

ROAD SAFETY AUDIT

Iyannough Road (Route 28) at Yarmouth Road

Town of Barnstable

September 2012

Prepared for:
Massachusetts Department of Transportation



Prepared by:
Howard/Stein-Hudson Associates
38 Chauncy Street
Boston, MA 02111



Table of Contents

Background	2
Project Data.....	2
Project Location Description	4
Road Safety Audit Observations and Potential Enhancements	7
Safety Issue #1. Congestion and Driver Frustration.....	8
Safety Issue #2. Unclear Lane Use.....	10
Safety Issue #3. Intersection Geometry.....	11
Safety Issue #4. Signage	14
Safety Issue #5. Access Management	15
Safety Issue #6. Railroad Crossing	16
Safety Issue #7. Signal Indications	17
Safety Issue #8. Limited Bicycle Accommodations	18
Safety Issue #9. Limited Pedestrian Accommodations	19
Safety Issue #10. Emergency Vehicles	20
Recommendations	21
List of Appendices	
Appendix A. RSA Meeting Agenda	
Appendix B. RSA Audit Team Contact List	
Appendix C. Detailed Crash Data	
Appendix D. Speed Regulations	
List of Figures	
Figure 1. Locus Map.....	3
Figure 2. Iyannough Road (Route 28) at Yarmouth Road.....	5
List of Tables	
Table 1. Participating Audit Team Members	2
Table 2. Summary of Potential Safety Enhancements	23

Background

The intersection of Iyannough Road (Route 28)/Yarmouth Road in the Town of Barnstable, Massachusetts, is listed in the Top 5% of High Crash Locations on Cape Cod. The Massachusetts Department of Transportation (MassDOT) has determined that the Town of Barnstable would be eligible to receive Highway Safety Improvement Program (HSIP) funding for reconstruction of the intersection if a Road Safety Audit (RSA) were conducted and the proposed design incorporated the safety improvements identified in the RSA. The intersection is currently at the preliminary design stage (MassDOT Project # 606272) and it is anticipated that reconstruction would commence in Spring 2016.

In general, the RSA is intended to identify potential safety improvements that can be evaluated and included as part of the design process for the reconstruction of the intersection. The short-term, low-cost potential improvements could be considered by the responsible agency for immediate implementation prior to reconstruction, as appropriate. The RSA study area is illustrated in **Figure 1**. During the RSA, the audit team also made safety observations of the intersection of Yarmouth Road/Camp Street, located approximately 150 feet south of the intersection, and the railroad crossing, located just 65 feet west of the intersection.

Project Data

The audit team conducted an RSA for the intersection of Iyannough Road (Route 28)/Yarmouth Road on Friday, September 28, 2012. The RSA agenda appears in **Appendix A**. **Table 1** lists the audit team members and their affiliations. **Appendix B** provides contact information for all team members.

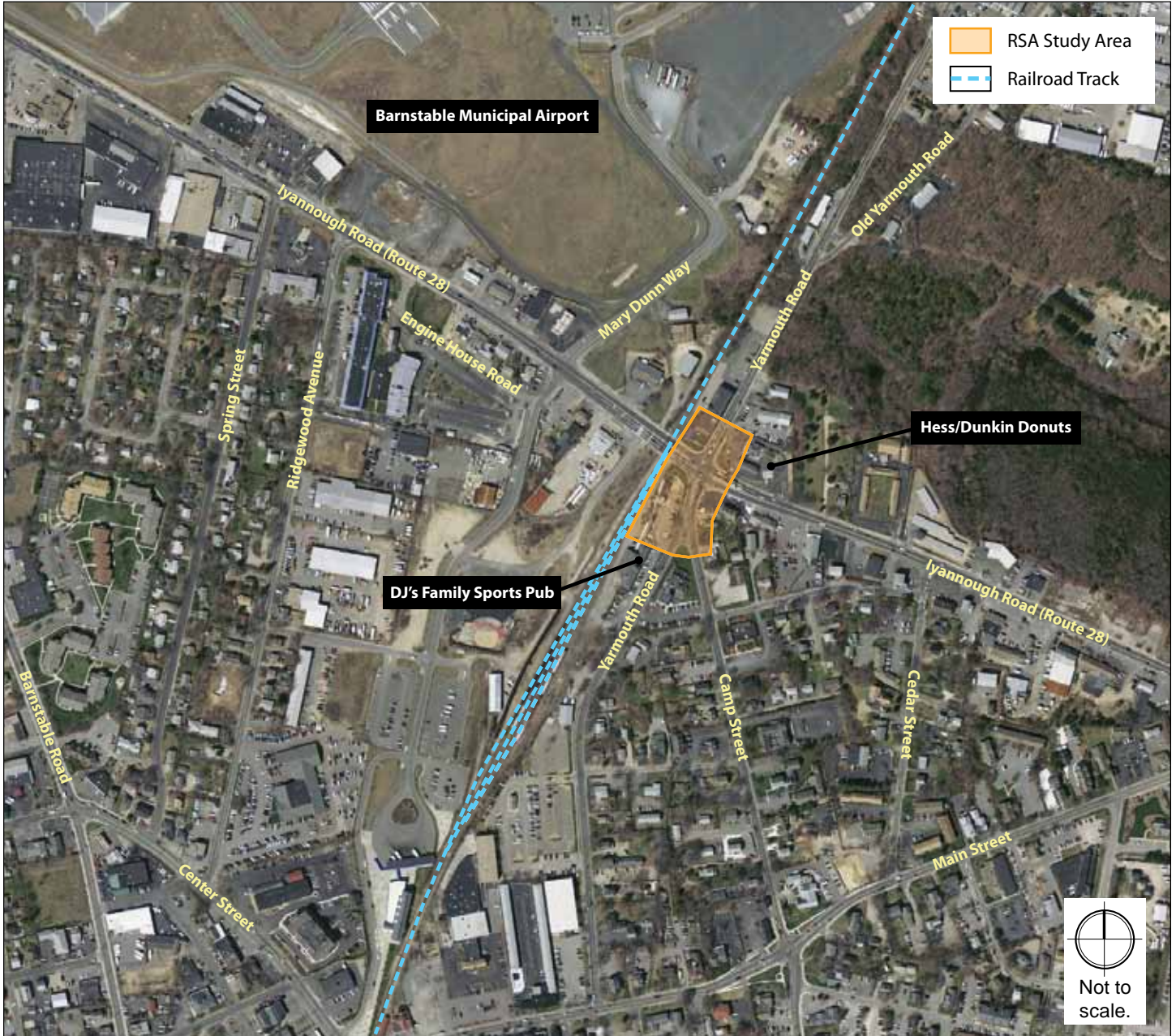
Table 1. Participating Audit Team Members

Audit Team Member	Agency/Affiliation
JoAnne Miller Buntich	Town of Barnstable Growth Management
Roger Parsons	Town of Barnstable DPW
Steve Seymour	Town of Barnstable Growth Management
Steven Tupper	Cape Cod Commission
Edward C. Feeney	MassDOT District 5 Traffic Operations
Tom Currier	MassDOT Project Management
Pamela Haznar	MassDOT District 5
Priscilla Leclerc	Cape Cod Commission
Corey O'Connor	MassDOT Highway Safety
Dean Melanson	Hyannis Fire
Lenny Velichansky	TranSystems
Barbara Lachance	MassDOT District 5 Traffic Operations
Lisa Schletzbaum	MassDOT, Highway Division
Joe SanClemente	Howard/Stein-Hudson (HSH)
Mike Tremblay	Howard/Stein-Hudson (HSH)

Road Safety Audit

Iyannough Road (Route 28) at Yarmouth Road, Barnstable, MA

Figure 1. Locus Map



Source: Mass GIS

Prior to the RSA, in order to begin assessing possible safety issues, the audit team reviewed collision diagrams and a crash detail summary for the intersection of Route 28/Yarmouth Road based on crash records supplied by the Barnstable Police Department. From September 1, 2009 through September 13, 2012, 45 crashes were reported at the intersection. Of those crashes, 17 (or 38%) were angle type, 11 (24%) were rear-end type, 11 (24%) were sideswipes, 5 (11%) were single-vehicle crashes, and 1 (3%) was a head-on collision. The crashes generally occurred during daylight conditions (28 or 62%) and on dry pavement (35 or 78%). Of the 45 crashes, 6 (or 13%) resulted in personal injury. No fatalities were reported during this time period. One crash reportedly involved a pedestrian, although the crash reports provided by the Barnstable Police Department indicated that the pedestrian was not found after the crash. **Appendix C** provides the detailed crash data for the intersection. Speed regulations in the vicinity of the intersection are presented in **Appendix D**.

Project Location Description

The RSA focused on the intersection of Route 28/Yarmouth Road in the Town of Barnstable, as shown in the aerial image in **Figure 2**. Safety observations were also made at the intersection of Yarmouth Road/Camp Street, which is located just 150 feet south of Route 28.

Route 28/Yarmouth Road is a four-way signalized intersection. The Route 28 eastbound approach consists of a left-turn lane, a through lane, and a shared through/right-turn lane. The Route 28 westbound approach consists of a through lane and a shared through/right-turn lane; left turns onto Yarmouth Road southbound are prohibited from Route 28 westbound. Route 28 eastbound and westbound narrow from two travel lanes to one travel lane on the departure side of the intersection in each direction. The Yarmouth Road northbound approach consists of one wide lane. Lane use pavement markings or signage are not provided. Field observations by the study team indicate that this approach often functions as either one or two lanes, typically a shared through/left-turn lane shared through/right-turn lane; however, vehicles were observed to travel through from both lanes even though there is only one receiving lane on the departure side of the intersection. The Yarmouth Road southbound approach consists of a shared left-turn/through lane and an exclusive right-turn lane. Two railroad crossings run north-south across Route 28 approximately 65 feet and 100 feet west of Yarmouth Road, respectively. Crosswalks and pedestrian ramps are not provided at the intersection, and sidewalks are only provided in some areas, particularly along the northern leg of the intersection on Yarmouth Road. Bicycle accommodations are limited.

Yarmouth Road/Camp Street is a three-way, unsignalized intersection, located just 150 feet south of Route 28. The Yarmouth Road northbound stop-controlled approach consists of a through lane. A right-turn slip lane provides access to Camp Street southeast-bound approximately 60 feet upstream of the stop line; vehicles can also turn left into DJ's Family Sports Pub from Yarmouth Road northbound in the vicinity of the slip lane. The Yarmouth Road southbound approach consists of one shared left-turn/through lane. Camp Street intersects with Yarmouth Road from the southeast at an acute angle, resulting in somewhat awkward intersection geometry. The Camp Street northwest-bound approach consists of a single uncontrolled travel lane, where vehicles can either make a sharp left turn onto Yarmouth Road southbound or continue straight along Yarmouth Road northbound.

Road Safety Audit

Iyannough Road (Route 28) at Yarmouth Road, Barnstable, MA

Figure 2. Iyannough Road (Route 28)/Yarmouth Road



Vehicles were also observed taking lefts onto Yarmouth Road southbound from Camp Street northwest-bound via the slip lane. There are no signage or pavement markings to show the intended use of the slip lane; it is unclear as to whether this lane is intended for right turns from Yarmouth Road northbound onto Camp Street southeast-bound, or for access to DJ's Family Sports Pub and access to Yarmouth Street southbound from Camp Street northwest-bound. Sidewalks are provided along both sides of Camp Street and along the east side of Yarmouth Road south of Camp Street. Crosswalks, pedestrian ramps, and bicycle accommodations are not provided.

These intersections form the junction of the following roadways, which are categorized according to MassDOT Office of Transportation Planning functional classifications:

Iyannough Road (Route 28) is an urban principal arterial and falls under MassDOT jurisdiction. Iyannough Road (Route 28) is an east-west roadway and runs between the East Main Street, where Route 28 continues to the east, and the airport rotary to the west, where Route 28 continues onto Falmouth Road. Route 28 serves as a major east-west roadway and provides connections to the Barnstable Municipal Airport, approximately a mile west of the study area, and Route 132, Main Street, and numerous commercial businesses along the corridor. In the vicinity of the intersection, Route 28 generally consists of one travel lane in each direction. The speed limit along Route 28 within the study area is listed at 35 mph according to speed regulations; however, it is not posted in the vicinity of the intersection.

Yarmouth Road is classified as an urban minor arterial south of Route 28 and is classified as an urban principal arterial to the north of Route 28. Yarmouth Road falls under the jurisdiction of the Town of Barnstable. Yarmouth Road is generally a north-south roadway and runs between Camp Street (in Yarmouth) to the north, where it turns into Willow Street, and Main Street to the south; Willow Street provides connection to Route 6 at Exit 7. Yarmouth Road serves as a key access route to Cape Cod Hospital, downtown Hyannis, and the ferry service. Within the vicinity of the study area, Yarmouth Road is generally one lane in each direction. The speed limit is not posted. ***Camp Street*** (in Barnstable) is an urban minor arterial and falls under the jurisdiction of the Town of Barnstable. Camp Street is generally a northwest-southeast roadway and runs between Yarmouth Road to the northwest and Main Street to the southeast. Camp Street is generally one-lane in each direction. The speed limit was not posted in the vicinity of the study area. Camp Street serves as a common route for ambulance traffic traveling to and from Cape Cod Hospital.

Road Safety Audit Observations and Potential Enhancements

Based on RSA team discussions on Friday, September 28, 2012, the RSA team determined that the intersection of Iyannough Road/Yarmouth Road has the following issues that affect safety:

1. Congestion and Driver Frustration;
2. Unclear Lane Use;
3. Intersection Geometry;
4. Signage;
5. Access Management;
6. Railroad Crossing;
7. Signal Indications;
8. Limited Bicycle Accommodations;
9. Limited Pedestrian Accommodations, and;
10. Emergency Vehicles.

The following sections describe in more detail the safety issues and enhancements determined during the RSA. Several of these issues require further study and engineering judgment to determine the feasibility of implementing enhancements to address them.

Safety Issue #1. Congestion and Driver Frustration

Observations:

Route 28, an urban minor arterial, serves as one of only three major east-west access routes through Cape Cod besides Route 6 and Route 6A. Meanwhile, Yarmouth Road is a key north-south corridor between Main Street in Hyannis, Route 6 at Exit 7 and Route 6A via Willow Road; thus, these roadways experience substantial traffic volume year-round. Yarmouth Road and Camp Street also see heavy ambulance traffic traveling to and from Cape Cod Hospital.



Congestion at Route 28/Yarmouth Road

Team members commented that these corridors are regularly congested, especially during peak hours and during the summer months, which contributes to increased motorist frustration and aggressive driving behavior. From September 2009 to September 2012, 9 (or 53%) of the 17 angle type crashes and 8 (73%) of the rear-end type crashes were reportedly as a result of aggressive driving behavior (e.g. traveling too fast, running red lights, following too closely, etc.) or not paying sufficient attention.

Of the 45 crashes reported at this intersection, five involved motorists running red lights; including two crashes involving a Route 28 eastbound vehicle colliding with a Yarmouth Road northbound vehicle after running a red light, and three crashes that were the result of a Yarmouth Road southbound vehicle running a red light and being struck by a Route 28 eastbound vehicle; one of these resulted in a collision with a third vehicle that was stopped at the Yarmouth Road northbound approach.

The study team observed that queues on Route 28 eastbound often experience very long queues, which can result in motorist inattention and frustration and may have contributed to rear-end crash experience at the intersection. During the field visit, which was conducted during off-peak hours, the team observed fairly substantial queues at all intersection approaches. A team member stated that he had observed queues as far back as the Radisson Hotel on Route 28 eastbound, which is located about a quarter-mile west of the intersection. Three of the 11 reported rear-end crashes occurred on Route 28 eastbound; one of these crashes resulted in personal injury. One rear-end crash was reported on Route 28 westbound. Five reported rear-end crashes occurred on Yarmouth Road northbound, one of which resulted in personal injury, another of which occurred north of the intersection at the Dunkin Donuts/Hess driveway. Two rear-end crashes occurred on

Yarmouth Road southbound, one of which occurred when the two involved vehicles were turning right onto Route 28 westbound.

Team members also observed that motorists at all approaches typically stop past the stop line when waiting at a red light. A team member commented that motorists wait as close to the intersection as possible to give them an advantage to get through the intersection when the light turns green.

Meanwhile, the Yarmouth Road northbound left-turn movements occur during a short permitted phase; thus vehicles are often observed turning left during the yellow and into the red phase and conflict with Route 28 eastbound and westbound adding to the congestion along the corridor.

Lastly, right-turning vehicles on Yarmouth Road southbound were also observed “rolling” through the red signal indication where right turns on red are permitted after a complete stop, and often do not yield to other movements in the intersection.

Enhancements:

1. Consider the feasibility of improving traffic signal operations (e.g. traffic signal improvements, signal phasing changes, roadway widening, lane use modifications, etc.) to reduce queuing conditions and motorist frustration.
2. Consider the appropriateness and safety benefits of providing a protected left-turn signal phase for Yarmouth Road northbound.
3. Enforce red light running violations where possible.
4. Review, and adjust as appropriate, clearance intervals per current standards in an effort to reduce rear-end and angle-type crashes.

Safety Issue #2. Unclear Lane Use

Observations:

The crash history provided by the Barnstable Police Department indicated that, of the 45 crashes reported between September 2009 through September 2012, 11 (24%) were sideswipe-type crashes, which were generally the result of motorist failure to keep in lane or other improper driving behavior.

The Yarmouth Road northbound approach at Route 28 has no clear intended lane use. It is wide enough for two separate lanes, though a team member noted that sometimes the first car queues in the middle of the approach so no other vehicle can queue next to it. Otherwise, when the Yarmouth Road northbound approach functions as two lanes, team members observed vehicles traveling northbound through from both lanes even though there is only one receiving lane on the departure side of the intersection. Thus, since there is no clear lane use, it is possible that two lanes of vehicle traffic could travel northbound at the same time into one receiving lane on Yarmouth Road, which would require these vehicles to merge within the intersection. According to the crash data, four sideswipe crashes involving Yarmouth Road northbound through vehicles in both lanes occurred between September 2009 and September 2012.

It was also noted that pavement markings indicating the right-turn lane on Yarmouth Road southbound were worn and not visible.

Enhancements:

1. Review traffic volumes and operations at the Yarmouth Road northbound approach to evaluate the appropriateness of formalizing two lanes. Repaint and maintain lane use pavement markings along Yarmouth Road southbound.



Unclear lane use on Yarmouth Road northbound

Safety Issue #3. Intersection Geometry

A. Iyannough Road (Route 28) at Yarmouth Road

Observations:

Team members noted that heavy vehicles have difficulty making left turns at the intersection due to small corner radii and the presence of vehicles that queue beyond the stop line. According to the crash data, one crash involved a tractor trailer traveling on Route 28 eastbound used the outside travel lane to make a left turn onto Yarmouth Road northbound. Another crash involved a vehicle traveling on Route 28 eastbound that attempted to turn left and hit the signal post on the northeast corner of the intersection.



Truck traveling on Route 28 westbound.

During the field observations, the team noted that the signal post was tilted slightly and the curbing was damaged. A third crash involved a motorist turning left from Route 28 eastbound that oversteered and hit a car on Yarmouth Road southbound that was queuing at the signal.

Enhancements:

1. Consider the feasibility of increasing curb radii, particularly at the northeast corner of the intersection, and/or staggering stop bar placement to allow/facilitate truck turns.
2. Consider the appropriateness of replacing the current signalized intersection with a multi-lane modern roundabout to reduce the occurrence of angle type crashes.

B. Yarmouth Road/Camp Street

Observations:

Camp Street intersects Yarmouth Road at an acute angle resulting in an awkward intersection geometry. The Camp Street northwest-bound approach consists of a single uncontrolled travel lane, where vehicles can either make a sharp left turn onto Yarmouth Road southbound or continue straight along Yarmouth Road northbound. Vehicles were also observed taking lefts onto Yarmouth Road southbound from Camp Street northwest-bound via the slip lane. The close proximity of the Yarmouth Road/Camp Street intersection to the Route 28/ Yarmouth Road intersection creates potential conflict, in that traffic coming from Yarmouth Road northbound are directed into the left lane of the northbound approach at the Route 28/Yarmouth Road intersection, while traffic coming from Camp Street northbound are directed into the right lane at the Route 28/Yarmouth Road intersection. Thus, vehicles wishing to access the other lane must at some point merge in to the other lane, which would be difficult if a queue has already formed.



Camp Street intersects Yarmouth Road at an acute angle.

Due to the acute intersection geometry, it is difficult for motorists waiting at the Yarmouth Road northbound stop line to see oncoming traffic on Camp Street northwest-bound, since they need to look over their shoulder. Meanwhile, southbound traffic from Yarmouth Road southbound continues to flow through the intersection, which Yarmouth Road northbound vehicles waiting at the stop line would not be able to see if they are looking for traffic coming from Camp Street northwest-bound.

There may also be motorist confusion about whether Camp Street northwest-bound or Yarmouth Road northbound has the right-of way at the intersection. One may consider Yarmouth Road the main roadway since the street name continues through the intersection, while Camp Street could also be considered the main roadway since it does not operate under stop control. Therefore, people may or may not use their directional signal based on their interpretation. One reported crash, which resulted in a personal injury, involved a motorist traveling on Yarmouth Road northbound that collided head-on with a vehicle traveling on Yarmouth Road southbound and turning onto Camp Street.

Queues from the right lane of the Yarmouth Road northbound approach at the intersection with Route 28 were observed to extend through the intersection of Yarmouth Road/Camp Street onto Camp Street; thus, motorists traveling along Yarmouth Road northbound that attempt to turn into this right lane often block vehicles from entering the Yarmouth Road northbound left-turn lane at Route 28. As a result, vehicles tend to use the slip lane, located approximately 65 feet upstream of

the stop line, to turn left onto Camp Street since it is easier to watch both northbound and southbound traffic and enter the right lane queue on Yarmouth Road northbound from this perspective. Another consequence of queuing on Camp Street is that motorists who wish to enter the left lane of the Yarmouth Road northbound approach at the Route 28/Yarmouth Road intersection sometimes attempt to drive around queuing vehicles in order to enter the left lane. One reported crash involved a vehicle that attempted to drive around a queued vehicle, but rear-ended that vehicle, which was then pushed into another vehicle.

One of the reported crashes between September 2009 and September 2012 involved a vehicle traveling on Camp Street northwest-bound that attempted to turn left into DJ's Family Sports Pub. It is likely that this motorist used the right-turn slip lane between Yarmouth Road and Camp Street. DJ's southern driveway is located across Yarmouth Road from this slip lane, approximately 70 feet upstream of the Yarmouth Road northbound stop line. The slip lane may also be used to access Yarmouth Road southbound from Camp Street northwest-bound. It is unclear if the slip lane is intended to be one-way or two-way as there are no pavement markings or signage dictating proper use.

Enhancements:

1. Explore the feasibility of making geometric changes, such as creating a 90 degree "T" intersection between Yarmouth Road and Camp Street, or a roundabout, to reduce conflicts, improve sightlines, reduce driver confusion, and improve overall safety. Consider emergency vehicle access/response times to Cape Cod hospital, queuing conditions along Yarmouth Road northbound at Route 28, and access to and from DJ's Family Sports Pub.
2. Consider the appropriateness of adding a dotted double yellow center line and dotted white edge lines through the Camp Street/Yarmouth Road intersection to clarify the main road from the side street.

Safety Issue #4. Signage

Observations:

The RSA team made the following observations with respect to signage:

- “Left Lane Must Turn Left” signage (R3-7) along Route 28 eastbound, located approximately 300 feet west of Yarmouth Road, is located behind a tree and is not visible to motorists.
- Route 28 eastbound guide signage for “Yarmouthport” is provided, but does not inform motorists how to get to Route 6, which is likely a primary destination for traffic on Route 28. Additional guide signage could potentially increase traffic through the intersection.
- Along Yarmouth Road northbound, guide signage for Route 28 northbound and southbound is provided on the southwest corner but is located behind a tree and is not visible. Also, no signage is provided for Route 6 along Yarmouth Road northbound.
- The “Caution Crossing Traffic” sign, located on Yarmouth Road northbound at the Dunkin Donuts/Hess driveway, is behind a shrub and not visible to motorists. The team commented that the sign seemed unnecessary, particularly since left turns out of the driveway are prohibited and may only add to motorist confusion.



Guide signs facing Yarmouth Road the northbound approach are blocked by trees.

Enhancements:

1. Relocate “Left Lane Must Turn Left” (R3-7) sign along Route 28 eastbound so that it is visible to motorists.
2. Consider improving guide signage for Route 28 eastbound to direct motorists to Route 6.
3. Trim and maintain overgrown trees along Yarmouth Road northbound to improve visibility of Route 28 guide signage.
4. Consider appropriateness for installing guide signage for Route 6 along Yarmouth Road northbound.
5. Remove “Caution Crossing Traffic” sign near Dunkin Donuts/Hess driveway to reduce sign clutter.

Safety Issue #5. Access Management

Observations:

The Dunkin Donuts/Hess site is located on the northeast corner of the intersection, and is currently provided with three access driveways, including one on Yarmouth Road, approximately 60 feet north of Route 28, that is restricted to right turns only, and two driveways on Route 28, located approximately 50 feet and 220 feet east of Yarmouth Road. During the audit, team members observed that vehicles sometimes take left turns out of the Dunkin Donuts/Hess driveways onto Route 28 eastbound (from eastern driveway) or onto Yarmouth Road southbound. According to crash data, one rear-end crash may have been the result of a motorist unexpectedly making a left turn from the Dunkin Donuts/Hess driveways onto Yarmouth Road southbound.



Slip lane between Yarmouth Road and Camp Street

Field observations indicated that there is no signage indicating that a left turn is prohibited from the eastern Dunkin Donuts/Hess driveway at the site; however, a motor vehicle would have to cross two lanes of traffic and a yellow median in order to turn left out of the driveway. No crashes were reported involving vehicles making a left-turn movement from the eastern driveway.

Enhancements:

1. Consider the appropriateness of physically precluding left turns out of Dunkin Donuts/Hess onto Yarmouth Road southbound through geometric changes and/or introduction of a median along Yarmouth Road as part of future reconstruction efforts.
2. Explore the feasibility of prohibiting left turns out of the eastern Dunkin Donuts/Hess driveway if crash experience worsens. Consider fuel delivery requirements and the impacts of restricting all left turns out of the Dunkin Donuts/Hess site.

Safety Issue #6. Railroad Crossing

Observations:

Two railroad crossings run across Route 28 approximately 65 feet and 100 feet west of Yarmouth Road, respectively. The tracks are currently primarily used by the Cape Cod Central Railroad. An audit team member stated that trains cross Route 28 approximately 6 to 8 times per day during the peak summer months.

Currently, the train must stop short of the intersection while railroad personnel manually stop traffic on Route 28 before lowering the arms. A team member commented that pre-emption for the railroad crossing was

provided, but may no longer be operational. When the arms are lowered, Route 28 eastbound traffic receives a red light from an upstream signal, which otherwise flashes yellow; however, no signal indications are provided for Route 28 westbound. Meanwhile, the traffic signal at Route 28/Yarmouth Road is not coordinated with the railroad crossing. Thus, vehicles continue to enter the intersection when trains are crossing, resulting in queues that block the intersection. Public safety officials noted that they have extreme difficulty getting through the intersection from Yarmouth Road when trains are crossing.



Railroad tracks across west leg of Route 28

Team members also noted that the number of train crossings may increase in the future with the anticipated reintroduction of passenger rail service on the Cape.

Enhancements:

1. Consider the feasibility of providing preemption for the railroad crossing and ways to coordinate Route 28/Yarmouth Road signal to reduce/eliminate queuing within the intersection and to improve emergency vehicle response time.
2. Consider the appropriateness of adding “Do Not Block Intersection” signage and appropriate pavement markings at Route 28/Yarmouth Road to discourage motorists from blocking the intersection during train crossings.
3. Consider the long-term feasibility of creating grade separation between Route 28 and the railroad crossings

Safety Issue #7. Signal Indications

Observations:

The Yarmouth Road northbound approach is provided with two post-mounted signal indications located on the northeast corner of the intersection. During field observations, the team noted that the visibility of the signal indications is easily blocked when large trucks are present in the Yarmouth Road northbound queue or turning at the intersection. Similarly, a team member commented that the signal indications along Route 28 westbound are also easily blocked by large trucks and that their visibility is further reduced by the horizontal curvature of Route 28 combined with overgrown trees on the north side of the roadway.



No overhead signal indications facing the Yarmouth Road northbound approach.

Lastly, the team noted that solar glare can be a safety issue during the mornings and evenings, since backplates are not provided on any of the signal indications, particularly on Route 28, which runs east-west within the study area. Solar glare was cited as a contributing factor in one of the reported crashes, which involved a vehicle traveling eastbound on Route 28 that struck an ambulance, which had its lights and siren on, traveling southbound on Yarmouth Road.

Enhancements:

1. Evaluate the visibility of the signal indications as part of the design process to ensure that it meets current Manual on Uniform Traffic Control Devices (MUTCD) standards. Relocate signal heads, and/or install additional overhead and/or post-mounted signal indications as appropriate to improve visibility.
2. Consider the appropriateness of installing backplates on all traffic signal indications to reduce solar glare.
3. Trim overgrown trees to improve visibility of the signal indications.

Safety Issue #8. Limited Bicycle Accommodations

Observations:

No bicycle provisions are currently provided at the intersection of Route 28/Yarmouth Road. Route 28 has a narrow shoulder upstream and downstream of the intersection; however, cyclists generally must travel in mixed traffic.

While no crashes involving cyclists were reported between September 2009 and September 2012, team members noted a fairly substantial level of cyclist activity at the intersection during the field visit.



Bicycle accommodations are limited at the intersection.

Lastly, the Cape Cod Commission (CCC) is currently undergoing the *Willow Street/Yarmouth Road Shared Use Path Study* that is exploring the feasibility of a shared use path along the west side of Willow Street and Yarmouth Road that would connect the proposed extension of the Cape Cod Rail Trail.

Enhancements:

1. Consider the feasibility/appropriateness of providing bicycle accommodations at the intersection (i.e., shared lanes and/or within a 4-foot shoulder, bicycle detection at signals, signage, and pavement markings) in accordance with the *2006 Project Development and Design Guide*.
2. As part of the design process and long-term planning efforts, include a Route 28 bicycle/pedestrian crossing to connect the future extension of the Cape Cod Rail Trail through the intersection.

Safety Issue #9. Limited Pedestrian Accommodations

Observations:

The intersection of Route 28/Yarmouth Road has limited pedestrian facilities. Sidewalks are currently provided along both sides of Yarmouth Road north of Route 28, and adjacent to the Dunkin Donuts/Hess station on the north side of Route 28 only. There are also sidewalks provided on both sides of Camp Street and on the east side of Yarmouth Road, south of Camp Street; however, these sidewalks do not provide a connection to Route 28.

Crosswalks, pedestrian ramps, and pedestrian indications are not provided at the intersection.

While conducting the audit, the team observed a moderate level of pedestrian activity along the study area roadways and crossing between gaps in the passing traffic stream. One crash was reported to have involved a pedestrian crossing in the vicinity of the railroad crossing; however, the pedestrian was not found.



Pedestrian running across Route 28.

Enhancements:

1. Evaluate the feasibility and safety benefits of providing pedestrian accommodations at the Route 28/Yarmouth Road intersection, including crosswalks, accessible ramps, and pedestrian signal indications, and providing a connection between the intersection and the existing sidewalks on Camp Street and Yarmouth Road south of Route 28.

Safety Issue #10. Emergency Vehicles

Observations:

Audit team members noted that there is currently no emergency vehicle preemption system at the intersection of Route 28/Yarmouth Road, despite the high volume of ambulances that use the intersection to access Cape Cod Hospital. Three (7%) of the 45 crashes reported at the intersection between September 2009 and September 2012 involved an emergency vehicle. Two of these crashes involved ambulances. One crash occurred when an ambulance traveling on Yarmouth Road southbound was struck by a driver traveling on Route 28 eastbound, who could not see the ambulance due to solar glare. Another occurred when a car traveling on Route 28 eastbound stopped for an ambulance traveling on Yarmouth Road southbound and was rear-ended by another vehicle. The third crash involved a police vehicle attempting to navigate through the intersection.



The study area experiences frequent ambulance traffic.

A team member noted that ambulances traveling on Yarmouth Road southbound often have trouble seeing Route 28 eastbound through traffic due to queues in the Route 28 eastbound left-turn lane.

Enhancements:

1. Provide Opticom detection at the intersection of Route 28/Yarmouth Road to improve emergency vehicle response times.

Recommendations

Based on its review of data, on-site field observations and group discussion, the RSA team identified the following possible enhancements that could improve safety at the intersection of Iyannough Road (Route 28)/Yarmouth Road in the Town of Barnstable. Further study and design work will need to be conducted to determine the feasibility of making some of the improvements.

Short-term enhancements include:

- Review and adjust clearance intervals;
- Improve signage;
- Enforce red light running; and
- Define lane groups with pavement markings and signage.

To enhance the safety of the intersection, the *long-term enhancements* are to:

- Improve traffic operations to reduce driver frustration;
- Improve intersection geometry at Yarmouth Road/Camp Street and at Route 28/Yarmouth Road;
- Improve traffic control/coordination for railroad crossing;
- Improve visibility of traffic signal indications;
- Provide emergency vehicle preemption;
- Evaluate driveway access near intersection;
- Improve bicycles conditions; and
- Improve pedestrian conditions.

Table 2 summarizes these safety issues, possible enhancements, estimated safety payoff, time frame, cost, and responsibility. Safety payoff estimates are based on engineering judgment and are categorized as low, medium, and high. The time frame is categorized as short-term (<1 year), mid-term (1 to 3 years), or long-term (typically >3 years). Long-term improvements are typically considered to be substantial improvements with an expected time frame for implementation greater than 3 years. The costs are categorized as low (<\$10,000), medium (\$10,001 to \$50,000), or high (>\$50,000).

It is the responsibility of MassDOT to ensure that the designer incorporates the relevant safety enhancements identified as part of this RSA. The RSA is intended to identify potential safety improvements that can be evaluated and included as part of the design process for the reconstruction. The short-term, low-cost potential improvements could be considered by the responsible agency for immediate implementation, as appropriate.

Table 2. Summary of Potential Safety Enhancements

Safety Issue	Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Party
Congestion	Consider the feasibility of improving traffic signal operations (e.g. traffic signal improvements, signal phasing changes, roadway widening, lane use modifications, etc.) to reduce queuing conditions and motorist frustration.	High	Long-term	High	MassDOT
	Consider the appropriateness and safety benefits of providing a protected left-turn signal phase for Yarmouth Road northbound.	Medium	Long-term	High	MassDOT
	Enforce red light running violations where possible.	Medium	Short-term	Low	Town of Barnstable
	Review, and adjust as necessary, clearance intervals per current standards in an effort to reduce rear-end and angle-type crashes.	Medium	Short-term	Low	MassDOT
Unclear Lane Use	Review traffic volumes and operations at the Yarmouth Road northbound approach to evaluate the appropriateness of formalizing two lanes.	Medium	Short-term	Low	MassDOT
	Repaint and maintain lane use pavement markings along Yarmouth Road southbound.	Low	Short-term	Low	MassDOT

Table 2. Summary of Potential Safety Enhancements (continued)

Safety Issue	Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Party
Intersection Geometry	Consider the feasibility of increasing curb radii, particularly at the northeast corner of the intersection, and/or staggering stop bar placement to allow/facilitate truck turns.	Medium	Long-term	High	MassDOT
	Consider the appropriateness of replacing the current signalized intersection with a multi-lane modern roundabout to reduce the occurrence of angle type crashes	Medium	Long-term	High	MassDOT
	Explore the feasibility of making geometric changes, such as creating a 90 degree "T" intersection between Yarmouth Road and Camp Street, or a roundabout, to reduce conflicts, improve sightlines, reduce driver confusion, and improve overall safety. Consider emergency vehicle access/response times to Cape Cod hospital, queuing conditions along Yarmouth Road northbound at Route 28, and access to and from DJ's Family Sports Pub.	Medium	Long-term	High	MassDOT
	Consider the appropriateness of adding a dotted double yellow center line and dotted white edge lines through the Camp Street/Yarmouth Road intersection to clarify the main road from the side street.	Medium	Short-term	Low	MassDOT

Table 2. Summary of Potential Safety Enhancements (continued)

Safety Issue	Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Party
Signage	Relocate “Left Lane Must Turn Left” (R3-7) sign along Route 28 eastbound so that it is visible to motorists.	Low	Short-term	Low	MassDOT
	Consider improving guide signage for Route 28 eastbound to direct motorists to Route 6.	Low	Long-term	Low	MassDOT
	Trim and maintain overgrown trees along Yarmouth Road northbound to improve visibility of Route 28 guide signage.	Low	Short-term	Low	MassDOT
	Consider appropriateness for installing guide signage for Route 6 along Yarmouth Road northbound.	Low	Long-term	Low	MassDOT
	Remove “Caution Crossing Traffic” sign near Dunkin Donuts/Hess driveway to reduce sign clutter.	Low	Short-term	Low	MassDOT
Access Management	Consider the appropriateness of physically precluding left turns out of Dunkin Donuts/Hess onto Yarmouth Road southbound through geometric changes and/or introduction of a median along Yarmouth Road as part of future reconstruction efforts.	Medium	Long-term	High	MassDOT
	Explore the feasibility of prohibiting left turns out of the eastern Dunkin Donuts/Hess driveway if crash experience worsens. Consider fuel delivery requirements and the impacts of restricting all left turns out of the Dunkin Donuts/Hess site.	Low	Short-term	Low	MassDOT

Table 2. Summary of Potential Safety Enhancements (continued)

Safety Issue	Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Party
Railroad Crossing	Consider the feasibility of providing preemption for the railroad crossing and ways to coordinate Route 28/Yarmouth Road signal to reduce/eliminate queuing within the intersection and to improve emergency vehicle response time.	Low	Short-term	Low	MassDOT
	Consider the appropriateness of adding "Do Not Block Intersection" signage and appropriate pavement markings at Route 28/Yarmouth Road to discourage motorists from blocking the intersection during train crossings.	Medium	Short-term	Low	MassDOT
	Consider the long-term feasibility of creating grade separation between Route 28 and the railroad crossings.	Medium	Long-term	High	MassDOT
Signal Indications	Evaluate the visibility of the signal indications as part of the design process to ensure that it meets current Manual on Uniform Traffic Control Devices (MUTCD) standards. Relocate signal heads, and/or install additional overhead and/or post-mounted signal indications as appropriate to improve visibility.	High	Long-term	High	MassDOT
	Consider the appropriateness of installing backplates on all traffic signal indications to reduce solar glare.	Medium	Short-term	Low	MassDOT
	Trim overgrown trees to improve visibility of the signal indications.	Low	Short-term	Low	MassDOT
Limited Bicycle Accommodations	Consider the feasibility of providing preemption for the railroad crossing and ways to coordinate Route 28/Yarmouth Road signal to reduce/eliminate queuing within the intersection and to improve emergency vehicle response time.	Low	Short-term	Low	MassDOT
	Consider the feasibility/appropriateness of providing bicycle accommodations at the intersection (i.e., shared lanes and/or within a 4-foot shoulder, bicycle detection at signals, signage, and pavement markings) in accordance with the <i>2006 Project Development and Design Guide</i> .	High	Long-term	High	MassDOT
	As part of the design process and long-term planning efforts, include a Route 28 bicycle/pedestrian crossing to connect the future extension of the Cape Cod Rail Trail through the intersection.	High	Long-term	High	MassDOT

Table 2. Summary of Potential Safety Enhancements (continued)

Safety Issue	Safety Enhancement	Safety Payoff	Time Frame	Cost	Responsible Party
Limited Pedestrian Accommodations	Evaluate the feasibility and safety benefits of providing pedestrian accommodations at the Route 28/Yarmouth Road intersection, including crosswalks, accessible ramps, and pedestrian signal indications, and providing a connection between the intersection and the existing sidewalks on Camp Street and Yarmouth Road south of Route 28.	High	Long-term	High	MassDOT
Emergency Vehicles	Consider the feasibility of providing preemption for the railroad crossing and ways to coordinate Route 28/Yarmouth Road signal to reduce/eliminate queuing within the intersection and to improve emergency vehicle response time.	Medium	Long-term	High	MassDOT
	Provide Opticom detection at the intersection of Route 28/Yarmouth Road to improve emergency vehicle response times.	Medium	Long-term	Low	MassDOT

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



CAPE COD
COMMISSION

Road Safety Audit (RSA) Meeting

BARNSTABLE, ROUTE 28 at YARMOUTH ROAD

Friday, September 28, 2012

1:00 p.m. – 3:00 p.m.

Location: Barnstable Department of Public Works Conference Room
382 Falmouth Road (Route 28), Hyannis, MA 02601

1:00 p.m. Welcome and Introductions

1:10 p.m. Review of Site Specific Material

- Crash and Traffic Volume Summaries– provided in advance
- 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 / Completion of RSA

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

3:00 p.m. Adjourn for the Day

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 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 in October 2012.

Appendix B. RSA Audit Team Contact List

Participating Audit Team Members

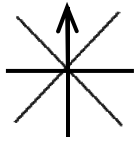
Date: Friday, September 28, 2012

Location: Barnstable DPW, 328 Falmouth Street, Barnstable, MA

Audit Team Members	Agency/Affiliation	E-mail Address	Phone Number
JoAnne Miller Buntich	Town of Barnstable Growth Management	joanne.buntich@town.barnstable.ma.us	508-862-4735
Roger Parsons	Town of Barnstable DPW	roger.parsons@town.barnstable.ma.us	508-790-6302
Steve Seymour	Town of Barnstable Growth Management	steve.seymour@town.barnstable.ma.us	508-862-4086
Steven Tupper	Cape Cod Commission	stupper@capecodcommission.org	508-328-3828
Edward C. Feeney	MassDOT District 5 Traffic Operations	Edward.feeney@state.ma.us	508-884-4242
Tom Currier	MassDOT Project Management	Thomas.currier@dot.state.ma.us	857-368-9348
Pamela Haznar	MassDOT District 5	Pamela.Haznar@state.ma.us	508-884-4239
Priscilla Leclerc	Cape Cod Commission	pleclerc@capecodcommission.org	508-362-3828
Corey O'Connor	MassDOT Highway Safety	corey.oconnor@state.ma.us	857-368-9638
Dean Melanson	Hyannis Fire	dmelanson@hyannisfire.org	508-775-1300
Lenny Velichansky	TranSystems	lavelichansky@transystems.com	857-453-5456
Barbara Lachance	MassDOT District 5 Traffic Operations	Barbara.lachance@dot.state.ma.us	508-884-4260
Lisa Schletzbaum	MassDOT, Highway Division	lisa.schletzbaum@state.ma.us	857 368-9634
Joe SanClemente	Howard/Stein-Hudson (HSH)	jsanclemente@hshassoc.com	617-348-3334
Mike Tremblay	Howard/Stein-Hudson (HSH)	mtremblay@hshassociates.com	617-348-3347

Appendix C. Detailed Crash Data

Collision Diagram



KAM

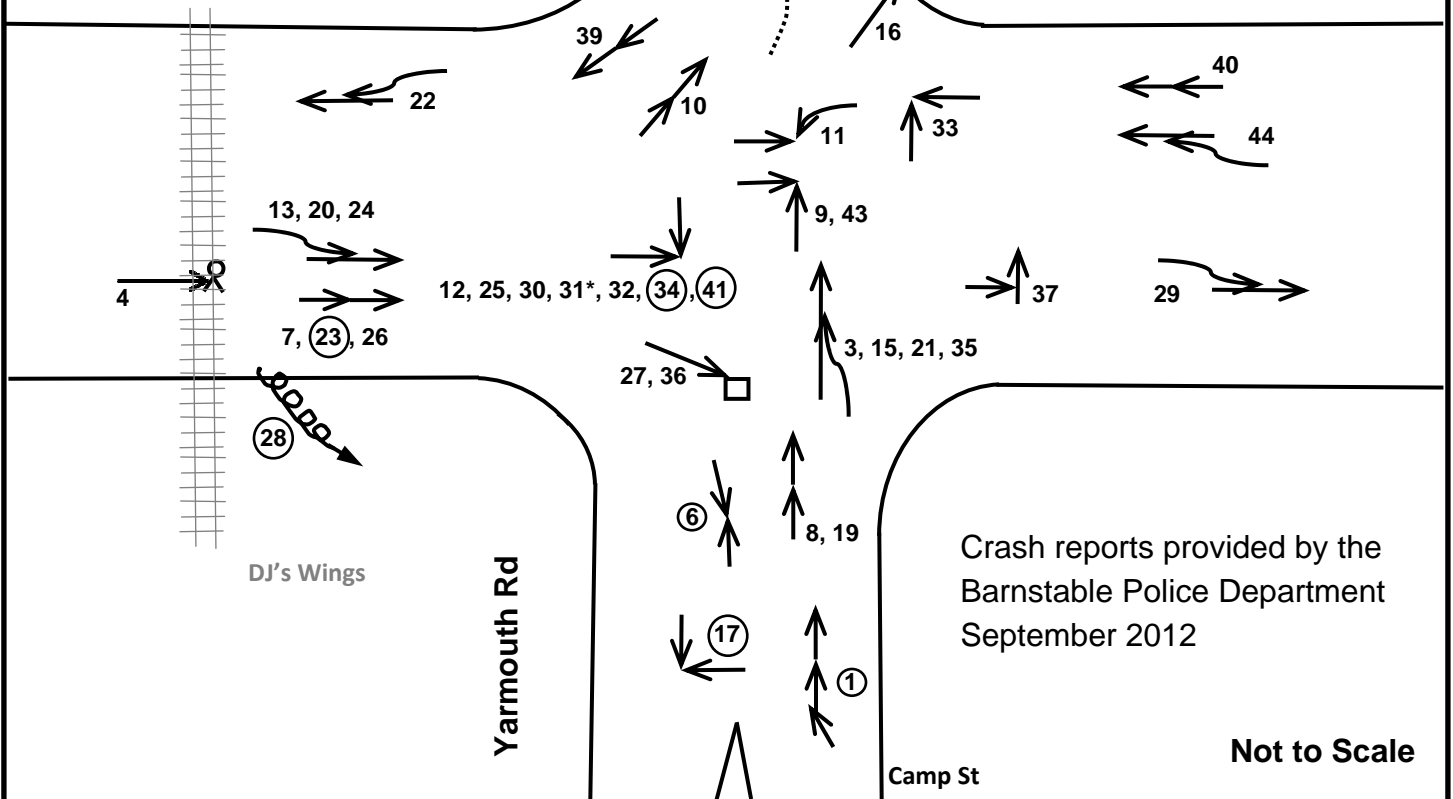
Indicate North by arrow

Route 28 (Iyannough Rd.)



Dunkin' Donuts and gas station

CAPE COD COMMISSION



Crash reports provided by the Barnstable Police Department September 2012

Not to Scale

SYMBOLS	TYPES OF COLLISIONS	ACCIDENT INFORMATION
<ul style="list-style-type: none"> Moving Vehicle Backing Vehicle Non-involved Vehicle Pedestrian Bicyclist Parked Vehicle Fixed Object Fatal Crash Injury Crash Vehicle Path 	<ul style="list-style-type: none"> Rear-End Head On Side Swipe Out of Control Turning Movement Angle Lane Departure Animal 	<p>Each crash number corresponds to the number on the summary list of crashes.</p> <p>Notes: Crash #31 involved a third vehicle (V3) that was stopped at the signal NB on Yarmouth Road; V1 hit V2 pushing V2 into V3. V3 is not shown in this diagram.</p> <p>Equivalent Property Damage Only = 73</p>

INTERSECTION Route 28 (Iyannough Road) AND Yarmouth Road **Town of Barnstable**

CRASHES FROM 9/1/2009 TO 9/13/2012

Road Safety Audit Crash Summary

Crash Diagram Reference Number	Crash Date	Day	Crash Time	# of Vehicles	# of injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Vehicle Sequence of Events	Age of Driver - Vehicle 1	Age of Driver - Vehicle 2	Road Surface	Weather	Driver Contributing Code
1	9/1/2009	Tuesday	4:33 PM	3	1	Angle (Rear-end)	V3 slowing or stopped V2 slowing or stopped at red traffic signal V4 changing lanes	V1: N V2: N V3: N	V3 stopped at red signal R lane; V2 slowing in L lane V1 attempts move in front of V2 who then hits V1 into V3	26	26	dry	clear	V1 10 reckless erratic
2	9/17/2009	Thursday	5:26 PM	2	0	Angle	V1 traveling straight V2 entering travel lane	V1: S V2: S	V2 entering lane in slow traffic V1 continued to move forward hitting V2	72	39	dry	cloudy	V1 97 Other improper action V2 99 unknown
3	10/12/2009	Monday	11:02 AM	2	0	Sideswipe same dir	V1 traveling straight V2 traveling straight	V1: N V2: N	Both veh stopped at the signal, light changed V1 and V2 move forward and collide	60	37	dry	clear	V1 99 unknown (motorcycle) V2 99 unknown
4	10/19/2009	Monday	7:29 PM	1	0	Head on (single veh crash)	V1 traveling straight (near RR tracks)	V1: E (ped)	Driver reported as approaching the signal, person in dark clothing walked right in front of her car (windshield smashed - no ped)	26		dry	clear	V1 99 unknown (windshield smashed)
5	10/20/2009	Tuesday	12:02 PM	2	0	Rear-end	V1 slowing or stopped V2 turning left	V1: N V2: N	V1 stopped behind 3rd veh letting car turn into gas/DD, and V2 rear-ends V1	47	32	dry	clear	V2 19 inattention
6	10/24/2009	Saturday	11:01 PM	2	1	Angle (Head on)	V1 traveling straight V2 traveling straight	V1: S V2: N	V1 on Yarmouth Road headed toward hospital from Rte. 28 when V2 plowed into them traveling from Main St.	23	25	dry	clear	V2 4 failed to yield ROW
7	11/24/2009	Tuesday	12:36 PM	2	0	Rear-end	V1 traveling straight V2 slowing or stopped	V1: E V2: E	V2 stopped due to ambulance going thru intersection towards hospital and hit by V1	42	77	wet	cloudy rain	V1 5 followed too closely
8	11/24/2009	Tuesday	5:21 PM	2	0	Rear-end	V1 traveling straight V2 slowing or stopped	V1: N V2: N	3rd veh slows/stops suddenly to left, and V2 stops; V1 rear-ends V2	23	61	wet	rain	V1 11 swerving avoiding...
9	12/3/2009	Thursday	5:57 PM	2	0	Angle	V1 traveling straight V2 entering lane	V1: N V2: E	V1 Yarm Rd NB hit by V2 (Rte 28 EB) in middle of intersection (V2 thru red signal)	34	67	dry	clear	V2 3 Disregarded traffic signs, signals, rd markings
10	12/17/2009	Thursday	5:05 PM	2	0	Angle	V1 turning left V2 turning left	V1: E V2: E	V1 turning left from LT lane; V2 in middle lane goes around V1 attempting LT cutting off V1; V1 hits trailer of V2	52	29	dry	clear	V2 6 made an improper turn
11	1/7/2010	Thursday	5:18 PM	2	0	Sideswipe opp dir	V1 traveling straight V2 turning left	V1: E V2: W to S illegal turn	V1 EB and V2 WB suddenly turns left and vehicles collide	19	30	dry	cloudy	V2 6 made an improper turn
12	2/12/2010	Friday	4:17 PM	2	0	Angle	V1 traveling straight V2 traveling straight	V1: S V2: E	V1 SB from Yarmouth Rd, as yellow signal turns red, and V2 Rte 28 EB w green light collide	23	56	dry	clear	V1 4 failed to yield ROW V2 99 unk
13	2/16/2010	Tuesday	8:41 AM	2	0	Sideswipe same dir	V1 turning left V2 traveling straight	V1: E V2: E	V1 truck w trailer swung right to navigate the LT and hit V2	42	30	dry	clear	V1 97 Other improper action V2 1 no improper driving
14	3/8/2010	Monday	7:13 AM	2	0	Angle	V1 turning left V2 slowing or stopped	V1: S V2: E	V1 turning left into Dunkin' Donuts driveway hits V2 waiting to ext site	54	25	dry	clear	V1 19 inattention

Road Safety Audit Crash Summary

Crash Diagram Reference Number	Crash Date	Day	Crash Time	# of Vehicles	# of injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Vehicle Sequence of Events	Age of Driver - Vehicle 1	Age of Driver - Vehicle 2	Road Surface	Weather	Driver Contributing Code
15	5/6/2010	Thursday	9:38 AM	2	0	Angle (Sideswipe same dir)	V1 traveling straight V2 traveling straight	V1: N V2: N	V1 and V2 NB at the signal; signal turns green and both proceed and collide	53	85	dry	clear	V2 4 failed to yield ROW
16	5/26/2010	Wednesday	10:10 PM	1	0	single veh crash	V1 turning left	V1: E to N	V1 Rte 28 EB attempted LT to Yarmouth Road and hits signal post	29		dry	clear	V1 9 Failure to keep in proper lane
17	7/4/2010	Sunday	4:03 PM	2	1	Angle	V1 traveling straight V2 turning left	V1: E V2: W	V2 NB from Camp St attempts LT into Djs Wings and hits V1 Yarmouth Rd SB	50	46	dry	clear	V1 1 no improper driving
18	7/14/2010	Wednesday	4:42 PM	2	0	Angle	V1 turning left V2 traveling straight	V1: S V2: E	V1 Rte 28 WB turning left into Pufferbellies (waved on by stopped vehicle driver) hit be V2 traveling Rte 28 EB	47	45	wet	cloudy rain	V1 4 failed to yield ROW V2 no improper driving
19	7/22/2010	Thursday	2:49 PM	2	0	Rear-end	V1 traveling straight V2 traveling straight	V1: N V2: N	Both veh NB in traffic and V1 rear ended V2	38	58	unknown	clear	V1 5 followed too closely
20	8/5/2010	Thursday	10:10 PM	2	0	Sideswipe same dir	V1 traveling straight V2 changing lanes	V1: E V2: E	V2 in L lane at signal but wants to go straight; V2 moves toward the right hitting V1 in the next lane	20	18	dry	clear	V2 9 Failure to keep in proper lane
21	9/8/2010	Wednesday	4:45 PM	2	0	Sideswipe same dir	V1 traveling straight V2 traveling straight	V1: V2: N	Red Pkup truck at signal to left of semi-trailer pulled out in front hitting front of semi-t and took off without stopping	unk	72	dry	clear	V2 1 no improper driving
22	9/18/2010	Saturday	5:21 PM	2	0	Sideswipe same dir	V1 overtaking passing V2 V2 traveling straight	V1: W V2: W	V1 and V2 both at signal going straight, and V2 pulls in front hitting bumper of V1	46	19	dry	clear	V1 cited for improper passing
23	11/15/2010	Monday	3:03 PM	2	2	Rear-end	V1 traveling straight V2 slowing or stopped	V1: E V2: E	V2 Rte 28 EB at signal; V1 rear-ends V2 in heavy traffic	72	81	dry	cloudy	V1 5 followed too closely
24	12/3/2010	Friday	6:06 PM	2	0	Sideswipe same dir	V1 traveling straight V2 leaving traffic lane	V1: E V2: E	V1 sideswiped in front by V2 moving in front of V1 in merge area; then V2 took off (Dennis Police apprehend)	63	43	dry	clear	V2 97 Other improper action
25	12/23/2010	Thursday	6:53 AM	2	0	Angle	V1 slowing or stopped V2 traveling straight	V1: E V2: S	V1 Rte 28 EB cannot stop in snow and hits V2 Yarmouth Road SB	43	22	snow	snow	V1 7 Driving too fast for conditions
26	4/10/2011	Sunday	6:58 PM	3	0	Rear-end	V1 traveling straight V2 slowing or stopped	V1: E V2: E	V1 hit V2 at red signal then V1 hit third vehicle as he pulls into the parking lot	26	31	dry	clear	V1 7 Driving too fast for conditions & 14 physical impairment
27	6/23/2011	Thursday	1:23 AM	1	0	single veh crash	V1 traveling straight	V1: E	V1 driver distracted by passengers and hits pole taking pole down	19		wet	rain	V1 19 inattention & 20 distracted
28	6/27/2011	Monday	3:44 AM	1	1	single veh crash	V1 traveling straight	V1: E	V1 high speed out of control ran off road and rolled over	34		dry	clear	V1 2 exceeded authorized speed

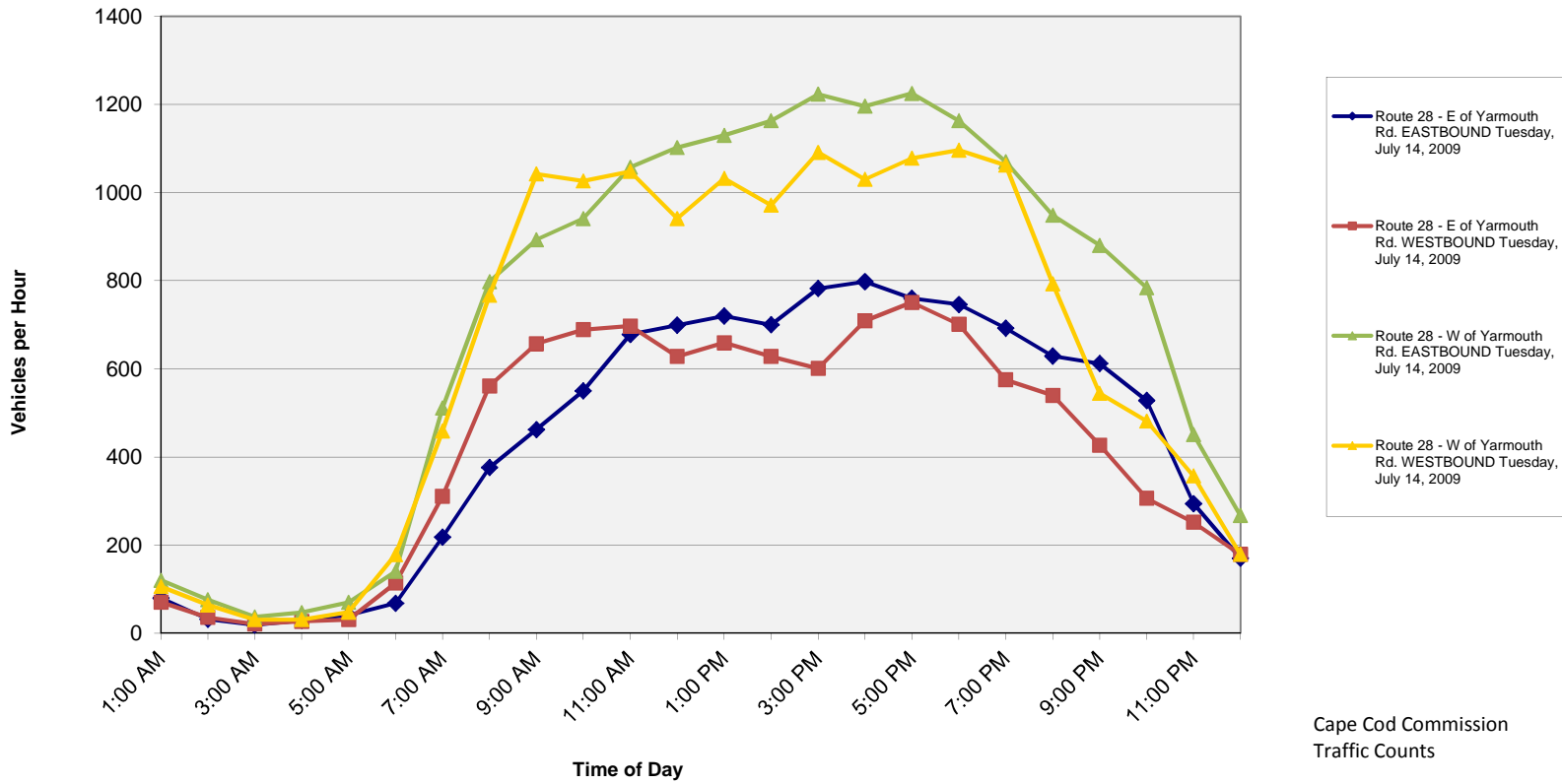
Road Safety Audit Crash Summary

Crash Diagram Reference Number	Crash Date	Day	Crash Time	# of Vehicles	# of injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Vehicle Sequence of Events	Age of Driver - Vehicle 1	Age of Driver - Vehicle 2	Road Surface	Weather	Driver Contributing Code
29	7/1/2011	Friday	11:26 AM	2	0	Angle (Sideswipe same dir)	V1 traveling straight V2 traveling straight	V1: E V2: E	V1 in L lane; V2 in R lane; collide at merge resulting in V1 going on traffic island	46	57	dry	clear	V1 99 unk V2 99 unk
30	8/25/2011	Thursday	12:46 PM	2	0	Angle	V1 traveling straight V2 traveling straight	V1: E V2: S	V2 YarmRd SB in traffic unable to clear intersection before opposing green signal Rte 28 and hits V1	59	68	dry	clear	V2 3 Disregard s, s, rd mrkngs & 4 failed to yield ROW
31	8/26/2011	Friday	10:48 AM	3	0	Angle	V1 traveling straight V2 traveling straight	V1: S V2: E V3: N	V3 stopped NB at signal; V2 traveling Rte 28 EB; V1 SB (running red signal) V1 hits V2 pushing V2 into V3	53	20	dry	clear	V1 3 Disregard traffic signs, signals, rd mrkngs
32	8/29/2011	Monday	9:52 AM	2	0	Rear-end (Angle)	V1 traveling straight V2 entering travel lane	V1: E V2: S	(power outage traffic signals flashing) V1 28 EB green flashing V2 YarmRd SB stopped and then proceeded V1 hits V2	31	52	dry	clear	V2 4 failed to yield ROW
33	8/29/2011	Monday	12:00 PM	2	0	Rear-end (Angle)	V1 turning left V2 traveling straight	V1: N V2: W	(power outage traffic signals flashing) V1 28 EB from middle lane turns left hitting V2 WB on Rte 28	28	46	dry	clear	V1 3 Disregard s, s, rd mrkngs & 6 made an improper turn
34	10/25/2011	Tuesday	5:52 PM	2	1	Angle	V1 traveling straight V2 traveling straight	V1: S V2: E	V2 Rte 28 EB turning right onto Yarmouth Rd SB hit by V1 Yarmouth Rd SB	30	35	dry	clear	V1 99 unk V2 99 unk (officer finds vchs parked at DJs)
35	10/28/2011	Friday	11:32 PM	2	0	Sideswipe same dir	V1 trav straight R lane V2 trav straight L lane	V1: N V2: N	V1 and V2 collide as both attempt to go north on Yarmouth Road	63	22	dry	clear	V1 99 unk V2 99 unk (officer finds vchs parked at KAM)
36	11/10/2011	Thursday	10:39 PM	1	0	single veh crash	V1 traveling straight	V1: E	V1 Rte 28 EB went over islands taking down all signs & damaging curbing, then continues EB to the island at Yarmouth Rd with more damage to	30		wet	rain	V1 10 reckless erratic
37	12/7/2011	Wednesday	9:41 AM	2	0	Angle	V1 traveling straight V2 traveling straight	V1: N V2: E	V1 Yarm Rd NB hit by unidentified grey truck on V1 bumper then grey truck continues thru the intersection Rte 28 EB	57		wet	cloudy	
38	12/23/2011	Friday	9:10 AM	2	0	Rear-end	V1 slowing or stopped V2 slowing or stopped	V1: S V2: S	V1 tried to stop but not in time and rear-ends V2	21	58	wet	cloudy	V1 5 followed too closely
39	1/21/2012	Saturday	11:50 AM	2	0	Rear-end	V1 turning right V2 turning right	V1: S to W V2: S to W	V1 behind V2 turning right from Yarmouth Road to Rte 28 WB and skidded on snowy roadway hitting V2	28	49	snow	snow	V1 5 followed too closely
40	4/19/2012	Thursday	11:38 AM	2	0	Angle (Rear-end)	V1 slowing or stopped V2 turning right	V1: W V2: W	V1 stopped Rte 28 WB at red signal, and V2 pulled out of Dunkin' Donuts and hit V1	64	24	dry	clear	V2 10 reckless erratic
41	5/7/2012	Monday	8:24 AM	2	3	Sideswipe opp dir (Angle)	V1 traveling straight V2 traveling straight	V1: S V2: E	V1 (Ambulance w lights & siren on) proceeding south thru intersection is hit by V2	25	50	dry	clear	V2 13 glare & 97 Other improper action

Road Safety Audit Crash Summary

Crash Diagram Reference Number	Crash Date	Day	Crash Time	# of Vehicles	# of injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Vehicle Sequence of Events	Age of Driver - Vehicle 1	Age of Driver - Vehicle 2	Road Surface	Weather	Driver Contributing Code
42	5/25/2012	Friday	10:10 PM	2	0	Angle	V1 turning left V2 slowing or stopped	V1: E V2: S	V2 stopped at signal SB YarmRd; V1 turning left from Rte 28 EB to N on YarmRd oversteers and runs into V2	53	53	dry	cloudy	V1 9 Failure to keep in proper lane
43	6/23/2012	Saturday	3:08 PM	2	0	Angle	V1 traveling straight V2 traveling straight	V1: E V2: N	V1 going thru intersection as signal turns red and hit by V2 who is proceeding with the green light	79	27	dry	clear	V1 19 inattention
44	8/14/2012	Tuesday	3:41 PM	2	0	Sideswipe same dir	V1 slowing or stopped V2 overtaking passing	V1: W V2: W	V2 (unmarked police veh w blue light & siren on) thought enough room to get by but sideswipes V1	27	48	dry	clear	1 no improper driving
45	8/30/2012	Thursday	12:59 PM	2	0	Rear-end	V1 slowing or stopped V2 slowing or stopped	V1: N V2: N	V1 stopped in traffic NB and rear-ended by V2 (Officer observed brak fluid leaking from V2)	60	49	dry	clear	V2 22 Operating defective equipment

Barnstable Route 28 near Yarmouth Road, Hourly Traffic Volumes by Direction



Cape Cod Commission
Traffic Counts

Appendix D. Speed Regulations

SPEED REGS

Barnstable Route 28

ROUTE 28 roughly by Google Earth
 Bams/Yarm TL To Ost-WB Rd 6.63
 Bams/Mashpee TL To Ost-WB Rd 3.88

speed regs	WESTBOUND	speed	EASTBOUND	speed				
Route 28 vicinity of Yarmouth Rd	0.90	35	0.90	35	10.36			
	0.17	25	0.17	25	9.46			
	0.50	40	0.50	35	9.29		35	326-B
	0.19	35	0.17	35	8.79		35	326-B
	0.47	45	0.49	45	8.62		45	
	1.08	50	1.08	45	8.13		50	326-F
	0.19	40	0.19	40	7.05		40	326-H
	0.66	50	0.66	45	6.86		60	326-D
	0.25	40	0.25	40	6.21		40	326-D
	2.05	50	2.05	50	5.96		50	
Route 28 vicinity of Ost-WB Rd	0.16	45	0.16	45	3.91		45	
	1.00	50	1.00	50	3.75		50	
	0.25	45	0.25	45	2.75		45	
	1.43	50	1.45	50	2.50		50	
	0.40	40	0.38	40	1.05		40	
	0.27	35	0.27	35	0.67		35	
to / from Mashpee TL	0.40	50	0.40	50	0.40		50	
	10.37		10.36					