provided by the Town of Bourne Police Department

Crash Number	Crash Date	Crash Time	# of vehicles	# of injuries	Manner	Vehicle action prior to crash	Veh. travel direction	Veh. sequence of events	Road Surface	Weather
1	1/22/2009	8:23 PM	2	0	sideswipe	Vehicle 1 & Vehicle 2 travelling in the same direction	Veh 1 SB Veh 2 SB	Vehicle 2 attempts RT from left lane into 1 STOP hitting Vehicle 1 in the next lane	dry	clear
2	5/14/2009	2:18 PM	2	1	angle	Vehicle 1 travelling NB thru intersection	Veh 1 NB Veh 2 EB motorcycle	Vehicle 1 crossing Rte. 6A while Vehicle 2 motorcycle EB lays down to avoid Vehicle 1 in path	dry	cloudy
3	7/13/2009	10:30 AM	2	0	angle	Vehicle 1 attempts LT while Vehicle 2 EB on Sandwich Rd	Veh 1 NB making LT Veh 2 EB	Vehicle 1 pulling out to turn left hit passenger side of Vehicle 2	dry	clear
4	8/14/2009	3:08 PM	2	0	angle	Vehicle 1 at Cranberry Highway STOP attempt LT while Vehicle 2 EB on Sandwich Rd	Veh 1 NB making LT Veh 2 EB	Vehicle 1 pulls out to take LT colliding with EB Vehicle 2	dry	clear
5	3/24/2010	4:31 PM	2	0	rear-end	Vehicle 1 and Vehicle 2 travelling same direction in traffic	Veh 1 WB Veh 2 WB	Vehicle 1 stopping in traffic is rear-ended by Vehicle 2	dry	clear
6	3/24/2010	5:08 PM	2	1	angle	Vehicle 1 WB on Sandwich Rd and attempts LT to Cranberry Hwy	Veh 1 WB making LT Veh 2 EB	Vehicle 1 turning left onto Cranberry Highway & Vehicle 2 hits passenger side	dry	clear
7	7/16/2010	9:29 AM	2	1	rear-end	Vehicle 1 and Vehicle 2 travelling same direction	Veh 1 WB Veh 2 WB	Vehicle 1 stops suddenly for a raccoon crossing and is rear-ended by Vehicle 2	dry	clear

Crash Number	Crash Date	Crash Time	# of vehicles	# of injuries	Manner	Vehicle action prior to crash	Veh. travel direction	Veh. sequence of events	Road Surface	Weather
8	8/22/2010	2:30 PM	2	0	angle	Vehicle 1 at Cranberry Highway STOP attempt LT while Vehicle 2 EB on Sandwich Rd	Veh 1 NB making LT Veh 2 EB	Vehicle 2 hits Vehicle 1 as Vehicle 1 attempts LT from Cranberry Highway to Sandwich Rd WB	wet	cloudy
9	3/27/2011	5:26 PM	4	1	sideswipe	Vehicle 1 EB Sandwich Rd then left, right and out of control rolling over	Veh 1 EB Veh 2-3 Prk Veh 4 WB	Vehicle 1 EB crosses into WB lane hitting mirror Vehicle 4 then right into two parked vehicles (2, 3) & roll over	dry	clear
10	5/5/2011	6:36 PM	2	1	head-on	Vehicle 2 WB on Sandwich Road and swerves	Veh 1 EB Veh 2 WB	Vehicle 1 travelling EB on Sandwich Rd. when hit head on by Vehicle 2	wet	cloudy
11	10/7/2011	10:59 AM	2	0	angle	Vehicle 1 WB on Sandwich Rd and swerves	Veh 1 WB Veh 2 EB	Vehicle 1 sees slow/stopped traffic in front and swerves into oncoming traffic and was hit by EB box truck	dry	clear
12	11/17/2011	7:43 AM	2	0	angle	Vehicle 1 at Cranberry Highway STOP attempt LT while Vehicle 2 EB on Sandwich Rd	Veh 1 NB making LT Veh 2 EB	Vehicle 2 hits Vehicle 1 as Vehicle 1 attempts LT from Cranberry Highway to Sandwich Rd WB	wet	cloudy

Source: Bourne Police Department crash reports for this location from 2009-2011.

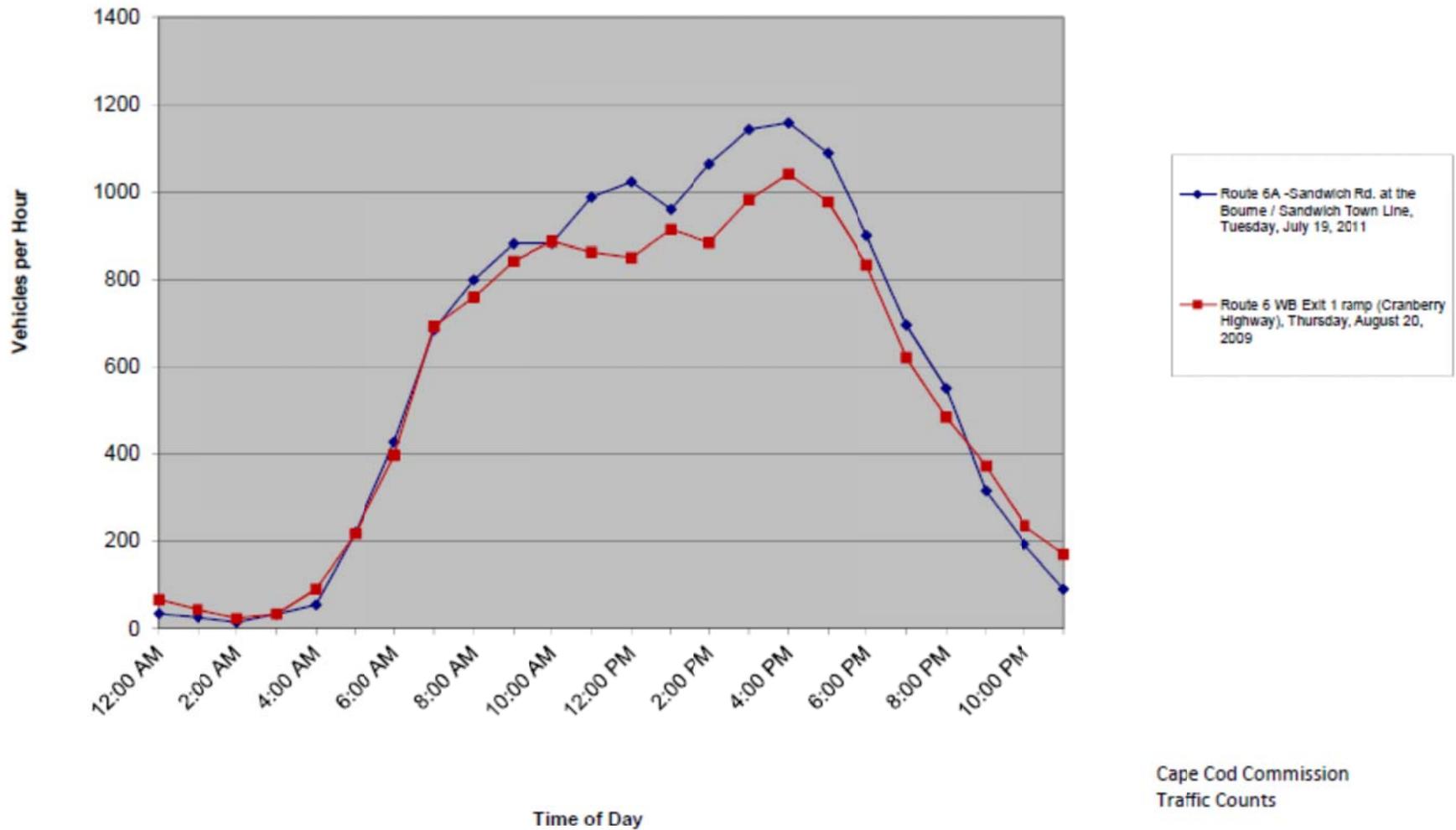




Appendix D. Additional Information

- Hourly Traffic Volumes Graph:

Bourne Route 6A-Sandwich Road and Cranberry Highway, Hourly Traffic Volumes



Cape Cod Commission
Traffic Counts

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