Cape Cod

RTP 2007

2007 Regional Transportation Plan

Chapter 3

Safety

April 2007

Prepared by CAPE COD COMMISSION Transportation Staff
on behalf of the

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

:

Massachusetts Executive Office of Transportation
Massachusetts Highway Department
Cape Cod Regional Transit Authority
Cape Cod Commission
Barnstable County
Town of Barnstable
Towns of Bourne, Sandwich, Falmouth, and Mashpee
Towns of Yarmouth, Dennis, Harwich, Brewster, and Chatham
Towns of Orleans, Eastham, Wellfleet, Truro, and Provincetown

in cooperation with:
Massachusetts Department of Environmental Protection
United States Department of Transportation Federal Highway Administration
United States Department of Transportation Federal Transit Administration

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3 Safety

The concern over safety is made clear in the first goal of the Regional Transportation Plan:

> "Create a transportation system that provides safe travel options for people and freight, and protects users from natural and external threats."

Transportation users have a right to a transportation system where their person and possessions will arrive at their destinations unharmed and undamaged. Moreover, protecting the value of freight traveling over the transportation network is essential to the economy of Cape Cod. Therefore, it is important that transportation infrastructure be designed to minimize the possibility of hazardous situations or accidents. Existing traffic laws must also be enforced to prevent the improper use of the transportation system. For all of these reasons, the 2007 Regional Transportation Plan sets the goal of providing safety for people and goods.

This chapter includes sections describing the seasonal and year-round issues affecting traffic safety including a description of the Cape demographics and some information about how they will change over time.

3.1 Safety Problem Areas

During the public process for this plan a comment form was distributed. One of the questions asked was "*Please list the top three areas within your town that you feel have the worst local safety problems*." The responses were reviewed and the following is a list of the top two locations in each town indicated as safety problems:

Table 3-1 - RTP Safety Problem Areas (from public comment form)

Town	Top Two (per town)	Safety Problem Areas
Barnstable	Airport Rotary	Rte 132/Shoot Flying Hill Rd
Bourne	Canal Area	MacArthur Blvd - Lefts
Brewster	Rte 6A/Millstone	Rte 6A/Underpass
Dennis	Rte 28/School St	Rte 28 - Dennis/Harwich TL
Eastham	Rte 6/Brackett Rd	Rte 6/Governor Prence Rd
Falmouth	Rte 28 - Downtown	Teaticket Post Office
Harwich	Rts 124 & 137 @ Rt 6 ramps	Rte 39/Rte 137
Mashpee	Mashpee Rotary/Rte 151	Rte 28 Mashpee Commons- Fal.
Orleans	Rte 28/Rte 6A	Rte 28/Rte 39
Sandwich	Rte 6/Exit 2	Cotuit Rd
Truro	Rte 6A	Rte 6
Yarmouth	Rte 6A/Union St	Rte 6/Exit 7

In December of 2005, MassHighway produced the "Top 1,000 High Crash Locations Report: 1999-2001." The following table includes a summary of the eleven Cape Cod locations that appeared in the report:

Table 3-2 – Cape Cod Locations from Massachusetts "Top 1,000 Crash Locations Report: 1999-2001"

RANK	MAP I.D. #	CITY/TOWN	MHD DISTRICT	ROUTE1	STREET	ROUTE2	INTERSECTING STREET	TOTAL CRASHES	PROPERTY DAMAGE CRASHES	INJURY CRASHES	FATAL CRASHES	WEIGHTED AVERAGE
49	1	BOURNE	5	6	CRANBERRY HIGHWAY	6	SAGAMORE ROTARY	297	233	64	0	553
203	2	BOURNE	5	28	BOURNE BRIDGE	25	ROUTE 25	145	119	26	0	249
207	3	DENNIS	5	134	ROUTE 134	6	MID CAPE HIGHWAY	99	62	37	0	247
212	4	BOURNE	5	28	SOUTH BOURNE ROTARY	28	MACARTHUR BOULEVARD NORTHBOUND	137	110	27	0	245
260	5	BARNSTABLE	5	28	FALMOUTH ROAD	28	AIRPORT ROTARY	94	63	31	0	218
438	6	BOURNE	5	28	MACARTHUR BOULEVARD NORTHBOUND	28	OTIS AIR FORCE BASE ROTARY	89	71	18	0	161
449	7	BARNSTABLE	5		IYANOUGH ROAD	6	MID CAPE HIGHWAY	69	47	22	0	157
467	8	MASHPEE	5	28	MASHPEE CIRCLE	28	FALMOUTH ROAD	75	55	20	0	155
485	9	BOURNE	5	6	CRANBERRY HIGHWAY	6	NORTH BOURNE ROTARY	66	45	21	0	150
874	10	YARMOUTH	5	6	MID CAPE HIGHWAY		WILLOW STREET	43	27	16	0	107
983	11	MASHPEE	5		GREAT NECK ROAD NORTH	130	FORESTDALE ROAD	32	15	17	0	100

Notes

- "Weighted Average" is a calculation assigning *1* to each Property Damage Crash, *5* to each Injury Crash, and *10* to each Fatality Crash.
- The old Sagamore Rotary is ranked 49th, the Bourne Bridge is ranked 203rd, and Route 134/Route 6 interchange is ranked 207th.

The eleven locations are shown on the map on the following page. Among the top Cape Cod Region accident locations, the old Sagamore Rotary is an active MHD project, nearing completion. The RTP includes a discussion of maintenance, operations, and replacement issues of both the Bourne Bridge and Sagamore Bridge. The Route 134/Route 6 interchange has been improved since 2001. Improvements at Yarmouth's Mid Cape Highway/Willow Street interchange (ranked 874th) are currently underway. Signalization has recently been installed at Mashpee's Great Neck Road/Route 130 intersection (ranked 983rd).

The remaining Cape Cod Region accident locations, based on MassHighway's "Top 1,000 High Crash Locations Report: 1999-2001", are recommended for study based on safety concerns.

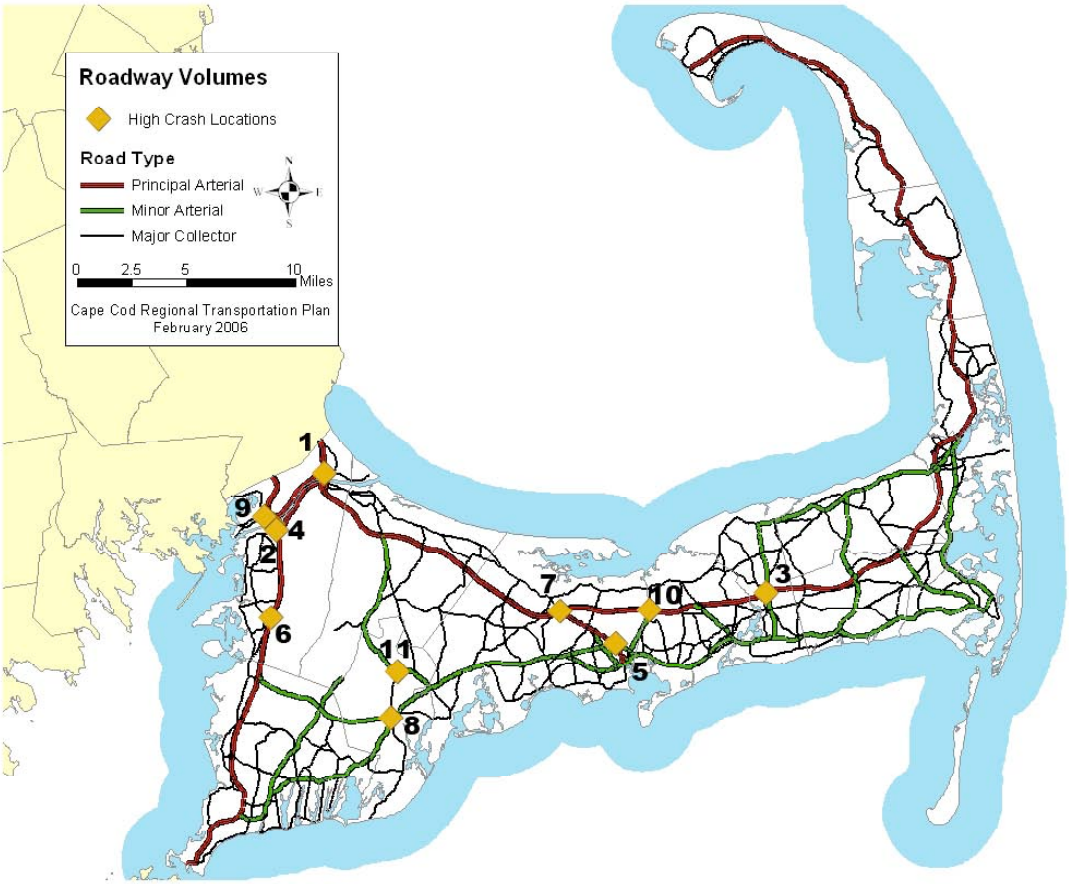


Figure 3-1 - Cape Cod's "Massachusetts' Top 1000 High Crash Locations Report: 1999-2001"

Source: MassHighway 1999-2001 Accident Records. See listing of locations on previous table.

3.2 Cape Cod Drivers

The demographics of Cape Cod depict a typical year-round resident that is older than the average population in the United States. Nearly 50% of Cape Cod's population as reported in the 2000 census were aged 45 or older. This trend is continuing. The migration of retirees to Cape Cod and a stable aging population is not being offset by new younger residents or births. With the trend toward an older population in America, the Federal Highway Administration (FHWA) has recognized that older drivers require special consideration. This recognition is demonstrated in the publication of several recent documents and a special address to Congress by the National Highway Traffic and Safety Administration (NHTSA). The focus in both cases was on the behavior of older drivers with respect to the "typical" driver. The NHTSA address also included issues related to younger drivers. Recommended guidelines for design standards that will help accommodate the needs of an older driver are also included in the literature.

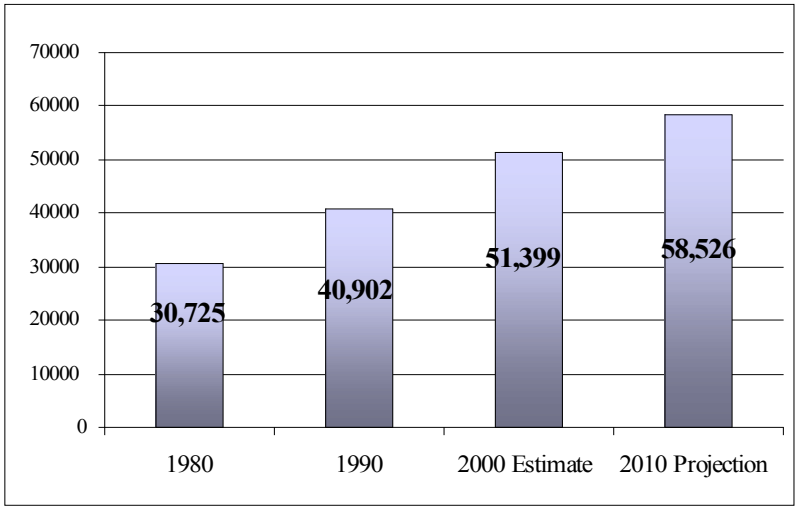
Another dimension defining the unique character of Cape Cod drivers is their seasonal nature. The Cape is inundated with visitors, many of whom are not familiar with Cape Cod roads. Drivers that are used to city streets or parkways are also subjected to the scenic rural roads that compose a significant part of the Cape's character. The physical nature of these roadways may be somewhat unfamiliar to off-Cape drivers, leading to safety concerns.

Among the many drivers that visit to the Cape in the summer are a large number of younger motorists. These drivers have less experience in familiar surroundings and even less in the Cape driving environment. This coupled with a "vacation attitude" requires more considerations for roadway design and planning. These considerations must also be balanced with the natural qualities that bring people to Cape Cod.

3.2.1 The Senior Driver

A large and increasing percentage of Cape drivers are 65 and older. According to the 2000 census, 23% or 51,399 residents of Barnstable County are aged 65 or older (see following table). This steadily increasing proportion of drivers will experience declining vision, slowed decision making and reaction times, additional difficulty in dividing attention between potential conflicts and traffic information, and reductions in strength, flexibility, and overall fitness. In many cases, these difficulties will outweigh the additional experience that older drivers have operating an automobile. The large majority of drivers who suffer from age-related driving deficiencies are not aware that a problem exists.

Table 3-3 - Cape Population over 65



The overwhelming majority of Cape intersections are at grade. Based on FHWA crash statistics for drivers, 80 years and older, more than 50% of fatal crashes occur at intersections. This is compared with 24% or less for drivers up to age 50. According to studies referenced in the FHWA *Older Driver Highway Design Handbook* (1998), as driver age increases, involvement in intersection crashes increase as well. Older drivers typically experience two types of at-grade intersection difficulties. Left turn difficulties result from lack of sufficient caution and poor positioning on the road during the turn. Stopping difficulties result from a failure to stop, a failure to make complete stops at stop signs, and stops that were abrupt. Comparing survey responses of drivers aged 66 to 68 with those aged 77 and older, showed that the older group had more difficulty following pavement markings, finding the beginning of left hand turn lanes, and driving across intersections. Another study of older drivers indicated that the most challenging aspect of intersection negotiation is making left turns during the green, left turn permitted signal phase. The protected "green arrow" left hand turn has been identified as an important improvement for older drivers.

Nighttime driving is associated with a higher crash risk for all drivers, however the effect of aging on vision is particularly compounded by the effect of darkness. The aging process causes gradual declines in a variety of ways; acuity, contrast sensitivity, glare recovery, and peripheral vision. These declining functions make night driving particularly difficult for older drivers. The ability to notice and recognize objects at night and in low-light conditions such as dawn, dusk, rain, fog, haze, and snow is a chief concern. According to studies referenced in the FHWA handbook show that between age 20 and age 70, contrast sensitivity is reduced by a factor of three. This places the typical older driver at a relative disadvantage in low-light conditions. As expected, older drivers

require significantly larger letters to read unfamiliar signs. Current sign standards are based on an assumed vision of 20/25 (as opposed to "perfect" 20/20 vision). Older drivers require a standard of 20/46.

3.2.2 Older Driver recommendations

Based on the issues associated with the older driving population on Cape Cod the following suggestions are recommended as considerations for Cape Cod roadway improvements. Many of these recommendations are from FHWA's *Older Driver Highway Design Handbook* (1998). This resource should be consulted for more details. The Older Driver Handbook includes other recommendations and guidelines that should be considered in Cape roadway design but their use should also be tempered to maintain the character of Cape Cod's roadways.

Recommendations to accommodate older drivers include:

- Considering protected left turn phases into signalized intersections;
- Maintaining delineation through more frequent restriping and street cleaning;
- Improving signage standards to include larger lettering;
- Improving lighting level standards, in particular at intersections. Consider placing utilities underground and installing breakaway safety poles for lighting;
- Considering "all red" phases for signalized intersections;
- Establishing driver education programs for older drivers; and
- Providing education on other options for mobility.

Mobility programs to provide alternatives to driving also need to be improved. This was a major topic at Cape Cod's February 2000 Transit Summit. The recommendations from the Summit included a "dual challenge" of reducing auto dependency and meeting the needs of the transit dependent and those in need of human services. By improving mobility options, significant safety improvements may be realized. A short-term public transportation plan by the Cape Cod Transit Task Force has been developed with an emphasis on human service needs.

3.2.3 Young Drivers

Safety and age-related crash statistics indicate that younger drivers' (under age 25) problems exceed those of any other age group. The shorter average trip length of older drivers is accompanied by a higher frequency of fatal crashes. Young drivers outnumber, out-travel, out-crash, and die more frequently by any other measure. There are slight differences between younger and older drivers in the types of crashes they experience. For example, young drivers have more speeding and alcohol-related crashes. Younger drivers' crashes are frequently caused by inexperience, poor judgment, and risk taking, while older drivers' crashes are more often related to reduced physical and cognitive capabilities.

Although most crashes occur at intersections, young drivers show a greater tendency than other age groups to be involved in non-intersection crashes. According to NHTSA statistics, 43% of crashes by drivers age 15 to 24 are at non-intersection locations. That number reduces to 41% for drivers age 25 to 64 and 31% for drivers age 65 to 74.

Younger drivers are more prone to risk-taking behavior and are subject to influences of youth culture and peer pressure. Many of these characteristics are evident in young visitors to Cape Cod.

3.2.4 Younger Driver Recommendations

Recommendations to accommodate younger driver safety issues are divided between residents and visitors:

- Increased education for local young drivers.
- Additional enforcement and warnings during the busy traffic season to reach out to young visitor drivers.
- Develop and implement an advertising campaign and roadside signage reminding drivers that traffic and drunk driving laws are strictly enforced on Cape Cod.

3.2.5 Additional Recommendations

Additional recommendations include:

- Better signage for visitors directing them to popular destinations (e.g., larger, well-located signs to direct patrons of the Hyannis Transportation Center may improve safety at the driveway on Route 28).
- Signage explaining the rotary "rules of the road" and similar information to be included in visitor brochures and Cape related websites such as 'Go Cape Cod: www.gocapecod.org

3.3 The Cape Cod Roadway

There are 3,854 miles of roadways in Barnstable County (note: mileage of divided highways is approximately doubled). 140 miles are considered Principal Arterials, 117 miles are considered Minor Arterials, 375 miles are considered Major Collectors, and there are 198 miles of Minor Collectors. The remaining 3,024 miles included local roads and the many miles of unimproved ways. The typical posted speed limit on the Cape is less than 40 miles per hour (mph) and, on average, the roadways carry 175% more traffic in July and August than they do in January and February.

The character of Cape Cod's rural roads includes narrow lanes and a typical speed limit of 35 mph. Most roads do not have shoulders and bicycles must often share the lanes with motorists. Many of the older roads evolved from Indian trails and stagecoach routes. Roadway geometry is therefore less accommodating than current state and federal standards. Included in the goals of this Plan is the preservation of the scenic and rural character of Cape Cod's narrow, winding roads. However, this must be accompanied by a program of enforcement and education especially for the drivers that visit the Cape in the summer. The following tables list crash rates for Routes 6, 6A, and 28, respectively. For comparison purposes, the latest available three years' data were from 1999-2001. Changes in reporting after this period have not yet been standardized to the point that comparisons among towns can be made.

Table 3-4 - Crash Rates (based on years 1999-2001): Route 6

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	326	0.3	2.58	0.26
Sandwich	58	0.7	0.24	0.27
Barnstable	84	0.0	0.61	0.00
Yarmouth	47	0.0	0.65	0.00
Dennis	49	0.0	2.09	0.00
Harwich	24	0.0	0.50	0.00
Brewster	8	0.0	0.38	0.00
Orleans	16	0.3	0.81	1.72
Eastham	122	1.3	2.05	2.23
Wellfleet	43	0.7	0.69	1.06
Truro	27	0.7	0.42	1.05
Provincetown	9	0.0	0.48	0.00
Total	**814**	**4.0**	**0.90**	**0.44**

Registry of Motor Vehicles' Crash Records supplied by MassHighway
Vehicle Miles Traveled (VMT) calculated using Cape Cod Commission traffic data

Table 3-5 - Crash Rates (based on years 1999-2001): Route 28

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	197	0.3	1.73	0.29
Falmouth	147	0.7	1.70	0.77
Mashpee	111	0.0	4.51	0.00
Barnstable	194	1.7	2.54	2.17
Yarmouth	248	0.3	4.41	0.59
Dennis	70	0.3	3.65	1.75
Harwich	71	0.0	3.84	0.00
Chatham	109	0.0	2.60	0.00
Orleans	34	0.3	2.01	1.95
Total	**1180**	**3.7**	**2.60**	**0.81**

Registry of Motor Vehicles' Crash Records supplied by MassHighway
Vehicle Miles Traveled (VMT) calculated using Cape Cod Commission traffic data

Table 3-6 - Crash Rates (based on years 1999-2001): Route 6A

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	18	0.0	6.52	0.00
Sandwich	37	0.3	1.49	1.33
Barnstable	14	0.0	0.59	0.00
Yarmouth	55	0.0	3.16	0.00
Dennis	41	0.0	2.36	0.00
Brewster	93	0.0	2.96	0.00
Orleans	71	0.3	9.05	4.27
Total	**329**	**0.7**	**2.64**	**0.53**

Registry of Motor Vehicles' Crash Records supplied by MassHighway
Vehicle Miles Traveled (VMT) calculated using Cape Cod Commission traffic data

3.3.1 Safety Improvements through Intersection Modification

To help quantify the benefits of various safety treatments, several resources were consulted including *The Traffic Safety Toolbox: A Primer on Traffic Safety*, Chapter 28, Institute of Transportation Engineers, 2000; and *Prediction of the Expected Safety Performance of Rural Two-Lane Highways*, Chapter 5, Federal Highway Administration, 2000. These reports include discussions on various vehicular access treatments and predictions of "Accident Reduction."

3.3.1.1 Modern Roundabouts v. Four-Way Intersections

A roundabout is a type of circular intersection with specific design and traffic control features. These features include yield control of all entering traffic, channelized approaches, and appropriate geometric curvature to ensure that travel speeds on the circulatory roadway are typically less than 20 mph. The decision to install a roundabout as a safety improvement should be based on a demonstrated safety problem of a type susceptible to correction by a roundabout. FHWA's *Roundabouts: an Informational Guide*, (FHWA –RD-00-067, June 2000) provides a review of the safety improvements

afforded by roundabouts. For example, safety problems that could be improved by a roundabout include:

- High rates of crashes such as right angle, head-on, left/through, U-turns, etc.
- High crash severity that could be reduced by slower speeds
- Site visibility problems that reduce the effectiveness of stop sign control
- Inadequate separation of movements, especially on single-lane approaches

The following figure shows that roundabouts have fewer annual injury crashes than rural two-way stop-controlled (TWSC) intersections, and the total number of crashes at roundabouts is relatively insensitive to minor street demand volumes.

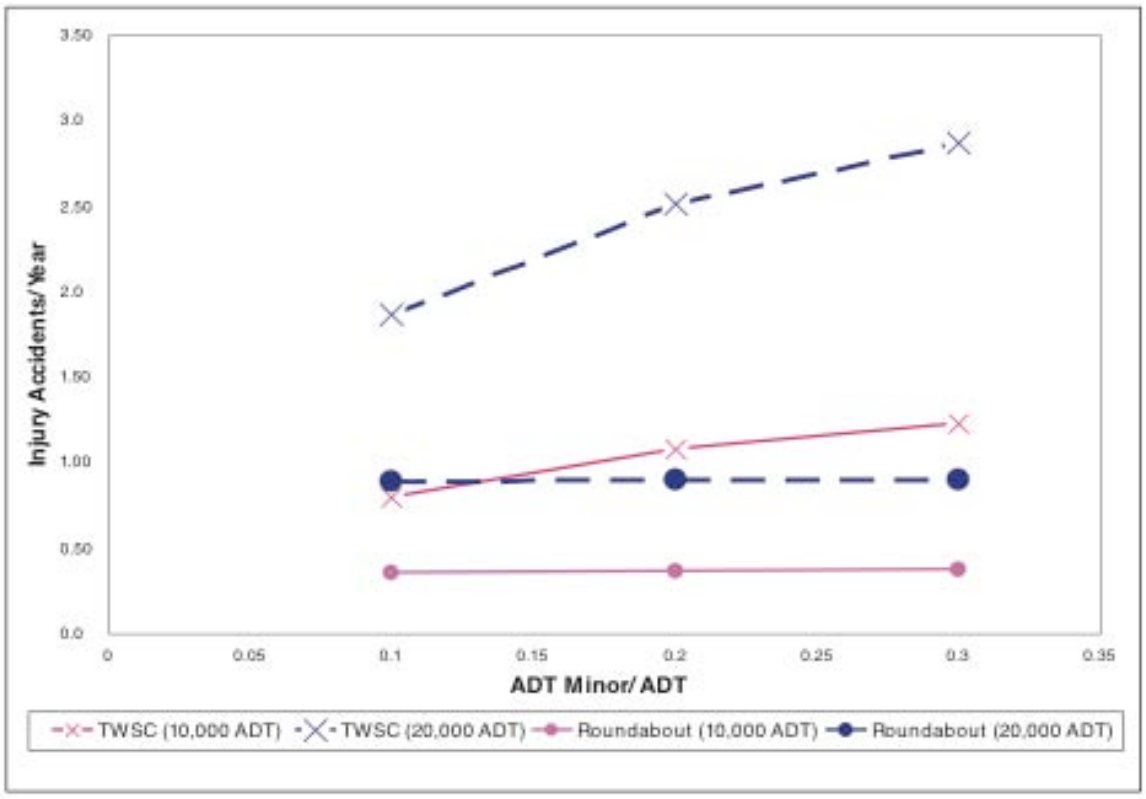


Figure 3-2 - Comparison of Predicted Roundabout Injury Crashes with Rural 2-Way Stop -Controlled Intersections.

(source: FHWA)

The Roundabout guide also includes information to compare roundabouts to signalized intersections. The following figure shows that roundabouts have fewer injury accidents per year than signalized intersections, particularly in rural areas. At volumes greater than 50,000 vehicles per day (shown on the figure as "ADT" – average daily traffic), urban roundabout safety may be comparable to that of urban signalized intersections.

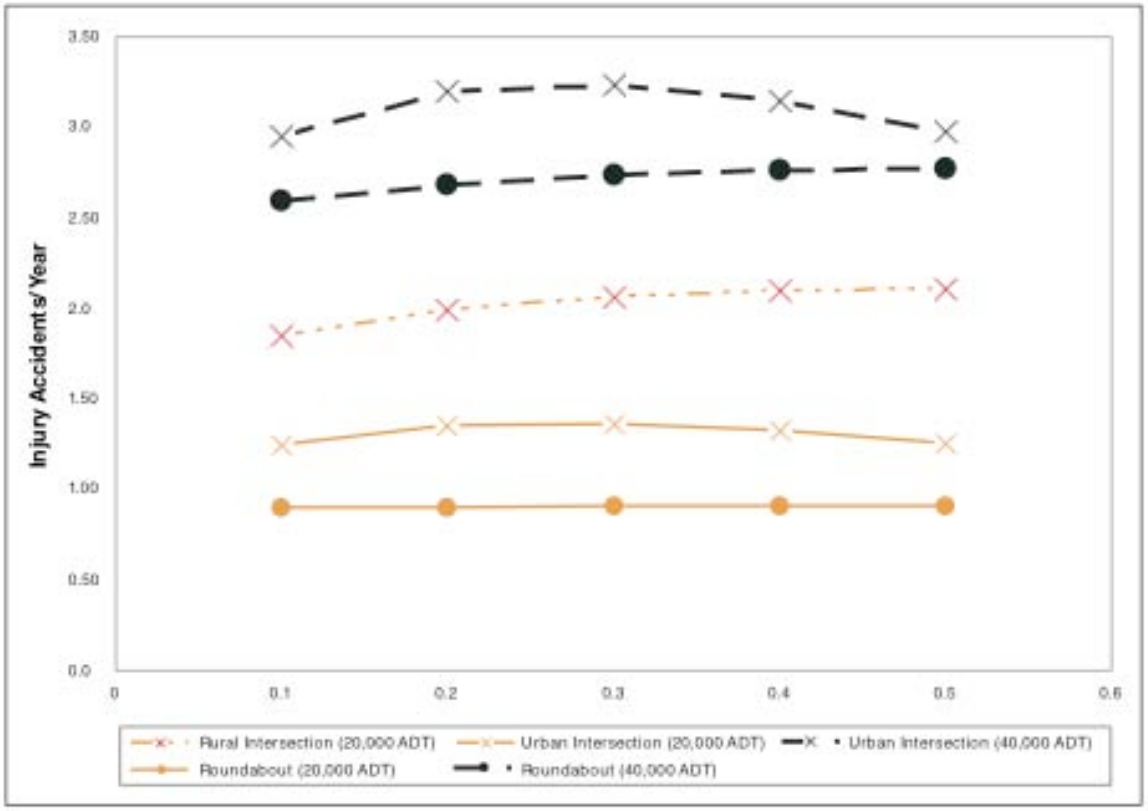


Figure 3-3 - Comparison of Predicted Injury Crashes for Single-Lane and Double-Lane Roundabouts with Rural or Urban Signalized Intersections.

(Source: FHWA)

3.3.2 Safety-Related Technology

Improved technology provides new options for the enforcement of traffic laws and speed control. The Insurance Institute for Highway Safety (IIHS) and the FHWA have favorable reviews of applications such as red-light enforcement and photo radar. These techniques should be coupled with education as well, since a goal is to improve safety by deterring unsafe driving. The greatest benefit of these techniques has been a "halo effect" whereby drivers are complying with traffic laws in un-monitored locations as well as those where the technology has been installed.

3.3.2.1 Red Light Enforcement

According to IIHS, nationwide, drivers who run red lights are responsible for 260,000 crashes each year. Of these, approximately 750 are fatal. Motorists are more likely to be injured in crashes involving red light running than in other types of crashes: occupant injuries occurred in 45% of red light running crashes compared with 30% for other crash types. Enforcing red light laws by traditional means poses special difficulties for police, who in most cases must follow a violating vehicle through a red light to stop it. This

poses a danger to motorists, pedestrians, as well as the officers. Red light running violations typically decrease by as much as 60% at intersections where cameras automatically enforce the law.

In areas where red light cameras have been installed as well as areas without cameras, most drivers have supported the use of red light cameras, 80% in cities with cameras and 76% in cities without.

3.3.2.2 Opticom System

Many of the Cape's signalized intersections are equipped with the Opticom priority-based pre-emption system. Opticom includes infrared detection equipment installed adjacent to the signal heads. When an emergency vehicle (ambulance, fire engine, etc.) equipped with an Opticom infrared emitter approaches the intersection, the detector notifies the signal controller and a green phase is maintained for the emergency vehicle (other approaches are held under a red phase). Signal pre-emption is vital for emergency responders to safely and quickly travel to incident sites. Agencies responsible for intersection signal maintenance should also ensure continuous operation of the Opticom system. Upgrades to existing signals and new signal installations should be equipped with Opticom.

3.3.3 Coordination with Massachusetts' Strategic Highway Safety Plan

Massachusetts EOT, the Governor's Highway Safety Bureau, and many other agencies are participating in developing a "Strategic Highway Safety Plan" (SHSP). The overall goal of the plan is to reverse the increasing trend of traffic-related fatalities and injuries – towards zero fatalities and injuries. It is understandable that "zero fatalities or injuries" may not be achievable, however, any progress made toward this goal is worthwhile. In the short-term, the draft safety plan includes two "measurable goals:"

1. Achieve a 20% statewide annual reduction from 476 (year 2004) lives lost in traffic-related fatal crashes.
2. Achieve a 20% statewide annual reduction from 5,554 (year 2004) in non-fatal traffic-related injuries requiring hospitalizations.

The purpose of the SHSP is to identify the key safety needs in the Commonwealth and guide investment decisions to achieve significant reductions in highway fatalities and serious injuries on all public roads. The SHSP brings together all highway safety partners in the Commonwealth and draws on their strengths to align and leverage resources to collectively address the Commonwealth's safety challenges. The most important benefit of the SHSP is that statewide goals and safety programs are coordinated to most effectively reduce highway fatalities and serious injuries on all public roads.

The SHSP provides a comprehensive framework, and specific goals and objectives, for reducing highway fatalities and serious injuries on all public roads.

More information on the Strategic Highway Safety Plan is available online at: <http://www.mhd.state.ma.us/default.asp?pgid=content/traffic/shsp&sid=level2>

Higher Risk Transportation System Users

The draft safety plan has identified "higher risk transportation system users" and potential strategies to improve their safety.

Pedestrian Safety

The safety plan promotes a vision that:

> "Increasing numbers of people throughout Massachusetts, residents and visitors alike, will be able to walk safely and conveniently to their destinations. Pedestrians, bicyclists, and drivers will be aware of each other's needs, and will act appropriately for the situation in which they are walking, riding, or driving. Walking will increase, while accidents involving pedestrians will decrease."

To support this vision, the safety plan includes a goal to "raise the awareness of pedestrian safety to motorists, the general public, visitors, and state legislators ultimately leading to a decrease in the number of crashes involving pedestrians."

Strategies suggested in the draft safety plan include:

- Publicize Pedestrian Safety resources
- Provide input to the Safety Chapter of the updated *Massachusetts Pedestrian Transportation Plan*
- Provide expert advice to communities that are trying to mitigate pedestrian risk

Young Driver Safety

The safety plan includes a goal to "reduce the number of crashes involving young drivers and encourage greater compliance with the Massachusetts Junior Operator Law."
Strategies suggested in the draft safety plan include:

- Evaluating before and after Junior Operator Law data for crashes involving teen drivers;
- Educating parents of Junior Operator Law responsibilities; and
- Conducting literature /program review to determine best practices in prevention and driver behavior modification methods.

The safety plan will also include discussions on bicycle safety and older driver safety.

Infrastructure Safety

In the development of the draft safety plan, a need to better prioritize improvement projects was identified. An overall goal emerged to: "Encourage greater compliance with the *Manual on Uniform Traffic Control Devices* (MUTCD) and the Massachusetts Highway Department's *Project Development and Design Guidebook*; and expedite safety-related infrastructure projects." Strategies suggested in the draft safety plan include:

- Institute Safety Project Prioritization Process
- Provide technical assistance to local communities
- Develop a draft Statewide Access Management Plan

Safety Project Selection Process

Through the development of the safety plan, participants noted the need to develop a process for prioritizing and funding safety projects. The following figure provides an overview of this process:

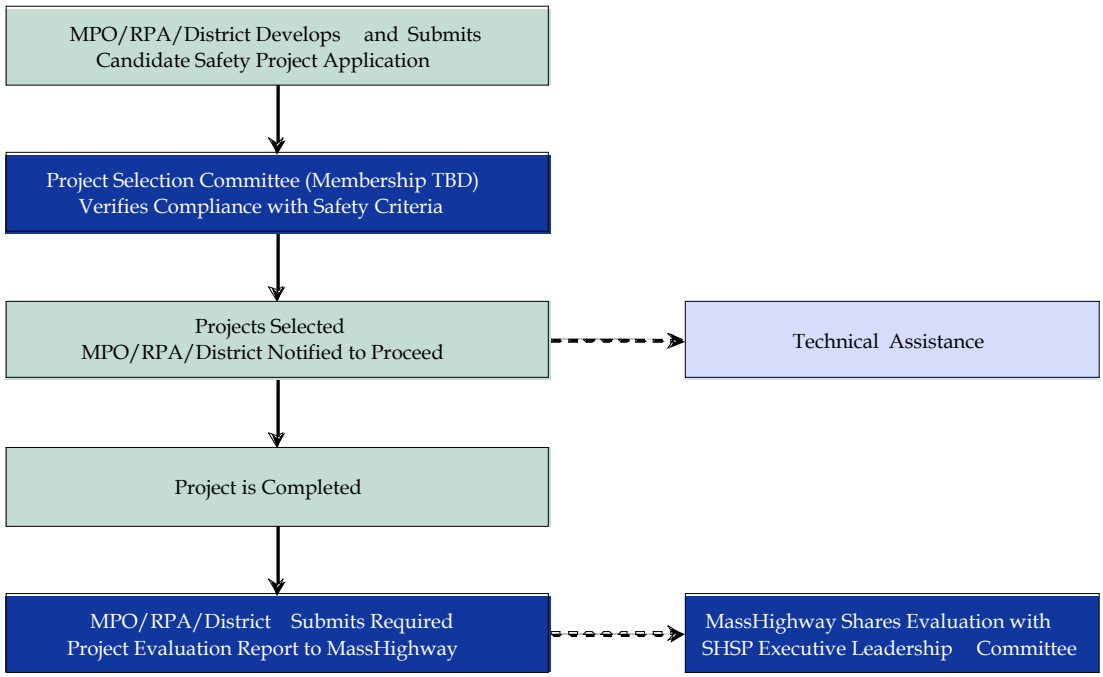


Figure 3-4 - Infrastructure Safety Project Selection Process

At-Risk Driver Behavior

The safety plan includes a goal to "reduce the number of fatal crashes involving unbelted drivers and passengers, speeding, and alcohol-impaired driving." Strategies include:

- Tailor Messages Regarding Speed, Alcohol-impaired Driving, and Occupant Protection to Specific Audiences, particularly in locations or communities of high risk;
- Support the passing, education, and subsequent enforcement of primary seat belt legislation;
- Develop a web-based Statewide Safety Calendar;
- Increase enforcement, particularly high visibility checkpoints, and penalties for speeding and alcohol impaired driving; and
- Institute a Massachusetts Safety Report Card.

Public Education and Media

The safety plan includes a goal to: "Broaden the awareness of safety issues through dissemination of messages to the public and elected officials; assist other Emphasis Area Teams with implementation of their education- or media-related strategies; and assist the Executive Leadership Committee with roll-out of the SHSP." Strategies include:

- Encourage the reporting of standard safety-related information in any article or story regarding a motor vehicle crash;
- Disseminate messages regarding legislative changes that impact drivers or licensing; and
- Develop and maintain a web-based Safety Calendar.

3.3.4 Policies & Strategies

In the interest of preserving the character of Cape Cod and achieving safer roads, non-traditional methods of improving safety must be explored. The following recommendations for improving safety will not substantially change the character of the roadways on Cape Cod:

- Consider Traffic Calming measures such as 4-way stop signs and roundabouts.
- Improve striping maintenance and use of more reflective treatments.
- Increase enforcement and police presence on rural roads such as 6A.
- Investigate photo enforcement of red light running and speeding.
- Make physical improvements that improve the safety and security of the transportation network a priority.
- Continuously monitor the condition of the transportation system to ensure that it is safe to travel on all modes throughout Cape Cod.
- Continue to identify the high priority safety locations throughout Cape Cod and then determine measures to increase safety at those locations.

- Separate high and low speed travel modes, so that those traveling at slower speeds, such as bicycles and pedestrians, do not conflict with those traveling at higher speeds, such as rail and automobile traffic.
- Encourage safe use of the transportation network through public awareness campaigns, promoting such things as seatbelts for motorists and helmet use for bicyclists.

3.3.5 Community Character/Safety Issues

The following recommendations are intended to preserve community character while addressing safety issues:

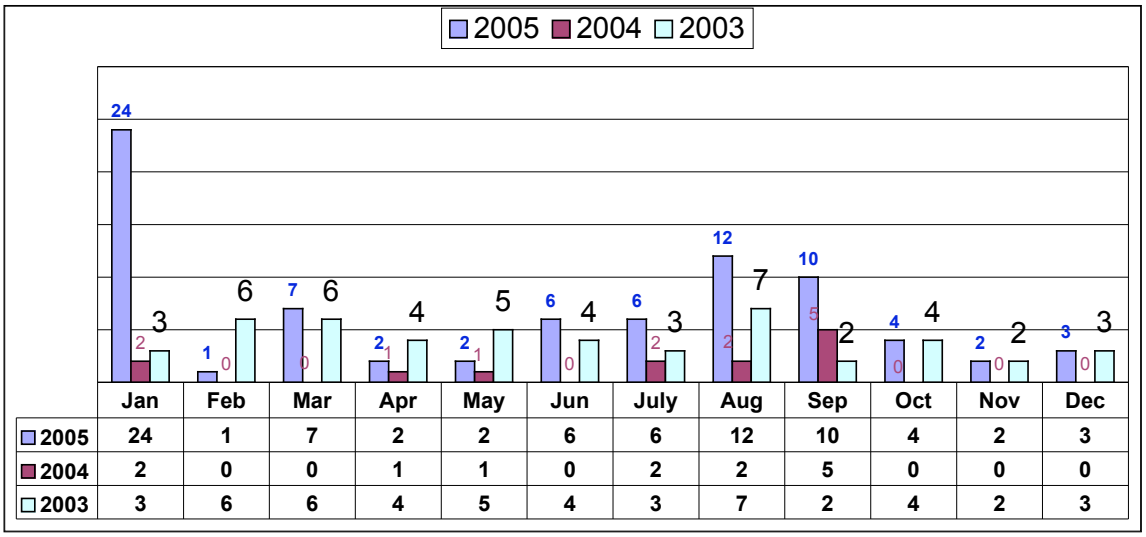
- Use alternative guardrail treatments, such as steel Corten or steel backed timber - all on wood posts, where guardrail is necessary.
- Consider roundabouts as an alternative to signalized intersections
- Continue policies that disallow business logo signs on state highways in Barnstable County.
- Preserve all state owned/town owned land along roads and other transportation rights-of-way, for transportation uses and/or conservation.
- Prohibit pruning and clearing within state rights-of-way except for safety purposes, such as making sight distance improvements.
- Encourage ornamental signal posts and mast arms.
- Develop design guidelines for Cape Cod to document preferred treatments in design concepts and details.
- Encourage use of simulated brick crosswalks and other contrasting materials in order to provide drivers with better visual identification. Crosswalks should be considered for all projects to accommodate walking as a viable mode of travel.
- Promote “Share the Road” and other bicycle education programs.

3.4 Multimodal Transportation Safety

Safety information is readily available for several modes of travel. The following sections provide safety issue details on several transportation modes.

3.4.1 Public Transit Safety

Public transit vehicles are generally considered to operate at a higher level of safety in comparison to private automobiles. Drivers are required to have higher qualifications and are subject to strict safety guidelines. The Cape Cod Regional Transit Authority has provided safety data for the years 2003-2005 as shown in the following figure.



	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
2005	24	1	7	2	2	6	6	12	10	4	2	3
2004	2	0	0	1	1	0	2	2	5	0	0	0
2003	3	6	6	4	5	4	3	7	2	4	2	3

Figure 3-5 - Cape Cod Regional Transit Authority Reported Accidents

The accidents listed in the figure above represent several categories including collisions of several types, boarding and alighting, on-board accidents, and glass. For example, of the 24 accidents reported in January 2005, the breakdown is as follows:

Intersection Collisions	3
Non-Intersection Collisions	5
Front End Collisions	8
Glass	8
January 2005 Total	**24**

3.4.2 Bicyclist Safety

Bicycling on Cape Cod roadways can be a challenge. The mixture of narrow roadways, high traffic volumes, and pleasant summer weather creates a great deal of difficult vehicle-bicycle interaction. Cape Cod's pleasant summer weather brings bicyclists onto roadways at the time when vehicular traffic is at its peak. As a mode that can efficiently transport travelers pollution-free, it is worthy of our attention in providing facilities that are safe for cyclists, pedestrians, and other transportation users.

The following table includes a town-by-town breakdown of bicycle-vehicle crashes for the years 1999-2001. With 41 reported crashes over the three-year period, Yarmouth had the greatest number of bicyclist-vehicle crashes (Dennis was second with 21 crashes). Staff have observed numerous cyclists along Route 28 (where many of the identifiable crashes occurred) during the summer season. Comments at public meetings indicate that many summer workers in Yarmouth use bicycling to commute to work; the many motels in the area appear to be the origin of vacationers that are biking to the various Route 28 attractions (e.g., mini-golf, ice cream, gift shops, etc.).

Table 3-7 - Bicyclist-Vehicle Crash History (1999-2001)

Town	All Crashes (3-year total)	Fatal Crashes (3-year total)
Bourne	12	0
Sandwich	4	0
Falmouth	9	0
Mashpee	6	0
Barnstable	7	0
Yarmouth	41	0
Dennis	21	1
Harwich	9	0
Chatham	10	0
Brewster	5	0
Orleans	9	0
Eastham	10	0
Wellfleet	5	0
Truro	0	0
Provincetown	17	0
Total	**165**	**1**

Bicyclists are often categorized into three subsets: (A) Experienced, long-distance riders, (B) Occasional riders, and (C) beginners and children. For the type-A rider, most of their travel is made along roadways because of the higher travel speed available and the fewer obstacles (driveways etc.) encountered on alternative routes. Type B riders prefer off-road opportunities such as bike paths, but can be comfortable in bike lanes or wide shoulders. Type C riders seek out the least busy sections of bike paths and sidewalks; these riders generally do not use biking for transportation purposes.

3.4.3 Pedestrian Safety

Pedestrians are among the most vulnerable users of the transportation system, and yet it is important to remember that almost all travelers become pedestrians for at least part of every trip. Safe accommodations for walking can encourage a reduction in traffic congestion and air pollution and encourage a healthier alternate mode. The figures shown in the following table list the number of vehicle-pedestrian crashes for each town. Yarmouth had the highest number (33) of crashes reported from 1999 to 2001. This number represents two sides of an issue: the high number of pedestrians observed along Route 28 in the summer, representing peoples' willingness to walk for transportation, however it also shows the deficiencies in pedestrian accommodation (e.g., pedestrian crossings at intersections) resulting in the high crash history.

Table 3-8 – Pedestrian-Vehicle Crash History (1999-2001)

Town	All Crashes (3-year total)	Fatal Crashes (3-year total)
Bourne	19	1
Sandwich	3	1
Falmouth	13	1
Mashpee	6	0
Barnstable	16	3
Yarmouth	33	1
Dennis	22	1
Harwich	11	0
Chatham	11	0
Brewster	2	0
Orleans	9	1
Eastham	3	1
Wellfleet	2	0
Truro	1	0
Provincetown	12	0
Total	**163**	**10**

Separate sidewalks and pathways are important to accommodate pedestrians. At intersection crossings, installation and maintenance of call buttons will provide for better compliance and safety of pedestrians. Research published by the Institute of Transportation Engineers ("Pedestrian Countdown Signals: Experience with an Extensive Pilot Installation," *ITE Journal*, January 2006) reports that the number of pedestrian injury crashes declined by 52 percent after the introduction of countdown signals. At the time when the pedestrian phase begins the flashing hand-symbol (i.e., flashing "Don't Walk") a numeric countdown signal shows the remaining number of seconds until the steady hand-symbol (i.e., steady "Don't Walk") is displayed. This provides the pedestrians with information necessary to determine whether they should start crossing or speed up their crossing.

3.4.4 Air Travel Safety

The Federal Aviation Administration has assembled a database of safety incidents at Cape Cod airports. During the years 1996-2005, 24 incidents occurred. Of these, there were eight fatalities and 43 injuries classified as "Minor/None." For a more thorough listing please see the appendix. These data are summarized in the following table:

Table 3-9 - Air Travel Safety Incidents

Year	Fatal	Serious	Minor/None
1996	1	0	6
1997	2	0	8
1998	1	0	1
1999	0	0	9
2000	0	0	8
2001	2	0	3
2002	0	0	3
2003	2	0	0
2004	0	0	2
2005	0	0	3

(Source: Federal Aviation Administration)

3.4.5 Summary of Transportation Safety Recommendations

- Work with state and local agencies to improve the accuracy and timeliness (e.g., within 12 months of the end of each year) of crash data
- Consider protected left turn phases into signalized intersections
- Maintain delineation through more frequent restriping and street cleaning
- Improve signage standards to include larger lettering
- Improve lighting level standards, in particular at intersections. Consider placing utilities underground and installing breakaway safety poles for lighting
- Consider extension of "all red" phases for signalized intersections
- Establish driver education programs for older drivers
- Provide education on other options for mobility
- Increase education for local young drivers
- Support additional enforcement and warnings during busy traffic season to reach out to young visitor drivers
- Develop and implement an advertising campaign and roadside signage reminding drivers that traffic and drunk driving laws are strictly enforced on Cape Cod.
- Provide better signage for visitors directing them to popular destinations
- Install signage explaining the rotary "rules of the road" and disseminate similar information to be included in visitor brochures and Cape related websites such as 'Go Cape Cod:'
  www.gocapecod.org
- Consider conversion of conventional intersections (signalized or unsignalized) which have high crash rates to roundabouts
- Promote the use of red-light cameras at high crash rate signalized intersections
- Support road designs which are estimated to reduce crashes and improve safety for all users

3.5 Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) are applications of advanced technology in the field of transportation, with the goals of increasing operation efficiency and capacity, improving safety, reducing environmental costs, and enhancing personal mobility. A policy of Cape Cod MPO is to advocate and endorse the consideration of Intelligent Transportation Systems solutions for transportation problems as a routine part of the transportation planning process. As a stakeholder in the Southeastern Massachusetts Regional ITS Architecture, the Cape Cod MPO is committed to continuing an active role in these ITS systems. This includes maintaining channels of communication between the Cape Cod Commission and other stakeholders, including but not limited to: the Massachusetts Highway Department; the Southeastern Regional Planning and Economic Development District (SRPEDD); the Old Colony Planning Council (OCPC), and the

Cape Cod Regional Transit Authority (CCRTA). A regional ITS architecture is a framework that defines component systems and their interconnections. Successful ITS deployment requires an approach to planning, implementation, and operations that emphasizes collaboration between relevant entities and compatibility of individual systems. The regional architecture is a mechanism design to ensure this collaboration and compatibility occurs. Inputs into ITS systems can involve any variety of a range of collection devices, including:

• Loop detectors in the pavement and sophisticated ground level radar systems are able to collect real time traffic volume and speed data.

• Video equipment is often used to monitor the transportation system, which is useful in allowing system operators to immediately detect areas of congestion that may be forming. It is also used to detect incidents such as crashes and disabled vehicles, in turn accelerating emergency dispatch and the overall incident management process. Video surveillance is also a useful tool for security and incident management in transit vehicles and around stops and terminals.

• Automatic vehicle locators (AVL) on board transit vehicles, emergency response vehicles, and roadside assistance vehicles allow operators to know where vehicles are in real time that allows for more efficient dispatch and adjustment of traffic controls if necessary.

• Automated Fare Payment Systems that allow riders on transit systems to pay electronically using a "smart card" (prepaid balance) or in the future conventional credit/debit cards rather than cash.

• Transmitters onboard transit and emergency vehicles alike are used to pre-empt traffic signals ahead or to alert travelers at a transit stop that the vehicle is approaching.

• Remote weather stations and Doppler radar provide real time weather conditions occurring throughout the transportation network, and provide alerts regarding events such as icing or flooding that may be occurring. These are some of the technological applications that can be utilized for managing the regional transportation network. All of this information travels over both hard-wired and wireless communication systems to systems that manipulate the data and distribute it to users of the transportation system. End users of ITS system and the output media include:

• Transit Operation Centers that monitor the transit system through video feed, radio communications, and AVL signals, allowing operators to make improved decisions regarding security, dispatch, and incident management.

• Traffic Operation Centers that monitor the roadway system through reports from systems like loop detection and video feed, allowing operators to make improved

decisions regarding congestion management, incident management, security, and maintenance management.

• Traveler Information Services such as the national 511 System or SmarTraveler locally, which receive traffic data from traffic and transit operations centers and distribute it to users via hard line and wireless communications.

• Variable Message Signage that allows operators from traffic and transit operation centers to instantly relay messages to users on the system.

• Kiosks that receive information from transit operation centers and transit vehicles, relaying it to users of the transit system.

MassHighway owns and operates several permanent variable message signs and a large fleet of portable variable message signs throughout the Commonwealth. Permanent stations are used to alert drivers to major events affecting locations such as the Route 128 belt and Interstate 93, as well as the tunnels. Portable variable message sign trailers are located throughout the state and are able to be dispatched to locations wherever and whenever needed. Often they are used for a major local event, such as a road race or sidewalk carnival. They can also be dispatched for major unplanned events, such as a chemical spill that forces an extended closure of a highway. All variable message signs are controlled from the MassHighway Traffic Operations Center in South Boston. The Massachusetts Highway Department is using automated vehicle locators on their snow removal and highway maintenance fleet, increasing the efficiency of dispatch of resources to where they are needed. Travelers are able to obtain real time traffic conditions for highways in the Commonwealth, including highway approaches to the Cape such as Routes 3 and 495 as well as the Cape Cod Canal bridges, through SmartRoutes phone and web links, and will soon be available through a statewide 511 system and MassHighway website.

3.6 Conclusion

Safety is the highest priority goal of the Regional Transportation Plan. The Cape's transportation system should ensure that travelers and their possessions will arrive at their destinations unharmed and undamaged. Travelers should be educated regarding transportation regulations and traffic laws, and these must also be enforced to prevent the improper use of the transportation system.

The importance of safety requires a spectrum of strategies including education, enforcement, and engineering. Specific programs and projects, such as roadway and intersection improvements, will be further refined in the alternatives analysis chapter of this RTP.