



CAPE COD  
COMMISSION

2012 REGIONAL TRANSPORTATION PLAN  
Chapter 3: Safety

**Endorsed**  
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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 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. Summaries of important safety studies are presented as well.

### 3.1 SAFETY PROBLEM AREAS

During the public process for this plan a comment form was distributed. Included in the questionnaire was a question asking each respondent to look at the Cape as a whole and identify the worst regional safety locations. Collectively, the greatest number of responses listed specific or generic locations along Route 6. This was followed up by responses listing Route 28.

One of the questions asked was tied to the town that each respondent either resided in or spent the most time in while visiting Cape Cod. The question asked “...*list the top three areas that have the worst LOCAL SAFETY problems.*” The responses were reviewed and the following table presents a list of the top two locations in each town indicated as safety problems:

TABLE 1 - RTP LOCAL SAFETY PROBLEM AREAS (FROM PUBLIC COMMENT FORM)

Town	Location #1	Location #2
Barnstable	Rt 28	Main St
Bourne	MacArthur Blvd	Bike/Pedestrian Safety
Eastham	Rt 6 (left turns)	Samoset Rd/Cape Cod Rail Tr
Falmouth	Rt 28 Teaticket Hwy	Woods Hole Rd/Locust St
Harwich	Rt 39/Pleasant Bay Rd	Rt 28/Sisson Rd
Mashpee	Mashpee Rotary	Rt 28/Quinnaquissett
Orleans	Rt 6A/Rt 28	Main St/Old Colony Way
Truro	Rt 6 (left turns)	Rt 6 (passing on right)
Yarmouth	Station Ave (between Old Townhouse Rd & Rt 6)	Rt 28

*(Responses as of 8/23/2010)*

### 3.1.1 INTERSECTIONS OF CRITICAL SAFETY CONCERN

In 2010, the Cape Cod Commission began an effort to rank the top intersections of critical safety concern across Cape Cod. Before the data could be gathered and sorted into any particular order or rank, it was necessary to specify the characteristics that signify an intersection as a safety concern. The Commission decided that there are several ways to interpret crash data – meaning, several possible ways to determine which intersections are of highest safety concern.

The Cape Cod Commission identified four methods of sorting data to create a top list of intersections of critical safety concern:

- **Based on Number of Crashes:** Perhaps most simple method is to look at the total number of crashes for each intersection and then rank them from most number of crashes to least. This method is very basic, in that it does not consider the severity of the crashes or the number of vehicles using the roadway.
- **Based on Equivalent Property Damage Only (EPDO):** This method considers the severity of each intersection’s crashes. An intersection’s EPDO value is determined using a formula that weights each crash based on whether it included a fatality, an injury but no fatality, or property damage only. Fatal crashes are assigned a value of ten; injuries are assigned a value of five; and property damage only crashes are assigned a value of one. To determine an intersection’s EPDO, the weighted values are summed to an aggregate value. Under this method, the intersection with the highest EPDO value is ranked most dangerous.

- **Based on Crash Rate:** A crash rate for an intersection compares the number of crashes to the number of vehicles passing through it. The crash rate is interpreted as number of crashes per million entering vehicles. It is possible an intersection with many crashes is not geometrically flawed or in poor condition, but merely a victim of the law of averages – many entering vehicles inflating the number of crashes. The crash rate method attempts to distinguish intersections with safety problems relative to their usage.
- **Based on EPDO Rate:** This method is based on the same idea as using the crash rate, whereas it compares an intersection’s EPDO to its usage. The EPDO rate is interpreted as EPDO per million entering vehicles. The vehicle with the largest EPDO rate is ranked number one under this method.

Base data for this analysis was provided by the Massachusetts Department of Transportation (MassDOT) in the form of geographically located crash clusters. The data provided by MassDOT included the number of reported crashes at each intersection and the severity of the crashes. It should be noted, however, that this dataset only includes incidents whose reports contained enough information to accurately locate them. Of the 12,001 crash reports collected by the Massachusetts Registry of Motor Vehicles, 9,220 incidents were located by MassDOT. The incidents are mapped on the following figure.

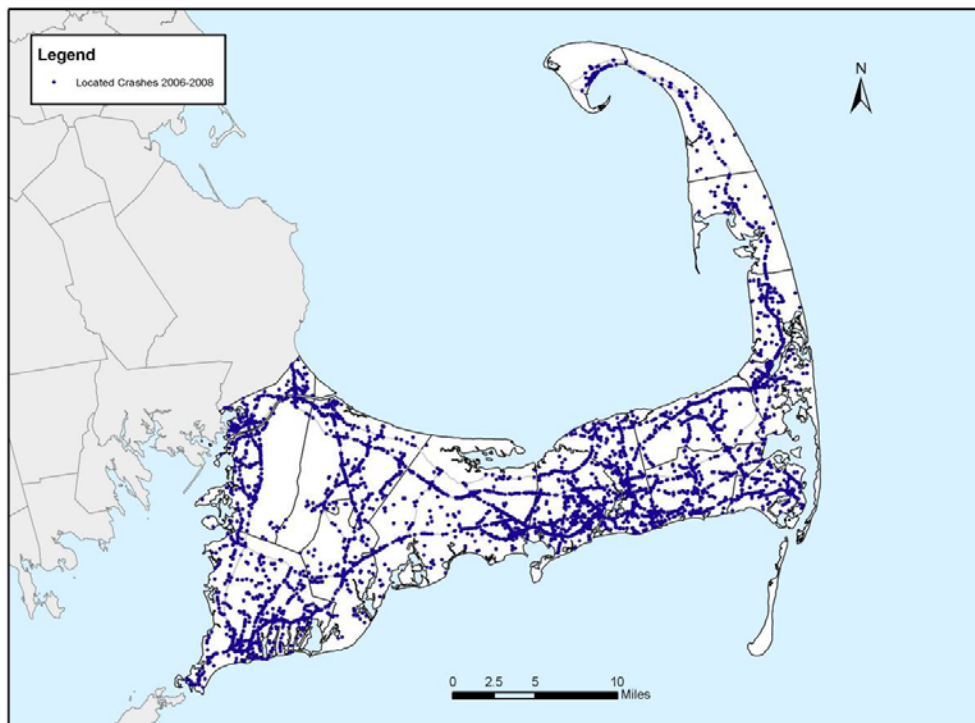


FIGURE 1 - CAPE COD LOCATED CRASHES 2006-2008  
 (Source: MassDOT Crash Records 2006-2008)

In an effort to create a more robust dataset, the Commission solicited the police department of each Barnstable County town for crash statistics on their most dangerous intersections. There is a wide range between towns in terms of their ability to produce this data. In total, the Commission received top crash lists and the supporting data from ten of fifteen towns. No department was able to provide the severities of crashes for their high crash lists. The information from local data is limited to the number of crashes per intersection. Without severity information, the local data could only bolster the data that were being used in creating the lists that use crash numbers and not EPDO. There are significant differences in the number of crashes at intersections as reported by MassDOT versus the local police departments.

In each of the following top crash location lists, select intersections are succeeded by a subscript. The subscript is a reference to a note in the Index of Notes table, which follows the fourth top crash list. The notes refer to any structural changes that have occurred or will occur at the intersections, and also highlight any studies that may have included the intersections.

TABLE 2 - TOP LOCATIONS BASED ON NUMBER OF CRASHES

Rank	Intersection	Town	Crash #
1	Route 6 (Mid-Cape Highway) @ Route 132 (Iyannough Road) - Exit 6 <sub>1</sub>	Barnstable	128
2	Route 6 (Mid-Cape Highway) @ Route 134 (East West Dennis Road) - Exit 9 <sub>2</sub>	Dennis	99
3	Otis Air Force Base Rotary @ Rt 28 / Sandwich Rd / Connery Ave <sub>3</sub>	Bourne	88
4	Route 6 (Mid-Cape Highway) @ Willow Street - Exit 7 <sub>4</sub>	Yarmouth	86
5	Route 6 (Mid-Cape Highway) @ Route 149 (Prospect Street) - Exit 5 <sub>5</sub>	Barnstable	83
6	Route 6 (Mid-Cape Highway) @ Station Avenue - Exit 8	Yarmouth	78
7	Route 6 (Mid-Cape Highway) @ Route 130 (Forestdale Road) - Exit 2 <sub>6</sub>	Sandwich	73
8	Bourne Rotary @ Rt 28 / Sandwich Rd / Trowbridge Rd	Bourne	71
9	Route 25 @ Bourne Bridge	Bourne	68
10	Route 28 (Falmouth Road) @ Bearses Way <sub>7</sub>	Barnstable	60
11	Route 28 (Falmouth Road) @ Route 149 (Prospect Street) <sub>8</sub>	Barnstable	56
12	Route 6 (Mid-Cape Highway) @ Chase Rd - Exit 4 <sub>6</sub>	Sandwich	55
13	Belmont Rotary @ Rt 28 / Rt 6 / Rt 6 Bypass / Head of the Bay Rd	Bourne	54
14	Route 28 (Falmouth Road) @ South County Road <sub>10</sub>	Barnstable	52
15	Route 28 (Iyannough Road) @ Yarmouth Road <sub>11</sub>	Barnstable	48
16	Route 134 (East West Dennis Road) @ Upper County Road <sub>12</sub>	Dennis	44
16	Route 6 (Mid-Cape Highway) @ Route 124 (Pleasant Lake Avenue) - Exit 10	Harwich	44
16	Route 6 (Mid-Cape Highway) @ Quaker Meeting House Rd - Exit 3 <sub>13</sub>	Sandwich	44
19	Route 28 (Falmouth Road) @ Osterville West Barnstable Road	Barnstable	43
19	Route 132 (Iyannough Road) @ Shoot Flying Hill Road <sub>14</sub>	Barnstable	43
21	Airport Rotary @ Rt 132 / Rt 28 EB/WB / Barnstable Rd <sub>15</sub>	Barnstable	42
22	Route 132 (Iyanough Road) @ Phinneys Lane <sub>16</sub>	Barnstable	40
23	Route 132 (Iyannough Road) @ Independence Road / Enterprise Road <sub>17</sub>	Barnstable	36
24	Eastham Rotary @ Rt 6A/28 / Rt 6, Smith Ln <sub>18</sub>	Eastham	35
24	Route 28 @ Route 151 (Nathan Ellis Highway)	Falmouth	35
24	Route 28 (Falmouth Road) @ Old Stage Road <sub>19</sub>	Barnstable	35
27	Route 28 (Chatham Road) @ Route 6A (Cranberry Highway) <sub>20</sub>	Orleans	33
28	Mashpee Circle @ Rt 28 / Rt 151 / Great Neck Rd	Mashpee	32
29	Route 28 (Falmouth Road) @ Pitchers Way	Barnstable	31
29	Route 28 (Falmouth Road) @ Lincoln Road	Barnstable	31
31	Sandwich Road @ Adams Street	Bourne	30
32	Route 134 (East West Dennis Road) @ Market Place	Dennis	27
33	Theophilus F. Smith Road @ Cumberland Farm / Patriot Square SD	Dennis	25
33	Route 6A (Sandwich Road) @ Sagamore Bridge Connector	Bourne	25
33	Route 28 (Main St / Iyannough Rd) @ East Main Street <sub>21</sub>	Yarmouth	25
36	Route 28 (Falmouth Road) @ Phinneys Lane <sub>22</sub>	Barnstable	24
36	Route 151 (Nathan Ellis Highway) @ Sandwich Road	Falmouth	24
36	Route 28 (Main Street) @ Depot Street	Dennis	24
36	Route 28 (Main Street) @ Route 134 / Swan River Road <sub>23</sub>	Dennis	24
40	Route 6 WB Off ramp @ Route 6 (Scenic Highway)	Bourne	22
40	Route 6 (GAR Hwy) @ Brackett Road / Old County Road <sub>24</sub>	Eastham	22
40	Route 6 (Mid-Cape Highway) @ Route 6A (Cranberry Highway) - Exit 12	Orleans	22
40	Route 6 (Mid-Cape Highway) @ Route 137 (Long Pond Road) - Exit 11 <sub>25</sub>	Harwich	22
40	Station Avenue @ Whites Path <sub>26</sub>	Yarmouth	22
45	Buck Island Road @ West Yarmouth Road	Yarmouth	20
45	Sandwich Road @ Brick Kiln Road	Falmouth	20
45	Station Avenue @ Old Town House Road	Yarmouth	20
45	Route 130 (Forestdale Road) @ Cotuit Road	Sandwich	20
49	Main Street @ Tonset Road	Orleans	19
49	Spring Bars Road @ Worcester Court	Falmouth	19
49	Route 28 (Teaticket Highway) @ Stop and Shop SD	Falmouth	19
49	Route 134 (East West Dennis Road) @ Bob Crowell Rd / Hemlock Ln / Agway SD	Dennis	19

Source: MassDOT 2006-2008 Crash Data and Towns of Barnstable County

TABLE 3 - TOP LOCATIONS BASED ON EQUIVALENT PROPERTY DAMAGE ONLY

Rank	Intersection	Town	Crash #	EPDO
1	Route 6 (Mid-Cape Highway) @ Route 132 (Iyannough Road) - Exit 6 <sub>1</sub>	Barnstable	128	314
2	Route 6 (Mid-Cape Highway) @ Willow Street - Exit 7 <sub>4</sub>	Yarmouth	86	204
3	Route 6 (Mid-Cape Highway) @ Route 134 (East West Dennis Road) - Exit 9 <sub>2</sub>	Dennis	99	187
3	Route 6 (Mid-Cape Highway) @ Route 149 (Prospect Street) - Exit 5 <sub>5</sub>	Barnstable	83	187
5	Route 6 (Mid-Cape Highway) @ Station Avenue - Exit 8	Yarmouth	78	182
6	Otis Air Force Base Rotary @ Rt 28 / Sandwich Rd / Connery Ave <sub>3</sub>	Bourne	88	172
7	Route 25 @ Bourne Bridge	Bourne	68	148
8	Route 6 (Mid-Cape Highway) @ Route 130 (Forestdale Road) - Exit 2 <sub>6</sub>	Sandwich	73	145
9	Route 6 (Mid-Cape Highway) @ Chase Rd - Exit 4 <sub>9</sub>	Sandwich	55	128
10	Bourne Rotary @ Rt 28 / Sandwich Rd / Trowbridge Rd	Bourne	71	115
11	Belmont Rotary @ Rt 28 / Rt 6 / Rt 6 Bypass / Head of the Bay Rd	Bourne	54	110
12	Route 6 (Mid-Cape Highway) @ Quaker Meeting House Rd - Exit 3 <sub>13</sub>	Sandwich	44	104
13	Route 134 (East West Dennis Road) @ Upper County Road <sub>12</sub>	Dennis	44	100
14	Route 6 (Mid-Cape Highway) @ Route 124 (Pleasant Lake Avenue) - Exit 10	Harwich	44	96
15	Mashpee Circle @ Rt 28 / Rt 151 / Great Neck Rd	Mashpee	32	80
16	Eastham Rotary @ Rt 6A/28 / Rt 6, Smith Ln <sub>18</sub>	Eastham	35	75
17	Route 151 (Nathan Ellis Highway) @ Sandwich Road	Falmouth	24	73
18	Route 28 @ Route 151 (Nathan Ellis Highway)	Falmouth	35	71
19	Route 6 (Mid-Cape Highway) @ Route 6A (Cranberry Highway) - Exit 12	Orleans	22	70
19	Airport Rotary @ Rt 132 / Rt 28 EB/WB / Barnstable Rd <sub>15</sub>	Barnstable	42	70
21	Route 6 (GAR Hwy) @ Brackett Road / Old County Road <sub>24</sub>	Eastham	22	62
22	Route 6A (Sandwich Road) @ Sagamore Bridge Connector	Bourne	25	58
23	Theophilus F. Smith Road @ Cumberland Farm / Patriot Square SD	Dennis	25	57
24	Route 6 (Mid-Cape Highway) @ Route 137 (Long Pond Road) - Exit 11 <sub>25</sub>	Harwich	22	54
25	Buck Island Road @ West Yarmouth Road	Yarmouth	20	52
25	Route 28 (Main Street) @ Depot Street	Dennis	24	52
25	Route 28 (Falmouth Road) @ Bearses Way <sub>7</sub>	Barnstable	24	52
28	Sandwich Road @ Adams Street	Bourne	30	50
28	Route 28 (Teaticket Highway) @ Figuerido Way	Falmouth	18	50
30	Buck Island Road @ Higgins Crowell Road	Yarmouth	17	49
31	Great Neck Road North @ Old Barnstable Road <sub>27</sub>	Mashpee	12	48
32	Route 28 (Teaticket Highway) @ Stop and Shop SD	Falmouth	19	47
33	Route 28 (Falmouth Road) @ Route 149 (Prospect Street) <sub>8</sub>	Barnstable	22	46
34	Route 28 (Main St / Iyannough Rd) @ East Main Street <sub>21</sub>	Yarmouth	25	45
35	Station Avenue @ Old Town House Road <sub>31</sub>	Yarmouth	20	44
35	Route 151 (Nathan Ellis Highway) @ Old Barnstable Road	Mashpee	12	44
35	Route 6A (Cranberry Highway) @ Eldredge Park Way	Orleans	16	44
38	Main Street @ Tonset Road	Orleans	19	43
39	Station Avenue @ Wood Road	Yarmouth	18	42
39	Route 28 (Falmouth Road) @ Osterville West Barnstable Road	Barnstable	14	42
41	Route 132 (Iyannough Road) @ Independence Road / Enterprise Road <sub>17</sub>	Barnstable	12	41
42	Rt 39 (Orleans Harwich Road) @ Pleasant Bay Road	Harwich	15	40
42	Forest Road @ Winslow Gray Road	Yarmouth	15	40
44	Route 6 WB Off ramp @ Route 6 (Scenic Highway)	Bourne	22	38
44	Sandwich Road @ Brick Kiln Road	Falmouth	10	38
44	Route 134 (East West Dennis Road) @ Airline Road	Dennis	14	38
44	Route 28 (Falmouth Road) @ Pitchers Way	Barnstable	10	38
48	Route 6A (Cranberry Highway) @ Union Street / Old Church Street	Yarmouth	13	37
48	Route 28 (Falmouth Road) @ South County Road <sub>10</sub>	Barnstable	13	37
48	Route 132 (Iyanough Road) @ Phinneys Lane <sub>16</sub>	Barnstable	17	37

Source: MassDOT 2006-2008 Crash Data

TABLE 4 - TOP LOCATIONS BASED ON CRASH RATE

Rank	Intersection	Town	Crash #	Crash Rate
1	Otis Air Force Base Rotary @ Rt 28 / Sandwich Rd / Connerly Ave <sub>3</sub>	Bourne	88	2.73
2	Rt 39 (Orleans Harwich Road) @ Pleasant Bay Road	Harwich	17	2.32
3	Route 6 (Mid-Cape Highway) @ Route 134 (East West Dennis Road) - Exit 9 <sub>2</sub>	Dennis	99	2.16
4	Route 28 (Falmouth Road) @ Route 149 (Prospect Street) <sub>8</sub>	Barnstable	56	2.14
5	Route 124 (Harwich Road) @ Tubman Road	Brewster	12	2.07
6	Theophilus F. Smith Road @ Cumberland Farm / Patriot Square SD	Dennis	25	2.04
7	Route 28 (Falmouth Road) @ South County Road <sub>10</sub>	Barnstable	52	2.03
8	Station Avenue @ Wood Road	Yarmouth	18	1.95
9	Route 6 (Mid-Cape Highway) @ Route 132 (Iyannough Road) - Exit 6 <sub>1</sub>	Barnstable	128	1.78
10	Route 28 (Falmouth Road) @ Bearses Way <sub>7</sub>	Barnstable	60	1.77
11	Spring Bars Road @ Worcester Court	Falmouth	19	1.73
11	Cotuit Road @ Harlow Road <sub>28</sub>	Sandwich	17	1.73
13	Route 6A (Sandwich Road) @ Sagamore Bridge Connector	Bourne	25	1.71
14	Sandwich Road @ Adams Street	Bourne	30	1.64
15	Route 6 WB Off ramp @ Route 6 (Scenic Highway)	Bourne	22	1.61
16	Route 28 (Falmouth Road) @ Osterville West Barnstable Road	Barnstable	43	1.53
16	Route 28 (Chatham Road) @ Route 6A (Cranberry Highway) <sub>20</sub>	Orleans	33	1.53
18	Route 132 (Iyannough Road) @ Shoot Flying Hill Road <sub>14</sub>	Barnstable	43	1.52
19	Route 6 (Mid-Cape Highway) @ Station Avenue - Exit 8	Yarmouth	78	1.49
19	Route 134 (East West Dennis Road) @ Upper County Road <sub>12</sub>	Dennis	44	1.49
21	Main Street @ Tonset Road	Orleans	19	1.43
22	Route 6 (Mid-Cape Highway) @ Willow Street - Exit 7 <sub>4</sub>	Yarmouth	86	1.42
23	Route 25 @ Bourne Bridge	Bourne	68	1.39
24	Route 6 (Mid-Cape Highway) @ Route 149 (Prospect Street) - Exit 5 <sub>5</sub>	Barnstable	83	1.38
24	Route 28 (Iyannough Road) @ Yarmouth Road	Barnstable	48	1.38
24	Belmont Rotary @ Rt 28 / Rt 6 / Rt 6 Bypass / Head of the Bay Rd	Bourne	54	1.38
27	Route 28 (Main Street) @ Depot Street	Dennis	24	1.33
28	Buck Island Road @ West Yarmouth Road	Yarmouth	20	1.30
28	Sandwich Road @ Brick Kiln Road	Falmouth	20	1.30
30	Route 28 (Falmouth Road) @ Pitchers Way	Barnstable	31	1.29
31	Route 6 (Mid-Cape Highway) @ Route 124 (Pleasant Lake Avenue) - Exit 10	Harwich	44	1.23
32	Route 6 (Mid-Cape Highway) @ Route 130 (Forestdale Road) - Exit 2 <sub>6</sub>	Sandwich	73	1.21
32	Bourne Rotary @ Rt 28 / Sandwich Rd / Trowbridge Rd	Bourne	71	1.21
34	Route 28A (Sandwich Road) @ County Road	Bourne	10	1.19
35	Depot Street @ Center Street	Harwich	9	1.17
36	Old Town House Road @ Forest Road <sub>29</sub>	Yarmouth	15	1.12
37	Depot Street @ Center Street	Dennis	9	1.10
38	Great Neck Road North @ Old Barnstable Road <sub>27</sub>	Mashpee	12	1.08
38	Route 132 (Iyanough Road) @ Phinneys Lane <sub>16</sub>	Barnstable	40	1.08
40	Route 130 (Forestdale Road) @ Cotuit Road	Sandwich	20	1.07
41	Route 134 (East West Dennis Road) @ Bob Crowell Rd / Hemlock Ln / Agway SD	Dennis	19	1.06
42	Adams Street @ Sagamore Bridge Connector	Bourne	15	1.05
43	Route 151 (Nathan Ellis Highway) @ Sandwich Road	Falmouth	24	1.04
44	Route 28 (Main Street) @ Route 134 / Swan River Road	Dennis	24	1.02
44	Eastham Rotary @ Rt 6A/28 / Rt 6, Smith Ln <sub>18</sub>	Eastham	35	1.02
46	Route 6 (Mid-Cape Highway) @ Chase Rd - Exit 4 <sub>9</sub>	Sandwich	55	1.00
47	Route 134 (East West Dennis Road) @ Market Place	Dennis	27	0.99
48	Buck Island Road @ Higgins Crowell Road	Yarmouth	17	0.98
48	Route 28 (Falmouth Road) @ Old Stage Road <sub>19</sub>	Barnstable	35	0.98
50	Route 28 (Main St / Iyannough Rd) @ East Main Street <sub>21</sub>	Yarmouth	25	0.97

Source: MassDOT 2006-2008 Crash Data and Towns of Barnstable County

TABLE 5 - TOP LOCATIONS BASED ON EPDO RATE

Rank	Intersection	TOWN	Crash#	EPDO	EPDO Rate
1	Route 124 (Harwich Road) @ Tubman Road	Brewster	12	32	5.51
2	Rt 39 (Orleans Harwich Road) @ Pleasant Bay Road	Harwich	15	40	5.45
3	Otis Air Force Base Rotary @ Rt 28 / Sandwich Rd / Connery Ave <sub>3</sub>	Bourne	88	172	5.33
4	Theophilus F. Smith Road @ Cumberland Farm / Patriot Square SD	Dennis	25	57	4.65
5	Station Avenue @ Wood Road	Yarmouth	18	42	4.54
6	Route 6 (Mid-Cape Highway) @ Route 132 (Iyannough Road) - Exit 6 <sub>1</sub>	Barnstable	128	314	4.36
7	Great Neck Road North @ Old Barnstable Road <sub>27</sub>	Mashpee	12	48	4.32
8	Route 6 (Mid-Cape Highway) @ Route 134 (East West Dennis Road) - Exit 9 <sub>2</sub>	Dennis	99	187	4.08
9	Route 6A (Sandwich Road) @ Sagamore Bridge Connector	Bourne	25	58	3.97
10	Sandwich Road @ Carriage Shop Road	Falmouth	7	31	3.96
11	Route 6 (Mid-Cape Highway) @ Station Avenue - Exit 8	Yarmouth	78	182	3.48
12	Old Bass River Road @ Old Chatham Road	Dennis	6	26	3.44
13	Depot Street @ Center Street	Harwich	9	26	3.39
14	Route 134 (East West Dennis Road) @ Upper County Road <sub>12</sub>	Dennis	44	100	3.38
14	Buck Island Road @ West Yarmouth Road	Yarmouth	20	52	3.38
16	Route 6 (Mid-Cape Highway) @ Willow Street - Exit 7 <sub>4</sub>	Yarmouth	86	204	3.36
17	Cotuit Road @ Harlow Road <sub>28</sub>	Sandwich	17	33	3.35
18	Main Street @ Tonset Road	Orleans	19	43	3.23
19	Route 151 (Nathan Ellis Highway) @ Sandwich Road	Falmouth	24	73	3.17
19	Depot Street @ Center Street	Dennis	9	26	3.17
21	Route 6 (Mid-Cape Highway) @ Route 149 (Prospect Street) - Exit 5 <sub>5</sub>	Barnstable	83	187	3.12
22	Route 28A (Sandwich Road) @ County Road	Bourne	10	26	3.10
23	Route 25 @ Bourne Bridge	Bourne	68	148	3.02
24	Route 28 (Main Street) @ Depot Street	Dennis	24	52	2.88
25	Buck Island Road @ Higgins Crowell Road	Yarmouth	17	49	2.83
26	Belmont Rotary @ Rt 28 / Rt 6 / Rt 6 Bypass / Head of the Bay Rd	Bourne	54	110	2.81
27	Route 6 WB Off ramp @ Route 6 (Scenic Highway)	Bourne	22	38	2.78
28	Sandwich Road @ Adams Street	Bourne	30	50	2.73
29	Route 6 (Mid-Cape Highway) @ Route 124 (Pleasant Lake Avenue) - Exit 10	Harwich	44	96	2.68
30	Route 28 (Teaticket Highway) @ Figuerido Way	Falmouth	18	50	2.66
31	Forest Road @ Winslow Gray Road	Yarmouth	15	40	2.55
32	Route 28 (Chatham Road) @ Finlay Road <sub>30</sub>	Orleans	8	32	2.55
33	Spring Bars Road @ Worcester Court	Falmouth	12	28	2.54
34	Sandwich Road @ Brick Kiln Road	Falmouth	10	38	2.46
35	Adams Street @ Sagamore Bridge Connector	Bourne	15	35	2.46
36	Route 6 (Mid-Cape Highway) @ Route 130 (Forestdale Road) - Exit 2 <sub>6</sub>	Sandwich	73	145	2.41
37	Route 6 (Mid-Cape Highway) @ Chase Rd - Exit 4 <sub>9</sub>	Sandwich	55	128	2.34
38	Route 6 (Mid-Cape Highway) @ EB approaching Exit 11	Harwich	10	30	2.31
38	Old Town House Road @ Forest Road <sub>29</sub>	Yarmouth	15	31	2.31
40	Route 6 (GAR Hwy) @ Brackett Road / Old County Road <sub>24</sub>	Eastham	22	62	2.29
41	Route 6A (Cranberry Highway) @ Main Street	Sandwich	11	27	2.26
42	Route 28 (Teaticket Highway) @ Stop and Shop SD	Falmouth	19	47	2.25
43	Mashpee Circle @ Rt 28 / Rt 151 / Great Neck Rd	Mashpee	32	80	2.23
43	Station Avenue @ Regional Avenue / Studley Road	Yarmouth	9	33	2.23
43	Route 134 (East West Dennis Road) @ Airline Road	Dennis	14	38	2.23
43	Sandwich Road @ Tanglewood Drive	Falmouth	7	27	2.23
47	Eastham Rotary @ Rt 6A/28 / Rt 6, Smith Ln <sub>18</sub>	Eastham	35	75	2.19
48	Station Avenue @ Old Town House Road <sub>31</sub>	Yarmouth	20	44	2.08
49	Route 6A (Cranberry Highway) @ Union Street / Old Church Street	Yarmouth	13	37	2.07
50	Route 130 (Forestdale Road) @ Quaker Meeting House Road	Sandwich	15	35	2.04

Source: MassDOT 2006-2008 Crash Data

TABLE 6 - INDEX OF NOTES

Note	Intersection	Town	Notes
1	Route 6 (Mid-Cape Highway) @ Route 132 (Iyannough Road) - Exit 6	Barnstable	Signalization; TIP year 2005, 2006, 2007
2	Route 6 (Mid-Cape Highway) @ Route 134 (East West Dennis Road) - Exit 9	Dennis	RSA 2009
3	Otis Air Force Base Rotary @ Rt 28 / Sandwich Rd / Connery Ave	Bourne	CCC Safety Study 2006
4	Route 6 (Mid-Cape Highway) @ Willow Street - Exit 7	Yarmouth	Additional lanes; TIP year 2004
5	Route 6 (Mid-Cape Highway) @ Route 149 (Prospect Street) - Exit 5	Barnstable	RSA conducted 2010; under design, TIP year 2010
6	Route 6 (Mid-Cape Highway) @ Route 130 (Forestdale Road) - Exit 2	Sandwich	CCC Safety Study 2008; RSA 2009; under design; TIP year 2010
7	Route 28 (Falmouth Road) @ Bearses Way	Barnstable	RSA conducted 2009; under review by town
8	Route 28 (Falmouth Road) @ Route 149 (Prospect Street)	Barnstable	Signal design; construction 2010; TIP year 2009
9	Route 6 (Mid-Cape Highway) @ Chase Rd - Exit 4	Sandwich	RSA 2009
10	Route 28 (Falmouth Road) @ South County Road	Barnstable	Signal design; construction 2010; TIP year 2009
11	Route 28 (Iyannough Road) @ Yarmouth Road	Barnstable	New design concepts recommended in Hyannis Access Study; part of Yarmouth Road Corridor Study
12	Route 134 (East West Dennis Road) @ Upper County Road	Dennis	RSA 2010; TIP year 2012
13	Route 6 (Mid-Cape Highway) @ Quaker Meeting House Rd - Exit 3	Sandwich	RSA 2009
14	Route 132 (Iyannough Road) @ Shoot Flying Hill Road	Barnstable	Route 132 construction relocated intersection - TIP year 2005, 2006, 2007
15	Airport Rotary @ Rt 132 / Rt 28 EB/WB / Barnstable Rd	Barnstable	New design concepts recommended in Hyannis Access Study
16	Rt 132 (Iyanough Road) @ Phinneys Lane	Barnstable	Upgrade signals/additional lanes 2009; TIP year 2005, 2006, 2007
17	Route 132 (Iyannough Road) @ Independence Road / Enterprise Road	Barnstable	Left turn lane added to 132 southbound
18	Eastham Rotary @ Rt 6A/28 / Rt 6, Smith Ln	Eastham	CCC Safety Study 2009; recommendations included in Route 6 Outer Cape Safety and Traffic Flow Study 2004
19	Route 28 (Falmouth Road) @ Old Stage Road	Barnstable	RSA 2007
20	Route 28 (Chatham Road) @ Route 6A (Cranberry Highway)	Orleans	CCC Safety Study 2006; TIP year 2012
21	Route 28 (Main St / Iyannough Rd) @ East Main Street	Yarmouth	Recommendations included in Route 28 Safety and Traffic Flow Study 2006
22	Route 28 (Falmouth Road) @ Phinneys Lane	Barnstable	RSA 2007
23	Route 28 (Main Street) @ Route 134 / Swan River Road	Dennis	Added left turn lanes and new signal phasing, pedestrian improvements 2009/2010
24	Route 6 (GAR Hwy) @ Brackett Road / Old County Road	Eastham	CCC Safety Study 2008; recommendations included in Route 6 Outer Cape Safety and Traffic Flow Study 2004; Signal upgrade and westbound left-turn lane added 2009, 2010
25	Route 6 (Mid-Cape Highway) @ Route 137 (Long Pond Road) - Exit 11	Harwich	Under design; TIP year 2011
26	Station Avenue @ Whites Path	Yarmouth	Signal upgrade and northbound left-turn lane added 2003, 2004
27	Great Neck Road North @ Old Barnstable Road	Mashpee	RSA 2009
28	Cotuit Road @ Harlow Road	Sandwich	RSA 2009; TIP year 2011
29	Old Town House Road @ Forest Road	Yarmouth	RSA 2010; TIP year 2010
30	Route 28 (Chatham Road) @ Finlay Road	Orleans	TIP project, advertised 2006
31	Station Avenue @ Old Town House Road	Yarmouth	Signal upgrades 2003, 2004

### 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 was 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.

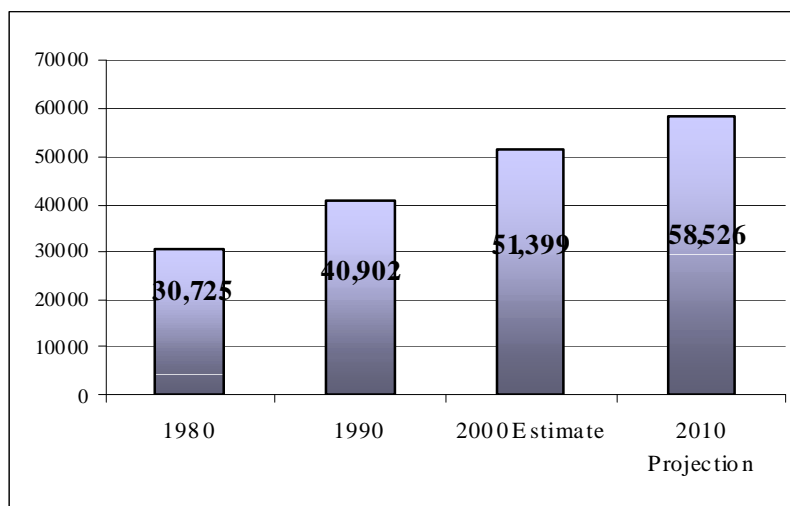


FIGURE 2 - CAPE POPULATION OVER 65

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](http://www.gocapecod.org)

## 3.3 THE CAPE COD ROADWAY

There are nearly 3,900 miles of roadways in Barnstable County. These include 608.5 miles of Arterials and 238.9 miles of Collectors. The remaining 3,018.5 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 2006-2008.

TABLE 7 - CRASH RATES (BASED ON YEARS 2006-2008): ROUTE 6

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	76	0.0	2.47	0.00
Sandwich	60	0.7	0.51	0.59
Barnstable	121	1.3	0.86	0.93
Yarmouth	64	0.7	0.88	0.96
Dennis	45	0.0	1.74	0.00
Harwich	41	0.0	0.77	0.00
Brewster	5	0.0	0.27	0.00
Orleans	12	0.0	0.58	0.00
Eastham	83	0.0	1.69	0.00
Wellfleet	36	0.7	0.68	1.31
Truro	16	0.0	0.36	0.00
Provincetown	5	0.0	0.50	0.00
<b>Total</b>	<b>564</b>	<b>3.4</b>	<b>0.89</b>	<b>0.53</b>

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

TABLE 8 - CRASH RATES (BASED ON YEARS 2006-2008): ROUTE 28

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	137	0.7	1.29	0.66
Falmouth	109	0.0	1.25	0.00
Mashpee	31	0.0	1.19	0.00
Barnstable	129	1.3	1.69	1.71
Yarmouth	174	0.3	5.33	0.92
Dennis	71	0.0	4.85	0.00
Harwich	42	0.0	1.68	0.00
Chatham	42	0.0	1.59	0.00
Orleans	25	0.3	1.37	1.64
<b>Total</b>	<b>760</b>	<b>2.6</b>	<b>1.85</b>	<b>0.63</b>

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

TABLE 9 - CRASH RATES (BASED ON YEARS 2006-2008): ROUTE 6A

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	21	0.3	8.82	12.61
Sandwich	47	0.3	2.11	1.35
Barnstable	11	0	0.56	0.00
Yarmouth	50	0.3	3.15	1.89
Dennis	38	0	3.17	0.00
Brewster	41	0.3	1.27	0.93
Orleans	61	0	6.17	0.00
<b>Total</b>	<b>269</b>	<b>1.2</b>	<b>2.35</b>	<b>1.05</b>

*Registry of Motor Vehicles' Crash Records supplied by MassDOT  
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.

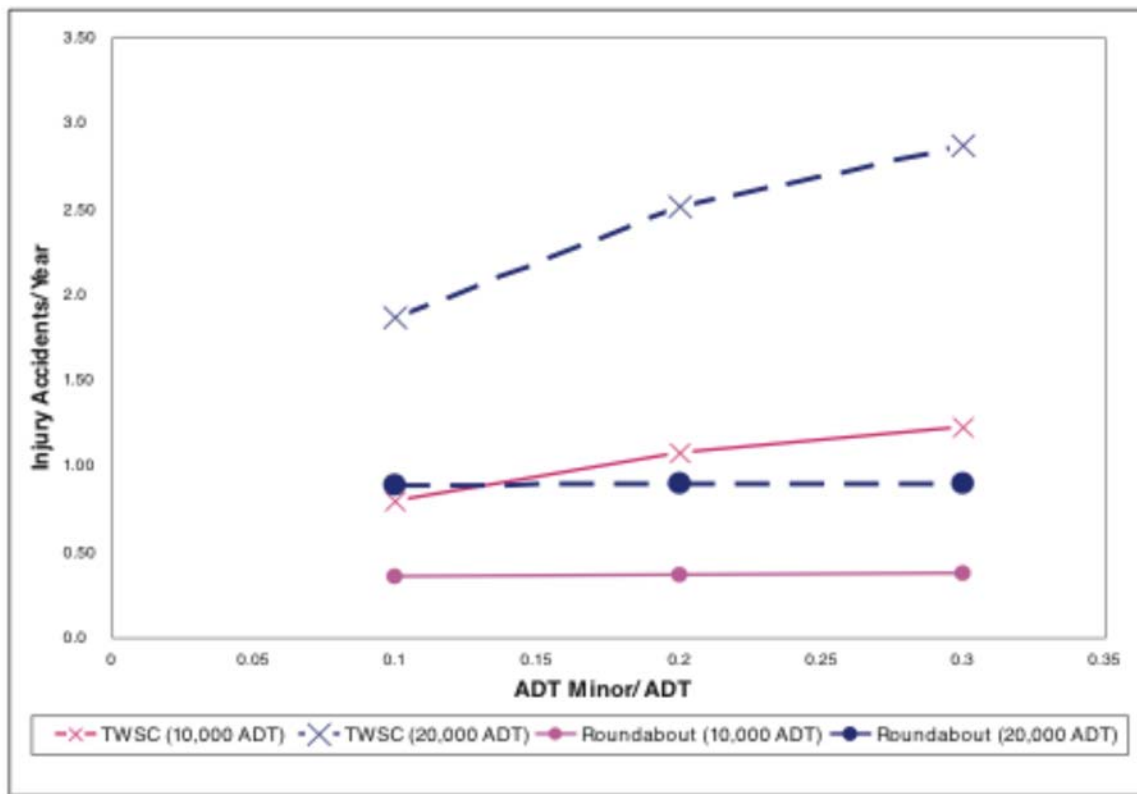


FIGURE 3 - COMPARISON OF PREDICTED ROUNDABOUT INJURY CRASHES WITH RURAL 2-WAY STOP -CONTROLLED INTERSECTIONS.  
(Source: FHWA)

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.

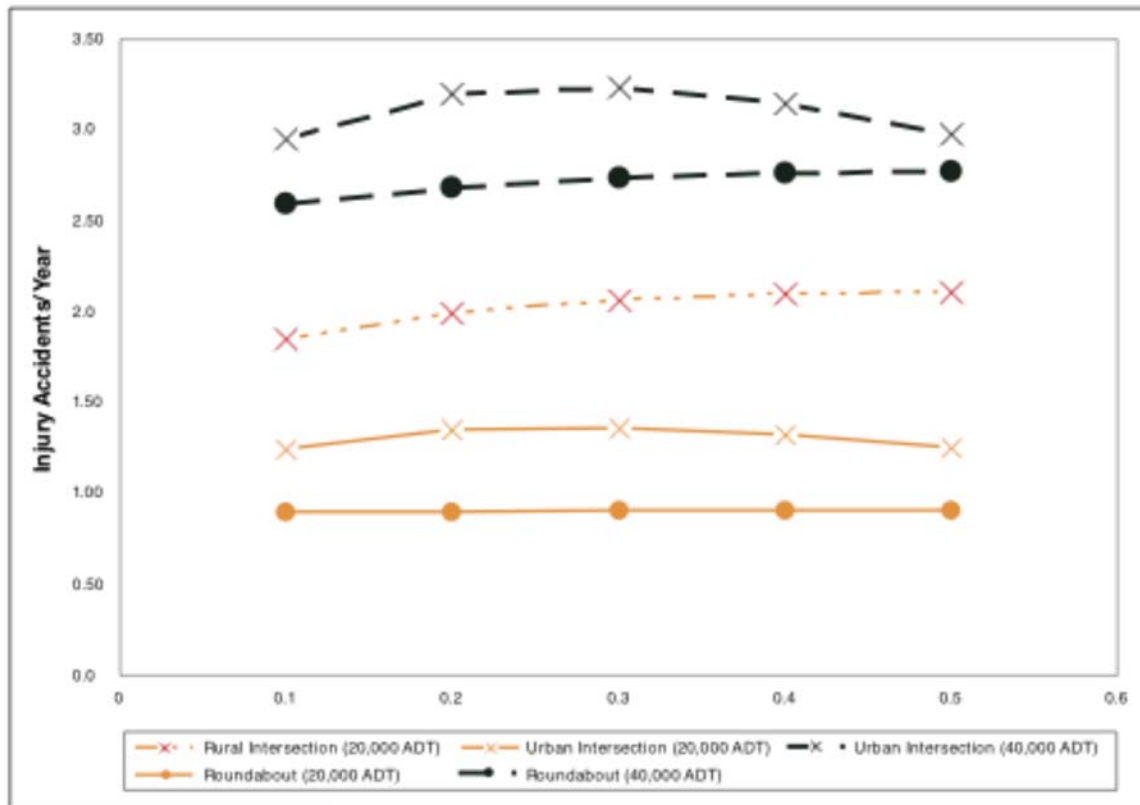


FIGURE 4 - COMPARISON OF PREDICTED INJURY CRASHES FOR SINGLE-LANE AND DOUBLE-LANE ROUNDABOUTS WITH RURAL OR URBAN SIGNALIZED INTERSECTIONS. (Source: FHWA)

### 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

MassDOT, the Governor's Highway Safety Bureau, and many other agencies have participated in developing the state's 2006 "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.

Since Safety is such an important goal of the RTP, it is important to recognize the link between this chapter and the State's 2006 "Strategic Highway Safety Plan" (SHSP). The SHSP lists several "Emphasis Areas" including:

- **Data Systems** (focus on Crashes, Roadway, Medical, Vehicle Registration, Driver History, Citations).
- **Infrastructure** (focus on Lane Departure Crashes, Intersection Crashes)
- **At-Risk Driver Behavior** (focus on Occupant Protection, Speeding, Alcohol/Impaired Driving)
- **Higher-Risk Transportation System Users** (focus on Young Drivers, Older Drivers, Pedestrians, Bicyclists, Motorcyclists)
- **Public Education and Media** (focus on Statewide Safety Marketing, Media messages, Public Awareness)
- **Safety Program Management** (focus on Process for Institutionalizing the SHSP)

These Emphasis Areas are discussed in further detail below. Additionally, RTP safety recommendations that support SHSP Emphasis Areas listed in Section 3.3.4 are indicated with an asterisk and footnote.

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 SHSP 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 MassDOT *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:

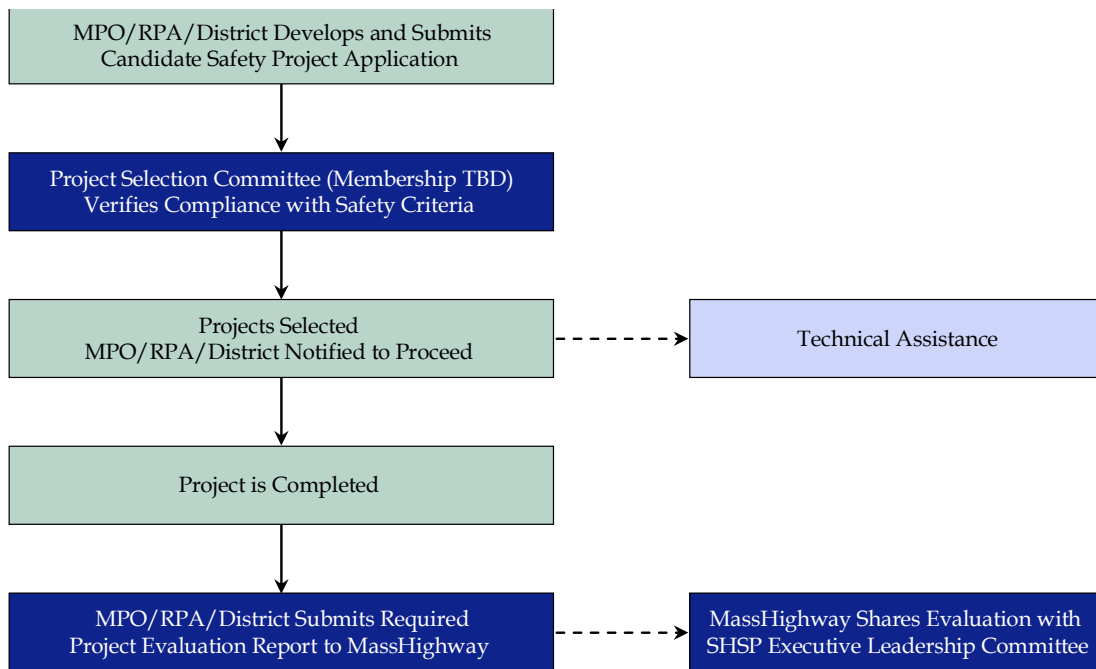


FIGURE 5 - INFRASTRUCTURE SAFETY PROJECT SELECTION PROCESS

*Source: MassDOT Highway Division*

## **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. Recommendations consistent with the Massachusetts’ *Strategic Highway Safety Plan’s* (SHSP) “Emphasis Areas” are indicated with an asterisk.

- 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.\*

*\*Supports Massachusetts’ Strategic Highway Improvement Program “Emphasis Areas”*

### 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 ROADWAY SAFETY AUDITS

Since 2007 there have been nine Road Safety Audits (RSAs) completed for locations throughout Cape Cod. The Audit process is overseen by MassDOT and brings together community officials and others in an intensive review of high-crash locations’ operational and geometric deficiencies. Each audit includes a review of traffic and crash information, an onsite field review.

It is important to note that the RSAs were borne directly from the U.S. DOT & MassDOT’s Highway Safety Improvement Program (HSIP). This program was formally created by the federal transportation legislation (SAFETEA-LU) and these efforts are intended to align the use of data to identify the most serious safety deficiencies responsible for fatal accidents and serious injuries.

### 3.4.1 BARNSTABLE ROAD SAFETY AUDITS

There have been three completed audits within the town of Barnstable since 2007:

#### 3.4.1.1 Route 28 in Barnstable – Lane Departure Safety Audit

Completed in 2007, this audit included an examination of a half section of Route 28 between Old Stage Road and Phinneys Lane in Centerville. The audit included Short Term and Additional Recommendations for Route 28:

#### **Short Term Recommendations:**

- An initial recommendation is to inspect sight distance for vehicles exiting all driveways along the corridor as some locations have vegetation which significantly inhibits sight distance of vehicles as well as pedestrians and bicycles. There is a need to maintain landscaping so that the sight distance will not be obstructed. Similarly, there was a recommendation for necessary tree-trimming along the north side of the roadway closer to the Phinneys Lane intersection.
- Enforcement was identified by the RSA team as one countermeasure which could address several of the existing safety problems along Route 28, including enforcement centered upon speeding, aggressive driving, and red-light running (specifically at Old Stage Road). It is also recommended that speed data collection be completed by the state, Cape Cod Commission, or the Town of Barnstable to track current operating speeds throughout the year; this may also prove useful in the establishment of enforcement thresholds.
- The gas station under development at Phinneys Lane has a curb cut located within the intersection. Consistent with the previous operation of the gas station, it is critical that this driveway remain an “entrance only.”
- One recommendation suggested at the RSA meeting was to explore the possibility of converting the existing lane usage at the intersection of Phinneys Lane. For consideration would be the designation of an exclusive right turn lane, which once reconfigured would make the center lane a shared left/through lane. This request was based upon a perceived dominant movement and would better utilize the existing slip lane. At a minimum this idea warrants further consideration.
- Pedestrian concerns at the intersection of Old Stage Road and Route 28 should be addressed. One recommendation was the inclusion of pedestrian placards, which explain the meaning of pedestrian indications. It was also noted that the time allocated to pedestrians at this intersection was inadequate and/or not functioning properly. The resulting recommendation is to verify current field timing versus phase plans, and adjust as necessary.
- It is recommended that the intersection of Old Stage Road and Route 28 be further analyzed. Of specific concern from a safety perspective would be the demand associated with justification of an EB left-turn phase to allow protected-permissive left-turn signal phasing (PPLT). An additional consideration would be the reconfiguration of existing lane usage, based upon the resulting signal phasing changes. It is also recommended the

adjacent intersection of Old Stage Road and Camp Opechee Road be studied in a similar fashion and at the same time.

- The merge at each end of the corridor was mentioned as a concern. At the intersection of Phinneys Road the taper on the east side of the intersection was reportedly short because of the adjacent herring run. Although potential redesign options should be considered (e.g. lengthen existing taper if possible) the existing markings and signage could be improved to alert drivers of the merge condition. Specifically, there appears to be an EB merge ahead warning sign missing from this location. Similar recommendations would be beneficial for the merge and existing taper on the west side of Old Stage Road, and should be addressed during any intersection study (see previous bullet).
- Utility poles are in close proximity to the traveled way along Route 28, which is in part negated by the presence of curbing. Nevertheless, it is recommended that the poles be reflectorized to add conspicuity. Although, it may be a longer-term solution, it is also recommended that plans to relocate the utility pole from the center of the shared pedestrian/bicycle route (see Figure 5 – located near intersection with Old Stage) be initiated in the near future.
- Maintenance along Route 28 appeared to be adequate at the time of the RSA meeting; however, given the prevalence of pedestrian and bicycles, it is recommended that pavement markings remain visible. Although most markings, also including all longitudinal markings, the crosswalk markings across the Centerville Plaza site drive were faded and should be refreshed. A similar, sustained approach is suggested for signage in the area as well. Routine maintenance of drainage features in the area is also recommended.
- Although the safety impacts resulting from the number of existing curb cuts and their respective volumes are better addressed through long-term solutions; it is recommended that short-term strategies resulting in the consolidation of curb cuts be further explored.
- The next section discusses longer-term strategies based in part on the time required to implement; however a short-term recommendation is to consider these alternatives as some of them could prove effective for a relatively low cost (e.g. conversion from 4 to 3 lanes).

### **Additional Route 28 Countermeasures:**

- *Consolidation of access drives:* It is important to note that many of the strategies discussed at the RSA meeting and described below are either predicated on the need for consolidation of existing access point, or will result in safer and improved flow based upon consolidation of access points. The notion is that traffic will move within the plazas and will be processed at a fixed number of access points at Route 28. For example, there is currently no access between the two main plazas (Centerville Plaza and Bell Tower Mall) on the north side of Route 28; however, access between them could be useful in implementing several of the countermeasures discussed.
- *Addition of a center median:* The addition of a divided median would not only separate the major flows of traffic, which will prevent cross-over the centerline crashes, but will also eliminate crashes at all plaza drives between left-turning vehicles. As a result of a center median all plaza drives would become right-in / right-out movements only. Several variations of a median approach were discussed including the application of curbed islands as well as the possibility of guard rail.

• *Reconfiguration of signalized intersections at Old Stage Road and Phinneys Lane:* The addition of a center median that eliminate left turn maneuvers throughout this segment of Route 28 would result in an increased demand at the two existing signalized intersections. Specifically, there would be an added demand for U-turn maneuvers. Based upon the existing geometry and available right-of-way there is some concern about the feasibility of accommodating U-turn maneuvers. Two variations which aim to accommodate these maneuvers would be as follows:

o The design of jughandles (north side at Old Stage and south side at Phinneys) that would allow for storage of the U-turn vehicles and provide a sufficient radius for all but was eliminated as possibility given the availability of existing right-of-way.

o The redesign of each existing intersection as a roundabout would allow for the accommodation of all intersection maneuvers, including the added U-turns. Initial concerns related to this concept are again related to the available right-of-way as well as the public's acceptance of roundabouts.

• *Controlled access from Centerville Plaza:* Adding control at the intersection of Centerville Plaza and Route 28 would undoubtedly improve safety along the corridor. Please note this option would be feasible either with or without the addition of a center median. Several alternatives were discussed at the RSA meeting and warrant consideration:

o One approach could be to signalize the intersection and totally control vehicles flows to provide an orderly flow. Please note that a traffic signal warrant analysis would be required to determine if this alternative is indeed feasible. Nevertheless, this configuration would likely allow for the creation of turn lanes with storage. It should be noted that this plan has been discussed, but was referred to as a "dead issue" at the time of the RSA meeting. Given its potential on both safety and efficiency this should be considered to the extent possible.

o Another alternative was to design and construct a roundabout at this location. In addition to the previous stated concerns of available right-of-way and public acceptance another possible concern would be the unbalanced nature of vehicle flows for the developed approaches, which may hinder the operational efficiency of a roundabout. Nevertheless, this warrants further consideration.

• *4 to 3 Conversion:* Conceptually this alternative would eliminate one of the existing four lanes and provide a single through lane in both the eastbound and westbound directions. The center lane could be either a series of alternating turn pockets which would improve sight distance, add storage, and force drivers to cross only a single lane when turning, or a two-way left turn lane could be employed. One concern would be the impact on overall efficiency and the resulting availability in sufficient gaps for left-turning vehicles that may result from creating a single lane of through traffic. Among all of the consideration listed in this section, this strategy could be implemented relatively quickly and likely at a lower cost. As such it probably warrants further consideration in the short-term as a possible countermeasure.

• *Creation of northern access road:* An idea that had been considered previously was discussed again at the RSA meeting. Specifically, the plan called for the creation of an access road that would provide connection to both Old Stage Road and Phinneys Lane. This plan would eliminate the need for left-turn maneuvers from Route 28 to Phinneys Lane and would eliminate the overall burden on the various plaza access points. As

noted, this was discussed previously and was deemed not feasible given requirements associated with acquiring right-of way.

• *Route 28 at Phinneys Lane*: The current skewed intersection results in sight distance challenges and is a likely contributor to existing crashes. Another long-term consideration would be any potential for realignment which would allow for the northbound and southbound approaches to be squared. In the meantime, some considerations should crashes remain problematic would be to fully split the phasing for the skewed approaches. As noted, the possible countermeasures discussed above are considered long-term as compared to other countermeasures which could be implemented immediately. Nevertheless, it is recommended that a short-term strategy be the consideration of these alternatives, which may prove to be feasible and cost-effective strategies for improved safety and efficiency along this corridor.

### 3.4.1.2 Route 28 (Falmouth Road)/Bearses Way

Completed in 2009, this study included proposed enhancements to address a series of 11 Safety Issues.

#### **Safety Issue #1. Access Control**

Enhancements:

1. Due to the high proportion of crashes associated with the access points for adjacent commercial uses, restrict access movements by signage and/or barriers. A median could be constructed in the site driveway to allow right-in/right-out-only movements and designed so as to deter left-in/left-out movements. Additionally, signage could be posted restricting the left-in/left-out turning movements from driveways. Enforcement of the restrictions would be necessary.
2. Increase enforcement of existing regulatory signs to prevent vehicles taking illegal turns out of adjacent commercial uses.
3. Increase enforcement of vehicles cutting through adjacent commercial uses to avoid the traffic signal.
4. Reduce the number of travel lanes on Falmouth Road (Route 28) and Bearses Way near the site driveways to decrease the number of travel lanes vehicles entering or exiting the adjacent site driveways need to cross.

#### **Safety Issue #2. Lane Configuration**

Enhancements:

1. Consider changing the right-most through lane to an exclusive right-turn lane for the Falmouth Road (Route 28) approaches.
2. Improve delineation of lanes approaching the intersection to accommodate turning lanes. To prevent a “turn-only lane trap,” provide painted island pavement markings on Falmouth Road (Route 28) eastbound and westbound and on Bearses Way northbound approaches to channelize vehicles into the through lane.

3. Increase the delineation of the merge on the departure side on Falmouth Road (Route 28) using the standard taper length and warning signs.

### **Safety Issue #3. Pavement Markings**

Enhancements:

1. The intersection of Falmouth Road (Route 28)/Bearses Way should be re-striped and maintained with durable pavement markings.

### **Safety Issue #4. Pedestrian Accommodations**

Enhancements:

1. Sidewalks should be considered for both sides of Falmouth Road (Route 28) and Bearses Way due to the adjacent commercial uses and existing multi-use path.

2. The intersection of Falmouth Road (Route 28)/Bearses Way should be upgraded to include pedestrian accommodations at the intersection. These accommodations should include pedestrian signals, crosswalks, and handicapped-accessible ramps.

### **Safety Issue #5. Bicycle Accommodations**

Enhancements:

1. “Share the Road” signs, bicycle boxes, and bicycle actuation should be considered for all intersection approaches, especially where the bike route ends.

2. Bike lanes or accommodations should be provided on each intersection approach.

### **Safety Issue #6. Bus Accommodations**

Enhancements:

1. Consider providing adequate bus pull-off areas, passenger shelters, and pedestrian accommodations for local bus routes.

### **Safety Issue #7. Traffic Signal Timing**

Enhancements:

1. Review and adjust signal timing to adequately process vehicles through the intersection.

2. Verify that adequate clearance times are provided for each intersection approach.

3. Review placement and operation of Bearses Way northbound vehicle detection.

### **Safety Issue #8. Emergency Access**

Enhancements:

1. Install pre-emption system for emergency vehicles.

### **Safety Issue #9. Presence of Utility Poles**

Enhancements:

1. Install reflectors on utility poles located within the clear zone.
2. Relocate utility poles located within the clear zone to a location 14 feet from the edge of Bearses Way.

### **Safety Issue #10. Signage Improvements**

Enhancements:

1. Merge warning signs (W4-2R) should be installed on Falmouth Road (Route 28) eastbound after the intersection where the roadway narrows from two travel lanes to one travel lane. A larger sign may be considered for both Falmouth Road (Route 28) approaches.
2. Install “Junction Route 28” signs on Bearses Way to inform driveways of the upcoming state highway.
3. Install “Left Lane Must Turn Left” signs and pavement markings on Bearses Way northbound.
4. Relocate “No Left Turn” signs located near Corporation Street to be visible from the gas station driveway.

### **Safety Issue #11. Drainage Issues**

Enhancements:

1. Clean out and maintain existing catch basins.
2. Redesign intersection and approaches to improve drainage and reduce standing water.

#### 3.4.1.3 Meetinghouse Way (Route 149)/Route 6 Ramps

Completed in 2010, the audit includes eight safety issues and identified enhancements for each:

### **Safety Issue #1. Intersection Control**

Enhancements:

1. Change the control of the intersection, utilizing either a traffic signal or a roundabout, to reduce angle crashes and clarify control.
2. Include emergency pre-emption if a traffic signal is installed.

View approaching the STOP sign on the Service Road westbound approach.

## **Safety Issue #2. Intersection Geometry**

### Enhancements:

1. Consider incorporating the Service Road EB approach into the intersection control (see Safety Issues #1) or modify the geometry of the eastbound ramp to increase conspicuity of vehicles entering the intersection from the Service Road EB approach. Consideration should be given to redesigning the Route 6 EB right-turn ramp to force vehicles to make a 90° turn and to increase the separation between the Route 6 EB and Service Road EB approaches. The intersection could also be redesigned as a 5-leg roundabout, incorporating both Service Road approaches. A change in traffic control will also reduce the number of conflicts a motorist must look for; a signal or a roundabout could accomplish this.
2. Any redesign should provide adequate turning radii to accommodate emergency vehicle and truck access through the intersection. The West Barnstable Fire Department's water trucks are of particular concern for the Town, since firefighters must use water tankers to fight fires because there is no water source north of Route 6 in West Barnstable. Include apron for emergency and truck access if a roundabout is installed.

## **Safety Issue #3. Sight Distance**

### Enhancements:

1. Trim trees and shrubs adjacent to the roadways to provide adequate sight distance.
2. Change the control of the intersection by installing either a traffic signal or a roundabout to lessen the effects of the horizontal and vertical alignment on sight distance. Install appropriate advance signage to warn motorists of the change in control at the intersection.

## **Safety Issue #4. Pavement Markings**

### Enhancements:

1. Re-stripe and maintain durable pavement markings at the intersection.
2. Delineate the Meetinghouse Way northbound through and right-turn lane at the intersection with the Route 6 WB ramps.

## **Safety Issue #5. Signage**

### Enhancements:

1. Provide guide signs with messages consistent with those on the Route 6 mainline at the ramp termini.
2. Remove or relocate local organizations' signs to improve sign clutter.
3. Relocate Route 6 guide signs on the Meetinghouse Way northbound approach in advance of the utility pole.
4. Ensure that all Route 6 guide signs are visible; trim trees and/or relocate signage as appropriate.

### **Safety Issue #6. Pedestrian Accommodations**

Enhancements:

1. With intersection improvement to a roundabout or traffic signal, include appropriate pedestrian accommodations. If the intersection remains unsignalized, consider installing crosswalks at the intersection with appropriate advance warning signage.

### **Safety Issue #7. Bicycle Accommodations**

Enhancements:

1. Redesign of the intersection should incorporate bicycle accommodations such as a 4-foot paved shoulder, bike route signing, and bicycle detection if a signal is installed.

### **Safety Issue #8. Speed**

Enhancements:

1. Conduct a speed study to determine the prevailing speeds and adjust speed regulation as necessary based on findings.
2. Increase enforcement in the vicinity of the intersection through the use of either speed trailers or uniformed officers.
3. Reconfiguration of the intersection into a 5-leg roundabout will reduce speeds through the intersection area.

## 3.4.2 DENNIS ROADWAY SAFETY AUDIT

### 3.4.2.1 Route 134 at the Route 6 Ramps

This study completed in 2009 identified six safety issues and associated enhancements:

### **Safety Issue #1. Interchange Geometry**

Enhancements:

1. Review operations and the feasibility of adding adequate acceleration and deceleration lanes at the interchange of Route 134/Route 6.
2. At the Route 6 eastbound off-ramp to Route 134 southbound, lengthen the solid white channelization line from the end of the delta island to reinforce the separation between the ramp and Route 134 southbound, and to delineate the additional lane. Replace the merge sign with an “add lane” warning sign. In conjunction, review the distance between the Route 6 eastbound ramps and the mall signal for appropriate weave distance.
3. Provide adequate turning radii to accommodate larger vehicles in a single lane on the Route 6 eastbound ramp to Route 134 southbound and on the Route 6 westbound ramp to Route 134 northbound.

### **Safety Issue #2. Pavement Markings**

Enhancements:

1. Re-stripe and maintain durable pavement markings at the interchange of Route 134/Route 6.

### **Safety Issue #3. Sign Improvements**

Enhancements:

1. Provide additional regulatory guide signs on Route 134 northbound prior to the bridge to alert drivers of the “right lane must exit” condition onto Route 6 westbound.
2. Upgrade existing signage with new reflectorized signs.

### **Safety Issue #4. Maintenance**

Enhancements:

1. Trim vegetation to maintain sign visibility and sight lines at the Route 134/Route 6 interchange.

### **Safety Issue #5. Pedestrian Accommodations**

Enhancements:

1. To accommodate pedestrians, a continuous sidewalk should be provided along Route 134. Additionally, crosswalks and appropriate control would be needed at the intersections of Route 134 and the Route 6 ramps.

### **Safety Issue #6. Bicycle Accommodations**

Enhancements:

1. Provide bicycle accommodations along Route 134 and bicycle connections to the multi- use path south of Route 6.

## 3.4.3 MASHPEE ROADWAY SAFETY AUDITS

Mashpee has had three audits completed since 2007:

### 3.4.3.1 Route 130 Lane Departure Road Safety Audit

Completed in 2007, this audit of lane departure crashes provided “Short Term Recommendations” and “Additional Countermeasures.”

### **Short Term Recommendations**

- Install “Curve Ahead” warning signs for each direction of the two horizontal curves. Signs should be placed in advance of the curve to allow adequate response time for

motorists. To further enhance the delineation (given the lack of lighting) roadside reflectors and/or chevrons should be considered as budget permits.

- Given the reported prevalence of high speeds among the lane departure crashes, it is recommended that Route 130 continue to remain a high speed enforcement area. It is also recommended that speed data collection be completed by the Town of Mashpee to track current operating speeds throughout the year; this may also prove useful in the establishment of enforcement thresholds. Installation of solar powered radar detector signs at key locations to bring awareness to the operator through the instant message “YOUR SPEED IS “\_\_\_”” may assist in reducing in speed violations.
- It is recommended that advance yield lines (see MUTCD Figure 3B-14) and accompanying sign (R5-1 – Yield Here to Pedestrians) be installed on both approaches to the existing mid-block crosswalk along Route 130.
- There are several signs (see Figure 8) located near the Mashpee-Barnstable line adjacent to the bike path which feature a nearly illegible message based upon the small font size. It is recommended that these signs be revised or removed as drivers may spend an increased amount of time fixated away from the roadway attempting to read the signs.
- Utility poles are in close proximity to the traveled way along Route 130. While longer term strategies are considered for possible relocation of the most hazardous poles, it is recommended that the poles be reflectorized to add conspicuity. Specific locations may include the utility poles at the following addresses 84 (struck 3 times), 223, 520, 544, and 621 Route 130. All utility poles along the corridor, however, should be considered.
- Continue to maintain level surface along roadside edges. At the time of the audit several spots of edge drop-off were observed north and west of the Great Neck Road North intersection which may in turn accelerate the impacts of lane departure crashes as motorists are unable to return to the roadway.

### **Additional Route 130 Countermeasures**

#### **Speed-related issues along entire Route 130 corridor:**

- Continue and expand upon a concentrated enforcement and educational (i.e. speed feedback, community meetings, etc.) effort.
- Investigate and explore possible low-cost speed-related strategies such as optical speed bars.
- Implement established traffic calming measures to meet specific needs. A candidate location would be bulb outs in the vicinity of the mid-block pedestrian crossing.

#### **Distracted or drowsy drivers**

- Consider rumble strips/stripes in future reconstruction for non-residential areas along roadway in the vicinity of the Air Force Base.

#### **Pavement markings**

- Maintain pavement markings for continued visibility.

#### **Horizontal curve delineation**

- Assure curve ahead warning signs, chevrons and roadside reflectors for
- the north/west horizontal curves.

#### **Driver failure to properly identify slowing/stopping vehicles in advance of a turn**

- Educational campaign alerting motorists to the frequency of turning vehicles. On the low end this may entail a warning sign “Watch for

- Turning Vehicles”, but may include the strategic use of a Variable Message Sign, Newspaper Articles, or other PI&E activities.
- To the extent possible (based on available right-of-way) explore the feasibility for turning bays or lanes for frequent turn pockets as part of access management program. Candidate locations would be in the vicinity of roadway N/W of the Great Neck Road intersection.

Cross over the centerline crashes resulting from passing vehicles

- Although there are currently no passing zones, it is recommended that the Town continue to restrict, and enforce no passing zones along the corridor.

Sight distance turning from Dunkin Donuts site drive

- Install warning sign for SB traffic. Short Term & Low Cost Low Roadway modifications to improve sight distance (i.e. cut back crest vertical curve inhibiting sight to west).

Presence of utility poles within the roadway clear zone

- Reflectorize utility poles.
- Add guard rails for particularly hazardous utility poles
- Work with utility company to remove utility poles from clear zone.

Edge drop-off at roadside

- Maintain and fill roadside as needed to prevent edge drop-off.

Safe crossing opportunities for pedestrians

- Install advance yield line with accompanying sign (R5-1) for existing mid-block crosswalk location.

Guard rail opportunities

In areas with insufficient clear zone, guard rail installation should be considered, including but not limited to embankments and utility poles. Specific locations include the dark area in the vicinity of the runway clear zone.

Sign efficiency

- Identify unnecessary signs in heavily signed areas (i.e. signalized intersection) that can be moved/removed to prevent sign clutter. A specific example is the pedestrian warning sign on the approach to a signalized intersection, as pedestrians would be expected.
- Remove/change warning signs located near the Mashpee-Barnstable line adjacent to the bike path with small font requiring significant driver attention for comprehension.

Illumination and supports for runway crossing at Otis Air Force Base

- Explore possibilities to shield runway supports and glare from runway lights for passing motorists.

Dark stretches of Roadway

- Install lighting along dark stretches of road on the N/W section of Route 130. Given challenges with power, it may be necessary to explore solar power option for the lighting.

Continued maintenance

- The pavement condition, drainage, and coverage resulting from brush are in good condition. To assure safety this needs to be maintained.

Herring observation area where vehicles and pedestrians conflict

- Consider warning sign and additional parking restrictions.

### 3.4.3.2 Great Neck Road North/Old Barnstable Road

Six safety issues and associated enhancements were identified in this 2009 study:

#### **Safety Issue #1. Intersection Geometry**

Enhancements:

1. Increase corner radii to accommodate larger vehicles.
2. Narrow the Old Barnstable Road westbound approach and align it with the departure lane on the other side of the intersection to the extent possible within the right-of-way.

#### **Safety Issue #2. Grading Issues**

Enhancements:

1. Change the crown line on Great Neck Road North to facilitate crossing and turning movements from Old Barnstable Road.
2. Re-grade the Old Barnstable Road westbound approach to eliminate the low spot.

#### **Safety Issue #3. Limited Sight Distance**

Enhancements:

1. Measure the sight distances from the Old Barnstable Road westbound approach and compare them to the required sight distances for the existing conditions. Based on these results, the following additional enhancements may be appropriate:
2. Relocate signs and fence on the southeast corner to increase visibility for vehicles exiting Old Barnstable Road westbound.
3. Re-align both the horizontal and vertical geometry of Great Neck Road North to provide adequate sight distance for all approaches.
4. Re-grade the slope on the eastern side of the Great Neck Road North northbound approach to provide adequate sight distance for the Old Barnstable Road westbound approach.
5. Study closing the Old Barnstable Road westbound approach to vehicle traffic. This would include traffic analysis of the Route 28/Great Neck Road/Route 151 rotary to ensure that the closure would not create undue traffic delay there.

#### **Safety Issue #4. Pavement Markings**

Enhancements:

1. Re-stripe and maintain durable pavement markings at the intersection of Great Neck Road North/Old Barnstable Road.

### **Safety Issue #5. Sign Improvements**

Enhancements:

1. Install new double-sided one-way signs on both sides of the roadway on the Old Barnstable Road westbound approach to improve their visibility to vehicles traveling northbound and southbound on Great Neck Road North.
2. Replace the worn Intersection Ahead warning sign for the Great Neck Road North northbound approach.
3. Install an Intersection Ahead warning sign for the Great Neck Road North southbound approach.
4. Relocate the 45 mph speed limit sign for Great Neck Road North northbound traffic farther beyond the intersection with Old Barnstable Road. This may require modifications to the speed regulations.
5. Adjust sign locations, sizes, and heights to conform to MUTCD requirements and not to impair sight distance.
6. Remove the CCRTA bus stop sign located on the eastern side of Great Neck Road North just north of Old Barnstable Road.

### **Safety Issue #6. Limited Pedestrian Accommodations**

Enhancements:

1. Provide a crosswalk at a safe location across Great Neck Road North with pedestrian warning signs to inform drivers.

#### 3.4.4 SANDWICH ROAD SAFETY AUDITS

Since 2007, two safety audits were completed in Sandwich:

##### 3.4.4.1 Cotuit Road/Harlow Road/South Sandwich Road

This study identified eight Safety Issues and associated Enhancements and was produced in 2009:

#### **Safety Issue #1. Intersection Skew**

Enhancements:

1. Re-align Harlow Road and South Sandwich Road to eliminate the skew.

#### **Safety Issue #2. Intersection Offset**

Enhancements:

1. Re-align Harlow Road and South Sandwich Road to eliminate the offset.
2. Relocate the utility pole located on the southeast corner across from South Sandwich Road.

### **Safety Issue #3. Asa Meiggs Road**

Enhancements:

1. Re-align Asa Meiggs Road to intersect Cotuit Road at the preferred 90° angle.

### **Safety Issue #4. Vertical Alignment of Cotuit Road**

Enhancements:

1. Re-align and re-grade Cotuit Road to eliminate the sag and crest curve combination.

### **Safety Issue #5. Horizontal Alignments of Side Streets**

Enhancements:

1. Re-align Harlow Road and South Sandwich Road to eliminate their horizontal curves prior to the intersection

### **Safety Issue #6. Grading Issues**

Enhancements:

1. Change the crown line on Cotuit Road to facilitate crossing and turning movements from Harlow Road and South Sandwich Road.

### **Safety Issue #7. Restricted Sight Distance**

Enhancements:

1. Trim vegetation and maintain intersection sight lines at the intersection of Cotuit Road/Harlow Road/South Sandwich Road.

### **Safety Issue #8. Sign Locations and Conformance**

Enhancements:

1. Verify that the locations of the “Stop Ahead” warning signs and pavement markings on Harlow Road and South Sandwich Road conform to MUTCD guidelines for size, location, and mounting height.
2. Verify that the locations of the “Intersection Ahead” warning signs on Cotuit Road conform to MUTCD guidelines for size, location, and mounting height.
3. Replace street name signs to conform to MUTCD guidelines for letter height.

#### 3.4.4.2 - Route 6: Major Highway Median Cross-Over Crashes

From 2009, this study included a series of recommendations to reduce frequency and severity of cross over crashes on Route 6 in Sandwich to address several “Risk Factors” and “Risk Ratings.”

#### **Areas of open, crossable median**

Risk Rating “E”

- Install barrier in open areas (1.3miles total)

Lack of shoulders (both inside and outside) with berms

Risk Rating “E” –

- Create 4 foot inside shoulders

High speeds

Risk Rating “D”

- Increase enforcement

“Authorized Vehicle Only” turnaround locations and misuse

Risk Rating “C”

- Optimize location and consolidate turnarounds
- Use alternative signage for restricted use

Drainage problem – ponding occur in several areas

Risk Rating “D”

- Rehabilitate surface

Short acceleration/deceleration lanes and inadequate signage

Risk Rating “D”

- Provide shoulders
- Extend accel-decel lane markings
- Provide adequate and regulating (YIELD) signage

Driver guidance – signs worn and obstructed

Risk Rating “C”

- Install new warn signs approaching Interchange No. 2
- Clear/trim vegetation
- Install delineator posts
- Install rumble strips – inside shoulder

### 3.4.5 YARMOUTH ROAD SAFETY AUDIT

There has been one audit completed since 2007 in Yarmouth.

#### 3.4.5.1 - Old Townhouse Road/Forest Road

This study completed in 2010 identified seven Safety Issues and associated Enhancements:

### **Safety Issue #1. Intersection Geometry**

Enhancements:

1. Reconstruct the intersection to remove the offset alignment of Forest Road and to simplify the movements (i.e., consolidate two Forest Road intersections into one) and clarify control (i.e., signalization).
2. Consider vehicular movements to/from the shopping plaza driveway southbound onto Old Town House Road to right-in/right-out only.
3. Consider vehicular movements to/from Constance Avenue in the redesign.
4. Provide adequate turning radii to accommodate emergency vehicle (e.g., fire truck) access through the intersection and to the shopping plaza.
5. Introduce a traffic signal to reduce angle crashes, clarify control, and better serve concentrated peak demand generated by the transfer station.
6. New traffic signal should include emergency pre-emption.

### **Safety Issue #2. Pavement Markings**

Enhancements:

1. Re-stripe and maintain durable pavement markings at the intersection.
2. Fill pot-holes and consider a more durable street print product rather than traditional paint or thermoplastic pavement markings.

### **Safety Issue #3. Sign Improvements Enhancements:**

1. Provide advance intersection warning signage on the Old Town House Road eastbound and westbound approaches in the short-term (unsignalized condition).
2. Install pedestrian crossing warning signage on the Old Town House Road westbound approach in the short-term (unsignalized condition).
3. Replace signage on the Forest Road northbound approach at Constance Avenue with W2-2L installed on right side of Forest Road northbound in advance of intersection with Constance Avenue.
4. Upgrade all existing signage with new reflectorized signs to meet standards of consistency with the MUTCD.

### **Safety Issue #4. Sight Distance**

Enhancements:

1. Trees located along the edge of Old Town House Road in the vicinity of the intersection should be relocated or removed. In the short-term, all trees in the vicinity of the intersection should be trimmed to improve sight lines.
2. The Garden Club planting area should be relocated to a location that will not block sight lines.
3. The wood guard rail posts along the south side of Old Town House Road should be removed.

4. Introduce traffic signal control or separate two Forest Road northbound lanes to improve sight lines.

#### **Safety Issue #5. Pedestrian Accommodations**

Enhancements:

1. Consider installing a crosswalk across the eastern leg of the intersection if signalized.
2. Install sidewalk along the north side of Old Town House Road between the shopping plaza and the Old Town House Road Park and Recreation area entrance.

#### **Safety Issue #6. Bicycle Accommodations**

Enhancements:

1. Redesign of the intersection should incorporate a bicycle connection between the two existing bicycle paths. Installation of a traffic signal, and a bike lane or path, would provide a safe connection
2. The alignment of the bicycle path across Forest Road near the transfer facility on the north side of Old Town House Road should be modified to minimize conflicts with transfer facility traffic. In the short-term, the transfer facility signage posted on the fence should be relocated to improve cyclist and pedestrian visibility.

#### **Safety Issue #7. Speed**

Enhancements:

1. Conduct speed study to determine the prevailing speeds and adjust as necessary based on findings.
2. Post speed limits.

### 3.5 MULTIMODAL TRANSPORTATION SAFETY

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

#### 3.5.1 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 2007-2009 as shown in the following table:

TABLE 10 - INJURIES FROM COLLISIONS/SLIPS AND FALLS IN TRANSIT VEHICLES AND ON TRANSIT PROPERTY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007				0				1				
2008				2					7			
2009					1			4	1	1		

*(Source: Cape Cod Regional Transit Authority)*

For the years 2007-2009, the values of property damage to CCRTA vehicles and private vehicles were \$27,393 in April 2007 and \$22,922 in August 2007 for a total of \$50,315.

### 3.5.2 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 2006-2008. With 39 reported crashes over the three-year period, Yarmouth had the greatest number of bicyclist-vehicle crashes (Dennis was second with 25 crashes). Staff has 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 11 - BICYCLIST-VEHICLE CRASH HISTORY (2006-2008)

Town	All Crashes (3-year total)	Fatal Crashes (3-year total)
Bourne	6	0
Sandwich	7	0
Falmouth	18	0
Mashpee	2	0
Barnstable	4	2
Yarmouth	39	0
Dennis	25	0
Harwich	8	0
Chatham	13	0
Brewster	8	0
Orleans	13	0
Eastham	6	0
Wellfleet	5	0
Truro	4	0
Provincetown	8	0
<b>Total</b>	<b>166</b>	<b>2</b>

*(Source: MassDOT)*

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.

### 3.5.3 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 (22) of crashes reported from 2006 to 2008. 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 12 – PEDESTRIAN-VEHICLE CRASH HISTORY (2006-2008)

Town	All Crashes (3-year total)	Fatal Crashes (3-year total)
Bourne	15	0
Sandwich	5	0
Falmouth	16	0
Mashpee	4	1
Barnstable	6	1
Yarmouth	22	1
Dennis	15	1
Harwich	10	0
Chatham	4	0
Brewster	6	0
Orleans	9	1
Eastham	7	0
Wellfleet	2	0
Truro	0	0
Provincetown	5	0
<b>Total</b>	<b>126</b>	<b>5</b>

(Source: MassDOT)

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.

### 3.5.4 AIR TRAVEL SAFETY

The Federal Aviation Administration has assembled a database of safety incidents at Cape Cod airports (Hyannis and Provincetown). During the years 2005-2008, 5 incidents were listed in the FAA database for these airports. These data are summarized in the following table:

TABLE 13 - AIR TRAVEL SAFETY INCIDENTS

Year	Fatal	Non-Fatal	Incident
2005	0	0	1
2006	0	1	0
2007	0	1	0
2008	1	1	0

(Source: Federal Aviation Administration)

### 3.5.5 SUMMARY OF GENERAL 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](http://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

### 3.6 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 MassDOT; 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.

MassDOT 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 MassDOT Traffic Operations Center in South Boston. MassDOT 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 MassDOT website.

### 3.7 CAPE COD COMMISSION'S LOCATION-SPECIFIC SAFETY STUDIES

The Cape Cod Commission has completed several “Safety at Three Locations” safety studies. The following is a summary of the locations that were studied and highlights of recommended safety improvements. Full reports are available on the internet:

[www.gocapecod.org/safety](http://www.gocapecod.org/safety)

#### 3.7.1 BOURNE: OTIS ROTARY

This location was one of three examined in the 2006 Transportation Safety Report.

As a short-term improvement, it is recommended that the rotary be restriped for 2-lanes with improved signage. A grade-separation alternative is recommended for consideration as the long-term solution for this location due to its expected benefits to traffic flow and safety.

The next-step for this location would be to hold a public meeting to discuss the alternatives outlined in this report. This meeting should include area residents and business representatives, local agencies, state and local officials, etc. The objective of this meeting is to build consensus for the optimal safety improvement at the Otis Rotary.

#### 3.7.2 EASTHAM: EASTHAM/ORLEANS ROTARY

In 2009, a Transportation Safety Report was completed featuring this and two other locations. The Cape Cod Commission Transportation Staff identified both short-term and long-term recommendations for the Eastham Rotary. Short-term

recommendations include looking at signage and ideas for safe pedestrian connections. Long-term recommendations include redesigning the rotary to incorporate elements of a modern roundabout.

The first recommendation of this study is for the towns of Eastham and Orleans evaluate the types of signage used to caution motorists of the upcoming rotary and the placement of those signs. There is a large disparity between the accidents on two of the approaches as compared to the other two, and driver awareness is likely related. It is recommended that the 'Rotary' signs currently placed on the rotary's island be moved leftwards. Each approach has this sign facing it from the island, but the sign is not visible until you are within two car lengths of the merge. Shifting the signs left would allow them to be visible from a farther distance.

On both the Route 6A/28 and Route 6 from Eastham approaches, where rear-ending crashes were most prevalent most drivers cited their lack of attention as the contributing factor to the crash. This study recommends that the towns of Eastham and Orleans investigate the potential use of grooved pavement as a means of alerting drivers to the upcoming rotary. Driving over grooved pavement creates a sound that can be disturbing to residents and nearby businesses, so appropriate siting is essential.

Route 6 has two travel lanes from Eastham towards the rotary until there is a lane-drop about a half mile before the rotary. Town officials have shown concern that the sign indicating the lane-drop may be presented to drivers too late. This study recommends an evaluation of signage regarding the reduction from two lanes to one.

As another short-term improvement, this study recommends the towns of Eastham and Orleans explore options to include sidewalks and crosswalks to accommodate pedestrians. Currently, no sidewalk connects around and through the rotary. There is also no understood method of traversing the intersection on foot; therefore the actions of pedestrians are unpredictable to the motorists.

Another recommendation is to conduct an analysis of the relationship and issues concerning the rotary, Route 6A/28, and Route 6A/28's northern intersection with Canal Road. This intersection is already a safety concern to town officials, and its risk to motorists may be exacerbated by additional development along Canal Road.

Town officials have cited a number of concerns related to the Smith Lane approach to the rotary. First, while the approach is indeed located in Eastham on Smith Lane, the road's name causes confusion to drivers who are not aware the road becomes Rock Harbor Road in Orleans in less than 150 feet of driving. Secondly, motorists traveling eastbound

on Rock Harbor Road have no warning of the upcoming, sharp, right-hand turn towards the rotary. This condition results in drivers missing their turns, then stopping short in a conflict zone once their mistakes are realized. Lastly, there is an unnecessarily wide turn from the off ramp at this approach onto Smith Lane eastbound. The size of the turning radius creates a large expanse of unmarked asphalt. This study recommends that Smith Lane be considered for improvements related to signage and traffic flow (which may or may not include roadway reconfigurations and restrictions in turning movements).

This study's long-term recommendation includes redesigning the rotary to integrate elements of a modern roundabout. Potential alterations include reshaping the approaches to have a larger angle of deflection, emphasis on yielding to vehicles already within the rotary, island refuge for pedestrians, and updated pavement markings that correlate with the changes. This would help foster a more pedestrian-friendly environment (in addition to the operational benefits). A proposed pedestrian network would encourage walkers to take the Canal Road sidewalk to its intersection with the Cape Cod Rail Trail. From there, users can use the bike trail to cross Route 6 and safely access Rock Harbor Road.

### 3.7.3 EASTHAM: ROUTE 6/BRACKETT ROAD

The 2008 Transportation Safety Report included this as one of three locations studied.

As a short-term improvement, it is recommended that the Town of Eastham move forward with additional stop signs at the Cape Cod Rail Trail Bike Path at Brackett Road, increase the sight distance at the corners of Brackett Road and the Cape Cod Rail Trail, construct a Gateway Entrance (signage and landscaping) on Brackett Road to alert motorists entering the North Eastham Village Area and work with the Village Green Shopping Center owner on parking lot improvements to reduce driver confusion with the plaza parking lot.

The Town of Eastham should advance the Brackett Road improvement plan currently under design and continue to work with local and state officials for an upgrade (including Route 6 left turn lanes) of the Route 6, Brackett Road and Old County Road intersection.

#### 3.7.4 HARWICH: ROUTE 137/ROUTE 39

This location was one of three examined in the 2006 Transportation Safety Report.

Interconnects and access management alternatives should be installed at each parcel in the vicinity of this intersection. Sidewalks should be installed on both sides of the approaching roadways to connect major land uses to the surrounding neighborhoods.

The next-step for this location would be to hold a public meeting to discuss the alternatives outlined in this report. This meeting should include area residents and business representatives, local agencies, state and local officials, etc. The objective of this meeting is to build consensus for the optimal safety improvement at the Route 137/39 intersection.

#### 3.7.5 ORLEANS: ROUTE 6A/ROUTE 28

This location was one of three examined in the 2006 Transportation Safety Report.

It is recommended that striping, crosswalks, and signage be installed immediately. In the longer term, it is recommended that signalization or a modern roundabout be considered along with driveway consolidation and other access management techniques.

The next-step for this location would be to hold a public meeting to discuss the alternatives outlined in this report. This meeting should include area residents and business representatives, local agencies, state legislators, MassDOT/ Highway, etc. The objective of this meeting is to build consensus for the optimal safety improvement at this intersection. MassDOT/Highway should proceed with designing safety improvements resulting from the public process.

#### 3.7.6 PROVINCETOWN: ROUTE 6/SHANK PAINTER ROAD

In 2009, a Transportation Safety Report was completed featuring this and two other locations.

The study found that the length of Shank Painter Road is in need of significant improvements. The amount and size of curb cuts on both sides of the street makes safe pedestrian travel difficult. Town officials and local property owners should work together to create a plan to consolidate the breaks in the curbing and make room for pedestrian facilities.

As this road is an important bicycle and pedestrian thoroughfare in Provincetown, accommodations for these modes should be made along its entire length. The paved shoulder stretches across many wide curb cuts, including many areas where cars are parking at right angles to the shoulder. Also, crosswalks need to be restriped, as they have become faded.

This study recommends that a sidewalk plan be created for Shank Painter Road, to create an organized, well-connected pedestrian path and bicycle route. The town may consider pursuing enhancement funds from the Transportation Improvement Program (TIP).

### 3.7.7 SANDWICH: ROUTE 6/ROUTE 130 RAMPS

The 2008 Transportation Safety Report included these ramps, on opposite sides of Route 6, as two of three locations studied.

The study recommends that the Massachusetts Department of Transportation/Highway division investigate the installation of modern roundabouts at the Route 130/Route 6 Westbound Ramp and the Route 130/Route 6 Eastbound Ramp. Commission staff finds modern roundabouts as the safest solution to the crash problems at these two intersections.

### 3.7.8 TRURO: ROUTE 6 SCHOOL ZONE

In 2009, a Transportation Safety Report was completed featuring this and two other locations.

The study recommends that a private consultant has been commissioned by the Cape Cod Commission with funds from the Unified Planning Work Program (UPWP) to develop a plan for the Truro Central School's installation of a school zone speed limit sign. The draft plan is included in this report's appendix. With the created plan, a meeting with the Massachusetts Department of Transportation/ Highway Division District 5 will be conducted to bring the project to completion.

Beyond the installation of a school zone, the town may consider a year-round pedestrian signal if conflicts between pedestrians and vehicles are present during the summer months. Beside Truro Central School, there is a youth baseball field that is used throughout the summer and school year. Furthermore, there is a restaurant serving pizza and ice cream on the opposite side of Route 6. Safe crossing between these two

destinations should be a priority to the town, especially during the summer season, when traffic volumes increase substantially.

Future plans may include a pedestrian refuge in the median of Route 6 to facilitate safe crossing. The following figure is a basic concept of how a refuge island could look on Route 6 south of the Truro Central School.

### 3.8 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.

