CAPE COD
COMMISSION

Hyannis Access Study
Implementation
Barnstable

June 2013

COUNTY OF BARNSTABLE
MASSACHUSETTS

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Executive Summary

The recommendations of this study include a major redesign of two intersections of Route 28 and several miles of roadway changes within the town of Barnstable to improve access to Cape Cod's major urban center in Hyannis village. The Cape Cod Commission undertook this effort as a part of its Massachusetts Department of Transportation (MassDOT)-sponsored transportation planning process. MassDOT completed the Hyannis Access Study in 2008, leaving several key decisions unmade regarding final recommendations at the Airport Rotary (intersection of Route 28, Route 132, Barnstable Road, and access to the Barnstable Municipal Airport), Yarmouth Road and its intersection with Route 28, and segments of Route 28 adjacent to the Airport Rotary. The figure on the following page provides an overview of the study area.

Goals of this effort include:

- Improve Mobility and Safety for All Users Within the Study Area
- Decrease Impacts to Residential Neighborhoods
- Support Land Use and Cultural interests
- Decrease Impacts to the Natural Environment
- Improve Economic Opportunities
- To Evaluate Project Costs and Impacts
- To Maintain Transportation Choices Within the Study Area

A first step undertaken by the Commission was the Yarmouth Road Corridor Study to identify a preferred alternative for the segment of Yarmouth Road from the end of the four-lane section (called Willow Street) in the town of Yarmouth to the Hyannis street network just south of Route 28. A task force, consisting of local officials, business interests and residents, concluded that a continuation of the four lane section, including a landscaped median divider and bicycle/pedestrian facilities best served the safety and traffic flow needs of the corridor's users. Major land takings are required on the west side of Yarmouth Road as is an expansion of the Yarmouth Road/Route 28 intersection to include additional turning and travel lanes.

After a two-year law-suit imposed hiatus, the *Implementation* effort continued, with the reconvening of a task force, again composed of local officials, business and residential interests. The focal point of this effort is the Airport Rotary and selection of a preferred alternative among the four major concepts brought forward in the Hyannis Access Study:

- Four-way signalized intersection
- Split signalized intersection
- Roundabout with grade separation of Route 28 West to Route 28 East
- Roundabout with grade separation of Route 132 to Route 28 East

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Other major consideration was given to the treatment of Route 28 between the rotary and the Yarmouth Road intersection:

- Two lanes
- Four lanes undivided
- Four lanes with landscaped divider

For traffic flow and safety, only the four-lanes with landscaped divider was brought forward for further consideration. The task force then identified the need for a median

break approximately midway between the rotary and Yarmouth Road and is was decided that Ridgewood Avenue would be most appropriate due to its accessibility to the Cape Cod Regional Transit Authority's transportation center. The intersection treatment at this location included two options:

- Signalization
- Modern roundabout

Fire department personnel noted that a signalized intersection would create undo hazard for fire apparatus that need to reverse direction and that a modern roundabout would serve this need effectively. Therefore the task force selected a modern roundabout for the intersection of Route 28 at Ridgewood Avenue.

The various permutations of the above elements initially resulted in a 16 alternatives, screened to eight alternatives that underwent a detailed evaluation. Evaluations are shown in the fold-out table on the following page.

Other considerations that were the focus of the task force include the proposed "transit-oriented development" of the Cape Cod RTA's property that hosts the Hyannis Transportation Center, the need for an effective stormwater management plan, coordination with a Route 28 improvement project to the west of the Cape Cod Mall, and preferred access to Iyannough Road businesses. As a result of this planning process, the task force has selected the so-called "Concept F" as the preferred alternative and "Concept H" as a secondary alternative,

Concept F, the preferred alternative, includes the following features:

Major Roadway Cross Sections

Yarmouth Road from Willow Street Yarmouth to Route 28 (from east side to west side of road)	**Route 28 from Airport Rotary to Yarmouth Road** (from south side to north side of road)
• 5' sidewalk • 5' shoulder • Two 11' northbound travel lanes • 1' shoulder • 20' landscaped median divider • 1' shoulder • Two 11' southbound travel lanes • 5' shoulder • 10' landscaped buffer • 12' multi-use path	• 10' multi-use path • 8' landscaped area • 4' bike accommodation shoulder • Two 11' eastbound travel lanes • 10' landscaped median divider (8' landscaped, 1' shoulder on each side) • Two 11' westbound travel lanes • 4' bike accommodation shoulder

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Stormwater Management recommendations include:

- Hydrodynamic separators
- Advanced bioretention systems
- Off-line deep sump catch basins
- Infiltration areas
- Dry swales to accommodate bypassed runoff

Other design features include:

- Replacing the Airport Rotary with a roundabout and underpass from Route 28 east to Route 132
- Installing of a roundabout at Route 28/Ridgewood Avenue
- Improving pedestrian and bicyclist accommodations

The estimated cost of the preferred alternative includes the following components:

Roadways	**Cost**
Routes 28 & 132 Construction	$ 7,500,000
Routes 28 & 132 Right-of-Way	$2,200,000
Yarmouth Road Construction	$11,920,000
Yarmouth Road Right-of-Way	$6,570,000
Intersections	
Route 132-28 Grade Separation/Roundabout	$20,000,000
Route 28/Yarmouth Road intersection Upgrade	$2,700,000
Route 28/Ridgewood Avenue roundabout	$1,000,000
Stormwater Management	$800,000
Total	$52,690,000


Typical Route 28 Cross Section (looking west)
Major Design Features
Replace Airport Rotary with a roundabout and Route 28 to Route 132 underpass
Widen Route 28 to four lanes with a median
Install a roundabout at Ridgewood Avenue
Improve pedestrian and bicyclist accommodations
Hyannis Access Study Implementation - Concept F
0 250 500 750 1000
Feet
Date: 1/22/13
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132
Iyannough Road
"AIRPORT PLAZA"
KEEP AND EXPAND
EXISTING LANDSCAPING
AIRPORT GREEN
28
Iyannough Road
LANDSCAPE CONCEPT: AIRPORT ROTARY
*ALL LANDSCAPING SHOULD BE
DROUGHT TOLERANT AND/OR L.I.D.
APPROPRIATE FOR PLANTING IN
ROADSIDE CONDITIONS-

BEFORE: Route 28 East Approach to Airport Rotary

AFTER: Route 28 East Approach to Airport Roundabout

BEFORE: Route 132 Approach to Airport Rotary

AFTER: Route 132 Approach to Airport Roundabout

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Introduction

BACKGROUND – STUDY OBJECTIVES

The need for this report on Hyannis Access Study *Implementation* is springs from a need to refine and define sustainable transportation solutions outlined in the Hyannis Access Study. Finalized in August 2008, the Massachusetts Executive Office of Transportation (now renamed the Massachusetts Department of Transportation) produced a comprehensive assessment with recommendations for access to downtown Hyannis. There remained, however, further work to refine recommendations for Yarmouth Road and selected preferred alternatives for this corridor, the intersection of Yarmouth Road/Route 28, improvements at the Airport Rotary, and segments of Route 28 and Route 132 in the town of Barnstable.

FIGURE 1 - HYANNIS ACCESS STUDY REPORT

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The objectives of Hyannis Access Study *Implementation* include:

- Economic Development
- Support for the Hyannis Growth Incentive Zone
- Improved safety for all users
- Improved bicycle & pedestrian accommodation
- Gateway Access to:
    - Cape Cod Hospital
    - Ferry docks
    - Barnstable Municipal Airport

The over-arching goal of this effort is to achieve a "sustainability triple bottom line" that results in positive social, economic, and environmental outcomes. This means that Livable/Complete Street principles, safe and efficient access, and support for travelers choice of mode are essential ingredients of a preferred solution.

Specifically, the study is intended to support and provide integration of travel by several modes:

- Rail
- Bus
- Cars
- Bicycles
- Pedestrians
- Emergency Responders
- Other transportation providers (air, ferry)

STUDY AREA

The study area, as shown in the following figure, extends along Yarmouth Road from just north of the Barnstable-Yarmouth town line south to Main Street in Hyannis. The western boundary of the study area includes Route 28 from the Cape Cod Mall traffic signal – and continues along Route 28 to the Yarmouth town line as the eastern boundary. The section of Route 132 from the Cape Cod Mall traffic signal to the Airport Rotary is included as is the Rotary itself.

FIGURE 2 - STUDY AREA

POPULATION & EMPLOYMENT

According to the Cape Cod Commission's online statistics service: www.statscapecod.org, Barnstable and Yarmouth have large concentrations of population and employment – serving as Cape Cod's de facto urban center. Some highlights of population, employment, and other demographics are presented in the following table:

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TABLE 1 – 2010 DEMOGRAPHIC INFORMATION

	Barnstable	Yarmouth	Barnstable County
Population Estimate	45,193	23,793	215,769
Households	20,119	11,825	96,775
Housing Units	26,343	17,464	160,281
Labor Force (persons working in the area)	26,075	8,436	120,515
Median Household Income	$62,191	$50,228	$56,167

Source: www.statscapecod.org

PROBLEM IDENTIFICATION/PUBLIC PARTICIPATION PROCESS

The goals, alternatives, and recommendations of this study were developed in concert with a robust public participation process. By engaging with the public, area officials, and many other interested parties from the beginning of this effort, a deeper understanding of problems facing the Yarmouth Road corridor has resulted in a comprehensive assessment of needs and opportunities for improvement.

HYANNIS ACCESS STUDY *IMPLEMENTATION* TASK FORCE

One of the first steps in the development of the study was to reach out to the following stakeholders for input and guidance:

- Public (with targeted efforts to reach residents and business owners)
- Metropolitan Planning Organization (MPO)
- Cape Cod Commission
- Town of Barnstable
- Town of Yarmouth
- Barnstable Airport
- Barnstable and Yarmouth Fire Departments
- Cape Cod and Hyannis Area Chambers of Commerce
- Commonwealth of Massachusetts
    - Massachusetts Department of Transportation (MassDOT)
    - MassDOT Highway Division (formerly Massachusetts Highway Department)

The outreach effort included periodic updates with the Cape Cod Joint Transportation Committee which serves as an advisory board to the MPO.

To further the goals of the study, a diverse and knowledgeable task force was established consisting of the following members:

CAPE COD STATE REPRESENTATIVE OR LEGISLATIVE AIDE

- Senator Dan Wolf, Cape and Islands District
- Sue Rohrbach – District Aide to Senator Dan Wolf
- Senator Therese Murray, Plymouth and Barnstable District
- William Keating, US Rep, 10th Congressional
- Rep. Brian Mannal, 2nd Barnstable District

BARNSTABLE TOWN COUNCIL

- Ann Canedy – Precinct 1
- Debra Dagwan – Precinct 9
- James Tinsley – Precinct 8

TOWN BOARD REPRESENTATIVES (BARNSTABLE)

- Al Baker – DPW Commissioners
- Deb Krau – Hyannis Water Board
- Felicia Penn – Planning Board

TRANSPORTATION ORGANIZATIONS

- Tom Cahir – Cape Cod Regional Transit Authority, Director
- Julie Quintero-Schulz – Cape Cod Regional Transit Authority
- Bud Breault-Barnstable Municipal Airport, Manager
- Wayne Lamson – Steamship Authority, General Manager
- John Pearson – MassCoastal Railroad, General Manager
- Rob Miceli – MassBike
- Chris Anzuoni – P&B Street Railway Company, General Manager

MASSDOT

- Pam Haznar – Massachusetts Department of Transportation (MassDOT) District 5
- Calli Cenizal – Cape Cod Metropolitan Planning Organization (MPO) Liaison
- Tim Kochan – Massachusetts Department of Transportation (MassDOT) District 5

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- John D. Harris – Chair, Cape Cod Commission, Minority Representative
- Jack McCormack, Jr. – Cape Cod Commission Member from Yarmouth
- Royden Richardson – Cape Cod Commission Member from Barnstable

CAPE COD HOSPITAL

- Terry Whittemore – Cape Cod Hospital

RESIDENTIAL COMMUNITY

- Joann Crippen, Barnstable Town Resident

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BUSINESS COMMUNITY

- Jessica Sylver – Hyannis Chamber of Commerce
- Wendy Northcross – Cape Cod Chamber of Commerce
- Leo Fein - Cape Cod Mall
- Kevin Gralton – KAM
- Taki Pantazopoulos – JPA Corp– Staples Plaza
- Jim Roberts – Nantucket Sound
- Gregory Botsivales – Botsini Prime LLC (Wendy's)
- Steve Hubbard – Hubbard Paint & Supply
- Ed Lambert – Commercial Realty Advisors (Botsini Prime alternate)

BARNSTABLE TOWN STAFF

- Mark Ells – Assistant Town Manager
- Roger Parsons – Senior Project Manager
- Jo Anne Miller Buntich – Director of Growth Management Department (GMD)
- Mike Trovato – GMD, Economic Development Specialist
- Steve Seymour – GMD, Senior Engineer
- Pending – DPW Director
- Pending – Barnstable Police Department
- Bud Breault – Barnstable Municipal Airport and K-Mart Plaza

HYANNIS FIRE DEPARTMENT

- Deputy Chief Dean Melanson – Hyannis Fire Department

YARMOUTH TOWN STAFF

- George Allaire – Town of Yarmouth DPW Director

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- Paul Niedzwiecki – Executive Director
- Patty Daley – Cape Cod Commission, Deputy Director
- Glenn Cannon – Cape Cod Commission, Technical Services Director
- Priscilla Leclerc – Cape Cod Commission, Senior Transportation Planner
- Lev Malakhoff – Cape Cod Commission, Transportation Engineer
- Steven Tupper – Cape Cod Commission, Technical Services Planner
- Taree McIntyre – Cape Cod Commission, Admin Assistant
- Leslie Richardson – Cape Cod Commission, Chief Economic Development Officer
- Nancy Hossfeld – Communications Coordinator

Membership includes representatives from many levels of government, business interests, transportation providers, local residents and other stakeholders. The Task Force met on the following dates at the Cape Cod Commission office:

- May 13, 2010
- July 8, 2010
- September 2, 2010
- September 16, 2010
- April 12, 2012

- November 27, 2012
- January 23, 2013

Task Force meetings were open to the public. In addition, Cape Cod Commission staff reached out and met with various stakeholders throughout the development of the study. The following is a listing of the meetings that took place.

- Public Meeting @ Barnstable Town Hall – June 30, 2010
- Public Meeting @ Barnstable Town Hall – June 20, 2012
- Public Meeting @ Hyannis Transportation Center – July 31, 2012
- Route 28 (west) business community @ Hubbard Paint Supply – July 24, 2012
- Barnstable Municipal Airport – October 4, 2012
- Barnstable Growth Management Department – October 31, 2012
- Hyannis Area Chamber of Commerce – November 30, 2012

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“No Build” Conditions

To form a foundation for developing and evaluating alternatives, data and analyses of traffic flow and safety conditions were collected and prepared.

BASE YEAR TRAFFIC VOLUMES

A basic unit of information considered in almost any traffic study is traffic flow at a study area location. Depending on the type of facility one of two collection methods was used:

For roadway segments, Cape Cod Commission (CCC) staff installed Automatic Traffic Recorders (ATRs) – usually for a period of 48 hours. ATR equipment consists of a pair of pneumatic tubes stretched across a roadway – connected to the ATR (a computerized recording device that senses the air pulses generated in the tubes from vehicles passing over them).

To record traffic data at an intersection, CCC staff perform Turning Movement Counts (TMCs). By observing the number of vehicles (cars, heavy vehicles, and bicycles) making each individual movement (left turn, straight, right turn) at each approach to the intersection (northbound approach, eastbound, etc.) – these movements are entered in real time on a computerized counting board. The number of pedestrians arriving at the intersection are also recorded.

The Hyannis Access Study used traffic volumes collected by the CCC and MassDOT to prepare the traffic flow diagrams shown in the following figures.

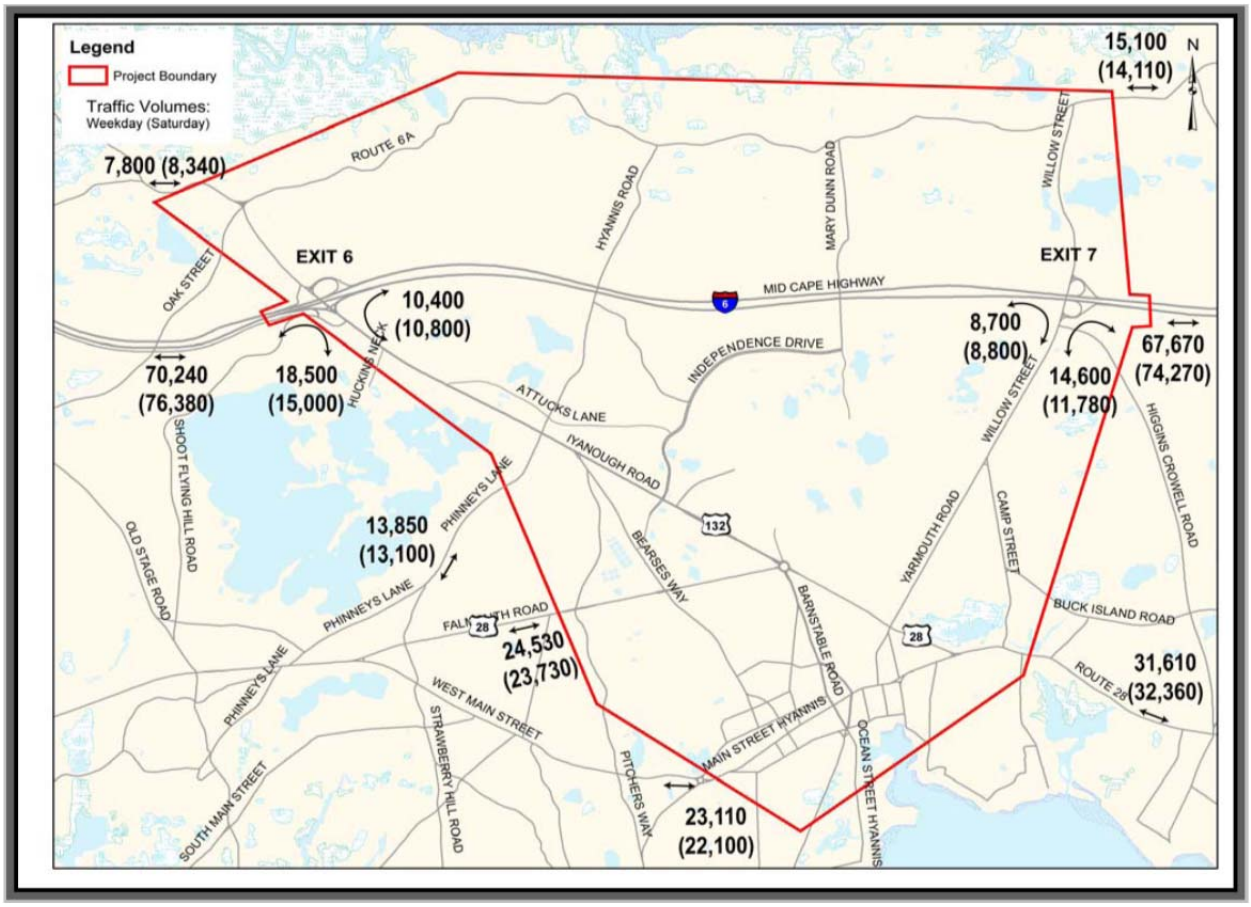


FIGURE 3 - STUDY AREA BASE YEAR TRAFFIC VOLUMES

Source: Hyannis Access Study

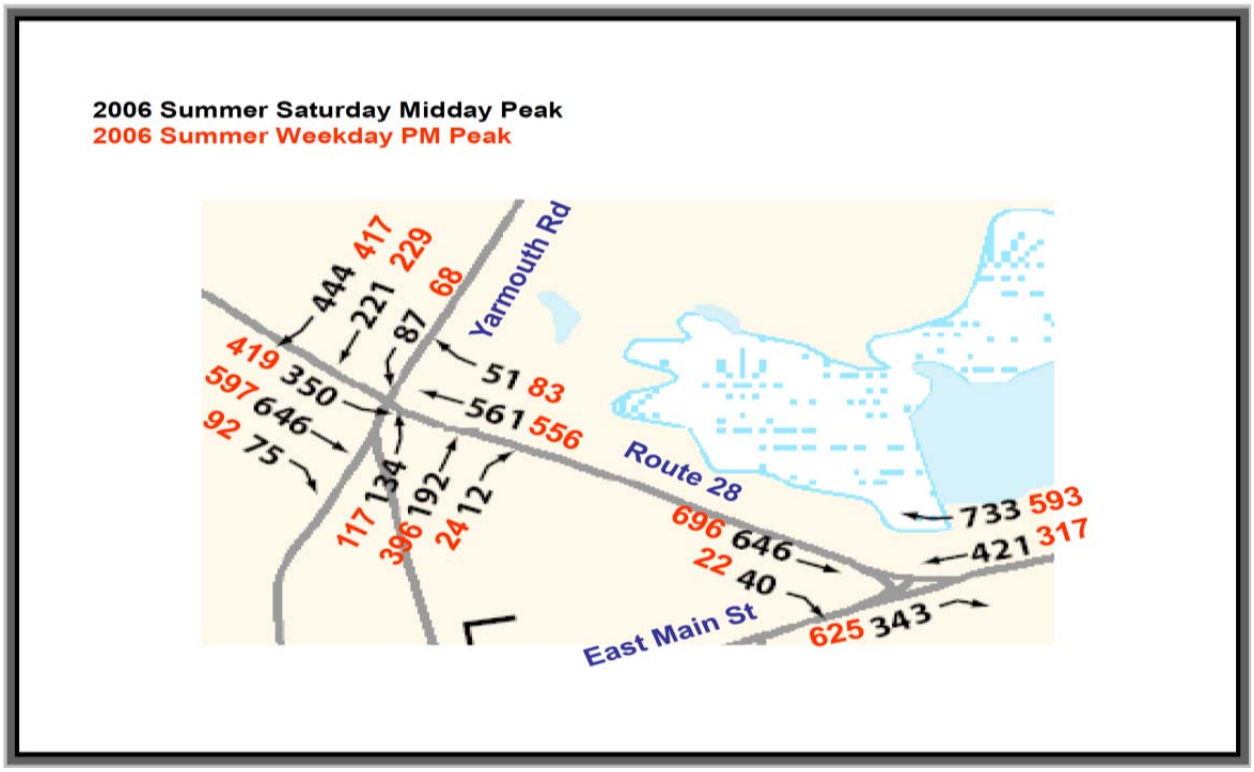


FIGURE 4 – BASE YEAR TRAFFIC VOLUMES ON RT 28 FROM YARMOUTH RD TO E. MAIN ST

Source: Hyannis Access Study

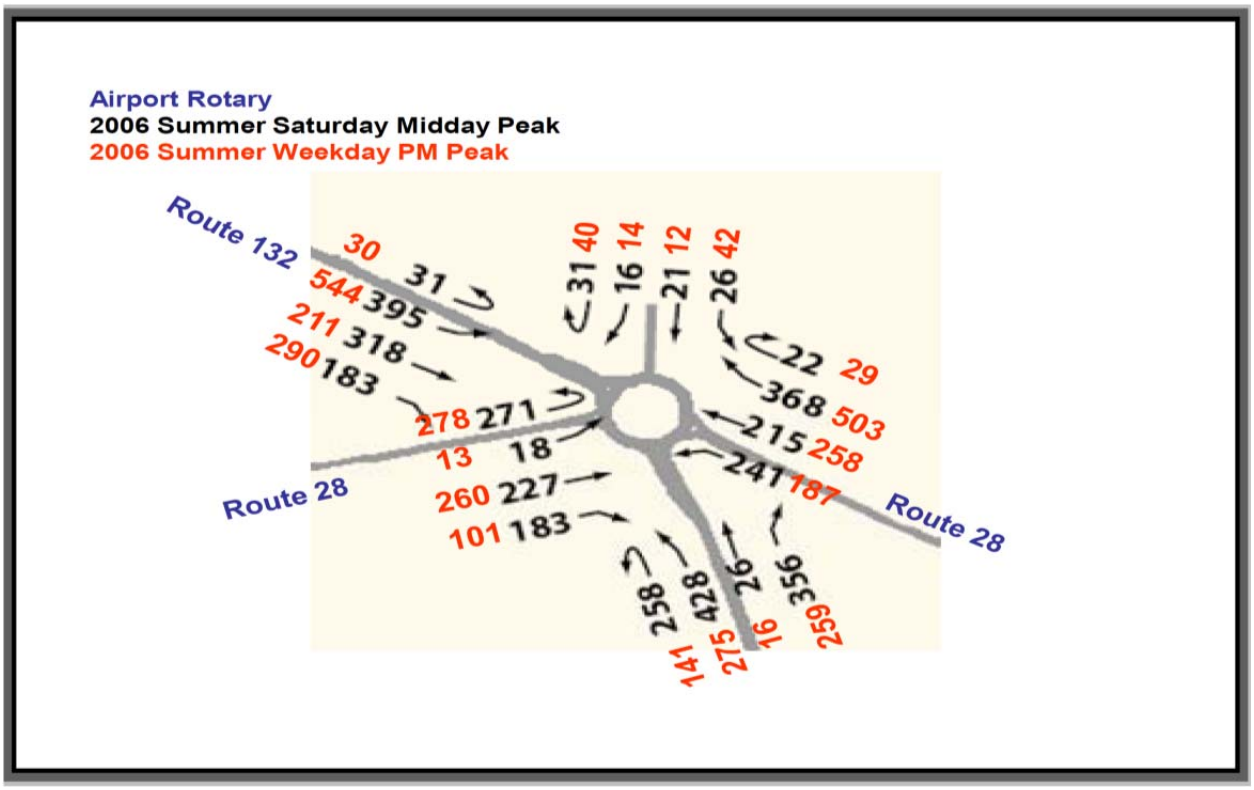


FIGURE 5 – BASE YEAR TRAFFIC VOLUMES AT AIRPORT ROTARY

Source: Hyannis Access Study

FUTURE YEAR TRAFFIC VOLUMES

For the future analysis year of 2030, traffic flows were estimated in the Hyannis Access Study using travel demand forecasting techniques. These traffic flows are presented in the following figures.

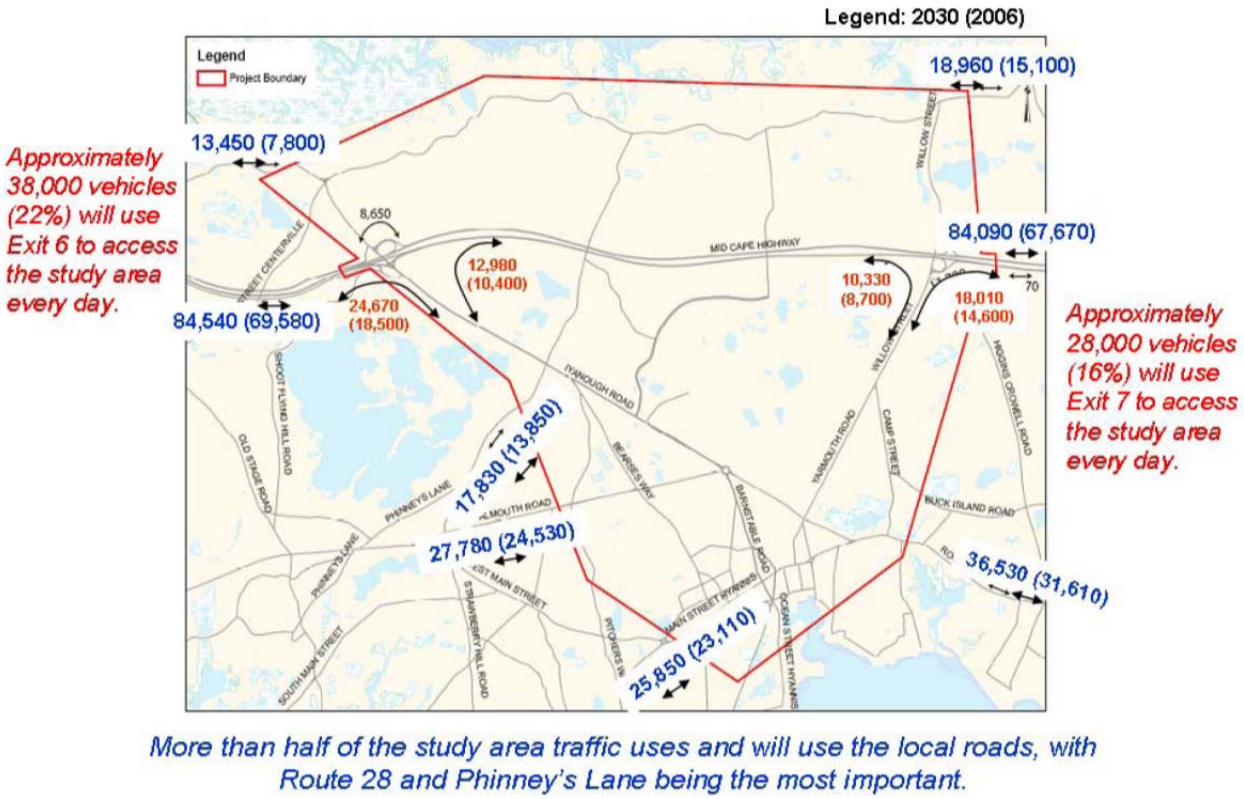


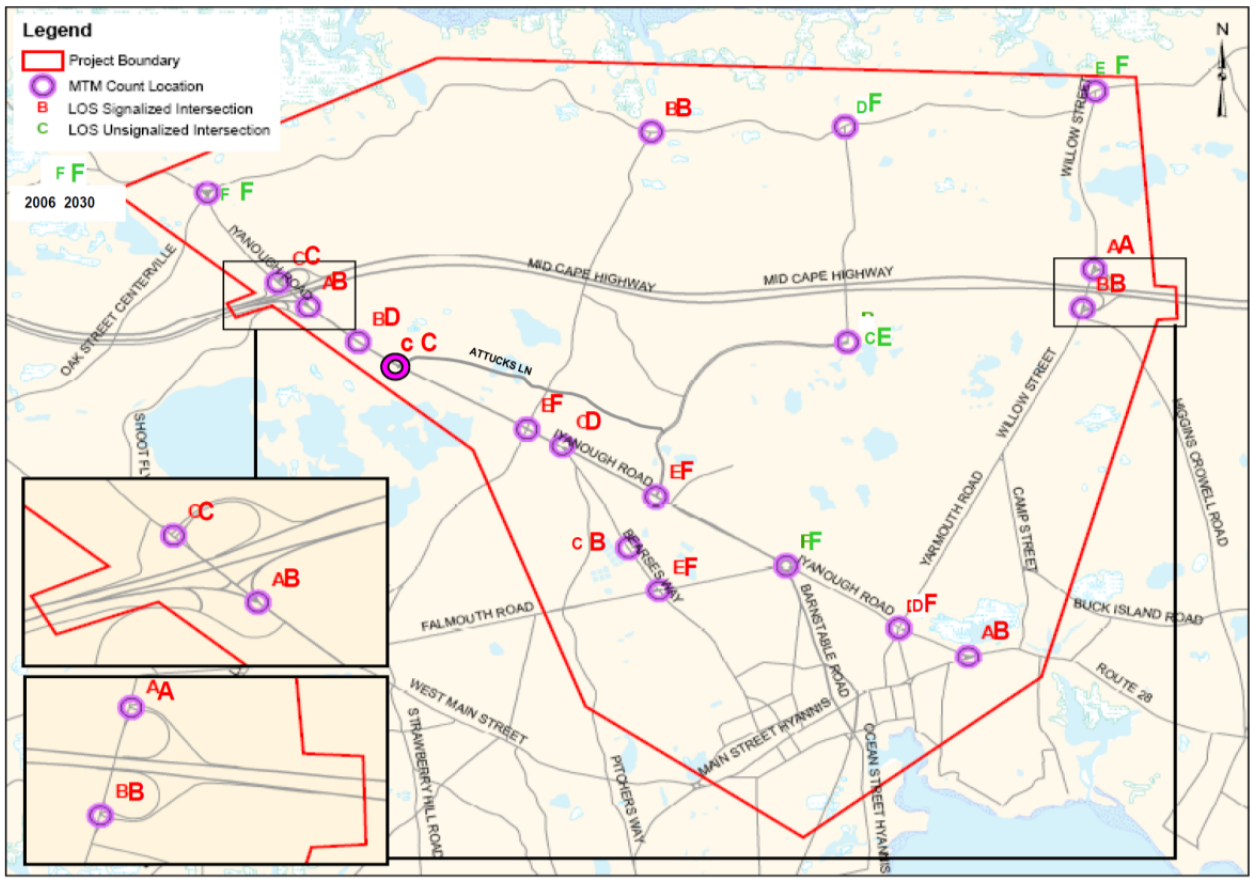
FIGURE 6 - STUDY AREA FUTURE YEAR TRAFFIC VOLUMES

Source: Hyannis Access Study

LEVEL OF SERVICE ANALYSIS

Using the ATR and TMC traffic volumes collected by the Cape Cod Commission, standard techniques published in the *Highway Capacity Manual* ("HCM", Transportation Research Board, Washington D.C.) were applied to calculate Levels of Service (LOS). LOS is an intersection's "report card" with possible grades ranging from LOS A to LOS F. LOS A corresponds to unimpeded travel with minimal delay while LOS F represents very high delays and possible gridlock. Inputs into HCM software include traffic volumes and associated intersection geometry such as number and type of approach lanes, signal timing schemes, and other factors affecting traffic operations.

Levels of Service for various study area intersections for both the base year (2006) and the future scenario year (2030) are presented in the tables below:



Source: Hyannis Access Study

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SAFETY DATA: CRASH HISTORY

Crash records from the Barnstable and Yarmouth Police Departments and the Massachusetts Registry of Motor Vehicles (provided by MassDOT) were reviewed to identify crash locations. These data are provided in the following figures.

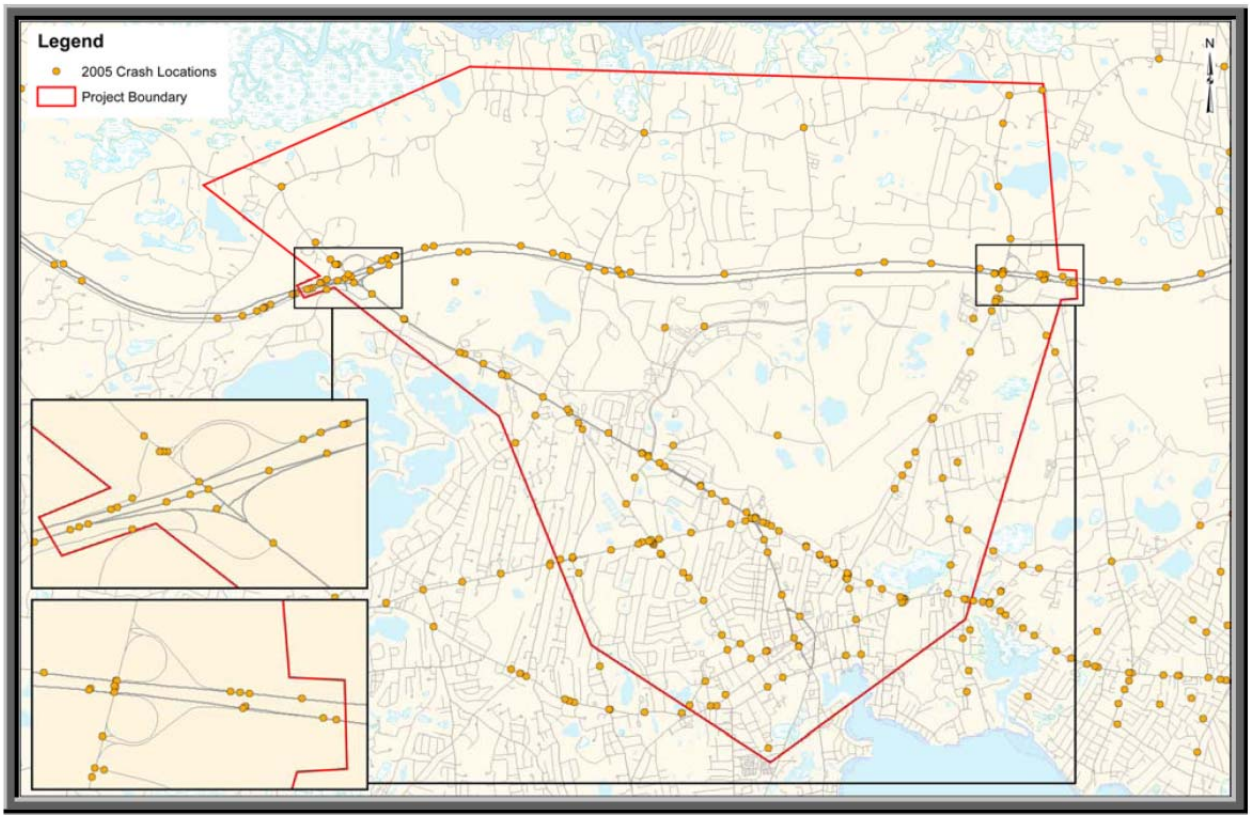


FIGURE 7 - CRASH LOCATIONS

Source: Hyannis Access Study

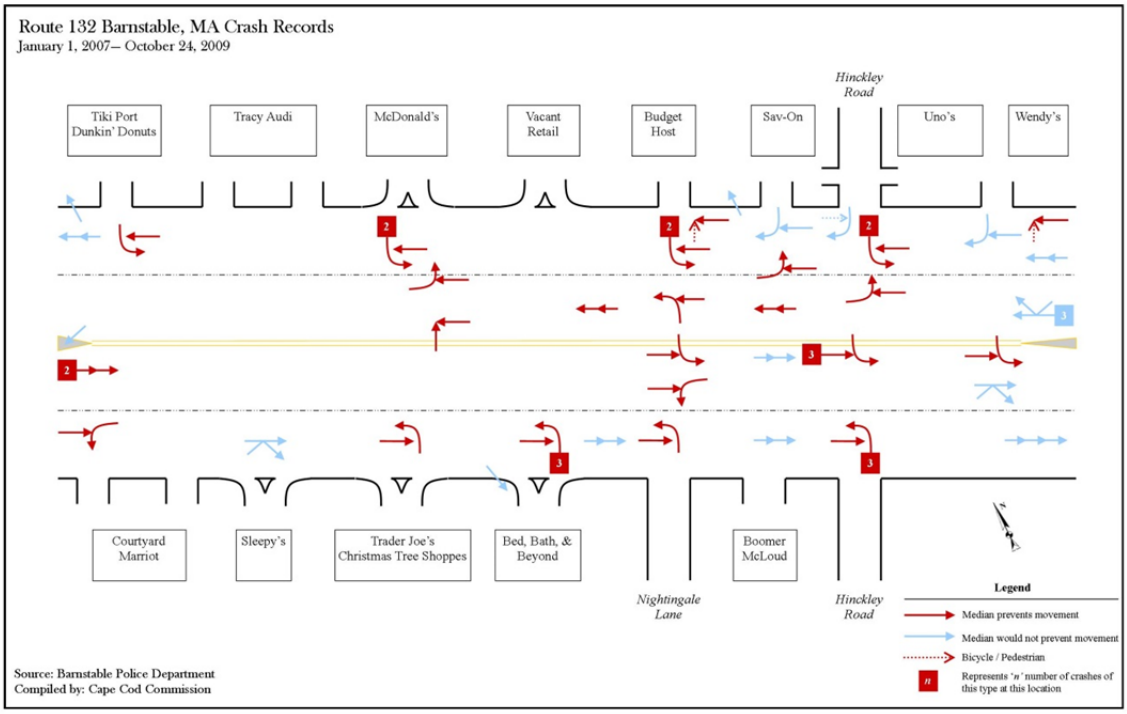
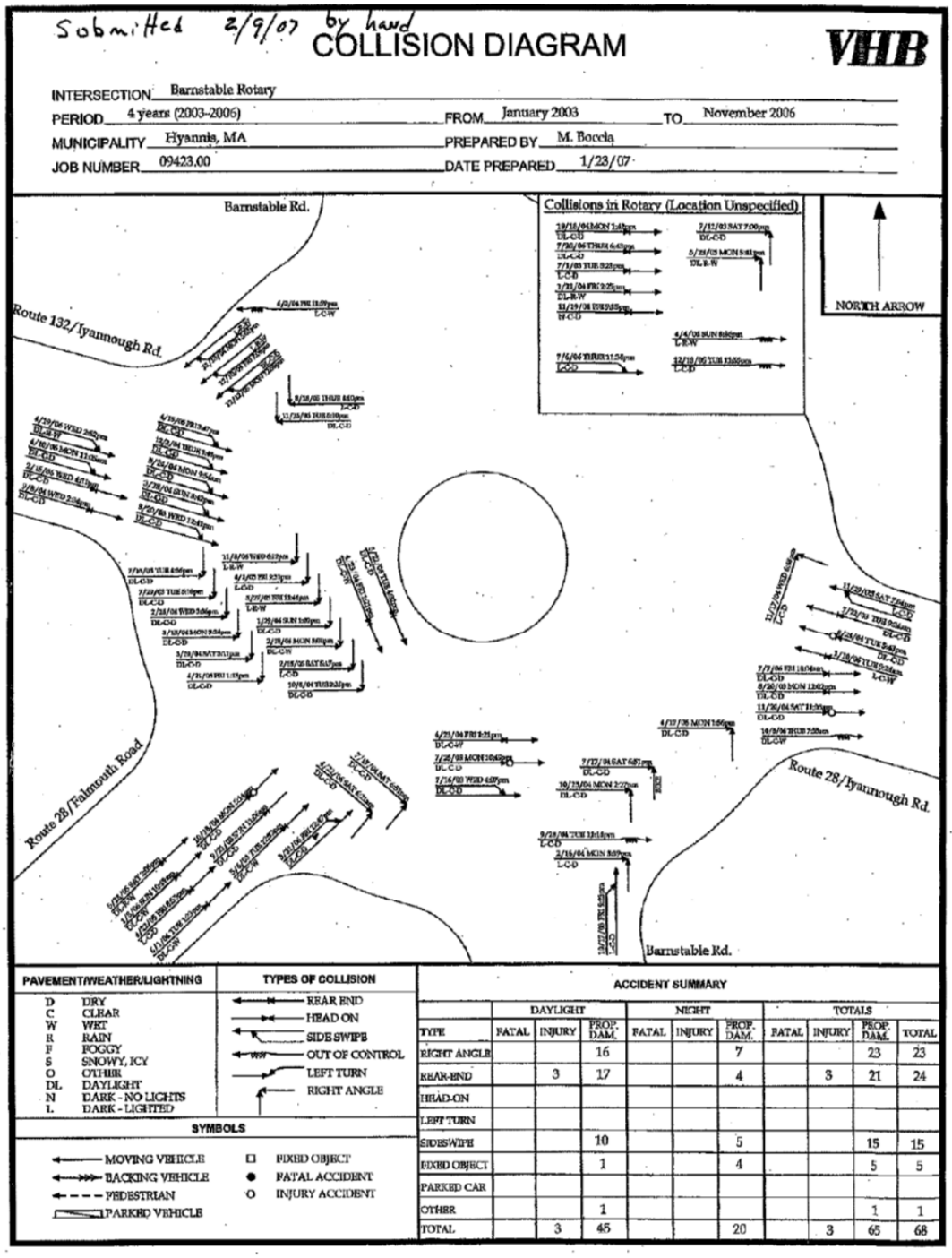


FIGURE 8 - ROUTE 132 CRASH DIAGRAM



	DAYLIGHT			NIGHT			TOTALS			
TYPE	FATAL	INJURY	PROP. DAM.	FATAL	INJURY	PROP. DAM.	FATAL	INJURY	PROP. DAM.	TOTAL
RIGHT ANGLE			16			7			23	23
REAR-END		3	17			4		3	21	24
HEAD-ON										
LEFT TURN										
SIDESWIPE			10			5			15	15
FIXED OBJECT			1			4			5	5
PARKED CAR										
OTHER			1						1	1
TOTAL		3	45			20		3	65	68

FIGURE 9 - AIRPORT ROTARY CRASH DIAGRAM

PAVEMENT CROSS SECTION: ROUTE 28 TO YARMOUTH ROAD

Although varying near intersections the road generally has a single 14' travel lane in each direction and approximately 6' shoulders on both sides.

The shoulders widths are often not clearly defined as they transition into paved parking areas with expansive curb cuts.

Approaching the intersection with Yarmouth Road the Westbound travel lanes expands to approximately 21 feet and functions as two lanes for a short distance. Eastbound turns into the travel lanes; one for left turning vehicles (approximately twelve feet), one for thru vehicles (approximately eleven feet), and one for thru and right turning vehicles (approximately eleven feet). The shoulders become narrower approaching the intersection.

The following pages detail the cross section at three points along the corridor as identified below.

FIGURE 10 - PAVEMENT CROSS-SECTION SAMPLE SITES

Location 1 (West of AutoZone):

- Measured at “plaza sign”
- North sloping paved berm 2’
- North shoulder 5’ from fog line to start of sloping berm
- WB lane 14’
- EB lane 14’
- South shoulder 7’ from fog line to start of parking lot (pavement change)

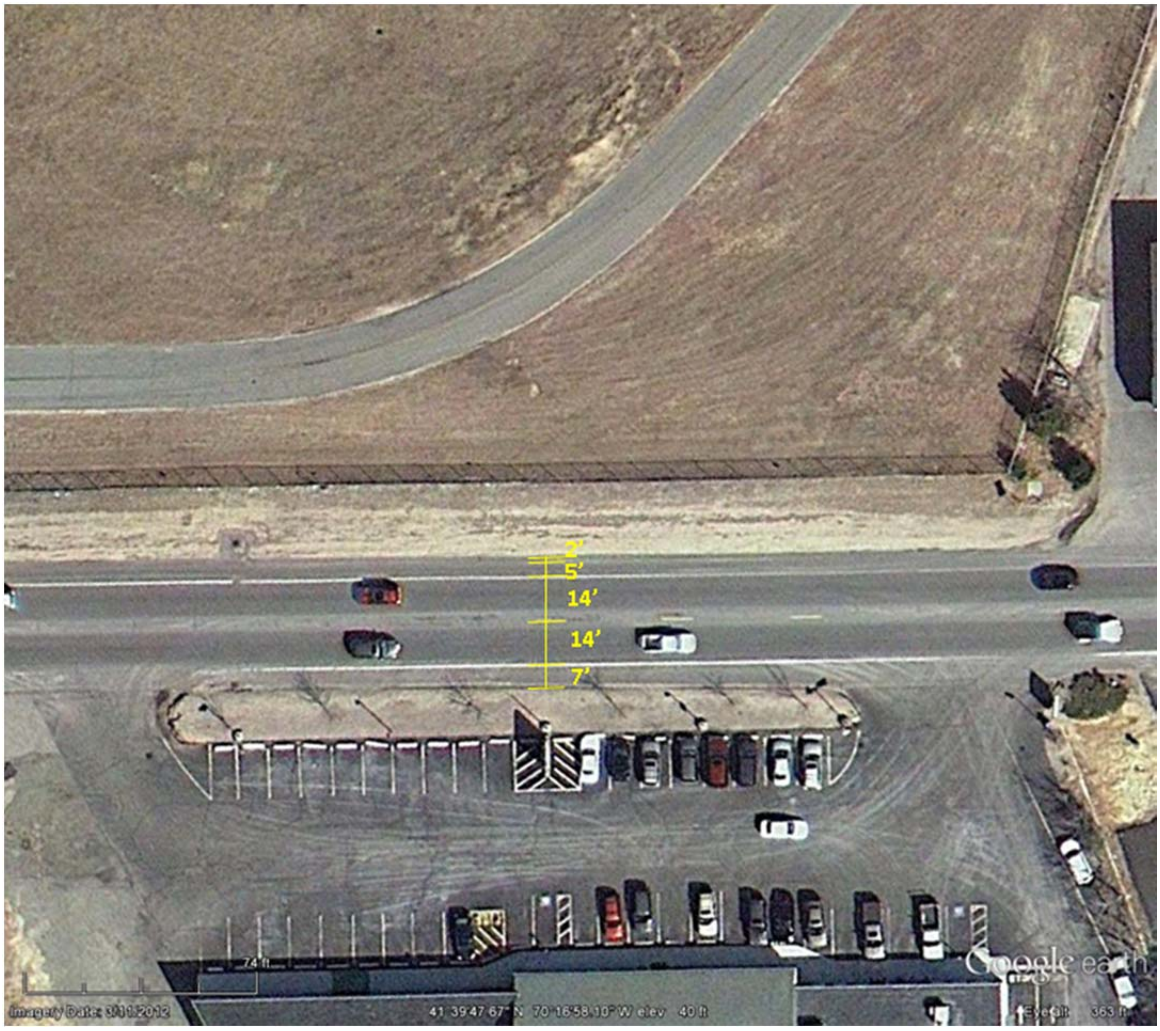


FIGURE 11 - RT 28 PAVEMENT WIDTH (WEST OF AUTOZONE)

Location 2 (East of AutoZone):

- Measured at "for sale sign at new building"
- North shoulder 6' from fog line to start of parking lot (pavement change)
- WB lane 14'
- EB lane 14'
- South shoulder 6' from fog line to start of parking lot (pavement change)

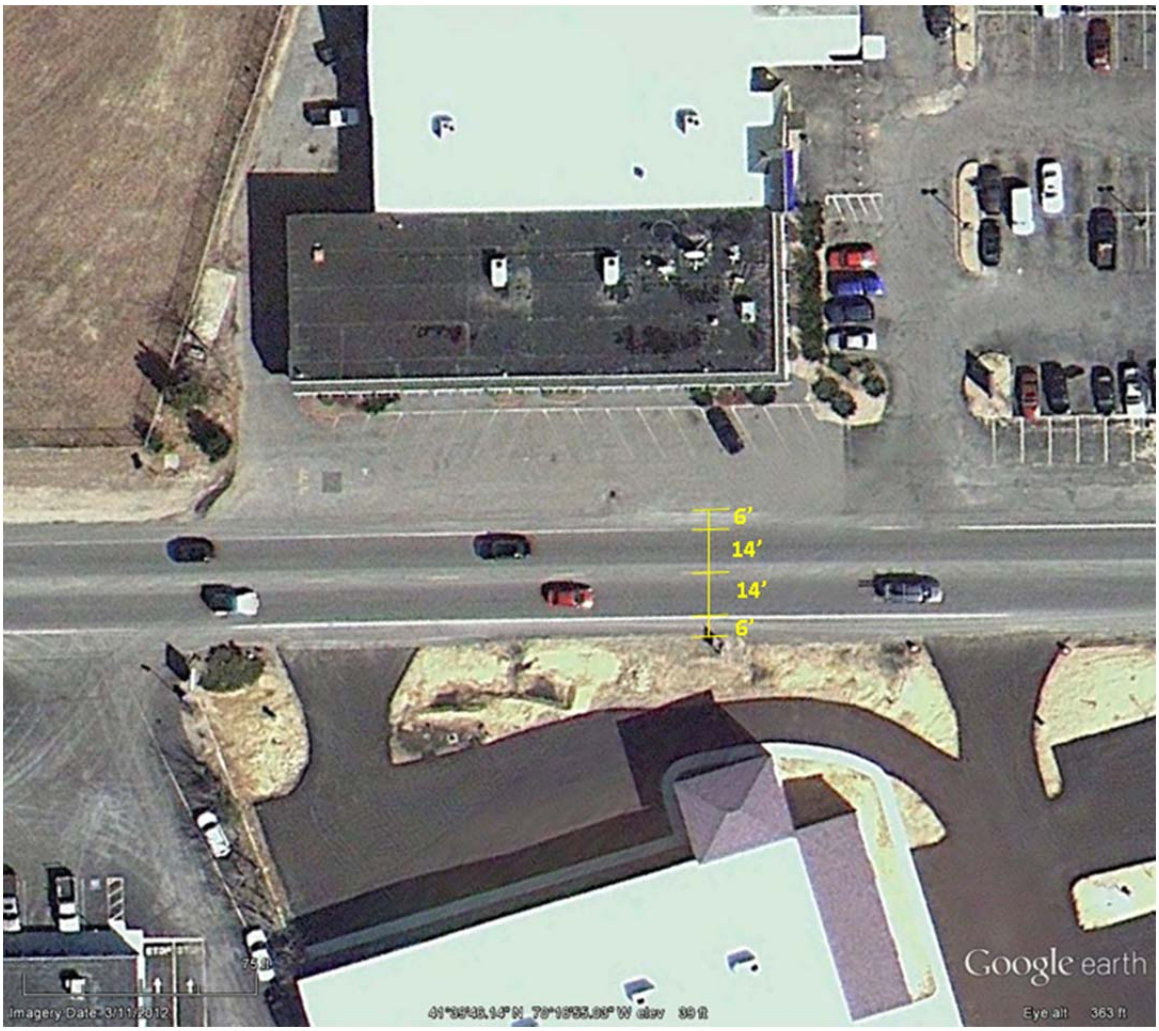


FIGURE 12 - RT 28 PAVEMENT WIDTH (EAST OF AUTOZONE)

Location 3 (West of Railroad Tracks):

- Measured at "North 28 Sign"
- North shoulder 4' from fog line to granite curb
- WB lane 21'
- EB LT lane 12'
- EB Thru lanes 11' each
- South shoulder ~2' from fog line to start of parking lot (pavement change)

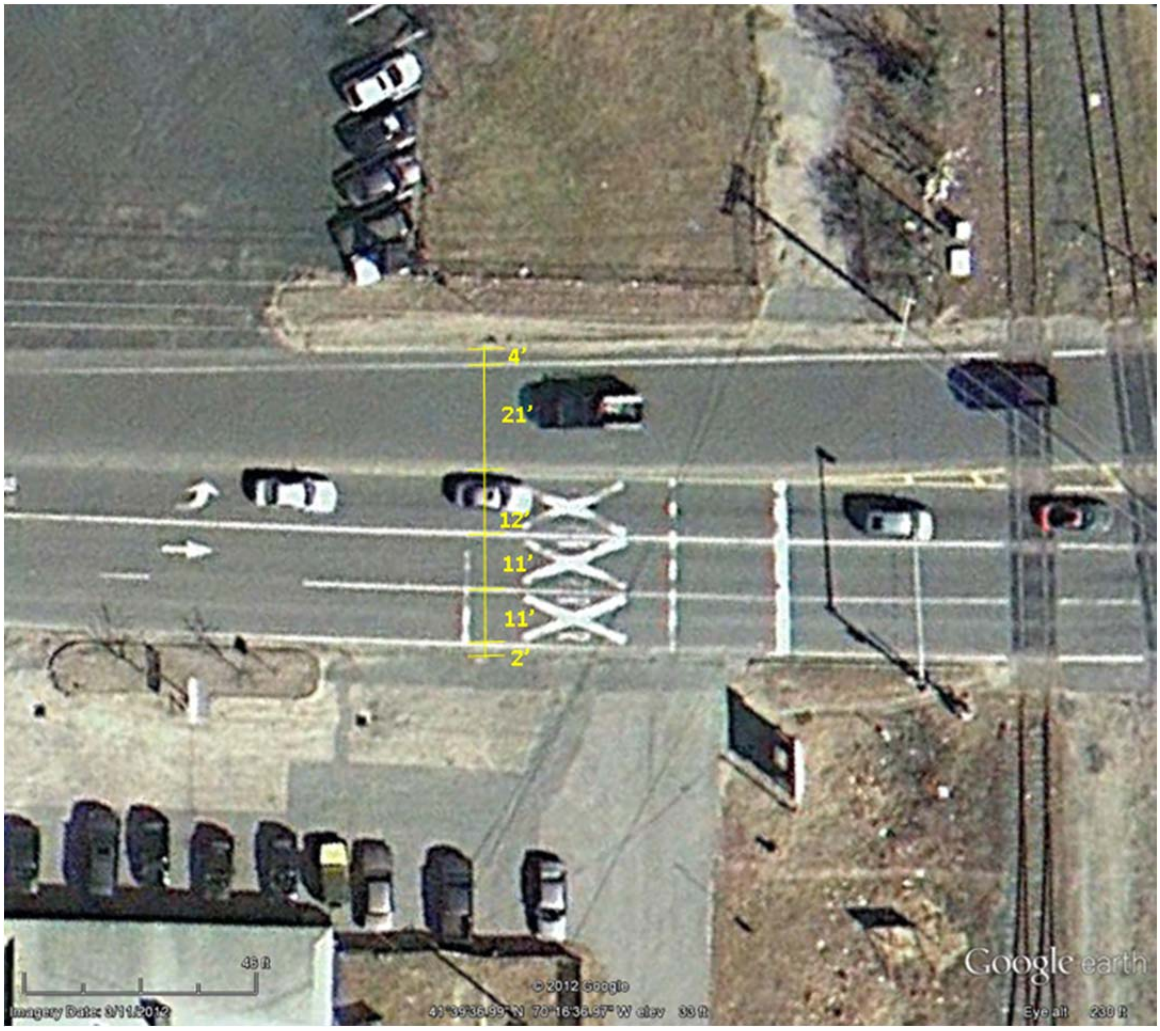


FIGURE 13 - RT 28 PAVEMENT WIDTH (WEST OF RAILROAD TRACKS)

Development of Alternatives

As the initial phase of the Hyannis Access Study *Implementation* effort, the Cape Cod Commission facilitated an examination of the section of Yarmouth Road from the Barnstable/Yarmouth town line to Camp Street in Hyannis, including the Route 28 intersection. This effort included the establishment of a task force, and resulted in the selection of a preferred alternative, discussed below.

The Hyannis Access Study included four major alternatives to replace the airport rotary. This location and the remaining intersections and roadways of the study area were the focus of the current effort.

YARMOUTH ROAD CORRIDOR STUDY – PREFERRED ALTERNATIVE

In 2010, the Yarmouth Road Corridor Study Task Force voted to support "Concept 1a" (see figure on following page). Concept 1a is a continuation of the four-lane divided Willow Street roadway that currently exists near Route 6 Interchange 7. Concept 1a continues that four-lane divided roadway from the Higgins Crowell Street/Willow Street intersection in Yarmouth to the Route 28/Yarmouth Road intersection in Barnstable. Concept 1a uses a westerly alignment at the Route 28/Yarmouth Road intersection

The recommended cross section (see following figure) includes the following features (listed starting from the east side of the roadway to the west side):

- 5' sidewalk
- 5' shoulder
- Two 11' northbound travel lanes
- 1' shoulder
- 20' landscaped median divider
- 1' shoulder
- Two 11' southbound travel lanes
- 5' shoulder
- 10' landscaped buffer
- 12' multi-use path

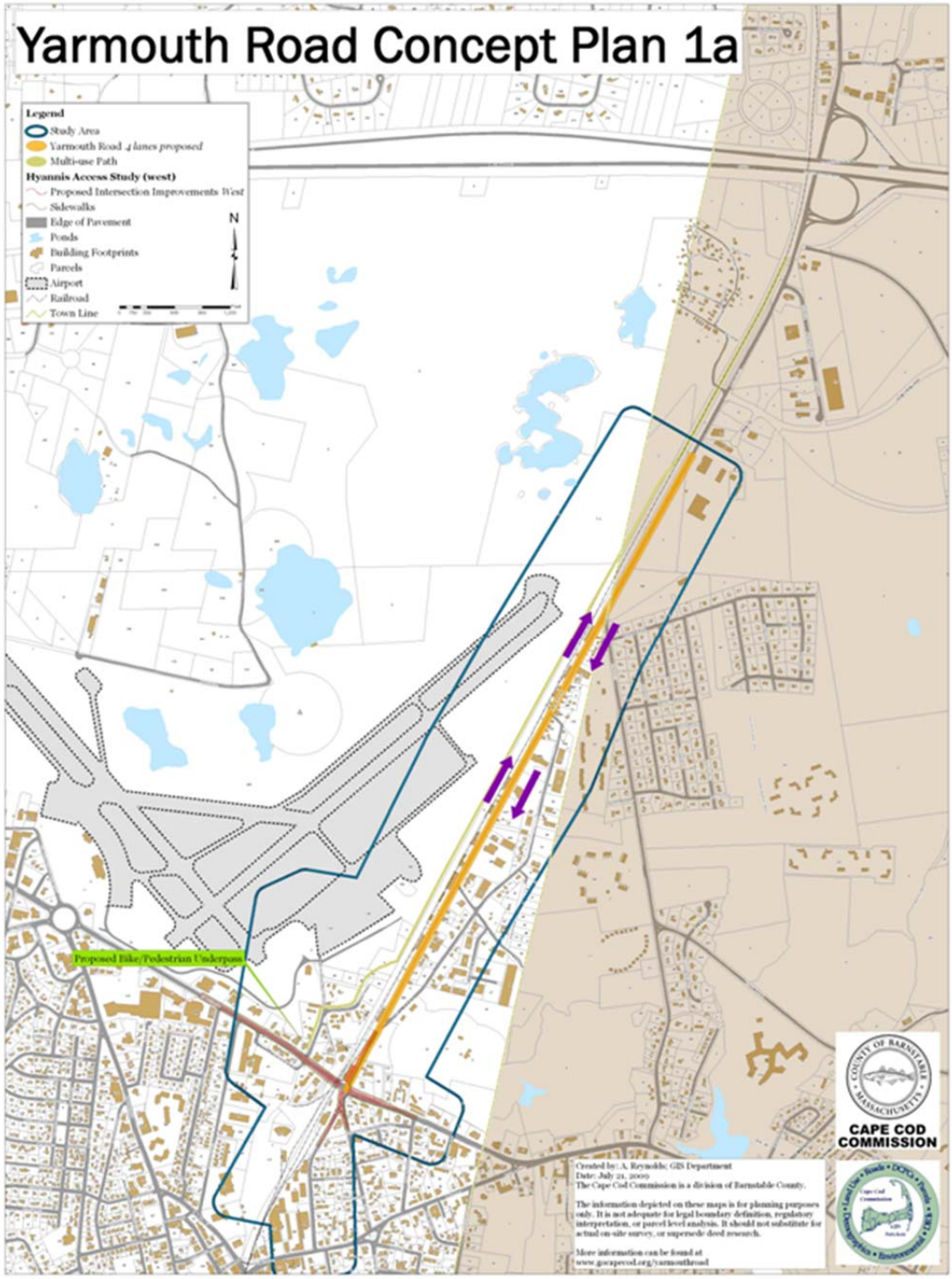


FIGURE 14 - YARMOUTH ROAD CORRIDOR STUDY - PREFERRED CONCEPT

FIGURE 15 - YARMOUTH ROAD CORRIDOR STUDY PREFERRED ALTERNATIVE CROSS SECTION

The Hyannis Access Study included two alignments for expansion of the Route 28/Yarmouth Road intersection. The Yarmouth Road Corridor Study Task Force selected the westerly alignment for this intersection (see figure below).

FIGURE 16 - YARMOUTH ROAD CORRIDOR STUDY - PREFERRED CONFIGURATION OF RT 28/ YARMOUTH RD INTERSECTION

Construction of the Alternative 1a cross section requires the relocation of businesses on the west side of the roadway as shown on the figure on the following page.

FIGURE 17 - YARMOUTH ROAD CORRIDOR STUDY - LAND TAKINGS

The Yarmouth Road Corridor Study final report is available on the Cape Cod Commission website at: www.capecodcommission.org/resources/transportation/Yarmouth_Road_2012_report_12272012.pdf

INITIAL SCREENING – 16 CONCEPTS

Through the public process and with input from the Task Force, 16 alternatives were initially developed and screened. These alternatives are identified by numbers 1-16. Eight of these alternatives (listed in red in the table below) were eliminated by the Task Force because of safety and traffic flow concerns.

TABLE 2 - INITIAL 16 CONCEPTS

1. Signalize Rotary, No Rt 28 Widening	9. Grade Separation (Rt 132-Rt 28), No Rt 28 Widening
2. Signalize Rotary, Rt 28 Widening, No Median	10. Grade Separation (Rt 132-Rt28), Rt 28 Widening, No Median
3. Signalize Rotary, Rt 28 Widening w/Median & Signals	11. Grade Separation (Rt 132-Rt28), Rt 28 Widening w/Median & Signals
4. Signalize Rotary, Rt 28 Widening w/Median & Roundabouts	12. Grade Separation (Rt 132-Rt28), Rt 28 Widening w/Median & Roundabouts
5. Dual Signals, No Rt 28 Widening	13. Grade Separation (Rt 28-Rt28), No Rt 28 Widening
6. Dual Signals, Rt 28 Widening, No Median	14. Grade Separation (Rt 28-Rt 28), Rt 28 Widening, No Median
7. Dual Signals, Rt 28 Widening w/Median & Signals	15. Grade Separation (Rt 28-Rt 28), Rt 28 Widening w/Median & Signals
8. Dual Signals, Rt 28 Widening w/Median & Roundabouts	16. Grade Separation (Rt 28-Rt 28) Rt 28 Widening w/Median & Roundabouts

The eight remaining alternatives (listed in green in the table above) were re-designated as Concepts A-H and are shown in the following figures and described in the following sections.

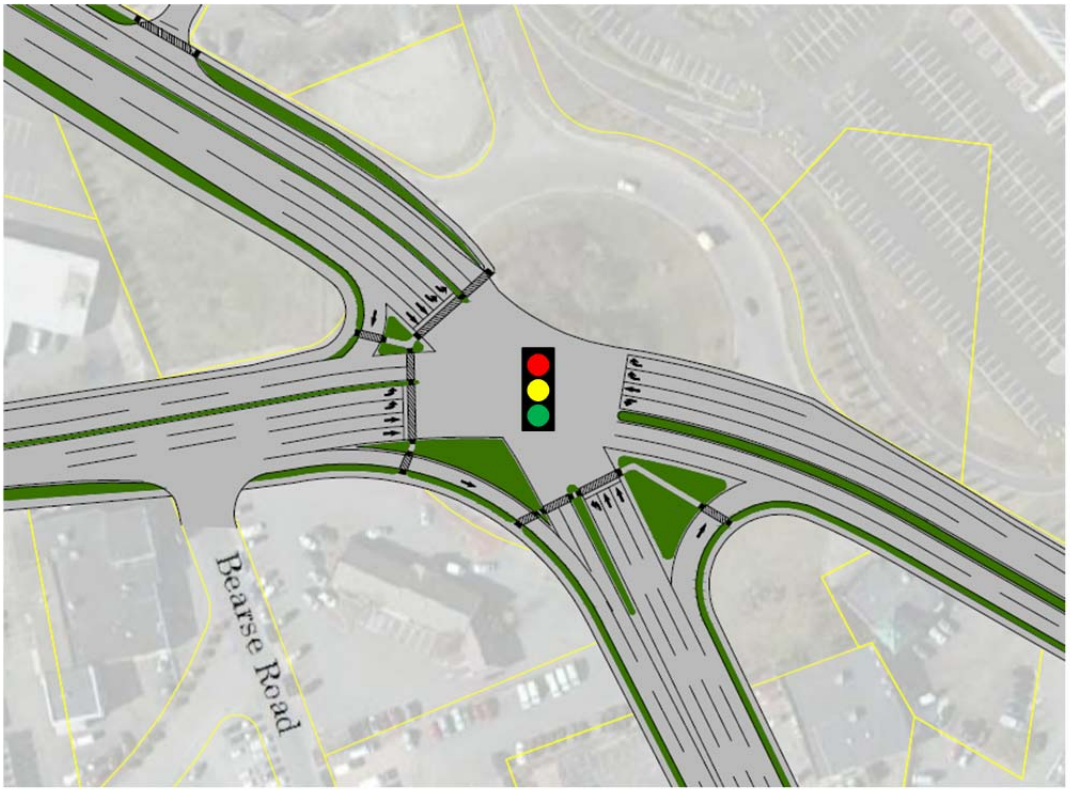


FIGURE 18 - CONCEPTS A, B 4-WAY SIGNAL DETAIL

Concepts A & B – Four-leg Signalization - Key Features

- Signalized intersection
- Roadways realigned as 4 leg intersection
- Rotary is eliminated
- Widened approaches to accommodate additional through and turning lanes
- Large intersection with numerous turning and through lanes
- A straightforward alternative
- Easier for bikes/pedestrians to navigate

FIGURE 19 - CONCEPTS C, D SPLIT SIGNALIZATION

Concepts C, D – Split Signalization -Key Features

- Roadways realigned as two offset intersections
- Route 28 is the through movement
- Barnstable Road and Route 132 offset from each other (~450')
- 2 coordinated signals
- 5 westbound lanes along Route 28 approaching from east
- CHANGES from Hyannis Access Study:
    - Barnstable Rd. intersection shifted east
    - Two southbound lanes from Route 132 to Barnstable Rd.

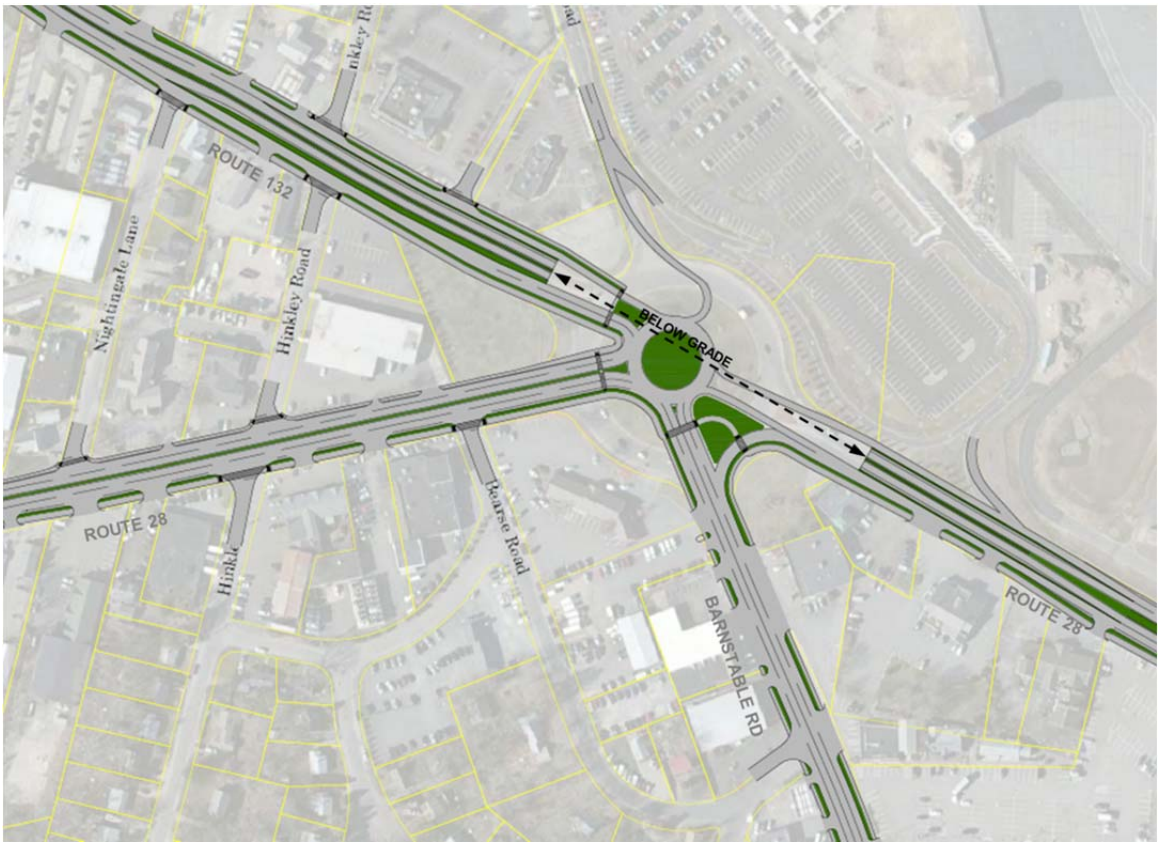


FIGURE 20 - CONCEPTS E,F - RT 132-RT28 UNDERPASS

Concepts E,F – Route 132-Route 28 Underpass Key Features

- Underpass section begins from just south of Nightingale to Staples/TJ Maxx shopping center entrance
- Very long underpass structure needed (~600' long tunnel)
- Will need to contend with possible drainage and groundwater issues
- Interrupts flow of through traffic on Rte. 28
- Requires 2 exiting lanes on Barnstable Road and Route 132
- Significantly increases future maintenance requirements and costs

FIGURE 21 - CONCEPTS G,H - RT 28-RT 28 UNDERPASS

Concepts G, H – Route 28-Route 28 Underpass - Key Features

- Free-flow through movement for 28→ 28 traffic
- Underpass section starts just west of Hinckley Lane and at Staples/TJ Maxx Parking Lot
- Potentially provides positive impacts on Main Street
- Bypass in keeping with regional connectivity on state route
- Requires less abutter impacts than signalized intersection
- Difficult construction sequencing and impacts
- 2 lane underpass needed
- Will need to contend with possible drainage and groundwater issues
- Significantly increases future maintenance requirements and costs

FIGURE 22 - RT 28/RIDGEWOOD AVENUE ALTERNATIVES

The distinguishing difference between the pairs of alternatives in the figures on the previous pages is the intersection treatment at Route 28/Ridgewood Avenue.

For Concepts A, C, E, and G, full signalization, including turning lanes and "bulbouts" for U-turning vehicles (including emergency vehicles) would be constructed at this location as shown in the above left figure.

For Concepts B, D, F, and H, turning movements and U-turns would be accommodated by the construction of a modern roundabout as shown in the above right figure.

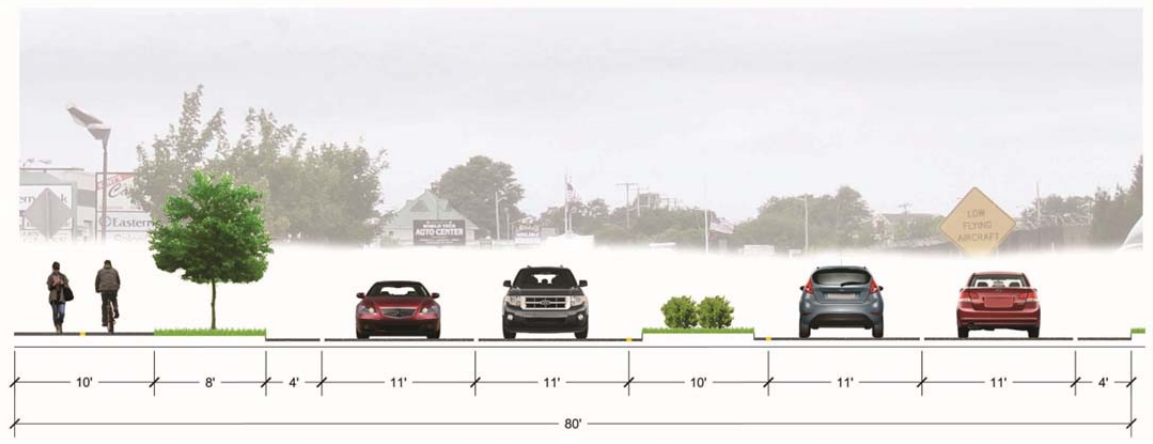


FIGURE 23 - TYPICAL CROSS SECTION – ROUTE 28 (LOOKING WEST)

For all Concepts A-H, the typical cross section for Route 28 (between Yarmouth Road and the existing Airport Rotary) consists of the following features listed starting on the south side of the road:

- 10' multi-use path
- 8' landscaped buffer
- 4' shoulder
- 2 11' travel lanes
- 10' landscaped median divider (8' landscaping with 1' shoulders on either side)
- 2 11' travel lanes
- 4' shoulder

ANALYSES

Queuing and Level of Service analyses were performed for the Airport Rotary signalized alternatives and Ridgewood Avenue/Route 28 intersections for Concepts A-D. Network delay analyses were prepared for the four major alternatives at the Airport including the remaining concepts. Results are presented in the following figures and table.

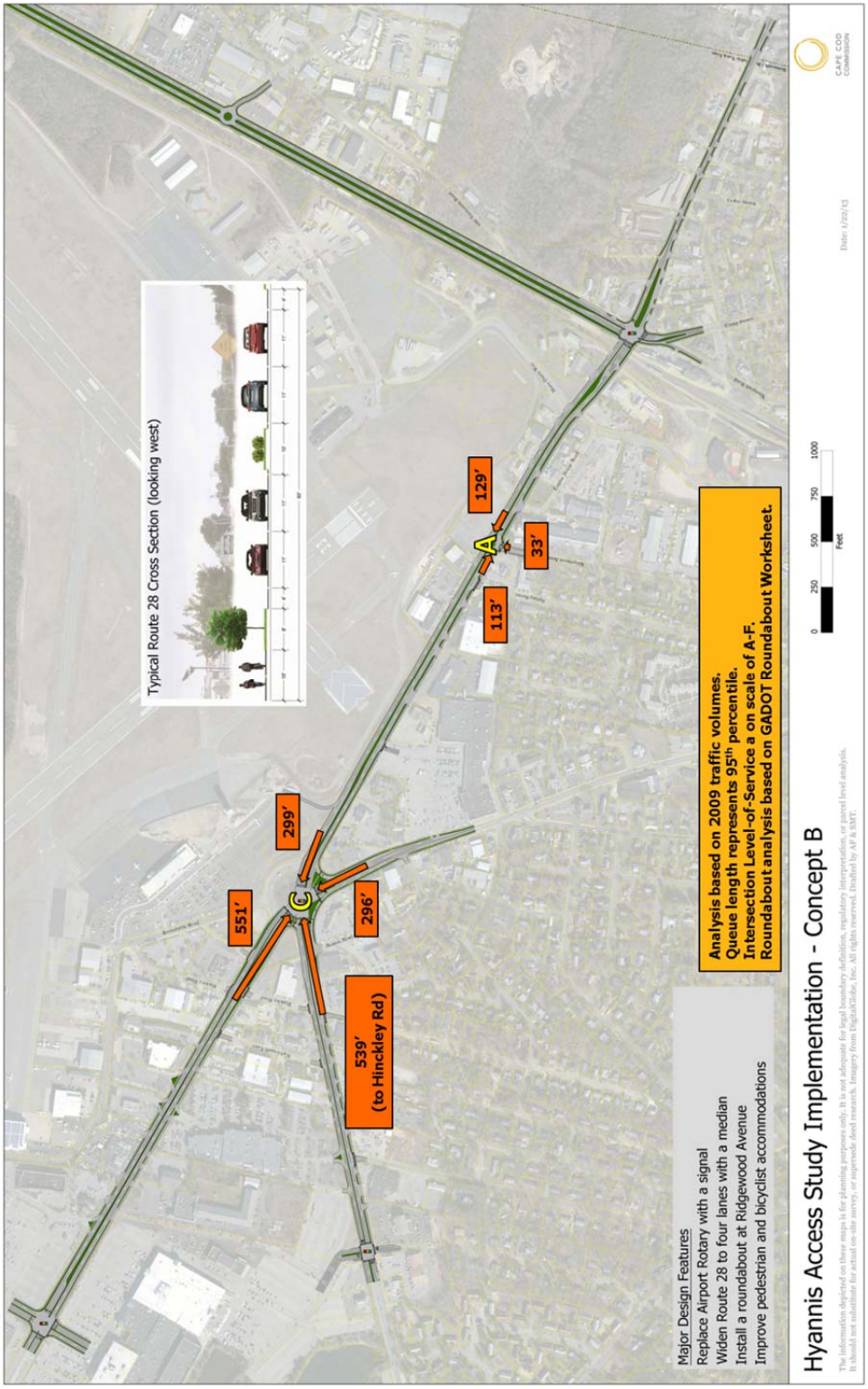


FIGURE 24 - QUEUEING AND LEVEL OF SERVICE - CONCEPT B

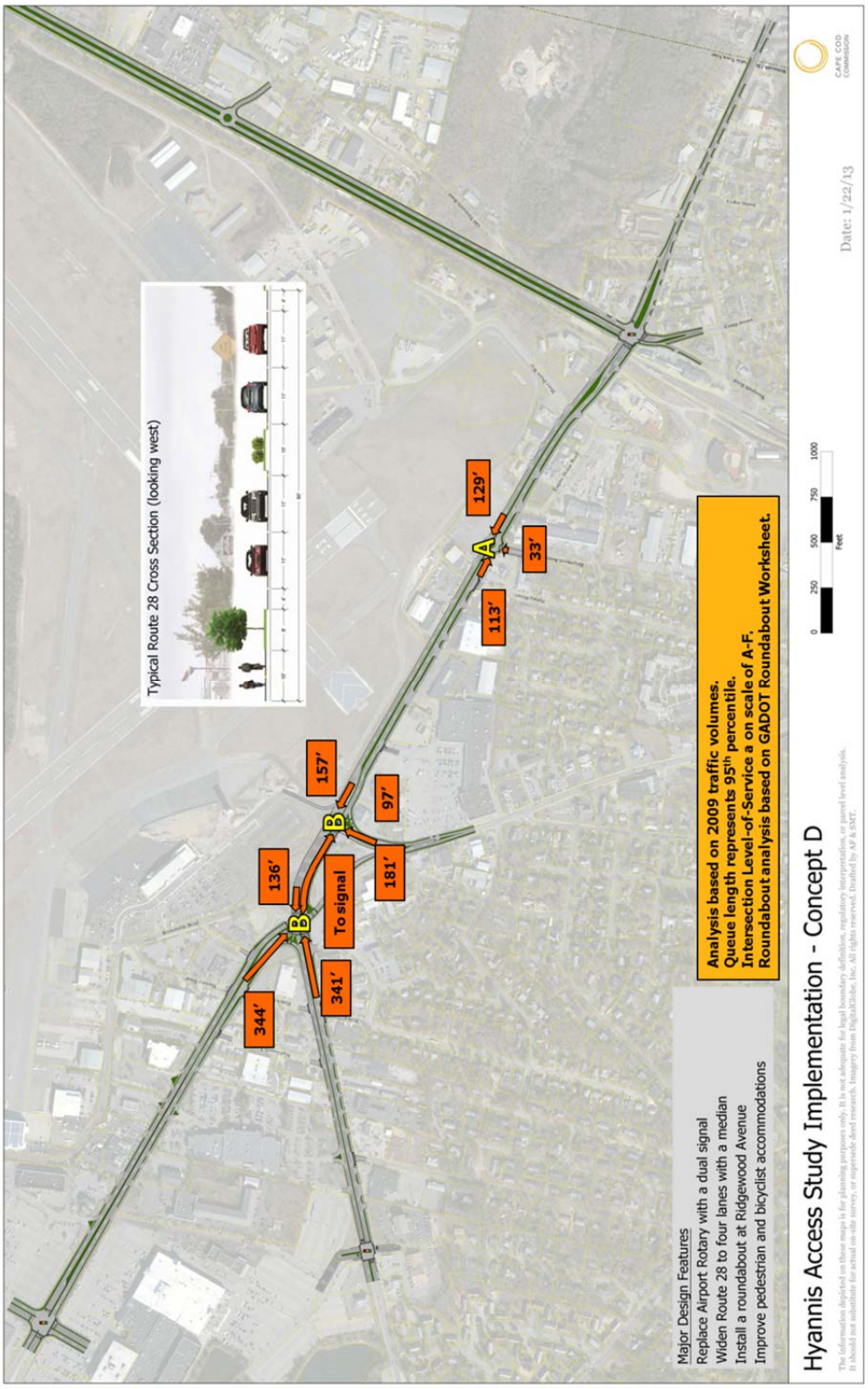


FIGURE 25 - QUEUEING AND LEVEL OF SERVICE - CONCEPT D

TABLE 3 - TOTAL DELAY OF ALL VEHICLES IN THE DESIGN HOUR

Concept	Hours of Vehicular Delay
Four-Way Signal (A, B)	56.6
Split Signal (C, D)	48.2
Rt 132-Rt 28 Underpass (E, F)	22.1
Rt 28-Rt 28 Underpass (G, H)	22.1

STORMWATER MANAGEMENT

A strong stormwater management plan is essential to meeting the environmental goals of the Hyannis Access Study. The following plan describes the stormwater issues and a recommended strategy.

STORMWATER OVERVIEW

What is Stormwater?
Stormwater runoff is caused by precipitation from rain and snowmelt events which flow over land or impervious surfaces and is unable to percolate into the ground. In natural systems, precipitation may be directly infiltrated to the subsurface, stored in natural depressions and through evapotranspiration reintroduced into the atmosphere. Development alters this native state and replaces it with impervious cover including heavily landscaped areas (such as lawns and playgrounds), roads, sidewalks, paved driveways and roofs. This increase in impervious cover that accompanies development results in two main issues: the increase in volume and peak flows of runoff resulting in increased flooding and the release of contaminants into groundwater.

Why is it Important?
Common pollutants found in stormwater runoff include oil; grease and metals from vehicular traffic; pesticides and fertilizers from landscaping activities; sediments from various activities; altered water temperatures and litter including cigarette butts, paper wrappers and plastic bottles. When conveyed by stormwater runoff these pollutants impair waterways, degrade animal habitat, pollute ground water, increase flooding, cause erosion of streambeds or siltation of waterways, and can increase or decrease the amount of water recharged to aquifers.

Why is the Cape Unique?
Cape Cod is a sand and gravel remnant of the last continental deglaciation that occurred from 15,000 to 20,000 years ago. This deglaciation created a series of broad gently sloping outwash plains that are truncated by long linear moraine deposits found along

the present day Route 6 Mid-Cape Highway and Route 28 MacArthur Boulevard. Cape Cod's only source of drinking water, the Sole Source Aquifer, is highly susceptible to contamination with the quality of the aquifer directly affecting our freshwater ponds, marine embayments and drinking water supplies. What makes the Cape a unique area for stormwater management is the combination of highly porous native soils left by the retreating glaciers and the often shallow groundwater levels which are especially apparent in our coastal communities. Stormwater Best Management Practices (BMPs), rely heavily on infiltration to improve the quality and reduce the quantity of runoff. While these well drained soils readily infiltrate runoff providing excellent volume reduction of stormwater, rapid infiltration allows contaminated runoff to enter the groundwater with little or no water quality treatment. The presence of a high groundwater table further decreases the potential for removal of contaminants prior to introduction to the aquifer.

Quality

Contaminant of Interest (Nitrogen)

Transported by stormwater runoff, pollutants from land use development, including nitrogen, find their way into the ground and surface waters throughout the Cape. These waters, along with their increased pollutant loads ultimately discharge to coastal embayments. The presence of increased nitrogen loading from land use development has a significant effect on the nitrogen-limited coastal embayments. Nitrogen limited ecosystems are ecosystems that have adapted under low nitrogen conditions. When an excess of nitrogen is introduced to an embayment changes in the community composition will occur. A common result from excess nitrogen loading is the increase of fast growing species (i.e. algae), which often outcompete other life forms resulting in the loss of species diversity and community richness. This is referred to as the process of eutrophication. In some severe cases eutrophication creates anoxic environments resulting in fish kills and aesthetically unpleasing conditions. The nitrogen load that changes a healthy system to a eutrophic condition is defined as a critical threshold, which under the federal Clean Water Act is referred to as a Total Maximum Daily Load (TMDL) and requires the restoration of impaired surface water bodies.

TMDL's

Under section 303(d) of the Clean Water Act, States are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet acceptable water quality standards. The law requires that priority rankings are established for waters on the lists in addition to developing TMDLs for these waters. A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards.

TMDLs must identify sources of the pollutant of concern (in this case nitrogen) from both point and non-point sources. TMDLs determine the allowable load to meet the state water quality standards and then allocate that load to all sources taking into consideration a margin of safety, seasonal variations, and several other factors. The use of Best Management Practices in conjunction with other nonpoint source pollution controls will reduce the contribution of nitrogen from stormwater runoff to these impaired waterways.

Quantity
In natural ecosystems runoff is infiltrated into groundwater and slowly discharged, in some cases over tens to hundreds of years, to freshwater streams, ponds, lakes, rivers and marine estuaries. Flooding is less significant in these natural systems due to of the quantity of runoff passed from the surface to the groundwater. In urbanized areas these natural systems are replaced with dense impervious cover reducing the amount of infiltration that can occur. Even in the Cape, an area with a naturally high infiltration rate, flooding can occur in urbanized areas causing damage to infrastructure and making roadways unsafe for travel.

PROPOSED LOW IMPACT DEVELOPMENT TECHNOLOGIES

Low Impact Development (LID) is an approach to development and re-development that mimics natural systems to facilitate the management of stormwater. LID utilizes approaches such as preserving and recreating natural landscape features and minimizing effective impervious cover to create functional and appealing site drainage systems that treat stormwater as a resource rather than a waste product. Many practices have been used to adhere to these principles such as bioretention systems, vegetated rooftops, rain barrels, and permeable pavements. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions.
Stormwater Best Management Practices are separated into two distinct categories, structural and non-structural. The primary LID characteristic of non-structural BMPs prevents stormwater runoff becoming generated on site. This differs from the goal of structural BMPs which mitigate stormwater related impacts after they have occurred. More specifically, non-structural BMPs take broader planning and design approaches, which are less “structural” in their form. Many nonstructural BMPs apply to an entire site and often to an entire community, such as wetland protection through a community wetland ordinance. They are not fixed or specific to one location. On the other hand, structural BMPs are more location specific and explicit in their physical form.

The following BMPs are proposed for use in the Hyannis Access Study:

BIORETENTION
Bioretention is a method of treating stormwater by ponding water in shallow depressions underlain by a sandy engineered soil media through which most of the runoff passes (“Design considerations associated with bioretention practices” *20th Anniversary Conference on Water Management in the'90s* Coffman et al., 1993).

Also referred to as a “raingarden,” it can easily be incorporated into the landscape to address and maintain many of the natural hydrologic functions. Pollutants within these systems are removed through both chemical and physical means within the bioretention soil mix (BSM). Bioretention systems also encourage biological treatment of nutrients, such as nitrogen, through nutrient uptake by vegetation within the system. Bioretention tends to work best in sandy soils such as are present in many areas of Cape Cod. Sandy soils allow bioretention systems to be designed as infiltration systems, which provide

better performance than filter designs. Properly designed bioretention systems have been shown to achieve 40% nitrogen removal on a yearly basis (UNHSC, 2012).

Recommended bioretention cross section includes a ¾ - 1" stone sub base, pea gravel choking layer and a bioretention soil mix followed by a loam/top soil layer with the option for additional surface cover including river stone or pea gravel for weed suppression.

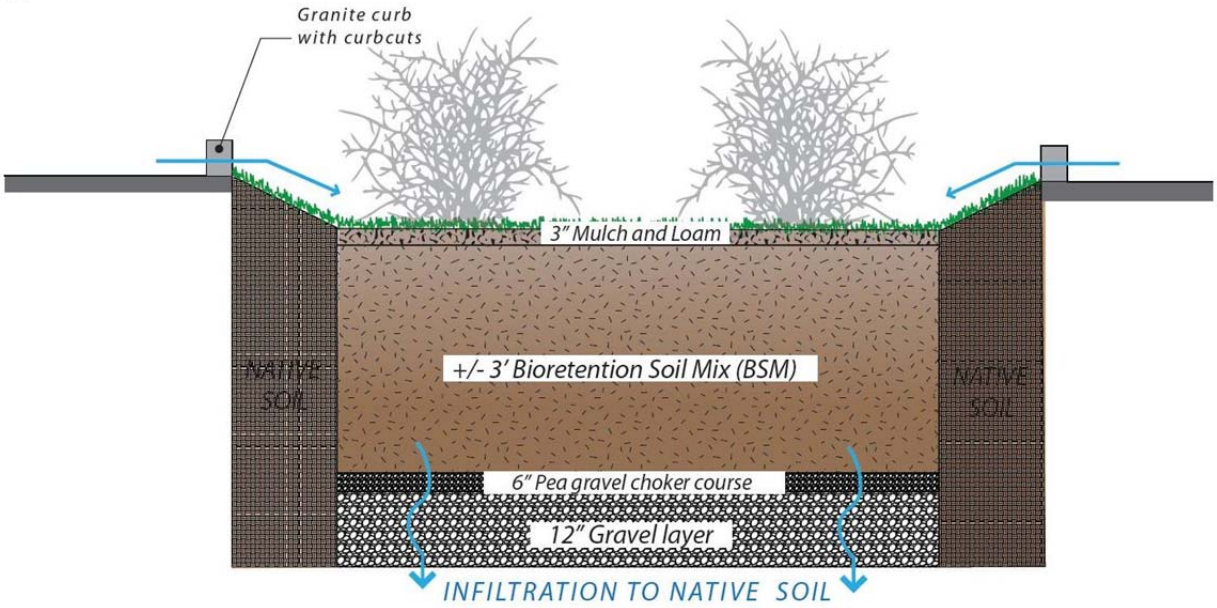


FIGURE 26 - TYPICAL BIORETENTION CROSS SECTION

ADVANCED BIORETENTION

Advanced Bioretention systems provide additional treatment through increased travel and residence time of stormwater. As runoff infiltrates vertically through the soil media (see figure above) an impermeable liner intercepts and redirects the flow horizontally. This horizontal flow increases contact between runoff, bioretention soil media and root vegetation thereby attaining a reduction in nutrients and various other contaminants greater than traditional bioretention systems. Advanced systems are often lined at the bottom of excavation preventing infiltration and rerouting water once again on a horizontal flow path prior to discharge.

Recommended advanced bioretention cross section includes an impermeable liner preventing infiltration throughout the base of the system, a ¾ - 1" stone sub base, pea gravel choking layer, bioretention soil mix followed by a loam/top soil layer with the option for additional surface cover including river stone or pea gravel for weed suppression. A HDPE membrane at a 1% slope is placed within the bioretention soil mix and stone base.

WATER QUALITY SWALES

Water Quality Swales are channels providing conveyance, water quality treatment, and flow attenuation of stormwater runoff. Water Quality Swales provide pollutant removal through vegetative filtering, sedimentation, biological uptake, and infiltration into the underlying soil media. Both wet and dry water quality swales can be implemented with the appropriate type being dependent upon site soils, topography, and drainage characteristics. Water Quality swale stormwater practices work best with well-drained soils that encourage infiltration as part of the water quality treatment approach. Recommended cross section of water quality swales includes a ¾ - 1" stone sub base covered with Type A native soils and vegetation.
A variety of shrubs, grasses, and ground covers are acceptable vegetation in both sun and shade conditions for the above mentioned stormwater technologies. Vegetation should be native and selected based on its tolerance to flooding and its ability to survive with little or no fertilizers and pesticides.

SUGGESTED STORMWATER MANAGEMENT APPROACH

The Hyannis Access stormwater management approach will incorporate the following:

- Pretreatment: 44 percent Total Suspended Solids (TSS) removal will be achieved prior to discharge into the proposed bioretention infiltration systems.
- Water Quality: Stormwater water quality treatment, including the treatment of TSS, metals, nutrients, bacteria and diesel range organics, will be provided for the 25-year 24-hour design event.
- Water Quantity: Stormwater runoff for the design event and greater will be managed and infiltrated close to the source ensuring groundwater recharge.
- Operation and Maintenance Plan: An operation and maintenance plan, not included in this report, specific to the proposed design will be required to ensure proper performance of the stormwater management system.
- Regulatory Requirements: The proposed stormwater management approach will be designed to meet the Massachusetts Department of Environmental Protection Stormwater Management Policy and Cape Cod Commission Regional Policy Plan Standards.

The Hyannis Access Study is located within a Zone II Wellhead Protection Area as shown on the Water Resources Classification Map I in the 2009 Cape Cod Regional Policy Plan. Wellhead Protection Areas are the areas of land that receive precipitation to recharge pumping well and, as such, are areas of critical concern for drinking water quality. Currently, stormwater runoff from existing impervious surfaces along Routes 28 and 132 drain into leaching catch basins placed intermittently along and adjacent to Routes 28 and 132. Leaching catch basins, while providing limited TSS removal, are primarily a tool for water quantity control and not capable of significantly improving stormwater runoff quality. The proposed stormwater management plan includes significant improvements to the drainage infrastructure and will result in a marked improvement to the quality of water recharging into the Zone II Wellhead Protection Area.

TABLE 4 - PROPOSED STORMWATER TECHNOLOGIES AND DESIGN FUNCTION

Hyannis Access Stormwater Management Approach	
Proposed Technologies	**Function**
Deep Sump Catch Basins	Pretreatment
Hydrodynamic Separators	Pretreatment
Bioretention	Treatment/Infiltration
Advanced Bioretention	Treatment/Infiltration
Water Quality Swales	Storage/Infiltration

As shown in the above table, Commission Staff suggests the use of conventional, proprietary and LID approaches to stormwater management for the proposed project. As needed, a combination of off-line deep sump catch basins, hydrodynamic separators and sediment forebays will achieve the required 44-percent total suspended solids pretreatment removal prior to the bioretention infiltration areas. Bioretention systems placed within the roadway median will be incorporated into the preferred alternative Concept F and designed to infiltrate and treat the 25-year 24-hour design event (see following figure).

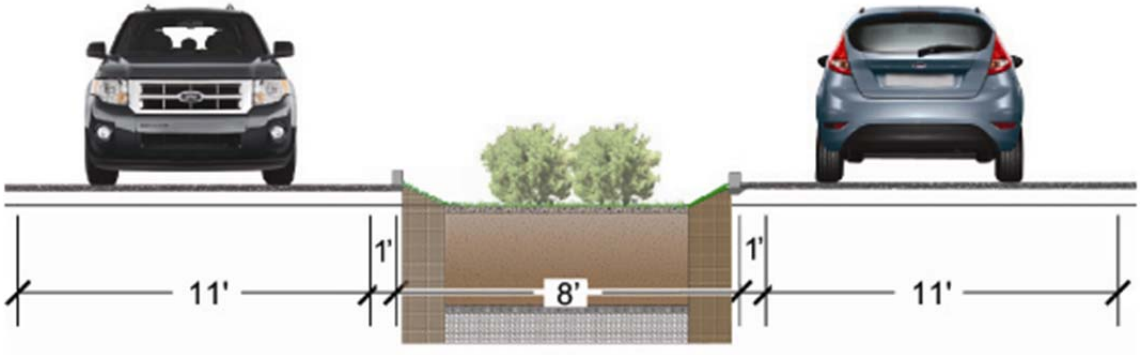


FIGURE 27 - BIORETENTION CROSS SECTION INCORPORATED INTO THE CONCEPT F PREFERRED ALTERNATIVE

Stormwater runoff will access bioretention systems through intermittent curb cuts followed by energy dissipaters which will facilitate both a reduction in velocity and decreased erosion potential. Sections of the roadway median not containing bioretention systems will be comprised of water quality dry swales with the capacity to store bypassed runoff from events greater than the design event. Events which bypass bioretention systems will pass through a rip rap apron prior to entering water quality swales (see next figure).

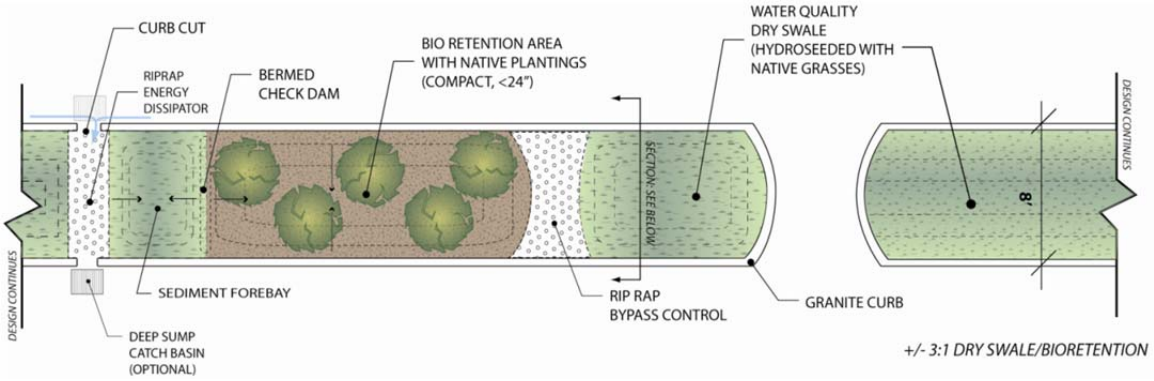


FIGURE 28 - PLAN VIEW LAYOUT OF PROPOSED STORMWATER MANAGEMENT APPROACH

Site specific requirements may include under drain piping with associated cleanouts and bypasses integrating proposed stormwater controls to existing infrastructure. The figure below, an adapted image from a similar project constructed in Arlington County Virginia, shows an example of a stormwater management system placed within a roadway median.

FIGURE 29 - ADAPTED IMAGE FROM THE PATRICK HENRY DRIVE "GREEN STREETS" PROJECT CONSTRUCTED IN ARLINGTON COUNTY VIRGINIA

The portion of the Hyannis Access study on Yarmouth Road/Willow Street lies directly up gradient of the town of Barnstable Maher Public Supply Wells, the source of drinking

water for a significant portion of the Town of Barnstable. Addressing water quality in an area in such close proximity to public drinking water supply wells is a high priority and special focus will be placed on increasing stormwater runoff treatment in this area. Commission Staff suggests that hydrodynamic separators replace off-line deep sump catch basins and advanced bioretention systems are utilized in place of the traditional bioretention systems proposed for the Route 28 section. This enhanced treatment will provide a valuable buffer between non-point source pollution and the drinking water supply.

Stormwater at the location of the Route 28 to Route 132 underpass will convey runoff away from the raised roundabout and towards the existing vegetated area adjacent to Barnstable Road, and the existing and proposed vegetated areas found in the median and splitter islands on the various approaches to the roundabout. The vegetated areas mentioned above will be designed as bioretention systems capable of treating the 25-year 24-hours design event. Due to potential spatial constraints Total Suspended Solids pretreatment will utilize off-line deep sump catch basins and hydrodynamic separators as needed. To prevent flooding in and around the proposed roundabout, storm flows in excess of the design event will be routed to the infiltration area adjacent to the south-east corner of the airport terminal parking lot.

Costs

A similar project constructed in 2011 by Arlington County in the median of Patrick Henry Drive (Arlington County 2013) captured a drainage area (DA) of 0.75 acres with a water quality volume (WQV) of 1,851 cubic feet at a cost of $56,000 (Tim McIntosh, Personal Communication, February 20, 2013). When compared to costs from the above mentioned project, the proposed Hyannis Access Study, with a DA of approximately 9.5 acres and a WQV of approximately 35,000 cubic feet, would have an estimated cost between $700,000 and $1,000,000.

ADDITIONAL CONSIDERATIONS

The implementation of Hyannis Access Study requires coordination with other transportation-related planning projects in the area. For example, the Cape Cod Regional Transit Authority's Hyannis Transportation Center parcel is being examined for a "Transit Oriented Development" (TOD) scenario. Potential areas on the parcel proposed for redevelopment are shown shaded in the following figure. As the TOD plan develops, it may be necessary to modify the Route 28/Engine House Road intersection (the northerly access point into the TOD).

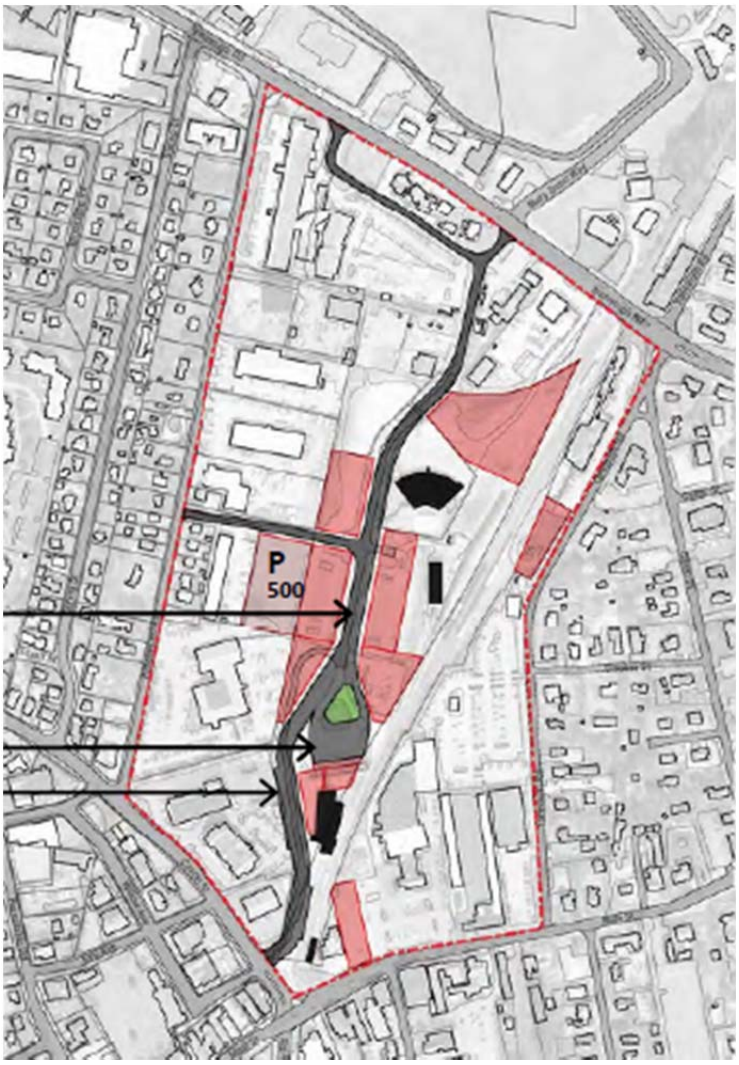


FIGURE 30 - HYANNIS TRANSPORTATION CENTER PARCEL - TRANSIT ORIENTED DEVELOPMENT AREAS

Another project requiring coordination is MassDOT's preferred alternative for Route 28 between Bearses Way and the Cape Cod Mall traffic signal. The proposal includes 2 travel lanes in each direction separated by a landscaped median divider, turning lanes, and sidewalks on both sides of Route 28. The figure on the following page shows the proposed configuration.

For consistency, and to improve traffic flow and safety, the task force has recommended a similar cross-section for Route 28 between the Cape Cod Mall signal and the Airport Rotary (see figures following next page).

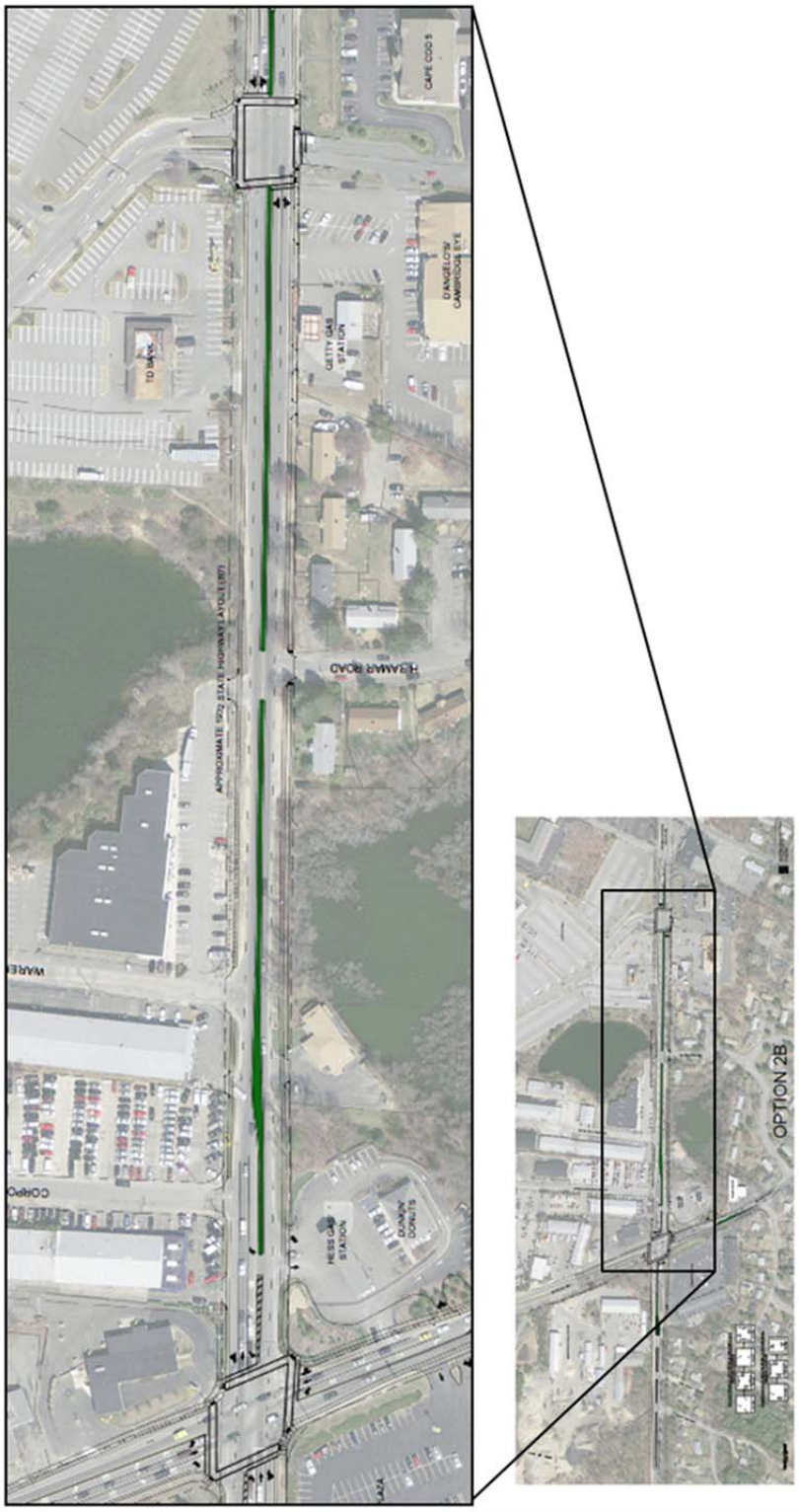


FIGURE 31 – PREFERRED ALTERNATIVE - RT 28/BEARSES WAY PROJECT

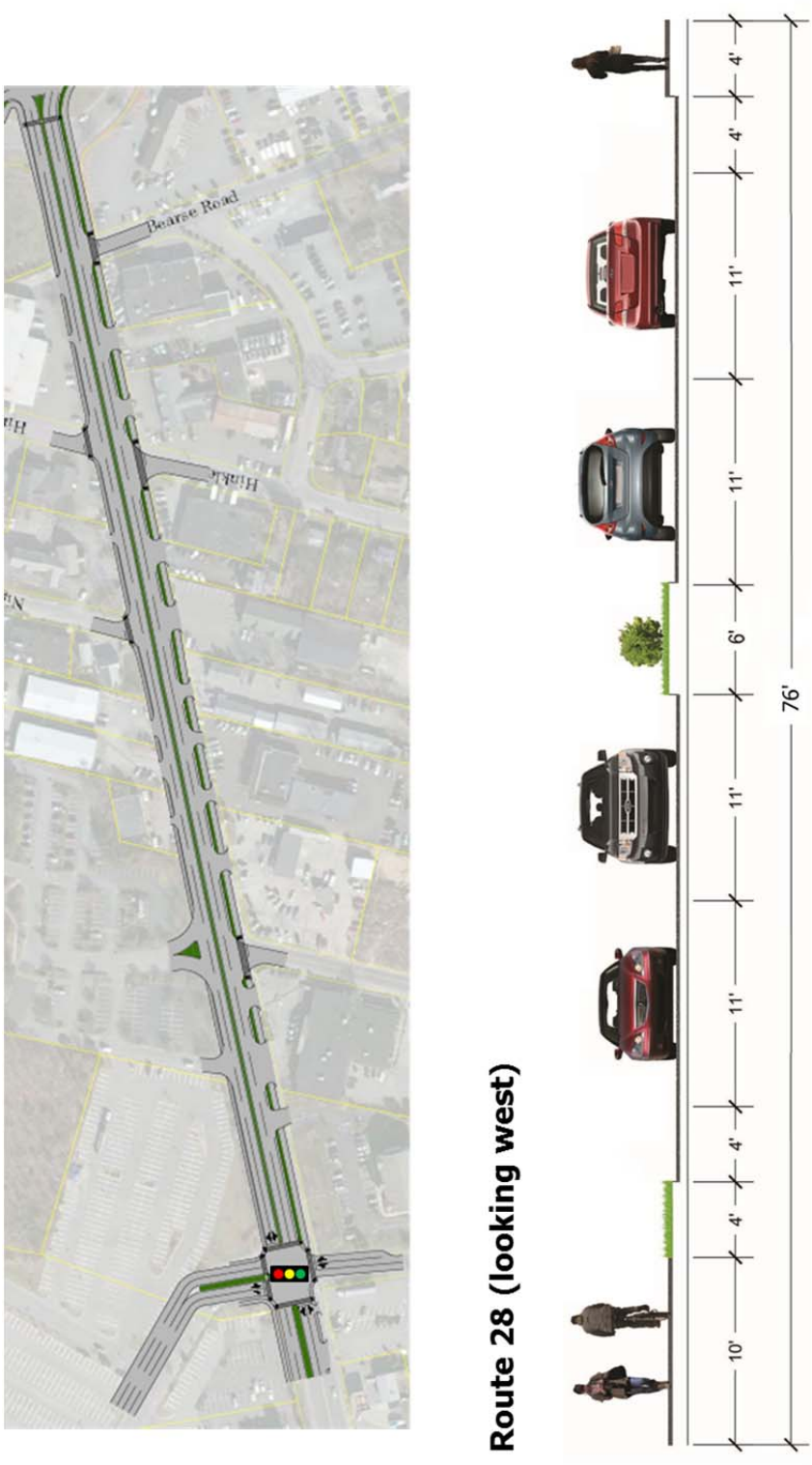


FIGURE 32 - PREFERRED CONFIGURATION RT 28 FROM CAPE COD MALL TO AIRPORT ROTARY

Another concern brought up at the task force meetings is the potential for driver confusion when traveling through the large areas of the signalized intersections proposed at the Airport Rotary for Concepts A-B. The following figure shows a scaled representation of a vehicle in the intersection to help the reader visualize the driver's dilemma in identifying the correct exit lane.

FIGURE 33 - DRIVER DILEMMA AT TRAFFIC SIGNAL ALTERNATIVES

The Cape Cod MPO's transportation planning process includes consideration of Environment Justice populations (Limited English Proficiency, Low Income) in decision-making. This is to equitably share the benefits and burdens of transportation projects among the population of Cape Cod. Environmental Justice populations are shown shaded on the map in the following figure.

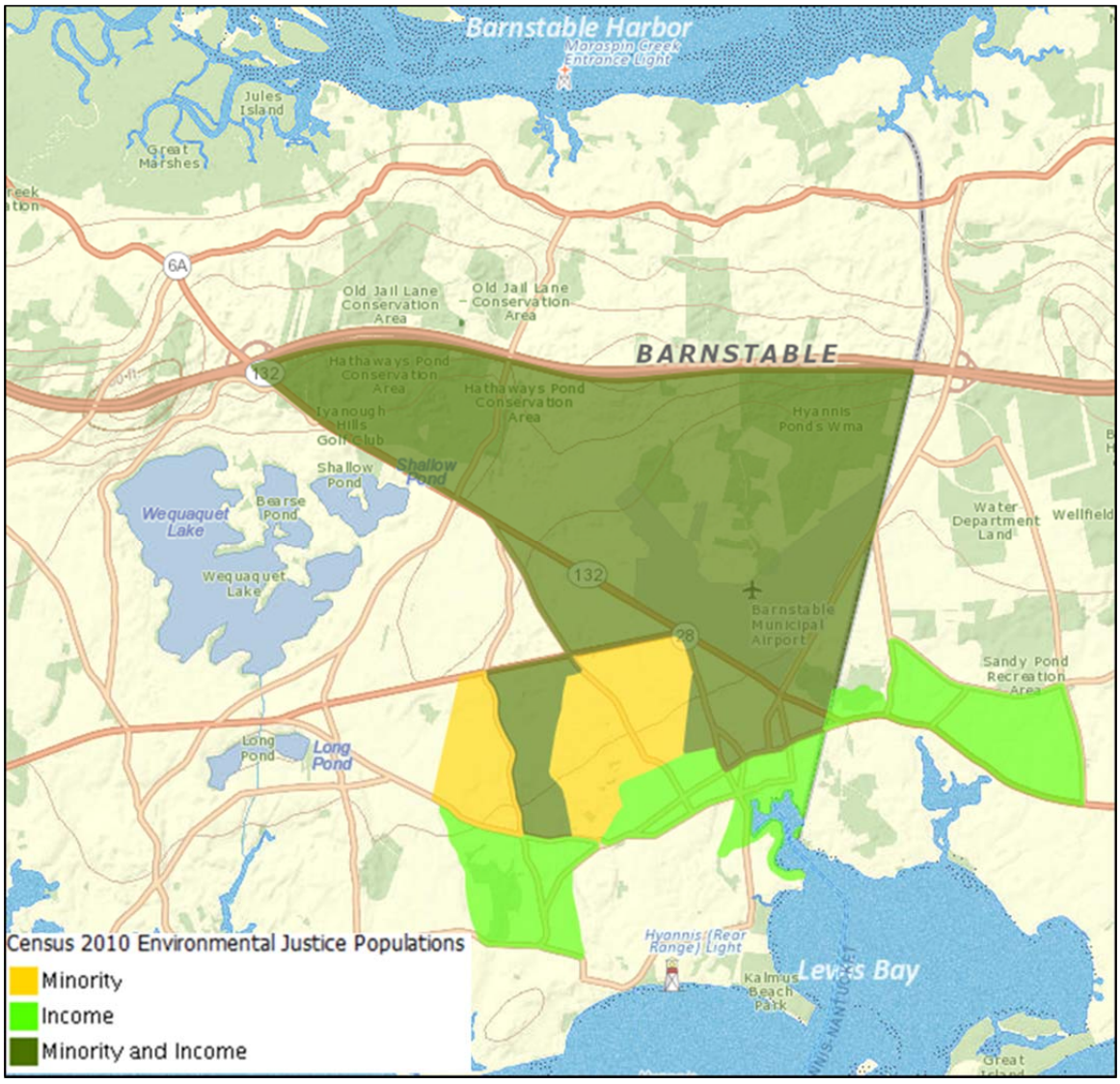


FIGURE 34 - CAPE COD ENVIRONMENTAL JUSTICE POPULATIONS

Criteria & Evaluation

Criteria used in the study for Concepts A-H were evaluated by CCC staff in consultation with the task force for positive (benefits), negative (detriments) or no (neutral) impacts. The magnitude of each impact was considered, ranging from "minor" through "moderate" to "major." The following table identifies the colors and symbols used in the evaluation tables. Green circles represent "benefits," red squares represent "detriments," and diamond shapes represent "neutral" impacts. Unshaded circles and squares are classified as "minor," half-shaded circles and squares are classified as "moderate," and solid-shaded circles and squares are classified as "major."

TABLE 5 - CRITERIA EVALUATION SYMBOLS

Evaluation Matrix Legend

	Minor	Moderate	Major
Benefits			
Detriments			
Neutral			

CRITERIA

The following tables provide the evaluation of Concepts A-H for each of the criteria used in the study. Note that almost all of the criteria are applied to the entire project (Yarmouth Road included). Due to the significant impacts of the Yarmouth Road component on local businesses and right-of-way, the effects of the eight concepts would be nearly impossible to differentiate. Therefore, Route 28-only impacts are evaluated for the following goals/criteria:

- Goal: Improve Economic Opportunities / Criterion: Impacts to Local Businesses along Route 28
- Goal: Evaluate Project Costs and Impacts / Criterion: Route 28 Right of Way Impacts

The proposed changes, under any of the eight scenarios, all occur within a presently heavily built environment. The area does not contain wetlands, nor are there rare species mapped within the vicinity of the proposed work area. There is presently very little natural vegetation within this corridor area, and thus it is not deemed significant as wildlife habitat. The proposed changes will neither harm nor enhance wetlands, rare species, or wildlife/plant habitat, and consequently are classified as neutral impacts on these resources.

Hyannis Access Study Implementation - Evaluation Criteria

Goal	Improve Mobility and Safety for all Users within the Study Area	
Objective	**Evaluation Criteria**	**Source / Comments**
Improve Automobile Traffic Flow In and Around the Study Area	Travel Times, Delays, Level of Service Analysis	Modeling
Improve Safety for Bicyclists, Pedestrian and Motorists	Crash Reduction	Safety Improvement Methods
Improve Emergency Access to the Hospital	Lane Widths and Increased Paved Shoulders	AASHTO and MassDOT Guidelines
Increase Mobility and Transportation Choice for Non-automotive Users	Increase Pedestrian and Bicycle Modes within the Study Area	Sidewalks and Multi-Use Path, ADA Compliance
Improve Pedestrian and Bicyclists' Access and a future connection to the Cape Cod Rail Trail	Multi-Use Path Layout and Connections	Sidewalks and Multi-Use Path, ADA Compliance
Goal	**Decrease Impacts to Residential Neighborhoods**	
Objective	**Evaluation Criteria**	**Source / Comments**
Minimize Impacts to Local Streets	Traffic Volumes, Access to Local Streets	Modeling
Minimize Impacts to Residential Neighborhoods	Reduced Traffic Congestion, Loss of Residential Neighborhood	Synchro, GIS Mappings of Existing Neighborhood
Goal	**Support Land Use and Cultural Interests**	
Objective	**Evaluation Criteria**	**Source / Comments**
Support Local Land Use Goals	Barnstable Local Comprehensive Plan - Land Use Goals	Barnstable Local Comprehensive Plan
Support Access to Hyannis Growth Incentive Zone and Land Use Vision	Barnstable Local Comprehensive Plan - Land Use Goals for Growth Incentive Zone	Barnstable Local Comprehensive Plan - Economic Development Component
Minimize Impacts to Historical, Cultural and Architectural Resources	Number of Historic Structures Demolished or Altered	Cape Cod Commission Staff Evaluation of Historic Structures
Goal	**Decrease Impacts to the Natural Environment**	
Objective	**Evaluation Criteria**	**Source / Comments**
Minimize Impacts to the Natural Environment	Acres of New Disturbance to Woodland, Meadow, etc.	Regional Policy Plan, Local Conservation Commissions
Minimize Impacts to Water Resources	Acres of Disturbance to Contributing Area to Public Supply Wells	Regional Policy Plan - Water Resources Classification, Time of Travel Flow Paths
Minimize Impacts to Rare Species	Acres of Impacts to Rare Species Habitat	Natural Heritage & Endangered Species Program
Minimize Impacts to Wetlands	Acres or Square Feet of New Disturbance to Wetlands or Buffer Areas	Local Conservation Commissions
Improve Air Quality	Emissions of VOCs and NOx	Traffic Volumes, Delays, Modeling
Goal	**Improve Economic Opportunities**	
Objective	**Evaluation Criteria**	**Source / Comments**
Minimize Impacts to Local Businesses along Route 28	Number of Properties Affected by Concept Plan and Business Turnover	Concept Plans and County Business Patterns
Convenient and reliable access to the Growth Incentive Zone	Ease of travel into/out of Growth Incentive Zone	Modeling and Concept Plans
Goal	**To Evaluate Project Costs and Impacts**	
Objective	**Evaluation Criteria**	**Source / Comments**
Reduce Construction Costs	MassDOT Cost Estimating	MassDOT
Reduce Right of Way Impacts along Route 28	Number of Properties Affected and Square Feet of Impact	Concept Plans
Goal	**To Maintain Transportation Choices Within The Study Area**	
Objective	**Evaluation Criteria**	**Source / Comments**
Minimize Impacts to the Railroad	Delays to Existing Rail Service, New At Grade Crossings	Modeling, New At Grade Crossing
Improve Access to Hyannis Transportation Center	Maintain/Improve Access to Hyannis Transportation Center	Modeling/Concept Plans
Improve Access to the Hyannis Ferries	Maintain/Improve Access to Hyannis Ferries	Modeling
To Enhance and/or Reduce Impacts to Barnstable Municipal Airport	Access to Barnstable Municipal Airport (BMA) and BMA Land Affected	Concept Plans

EVALUATION OF ALTERNATIVES

The Cape Cod Commission transportation staff met with Town of Barnstable staff and staff from other Commission departments (planning, economic development, water resources, and natural resources, historic preservation) to develop evaluations of the eight concepts. A draft evaluation matrix was discussed and refined with Town of Barnstable staff and presented for approval of the Task Force. Evaluations are shown in the following table.

Hyannis Access Study *Implementation* ◆ Evaluation of Concepts

	Goals:	Improves Safety for Motorists, Pedestrians, and Bicyclists					Decrease Impacts to Residential Neighborhoods		Support Land Use and Cultural Interests			Decrease Impacts to the Natural Environment					Improve Economic Opportunities		Evaluate Project Costs and Impacts		Maintain Transportation Choices within the Study Area			
	Concept	Traffic Flow In and Around the Study Area	Improves Safety for Motorists, Pedestrians, and Bicyclists	Impacts Emergency Access	Increase Mobility and Transport-ation Choices	Pedestrian and bicyclist access and a future con-nection to the Cape Cod Rail Trail	Impacts Local Streets	Impact Long Established Residential Neighborhoods	Supports Local Land Use Goals	Supports Growth Incentive Zone and Land Use Vision	Impacts to Historical, Cultural and Architectural Resources	Impacts to the Natural Environment	Impacts to Water Resources (Drinking Water)	Impacts to Rare Species	Impacts to Wetlands	Impact to Air Quality	Impacts to Local Businesses along Rt 28	Access to Growth Incentive Zone	Construction Costs	Rt 28 Right of Way Impacts	Impact to Railroad Line	Impact to Hyannis Transport-ation Center	Impact to Hyannis Ferries	Impact to Barnstable Municipal Airport
A	Replace rotary with signal, widen Rt 28, add median & signal	○	○	○	○	●	○	○	▭	▭	◇	◇	◒	◇	◇	○	◇	○	▭	□	◇	○	○	▭
B	Replace rotary with signal, widen Rt 28, add median & roundabout	○	○	○	○	●	○	○	▭	▭	◇	◇	◒	◇	◇	◒	◇	○	▭	□	◇	○	○	▭
C	Replace rotary with dual signals, widen Rt 28, add median & signal	○	○	○	○	●	○	○	■	■	◇	◇	◒	◇	◇	○	□	○	▭	■	◇	○	○	■
D	Replace rotary with dual signals, widen Rt 28, add median & roundabout	○	○	○	○	●	○	○	■	■	◇	◇	◒	◇	◇	◒	□	○	▭	■	◇	○	○	■
E	Replace rotary with roundabout & Rt 132-28 underpass, widen Rt 28, add median & signal	●	●	◒	◒	●	○	○	○	○	◇	◇	◒	◇	◇	◒	◇	●	■	□	◇	●	◒	○
F	Replace rotary with roundabout & Rt 132-28 underpass, widen Rt 28, add median & roundabout	●	●	●	◒	●	○	○	○	○	◇	◇	◒	◇	◇	●	◇	●	■	□	◇	●	◒	○
G	Replace rotary with roundabout & Rt 28-28 underpass, widen Rt 28, add median & signal	●	●	◒	◒	●	○	○	◇	◇	◇	◇	◒	◇	◇	◒	◇	●	■	□	◇	●	◒	○
H	Replace rotary with roundabout & Rt 28-28 underpass, widen Rt 28, add median & roundabout	●	●	●	◒	●	○	○	◇	◇	◇	◇	◒	◇	◇	●	◇	●	■	□	◇	●	◒	○

Evaluations

Benefits : ○ Minor ◒ Moderate ● Major

Detriments : □ Minor ▭ Moderate ■ Major

Neutral : ◇

Recommendations

After several meetings with the Task Force, interested members of the public, local officials, and affected stakeholders, the Hyannis Access Study *Implementation* Task Force has selected a preferred alternative for design and construction. As part of the refinement of alternatives, the Task Force consensus was to eliminate from further consideration alternatives which including traffic signalization (at either the Airport Rotary intersection or Route 28/Ridgewood Avenue intersection). In addition, the Task Force consensus recommends a consistent four-lane with median cross section for Route 28 between the Airport Rotary and the Cape Cod Mall intersection.

RECOMMENDED ALTERNATIVE

The Hyannis Access Study *Implementation* Task Force has selected Concept F as the preferred alternative, and Concept H as a secondary alternative.

Concept F includes the replacement of the Airport Rotary with a modern roundabout and an underpass for vehicles traveling between the eastern leg of Route 28 and Route 132 to the northwest; an additional feature is the installation of a modern roundabout at the intersection of Route 28 and Ridgewood Avenue. Concept H is similar to Concept F with the difference being that the underpass would serve vehicles traveling between the west and east legs of Route 28.

The Task Force's consensus also included a typical cross-section (see following figure) for Route 28 between the Airport Rotary and the intersection of Yarmouth Road with the following features (listed starting from the south side of the roadway to the north side):

- 10' multi-use path
- 8' landscaped area
- 4' bike accommodation shoulder
- Two 11' eastbound travel lanes
- 10' landscaped median divider (8' landscaped, 1' shoulder on each side)
- Two 11' westbound travel lanes
- 4' bike accommodation shoulder

Stormwater Management recommendations include:

- Hydrodynamic separators
- Advanced bioretention systems
- Off-line deep sump catch basins
- Infiltration areas
- Dry swales to accommodate bypassed runoff

An overview plan and details are presented in a following figure.

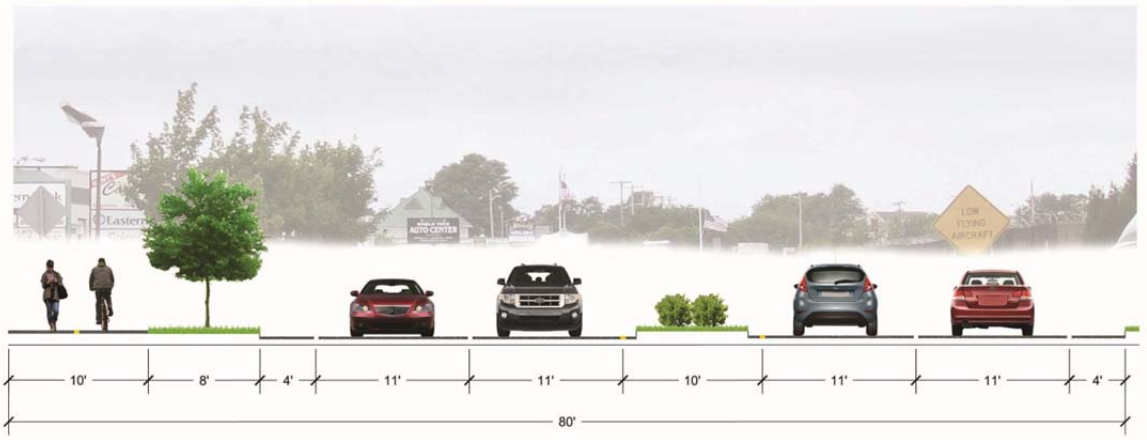


FIGURE 35 - RECOMMENDED ROUTE 28 CROSS-SECTION – *LOOKING WEST*

An overview of preferred alternative is shown on the following figure. Major design features include:

- Replacing the Airport Rotary with a roundabout and underpass from Route 28 east to Route 132
- Widening Route 28 to four lanes with a landscaped median divider
- Installing of a roundabout at Route 28/Ridgewood Avenue
- Improving pedestrian and bicyclist accommodations

FIGURE 36 - RECOMMENDED ALTERNATIVE OVERVIEW

A scheme showing the improved alignment of Yarmouth Road/Route 28 intersection is shown in the following figure.

FIGURE 37 - PREFERRED CONFIGURATION OF RT 28/YARMOUTH RD INTERSECTION

The following figures show landscaping features at the proposed Airport Roundabout. In addition, the traffic flow patterns for vehicles traveling from various entry legs to differing exiting legs are presented as well.

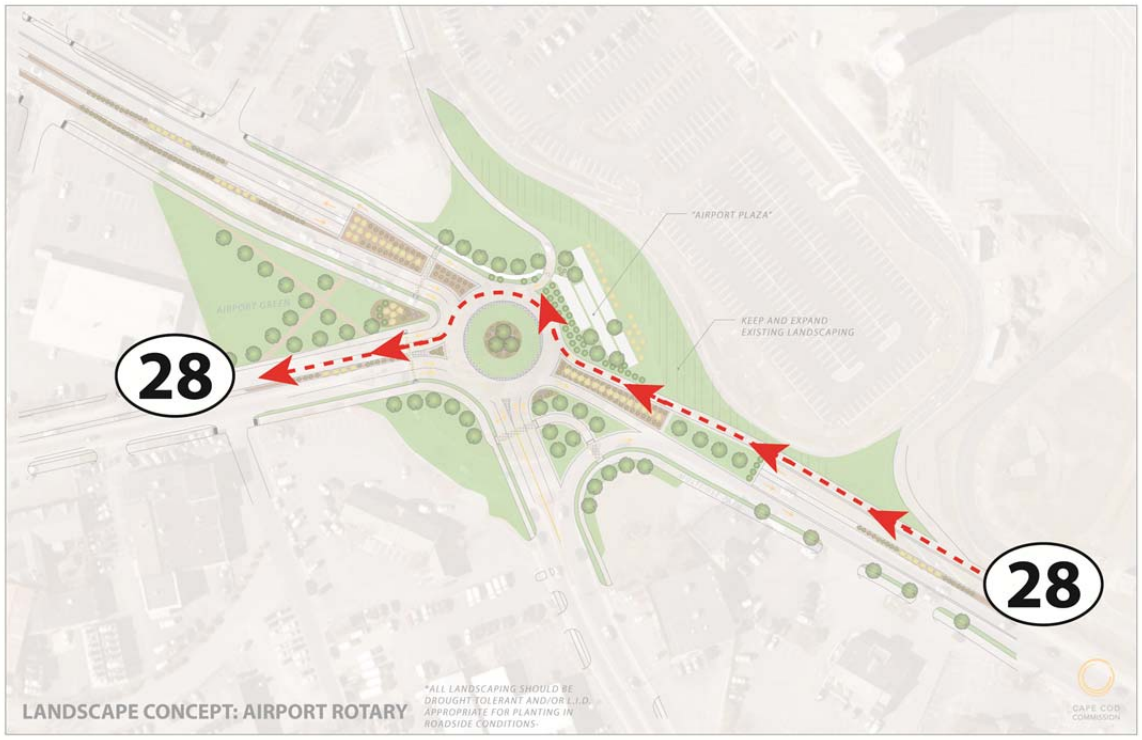


FIGURE 38 - TRAFFIC FLOW RT 28E TO RT 28W

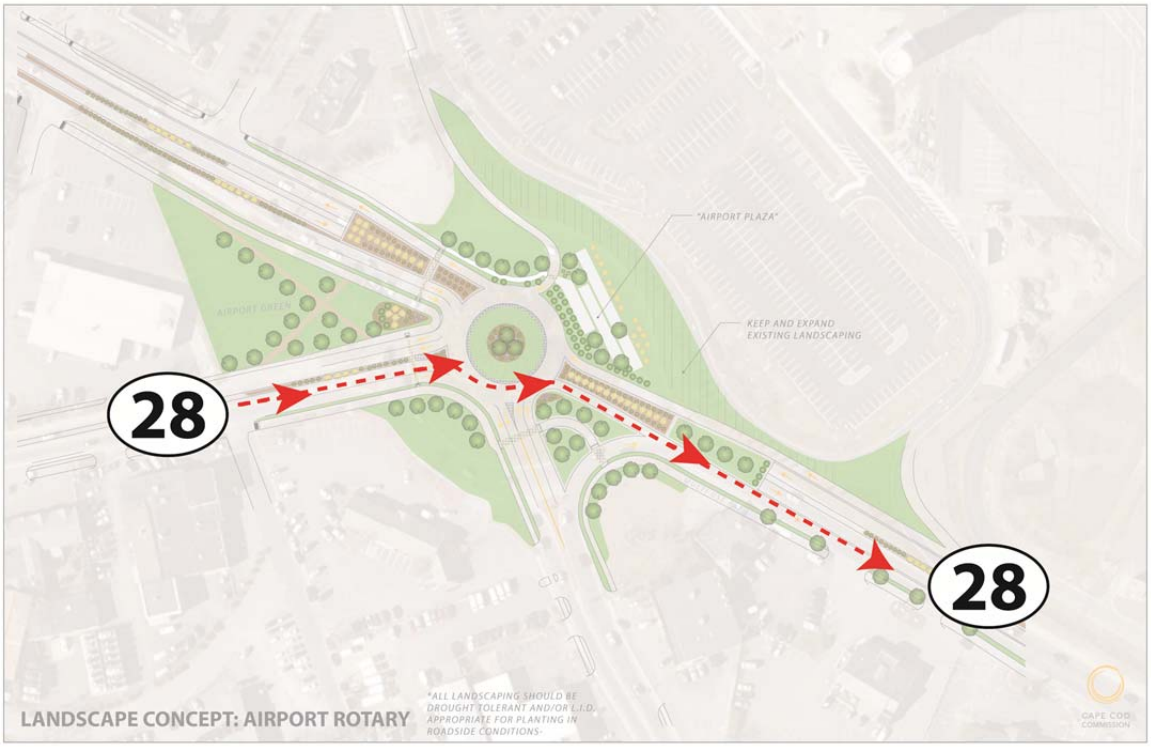


FIGURE 39 - TRAFFIC FLOW RT 28W TO RT 28E

FIGURE 40 - TRAFFIC FLOW RT 28E TO RT 132

The figures on the following pages provide before (no-build) and after (build) renderings of approaches to the proposed Airport Roundabout.

FIGURE 41 – BEFORE: ROUTE 28 EAST APPROACH TO AIRPORT ROTARY

FIGURE 42 – AFTER: ROUTE 28 EAST APPROACH TO AIRPORT ROUNDABOUT

FIGURE 43 - BEFORE: ROUTE 132 APPROACH TO AIRPORT ROTARY

FIGURE 44 - AFTER: ROUTE 132 APPROACH TO AIRPORT ROUNDABOUT

COST ESTIMATES FOR PREFERRED ALTERNATIVE

The estimated cost of improvements to roads/ for the preferred alternative is almost $52 million. The costs for stormwater management add an estimated additional $800,000. Therefore, the total cost of the preferred alternative is $52,690,000.

The estimated cost includes the following components:

Roadways	**Cost**
Routes 28 & 132 Construction	$ 7,500,000
Routes 28 & 132 Right-of-Way	$2,200,000
Yarmouth Road Construction	$11,920,000
Yarmouth Road Right-of-Way	$6,570,000
Intersections	
Route 132-28 Grade Separation/Roundabout	$20,000,000
Route 28/Yarmouth Road intersection Upgrade	$2,700,000
Route 28/Ridgewood Avenue roundabout	$1,000,000
Stormwater Management	$800,000
Total	$52,690,000

Next steps include refinement of right-of-way acquisition costs, enlistment of support from public officials, and identification of funding sources.

CAPE COD COMMISSION

3225 MAIN STREET • P.O. BOX 226 • BARNSTABLE, MASSACHUSETTS 02630
(508) 362-3828 • Fax (508) 362-3136 • www.capecodcommission.org