



## CAPE COD COMMISSION

3225 MAIN STREET  
P.O. BOX 226  
BARNSTABLE, MA 02630  
(508) 362-3828  
Fax (508) 362-3136

# 2006 Transportation Safety Report



Bourne: Route 28 Otis Rotary  
Harwich: Route 137/Route 39  
Orleans: Route 6A/Route 28

December 2006

*Prepared by CAPE COD COMMISSION Transportation Staff  
on behalf of the*

## CAPE COD METROPOLITAN PLANNING ORGANIZATION:

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

*in cooperation with:*

Massachusetts Department of Environmental Protection  
United States Department of Transportation Federal Highway Administration  
United States Department of Transportation Federal Transit Administration



## Table of Contents

1. Introduction.....	3
2. Bourne: Otis Rotary .....	5
2.1. Problem Identification .....	5
2.1.1. Location & Geometrics.....	5
2.1.2. Crash History .....	6
2.1.3. Traffic Operations – Existing & Future.....	9
2.2. Development & Analysis of Alternatives.....	10
2.3. Recommendations & Next Steps .....	15
3. Harwich: Route 137/Route 39 Intersection.....	16
3.1. Problem Identification .....	16
3.1.1. Location & Geometrics.....	16
3.1.2. Crash History .....	19
3.1.3. Traffic Operations – Existing & Future.....	20
3.2. Access Management Alternatives.....	23
3.3. Recommendations & Next Steps .....	25
4. Orleans: Route 6A/Route 28.....	26
4.1. Problem Identification .....	26
4.1.1. Location & Geometrics.....	26
4.1.2. Crash History .....	31
4.1.3. Traffic Operations – Existing & Future.....	32
4.2. Development & Analysis of Alternatives.....	33
4.3. Recommendations & Next Steps .....	34
5. Conclusion .....	35
5.1. Summary of Recommendations.....	35
5.2. Next Steps.....	35

### List of Figures

Figure 1 - Study Area Intersections .....	4
Figure 2 - Bourne: Otis Rotary Roadway .....	6
Figure 3 - Crash Diagram [Otis] .....	8
Figure 4 – Summer Weekday P.M. Traffic Volumes [Otis].....	9
Figure 5 - Summer Saturday Midday Traffic Volumes [Otis].....	10
Figure 6 - Signage & Striping Improvements [Otis-1] .....	11
Figure 7 - Signalized Intersection Alternative [Otis-2] .....	12
Figure 8 - Modern Roundabout Alternative [Otis-3].....	13
Figure 9 - Diamond Interchange [Otis-4] .....	14
Figure 10 - Route 137/Route 39 Intersection.....	17



Figure 11 - Curb Cut Locations [137/39] ..... 18  
 Figure 12 - Crash Diagram [137/39]..... 20  
 Figure 13 - Traffic Volumes – Summer Weekday P.M. Peak Hour [137/39] ..... 21  
 Figure 14 - Traffic Volumes Summer Saturday Midday [137/39] ..... 22  
 Figure 15 – Access Management Alternatives [137/39]..... 24  
 Figure 16 - Raised Median, Sidewalk [137/39] ..... 25  
 Figure 17 - Route 6A/Route 28 Intersection Diagram..... 27  
 Figure 18 - Route 6A/Route 28 Intersection (looking east)..... 28  
 Figure 19 - Route 6A/Route 28 Intersection (looking west)..... 29  
 Figure 20 - Curb Cut Locations [6A/28]..... 30  
 Figure 21 - Summer PM Peak Hour Traffic Volumes [6A/28] ..... 32

**List of Tables**

Table 1 - Crash History [Otis] ..... 7  
 Table 2 – Traffic Delay for Alternatives [Otis] ..... 15  
 Table 3 - Summary of Alternatives [Otis] ..... 15  
 Table 4 - Crash History [137/39] ..... 19  
 Table 5 - Level of Service [137/39] ..... 22  
 Table 6 - Crash History [6A/28] ..... 31  
 Table 7 - Level of Service Analysis [6A/28] ..... 33



## 1. Introduction

The purpose of this study is to evaluate safety problems at three high-crash locations on Cape Cod and to propose improvements. As a priority of federal (Federal Highway Administration), state (Massachusetts Highway Department), and regional agencies (Cape Cod Commission), the Cape Cod Metropolitan Planning Organization (MPO) has identified the need to examine high crash locations as outlined in the Capes' Regional Transportation Plan.

This effort is outlined by the MPO's Unified Planning Work Program (UPWP) to focus on three intersections that offer a wide spectrum of safety problems in the region. Through the process of public participation used to develop the Cape Cod Regional Transportation Plan, review of the Massachusetts Highway Department's "Top 1000 High Crash Locations" listing, and recommendations from local transportation officials, three locations have been selected for this study (and are shown on the map in Figure 1). The locations include a rotary, a signalized intersection, and an unsignalized intersection:

- Bourne: Route 28 Otis Rotary
- Harwich: Route 137/Route 39
- Orleans: Route 6A/Route 28

This report is organized by location. For each location, the following issues are discussed:

1. Local Roadway Network, Geometry & Curbcuts
2. Safety History
3. Existing & Expected Future Traffic Volumes & Operations
4. Development, Analysis, and Evaluation of Alternatives
5. Recommendations & Next Steps

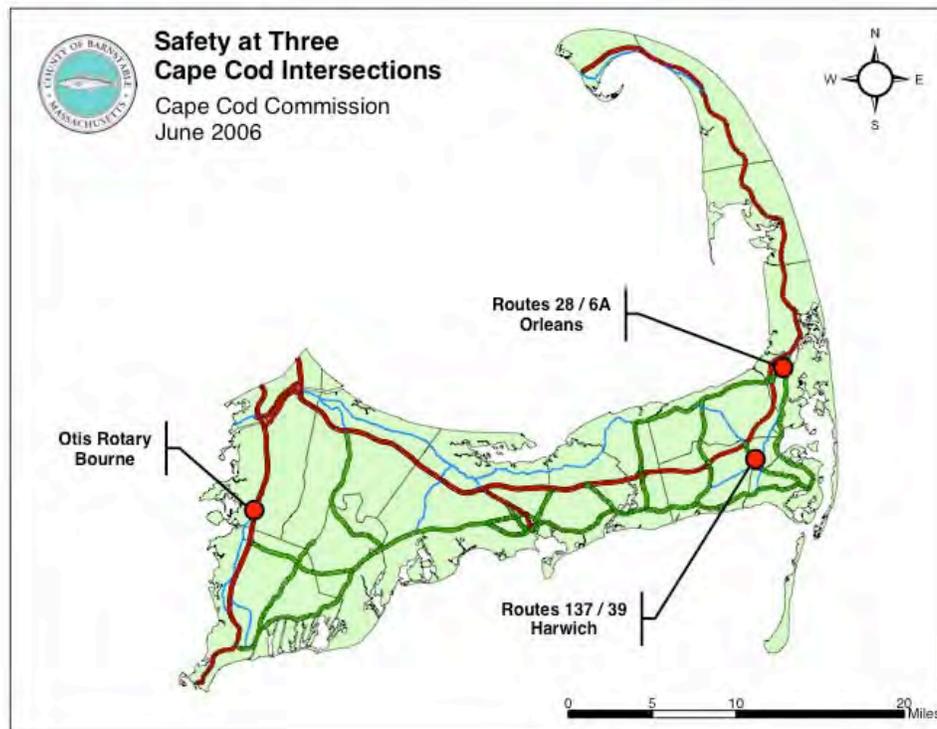
The fourth item on the above list includes evaluation of each alternative. For this step, criteria may include any or all of the following:

- Existing and future levels of service
- Potential change in safety
- Timing of improvements (short, intermediate, long term)
- Right-of-way issues
- Cost
- Responsible party(ies)
- Possible funding sources for design and construction (where necessary)



Item #5 above, “Recommendations” will be organized as appropriate for the timing of each improvement (short, intermediate, long term)

When completed, this report will be a source of identified improvements for inclusion in the Cape Cod Regional Transportation Plan, Cape Cod Transportation Improvement Program, and implementation by MassHighway and other responsible entities.



**Figure 1 - Study Area Intersections**



## 2. Bourne: Otis Rotary

The Otis Rotary is a major intersection in the town of Bourne and for the Cape Cod region. The major road, Route 28, is oriented north to south, and predominantly serves motorists traveling from northerly and westerly regions outside of Barnstable County to southerly destinations in Bourne, Falmouth and parts of Mashpee. Route 28 is a state-numbered route beginning at the Eastham/Orleans border on Cape Cod and eventually leads to the New Hampshire border. The Otis Rotary intersection also provides access to the Massachusetts Military Reservation to the east and to local roads such as Route 28A to the west.

### 2.1. Problem Identification

The Otis Rotary is a high-speed, heavily traveled intersection with a history of high-frequency crashes. This location has been appearing regularly in MassHighway's "Top 1000 High Crash Location" listings. The following sections provide details on the rotary's characteristics.

#### 2.1.1. Location & Geometrics

The geometry of the Otis Rotary differs from most of the other rotaries on Cape Cod and is shown in the following figure. The large radius and oval configuration provide for Route 28 through-traffic to maintain a high rate of speed. In fact, the curvature of some interior segments of the rotary is of such a smaller radius that vehicles are likely to travel at a lower speed while in the rotary than during entry.

Route 28 south of the rotary operates as a limited access highway with two lanes in each direction separated by a vegetated median. To the north, Route 28 northbound operates as a limited access highway with occasional u-turn locations installed in the vegetated median; Route 28 southbound provides local access to businesses along the western side.

There appear to be no curbcuts in the operational area of the rotary.





**Figure 2 - Bourne: Otis Rotary Roadway**

**2.1.2. Crash History**

The Otis rotary qualifies as a “High Crash Location” with an average of 28 crashes/year (anything over 3 crashes/year qualifies for this designation according to CCC guidelines). There are approximately 1.89 crashes per million entering vehicles (in comparison to the MHD District 5 unsignalized intersection average of 0.67). From the MassHighway “Top 1000” listing, this location is ranked sixth on Cape Cod.



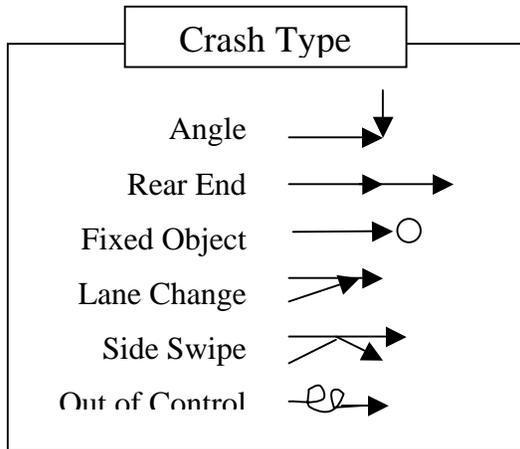
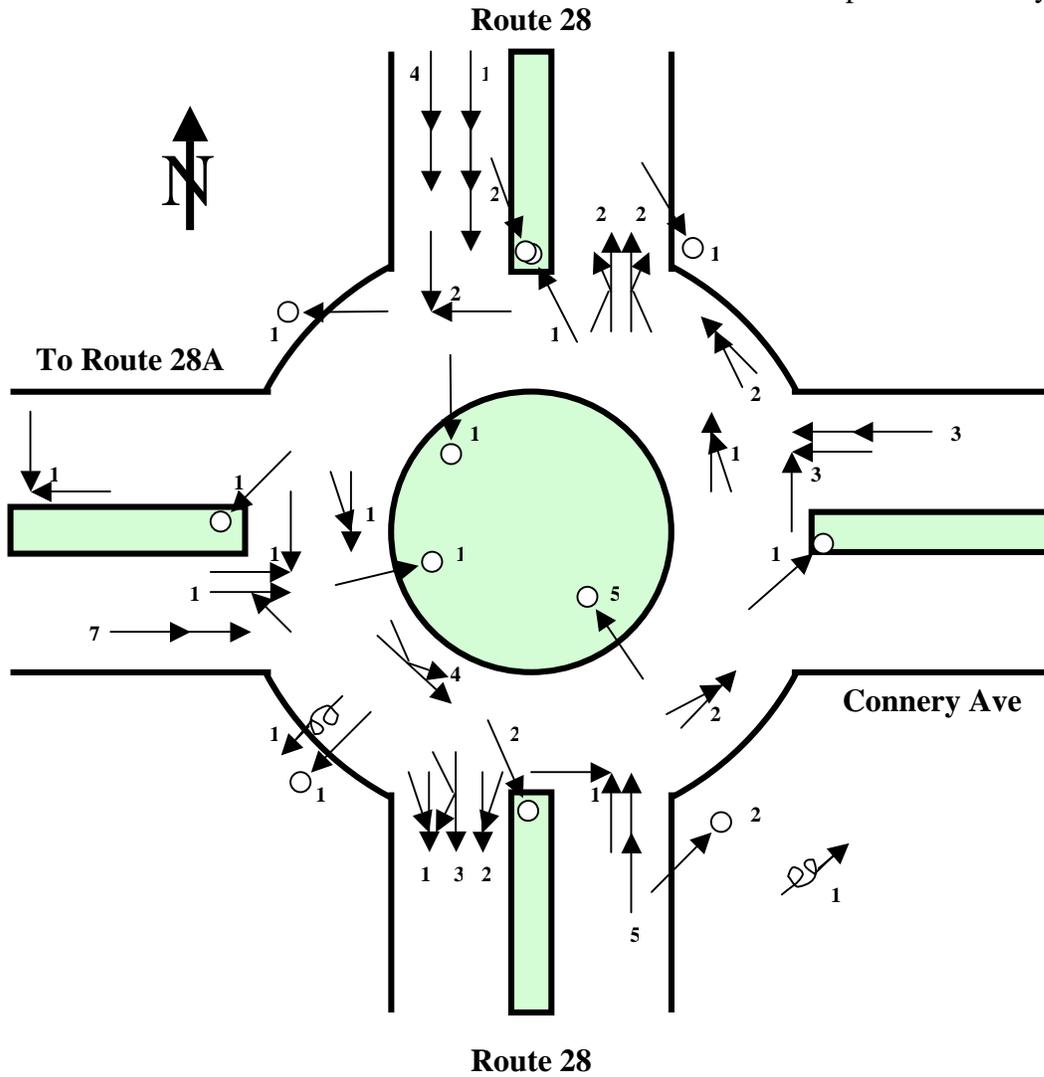
**Table 1 - Crash History [Otis]**

Otis Rotary, Route 28, Connery Ave., Lake St.  
Bourne  
Crash History

	<b>Year</b>						<b>Totals</b>
	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	
<b>Total</b>	29	21	29	26	24	36	165
Fatal	0	0	0	0	1	0	1
Non-Fatal Injury	6	4	4	6	4	9	33
Property Only	23	17	25	19	18	26	128
Not Reported	0	0	0	1	1	1	3
Angle	12	4	15	3	5	8	47
Rear-End	10	11	9	9	2	7	48
Sideswipe (same direction)	0	0	0	3	7	5	15
Sideswipe (opposite dir)	0	0	0	0	0	0	0
Pedestrian/Bicycle	0	0	0	0	0	0	0
Single Vehicle	0	0	0	10	9	16	35
Head On	0	1	2	0	0	0	3
Not Reported	7	5	3	1	1	0	17
Crashes per year	28						
Crash Rate	1.881 per MEV						

*Source: MassHighway Crash Records*





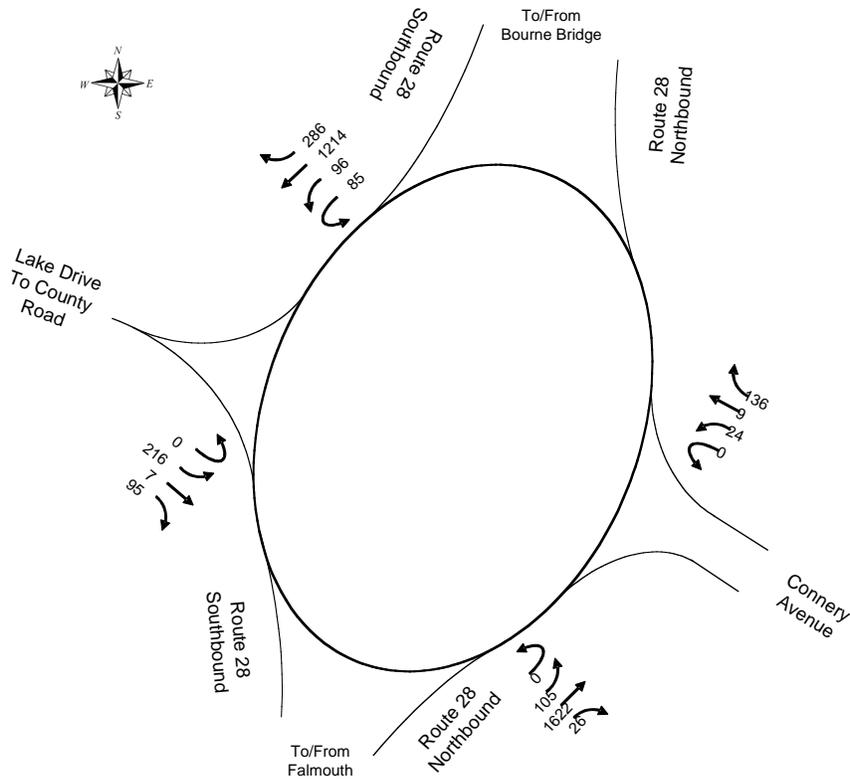
**Figure 3 - Crash Diagram [Otis]**

Source: Canalside Commons traffic study, VAI, December 2005



### 2.1.3. Traffic Operations – Existing & Future

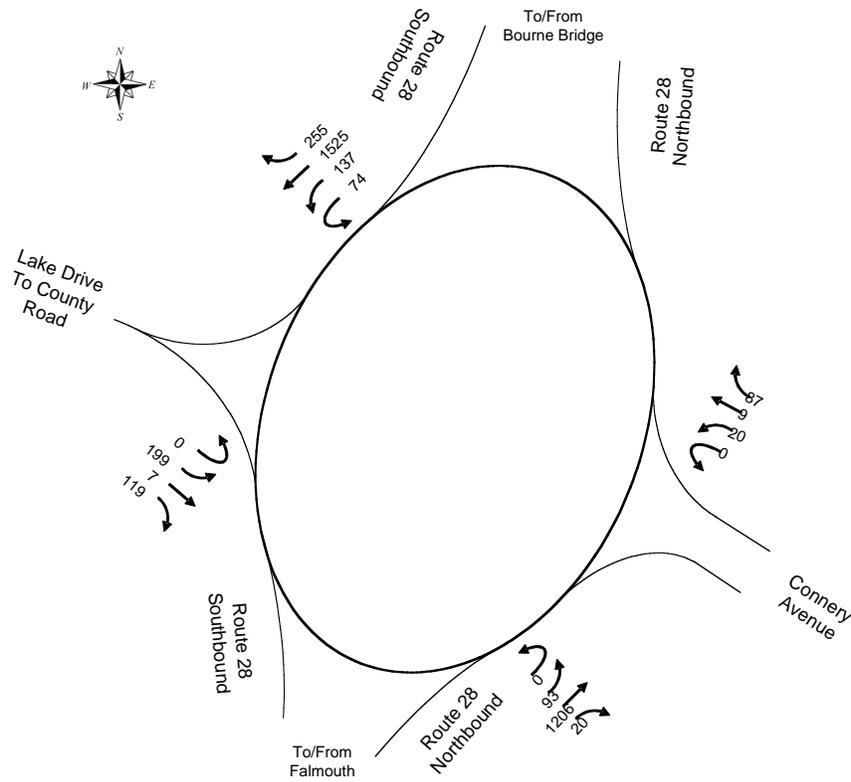
The Otis Rotary serves approximately 23,000 entering vehicles per day on an annual average basis. An average summer day includes approximately 35,000 entering vehicles.



**Figure 4 – Summer Weekday P.M. Traffic Volumes [Otis]**

*Source: adjusted traffic counts by VAI, Inc., summer 2005*





**Figure 5 - Summer Saturday Midday Traffic Volumes [Otis]**

*Source: adjusted traffic counts by VAI, Inc., summer 2005*

## 2.2. Development & Analysis of Alternatives

This section includes discussion, analyses, and evaluation of several alternatives. The amount of detailed analysis varies for each alternative. The variation of analysis is based on the availability of information for and the feasibility of each alternative. The following sections include discussions of several alternatives:

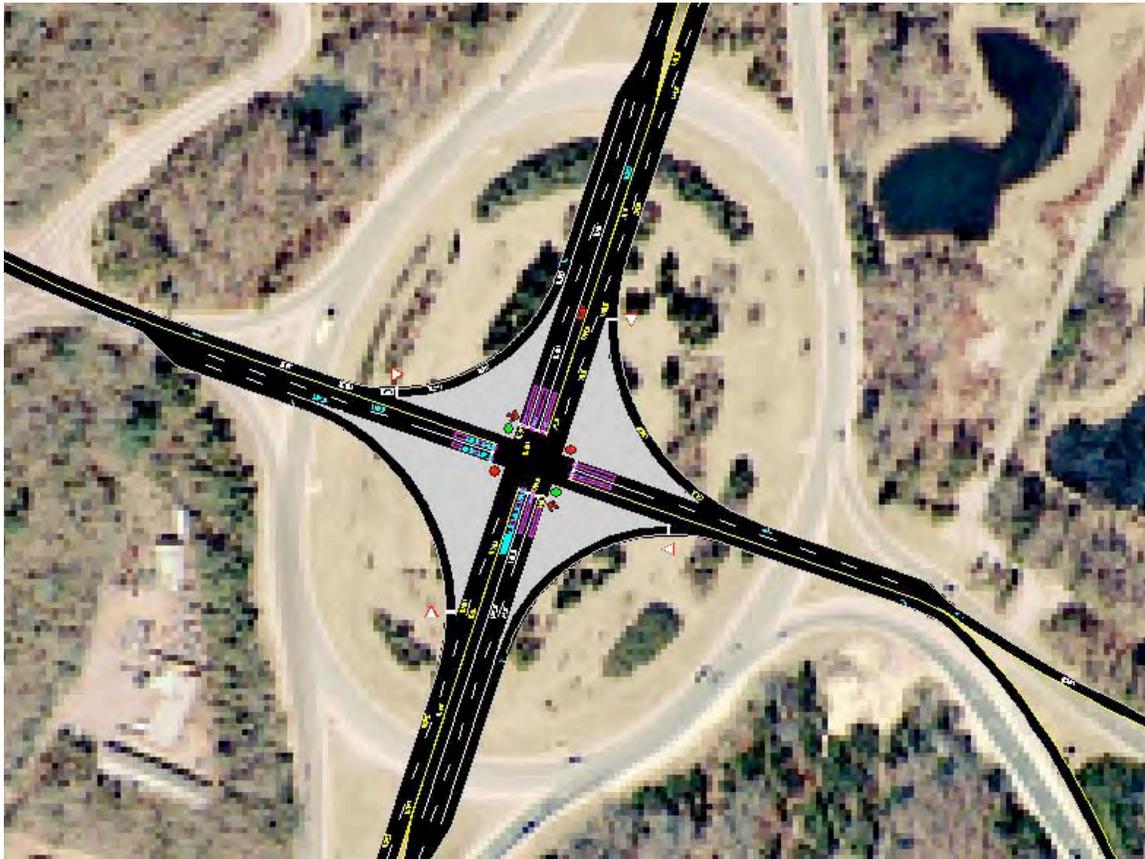




[Otis-2] Replace rotary: install at-grade signalized intersection

This alternative would involve realignment and construction of an at-grade signalized intersection. Most of the existing rotary pavement would be removed. The facility would include:

- Two through lanes
- Right & left turn lanes
- Dual left turns – Route 28A



**Figure 7 - Signalized Intersection Alternative [Otis-2]**



[Otis-3] Reconfigure rotary: redesign as modern roundabout

This alternative would include the signage and striping principles described in alternative Otis-1. In addition, the large oval configuration would be removed and replaced with a smaller circular roundabout. Entering roadways would be aligned in a manner to encourage lower entry speeds (as compared to circulating traffic).



**Figure 8 - Modern Roundabout Alternative [Otis-3]**



[Otis-4] Replace rotary: grade separation and diamond interchange

This alternative totally removes the rotary and includes construction of new road segments with direct connections of Route 28. It appears that the interchange ramps would fit within the existing layout. Under this alternative, the ramps would be unsignalized.



**Figure 9 - Diamond Interchange [Otis-4]**



The previous alternatives have been analyzed. Results are as follows:

**Table 2 – Traffic Delay for Alternatives [Otis]**

**Otis Rotary, Route 28, Connery Avenue, Lake Street, Bourne  
Operations Analysis through Simulation**

Configuration	Overall Delay per Vehicle (Seconds)	
	Weekday Afternoon	Saturday Midday
Current	32.8	34.3
Roundabout	25.4	26.8
Signalized Intersection	32.3	30.6
Diamond Interchange	13.5	12.7

The following table presents a summary of the effects of the various alternatives. Each alternative is rated for the relative cost, relief of traffic congestion, improvement of safety, and potential environment and right-of-way impacts.

**Table 3 - Summary of Alternatives [Otis]**

Alternative	Relative Cost	Congestion Relief	Safety Improvement	Environmental/ROW
Restriping	Low	Minimal	Minimal	None
Roundabout	Medium	Medium	Medium	Low
Signalized Intersection	Medium	Minimal	Minimal	Low
Diamond Interchange	High	High	High	Medium

**2.3. Recommendations & Next Steps**

As a short-term improvement, it is recommended that the rotary be restriped for 2-lanes with improved signage (alternative “Otis-1”). The grade-separation alternative (“Otis-4”) 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. Harwich: Route 137/Route 39 Intersection**

The intersection of Route 137 and Route 39 is located in the eastern part of the town of Harwich known as the “East Harwich Business District.” Route 137 provides direct access to Route 6 at interchange 11 to the north, and to Chatham to the south. Route 39 is a direct route to Harwich center on the west and to South Orleans to the east. This area is undergoing a planning effort by the local community to incorporate “village-style” design and the possibility of constructing by-pass roads.

#### **3.1. Problem Identification**

There has long been public perception that something is wrong with the intersection of Route 137/Route 39. Despite large numbers of crashes attributed to this intersection, further analysis has shown that many crashes had in fact occurred at driveways of nearby parcels. Despite the extensive commercial development in this area, there remains a lack of continuous sidewalks along these roadways.

##### **3.1.1. Location & Geometrics**

The following figures show the intersection in the context of the surrounding land uses. Curb cuts are identified in proximity to the intersection. In 2006 the intersection was upgraded to provide a left-turn lane, a through lane, a right-turn lane and a crosswalk. The signalization includes a pedestrian phase. Before the 2006 upgrade, the intersection geometry was as follows: Route 137 Southbound had a left-turn lane, a through lane, and a right turn lane; Route 137 Northbound has a left turn lane and a wide through/right turn lane; Route 39 Westbound and Eastbound both had a left turn/through lane and a dedicated right turn lane.





**Figure 10 - Route 137/Route 39 Intersection**





**Figure 11 - Curb Cut Locations [137/39]**



**3.1.2. Crash History**

A detailed analysis of crashes at this location has indicated that about half are in fact found to occur at the driveways of nearby parcels as shown in the figure on the following page.

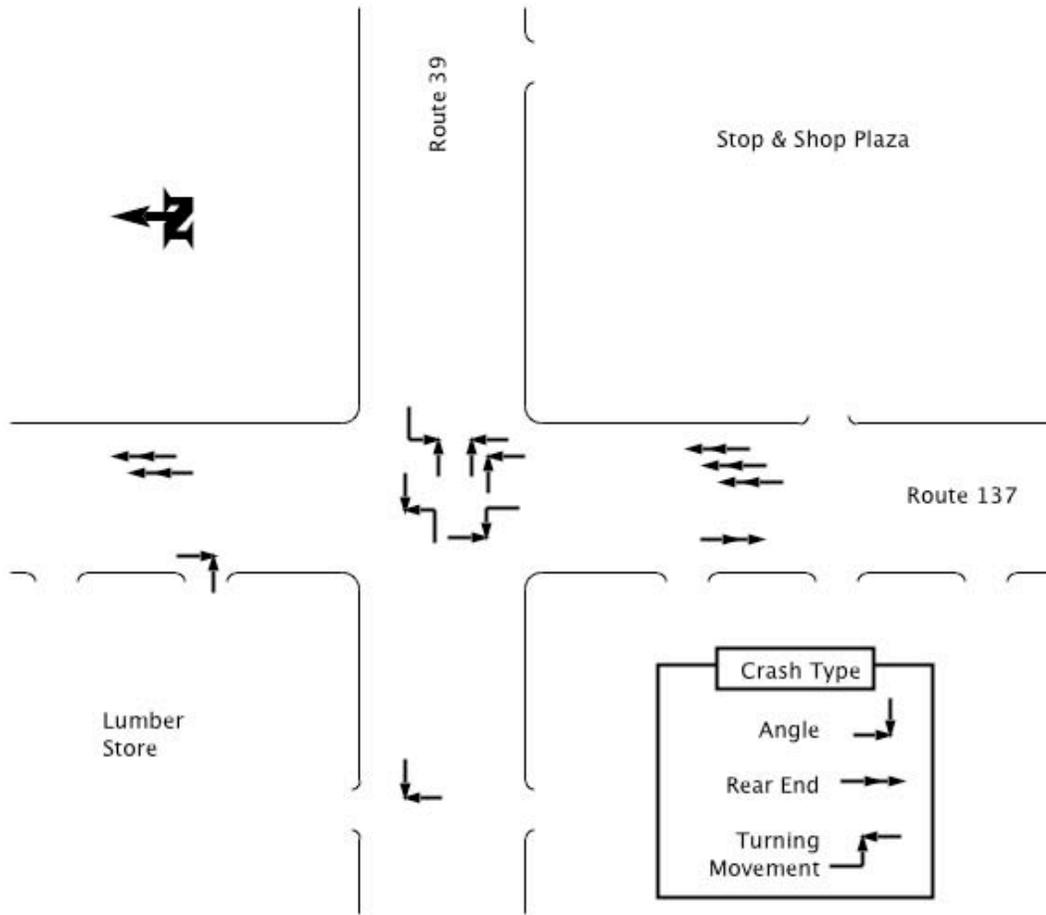
**Table 4 - Crash History [137/39]**

**Route 39 Orleans Road and Route 137 Long Pond Road,  
Harwich  
Crash History**

	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<b>Totals</b>	<b>Average</b>	<b>%</b>
<b>Total</b>	5	9	13	5	4	4	40	6.67	
Fatal	0	0	0	0	0	0	0	0.00	0.0%
Non-Fatal Injury	2	4	4	2	1	1	14	2.33	35.0%
Property Only	3	5	9	3	3	2	25	4.17	62.5%
Not Reported	0	0	0	0	0	1	1	0.17	2.5%
<b>Check Total</b>	<b>5</b>	<b>9</b>	<b>13</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>40</b>	<b>6.67</b>	<b>100%</b>
Angle	3	5	6	4	1	2	21	3.50	52.5%
Rear-End	2	4	7	0	3	1	17	2.83	42.5%
Sideswipe (same direction)	0	0	0	1	0	1	2	0.33	5.0%
Sideswipe (opposite dir)	0	0	0	0	0	0	0	0.00	0.0%
Pedestrian/Bicycle	0	0	0	0	0	0	0	0.00	0.0%
Single Vehicle	0	0	0	0	0	0	0	0.00	0.0%
Head On	0	0	0	0	0	0	0	0.00	0.0%
Not Reported	0	0	0	0	0	0	0	0.00	0.0%
<b>Check Total</b>	<b>5</b>	<b>9</b>	<b>13</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>40</b>	<b>6.67</b>	<b>100%</b>
Crashes per year	6.67								
Crash Rate	0.81 per MEV								

*Source: MassHighway Crash Records*





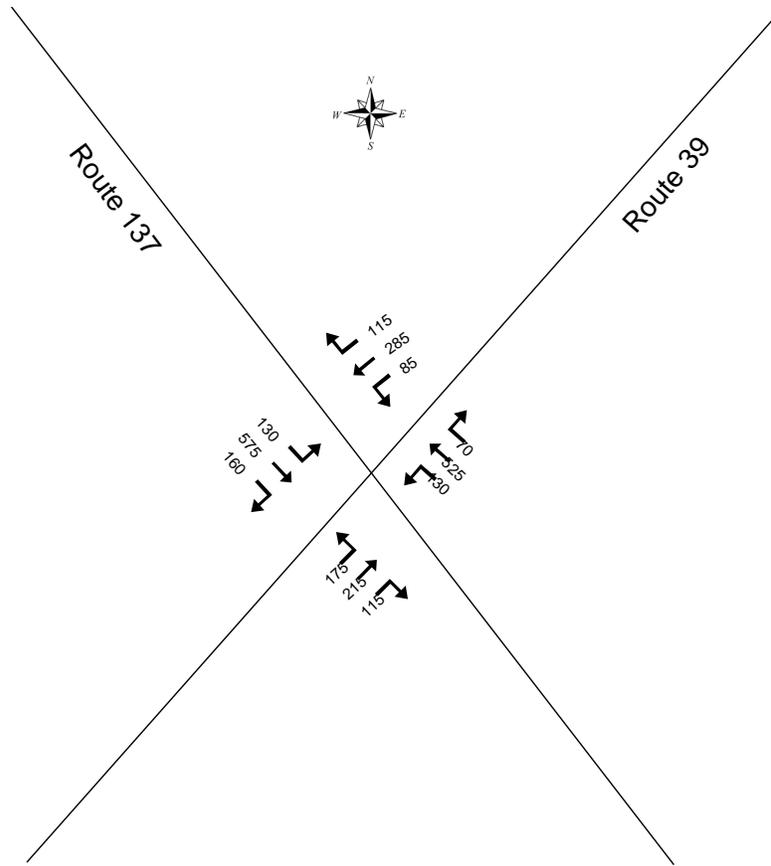
**Figure 12 - Crash Diagram [137/39]**

*Source: Town of Harwich Police Department Accident Reports (2000, 2001)*

**3.1.3. Traffic Operations – Existing & Future**

The following diagrams show the hourly turning movements at the intersection during summer weekday p.m. peak hour and Saturday midday. The following table presents delay and Level of Service (LOS) information for the previous “Existing” geometry and future scenarios. The future scenarios include without and with mitigation (as-built lane configuration). This information was prepared by a private developer as part of a traffic study.

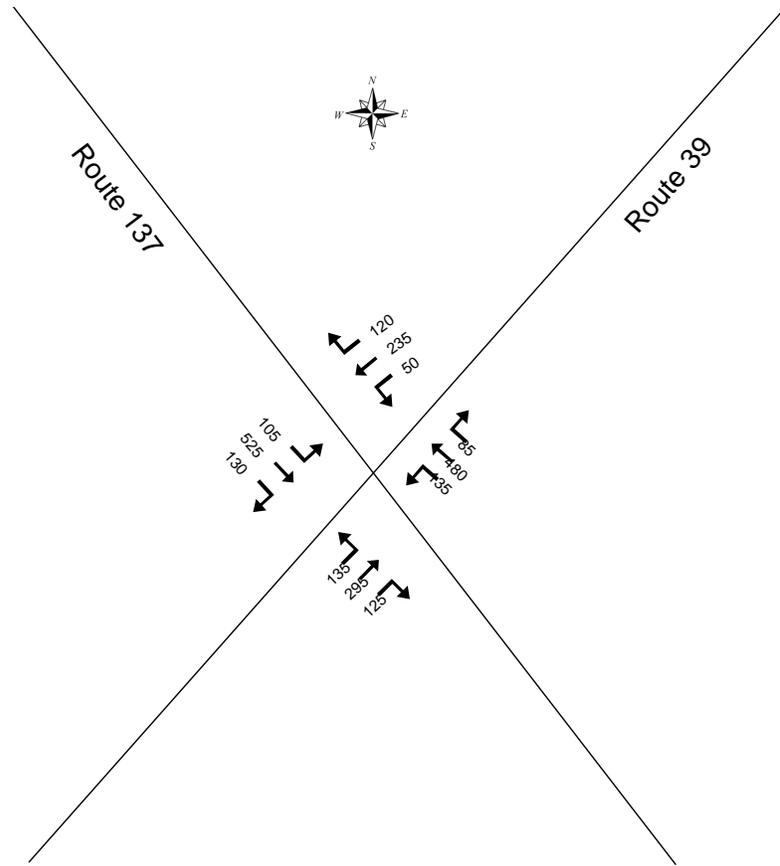




**Figure 13 - Traffic Volumes – Summer Weekday P.M. Peak Hour [137/39]**

*Source: VHB forecasted traffic after Stop & Shop expansion*





**Figure 14 - Traffic Volumes Summer Saturday Midday [137/39]**

*Source: VHB forecasted traffic after Stop & Shop expansion*

**Table 5 - Level of Service [137/39]**

Route 137 and Route 39, Harwich, Level of Service

From VHB Study for Stop and Shop Harwich (November 2001, March 2003)

	2001 Existing		2006 No Build		2006 Build w/out Mitigation		2006 Build w/ Mitigation	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Weekday Evening	33	C	41	D	42	D	33	C
Saturday Midday	28	C	35	D	37	D	30	C

Improvements consisted of retiming the signal and coordination with new signal at Stop and Shop/gas station driveway and re-marking lanes to L, T, R for all approaches (but was being used that way anyway and is reflected as such in the first three scenarios above)



### 3.2. Access Management Alternatives

This section includes discussion of alternative access configurations. Access Management is a strategy reorganizing traffic movements to improve safety and traffic flow operations. For example, by redistributing left turn movements at an un-signalized driveway to a signalized intersection, it is possible to retime the signal for an overall improvement and eliminate several conflicting (and potentially hazardous) maneuvers. These issues are mostly located on the approaches to the intersection.

#### Interconnects

Paved connections between adjacent parcels' parking areas allow for motorists to travel between businesses without adding traffic to the road network. This reduces turning conflicts and congestion and improves traffic flow and safety.

#### Sidewalk/Crosswalk Improvements.

An important regional objective is the improvement of pedestrian facilities to help make the Cape more walkable. Due to large roadway width, sidewalks should be provided on both sides of all approaches. Crosswalks should be provided at all major driveways.

#### Raised Medians

In addition to the benefits of controlling left-turning conflicts, raised medians can provide pedestrian refuge as part of crosswalk design to support walkability. Medians can also separate oncoming traffic thus reducing the potential for head-on collisions. With landscaping, medians provide for an aesthetic appeal of the roadway.

#### By-Pass Roads

To support village-style designs, a separate planning study is underway. This study will examine the issues surrounding new road links.

The following figures illustrate access management principles by restricting or eliminating turning movements at a driveway near the intersection. In this example, the parcel has additional access at another driveway at a safer location (away from intersection turning lanes).





**Existing**



**Turn Restrictions**



**Driveway Closure  
with Sidewalk**

**Figure 15 – Access Management Alternatives [137/39]**





**Figure 16 - Raised Median, Sidewalk [137/39]**

*Source: The Cecil Group*

### **3.3. Recommendations & Next Steps**

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.



## 4. Orleans: Route 6A/Route 28

The intersection of Route 6A and Route 28 is located in the northern part of the town of Orleans. Route 6A serves travelers from points west such as downtown Orleans. Route 28 connects to southerly destinations such as Chatham. To the north, Route 6A and Route 28 combine to connect to the Eastham Rotary (Route 6).

### 4.1. Problem Identification

Observations made at the intersection of Route 6A and Route 28 includes several noted problems:

- Lack of lane delineation (caused by worn lane markings)
- Insufficient pedestrian accommodation (no crosswalks)
- Poor access management

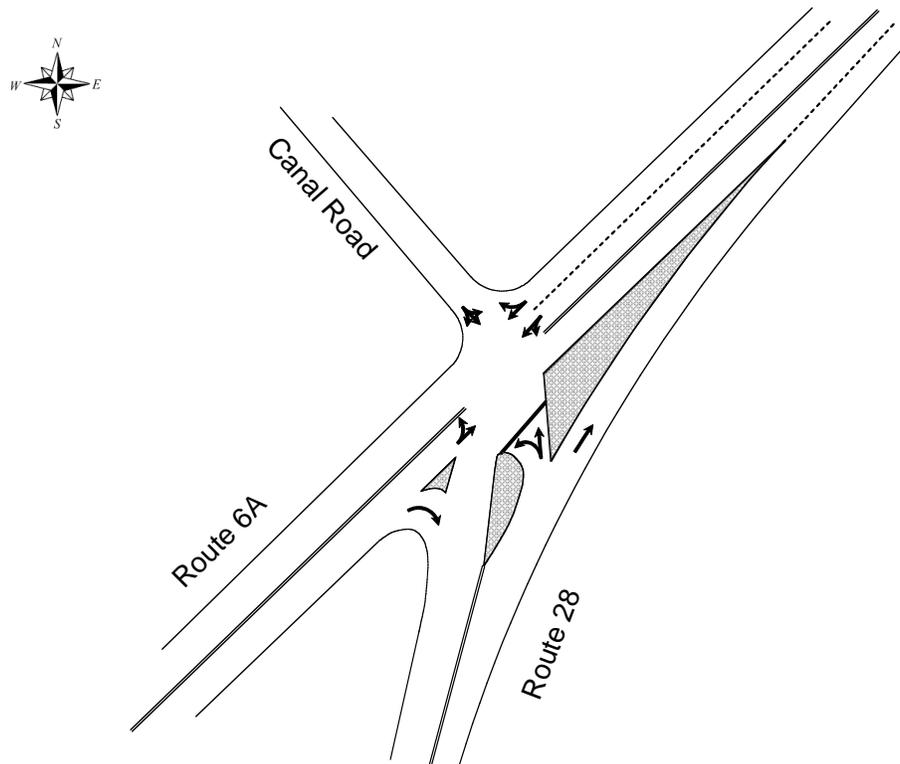
#### 4.1.1. Location & Geometrics

The following figures show the intersection in the context of surround land uses and the driveway locations of adjacent parcels. Note that the intersection includes Canal Road as a western approach.

The geometry of approaching roadways (shown in the following figure) is as follows:

- Route 6A/Route 28 (northern leg): two approach lanes; one wide (approx. 24 feet width) exit lane
- Route 6A (south leg): one approach lane; one exit lane
- Route 28 (east leg): one approach lane dividing to a through/left lane and a dedicated right turn lane; one exit lane
- Canal Road (western leg): one approach lane; one exit lane





**Figure 17 - Route 6A/Route 28 Intersection Diagram**





**Figure 18 - Route 6A/Route 28 Intersection (looking east)**





**Figure 19 - Route 6A/Route 28 Intersection (looking west)**





**Figure 20 - Curb Cut Locations [6A/28]**



**4.1.2. Crash History**

There have been 52 crashes over a 6 year period (average of 9 crashes/year) , by far exceeding the 3 crashes per year threshold for a “high crash location.” These have included a number of angle crashes.

**Table 6 - Crash History [6A/28]**

**Route 6A (Cranberry Highway) and  
Route 28 (South Orleans Road) and Canal Street, Orleans  
Crash History**

	Year						Totals	Average	%
	1999	2000	2001	2002	2003	2004			
<b>Total</b>	10	6	5	14	9	8	52	8.67	
Fatal	0	0	0	0	0	0	0	0.00	0.0%
Non-Fatal Injury	2	2	3	4	6	5	22	3.67	42.3%
Property Only	8	4	2	5	1	3	23	3.83	44.2%
Not Reported	0	0	0	5	2	0	7	1.17	13.5%
<b>Check Total</b>	10	6	5	14	9	8	52	8.67	100%
Angle	7	5	5	5	6	8	36	6.00	69.2%
Rear-End	2	0	0	3	0	0	5	0.83	9.6%
Sideswipe (same direction)	0	0	0	2	0	0	2	0.33	3.8%
Sideswipe (opposite dir)	0	0	0	1	0	0	1	0.17	1.9%
Pedestrian/Bicycle	0	0	0	0	0	0	0	0.00	0.0%
Single Vehicle	0	0	0	0	2	0	2	0.33	3.8%
Head On	0	0	0	0	1	0	1	0.17	1.9%
Not Reported	1	1	0	3	0	0	5	0.83	9.6%
<b>Check Total</b>	10	6	5	14	9	8	52	8.67	100%
Crashes per year	9								
Crash Rate	1.09 per MEV								

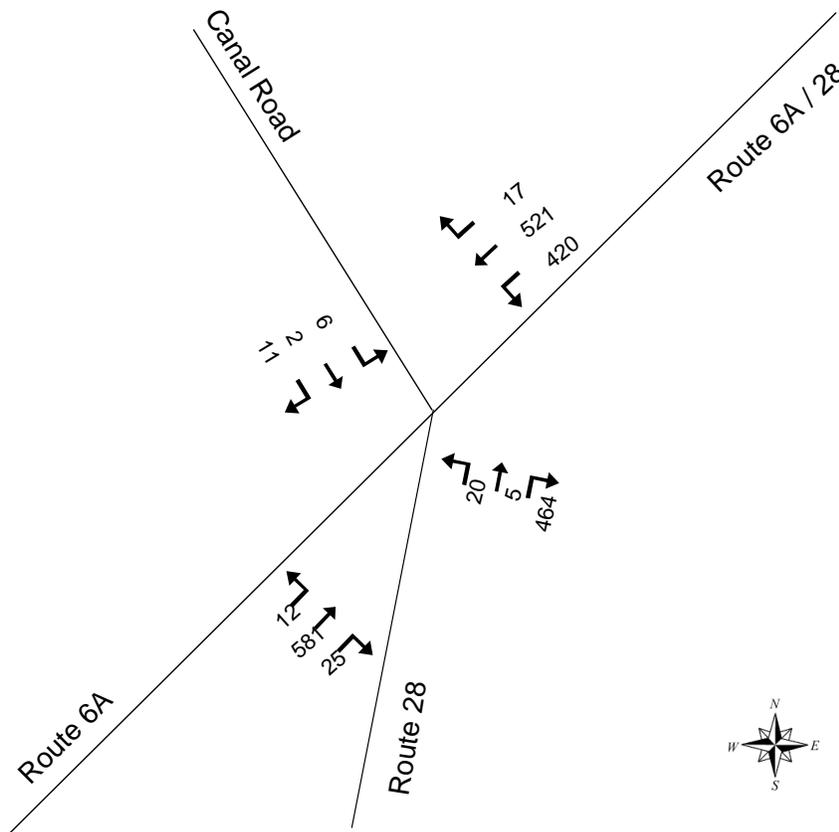
*Source: MassHighway Crash Records*



### 4.1.3. Traffic Operations – Existing & Future

Observations have documented many pedestrians crossing this intersection without the benefit of crosswalks or the protection of advanced warning signs.

The following diagrams show the hourly turning movements at the intersection during summer weekday p.m. peak hour and Saturday midday. The following table presents delay and Level of Service (LOS) information for the existing geometry and three alternatives (these alternatives are discussed in the next section of the report).



**Figure 21 - Summer PM Peak Hour Traffic Volumes [6A/28]**

*Source: adjusted max 2006 CCC traffic count*



**Table 7 - Level of Service Analysis [6A/28]**

**Route 6A and Route 28 / Canal Street,  
Orleans  
Level of Service Analysis**

Configuration	HCS LOS	Simulated Delay/Veh (seconds)
Current Unsignalized*	F	31.4
Signalized	B	14.5
Roundabout (135' outer, 90' inner circle, 15 mph)	NA	14.3
Roundabout (110' outer, 66' inner circle, 15 mph)	NA	15.7

## 4.2. Development & Analysis of Alternatives

This section includes discussion, analyses, and evaluation of several alternatives. The amount of detailed analysis varies for each alternative. The variation is based on the availability of information for and the feasibility of each alternative. The following sections include discussions of several alternatives:

### Improve striping and signage

The Route 6A/Route 28 (northern leg) approach operates as a through-lane and a 'de-facto' left-turn lane. The left-turn lane should be striped and signed as an exclusive left-turn lane to facilitate traffic flow and improve safety. This northern-leg's exit lane should be striped as two lanes to clearly identify exclusive lane usage for traffic from right-turning Route 28 (eastern leg).

### Sidewalk/Crosswalk Improvements.

An important regional objective is the improvement of pedestrian facilities to help make the Cape more walkable. Due to large roadway width, sidewalks should be provided on both sides of all approaches. Crosswalks should be provided at all major driveways.

### Access management: driveway relocation, turn restrictions, driveway consolidation

Access Management is a strategy reorganizing traffic movements to improve safety and traffic flow operations. For example, by redistributing left turn movements at an unsignalized driveway to a signalized intersection, it is possible to retune the signal for an overall improvement and eliminate several conflicting (and potentially hazardous) maneuvers. These issues are mostly located on the approaches to the intersection.



#### Interconnects

Paved connections between adjacent parcels' parking areas allow for motorists to travel between businesses without adding traffic to the road network. This reduces turning conflicts and congestion and improves traffic flow and safety.

#### Signalization

Signalization of this location could be accomplished without realigning any of the approaches or any land takings. Signalization can improve safety by controlling left-turn movements. As shown in the table above, this alternative results in a good level of service (LOS B).

#### Replace intersection with modern roundabout

A modern roundabout (smaller than most rotaries) would serve as means to organize traffic movements at safe speeds and minimal delay. Although a roundabout would have an acceptable level of service (see table above) and is expected to improve safety at this location, it is anticipated that right-of-way takings would be necessary.

### **4.3. Recommendations & Next Steps**

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, MassHighway, etc. The objective of this meeting is to build consensus for the optimal safety improvement at this intersection. MassHighway should proceed with designing safety improvements resulting from the public process.



## 5. Conclusion

A review of traffic safety issues at the three locations has resulted in a comprehensive package of improvements. In some cases, improvements have been identified for short term (e.g., signing and striping) with other, more complex improvements being listed for longer-term implementation.

### 5.1. Summary of Recommendations

The following list is a summary of recommendations as found in the previous sections. Please refer to the individual sections for details.

#### Otis Rotary

- Short term: restriping and signage
- Long term: diamond interchange

#### Route 137/Route 39

- Access management
- Pedestrian accommodation (sidewalks & crosswalks)

#### Route 6A/Route 28

- Short term: restriping and signage
- Short term: pedestrian accommodation (crosswalks)
- Long term: access management
- Long term: signalization or modern roundabout

### 5.2. Next Steps

Through a thorough review process and public participation, it is expected that implementation of the recommendations of this report will result in improved safety for Cape Cod. Typically, next steps include holding meetings, consensus-building, initiation of the design process, and securing funding.

