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# 2008 Transportation Safety Report

**Eastham:** Route 6/Brackett Road

**Sandwich:** Route 6/Route 130 (Exit 2)  
(Westbound & Eastbound Ramps)

**Final Report**  
May 2009

*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**

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## 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 variety of safety problems in the region. Through the process of public participation used to develop the Cape Cod Regional Transportation Plan, review of the former 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 listed below include one signalized intersection in Eastham and two unsignalized highway ramp intersections in Sandwich:

- Eastham: Route 6, Brackett Road and Old County Road
- Sandwich: Route 6 Interchange 2 Westbound Ramps/Route 130
- Sandwich: Route 6 Interchange 2 Eastbound Ramps/Route 130

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

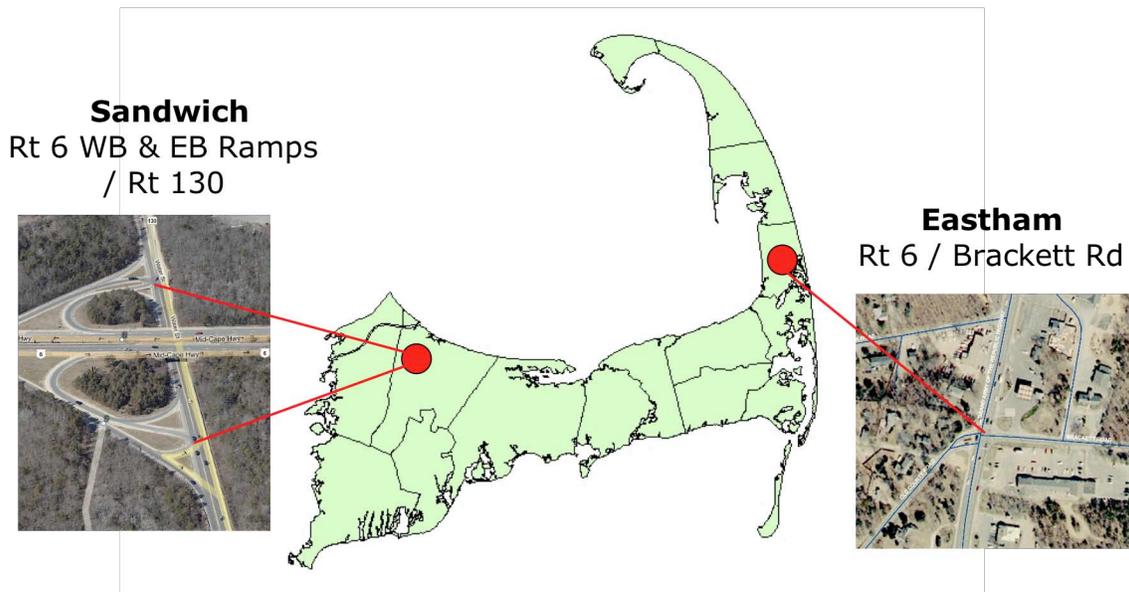
1. Local Roadway Network, Geometry & Driveways
2. Safety History
3. Existing & Expected Future Traffic Volumes & Operations
4. Development, Analysis, and Evaluation of Alternatives
5. Recommendations & Next Steps

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)

The fifth item 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**

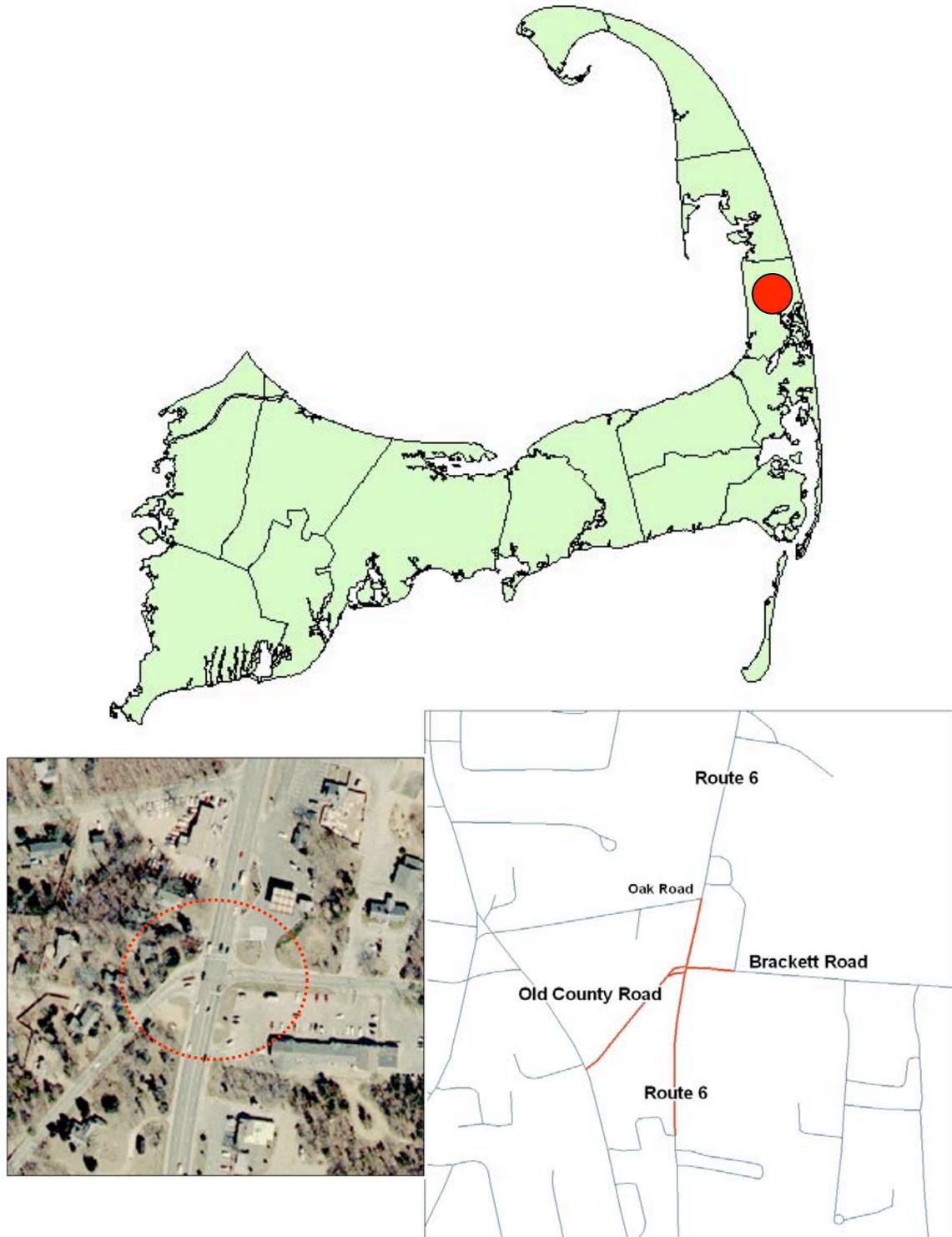
## **2. Eastham: Route 6, Brackett Road and Old County Road**

### **2.1. Problem Identification**

Route 6 in Eastham is a heavily traveled roadway with a history of high-frequency crashes. This location has been a concern for the Town of Eastham for a number of years. The following sections provide details on the existing signalized intersection's characteristics.

#### **2.1.1. Location & Geometrics**

Route 6, Brackett Road and Old County Road form a signalized, 4-way intersection. Route 6 is a four-lane undivided roadway that enters from the north and south. Brackett Road is a two lane undivided roadway that enters from the east. Old County Road is a two lane undivided roadway that enters from the west. The lane configuration of the Route 6 northern and southern lanes of the intersection consist of a shared left/through lane and a shared right/through lane. The Old County Road western leg includes a shared left/through lane and an exclusive right-turn lane. The Old County Road approach has a division island dividing westbound and eastbound traffic.



**Figure 2 - Eastham: Route 6, Brackett Road and Old County Road Location**

### 2.1.2. Crash History

The intersection of Route 6, Brackett Road and Old County Road is an existing signalized intersection. The Route 6, Brackett Road and Old County Road intersection qualifies as a “High Crash Location” with an average of approximately nine (9) crashes per year (an intersection with over three (3) crashes per year qualifies for this designation according to Cape Cod Commission Regional Policy Plan guidelines).

The intersection was recently upgraded in 2004 with new traffic signal equipment and timing changes. The intersection continued to experience a significant crash history even after the traffic signal upgrades. With the significant safety improvements associated with modern roundabouts, Cape Cod Commission transportation staff questions that if a modern roundabout were originally designed and installed at this location that motorist would benefit from a reduced crash history. In addition, motorist would not be inconvenienced by the necessity of roadway construction impacts every few years and the tax dollars saved at this location could be used at other locations to improve the infrastructure of Eastham.

The Route 6/Brackett Road/Old County Road intersection has experienced a significant number of crashes over the years. The majority of these crashes are angle type indicating problems with left turns. Further analysis of the crashes at the Route 6/Brackett Road intersection indicates that many sideswipe crashes occur as vehicles; which are stopped behind a vehicle waiting to turn left, turn into the adjacent lane and sideswipe the vehicle traveling in the appropriate lane. This is another indication that exclusive left turn lanes on Route 6, both northbound and southbound, would enhance the safety at this intersection.

The Town of Eastham is designing improvements to Brackett Road, which include a through/right turn lane on Brackett Road. The design of the through/right turn lane on Brackett Road will allow the existing lane on Brackett Road to be designated as an exclusive left turn lane. The existing traffic signal at Route 6 and Brackett Road will be modified to accommodate the left turn phase. This project from the Town of Eastham will enhance the safety operation at this intersection.

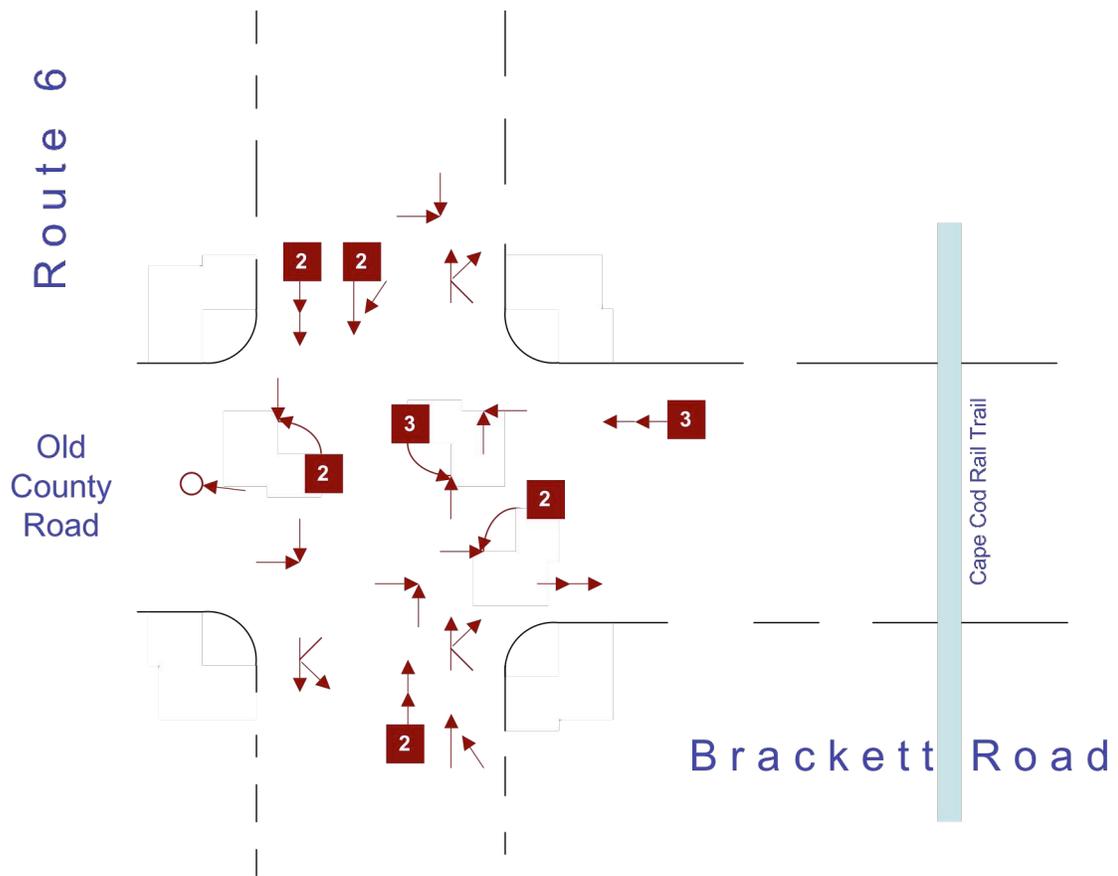
**Table 1 - Crash History – Route 6, Brackett Road and County Road**

<b>2005</b>			
<b>Severity</b>	Property Damage Only	7	
	Injury	1	
<b>Crash Type</b>	Angle	4	
	Rear-end	3	
	Sideswipe	1	<b>2005 Total</b>
	Fixed Object		
			<b>8</b>

<b>2006</b>			
<b>Severity</b>	Property Damage Only	7	
	Injury	2	
<b>Crash Type</b>	Angle	4	
	Rear-end	3	
	Sideswipe	2	<b>2006 Total</b>
	Fixed Object		
			<b>9</b>

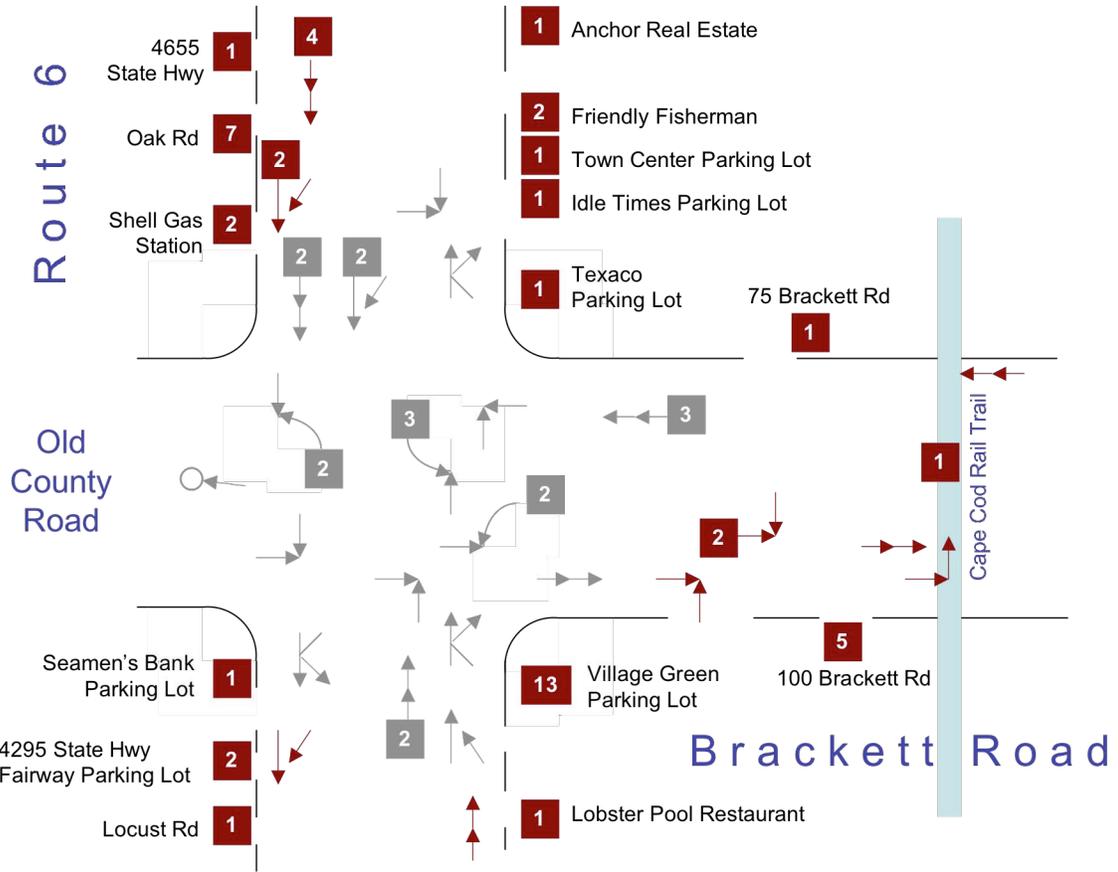
<b>2007</b>			
<b>Severity</b>	Property Damage Only	7	
	Injury	3	
<b>Crash Type</b>	Angle	6	
	Rear-end	2	
	Sideswipe	1	<b>2007 Total</b>
	Fixed Object	1	
			<b>10</b>

Source: Town of Eastham Police Department 2005, 2006, 2007



**Figure 3 - Crash Diagram Route 6, Crash Diagram Route 6, Brackett Road and Old County Road**

*Source: -- Town of Eastham Police Department, 2005, 2006, 2007*

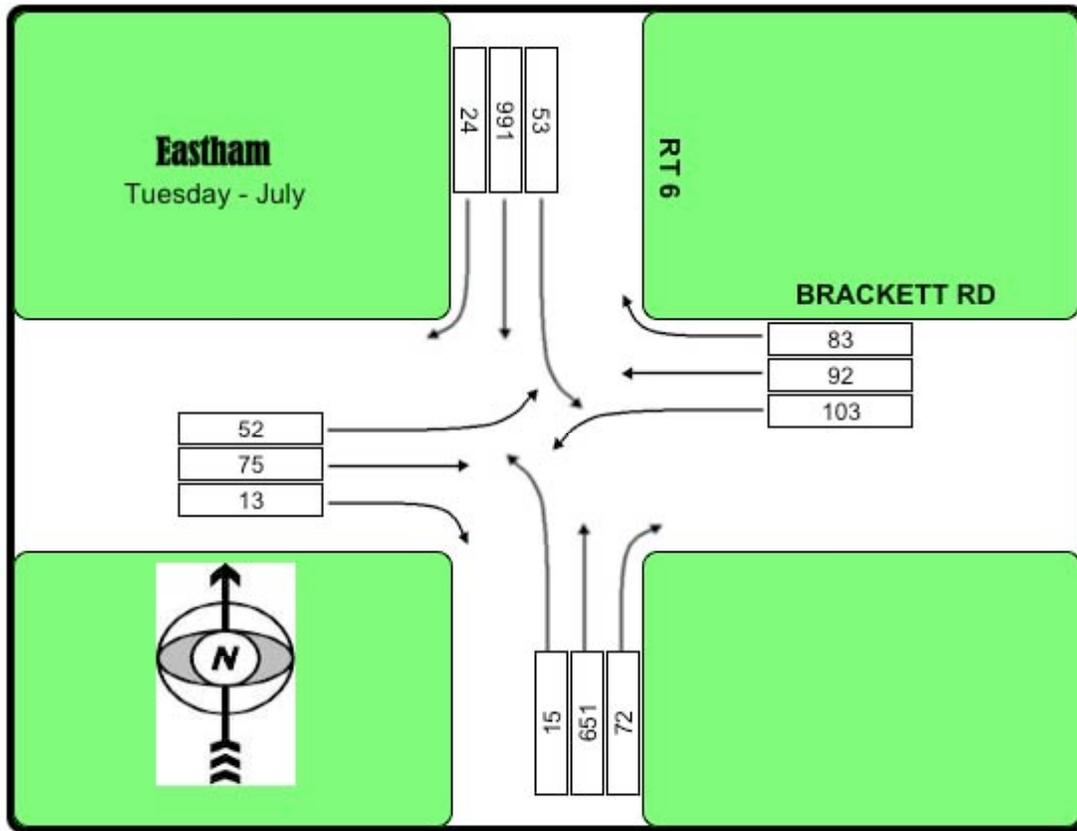


**Figure 4 - Crash Diagram – Route 6/Brackett Road/Old County Road Including Adjacent Areas**

*Source: Town of Eastham Police Department for the years 2005, 2006 and 2007----*

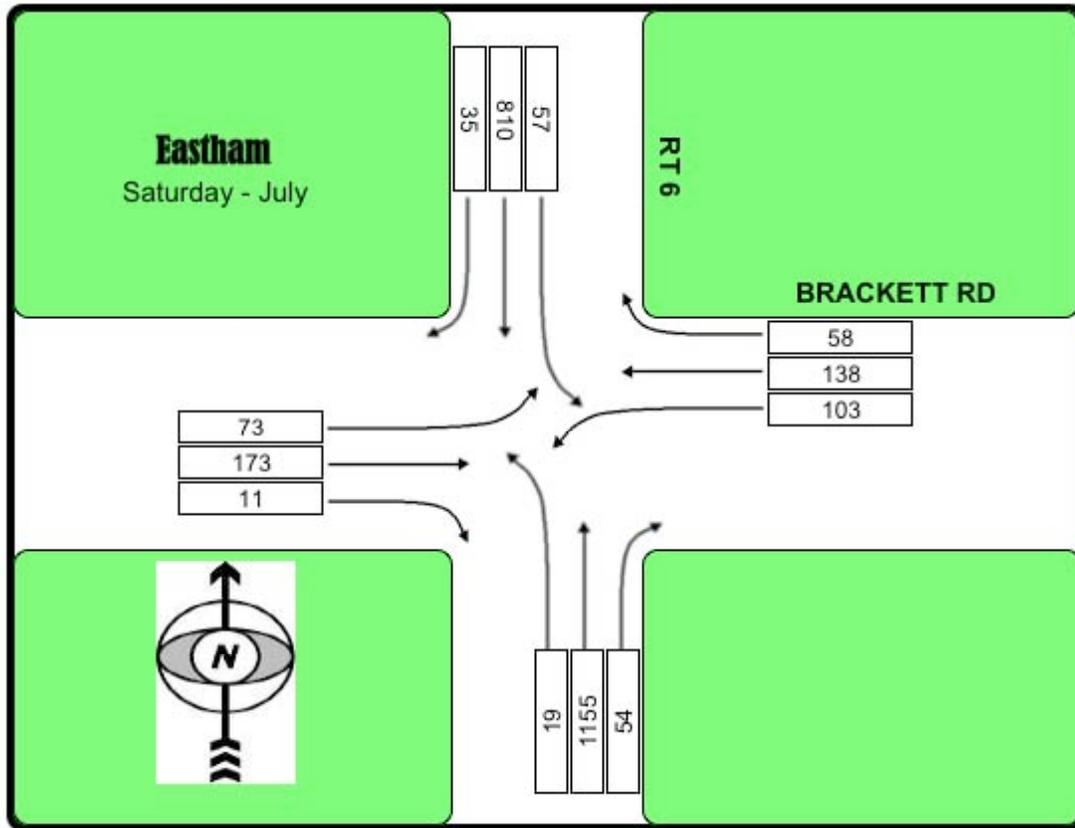
**2.1.3. Traffic Operations – Existing & Future**

The intersection serves approximately 18,402 entering vehicles per day on an annual average basis, 23,294 on an average summer weekday and 28,766 on an average summer weekend day. As shown in Table 2, the Level of Service analysis for both the roundabout and an upgraded intersection (with left turn lanes) functions at the similar levels.



**Figure 5 – Summer Weekday P.M. Traffic Volumes [Route 6/Brackett]**

*Source: Cape Cod Commission*



**Figure 6 - Summer Saturday Midday Traffic Volumes [Route 6/Brackett]**

*Source: Cape Cod Commission*

## 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:

### **Route 6, Brackett Road and Old County Road – Area Improvements**

As outlined in Figure 2, many crashes occur within close proximity to the Route 6, Brackett Road and Old County Road intersection. These crashes are the result of many factors which are not correctable by intersection improvements. However, in an attempt

to assist the Town of Eastham with safety improvement in the vicinity of the intersection, Cape Cod Commission transportation staff and the Town of Eastham DPW Director discussed the following changes along the approaches to the intersection:

- Consider 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. Increasing the sight distance can be accomplished with brush removal, tree trimming and minor leveling of dirt mounds.
- Construct a Gateway Entrance (signage and landscaping) on Brackett Road to alert motorist entering the North Eastham Village Area from the east.
- Work with the Village Green Shopping Center owner on parking lot improvements to reduce driver confusion with the plaza parking lot.

### **Route 6, Brackett Road and Old County Road – Brackett Road Improvements**

The Town of Eastham is currently in the process of providing roadway improvements along Brackett Road. This roadway improvement project will include designing an additional lane on the Brackett Road approach to the intersection and upgrades at the Route 6, Brackett Road and Old County Road intersection. The Brackett Road work will include widening Brackett Road to accommodate a right turn lane and a sidewalk on the south side of Brackett Road. This design is being done by the Town of Eastham under limited budget constraints. Construction funding for this project is to be determined. The primary benefit of this improvement is to reduce congestion on the Brackett Road approach to the intersection.

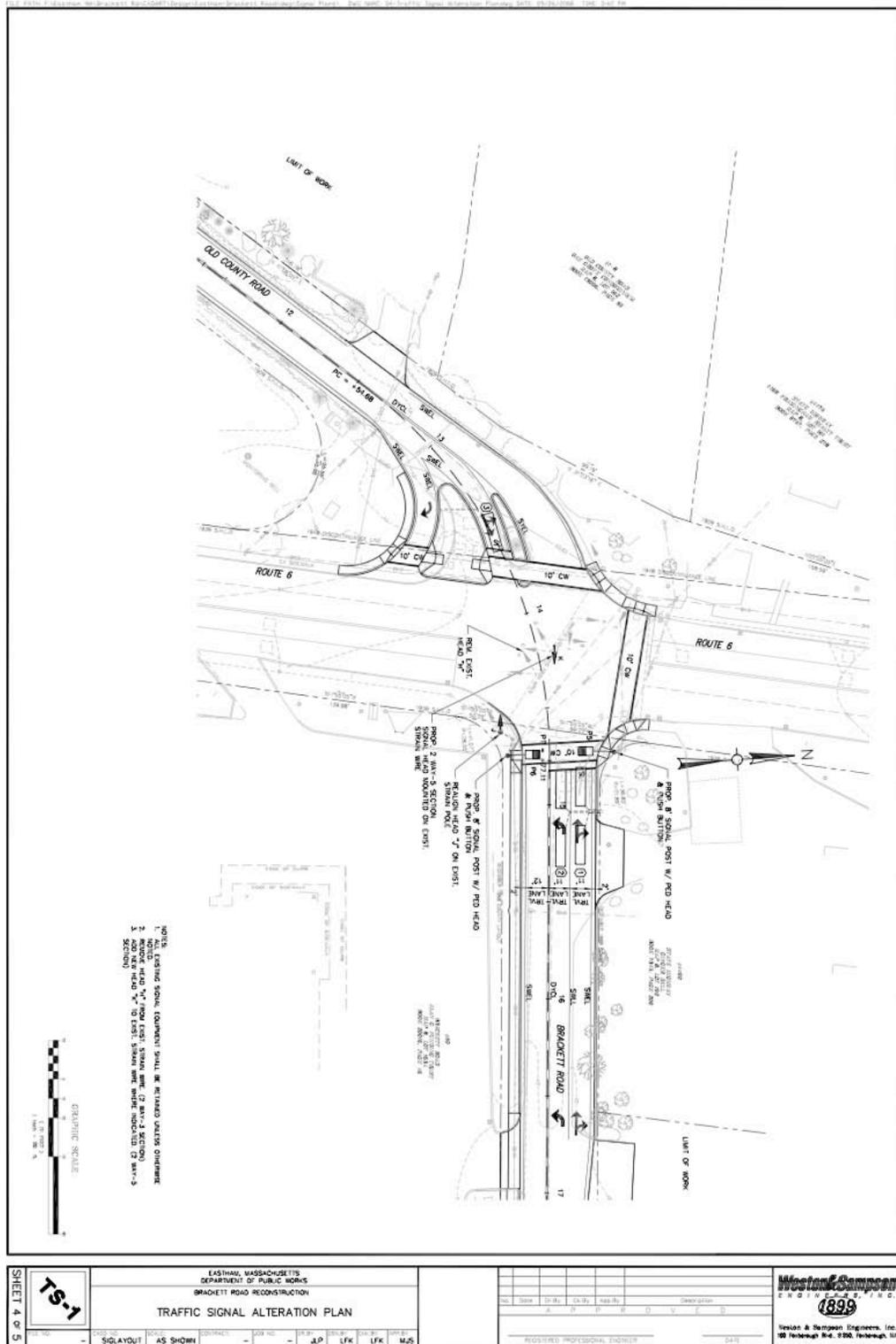


Figure 7 - Brackett Road Improvements - Route 6/Brackett Road/Old County Road

**Route 6, Brackett Road and Old County Road – Intersection Improvements**

The crash diagram (Figure 1) and Table 1 show that the majority of crashes at the Route 6, Brackett road and Old County Road intersection occur as a result of left-turning traffic from Route 6 (both northbound and southbound). Upon review of the crash reports from the Eastham Police Department indicates that many of the rear-end and side-swipe collisions on Route 6 are the result of motorists trying to maneuver around vehicles queued up waiting to turn left at this intersection.

The Route 6 Safety & Traffic Flow Study for Eastham, Wellfleet, Truro and Provincetown by Cape Cod Commission Transportation Staff (March 2004) recommended left turn lanes and exclusive left turn phases at this location. Based on the crash analysis conducted for this report, Cape Cod Commission transportation staff would continue to recommend left turn lanes and exclusive left turn phases at this location. Cape Cod Commission transportation staff anticipates that a significant number of crashes will continue to occur until left turn lanes and exclusive left turn lanes are installed at this location.

**Route 6, Brackett Road and Old County Road – Modern Roundabout**

Converting the existing signalized intersection into a modern roundabout would be a significant cost at this location. However, roundabouts have been shown to significantly reduce crashes and reduce injury crashes. Cape Cod Commission transportation staff estimates that a modern roundabout would function at Level of Service A during summer peak hours. In addition, a modern roundabout would not need the continuous upgrading required at this signalized location.

Although a modern roundabout is not recommended at this time, communities on Cape Cod should consider installing modern roundabouts at all high crash locations.



**Figure 8 - Modern Roundabout - Route 6, Brackett Road and Old County Road**

The previous alternatives have been analyzed as shown in Table 2:

**Table 2 – Traffic Delay for Alternatives**

<b>Alternative</b>	<b>Overall Level Of Service</b>	
	<b>Weekday Afternoon</b>	<b>Saturday Midday</b>
Existing Conditions	D	N/A
Brackett Road Improvements	N/A	N/A
Route 6 Left Turn Lanes	B	N/A
Modern Roundabout	A	B

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**

<b>Alternative</b>	<b>Relative Cost</b>	<b>Congestion Relief</b>	<b>Safety Improvement</b>	<b>Environmental/ ROW</b>
Brackett Road Area Improvements	Low	Low	Minimal/Medium	None
Brackett Road Improvements	Medium	Minimal	Medium*	None
Route 6 Left Turn Lanes	Medium	Medium	Medium	Low
Roundabout	High	Medium	High	Medium

\*The Brackett Road improvement will provide safety improvement along Brackett Road as well as at the Route 6/Brackett Road intersection.

### **2.3. Recommendations & Next Steps**

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.

The next-step for this location would be to hold a public meeting to discuss the possibility of MassHighway designing and constructing left turn lanes on Route 6. This meeting should include area residents and business representatives, local agencies, state and local officials, and other interested stakeholders. The objective of this meeting is to build consensus for designing and constructing left turn lanes with exclusive left turn phases on Route 6 both northbound and southbound.

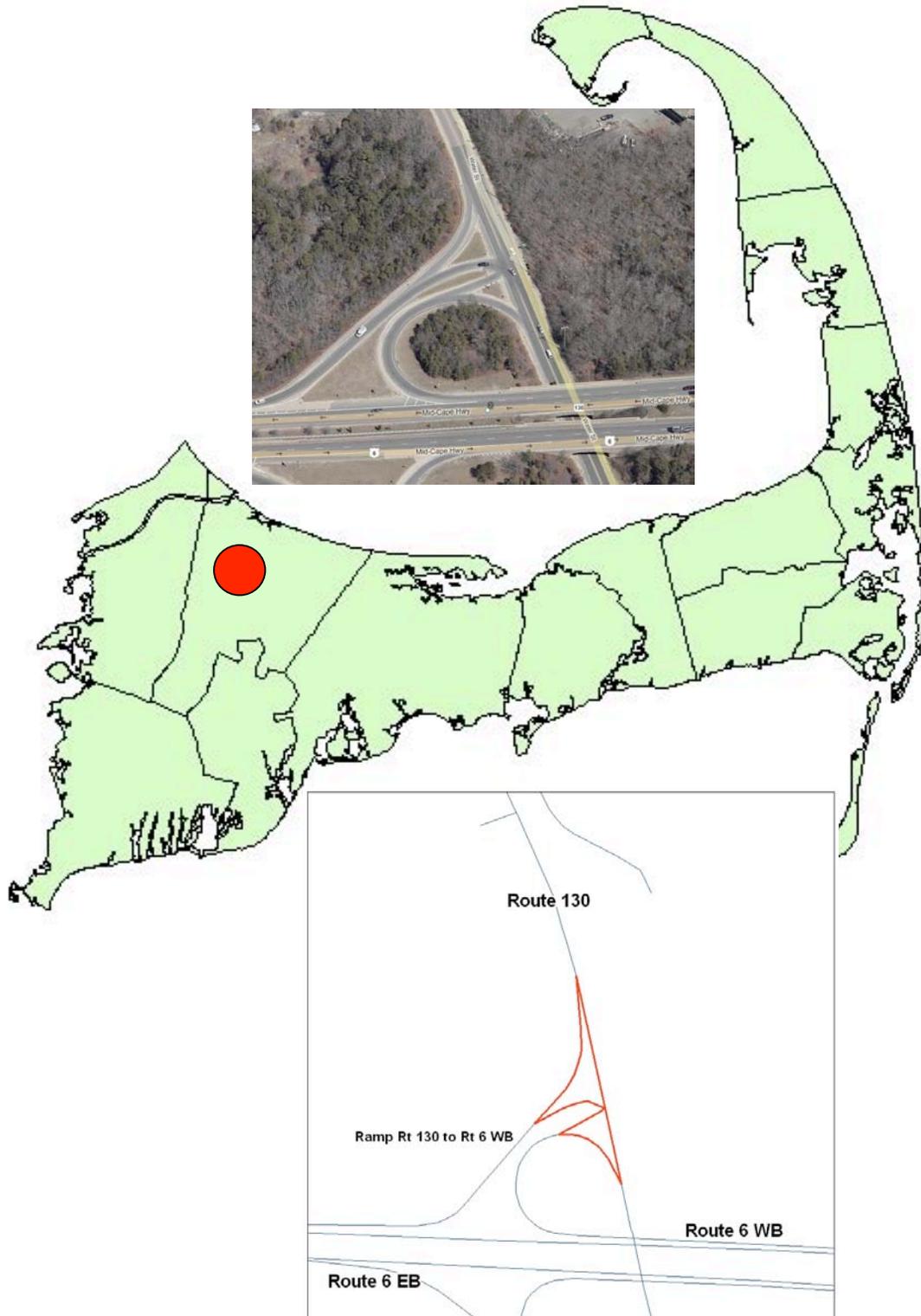
### **3. Sandwich: Route 6/Route 130 (Exit 2) Intersections**

The interchange of Route 6 and Route 130 is located in the central part of Sandwich and serves as the gateway to historic Sandwich village to the north and the “South Sandwich Village Center” to the south.

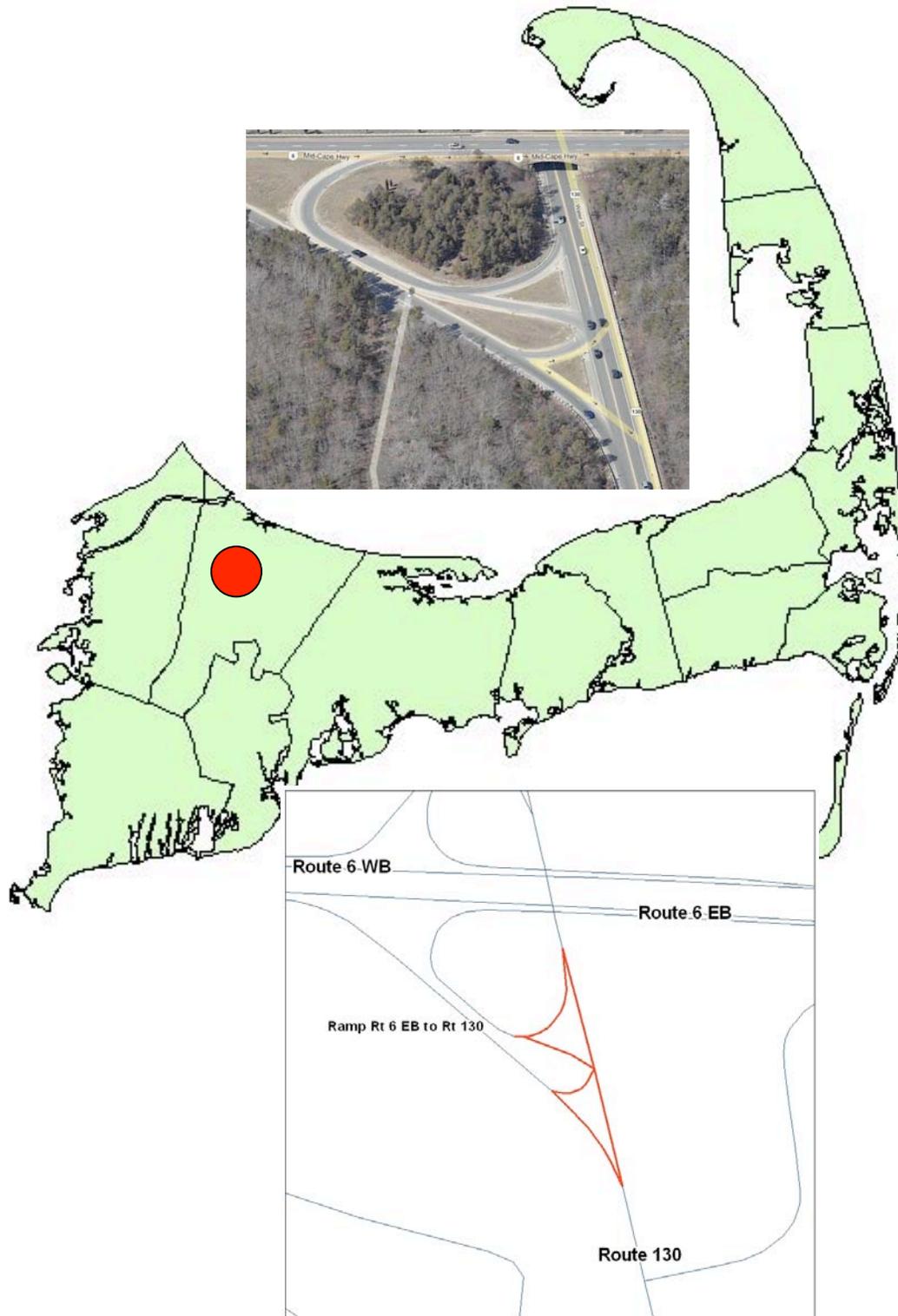
#### **3.1. Problem Identification**

The Route 6 highway ramps at Route 130 in Sandwich are a pair of heavily traveled unsignalized highway ramps with a history of high-frequency crashes. This location has been a concern for the Town of Sandwich for a number of years. The following sections provide details on the existing unsignalized intersection’s characteristics.

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



**Figure 9 - Route 6/Route 130 Interchange – Westbound Ramps**



**Figure 10 - Route 6/Route 130 Interchange – Eastbound Ramps**

**3.1.2. Crash History**

The Route 6 highway ramps at Route 130 form two (2) unsignalized intersections. These intersections are in close proximity to each other and coordination of the intersection improvements is important to smooth operation of the intersections. Both Route 6 highway ramps at Route 130 intersections qualifies as a “High Crash Location” with an average of approximately nine (9) crashes per year (an intersection with over three (3) crashes per year qualifies for this designation according to Cape Cod Commission Regional Policy Plan guidelines).

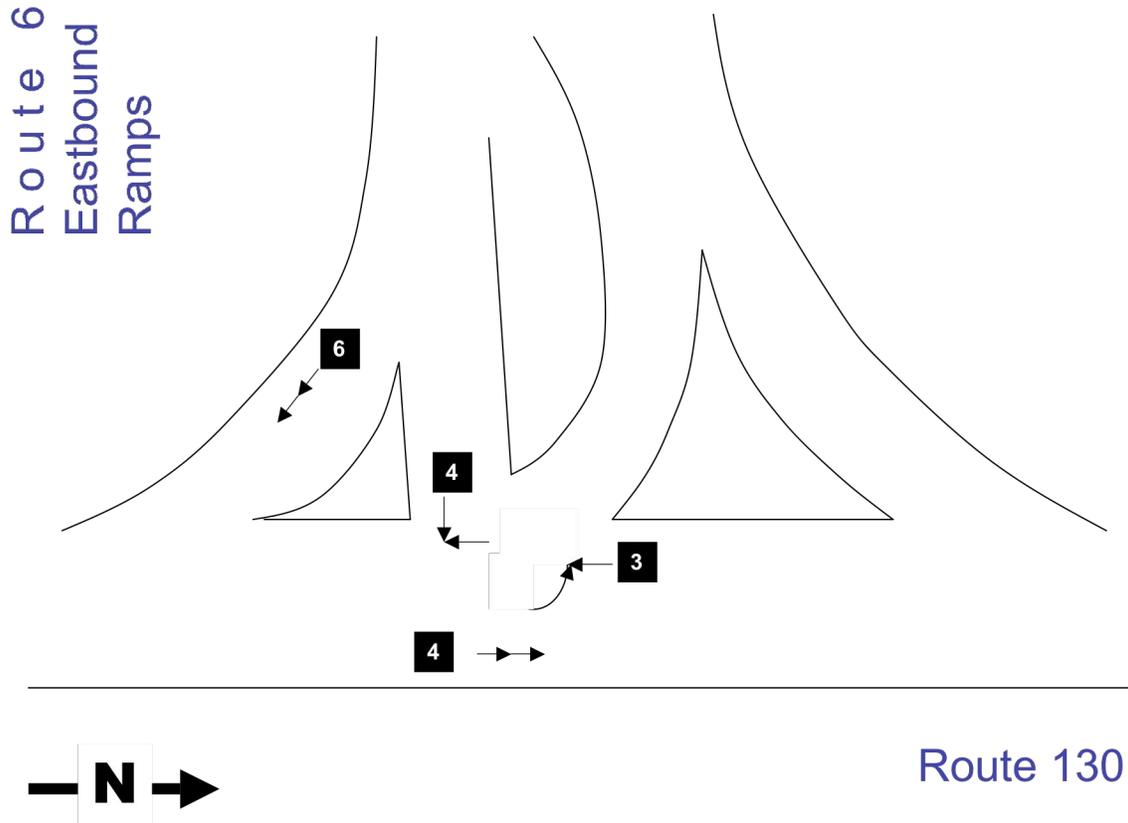
**Table 4 - Crash History at the Route 130/Route 6 Ramps (eastbound and westbound)**

<b>2005</b>			
<b>Severity</b>	Property Damage Only	4	
	Injury	2	
<b>Crash Type</b>	Angle	3	
	Rear-end	3	
	Sideswipe		<b>2005 Total</b>
	Fixed Object		
			<b>6</b>

<b>2006</b>			
<b>Severity</b>	Property Damage Only	7	
	Injury	5	
<b>Crash Type</b>	Angle	3	
	Rear-end	9	
	Sideswipe		<b>2006 Total</b>
	Fixed Object		
			<b>12</b>

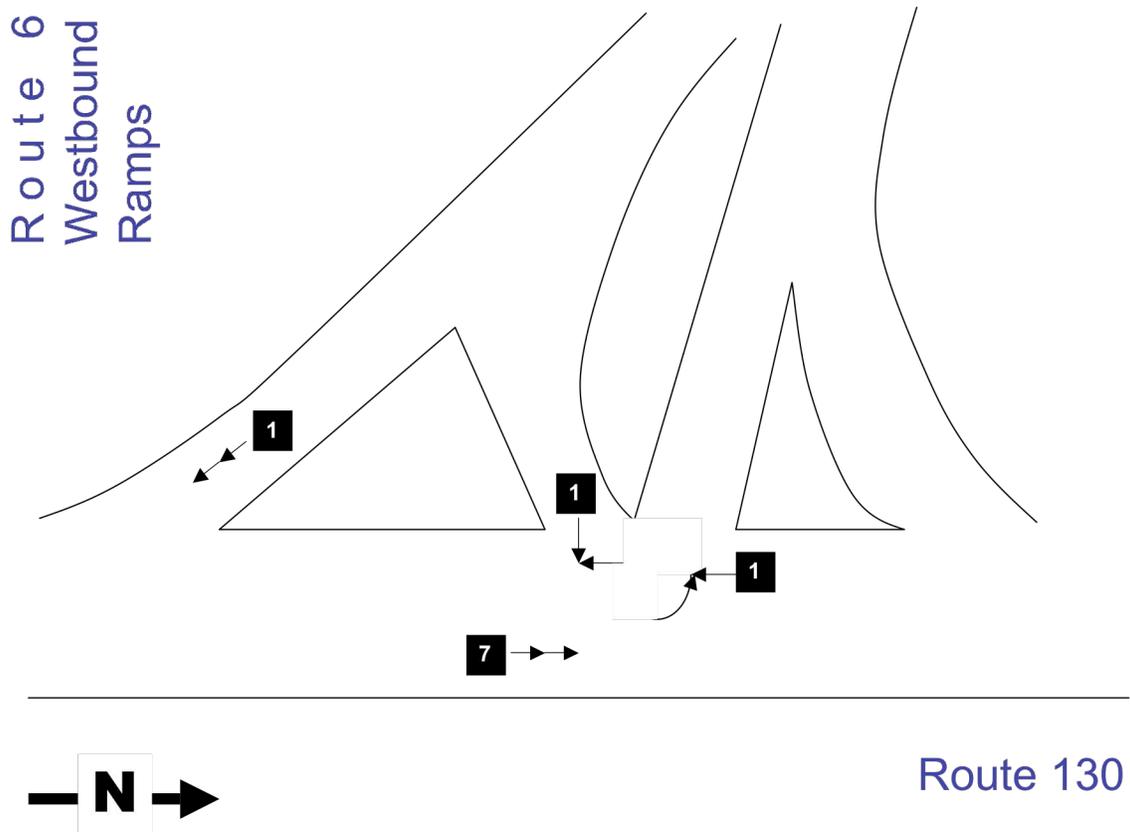
<b>2007</b>			
<b>Severity</b>	Property Damage Only	5	
	Injury	3	
<b>Crash Type</b>	Angle	3	
	Rear-end	6	
	Sideswipe		<b>2007 Total</b>
	Fixed Object		
			<b>9</b>

*Source: MassHighway Crash Records  
 Compiled by Cape Cod Commission transportation staff*



**Figure 11 - Crash Diagram – Eastbound Ramps [6/130]**

*Source: Town of Sandwich Police Department, 2005, 2006, 2007  
Complied by Cape Cod Commission transportation staff*

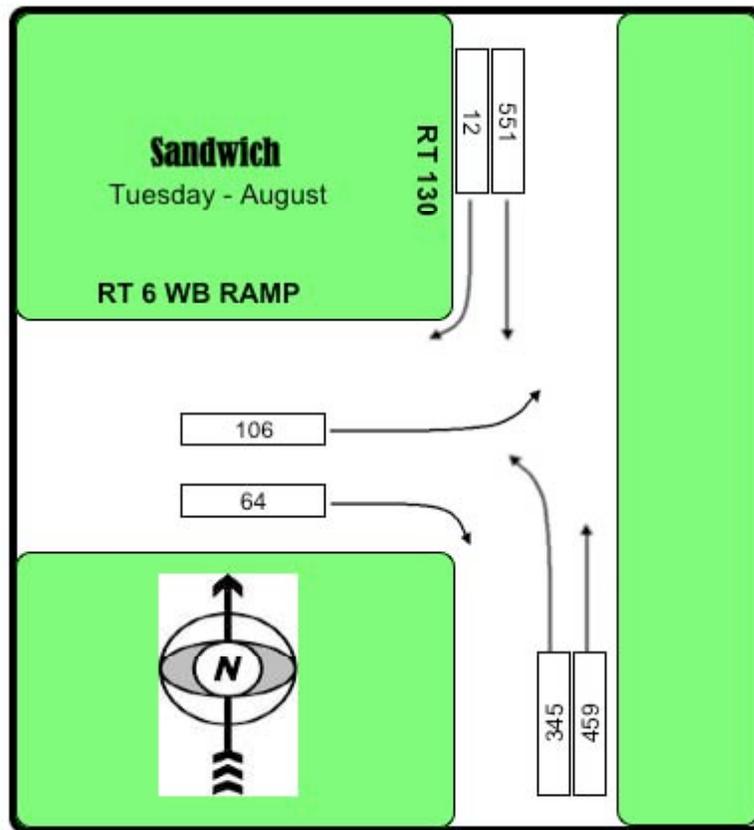


**Figure 12 - Crash Diagram – Westbound Ramps [6/130]**

*Source: Town of Sandwich Police Department, 2005, 2006, 2007  
Complied by Cape Cod Commission transportation staff*

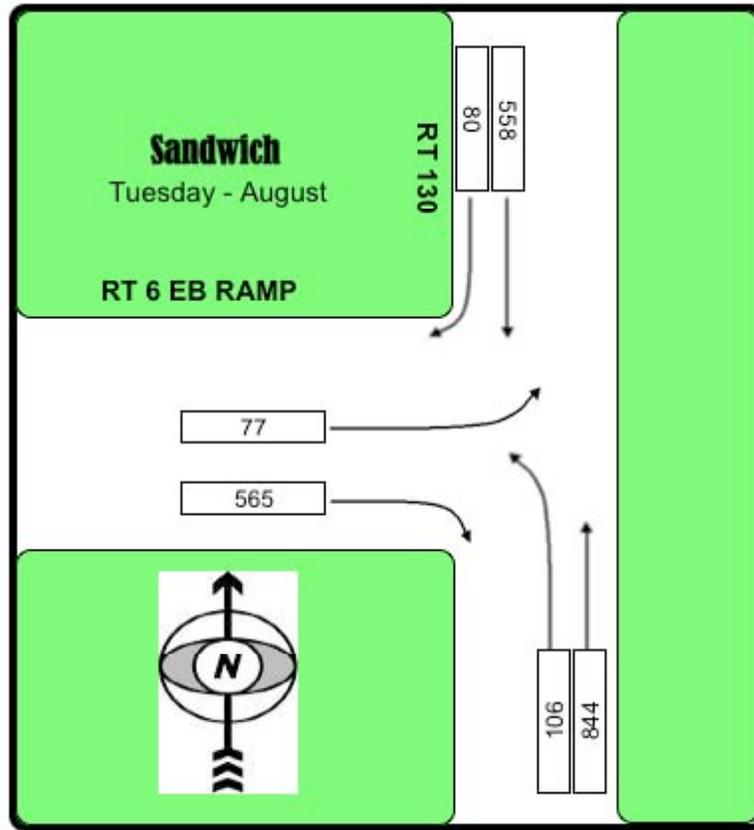
### 3.1.3. Traffic Operations – Existing & Future

The following diagrams show the hourly turning movements at the intersection during the summer weekday afternoon peak hour at each ramp. The following table presents delay and Level of Service (LOS) information for alternatives outlined in this report.



**Figure 13 - Traffic Volumes – Summer Weekday Afternoon Peak Hour  
Route 6/Route 130 Westbound Ramp**

*Source: Cape Cod Commission*



**Figure 14 - Traffic Volumes Summer Saturday Midday Route 6/Route 130 Eastbound Ramp**

*Source: Cape Cod Commission*

**Table 5 - Level of Service at the Route 130/Route 6 Westbound Ramp**

Alternative	Overall Level of Service Weekday Afternoon
Existing Conditions	F
Traffic Signal	C
Modern Roundabout	C
Full Cloverleaf Interchange	A

**Table 6 - Level of Service at the Route 130/Route 6 Eastbound Ramp**

<b>Alternative</b>	<b>Overall Delay Per Vehicle (seconds)</b>
	<b>Weekday Afternoon</b>
Existing Conditions	F
Traffic Signal	B
Modern Roundabout	B
Full Cloverleaf Interchange	A

### **3.2. 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:

#### **Route 6 Highway Ramps at Route 130 – Area Improvements**

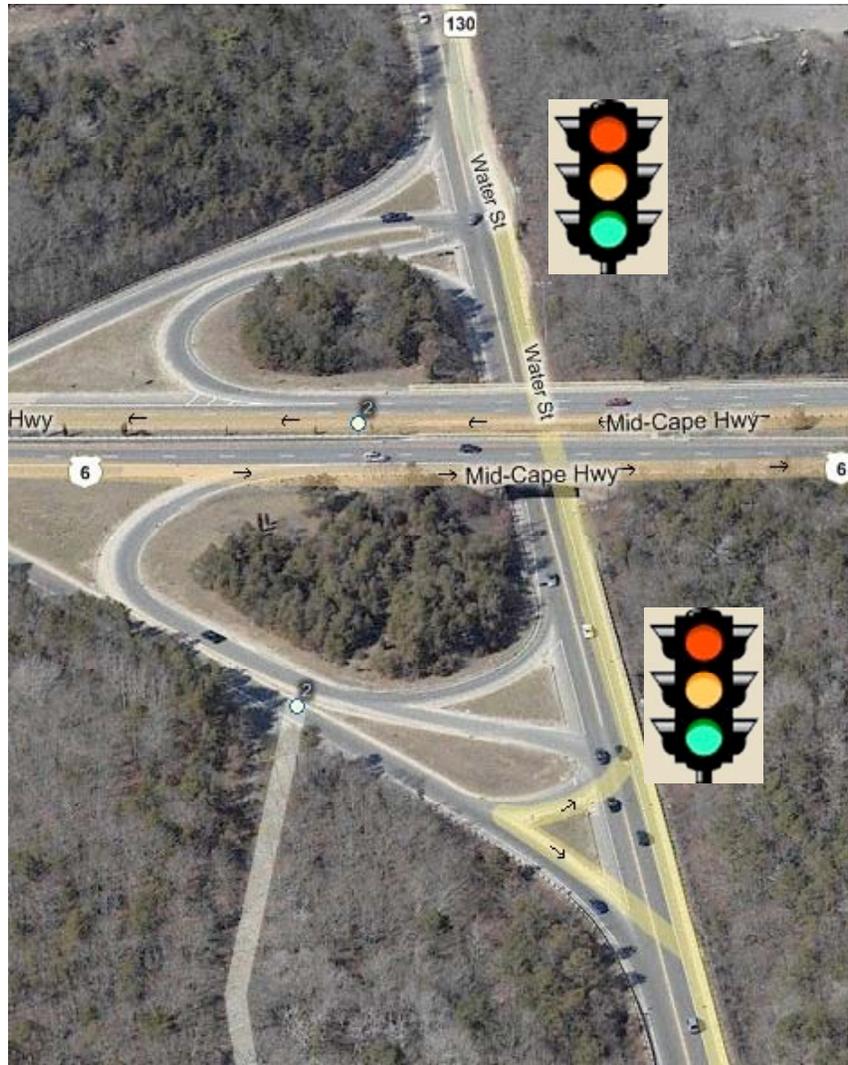
In an attempt to assist the Town of Sandwich to identify safety improvement in the vicinity of the Route 6 highway ramps at Route 130 intersections, Cape Cod Commission transportation staff and the Town of Sandwich DPW Director discussed the following changes along the Route 130 corridor:

- Provide a paved shoulder on east side of Route 130 north of the Route 6 ramps. During peak hours of operation of the Sandwich transfer station, patrons form a queue onto Route 130 blocking the travel lane for motorist and for emergency vehicles. A paved shoulder on Route 130 could be used as temporary storage of vehicle queued up waiting to get into the Sandwich Transfer Station.
- Install “Sharks Teeth” pavement markings at the bottom of the Route 6 highway ramps to inform motorist of the requirement to “Yield” before entering into the traffic stream.
- Install “ladder” signs at the bottom of the highway ramps to inform motorist of destinations within Sandwich.
- Upgrade all pavement marking on the Route 6 highway ramps. Worn stop bars and fog lines need replacement.

#### **Route 6 Highway Ramps at Route 130 - Signalization**

MassHighway is currently in the process of providing roadway improvements including possible signalization of the Route 6 eastbound and westbound highway ramps at Route 130. Cape Cod Commission staff is concerned that left turn lanes on Route 130 will not be long enough due to the limited width of the Route 6 bridge over Route 130. In

addition, within the context of a safety report, Cape Cod Commission staff are finding it hard to recommend traffic signal over modern roundabouts. The next section will explain the benefits of modern roundabouts over traffic signals.



**Figure 15 – Route 6 Highway Ramps at Route 130 - Signalization**

### **Route 6 Highway Ramps at Route 130 - Roundabouts**

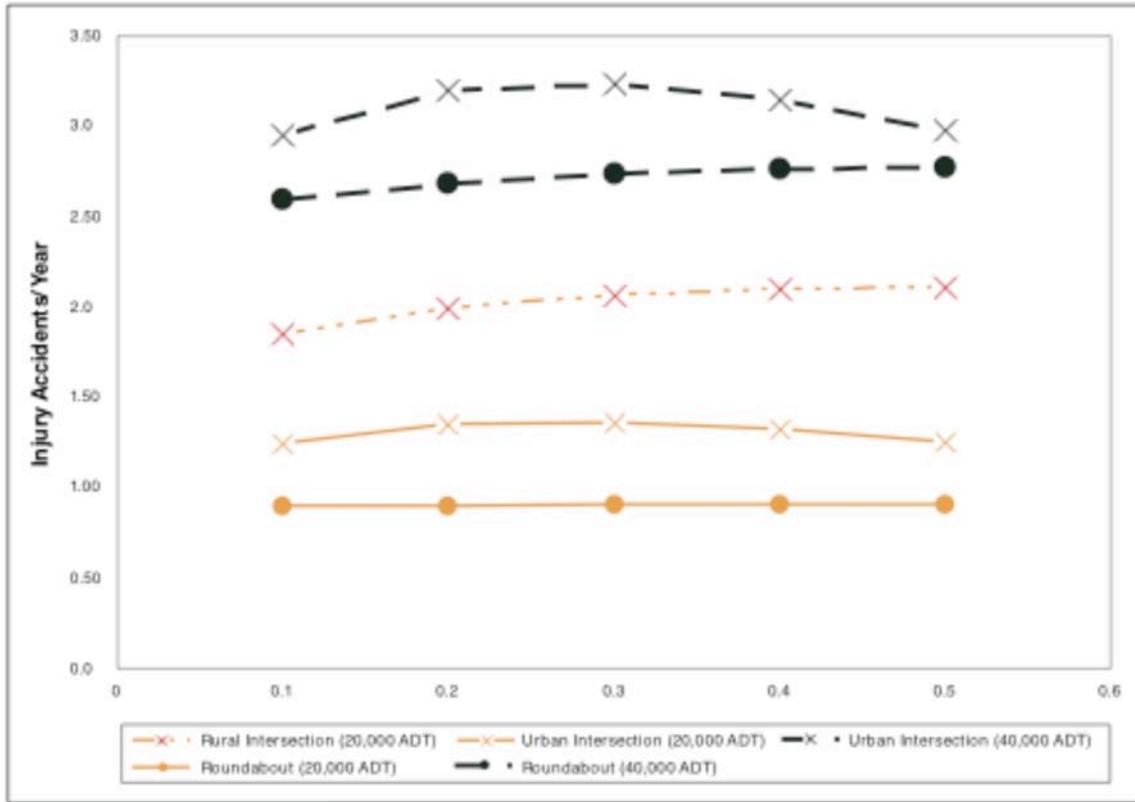
To help quantify the benefits of various safety treatments, several resources were consulted including *The Traffic Safety Toolbox: A Primer on Traffic Safety* (Chapter 28, Institute of Transportation Engineers, 2000) and *Prediction of the Expected Safety*

*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.”

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

*(Source: FHWA)*



**Figure 17 – Roundabout [6/130]**

**Route 6 Highway Ramps at Route 130 – Cloverleaf Interchange**

Cape Cod Commission transportation staff is concerned with the amount of property taking required with the construction of a full cloverleaf interchange at this location. In Addition, Commission staff considers the construction of roundabouts to provide equal safety measures.



**Figure 18 – Full Cloverleaf Interchange [6/130]**

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

Cape Cod Commission staff recommends the Massachusetts Highway Department 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.

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, and other interested stakeholders. The objective of this meeting is to build consensus for the optimal safety improvement at the Route 130/Route 6 intersections.

## 4. Conclusion

A review of traffic safety issues at these locations has resulted in a comprehensive package of improvements. In some cases, improvements have been identified for short term with other, more complex improvements being listed for longer-term implementation.

### 4.1. 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.

#### Route 6/Brackett Road/Old County Road

- Short term: Implement the Town of Eastham, Brackett Road Improvement Project
- Long term: Design and Construct exclusive left turn lanes on Route 6 on both the southbound and northbound lanes.

#### Route 6 Ramps/Route 130

- Short term: Provide a paved shoulder on east side of Route 130; north of the Route 6 ramps.
- Short term; Install “Sharks Teeth” pavement markings at the bottom of the Route 6 highway ramps.
- Short term: Install “ladder” signs at the bottom of the highway ramps.
- Short term: Upgrade all pavement markings on the Route 6 highway ramps.
- Long term: Design and construct modern roundabouts at both the eastbound and westbound Route 6 ramps.

### 4.2. Next Steps

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.