CHAPTER 9
SAFETY

9.0 Introduction

Traveling safety is one of the public's highest expectations from the transportation system. Ongoing coordination among all agencies is necessary to cover the many factors related to maintaining and improving safety, such as, drive skill level, driver impairment, the use of safety equipment, vehicle condition, and road and weather conditions. Incorporating safety into transportation planning often means integrating safety into all aspects of an agency's operations.

9.1 Highway

Although improvements in the fatality rates on our highways have been achieved, the overall yearly number of fatalities remains unacceptable. Approximately 43,000 people lose their lives each year on U.S. roads. In addition, there is the high economic impact of all the motor vehicle crashes each year.

SAFETEA-LU and SHSP

The highway re-authorization bill, SAFETEA-LU of 2005, places greater focus on transportation safety than its predecessors ISTEA and TEA-21. Saving lives is the number one priority of SAFETEA-LU. Our transportation systems also face significant challenges in the areas of homeland security as well as overall safety, congestion, and inter-modal connectivity.

SAFETEA-LU created a new stand-alone program for funding safety projects. This program, Highway Safety Improvement Program (HSIP), is designed to provide states with funds to institute programs that reduce the fatalities and injuries that occur annually on the highway system; reinforce FHWA's safety partnerships; and complement National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Carrier Safety Administration (FMCSA) safety programs.

The HSIP program requires that states have a process in place to analyze highway safety problems, identify opportunities for prevention of hazardous conditions, and produce a list of projects to be funded based upon the analysis and opportunities identified. The FHWA will formulate programmatic guidelines for states including the following components:

- Adoption of strategic and performance-based goals for the Highway Safety Improvement Program (HSIP) that address all roadways within the state and focus on areas of greatest need.
- Advancement of the states' capabilities in traffic records data collection, analysis, and integration with other sources of safety data.
- Provide flexibility to the states to address existing and potential highway safety problems.
- Requirement that states establish an evaluation process to assess the results of safety improve projects and use the results to set priorities for future projects.
- States are to report their progress in implementing safety improvement projects and the effectiveness of the improvements to the Secretary of Transportation.

Massachusetts has adopted the following policies and procedures in response to HSIP implementation, although FHWA programmatic guidelines for HSIP are currently pending.

- A proposed improvement project for a specific intersection must meet certain criteria thresholds to be eligible as a safety project.
- The intersection must appear on the state's top 1000 intersection crash list and experience an above average crash rate or the crash rate must exceed the critical crash rate.
- The project should reduce the number of crashes at the subject intersection location.

In addition, the state has adopted the following policies and procedures:

- The Top 1000 Crash List is based on the state crash records system and is updated periodically.
- Average crash rates are based on a compilation of information from a wide-array of intersections from around the Commonwealth (currently 0.87 crashes/million entering vehicles (C/MEV) for signalized and 0.66 C/MEV for un-signalized).
- Critical Crash Rate, the rate at which an intersection is considered a high crash location, is based on the Rate Control Quality Method [$xp = xc + k * (xc/m)^{0.5} - 1/(2m)$] yielding 1.77 C/MEV for signalized and 1.38 C/MEV for un-signalized intersections.

Ongoing state efforts to improve the HSIP include:

- Refining the Top 1000 Crash List to segregate by location type.
- Improving the crash location data by working with the Governor's Highway Safety Bureau (GHSB), law enforcement, and Registry of Motor Vehicles (RMV).
- Improving of the timeliness of crash data records.
- Completing the crash data system interface with Geographic Information Systems (GIS) and the Road Inventory File (RIF).
- Expanding current roadway volume data.
- Developing of crash rates for location type.
- Establishing an evaluation process of crash reduction factors (pre- and post-improvement crash analyses) and cost-benefit ratio of improvement.

In response to the requirements of SAFETEA-LU, MassHighway has undertaken the development of the Strategic Highway Safety Plan (SHSP). The SHSP will enable MassHighway to fulfill the component requirements of the HSIP process. States that adopt and implement an SHSP are provided additional flexibility to use federal Highway Safety Improvement Program (HSIP) funds for public awareness, education, and enforcement activities otherwise not eligible under this program. SAFETEA-LU states that in order to qualify for flexible safety funding, the state SHSP must be based on a collaborative process that includes the State DOT, the Governor's Representative for Highway Safety, and other major State and local safety stakeholders, including: engineering, education, enforcement, and emergency services. The plan must also include an effective analysis of State crash data.

In order to initiate the development of the Massachusetts SHSP, MassHighway established the Massachusetts Strategic Highway Safety Plan Executive Leadership Committee. This committee is an interagency, intergovernmental committee with a membership from the following: Commissioner, Massachusetts Highway Department; Director, EOT - Office of Transportation Planning; Director, Governor's Highway Safety Bureau; Colonel, Massachusetts State Police; Registrar, Registry of Motor Vehicles; Commissioner, Department of Public Health; President, Massachusetts Chiefs of Police Association; Co-Chairs of the Joint Transportation Committee; Executive Director, Massachusetts Association of Regional Planning Agencies; and Division Administrators of Federal Highway Administration and Federal Motor Carrier Safety Administration; Regional Administrator, National Highway Traffic Safety Administration. On January 19, 2006, MassHighway hosted meetings of the Executive Leadership and the Steering/Advisory Committee, which was established to oversee the development of the plan. The Steering/Advisory Committee drafted a mission statement, a vision, and

goals to guide the development of the plan. The members of the Executive Leadership Committee agreed to support MassHighway in its efforts to achieve the Mission, Vision, and Goals. The following Mission, Vision, and Goals have been established:

MISSION: Develop, promote, implement, and evaluate data-driven, multi-disciplinary strategies to maximize safety for users of the roadway system.

VISION: Provide the safest roadway system in the country and promote its safe use.

GOALS: Reverse the increasing trend of traffic-related fatalities and injuries upon implementation of the Massachusetts SHSP (towards zero fatalities and injuries).

- Achieve a 20% reduction from 476 (2004) lives lost in traffic-related fatal crashes by 2010.
- Achieve a 20% reduction from 5,554 (2004) in non-fatal traffic-related injuries requiring hospitalizations by 2010.

Six potential emphasis areas were established to serve as the major components of the Plan. Under each of these areas, multiple safety issues will be examined. The goal of this process is to have a multi-disciplinary team of stakeholders who have knowledge, interest, and experience in addressing the relevant issues of each emphasis area. The action teams are responsible for identifying, evaluating, and recommending strategies to address the following emphasis areas:

- Data Systems (including crash records, EMS data, etc.).
- At Risk Driver Behavior, (including impaired driving, speeding, and occupant protection).
- Infrastructure (including lane departure crashes and intersection crashes).
- Public Education and Media (including how to "market" safety in Massachusetts).
- Leadership (safety program management, including legislative support).
- Vulnerable Transportation System Users (including young drivers, older drivers, mobility needs of diverse populations, pedestrians, bicyclists, and motorcyclists).

Corridors

In order to present, an opportunity for safety agencies at all levels of government to coordinate plans and efforts in saving lives on the road and highway network, the Old Colony Joint Transportation Committee (JTC) sponsored a presentation, and subsequent discussion, on September 14, 2006 by MassHighway safety analysts on lane departure crashes. Lane departure crashes are crashes where the vehicle leaves the roadway but does not strike another moving vehicle, or collides with a parked vehicle, or collides head on with another vehicle. The purpose of the discussion was to identify some of the "hot spot" crash locations in the region and to identify potential strategies to reduce and eliminate crashes at these locations. MassHighway provided OCPC with maps and data on lane departure crashes within the region. Invitations to participation at the meeting were extended to local highway officials, planners, boards of selectmen, local police, and state police. The overall goal of the initiative was to better understand the nature of lane departure crashes and to develop strategies to reduce these crashes. MassHighway presented their data on lane departures in the region and led the discussion at the meeting, which was attended by state police, local police, and highway officials. MassHighway will perform safety audits at the specific problem locations cited by the participants. OCPC staff will finalize the information, when feedback is collected from all OCPC communities, and will then submit the priorities on lane departure locations to MassHighway. Currently, the following corridors have been cited as priorities for lane departure crashes within the region:

- Route 24 - Including Route 24 in all OCPC communities: Stoughton, Avon, Brockton, West Bridgewater, and Bridgewater
- Thatcher Street - In Brockton and East Bridgewater
- The intersection of Prospect Street at North Main Street in Brockton
- Oak Street in Brockton
- Route 123 in Easton
- Route 138 in Easton
- Route 106 in Easton
- The intersection of Depot Street at Turnpike Street at the Easton/West Bridgewater line
- The intersection of Route 106 at Route 36 in Halifax
- The intersection of Route 58 and East Washington Street in Hanson
- Barker Street in Pembroke
- The Route 3A corridor in Kingston and Plymouth

Intersections

The Massachusetts Highway Department maintains a database of crashes occurring in Massachusetts based on crash reports submitted to the Massachusetts Registry of Motor Vehicles. MassHighway compiles a report annually on the top 1000 crash locations in the Commonwealth, as part of its HSIP development. The top 1000 crash locations list is based on a weighted average, with higher weights given to fatal crashes and injury crashes. This data is obtained from the Registry of Motor Vehicles and is based on local and state police crash reports.

The crash data provides information about each crash, including: the time of day the crash occurred; the number of people injured; the number of people killed; the direction of travel of vehicles involved; weather and lighting conditions at time of crash; the type of crash; and other pertinent location information. OCPC uses this data to discern trends in crashes and to develop a list of top 100 crash locations for the region. The frequency of types of crashes and the frequency of crashes at certain locations provides insight into crash exposure and helps to determine safety needs.

The weighted crash average is calculated to reflect the severity of crashes at intersections. The Weighted Crash Average is a numeric calculation derived by assigning a value of 1 for all crashes involving property damage only, 5 for all crashes that involve personal injury, and 10 to all crashes that result in a fatality.

Table 9-1 summarizes the top 100 high crash locations in the region based on MassHighways' crash database. This list of hazardous intersections is prioritized by the highest weighted average, utilizing the same weighted methodology used by MassHighway. Table 9-1 is based on the latest available data for the region (years 2003, 2004, and 2005). The latest available MassHighway Top 1000 High Crash Locations Report, which includes OCPC intersections, uses data from 1999, 2000, and 2001; therefore, OCPC researched the MassHighway database independently to derive the top 100 hazardous locations in the region in order to use more up to date crash data for this report.

Table 9-1 Most Hazardous Intersections in the Old Colony Region (2003-2005)

Rank	City/Town	Intersection	Number of Crashes	*Traffic Control	Property Damage Only	Injury Crashes	Fatal Crashes	Avg.
1	Brockton	West Elm Street / Ash Street	61	SS	25	36	0	**205**
2	Brockton	West Elm Street / Belmont Avenue	48	SS	13	34	1	**193**
3	Brockton	Crescent Street (Route 27) / Lyman Street	48	S	19	28	1	**169**
4	Brockton	West Elm Street / Newbury Street	53	SS	25	28	0	**165**
5	Brockton	North Main Street / Oak Street / Howard Street	54	S	27	27	0	**162**
6	Brockton	Reynolds Memorial Highway (Route 27) / Westgate Drive	62	S	38	24	0	**158**
7	Brockton	Belmont Street (Route 123) / Manley Street	48	S	23	25	0	**148**
8	East Bridgewater	Bedford Street (Route 18) / West Street (Route 106) / East Street	59	S	37	22	0	**147**
9	Brockton	Pleasant Street (Route 27) / Warren Avenue / North Warren Avenue	61	S	41	20	0	**141**
10	Brockton	North Montello Street (Route 28) / Howard Street (Route 37) / Albion Street	53	S	33	20	0	**133**
11	Brockton	Centre Street (Route 123) / Legion Parkway (Route 123) / Main Street	46	S	25	21	0	**130**
12	Brockton	Belmont Street (Route 123) / Pearl Street	48	S	28	20	0	**128**
13	Brockton	Court Street (Route 27) / Main Street / Pleasant Street (Route 27) / North Main Street	38	S	16	22	0	**126**
14	Brockton	Belmont Street (Route 123) / Belmont Avenue / Manomet Street	34	SS	11	23	0	**126**
15	Brockton	Centre Street (Route 123) / Quincy Street	47	S	29	18	0	**119**
16	Brockton	Main Street / Nilsson Street	46	SS	28	18	0	**118**
17	Brockton	North Montello Street (Route 28) / East Ashland Street	42	S	23	19	0	**118**
18	Brockton	North Main Street / East Ashland Street / West Ashland Street	40	S	21	19	0	**116**
19	Brockton	North Pearl Street (Route 27) / Oak Street Extension	43	S	25	18	0	**115**
20	Brockton	Belmont Street (Route 123) / West Street	33	S	13	20	0	**113**
21	Abington	Bedford Street (Route 18) / Brockton Avenue (Route 123)	44	S	27	17	0	**112**
22	Stoughton	Washington Street (Route 138) / Central Street	58	S	45	13	0	**110**
23	Pembroke	Washington Street (Route 53) / Columbia Road (Routes 53 & 139) / Schoosett Street (Route 139)	36	S	19	16	1	**109**
24	Brockton	Warren Avenue / West Elm Street	36	S	18	18	0	**108**
25	Abington	Bedford Street (Route 18) / North Avenue (Route 139) / Randolph Street (Route 139)	67	S	57	10	0	**107**
26	Plymouth	Long Pond Road / South Street / Pilgrims Highway (Route 3)	36	S	19	17	0	**104**
27	Brockton	Montello Street (Route 28) / Centre Street (Route 123)	38	S	23	15	0	**98**
28	Brockton	Montello Street (Route 28) / Court Street (Route 27) / North Montello Street (Route 28)	38	S	24	14	0	**94**
29	Brockton	North Montello Street (Route 28) / Field Street / Livingston Road	29	SS	13	16	0	**93**
30	Stoughton	Canton Street (Route 27) / School Street	41	SS	28	13	0	**93**
31	Whitman	Bedford Street (Route 18) / Auburn Street (Route 14)	47	S	37	9	1	**92**
32	East Bridgewater	Franklin Street (Route 27) / Oak Street (Route 14) / West Washington Street (Route 14)	43	SS	31	12	0	**91**
33	Avon	Harrison Boulevard / West Main Street	26	S	10	16	0	**90**
34	Brockton	Centre Street (Route 123) / Plymouth Street	34	FB	20	14	0	**90**
35	Plymouth	Samoset Street / Pilgrims Highway (Route 3) / Samoset Street (Route 44)	34	S	20	14	0	**90**
36	Brockton	Belmont Street (Route 123) / AmVets Memorial Highway (Route 24)	34	Yield	20	14	0	**90**
37	Brockton	Montello Street (Route 28) / Grove Street	25	S	9	16	0	**89**
38	Brockton	North Cary Street / East Ashland Street	37	S	24	13	0	**89**
39	Brockton	Pleasant Street (Route 27) / Ash Street / North Ash Street	31	SS	17	14	0	**87**
40	Easton	Eastman Street (Route 106) / Foundry Street (Route 123)	39	S	27	12	0	**87**
41	Brockton	Oak Street / Reservoir Street / Oak Street Extension	22	S	6	16	0	**86**
42	Bridgewater	Pleasant Street (Route 104) / AmVets Memorial Highway (Route 24)	30	None	16	14	0	**86**
43	Brockton	Belmont Street (Route 123) / Linwood Street	34	SS	21	13	0	**86**

Table 9-1 Most Hazardous Intersections in the Old Colony Region (2003-2005)(continued)

Rank	City/Town	Intersection	Number of Crashes	*Traffic Control	Property Damage Only	Injury Crashes	Fatal Crashes	Avg.
44	Brockton	Forest Avenue / Bouve Avenue / Manomet Street	32	SS	19	13	0	**84**
45	Stoughton	Lindelof Avenue (Route 139) / Technology Center Drive / Kay Way	35	S	23	12	0	**83**
46	Brockton	Pleasant Street (Route 27) / Reynolds Memorial Highway (Route 27)	29	S	17	11	1	**82**
47	Abington	Plymouth Street ((Route 58)) / Central Street	30	S	17	13	0	**82**
48	Brockton	Belmont Street (Route 123) / Forest Avenue	30	S	17	13	0	**82**
49	Whitman	Bedford Street (Route 18) / Temple Street (Route 27)	45	S	36	9	0	**81**
50	Easton	Foundry Street (Route 106) / Turnpike Street (Route 138)	32	S	20	12	0	**80**
51	Brockton	Montello Street (Route 28) / Lawrence Street	20	S	5	15	0	**80**
52	Brockton	Court Street / Cary Street / North Cary Street / Provost Street	19	S	4	15	0	**79**
53	Brockton	Pleasant Street (Route 27) / West Street	34	S	23	11	0	**78**
54	Brockton	Oak Street / Battles Street	24	S	12	11	1	**77**
55	Brockton	Pleasant Street (Route 27) / Belmont Avenue / Augusta Avenue	29	SS	17	12	0	**77**
56	Brockton	West Chestnut Street / Liberty Street	24	S	11	13	0	**76**
57	Brockton	North Quincy Street / East Ashland Street	24	SS	11	13	0	**76**
58	Stoughton	Pleasant Street (Route 139) / Central Street	35	S	25	10	0	**75**
59	Brockton	Ash Street / Forest Avenue	22	S	9	13	0	**74**
60	Kingston	Main Street (Route 106) / Summer Street (Route 3A)	34	FB	24	10	0	**74**
61	West Bridgewater	North/South Main Street (Route 28) / East/West Center Street (Route 106)	34	S	24	10	0	**74**
62	Pembroke	Church Street (Route 139) / Oak Street	26	S	14	12	0	**74**
63	Brockton	Pearl Street / West Chestnut Street	21	SS	9	11	1	**74**
64	Brockton	Main Street / Perkins Avenue / South Street	25	S	13	12	0	**73**
65	Brockton	Warren Avenue / Forest Avenue	27	S	16	11	0	**71**
66	Avon	East Main Street (Route 28) / East Spring Street / West Spring Street	27	FB	16	11	0	**71**
67	Brockton	Crescent Street (Route 27) / Quincy Street	31	S	21	10	0	**71**
68	Kingston	Duxbury Road (Route 3A) / Summer Street (Route 53)	22	S	11	10	1	**71**
69	Stoughton	Central Street / Pearl Street	39	S	31	8	0	**71**
70	Brockton	Belmont Street (Route 123) / Clinton Avenue / Cottage Street	19	SS	6	13	0	**71**
71	Whitman	Washington Street / Park Avenue / West Street	26	FB	15	11	0	**70**
72	Brockton	North Montello Street (Route 28) / East Battles Street	25	SS	14	11	0	**69**
73	Plymouth	Court Street (Route 3A) / Samoset Street (Route 44) / North Park Avenue	25	S	14	11	0	**69**
74	Brockton	Reynolds Memorial Highway (Route 27) / North Pearl Street (Route 27)	29	S	19	10	0	**69**
75	Stoughton	Turnpike Street (Route 139) / Page Street	33	S	24	9	0	**69**
76	Bridgewater	Broad Street (Route 18) / Main Street (Route 28) / Summer Street (Route 104) / Central Square	33	S	24	9	0	**69**
77	Brockton	Warren Avenue / Legion Parkway / Highland Street	21	S	9	12	0	**69**
78	Brockton	Belmont Street (Route 123) / Warren Avenue	24	S	13	11	0	**68**
79	Brockton	West Street / West Elm Street	27	S	18	8	1	**68**
80	Brockton	West Elm Street / Moraine Street	20	SS	8	12	0	**68**
81	Brockton	North Main Street / Battles Street / East Battles Street	23	S	12	11	0	**67**
82	East Bridgewater	Bedford Street (Route 18) / Whitman Street (Route 106)	27	S	17	10	0	**67**
83	Easton	Washington Street (Route 138) / Purchase Street	22	SS	11	11	0	**66**
84	Brockton	Warren Avenue / West Chestnut Street	22	SS	11	11	0	**66**
85	Pembroke	School Street (Route 27) / Center Street (Route 36)	25	S	16	8	1	**66**
86	Brockton	Commercial Street (Route 27) / Perkins Street / Crescent Street (Route 123)	26	S	16	10	0	**66**
87	Brockton	Bartlett Street / Fuller Street	14	SS	1	13	0	**66**

Table 9-1 Most Hazardous Intersections in the Old Colony Region (2003-2005)(continued)

Rank	City/Town	Intersection	Number of Crashes	*Traffic Control	Property Damage Only	Injury Crashes	Fatal Crashes	Avg.
88	Bridgewater	Pleasant Street (Route 104) / Elm Street / Old Pleasant Street	21	S	10	11	0	**65**
89	Brockton	Centre Street (Route 123) / Sheridan Street / Gladstone Street	17	SS	5	12	0	**65**
90	Stoughton	Central Street (Route 27) / Island Street	28	SS	19	9	0	**64**
91	Brockton	North Quincy Street / Chestnut Street / Boundary Avenue	19	SS	9	9	1	**64**
92	Brockton	Warren Avenue / Market Street	23	SS	13	10	0	**63**
93	East Bridgewater	Plymouth Street (Route 106) / Washington Street / Old Plymouth Street	23	SS	13	10	0	**63**
94	Brockton	Grove Street / Clinton Street / Curve Street	19	SS	8	11	0	**63**
95	Brockton	North Main Street / Wyman Street	17	SS	6	11	0	**61**
96	Brockton	North Warren Avenue / Spring Street	17	SS	6	11	0	**61**
97	Brockton	Torrey Street / West Street	21	S	11	10	0	**61**
98	Kingston	Cranberry Road / Independence Mall Way / Pilgrim Highway (Route 3)	24	S	15	9	0	**60**
99	Kingston	Duxbury Road (Route 3A) / Pilgrim Highway (Route 3)	28	Yield	20	8	0	**60**
100	Brockton	Warren Avenue / Nilsson Street	19	SS	9	10	0	**59**

*S = Signal, SS = Stop Sign, FB = Flashing Beacon
** This data relies on only accidents reported and defined by severity*
DATA SOURCE: MassHighway Traffic Operations, and Safety Management Unit

Information on fatal crashes in the region was compiled from MassHighway crash data. The information compiled from the data was specific to discern, as much as possible, the types, locations, and circumstances concerning the crashes, with the purpose of finding the root causes of fatal crashes. It is expected that an understanding of these causes will lead to specific improvements that can prevent future fatalities in motor vehicle crashes in the region. Table 9-2 shows the number of fatal crashes in OCPC communities for the period between 1990 and 2005.

Table 9-2
Fatal Crashes in the Region 1990 - 2005

Community	Angle	Bicycle	Head On	Pedestrian	Rear End	Ran off road	Side swipe	Unknown	Total
Abington	5	0	5	2	1	7	0	1	21
Avon	3	0	3	3	2	1	1	1	14
Bridgewater	7	0	3	3	0	12	0	0	25
Brockton	32	1	11	22	2	41	1	8	118
East Bridgewater	3	0	2	4	0	2	0	1	12
Easton	3	0	8	1	0	16	0	1	29
Halifax	1	0	1	1	1	5	0	0	9
Hanson	1	0	3	2	0	7	0	1	14
Kingston	2	0	3	3	2	9	0	1	20
Pembroke	3	2	6	2	0	12	0	0	25
Plymouth	11	1	9	5	4	35	0	2	67
Plympton	2	0	1	0	0	2	0	1	6
Stoughton	9	2	0	7	2	10	2	0	32
West Bridgewater	3	0	1	5	1	9	0	0	19
Whitman	0	0	2	5	0	1	1	0	9
Totals	85	6	58	65	15	169	5	17	420

The City of Brockton experienced the most crashes that resulted in fatalities within the study time-period with 118 crashes. Plymouth had the second highest with 67 fatal crashes. Stoughton had 32, the third most highest, followed by Easton with 29, and Pembroke and Bridgewater each with 25. Abington had 21 fatal crashes, Kingston had 20, and West Bridgewater had 19 fatal crashes within the study period. Hanson and Avon each had 14 fatal crashes, followed by East Bridgewater with 12. Halifax and Whitman each had nine fatal crashes and Plympton had the least with six within the study time-period. In all, the OCPC communities experienced 420 fatal crashes between 1990 and 2005. Some of these crashes resulted in multiple deaths, therefore there were 445 fatalities that occurred due to the 420 crashes between 1990 and 2005.

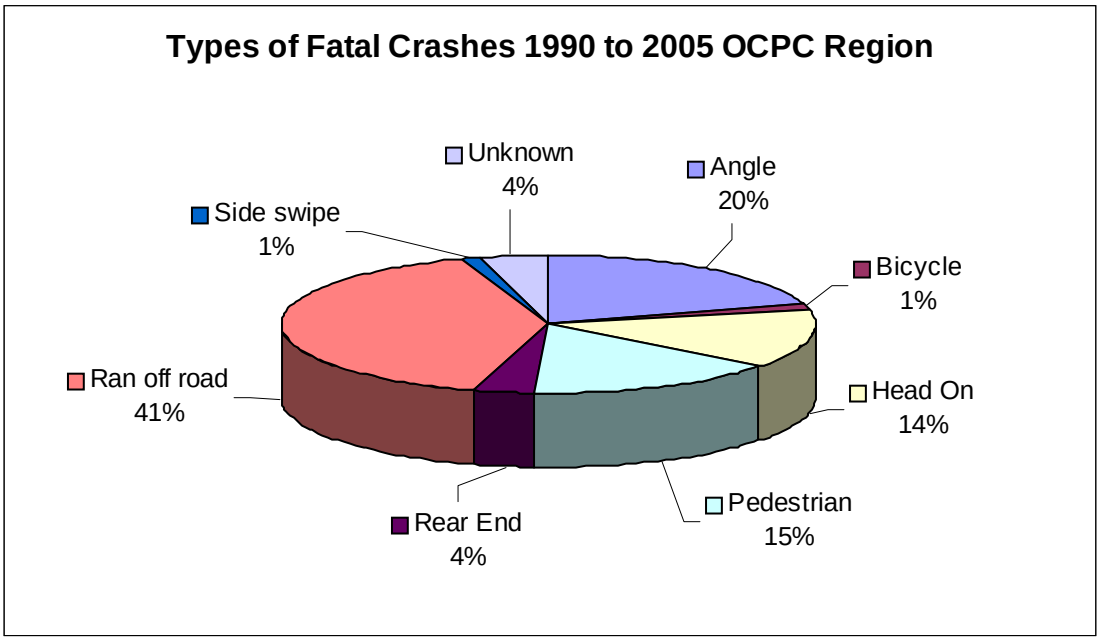
Table 9-2 shows that there were 169 ran off the road type crashes that resulted in fatalities, 85 angle fatal crashes, 65 vehicle crashes that resulted in pedestrian deaths, and 58 fatal head-on collisions during the study period. There were 17 fatal crashes that were reported as unknown, 15 rear-end fatal collisions, six fatal collisions with a bicyclist, and five sideswipe collisions.

Communities with major arterials, including Route 24 and Route 3, experienced higher numbers of fatal crashes, since many of the crashes occurred along these limited access highways, and on the ramps that connect them to the roadway system, due to higher speeds and higher volumes, which lead to higher exposure. Arterials and collectors that serve rural and suburban areas also experience high numbers of fatalities due to "ran off the road" type crashes that occur due to winding curves and limited sight distances. Some of these roads such as Route 106 in Kingston, Turnpike Street in West Bridgewater, North Cary Street in Brockton, and Bay Road in Easton, which were in existence before the prevalent use of the automobile, are not able to provide for safe travel at higher speeds due to limitations in the geometric design. These hazardous situations become amplified in those cases where driving conditions are slippery or the driver is impaired due to alcohol or lack of sleep. Pedestrian fatalities occurred in either urban situations, such as Brockton, or suburban situations whereby pedestrians were attempting to cross major high-speed, high-volume arterials.

Brockton led the OCPC communities regarding pedestrian fatalities with 22, Stoughton was second with seven, and Plymouth, West Bridgewater, and Whitman each had five pedestrian fatalities within the study area time period. All OCPC communities experienced pedestrian fatalities within the fifteen-year period except for Plympton. Some of these deaths were due to pedestrians being struck on high speed, limited access facilities such as Route 3 and Route 24 in Pembroke, Brockton, and West Bridgewater; however, most of the pedestrian fatalities occurred on facilities through urbanized areas, and on major arterials that have experienced commercial and residential growth. These facilities, such as Route 28 in Avon and Washington Street and Turnpike Street in Stoughton, combine higher speed through traffic (35 to 50 miles per hour) with increased commercial and residential activities. Although the preferred mode of choice along these routes is the automobile, pedestrian activity has increased and, in general, there are no pedestrian amenities such as sidewalks, crosswalks, or pedestrian signals available to accommodate pedestrian activity on these types of roads.

Figure 9-1 shows the types of fatal crashes in the region. Lane departure crashes (ran of the road, sideswipe, and head-on) make up the highest percentage of fatal crashes (total 56 percent.) Angle type crashes, which usually occur at intersections, but sometimes occur along a roadway at curb cuts, make up the second highest percentage of crashes (20 percent.) Crashes involving pedestrians also account for a significant percentage of fatal crashes with 15 percent of all fatalities involving a motor vehicle collision with a pedestrian. There were four percent rear-end fatal type crashes and four percent fatal crashes reported with unknown crash type occurring within the study time period. Bicycle fatalities make up the least percentage of fatal crashes in the region with one percent occurring in the study time-period.

Figure 9-1



Evaluation Criteria

An evaluation process to prioritize transportation projects included in the Transportation Improvement Program (TIP) was implemented several years ago. Among the criteria utilized as part of the effort, are safety and security.

Highway Safety Patrols

The term "highway safety patrols" is traditionally referring to state troopers patrolling state highways. However, in Massachusetts, that term also refers to the MassHighway's CaresVans program. Specially equipped vehicles patrol four different routes along 332 miles of interstate and express highways in the Boston region to aid motorists with disabled vehicles.

9.2 Transit

The Commonwealth's regional transit authorities and the Massachusetts Bay Transportation Authority (MBTA) maintain rigorous programs to ensure the safety of employees, passengers, and the general public. These programs range Because of safety concerns, EOT discourages the establishment of any new at-grade rail crossings in the state. EOT is also seeking to reduce the number of at-grade crossings by working with towns to consolidate crossings that are in close proximity to each other.

Due to the nature of safety and security for the MBTA's transit system, many safety initiatives also have a security aspect to them. The reverse relationship is, of course, true as well. Security cameras, as an example, could also be called safety cameras, because they provide both safety from an assailant in an isolated area of a train station, as well as provide security from a would-be terrorist on a train platform or a bus.

All of the grade crossings are equipped with audible and visual warnings systems for motorists and pedestrians. However, the pedestrian crossings at the stations and a single crossing in East Bridgewater do not have physical barriers to protect vehicles or pedestrians. The single crossing in East Bridgewater is an unused spur that serves the former Shaw's warehouse and is not owned by the MBTA. The pedestrian grade crossings are located at the Montello, Brockton, Whitman and Halifax stations.

Other physical barriers include fencing, soundproofing, jersey barriers and gates to reduce the potential for right of way intrusions. These barriers require regular upkeep to maintain their ability to deter unauthorized activates along the right of way. The MBTA stations and layover yards are lighted during times of darkness with additional security protection added to the layover yards.

MBTA Police Department

Through a combination of approximately 250 uniformed and plainclothes police officers, the MBTA Police Department carries out its primary mission of maintaining safety within the MBTA transit system. The MBTA police accomplish this through mobile, line, and canine patrol teams on both scheduled and random patrols, all of which serve to maintain a high degree of visibility within the system. 115 police officers, four police substations, and 15 police kiosks are assigned to the Blue, Green, Orange, and Red Lines, while additional surface patrols provide support to buses and commuter rail.

The three primary components of its safety operations are:

- Community Policing Patrol Plan
- Investigation and Prosecution (arrests and trials)
- Police Community Relations (public outreach)

MBTA Safety Department

The primary role of the MBTA Safety Department is to ensure the safety of its employees, its customers, and members of the general public throughout the MBTA system. In order to accomplish this, the MBTA Safety Department designs, implements, supports, and monitors safe work practices for and among its employees, whether they are working in MBTA vehicles and facilities or on MBTA property and rights-of-way. These safe practices are outlined in the MBTA's System Safety Program Plan and their Safety Policies and Procedures Manual.

Examples of the types of activities conducted by the MBTA Safety Department include:

- Right-of-Way Safety Training
- Tracking Accidents
- Operation Lifesaver
- Safety Audits
- Safety Hazard Correction
- Safety Drills

MBTA Security Cameras

The MBTA will increase the number of surveillance and security cameras in the subway system by an additional 186, bringing the total number operating in the subway system to 488. This will provide a security camera in every subway station in the entire system. The cameras will be monitored from a number of different locations, including the MBTA Operations Control Center, the Transit Police Department, and the Massachusetts Emergency Operations Center in Framingham.

In addition, the MBTA has embarked upon a program of installing security cameras in new buses. There is also a strong surveillance component to the MBTA's Station Management Program, which includes the

Automated Fare Collection System Project, the Hub Stations Project, and the Wide Area Network Project. The Hub Stations and Wide Area Network Projects surveillance components consist of closed-circuit television cameras and the fiber optic cable required connecting them to their monitors.

Grade Crossing Redesign

Improving grade crossing safety has long been one of the top priorities of the Federal Railroad Administration. From 1995 to 2004, the number of grade-crossing collisions declined by 3%, the frequency of such collisions per million train miles decreased by 42%, and the number of fatalities fell by 36%. During the first 11 months of 2005, grade crossing collisions were down 5.1%, and fatalities declined 5.3% compared to the same period of 2004. In Massachusetts, funding exists under the Section 130 Program of MGL Chapter 160 for the upgrading and improving of railroad crossings.

Advanced Warning Techniques

The Commonwealth of Massachusetts, the MBTA, and a majority of those in the railroad industry agree that the use of locomotive horns helps to promote safety at highway-rail grade crossings. Although the custom in Massachusetts is for trains to blow their horns at highway-rail grade crossings, horn bans have been created by the legislature in many communities. The MBTA complies with these bans within those communities. Like other transit property owners across the United States, the MBTA continues to await the implementation of Federal Railroad Administration regulations on the use of train locomotive horns at highway-rail grade crossings.

Meanwhile, the MBTA has taken steps to improve safety at its 200 public highway-rail grade crossings. Included among these steps is an investment in automatic warning systems, such as crossing gates, both two-way and four-way, flashing lights, and warning bells, to be installed on almost all of the public grade crossings used by the MBTA. A MBTA demonstration project was recently completed for the Federal Transit Administration using four-quadrant gates and motor vehicle detection systems at grade crossings on the Old Colony Line.

Communications Interoperability

One of the issues facing the MBTA in its safety emergency response planning is that of interoperability. Interoperability is defined as the ability of radio equipment belonging to one department's emergency first responders to communicate with that of another department's first responders. Currently, radio coverage inside MBTA subway system tunnels does not meet these operational standards. This affects the response capabilities of not only the Boston and Cambridge Fire Departments, but both cities' police departments, emergency medical services, and the MBTA Police Department. Interoperability affects nearly every community in the Commonwealth. The MBTA is working with other members of the State Interoperability Committee to explore this issue and develop solutions to improve radio communications.

Operation Lifesaver

Operation Lifesaver is an educational program created to stop deaths, injuries, and crashes at railroad grade crossings and along railroad rights-of-way. Crashes between trains and trucks are especially harmful, as they typically result in mass-casualty scenarios. As so much of the hazardous material transported in the United States is moved by truck, the reduction of grade crossing collisions for this type of vehicle is especially important.

9.3 Bicycle and Pedestrian Safety

Bicycle Crashes

In 2003, 622 bicyclists were killed and an additional 46,000 were injured in traffic crashes in the United States. Cyclists accounted for 1 percent of all traffic fatalities and 2 percent of all persons injured in crashes in the United States in 2003. In Massachusetts, the percent of cyclists among all traffic fatalities is higher than the national average: 2.4 percent, or 1.71 cyclist fatalities per million in population. Perhaps a major reason for the higher rate in Massachusetts is the urban nature of development in the state, particularly in the eastern half. According to the National Highway Traffic Safety Administration (NHTSA), cyclist fatalities occurred much more frequently in 2003 in urban areas (69 percent urban areas verse 31 percent elsewhere).

While the average age of cyclists killed in the nation is increasing (35.8 years in 2003 vs. 27.8 in 1993), still over one-fifth of cyclists killed in 2003 were children between the ages of 5 and 15 years old.

Locally within the region, cyclists suffered 1.4 percent of traffic fatalities between 1990 and 2005.

Crashes Involving Pedestrians

In 2003, 4,749 pedestrians were killed in traffic crashes in the United States, an average of one pedestrian killed every 111 minutes. In addition, 70,000 pedestrians were injured in traffic crashes that same year, an average of a pedestrian hurt in a traffic crash every 8 minutes. Eighty-six (86) of those 4,749 pedestrians killed in 2003 occurred in traffic crashes on Massachusetts roads. Overall, 18.6 percent of the State's traffic fatalities in 2003 were pedestrians.

Like cyclists fatalities, pedestrians are much more likely to be killed in urban areas. Seventy-two (72) percent of pedestrian fatalities in 2003 occurred in an urban area, and 79 percent occurred away from intersections. Approximately one-forth of pedestrians killed in 2003 were children between 5 and 9 years old, and one-fifth were under 16 years old.

Within the Old Colony region, 65 of the 420 (15.5 percent) persons killed in traffic crashes between 1990 and 2005 were pedestrians.

Bicycle Transportation Design

Paths for bicyclists (which generally also serve other non-motorized users) supplement the roadway network. Roadway design should consider these factors to best accommodate bicyclists:

- Providing width sufficient for motorists to pass bicyclists without changing lanes or crossing the centerline on high speed and/or high volume roads.
- Removing roadway obstacles that could cause bicyclists to crash.
- Directing bicyclists to scenic and low traffic routes by guide signs and/or pavement markings.
- Providing signalized crossings of major roadways when warranted for those who are not comfortable making left turns in heavy traffic.

When bicycles are used on public streets and roads, bicyclists are subject to the same traffic laws as motor vehicle operators with some exceptions as noted in the Massachusetts General Laws.

Road construction projects in the Old Colony region should be designed and constructed in accordance to the MassHighway Project Development and Design Guide, and controls built to standards set forth in the Manual On Uniform Traffic Controls, to best accommodate bicyclists.

Pedestrian Transportation Design

Road construction projects in the Old Colony region should be designed and constructed in accordance to the MassHighway Project Development and Design Guide, and controls built to standards set forth in the Manual On Uniform Traffic Controls, to best accommodate pedestrians of all types.

Safe Routes To School

The Massachusetts Safe Routes to School program promotes healthy alternatives for children and parents in their travel to and from school. The SRTS program educates students, parents and community members on the value of walking, bicycling, carpooling, and taking public transit and the school bus for travel to and from school.

The Safe Routes to School program elements, education, encouragement, enforcement, engineering, and evaluation ensure a comprehensive and successful program to increase walking and bicycling to and from school.

- Education Teaching children and parents about the broad range of transportation choices, instructing them in important lifelong bicycling and walking safety skills, creating awareness among drivers near schools, and improving the health benefits of our children through regular exercise.
    - Physical Health
    - Environmental Health
    - Safety

- Encouragement Using events and activities to promote healthy transportation alternatives.
    - Walking
    - Bicycling
    - Multi-family carpooling
    - Riding the bus

- Enforcement Partnering with local law enforcement to ensure traffic laws are obeyed in the vicinity of schools (this includes enforcement of speeds, yielding to pedestrians in crossings, and proper walking and bicycling behaviors), and initiating community enforcement such as crossing guard programs.
    - Creating awareness
    - Changing driver behavior
    - Offering safety training

- Engineering Creating operational and physical improvements to the infrastructure surrounding schools that lower speeds, reduce potential conflicts with traffic, and establish safer and fully accessible crossings, walkways, trails, and bikeways.
    - Improvement to physical environments
    - Safer routes for children

- Evaluation Monitoring outcomes and documenting trends through data collection before and after Safe Routes activities.

- Student Hand Survey
- Parent Survey
- Walkability Checklist
- Bikability Checklist

To assist with implementing this program, OCPC has been distributing program materials to the communities in the planning region. Recipients (over 175) of the materials include chief elected officials, planners, police chiefs, school superintendents, principals, school committees, planning boards. Presentations by MassRides have been provided at meetings of the Joint Transportation and Metropolitan Planning Organization.

9.4 Recommendations

Reduce the rates of motor vehicle, bicycle, and pedestrian fatalities by incorporating engineering, enforcement, education, and emergency response into the planning process.

Support the increase of safety of highway & railroad grade crossings and other locations where modes intersect.

Support the increase and improvement of safety of services, vehicles and facilities for transit, and for the transportation disadvantages.

Support the implementation of emergency response and evacuation plans in cooperation with emergency management agencies.

Continue to utilize safety performance measures in the planning process.

Broaden the awareness of safety issues through dissemination of messages o the public and elected officials.

Identify top lane departure and crash location and work at the local and regional levels to develop and implement location specific strategies to mitigate the deficiencies.

Expand the Safe Routes to School Program.

Support the increase of seat belt use in the State.

Increase the awareness of the dangers of speeding.