CAPE COD COMMISSION

Cape Cod 2012
Regional Transportation Plan
2012-2035

Endorsed August 22, 2011

Revised May 20, 2013




Prepared by:

CAPE COD COMMISSION Transportation Staff

on behalf of the

Cape Cod Metropolitan Planning Organization

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

in cooperation with:
Massachusetts Department of Environmental Protection
United States Department of Transportation Federal Highway Administration
United States Department of Transportation Federal Transit Administration

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www.capecodcommission.org

CAPE COD METROPOLITAN PLANNING ORGANIZATION (MPO)
Cape Cod Regional Transportation Plan (RTP)
2012-2035

The signatures to follow certify that the Cape Cod Metropolitan Planning Organization (MPO), at their meeting on August 22, 2011, hereby approves the following action in accordance with the Comprehensive, Cooperative and Continuing transportation planning process. In accordance with the requirements of 23 CFR Part 450 Section 308(c) of Federal Regulations, the MPO for Cape Cod has completed its review and hereby endorses the Cape Cod Regional Transportation Plan for 2012-2035.

SIGNATORY CERTIFICATION:

for

Jeffrey B. Mullan, Secretary/Chief Executive Officer – Massachusetts Department of Transportation (MassDOT)

Francis A. DePaola, Administrator
Massachusetts Department of Transportation (MassDOT) Highway Division

Peter Graham
Cape Cod Commission

Ronald Bergstrom, Chair
Cape Cod Regional Transit Authority

William Doherty
Barnstable County Commissioners

Frederick Chirigotis, President
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Lawrence Cole, Ph.D.
Brewster, Chatham, Dennis, Harwich, Yarmouth

Aimee Eckman
Eastham, Orleans, Provincetown, Truro, Wellfleet

Jason Stieding
Mashpee Wampanoag Tribal Council

CAPE COD
COMMISSION

2012 REGIONAL TRANSPORTATION PLAN

Chapter 1: Goals and Objectives

Endorsed
August 22, 2011

COUNTY OF BARNSTABLE
MASSACHUSETTS

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1. Introduction

This 2012 Cape Cod Regional Transportation Plan (RTP) is a fiscally constrained set of transportation projects, programs, "smart" solutions, and transportation studies for the 25 years from 2011 to 2035. The planning area of the RTP includes all major (and many minor) modes of travel throughout all 15 communities of Barnstable County and is undertaken by the Cape Cod Commission transportation staff on behalf of the Cape Cod Metropolitan Planning Organization (MPO).

This chapter includes background information on the roles and responsibilities of participating agencies, a synopsis of the public participation process, and a section on the goals and objectives of the current plan. Changes and progress since the 2007 plan are also discussed in this chapter as well as an outline of the demographic characteristics of Barnstable County.

The remaining chapters of this Plan include:

- An examination of the Cape's existing transportation system and future trends and forecasts
- A discussion of safety & security transportation issues (e.g., crash rates, hurricane evacuation etc.)
- An analysis of congestion management issues (e.g., travel times and delays)
- A review of existing and needed bicycle facilities
- Listings of alternatives including evaluation based on RTP conformity criteria
- Integration of recent transportation studies
- A set of recommended projects, programs, "smart" solutions, and transportation studies that a fiscally constrained based on estimated available funding

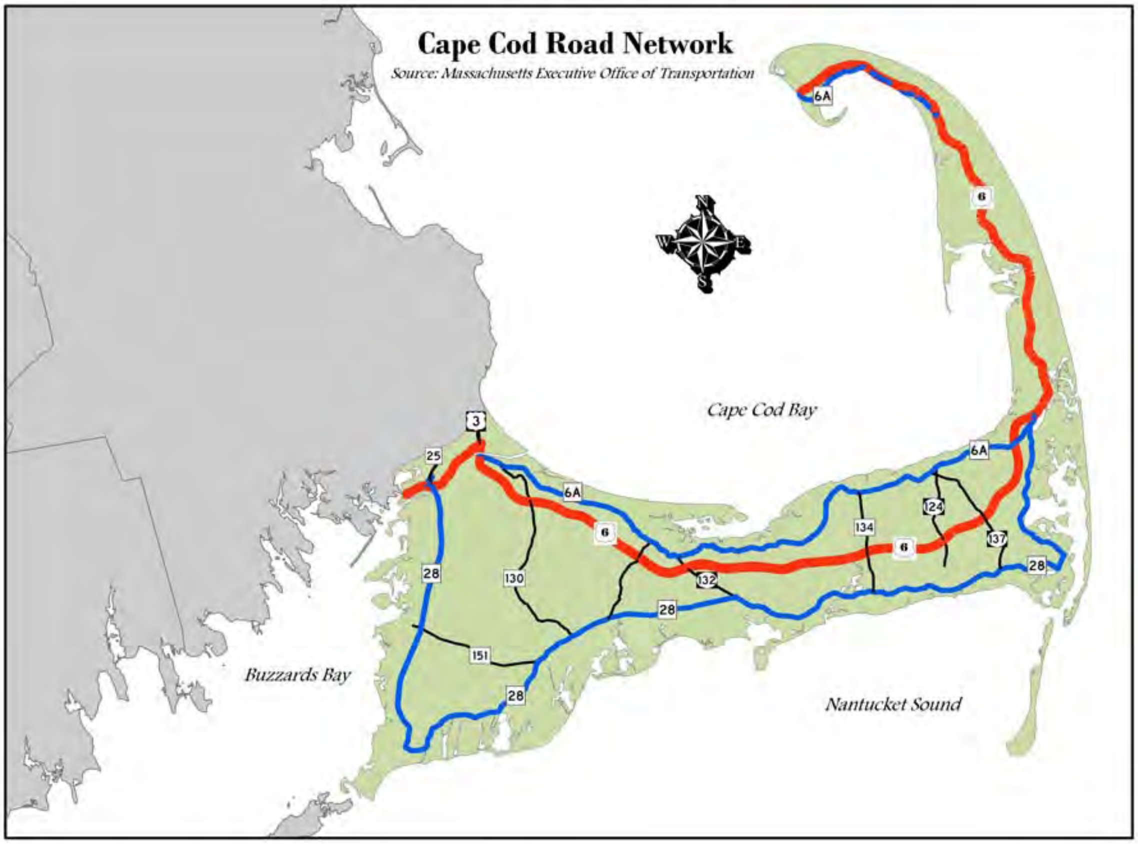


FIGURE 1 - BARNSTABLE COUNTY/CAPE COD OVERVIEW MAP

The map shown above identifies the fifteen Cape Cod communities and major highways such as Routes 6, 28, and 6A.

1.1 TRANSPORTATION PLANNING PROCESS

The Cape Cod Metropolitan Planning Organization (MPO) is responsible for reviewing, guiding, and endorsing the RTP. Currently, the official position/agency of each membership is as follows:

Secretary, Massachusetts Department of Transportation
Administrator, Massachusetts Department of Transportation/Highway Division
Chair/Cape Cod Regional Transit Authority
Chair/Cape Cod Commission
Commissioner/Barnstable County
Council President/Town of Barnstable
Selectman*/Towns of Bourne, Sandwich, Falmouth & Mashpee
Selectman*/Towns of Yarmouth, Dennis, Harwich, Brewster & Chatham
Selectman*/Towns of Orleans, Eastham, Wellfleet, Truro & Provincetown
Chair/Mashpee Wampanoag Tribal Council

**One selectman from each set of towns is elected by the selectmen to serve*

The MPO is served by an advisory body: the Cape Cod Joint Transportation Committee (CCJTC). The CCJTC membership includes representatives from each of Barnstable County's fifteen towns and a bicycle advocate.

Development of the RTP also includes consultation with or consideration of a wide-range of federal, state, and local agencies and organizations. Such agencies include:

Regulatory Agencies

Cape Cod Metropolitan Planning Organization
Cape Cod Joint Transportation Committee
Cape Cod Commission
Massachusetts Department of Transportation
Massachusetts Department of Recreation and Conservation
Cape Cod Towns
Federal Highway Administration
Federal Transit Administration
U.S. Army Corps of Engineers
Barnstable County Government

Coordinating Agencies

MassRides
MassBike
Cape Cod National Seashore (National Park Service)

Transportation Providers

Cape Cod Regional Transit Authority
Woods Hole, Martha's Vineyard and Nantucket Steamship Authority
Plymouth and Brockton Street Railway Company
Peter Pan – Bonanza Bus Lines
Cape Cod Central Railroad
Bay Colony Railroad
Other Freight Companies
Hy-Line Cruises

Air Transportation Companies

Cape Air
Nantucket Air

Neighboring Agencies

Old Colony Planning Council
Southeastern Regional Planning and Economic Development District
Martha's Vineyard Commission
Nantucket Planning and Economic Development Commission

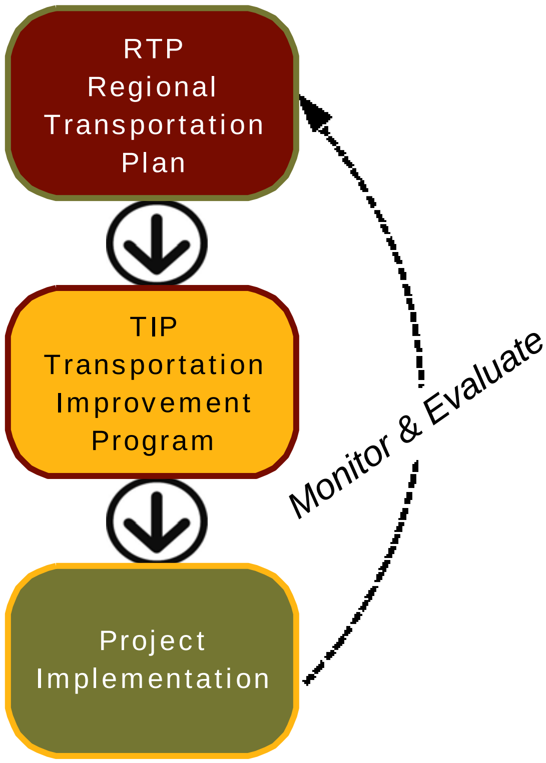


FIGURE 2 - TRANSPORTATION PLANNING PROCESS FLOWCHART

The figure above shows the relationship between the development of the long-range plan (RTP), the funding element known as the Transportation Improvement Program (TIP), and implementation (e.g., construction of road improvements, operation of new transit services, etc.). Federal legislation requires updates to the TIP every four years; however the Cape Cod MPO typically performs this update on an annual basis. Note the dashed red arc from "Project Implementation" to the "RTP." This line represents the on-going monitoring and evaluation of the transportation system that is used to inform the RTP decision-making. The primary method whereby this is accomplished is through the MPO's Unified Planning Work Program (UPWP). The UPWP, developed annually, outlines all major transportation studies and planning efforts (including the development of the RTP and TIP). The MPO staff's efforts through UPWP studies form the bases for most of the projects prioritized in the RTP and TIP.

1.2 PUBLIC PARTICIPATION PROCESS

Adequate opportunity for public official (including elected officials) and citizen involvement must be provided in the development of the transportation plan. Review procedures shall include opportunities for interested parties (including citizens, affected public agencies, representatives of transportation agency employees, and private providers of transportation) to be involved in the early stages of the plan development/update process. The public participation elements associated with the development of the Plan for the Cape Cod region include the following elements.

1.2.1 MEETINGS

Numerous meetings have been held to discuss development of the Cape Cod Regional Transportation Plan. The following list includes partial list of meetings held solely for the plan, as well as meetings of various organizations at which the RTP was discussed. Meetings held are listed by organization or meeting type, the most recent meetings are listed first. The latest list of RTP meetings is available online at the Cape Cod Commission's websites.

Cape Cod Metropolitan Planning Organization, time and day varies, Cape Cod Commission Office, Barnstable

- Meetings beginning in July 2010 and continuing throughout the development of the RTP

Cape Cod Joint Transportation Committee – 8:30 Fridays once per month, Cape Cod Commission office, Barnstable

- Meetings beginning in February 2010 and continuing throughout the development of the RTP.

RTP Focus Workshops (Hyannis Transportation Center)

- Roadways & the Environment: Wednesday, July 28, 2010 – 3:00 PM
- Air, Ferry, and Rail: Monday, July 19, 2010 – 3:00 PM
- Public Transit: Tuesday, July 13, 2010 – 3:00 PM
- Bicycle and Pedestrian: Saturday, June 26, 2010 – 1:30 PM

Regional Transportation Plan Public Meetings:

- August 16, 2011 – 3:30 PM – Cape Cod Commission Office (Barnstable)
- Thursday, March 18, 2010 – 1:30 PM - Bourne Memorial Community Center
- Tuesday, March 16, 2010 – 4:00 PM – Hyannis Transportation Center
- Monday, March 15, 2010 – 7:00 PM – Salt Pond Visitors' Center (Eastham)

CCJTC Projects Review Subcommittee - Hyannis Transportation Center

- Friday, February 4, 2011 - 10 AM

Transportation Public Meeting – Cape Cod Commission office, Barnstable

- Tuesday, January 4, 2011 – 4:00 PM

National Park Service – Teleconference with Denver Service Center @ Cape Cod Commission office, Barnstable

- Tuesday, December 14, 2010 – 2:00 PM

Transportation Open House – Cape Cod Commission office, Barnstable

- Thursday, August 12, 2010 – 1:30 PM

Orleans Traffic Safety Committee - Orleans Police Department

- Wednesday, May 26, 2010 - 10 AM

Harwich Board of Selectmen - Harwich Town Hall

- Monday, May 24, 2010 - 7:15 PM

Sandwich Bicycling Committee - Sandwich Hollows Function Room

- Tuesday, May 4, 2010 - 7 PM

MassDOT State Transportation Plan Workshop - Hyannis Transportation Center

- Tuesday, April 20, 2010 - 6 PM

1.2.2 SURVEYS AND COMMENT FORMS

Every five years, the Cape Cod Commission (CCC) prepares a Regional Policy Plan (RPP) to guide development throughout Barnstable County. The Plan seeks to balance population growth and economic development with protection of the Cape's natural resources and community character. In order to produce an updated RPP that meets the needs and goals of all Cape residents, the CCC engaged the Center for Survey Research (CSR) at the University of Massachusetts Boston to conduct a survey of Cape Cod residents to solicit their views about important local issues. A key finding from the report pertained to transportation. Under the category of "Current Problems for Towns and for the Cape:"

> "*Respondents consistently identify traffic congestion as a big problem for their town and for the Cape as a whole. They see it as a serious problem for the future as well.*"

From a list of twenty potential problems, traffic congestion was identified by respondents as the most serious problem for their town (57% rated as "Serious"; 92% rated as "Serious or Moderate"). For the entire Cape, traffic congestion was also identified as the most serious problem (73% rated as "Serious"; 98% rated as "Serious or Moderate"). Looking again at the list of twenty potential problems, the results are consistent as traffic congestion was mentioned as among the three worst problems for their town by about 39% of respondents and for the Cape by about 46% of respondents.

Respondents also identified “Future Problems for Towns and for the Cape.” The top issue respondents believe will be a problem in the next five years is traffic congestion. 91% of respondents rated traffic congestion in their town as a serious problem in the next 5 years; for the entire Cape, this figure is 94%. The concern about traffic may translate directly to respondents’ ideas about setting priorities and development. 68% of respondents indicated that the amount of development on Cape Cod is too much (4% said too little and 28% feel there is about the right amount).

RTP Questionnaire Results

To further facilitate public comment, a five-page RTP questionnaire was distributed at public meetings. The questionnaire was also announced in the Cape Cod Commission *Reporter* newsletter, and on the Cape Cod Commission Transportation Information Center at www.gocapecod.org/rtp with an on-line option for respondents to use. The questionnaire included questions on goals and priorities, identification of local and regional safety problems, and regional congestion problems. There were also a number of example projects for respondents to indicate their support (or opposition).

Twenty-eight comment forms were submitted electronically or collected at public meetings. One of the most valuable benefits of this input was the generation of potential solutions. These are discussed at length in a later chapter of the RTP (Analysis of Alternatives). The questionnaire was also used to gauge respondents’ views regarding safety and congestion. The most common “Factor to Consider” in determining the most important transportation projects for the Cape was improved public transportation. Also listed prominently were recommended improvements for bicycling and walking and safety improvements.

RTP Objectives

Respondents were presented with a list of 15 potential transportation objectives for Cape Cod and asked to assign a value of 1 – 5 (5 being the most important) to the top five priorities. Results included:

- The highest number of responses (17) included “Maintain roads and bridges to avoid costly reconstruction” as a top 5 priority (average response =2.88).
- 16 respondents supported “Improve hazardous locations by constructing safety improvements (e.g., turning lanes, median barriers, etc.) at an average response of 3.50
- Also reaching a threshold of 3.50 average response, 14 respondents highly ranked “Improve public transportation (bus, air, rail, and water transportation)”

- The highest average response, 4.50, was given by 2 respondents for "Allow traffic congestion within 'growth centers' to be offset with reduced congestion outside 'growth centers.'

Potential projects

There were 17 potential projects listed in the questionnaire, and respondents were asked to rate their support (or opposition) to each.

None of the projects fell into the "-2" (greatly oppose) or "-1" (oppose) categories. Five projects fell into the "0" (neutral) range. Projects in the "+1" (support) range include:

- Expand Cape-wide year-round bus service
- New "Bus-Only" lanes for Route 3 and Route 6 (to improve reliability of public transit)
- Transportation management center (facility to monitor and coordinate traffic & transit operations)
- Extension of Cape Cod Rail Trail from S. Wellfleet to Provincetown
- Hyannis: underpass of major traffic flows at the Barnstable Airport Rotary

Projects achieving the "+2" (greatly support) rating include:

- Rail service to Hyannis (connections to Boston/Providence)
- Variable message signs (for alerting motorists about traffic conditions)
- Live traffic reports (via radio, internet, etc.) for Cape Cod Canal area roads & bridges
- Falmouth-Chatham: Route 28 bicycle accommodations (e.g., bike lanes, wider shoulders, "share the road" program)
- Route 6: reconfigure Exit 1 (move westbound ramps away from Sagamore Bridge)
- Bourne Rotary replacement (similar to Sagamore Rotary project)
- Additional travel lanes and multi-use path on Yarmouth Rd/Willow St
- Improved crossing of Cape Cod Canal (new bridge or tunnel)

Congestion Areas:

One section of the questionnaire queried respondents on their perceptions of congestion. When considering the region as a whole, common themes emerged including:

- Cape Cod Canal Bridges
- Yarmouth Road/Willow Street in Barnstable
- Route 28 from Falmouth to Yarmouth, especially in the Hyannis area.

The respondents were also asked to "*...list the top three areas that have the worst LOCAL TRAFFIC DELAY problems*" for the town that they resided in or spent the most time in. The following table presents a list of the top two locations identified from the questionnaire:

TABLE 1 - RTP LOCAL TRAFFIC DELAY AREAS (FROM PUBLIC COMMENT FORM)
(Responses as of 8/23/2010)

Town	Location #1	Location #2
Barnstable	Route 132 signals	Yarmouth Road/Willow Street
Bourne	Bourne Rotary	Sandwich Road
Eastham	Route 6 southbound to Eastham Rotary	Route 6 northbound @ Wellfleet town line
Falmouth	Teaticket Highway (Route 28)	Route 28 @ Jones Road/Ter Heun Drive
Harwich	Main Street (Route 39) @ Route 124	Route 6 Exit 11 off ramp
Mashpee	Mashpee Rotary	Route 151 @ Old Barnstable Road
Orleans	Route 6A @ Main Street	Main Street @ Old Colony Way
Truro	Left turns onto Route 6	
Yarmouth	Route 28 in West Yarmouth	Route 28 @ Station Avenue

Safety Problem Areas:

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

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

TABLE 2 - RTP LOCAL SAFETY PROBLEM AREAS (FROM PUBLIC COMMENT FORM)

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

1.2.3 INCLUSION OF ENVIRONMENTAL, HUMAN SERVICE, AND CULTURAL RESOURCE ORGANIZATIONS

Notices of meetings and announcements of RTP development activities have been sent to federal, state, and local elected representatives and public officials. Among the approximately 150 contacts on the transportation mailing list are many members of the public. Several environmental, human service, cultural resource, and related stakeholder organizations are included in this process. These include:

- Barnstable Historical Commission
- Association to Preserve Cape Cod
- Barnstable County Department of Human Services
- Cape Organization for the Rights of the Disabled
- Massachusetts Coastal Zone Management
- Massachusetts Department of Environmental Management
- Massachusetts Department of Conservation and Recreation
- Massachusetts Bike Coalition

1.3 LIVABILITY Ⓛ

Livability refers to the social and environmental quality of an area as perceived by residents, workers, and visitors. The U.S. Department of Transportation considers the principle of Livability to be essential to the success of regional transportation planning. According to the Victoria Transport Policy Institute, this includes safety and health (traffic safety, personal security, public health), local environmental conditions (cleanliness, noise, dust, air quality, water quality), the quality of social interactions (neighborliness, fairness, respect, community identity and pride), opportunities for recreation and entertainment, and aesthetics. In the particular case of Cape Cod, especially important are the existence of unique cultural and environmental resources (e.g., historic structures, mature trees, traditional architectural styles).

Livability directly benefits people who live in, work in or visit Cape Cod, increases property values and business activity, and it can improve public health and safety. Livability is largely affected by conditions in our public spaces, places where people naturally interact with each other and their community, including roads, conservation lands, transportation hubs and other public facilities, and so is affected by public policy and planning decisions.

Transportation decisions can have a major impact on Livability. Streetscapes that are attractive, safe and suitable for a variety of transportation modes (particularly walking) are a key factor in Livability. Traffic safety, traffic noise and local air pollution, affordability, impervious surface coverage (i.e., the portion of land devoted to roads and parking), preservation of environmental and cultural structures, and opportunities for recreation are all Livability factors often affected by transportation policies and practices. Transportation decisions can also affect social interactions and community cohesion. Pedestrian-friendly streets create opportunities for people to meet and interact, helping to create community networks.

Traditional transportation planning tends to emphasize vehicle mobility improvements over other Livability objectives. Many roads were designed primarily to maximize traffic flow, and buildings were designed to maximize parking convenience. Far greater resources were devoted to automobile facilities (road and parking) than for nonmotorized modes. There is now increasing appreciation of the importance of Livability objectives. Planners realize that roads often play multiple roles as both travel corridors and places for community interaction. Many communities now favor roadway improvements that reduce traffic speeds and limit traffic volumes for the sake of Livability. The principles of Livability have been implicit in all editions of the Cape Cod Regional Transportation Plan (RTP). In this 2012 RTP as a guide to readers, each section that directly supports Livability is identified with the green circled L symbol:

Ⓛ

The MPO continues to support Livability through the endorsement of supporting projects developed for the Transportation Improvement Program (TIP). Recent TIP projects are shown in Section 1.5.1 later in this chapter. Livability projects are indicated with the green circled L symbol in Table 3.

1.4 GOALS OF THE 2012 PLAN

The purpose of these goals is to produce a coherent and comprehensive framework for the development of projects and programs that address the transportation needs of the Cape Cod Region.

Mission Statement:

The Regional Transportation Plan will propose a strategy that will maintain and improve a transportation system on Cape Cod for present and future year round and seasonal needs which is safe, convenient, accessible, cost-effective, and consistent with the Cape's historic, scenic and natural resources.

This mission statement and Cape Cod Metropolitan Planning Organization (MPO) guidance served as a foundation for the formation of eight goals for the 2007 Regional Transportation Plan:

- Safety and Security
- Congestion Relief
- Multimodal Accessibility
- System Maintenance
- Environmental Protection
- Community Orientation
- Equitability
- Cooperation among Stakeholders

Input received through public meetings, surveys, and presentations to local organizations contributed to the development of these goals. Moreover, the Regional Transportation Plan is designed to conform to federal, state and local transportation goals.

1.4.1 SAFETY AND SECURITY

Transportation users have a right to a transportation system where their person and possessions will arrive at their destinations unharmed and undamaged. Moreover, protecting the value of freight traveling over the transportation network is essential to the economy of Cape Cod. Therefore, it is important that transportation infrastructure be designed to minimize the possibility of hazardous situations or accidents. Existing traffic laws must also be enforced to prevent the improper use of the transportation system. The transportation system must also prepare for natural disasters, such as hurricanes or flood. Moreover, in a post-9/11 world, protecting users from external threats is also a priority, as indicated by the increased emphasis on security in federal and state transportation regulations and guidelines. For all of these reasons, the

Regional Transportation Plan is developed with the first goal of providing safety and security to people and goods.

Goal #1:

Create a transportation system that provides safe travel options for people and freight, and protects users from natural and external threats.

The following items include actions and policies to support this Goal:

- Make physical improvements that ***improve the safety and security*** of the transportation network a priority.
- ***Continuously monitor*** the condition of the transportation system to ensure that it is safe to travel on all modes throughout Cape Cod.
- ***Identify high priority safety locations*** throughout Cape Cod and then determine measures to increase safety at those locations
- ***Separate high- and low-speed travel modes***, so that those traveling at slower speeds, such as bicycles and pedestrians, do not conflict with those traveling at higher speeds, such as rail and automobile traffic.
- For proposed roadways with cross-sections of four or more lanes, ***landscaped median dividers shall be included*** to provide a reasonable level of safety and access management.
- Existing multilane roads (cross-sections of four or more lanes) are recommended to be modified via removal of unneeded lanes or installation of ***landscaped median dividers*** to provide a reasonable level of safety and access management.
- To reduce injury crashes, when developing intersection improvements such as the signalization of previously unsignalized locations, include construction of a ***modern roundabout*** as an alternative.
- ***Encourage safe use*** of the transportation network through public awareness campaigns, promoting such things as seatbelts for motorists and helmet use for bicyclists
- ***Incorporate intelligent transportation systems***, such as variable message signs and other media alerts, into the emergency response system.
- Foster ***communication and cooperation*** between federal, state, and local agencies for the planning, practice, and implementation of emergency scenario plans.

- Designate and indicate, through road signs, ***emergency evacuation routes, and shelters.***
- Support enforcement of state and local traffic laws.
- Increase ***surveillance and security efforts at transportation facilities*** throughout Cape Cod, such as the Hyannis Transportation Center, Falmouth Bus Depot, Woods Hole port facilities, park-and-ride lots, and Cape Cod Canal Bridges.

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

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

Implementation of many of these Emphasis Areas is demonstrated through the recommendations provided in Chapter 3 –Safety of this RTP.

1.4.2 CONGESTION RELIEF

Congestion presents users with longer travel times, increased safety concerns, and greater frustration. It also makes it harder for travel by alternative transportation modes, such as buses, bicycles, and pedestrians. Additionally, congestion affects other entities, such as businesses that rely on transportation access for their employees and customers. Congestion also produces more air pollution and increases greenhouse gas emissions that contribute to global warming, and decreases the overall attractiveness of the region. For all these reasons, addressing the deficiencies in infrastructure, land use and behavioral choices that lead to congestion is a priority of the Regional Transportation Plan.

Goal #2:

Optimize travel time throughout the transportation system for people and freight by pursuing strategies to reduce congestion in areas where it exists and taking proactive measures to prevent congestion in currently free-flowing areas.

The following items include actions and policies to support this Goal:

- ***Identify high-traffic congestion locations*** throughout Cape Cod and consider solutions to address that congestion.
- Consider strategies that ***encourage alternative transportation modes*** in identified high-congestion locations, so that people have options other than automobiles.
- Consider strategies to ***address the behavioral causes*** of traffic congestion such as VMT reduction strategies as well as changes to transportation infrastructure.
- Where possible, ***incorporate the Congestion Management System***, including new roadways, intersection improvements, park-and-ride, and transit capacity, into transportation projects and programs.
- ***Support all strategies*** for transportation demand management including, but not limited to, Transportation Management Associations, flexible hours, carpooling, bus pas programs, preferential parking, and telecommuting.
- Encourage ***transit-oriented development*** and provide alternatives to automobile travel by linking land use decisions with transit, bikeway, pedestrian, and park-and-ride investments.
- To reduce traffic congestion and facilitate free-flowing traffic, when developing intersection improvements such as the signalization of previously unsignalized locations, include construction of a ***modern roundabout*** as an alternative.
- Consider the feasibility of ***congestion pricing*** on major routes on Cape Cod.
- Assess the capacity of Cape Cod's ports and harbors in accommodating ferry traffic and recommend strategies to solve existing ***ferry congestion*** or prevent future congestion.
- Examine the ***road traffic around Cape Cod's ports and harbors*** to determine the ability of the current infrastructure to accommodate ferry-related auto traffic
- Assess the capacity of Cape Cod's airports in accommodating air traffic and recommend strategies to solve existing ***air traffic congestion*** or prevent future congestion.
- Examine the ***road traffic around Cape Cod's airports*** to determine the ability of the current infrastructure to accommodate air-related auto traffic.

1.4.3 MULTIMODAL ACCESSIBILITY Ⓛ

The purpose of a transportation system is to get people from where they are to where they want to go. Additionally, freight must be transported from where it is to where it can be consumed or processed. The costs of this transportation system in time and money are increased for the user if it is difficult to access the transportation system, or if circuitous routes must be taken to reach a destination. Addressing accessibility, connectivity, and mobility with a multimodal approach is one of the goals of the Regional Transportation Plan.

Goal #3:

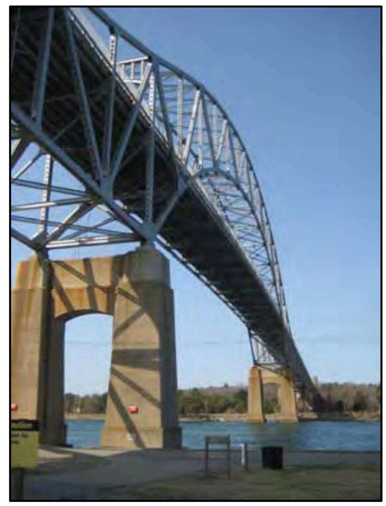
Connect village centers, economic and employment centers, and points of interest using multiple coordinated modes of transportation in a direct and efficient manner.

The following items include actions and policies to support this Goal:

- ***"Complete Streets"*** are encouraged as a design guideline to accommodate all users including pedestrians, bicyclists, persons in wheelchairs or strollers, public transportation users, and motorists. In order to provide transportation options for Cape Cod residents and visitors to conveniently travel between destinations, each public right of way should be planned, designed, constructed, and/or maintained considering all users for a Complete Street design. A Complete Street design on Cape Cod also considers the environmental and physical context along with local public input.
- ***Sufficient mobility*** must be provided to ensure that individuals and freight can travel safely and efficiently among the communities of Cape Cod and their neighbors
- ***Support established village and town centers*** and growth areas as identified in the Commission's Regional Land Use Vision Maps with a broad range of transportation options, such as roadways, transit, bicycle and pedestrian facilities
- ***Examine expansion of bus, rail and bicycle*** services and infrastructure to villages and town centers currently un-served by alternative transportation modes
- Create ***mini-intermodal centers*** in village and town centers, where appropriate, to encourage better connection and coordination between modes.
- ***Coordinate public transportation*** services and schedules between regions and between providers to decrease wait times for users during connections.
- ***Provide bicycle amenities***, such as racks and/or lockers, at park-and-ride lots, transit centers, and village and town centers that support bicycle networks.
- ***Enhance the transportation of freight*** on Cape Cod to decrease travel times, increase reliability and lower costs for freight transportation providers, with minimal disruption to other transportation activities.

- Where possible, work to ***consolidate freight*** so as to move goods in the most efficient manner.
- Make available ***multiple modes for freight*** transportation, with infrastructure and facilities that are designed to support quick and efficient changes in mode.

1.4.4 SYSTEM MAINTENANCE



Millions of public and private dollars of have been invested in Cape Cod's current transportation system. Implicit in this investment is a trust placed in public agencies to maintain and upkeep transportation infrastructure, capital, and programs. Moreover, new technologies present the possibility of safely increasing the capabilities of the current transportation system beyond original design limitations. By maintaining the current system and incorporating new technologies, the life of the existing system can be extended and the value returned to users can be maximized. For these reasons, the Regional Transportation Plan includes the preservation, maintenance and modernization of the existing transportation system as a goal.

Goal #4:

Preserve, Maintain, and Modernize the Existing Transportation System.

The following items include actions and policies to support this Goal:

- Ensure that ***adequate funds*** are reserved for maintenance and operation of the existing transportation system before new capital projects are considered in accordance with the Commonwealth's "Fix-it-First" policy.
- Reserve adequate funds for the maintenance of ***alternative modes of transportation,*** such as public transportation services, sidewalks, and bicycle paths.
- As transportation services are considered for areas subject to the effects of ***sea-level rise***, new facilities shall be constructed with consideration to vulnerability.
- Create and implement asset management tools for ***monitoring*** and maintaining the existing transportation system. Include automatic traffic monitoring equipment as part of intersection upgrades.
- Support maintenance strategies and programs that ***accommodate safe travel*** throughout the transportation network, regardless of mode.
- Consider the ***use of new technologies*** that will lower costs, extend infrastructure life, lower environmental impacts, and reduce energy consumption and emissions.

- New transportation projects must consider inclusion of ***intelligent transportation system (ITS)*** elements, such as variable message signs, highway advisory radio, local television, web travel services, and smart signals that can provide travel data as well as react to changes in demand.

1.4.5 ENVIRONMENTAL PROTECTION

The natural environment is a valuable asset that we share. Clean air, clean water, and sustainable ecosystems benefit all of the residents of Cape Cod. The natural environment also serves as an attraction for tourists and recreational users, which benefits the economy of Cape Cod. The 2008 Global Warming Solution Act requires 10-25% reductions in greenhouse gas emissions below 1990 levels by 2020. The Massachusetts Executive Office of Energy and Environmental Affairs will be setting target reductions. According to the U.S. Environmental Protection Agency, vehicle miles traveled (VMTs) in Barnstable County increased 28.9 % between 1996 to 2007, and are expected to increase another 45.6% between 2007 to 2030 under current trends.

To protect and preserve our environment, MassDOT has recently instituted the "GreenDOT" policy initiative. This, in part, is intended to conform with the Massachusetts' Global Warming Solutions Act. GreenDOT policy advises MPO's to monitor and track greenhouse gas (GHG) impacts throughout the regional planning process.

In order to maintain and enhance the current state of the environment for future generations, the Regional Transportation Plan includes environmental protection as a goal.

Goal #5:

Create a transportation system that maintains, protects, and enhances the natural environment of Cape Cod.

The following items include actions and policies to support this Goal:

- ***Design an environmentally friendly transportation system*** that protects and enhances the natural environment, including the protection of habitat, water quality, and agricultural and forest land, while minimizing invasive species and reducing greenhouse gas emissions.
- Develop strategies to reduce vehicle miles traveled (VMTs)

- Comply with state and federal environmental regulations.
- Encourage the use of ***alternative transportation*** modes that reduce air pollution, fuel consumption, and other environmental impacts such as greenhouse gas emissions.
- Pursue strategies that will get automobiles and trucks moving at ***speeds that will minimize air pollution***.
- To reduce emissions from idling vehicles, when developing intersection improvements such as the signalization of previously unsignalized locations, include construction of a ***modern roundabout*** as an alternative.
- Replace public buses and vehicles with ***fuel-efficient, hybrid, or bio-diesel*** vehicles that will reduce fossil fuel consumption.
- As roadway improvement projects are developed, ***stormwater management*** techniques shall be included to control surface runoff and avoid contamination of nearby water bodies. Special concern should be given to impaired marine and fresh water bodies identified by the Department of Environmental Protection.
- Design roadways to ***drain and cleanse oil and gasoline runoff*** away from aquifers and other sensitive environmental areas.
- ***Create Harbor and Bay Management Plans*** to protect Cape Cod harbors and bays from pollution caused by excessive or improper boating use.
- ***Protect drinking water*** from materials used in the design, construction, operation, and maintenance of transportation facilities, such as road salt.
- Use ***landscaping and noise barriers*** to protect communities and minimize adverse impacts.
- Provide safe right-of-way crossings for wildlife

1.4.6 COMMUNITY ORIENTATION Ⓛ

The transportation system is part of a larger societal system that includes land use, economic activity, cultural, and historical elements that vary by community. Inappropriate development will negatively affect these and other areas and undermine local goals. Transportation improvements and programs must instead work in concert with community goals and policies. Therefore, the Regional Transportation Plan includes community orientation as a goal.

Goal #6:

Create a transportation system that reinforces local development, land use, economic, cultural, and historic preservation goals.

The following items include actions and policies to support this Goal:

- All transportation projects and programs must be ***responsive to the natural and built environments*** within which they are undertaken.
- Develop a transportation system that ***supports the economic vitality of Cape Cod*** and its metropolitan areas, especially by enabling global competitiveness, productivity, and efficiency, through services provided by public and private operators.
- ***Involve community and business leaders*** in transportation projects and programs to ensure that local concerns are addressed.
- Develop context-sensitive design measures that support the "**Cape Cod Character**," while maintaining safety, accessibility, and sustainability. This leads to transportation projects that are in harmony with the community, and that preserve the environmental, scenic, aesthetic, historic, and natural resource values of the area.
- ***"Complete Streets"*** are encouraged as a design guideline to accommodate all users including pedestrians, bicyclists, persons in wheelchairs or strollers, public transportation users, and motorists. In order to provide transportation options for Cape Cod residents and visitors to conveniently travel between destinations, each public right of way should be planned, designed, constructed, and/or maintained considering all users for a Complete Street design. A Complete Street design on Cape Cod also considers the environmental and physical context along with local public input.
- Avoid, minimize or mitigate the impact of transportation improvements on parks, recreation areas, historic sites, and other ***scenic or cultural resources*** and minimize impact on overall community character.
- Support transportation projects consistent with Local Comprehensive Plans.

Current MassDOT sign policy does not allow business logo signs east of the Cape Cod Canal. The Cape Cod MPO recommends that this policy be maintained, except for "sponsor a highway" signs. On "sponsor a highway" signs, the Cape Cod MPO recommends that business logos be allowed at the discretion of the MassDOT District Office Director.

1.4.7 EQUITABILITY

Transportation is necessary for any individual who wishes to participate in today's modern society. An equitable transportation system can provide independence and mobility to senior citizens and the disabled, while also providing access and opportunities for low income individuals. For these reasons, it is vital that the transportation facilities of Cape Cod be safe, accessible and equitable for all citizens and visitors.

Goal #7:

Promote the equitable sharing of the transportation system's benefits and burdens including consideration of income, age, physical and mental ability, and transit dependency.

The following items include actions and policies to support this Goal:

- Ensure that new transportation projects ***treat all demographic groups equally***, so that particular demographic groups, such as seniors, low-income individuals or children, are not subjected to inequitable environmental, health, or financial impacts.
- Support programs that address the transportation needs of low income and transit dependent populations such as ***lifeline transit services.***
- Meet or surpass the ***requirements of the Americans with Disabilities Act***, for all transportation projects and programs.
- ***Support self-sufficiency*** by providing specialized transportation services.
- Tailor specific transportation programs for those without access to automobiles, such as students and senior citizens.
- Improve the engagement of low income and minority populations in the transportation decision-making process.

1.4.8 COOPERATION AMONG STAKEHOLDERS

The transportation system has an effect on local communities. Moreover, no improvements can be made to the system without the participation of multiple public and private organizations. When these stakeholders, whom include private citizens, businesses, and government agencies, get together to pool resources, share ideas, and coordinate activities, better projects and programs are produced. Hence, a goal of the Regional Transportation Plan is to foster cooperation among transportation stakeholders. In 2007 the Mashpee Wampanoag tribe gained sovereign status through federal recognition and efforts are being made to include tribal leaders in the transportation planning process.

Goal #8:

Base projects and programs on an objective, transparent and inclusive decision-making process in cooperation with federal, state, regional, and local transportation agencies, government officials, businesses and citizens.

The following items include actions and policies to support this Goal:

- Encourage ***public attendance*** at meetings of the MPO and other transportation agencies that participate in the planning of Cape Cod's transportation system.
- Have the various transportation agencies on Cape Cod hold regular ***Open Houses***, where the public can observe the transportation development process.
- Foster ***greater communication and involvement*** between the various transportation agencies on Cape Cod.
- Ensure ***Consistency with Federal and State Transportation Regulations*** and Guidelines, such as SAFETEA-LU, the "Massachusetts Long-Range Transportation Plan," and the emissions reductions required under the Global Warming Solutions Act.
- Pursue projects and studies that conform to and reinforce the vision of the Cape Cod Regional Policy Plan.
- Develop a set of ***objective transportation project evaluation criteria*** so that stakeholders can compare proposed projects in a consistent manner.
- Maintain a ***continuous transportation survey***, available via the internet or by request through the mail.
- Work within funding constraints, so that the transportation system is maintained, built and operated in an ***efficient and cost-effective*** manner.
- ***Disclose funding sources and disbursements*** in an open, simple and straightforward manner.
- Publish all existing data, studies, and activities relevant to Cape Cod's transportation system

1.5 CHANGES SINCE THE 2007 PLAN

This section includes discussions of new or expanded transportation planning goals and a status listing of projects since the 2007 RTP.

1.5.1 TRANSPORTATION PROJECTS SINCE THE 2007 PLAN

Subsequent to the creation of the 2007 RTP, the following table includes a listing of the Cape's Transportation Improvement Program (TIP) projects. The TIP is the short-term funding element of the transportation planning process. The listed projects have either been constructed, implemented, advertised, or are undergoing construction.

The nineteen projects listed in the following table include funding for public transit, roadway maintenance and intersection improvement, bridge reconstruction, bicycle facilities and design of safety improvements. The total estimated cost or award amounts for all of these projects are over 86 million dollars.

TABLE 3 - TIP PROJECTS CONSTRUCTED, IMPLEMENTED, ADVERTISED, OR UNDERWAY

Town	Location	Est. Cost or Award Amount
BARNSTABLE	Hyannis Gateway / Main Street Ⓛ	$378,944
BARNSTABLE	Route 6A resurfacing	$3,045,000
BARNSTABLE	Route 132 Boulevard Ⓛ	$9,600,000
BARNSTABLE	Route 132 Boulevard Landscaping Ⓛ	$1,100,000
BARNSTABLE	Route 28 at three locations: Route 149, South County Road, Lumbert Mill Road	$3,200,000
BOURNE	Route 6 Scenic Highway at Edgehill Road	$3,948,728
BOURNE	Route 6 Scenic Highway resurfacing	$1,651,519
CAPEWIDE TRANSIT	Cape Cod Regional Transit Authority (CCRTA) Ⓛ	$34,409,544
DENNIS	Swan River Road reconstruction Ⓛ	$2,300,000
DENNIS	Route 28 at Route 134 intersection improvements	$596,000
DENNIS	Route 6A resurfacing	$1,680,620
EASTHAM/ ORLEANS	Route 6 resurfacing and related	$2,200,000
FALMOUTH	Shining Sea Bikeway Phase III Ⓛ	$4,000,000
FALMOUTH	Water Street Drawbridge, Woods Hole	$8,000,000
FALMOUTH	Chapaquoit Road Bridge over West Falmouth Harbor	$3,000,000
FALMOUTH	Route 28 Section known as "Reine's Corner"	$2,000,000
HARWICH	Route 124 at Queen Anne Road intersection improvements	$859,800
ORLEANS	Route 28 and Finlay Road intersection	$590,000
PROVINCETOWN	Route 6 at Province Lands Road	$2,500,000
SANDWICH	Route 130/Water St and Main Street intersection (Town Hall Square) Ⓛ	$600,000
SANDWICH	Highway Safety Improvement Program Design(Sandwich: Cotuit Road/Harlow Road)	$458,514
YARMOUTH	Packet Landing site improvements Ⓛ	$633,436
Total:		**$86,752,105**

(Note: Ⓛ indicates project supports Livability principles. See section 1.3.)

1.6 COMPARING GOALS WITH OTHER PLANS

Effective transportation planning includes consideration of goals formulated at state and federal levels, and adjacent Regional Planning Agencies.

1.6.1 CONSISTENCY WITH FEDERAL TRANSPORTATION PLANNING GOALS

The RTP is formulated under a federal process as required in the 2005 transportation funding legislation known as the "Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users" (SAFETEA-LU). A comparison of SAFETEA-LU planning goals with those of the RTP is presented in the following table.

TABLE 4 - GOALS COMPARED: FEDERAL VS. RTP

	Safety and Security	Reduced Congestion	Accessible, Multi-modal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders
SAFETEA-LU	**Regional Transportation Plan Goals**							
Support the Economic vitality of the Metropolitan Area						◇		
Increase the safety of the transportation system	◇							
Increase the security of the transportation system	◇							
Increasing the accessibility and mobility of people and for freight			◇				◇	
Protecting and Enhancing the environment, promoting energy conservation…					◇			◇
…and promoting consistency with land use and economic development patterns						◇		
Enhancing the integration and connectivity of the transportation system			◇					
Promoting efficient system management and operation		◇		◇				◇
Emphasizing the preservation and efficient use of the existing transportation system		◇		◇				

1.6.2 CONSISTENCY WITH COMMONWEALTH TRANSPORTATION PLANNING GOALS

The RTP is formulated in cooperation with statewide planning efforts. The latest Massachusetts transportation plan (draft) is called “You Move Massachusetts.” A comparison of state planning themes with those of the RTP is presented in the following table.

TABLE 5 - GOALS COMPARED: MASSACHUSETTS TRANSPORTATION PLAN VS. RTP

Commonwealth of Massachusetts "You Move Massachusetts" Themes	Regional Transportation Plan Goals: Safety and Security	Reduced Congestion	Accessible, Multimodal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders
Improve Transportation System Reliability		◇	◇					
Focus More Attention on Maintaining our Transportation System				◇				
Design Transportation Systems Better	◇	◇				◇		
Encourage Shared Use of Infrastructure						◇		
Increase Capacity by Expanding Existing Facilities and Services		◇	◇					
Create a More User-Friendly Transportation System			◇			◇		
Broaden the Transportation System to Serve More People			◇				◇	
Provide Adequate Transportation Funding and Collect Revenue Equitably							◇	◇
Minimize Environmental Impacts					◇			
Improve Access to our Transportation System			◇				◇	

1.6.3 COMPARISON WITH CAPE COD REGIONAL PLANNING GOALS

The RTP is also formulated in consultation with the regional planning agency for Cape Cod – the Cape Cod Commission. Every five years, the Barnstable County ordinance known as the Regional Policy Plan (RPP) undergoes an update. A comparison of the current RPP (approved in 2009) transportation goals with those of the RTP is presented in the following table.

TABLE 6 - GOALS COMPARED: REGIONAL POLICY PLAN VS. RTP

	Safety and Security	Reduced Congestion	Accessible, Multimodal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders*
Transportation Goals from the Cape Cod Regional Policy Plan	**Regional Transportation Plan Goals**							
To improve safety and eliminate hazards for all users of Cape Cod's transportation system	◇						◇	
To reduce and/or offset the expected increase in motor vehicle trips on public roadways, reduce dependency on automobiles, and reduce air and noise pollution. To promote a balanced and efficient transportation system that includes alternatives to automobile travel.		◇	◇		◇		◇	
To maintain or improve travel times and Level of Service on roads and intersections and to ensure that all road and intersection construction or modifications are consistent with community character, historic resources, and scenic resources		◇		◇	◇	◇		

**The Commission conducts an inclusive public participation process during the review of Developments of Regional Impact, Local Comprehensive Plans, and other planning efforts.*

1.7 BACKGROUND AND DEMOGRAPHIC INFORMATION

Some concerns transcend region or mode, such as demographic changes, economic trends, or housing issues. This section addresses issues relating to Cape Cod as a region. An update of these demographics, include forecasts to RTP future milestone years is available in Chapter 7.

1.7.1 DEMOGRAPHICS

According to the Cape Cod Commission, from 1920 to 2000, Cape Cod was among the leading counties in Massachusetts for population growth. Between 1990 and 2000, Barnstable County added about 35,600 residents, an increase of 19.1% according to the

Census. The most recent estimates have shown a decline in population for Cape Cod since the 2000 Census. Barnstable County's 2009 population estimate is 221,151 residents – almost a half percent reduction from 2000. The following figure displays the Census Bureau's annual population estimates for Barnstable County.

Between 2000 and 2009, only two counties in Massachusetts experienced negative population growth: Barnstable County (-0.49%) and Berkshire County (-4.2%). Both of these counties were inconsistent with Massachusetts' 3.85% positive growth. The two counties with the most estimated growth for this time period are Nantucket County (18.93%) and Suffolk County (9.25%).

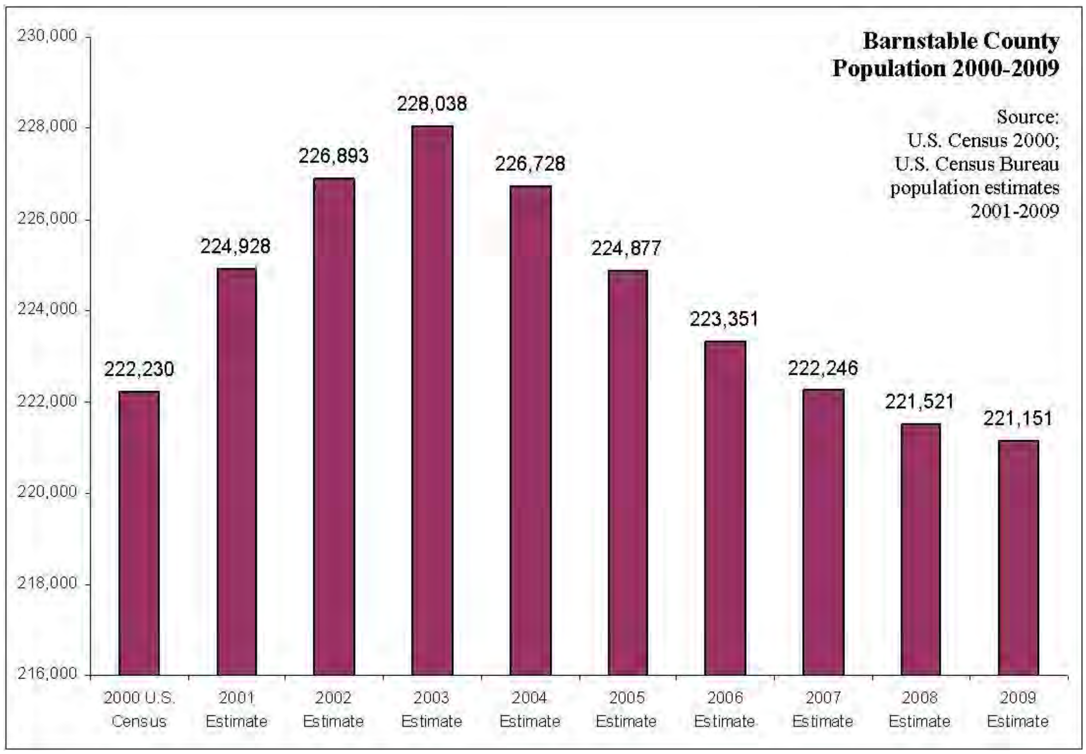


FIGURE 3 - BARNSTABLE COUNTY POPULATION GROWTH 2000-2009

While Barnstable County's overall population has been estimated to have declined since 2000, there has been a lot of variability between the included towns. Of the fifteen towns within Barnstable County, five have shown positive growth. Mashpee has grown the most during the eight year time span, adding almost 10% to its 2000 population. According to the Census, the other four towns with positive growth are Bourne, Chatham, Falmouth, and Truro. Yarmouth and Dennis have shown the greatest decline: -4.15% and -3.91%, respectively.

TABLE 7 - A COMPARISON OF CAPE COD TOWNS' 2000-2008 POPULATION CHANGE

Cape Cod Town	2000 Census	2008 Est.	00-'08 Change
Barnstable	47,821	46,184	-3.42%
Bourne	18,721	19,392	+3.58%
Brewster	10,094	9,936	-1.57%
Chatham	6,625	6,701	+1.15%
Dennis	15,973	15,349	-3.91%
Eastham	5,453	5,438	-0.28%
Falmouth	32,660	33,123	+1.42%
Harwich	12,386	12,298	-0.71%
Mashpee	12,946	14,227	+9.89%
Orleans	6,341	6,269	-1.14%
Provincetown	3,431	3,376	-1.60%
Sandwich	20,136	20,129	-0.03%
Truro	2,087	2,125	+1.82%
Wellfleet	2,749	2,724	-0.91%
Yarmouth	24,807	23,778	-4.15%

Transportation infrastructure on Cape Cod must accommodate those areas where population growth is attracting new residential development. Otherwise, new residents will not be able to access jobs, shopping, schools, or other basic services.

While overall population is one way to assess demand for transportation, examining the number of households is another indicator of the number of trips generated. Households are the start and end to almost all trips, such as trips to work, shopping, and school. The number of households and household sizes are used by travel demand models to predict regional travel patterns. On Cape Cod, there are 94,822 households, with an average size of 2.28. Of all Cape towns, Barnstable has the most households with 19,626, while Truro has the least with 907 (See Table below). There have also been significant disparities between towns regarding changes in the number of households. While Mashpee experienced almost three times as much growth in households as the entire Cape (66.4%), Provincetown actually lost households (-5.4%). For all Cape Cod, the number of households increased by 22.2% between 1990 and 2000, but the average size of those households decreased. This means that there are more households on Cape Cod with less people. The average household shrank in size for all Cape Cod towns, except Mashpee. Bourne (-0.21), Falmouth (-0.12), and Dennis (-0.11) had the greatest decreases in average household size in the county (See Table below). Cape Cod towns must ensure that the changes in the number and type of trips made by these households are provided for by the transportation system.

TABLE 8 - NUMBER OF HOUSEHOLDS AND HOUSEHOLD SIZE FOR CAPE COD AND TOWNS

	Total Households 2000	% Change from 1990	Avg. Household Size 2000	Change from 1990
United States	105,480,101	14.7%	2.59	-0.04
Massachusetts	2,443,580	8.7%	2.51	-0.07
Cape Cod	94,822	22.2%	2.28	-0.07
Barnstable	19,626	18.2%	2.38	-0.02
Bourne	7,439	26.1%	2.39	-0.21
Brewster	4,124	21.9%	2.34	-0.08
Chatham	3,160	4.5%	2.00	-0.10
Dennis	7,504	21.1%	2.11	-0.11
Eastham	2,396	25.6%	2.24	-0.10
Falmouth	13,859	22.9%	2.30	-0.12
Harwich	5,471	21.4%	2.20	-0.07
Mashpee	5,256	66.4%	2.91	No change
Orleans	3,087	13.4%	2.00	-0.09
Provincetown	1,837	-5.4%	1.69	-0.11
Sandwich	7,335	32.0%	2.72	-0.02
Truro	907	29.8%	2.18	-0.07
Wellfleet	1,301	15.2%	2.11	-0.10
Yarmouth	11,520	20.1%	2.68	-0.01

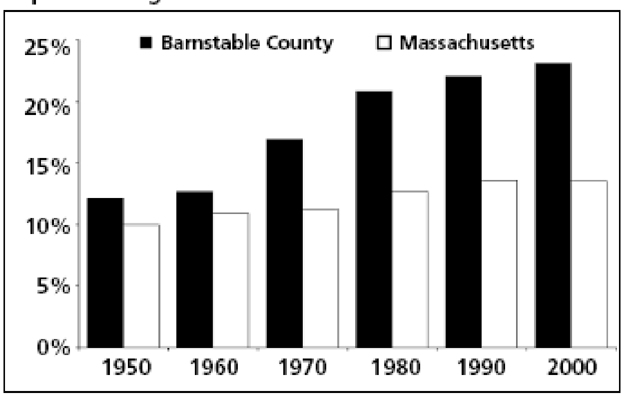
(Source: U.S. Census)

Age is an important demographic factor to be considered on Cape Cod. Between 1950 and 2000, the percentage of Cape Cod residents over 65 years of age almost doubled, from 12.1% to 23.1%. Between 1990 and 2000, the over 65 population on Cape Cod grew from 22.0% to 23.1%. By contrast, the over 65 population of the Commonwealth grew as a proportion to the overall population, from 10% to 13.5% (Figure 3). According to the Census, Barnstable County ranked 126th out of 3,141 counties nationally in terms of percent of population over the age of 65. At the time of the 2000 Census, the total number of residents on Cape Cod over 65 was 51,265, of which 57% are women. This means that the regional transportation system must consider the needs of the elderly to a greater extent than other local counties. Elderly residents generally have reduced vision, increased response time, and reduced mobility compared to the overall population. These concerns must be addressed in order to ensure safety and accessibility.

Of the Commonwealth's towns with the highest percentage of residents 65 and over in 2000, eight of the top ten towns were located in Cape Cod. Orleans led the

Commonwealth with 36.0% of residents over 65. Chatham (34.3%), Yarmouth (30.1%), Harwich (29.6%), Dennis (28.4%), Brewster (26.2%), and Eastham (26.0%), followed behind (Table 9). It should be noted that a higher percentage of elderly people does not equate to a higher number of elderly residents. The total elderly population is a product of the elderly percentage and the town's total population. The transportation facilities in these towns must be adapted to serve this population safely and conveniently.

Percent of Barnstable County and Massachusetts Population Age 65+



Source: U.S. Census 1950, 1960, 1970, 1980, 1990, 2000

FIGURE 4 - PERCENT OF BARNSTABLE COUNTY AND MASSACHUSETTS POPULATION AGE 65+

State Ranking by Town: Percent of Cape Residents Age 65+

Town	% Age 65+	State Rank*
Barnstable	20.1%	17
Bourne	17.6%	45
Brewster	26.2%	6
Chatham	34.3%	2
Dennis	28.4%	5
Eastham	26.0%	7
Falmouth	22.5%	10
Harwich	29.6%	4
Mashpee	18.6%	30
Orleans	36.0%	1
Provincetown	17.8%	41
Sandwich	13.7%	152
Truro	17.0%	59
Wellfleet	21.7%	11
Yarmouth	30.1%	3

*Ranked oldest to youngest among 351 Massachusetts municipalities. Source: U.S. Census 2000

TABLE 9 - STATE RANKING BY TOWN: PERCENT OF CAPE RESIDENTS AGE 65+

(Source: U.S. Census)

Teenagers comprise another demographic group that deserves special consideration. Residents aged 12-16 are old enough to be potential transportation users but are in most cases dependent on parents or others for transportation. This means that public transportation can offer an alternative and help 12-16 year olds gain mobility and independence. Residents aged 17-21 are in many cases new drivers. In order to ensure the safety of these new drivers, as well as existing drivers, the transportation system must be easy to use.

TABLE 10 - RESIDENTS AGED 12-21 ON CAPE COD, BY TOWN

	Population Aged 12-16	% of Total Population Aged 12-16	Population Aged 17-21	% of Total Population Aged 17-21	% of Total Population Aged 12-21	Rank
Barnstable	3,041	6.4%	2,215	4.6%	11.0%	4
Bourne	1,090	5.8%	1,339	7.2%	13.0%	2
Brewster	730	7.2%	424	4.2%	11.4%	3
Chatham	301	4.5%	226	3.4%	7.9%	13
Dennis	870	5.4%	604	3.8%	9.2%	9
Eastham	311	5.7%	208	3.8%	9.5%	8
Falmouth	2,163	6.6%	1,334	4.1%	10.7%	5
Harwich	681	5.5%	459	3.7%	9.2%	10
Mashpee	873	6.7%	512	4.0%	10.7%	6
Orleans	288	4.5%	208	3.3%	7.8%	14
Provincetown	93	2.7%	113	3.3%	5.9%	15
Sandwich	1,665	8.3%	978	4.9%	13.2%	1
Truro	117	5.6%	68	3.3%	8.9%	11
Wellfleet	172	6.2%	117	4.3%	10.5%	7
Yarmouth	1,248	5.0%	896	3.6%	8.6%	12
Cape Cod	13,643	6.1%	9,701	4.4%	10.5%	-

(Source: U.S. Census)

Overall, 6.1% of Cape Cod Residents are aged 12-16. Among towns, there is variation, since 12-16 year olds generally live with their parents, and some towns have larger households than others. The town with the greatest percentage of 12-16 year olds is Sandwich, at 8.3%. Following behind Sandwich are Brewster (7.2%), Mashpee (6.7%), Falmouth (6.6%), and Barnstable (6.4%). The town with the smallest percentage of 12-16 year olds is Provincetown, at 2.7% (See Table above). The data indicate that Upper Cape towns have the highest percentage of 12-16 year olds. Transportation services in this sub-region must consider their potential use by 12-16 year olds.

Residents 17-21 are generally high school and college students. College students often live on Cape Cod seasonally, returning home for the summer and for school vacations. In many cases, both high school students and college students are new drivers. On Cape Cod, the percentage of the population that is 17-21 is 4.4%. With the exception of Bourne, there are only a few percentage points of variation among towns, which is probably due to the fact that students move to other regions to attend college. Bourne has the highest percentage of residents 17-21 at 7.2%. This may be related to the Mass. Maritime Academy and the Mass. Military Reservation located within the town.

Sandwich (4.9%) and Barnstable (4.3%) follow behind. Truro has the smallest percentage of residents aged 17-21, at 3.3% (See Table on previous page). Like the 12-16 year old demographic, the Upper Cape towns have higher percentages of 17-21 year olds. However, pockets of 17-21 year olds can be found in Wellfleet and Brewster. Towns with higher percentages of 17-21 year olds must accommodate these young people in order to ensure that transportation infrastructure and services are safe, convenient, and not congested.

1.7.2 ECONOMICS

Economic factors also have an influence on transportation. Better economic times mean that people are working more, shopping more, and traveling more. Moreover, higher income families generate more trips, in most cases. More money means that people can purchase more gas and larger, more expensive vehicles. The types of jobs people have also influence transportation patterns. White collar workers generally have longer commutes, while blue collar service workers are located near their work sites.

Median household income on Cape Cod was $45,933 in 1999, below the statewide average. In fact, Cape Cod's median household income has been below the statewide average for the past 30 years. However, economic growth in Cape Cod has exceeded that of the state in the past decade. Sandwich is the highest income town in Barnstable County at $61,250, and has remained so for the last 30 years. By contrast, the median household income in Provincetown has remained the lowest in Barnstable County for the last 30 years. In 1999, the median household income in Provincetown was $32,716. Between 1989 and 1999, Wellfleet had the largest growth in household income of any town, at over 80% (See Table on next page).

TABLE 11 - MEDIAN HOUSEHOLD INCOME IN BARNSTABLE COUNTY

Median Household Income in Barnstable County

Town	1979 Income	1979 Rank in County	1989 Income	1989 Rank in County	1999 Income	1999 Rank in County	%Change 1989–1999
Barnstable	$16,312	4	$33,411	5	$46,811	5	40.1%
Bourne	$15,742	6	$34,159	3	$45,113	7	32.1%
Brewster	$15,687	7	$34,935	2	$49,276	3	41.1%
Chatham	$15,441	8	$31,315	8	$45,519	6	45.4%
Dennis	$13,944	12	$27,900	12	$41,598	12	49.1%
Eastham	$15,392	9	$31,339	7	$42,618	10	36.0%
Falmouth	$16,572	2	$33,944	4	$48,191	4	42.0%
Harwich	$14,731	10	$28,259	11	$41,552	13	47.0%
Mashpee	$16,179	5	$32,524	6	$50,871	2	56.4%
Orleans	$16,513	3	$29,519	9	$42,594	11	44.3%
Provincetown	$10,108	15	$20,487	15	$32,716	15	59.7%
Sandwich	$20,199	1	$43,500	1	$61,250	1	40.8%
Truro	$13,723	13	$28,333	10	$42,981	9	51.7%
Wellfleet	$12,816	14	$24,149	14	$43,558	8	80.4%
Yarmouth	$14,560	11	$27,222	13	$39,808	14	46.2%
Barnstable County	$15,553	–	$31,766	–	$45,933	–	44.6%
Massachusetts	$17,575	–	$36,952	–	$50,502	–	36.7%

Source: U.S. Census 1980 (1979 income), 1990 (1989 income), and 2000 (1999 income).

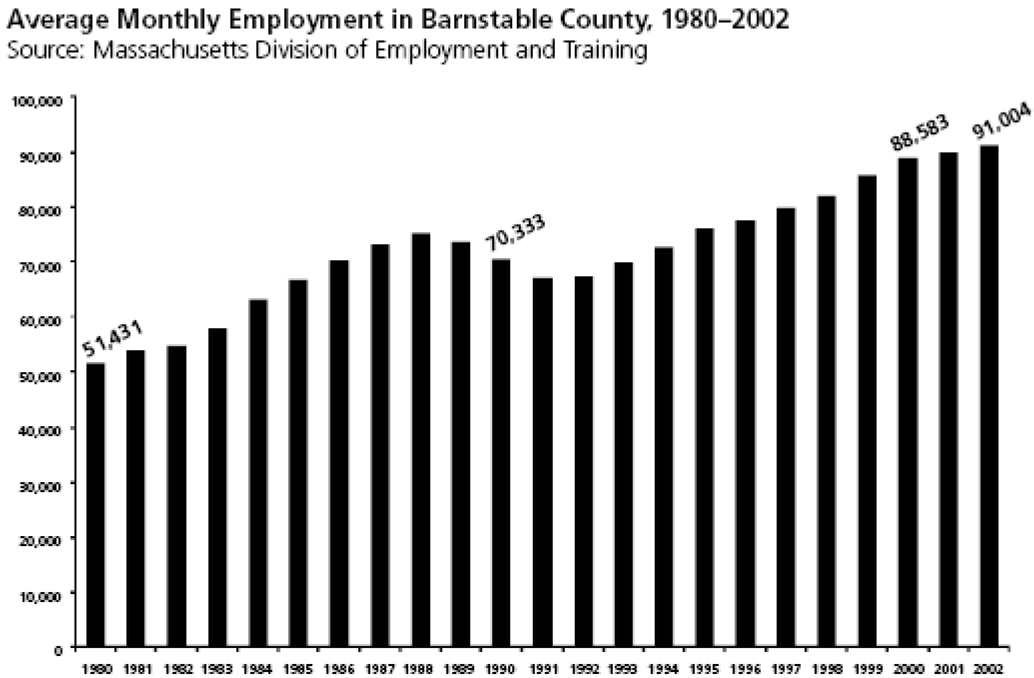


FIGURE 5 - EMPLOYMENT IN BARNSTABLE COUNTY - AVERAGE MONTH, 1980-2002

TABLE 12 - RESIDENTS LIVING AND WORKING WITHIN CAPE COD AND TOWNS, 2000

	# of County Residents Employed	# Who Live and Work in County	% of Total Workers
Barnstable County	99,197	84,704	85.4%
	# of Town Residents Employed in Barnstable County	**# Who Live and Work in Town**	**% of Total Workers**
Barnstable	23,106	12,147	52.6%
Bourne	4,804	2,641	55.0%
Brewster	3,064	1,345	43.9%
Chatham	3,515	1,715	48.8%
Dennis	5,008	2,041	40.8%
Eastham	1,547	756	48.9%
Falmouth	12,836	8,594	67.0%
Harwich	3,772	1,554	41.2%
Mashpee	4,154	1,480	35.6%
Orleans	3,477	1,159	33.3%
Provincetown	2,197	1,228	55.9%
Sandwich	5,286	2,780	52.6%
Truro	489	283	57.9%
Wellfleet	1,466	622	42.4%
Yarmouth	9,983	3,314	33.2%
Total	84,704	41,659	49.2%

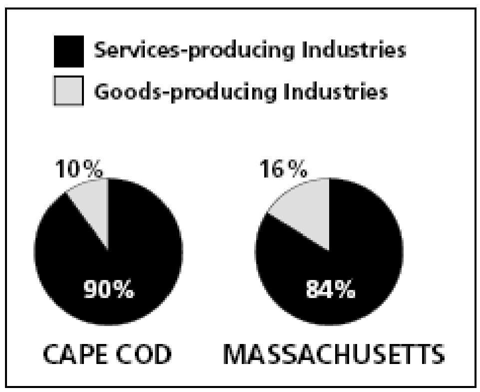
(Source: U.S. Census)

Between 1980 and 2000, employment on Cape Cod increased from 51,431 to 88,583, an increase of 72.2%. Of the 88,583 jobs in Barnstable County in 2000, 84,704 were filled by Cape Cod residents. This means that 4.4% of people employed on Cape Cod commute from off-Cape. Similarly, 14.6% of employed Cape Cod residents work off-Cape, or 14,493 people.

Assume that all of those living on Cape Cod and working off-Cape, and all of those living off-Cape and working on Cape Cod must cross the Cape Cod Canal to reach their destination. This translates into 15,322 people who must cross the Cape Cod Canal daily. This creates over 30,000 trips a day, assuming that those people do not carpool, ride transit, or take the day off. Given these assumptions, commuting trips would have accounted for roughly a third of average daily traffic over the canal roadways in 2000.

In 2000, 85.4% of employed Cape Cod residents worked on Cape Cod and 49.2% of those live and work in the same town. Thus, despite the significant trips generated by long distance commuters, almost half of journey-to-work trips made by Cape Cod residents are local.

The financial crisis that shattered the U.S. stock market in September of 2008 and plunged the U.S. and the rest of the industrialized world into a recession has affected citizens everywhere in tangible ways. One of the most salient effects of the recession has been the high unemployment rate that has kept around 10% of the country's labor force without work for over a year. The most recent data for Barnstable County show 100,822 people employed in a labor force of 113,733 – giving the county an unemployment rate of 11.4% for December 2009. According to the U.S. Department of Labor, during this month, only Bristol County in Massachusetts had a higher unemployment rate (12.2%). The counties of Hampshire and Middlesex had the lowest unemployment rates in Massachusetts at 6.8% and 7.5%, respectively.



Source: Massachusetts Division of Employment and Training, 2002

FIGURE 6 - GOODS VS. SERVICE PRODUCING INDUSTRIES IN CAPE COD AND MASS.

The vast majority of jobs on Cape Cod, 90.4%, are service-producing, which is higher than the Commonwealth as whole, where 84% of jobs are service-producing. Of these, the industries with the highest number of employees in 2002 were Trade, Transportation, and Utilities (21,032), Education and Health Services (19,652), and Leisure and Hospitality (17,353). These industries also pay some of the lowest weekly wages on Cape Cod. Information services pay their employees the most, an average of $933 per week (See Table below). Transportation providers should understand the types of jobs Cape Cod residents have, in order to properly tailor their services to meet their needs.

TABLE 13 - BARNSTABLE COUNTY EMPLOYMENT BY MAJOR INDUSTRY SECTOR, 2002

Barnstable County Employment by Major Industry Sector, 2002
Source: Massachusetts Division of Employment and Training

Industry	Establishments	Average Monthly Employment	% of Total	Total Wages	Average Weekly Wages*
Goods-producing	**1,306**	**8,728**	**9.6%**	**$356,034,701**	**$784**
Natural Resources and Mining	76	284	0.3%	$9,814,836	$665
Construction	994	5,668	6.2%	$229,392,558	$778
Manufacturing	236	2,776	3.1%	$116,827,307	$809
Service-providing	**7,572**	**82,276**	**90.4%**	**$2,558,630,026**	**$598**
Trade, Transportation, and Utilities	2,115	21,032	23.1%	$573,345,427	$524
Information	166	2,188	2.4%	$106,198,100	$933
Financial Activities	693	4,449	4.9%	$186,450,076	$806
Professional and Business Services	1,377	8,850	9.7%	$346,816,851	$754
Education and Health Services	769	19,652	21.6%	$710,843,049	$696
Leisure and Hospitality	1,372	17,353	19.1%	$320,124,962	$355
Other Services	941	3,638	4.0%	$84,763,094	$448
Public Administration	139	5,114	5.6%	$230,088,466	$865
Total – All Industries	**8,878**	**91,004**	**100.0%**	**$2,914,664,727**	**$616**

*Average Weekly Wages represent the calendar year average of wages reported by public- and private-sector Cape employers for full time, part time, year-round, and temporary employment.

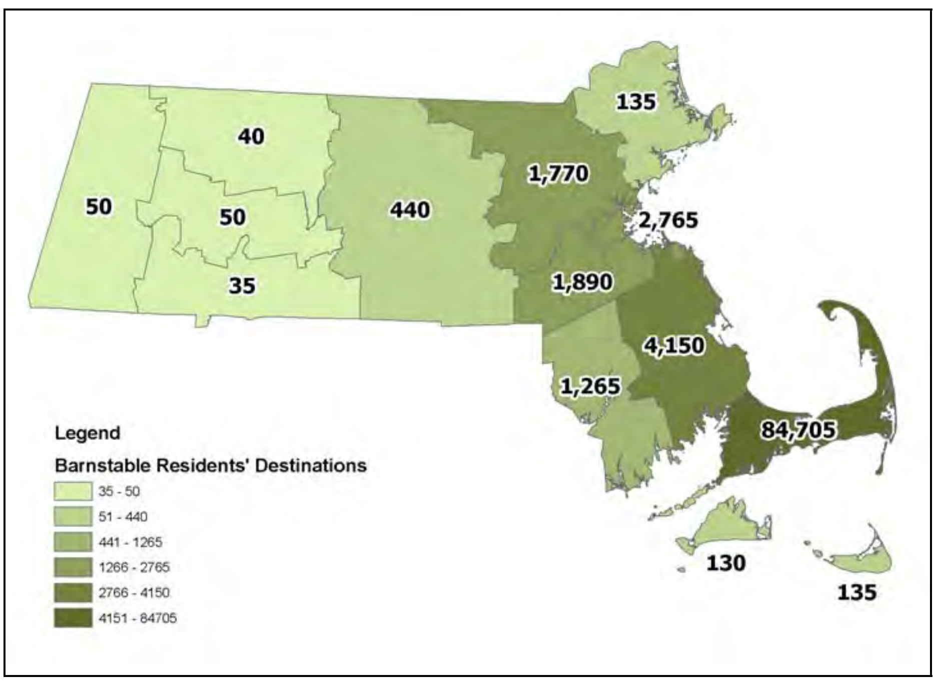


FIGURE 7 - WORK DESTINATIONS OF BARNSTABLE RESIDENTS
Source: American Community Survey, 2006-2008, Caliper C0rp.

The above figure shows Massachusetts' workplace counties for Barnstable County residents. Aside from the 84,705 residents employed within Barnstable County, the most popular destination is Plymouth County with 4,150 employees from Barnstable County. A complete table of Barnstable County journey to work origin/destination information is presented at the end of this section.

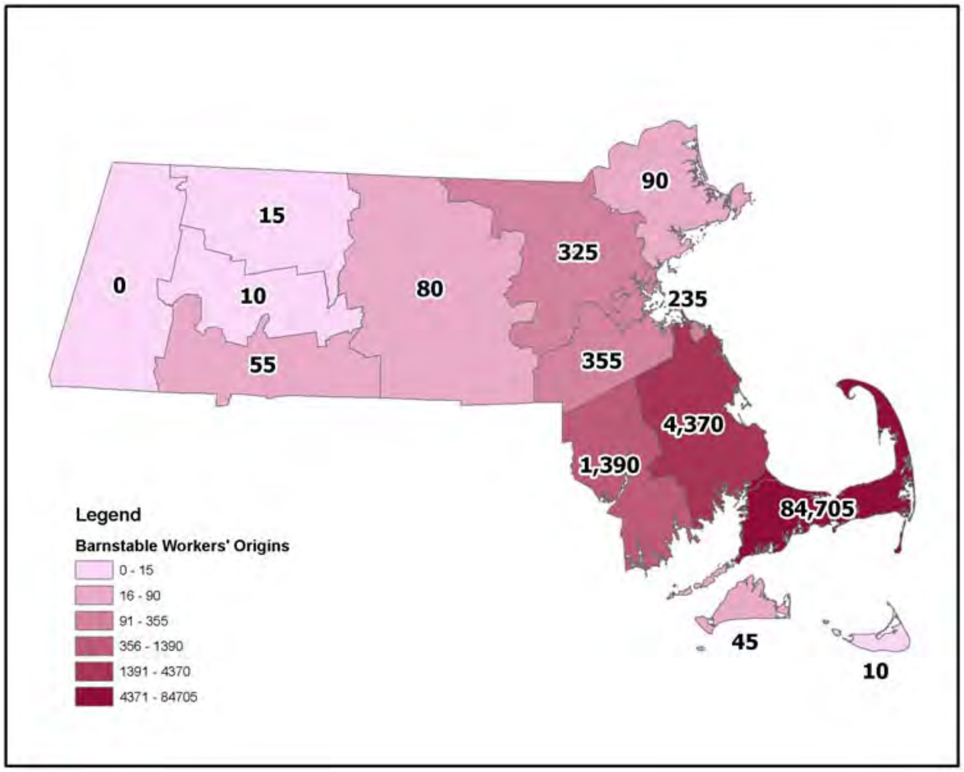


FIGURE 8 - WORK ORIGINS TO BARNSTABLE COUNTY
Source: American Community Survey, 2006-2008, Caliper C0rp.

The above figure shows Massachusetts' origin counties for Barnstable County employees. Aside from the 84,705 workers that reside within Barnstable County, the most popular origin is Plymouth County with 4,370 residents employed in Barnstable County. A complete table of Barnstable County journey to work origin/destination information is presented at the end of this section.

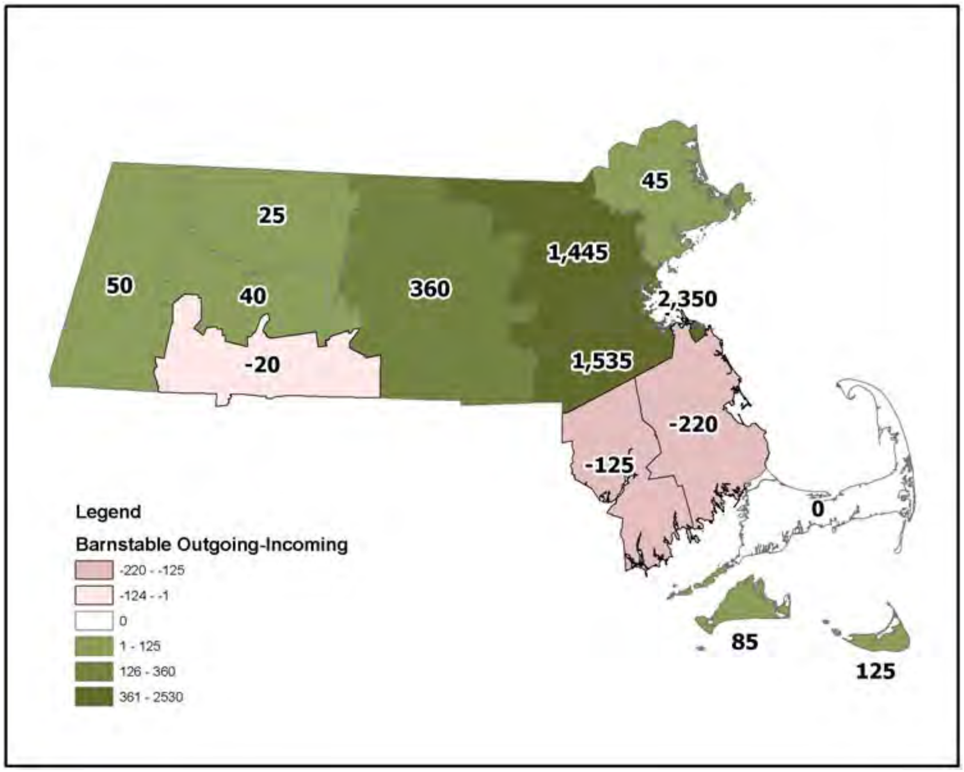


FIGURE 9 - NET DIFFERENCE OF WORKER DESTINATIONS-ORIGINS
Source: American Community Survey, 2006-2008, Caliper C0rp.

The above figure shows the net difference of Massachusetts' workplace counties less residence counties for Barnstable County residents/workers. Suffolk County (Boston) has the largest imbalance, employing a net 2,530 more Barnstable County Residents than are destined from Suffolk County for employment in Barnstable County. Plymouth County is the largest net contributor with 220 more residents employed in Barnstable County than are destined from Barnstable. A complete table of Barnstable County journey to work origin/destination information is presented on the next page. One column of the table shows the number of Barnstable residents that work in each county in Massachusetts. The next column shows the number of workers employed in Barnstable County by their county of residence.

TABLE 14 - BARNSTABLE COUNTY JOURNEYS TO WORK

County	Journey to Work from Barnstable	Journey to Work to Barnstable	Net Difference
Barnstable	84,705	84,705	0
Berkshire	50	0	50
Bristol	1,265	1,390	-125
Dukes	130	45	85
Essex	135	90	45
Franklin	40	15	25
Hampden	35	55	-20
Hampshire	50	10	40
Middlesex	1,770	325	1,445
Nantucket	135	10	125
Norfolk	1,890	355	1,535
Plymouth	4,150	4,370	-220
Suffolk	2,765	235	2,530
Worcester	440	80	360

Source: American Community Survey, 2006-2008, Caliper C0rp.

1.7.3 LAND USE

Land use patterns on the Cape have changed in the last 50 years from a village-centered pattern of relatively dense development in centers surrounded by little or no development, to a suburban style of subdivisions and strip malls. Such changes have transportation implications; and future land use patterns will both be affected by future transportation improvements and will create the need for new improvements.

Land use on Cape Cod is dominated by housing and open space. According to tax assessor's data collected from 1988 to 1996, 38% of land on Cape Cod (excluding Camp Edwards and Otis Air Force Base) is used for housing, while 26% is open space or recreational land. Information developed by the Cape Cod Commission Geographic Information System shows that an additional 30% is publicly-owned land, of which much is open space. Less than 3 percent is used for employment.

1.7.3.1. Housing

Housing is not only the most common land use on Cape Cod; it is also the one that is experiencing the highest rate of growth. As population grows, so does the need for places to live. In a region such as Cape Cod that tends heavily toward single-family detached housing, this population growth translates into an increase in the use of land for housing. The housing density on the southern shore and the Buzzards Bay coastline is greatest. Outer Cape development is denser in the town centers of Provincetown and Eastham than the rest of the sub-region. Generally, lot sizes are largest on the Cape Cod Bay side of the Cape. Multifamily housing units are concentrated in areas, such as Hyannis, downtown Wellfleet, and Dennisport. Other areas, such as Sandwich and Barnstable Village, are almost devoid of multifamily housing units. Falmouth, Yarmouth, Dennis, Chatham and parts of Barnstable are the "year-round core" of the Cape, where the population is still significant in the off-season. Meanwhile, Truro, Wellfleet, Eastham, and Brewster are far less densely populated, revealing the seasonal nature of their housing stock at present.

Even though Census Bureau estimates have shown a decrease in Barnstable County population since the 2000 Census, housing units have been estimated to have increased. The following figure displays the estimated increase in housing units each year since 2000.

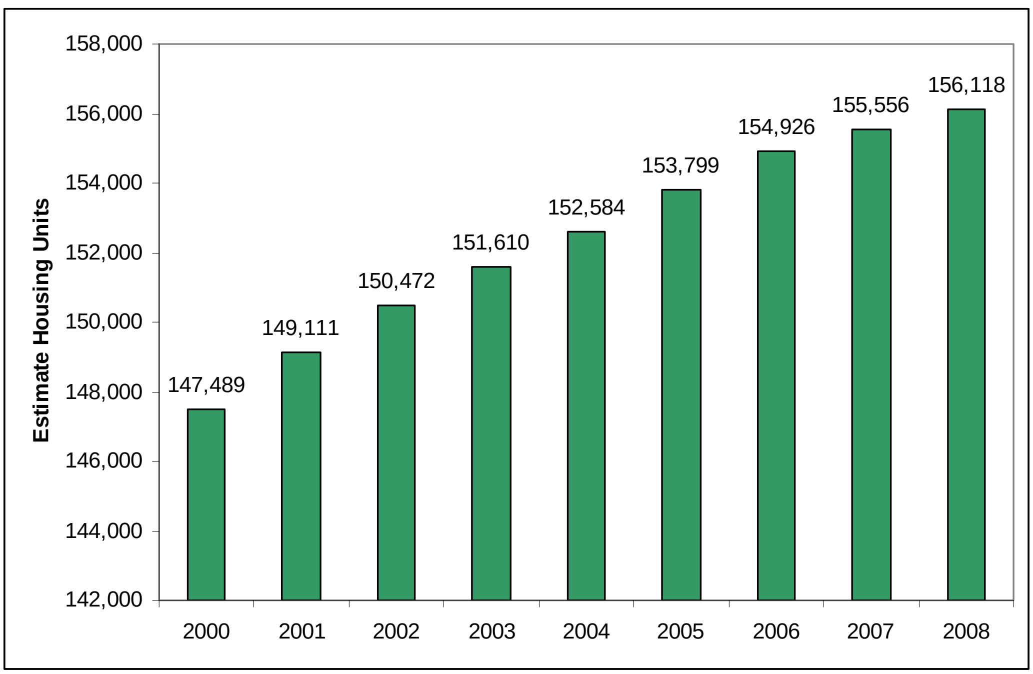


FIGURE 10 - BARNSTABLE COUNTY HOUSING UNIT ESTIMATES 2000 - 2008
(Source: U.S. Census)

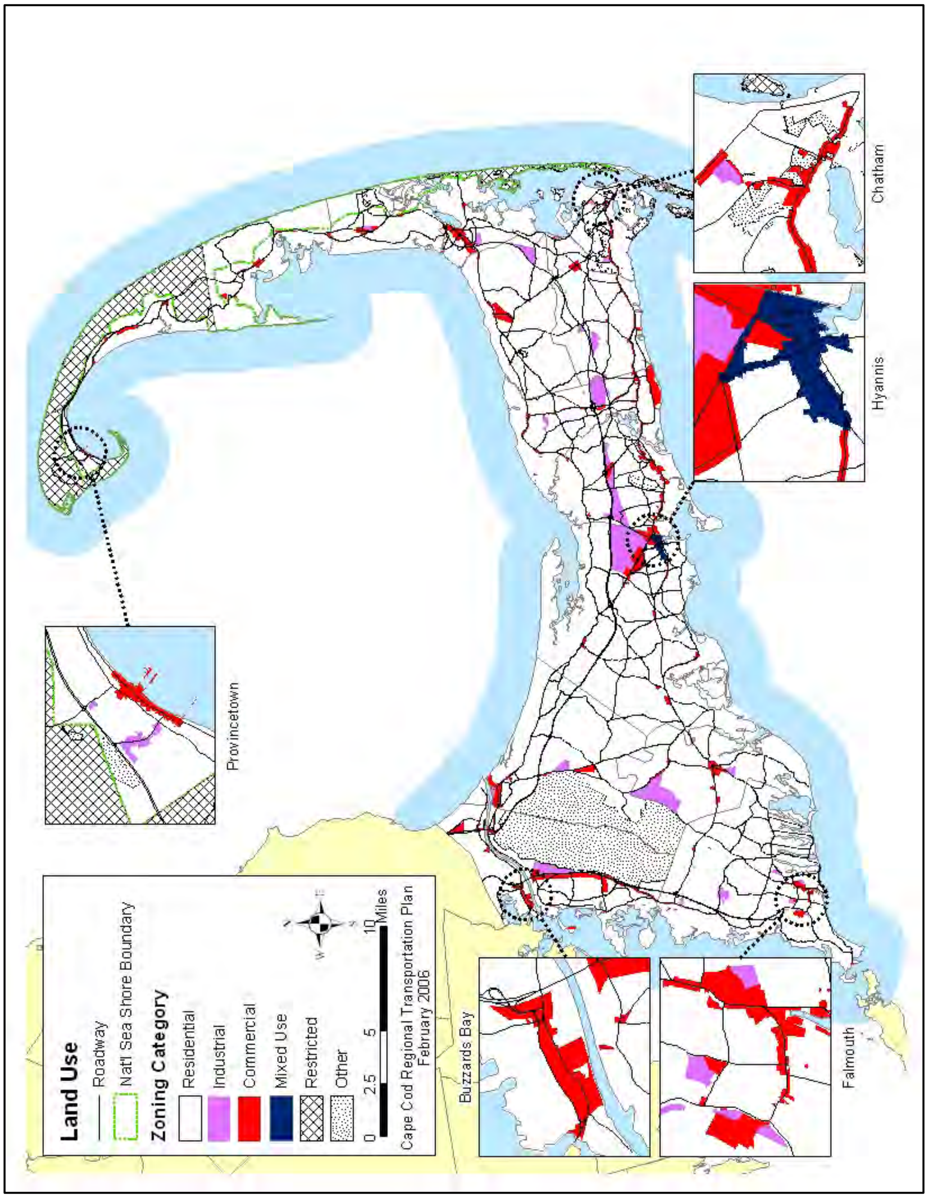


FIGURE 11 - CAPE COD ZONING AND LAND USE PATTERNS

1.7.3.2. Seasonal Uses

In a tourist area such as Cape Cod, lodging units such as hotel and motel rooms also play an important role in regional transportation planning. Seasonal lodging is spread in clusters throughout the Cape, including communities such as those in Provincetown, Chatham, Brewster, Harwich, Yarmouth, and Barnstable. There are also significant amounts of seasonal land uses along the south shore of the Cape.

1.7.3.3. Commercial and Industrial

Commercial and industrial land use varies by specific type, although generally they are more common uses on the Upper Cape than elsewhere:

Office Uses: Office land uses are concentrated in Orleans, Chatham, Falmouth, Bourne, and the Route 28 corridor from Hyannis to Dennis. To a lesser extent there is also office use along Route 132 and Route 6A in Sandwich.

Retail Uses: Retail uses are more dispersed, although there is still a concentration along Route 28 from Hyannis to Dennis, Route 132 in Hyannis, Route 28 in Bourne, Route 6A in Orleans, and Route 134 in Dennis.

Manufacturing Uses: Manufacturing largely occurs inland from Barnstable to Dennis, and in Falmouth and Bourne. On the whole there is not a large amount of manufacturing on Cape Cod.

Mining: Mining is not widespread on Cape Cod, although there is some sand and gravel mining in Falmouth, Bourne, and Barnstable.

1.7.3.4. Open Space

FIGURE 12 - NAUSET BAY AND THE CAPE COD NATIONAL SEASHORE IN EASTHAM

At present, a significant percentage of the land on Cape Cod is devoted to preservation as open space, recreational land, or public land. In addition, the Cape Cod National

Seashore on the Lower Cape not only preserves a great deal of land in that area, but also restricts additional growth on land already developed within its borders.

In 1998, the Cape Cod Land Bank Act was passed, and in the first year nearly 800 acres were approved for preservation across the region. Most of the parcels are for conservation or passive recreational use but some towns have purchased properties for other purposes such as future water supply well sites and trail links to the Cape Cod Pathways network.

Generally, open space uses are common inland and on the outer Cape, while not as common on the south shore of the Cape. The Cape Cod Bay and Buzzards Bay shores falls somewhere in between. Both transportation and local land use decisions have played a major role in the loss of open space. The one area that appears to suffer from a lack of open space uses is the southern shore of the Cape from Hyannis to Harwich, where development pressures have been strong. On the rest of the Cape, "perceived" open space (undeveloped land as well as protected conservation land) is generally not hard to find, at present. Whether this condition will continue depends on the development and transportation policies adopted by the region and its towns in the future.

1.7.4 ENVIRONMENTAL JUSTICE Ⓛ

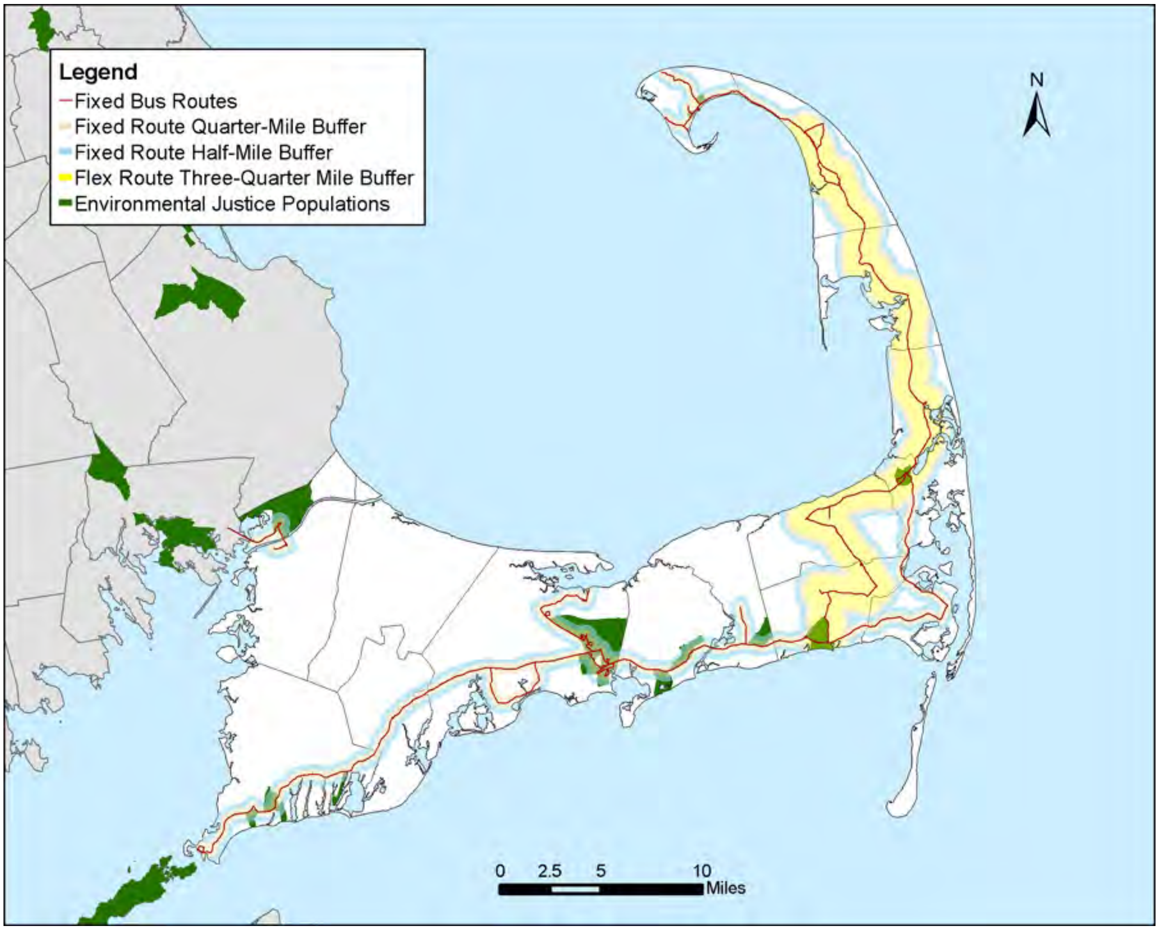


FIGURE 13 - MAP OF ENVIRONMENTAL JUSTICE POPULATIONS ON CAPE COD

The Commonwealth of Massachusetts identifies an area as an Environmental Justice Population if their annual median household income is equal to or less than 65 percent of the statewide median or their population is 25 percent minority, foreign born, or lacking English language proficiency.

To best serve those with greater transportation needs on Cape Cod, Commission Staff has identified the Cape's Environmental Justice Areas. This may allow Commission and local staff and officials to target needs and shortfalls within the system, as well as to identify where the network currently offers adequate options. The figure above shows these Environmental Justice Areas in relation to bus services on the Cape. Assuming a "reasonable walking distance" of one-half mile to access transit, a majority of the Cape's

Environmental Justice Areas receive transit service. Future expansions to the network should consider these areas, currently not served by the existing transit network.

1.8 CONCLUSION

Transportation safety, security, congestion, accessibility, and mobility are all affected by changes in population, housing, and economics. The remaining chapters will address the various modes of transportation available on Cape Cod as well as sub-regional and local issues. These chapters will focus on the history of Cape Cod transportation, current and future trends, and the accessibility, mobility, and connectivity of the existing system. This information is used to evaluate projects and programs, and to make informed planning decisions for the future of transportation on Cape Cod.

CAPE COD COMMISSION

2012 REGIONAL TRANSPORTATION PLAN

Chapter 2: Existing Conditions

Endorsed
August 22, 2011

COUNTY OF BARNSTABLE • MASSACHUSETTS •

Chapter 2: Table of Contents

2.1 LAND USE AND THE ENVIRONMENT

The Cape Cod Commission has always supported a strong relationship between land use, environmental issues, and transportation planning. This relationship is most evident when consulting the transportation section of the Regional Policy Plan (RPP) as it relates to the goals of the Regional Transportation Plan (RTP). The RPP relies heavily on land use planning and environmental protection in tandem with developing transportation solutions consistent with the Cape Cod Commission Act.

This section addresses the Cape's land use and environmental issues and includes discussion of a growing concern – climate change – and its potential for impact to the transportation network.

2.1.1 LAND USE VISION MAP Ⓛ

The Regional Land Use Vision Map (RLUVM - adopted with the 2009 RPP) expresses a vision for the future of Cape Cod. The Cape Cod Commission is working collaboratively with all 15 towns in Barnstable County to develop this vision. The land uses are categorized as Economic Centers, Villages, Industrial and Service Trade Areas, Resource Protection Areas, and Other Areas. Towns where the planning board has endorsed the vision map for their community are included on the Regional Land Use Vision Map after adoption by the Barnstable County Assembly of Delegates. The RLUVM is used to tailor minimum performance standards applied to Developments of Regional Impact (DRIs) according to planning areas. Adoption of each town's Land Use Vision Map also allows a town to seek revisions to DRI thresholds based on the land use categories listed in Commission regulations. The intent is to encourage growth and redevelopment in appropriate areas that contain existing or proposed infrastructure – and – to discourage sprawl in more environmentally sensitive areas.

Land Use Categories include:

- **Economic Centers** – Areas designated as appropriate for growth and redevelopment. These areas serve the region or sub-region and could include characteristics such as civic and institutional uses, retail, and mixed use. Economic Centers are defined by parcel data and/or zoning district boundaries, shown in detail on individual town maps. Developments of Regional Impact (DRI) proposed within Economic Centers benefit from some reduced minimum performance standards during DRI review under the RPP.
- **Industrial and Service Trade Areas** – Areas designated for industrial uses, construction trades, and/or public works facilities. Areas are intended for uses that are incompatible with residential and village settings, with a high square-footage-to-employee ratio.
- **Resource Protection Areas** – Areas designated that warrant protection and where additional growth is not desired due to the presence of one or more sensitive resources. These resources shall include at a minimum Wellhead

Protection Areas, Land Subject to Coastal Storm Flowage or Sea, Lake, and Overland Surges by Hurricanes (SLOSH) zones, historic districts, and the Cape Cod National Seashore. Resource Protection Areas may also include but not be limited to wetlands, vernal pools, protected open space, and designated Districts of Critical Planning Concern (DCPCs).

- **Villages** – Areas designated to preserve historic and/or community character. Consist of small, compact areas with development at a local scale. Characteristics could include civic uses, mixed use, and/or home occupations.
- **Other** – Areas remaining after the other areas have been identified. The land use category boundaries are based on digital data obtained from MassGIS, Army Corps of Engineers, NHESP, and Town GIS Departments, including town-based zoning and parcel information.

The Land Use Vision Map is presented in the following figure. Please consult the Cape Cod Commission website for full explanations of assumptions and to see the latest update (June 18, 2010):

http://www.capecodcommission.org/RPP/capevision_rpp_amend10.pdf

Link for Cape Cod Commission regional maps

http://www.capecodcommission.org/GIS/regionalmaps.htm

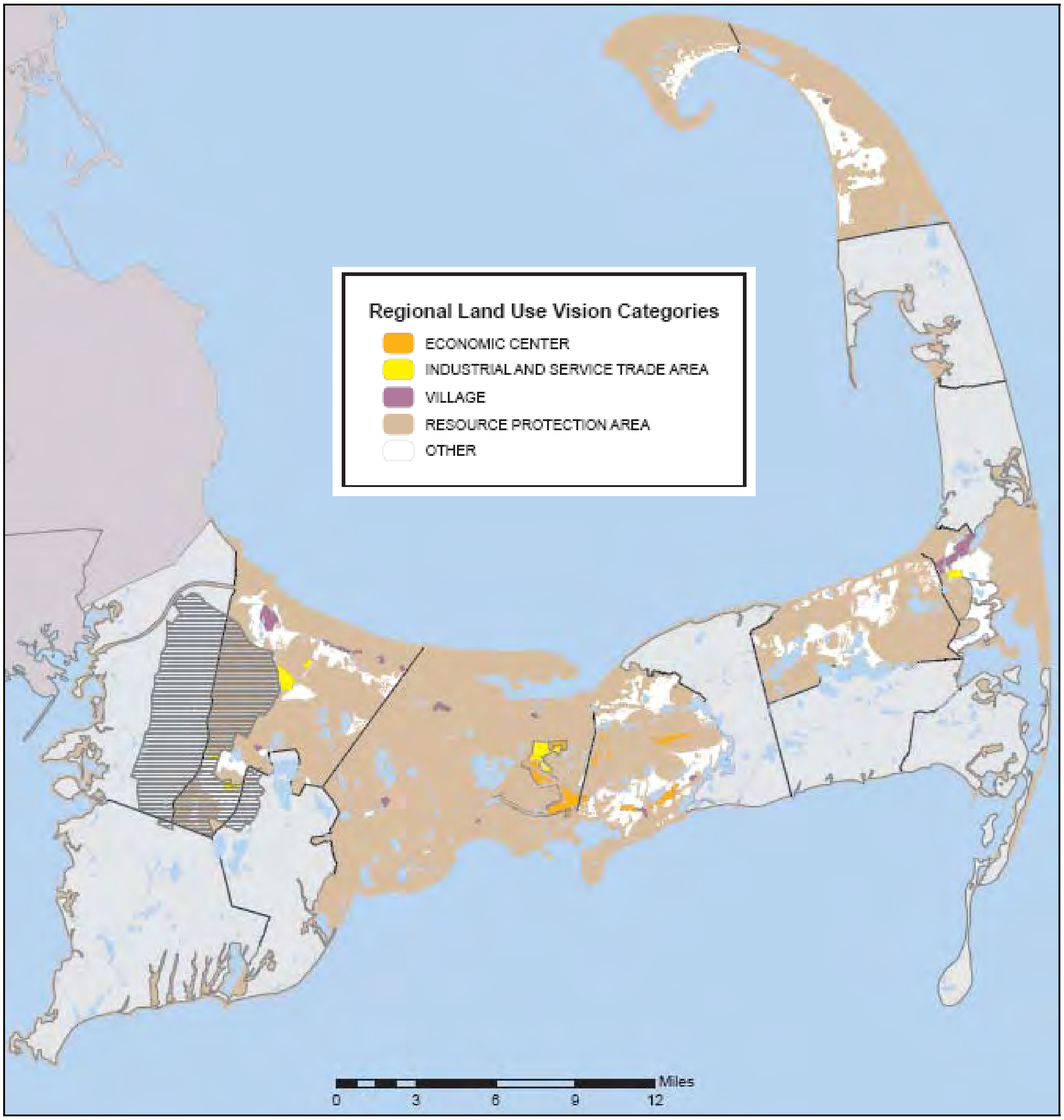


FIGURE 1 - LAND USE VISION MAP

2.1.2 LAND USES ALONG MAJOR ROADWAYS

Of the major roadway corridors of Barnstable County, existing land use varies by the characteristics of the town or sub-region as well as along each corridor. The following includes a summary of these characteristics.

Route 6:

Adjacent land uses vary by location. In the limited access sections of the road there is some residential development and some industrial development along the corridor. In the sections with curb cuts there is more commercial development, including retail activity.

In addition to being the main thoroughfare for the Cape as a whole, it also is the "Main Street" of several Cape towns. Buzzards Bay, Eastham, and to a lesser degree, Truro and Wellfleet, all use Route 6 as a downtown thoroughfare. This dual purpose for the road has created some conflicts for this corridor.

Route 28:

Land use along Route 28 may vary to a greater extent than any other roadway on Cape Cod. Sections between Chatham and Orleans for example are lightly settled with scenic vistas of Pleasant Bay. In the Upper Cape, Route 28's MacArthur Boulevard is nearly a freeway with the undeveloped Massachusetts Military Reservation to the east and sprawling commercial enterprises along the west. Route 28 serves as a Main Street to numerous villages such as Falmouth, Dennisport, Harwichport or Chatham, where close-to-the-street business and residences are complemented by the lower travel speed of the road. In the Mid-Cape towns of Barnstable and Yarmouth, much of Route 28 is congested due to high traffic demands and frequent curb-cuts for the many businesses taking advantage of the proximity to drive-by customers.

Route 6A:

Typical commercial uses include inns, motels, and cottages, restaurants, antique shops, galleries, gift shops, services such as gas stations, banks, small markets, and small professional offices. Residential uses, including home occupations, mixed with churches, municipal buildings, and open land, continue to dominate the rest of the roadway. Over 3,350 acres of vacant developable land is located within the Route 6A corridor, most of it zoned for residential use. Development of vacant parcels that abut the roadway or are located within or adjacent to historic resource areas and scenic viewsheds could diminish the distinctive character. Several village centers exist along the corridor, such as Barnstable Village, Yarmouthport, and Brewster. Several "new villages" have also sprung up as strip development in the last 20 years, such as the development in Orleans. In addition, Sandwich Center lies just off 6A to the south.

Much of the corridor remains residential, or is undeveloped due to the proximity of wetlands with Sandwich and Orleans the notable exceptions. Bike travel along the corridor is common despite the fact that it is best suited for experienced bicyclists. This is due to the narrow lane widths and lack of shoulders, scenic nature of the corridor, and residential and commercial development.

2.1.3 CONTEXT SENSITIVE DESIGN

To address transportation problems with infrastructure solutions, the Federal Highway Administration recommends that we "...develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility." The concept of Context-Sensitive Design has a strong influence on design criteria for transportation projects as will be evident in the Alternatives Analysis Chapter of this RTP.

FIGURE 2 - A CAPE COD SCENE

2.1.4 CAPE COD ENVIRONMENTAL RESOURCES

Cape Cod is rich in environmental features that both deserve and are required by statute to be protected. Land use planning, transportation planning, and many other related efforts are influenced by, and have an influence on the environmental resources of Cape Cod. The following figure shows a number of these features including:

- Wellhead Protection Areas
- Vernal Pool Buffers
- Water Bodies
- Pond Shore Buffers

- Potential Public Water Supply Area
- Habitats
- Wetlands

For reference, major roads and town boundaries are displayed as well.

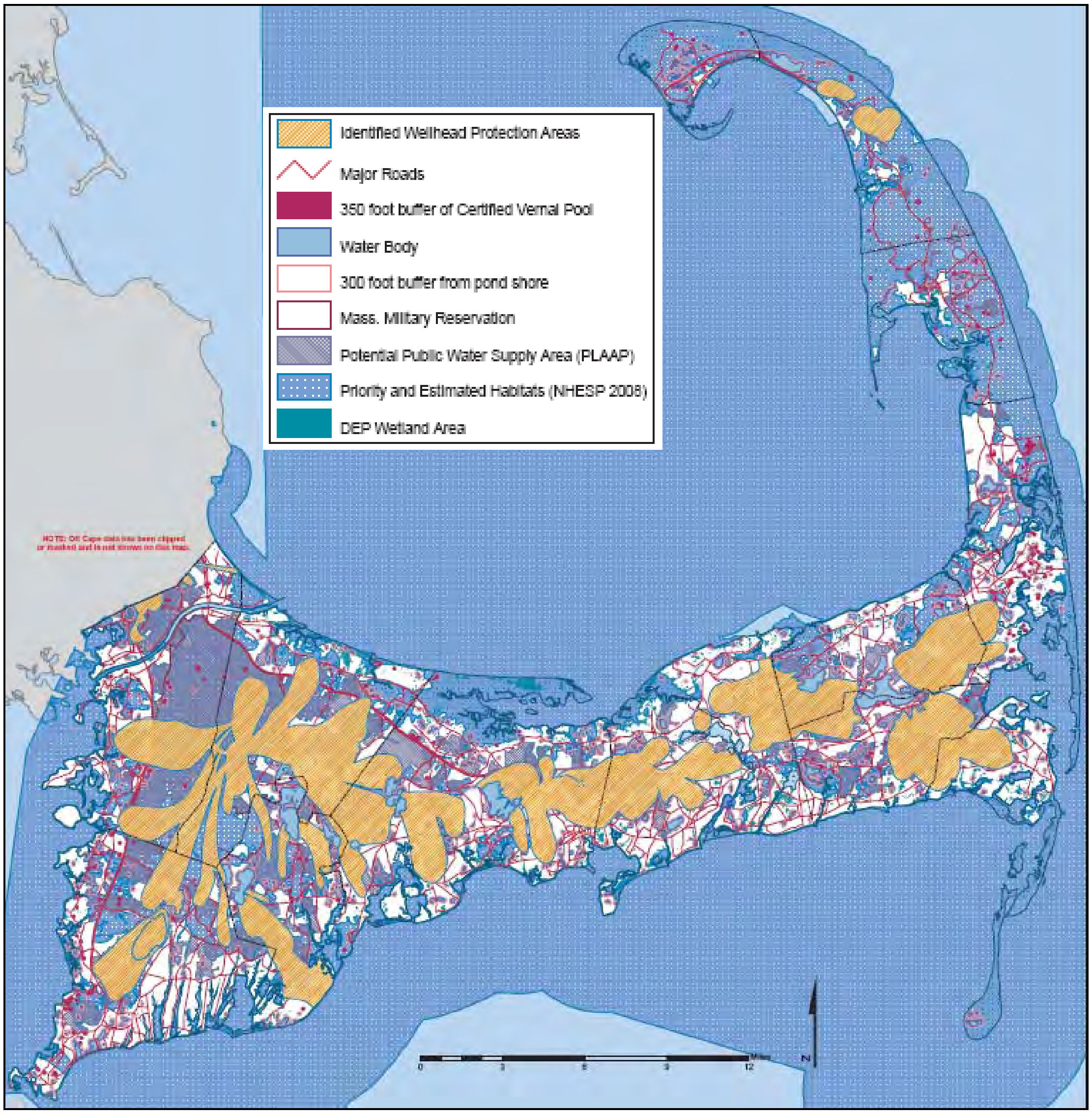


FIGURE 3 - CAPE COD SIGNIFICANT NATURAL RESOURCE AREAS

Source from the Cape Cod Commission:
http://www.capecodcommission.org/RPP/CCSNR_08RPP0609amend0610.pdf

Link for Cape Cod Commission regional maps:
http://www.capecodcommission.org/GIS/regionalmaps.htm

The Cape Cod Commission's Geographic Information System department and Natural Resources' staff have developed an interactive mapping technique that can be used in assessing the proximity of planned infrastructure (e.g., road improvements) and the various geographic layers of natural resource information. This tool will be of increasing usefulness in minimizing impacts to natural resources in the advanced planning stage of transportation projects. This effort will result in an interactive online application that will allow the public to review transportation projects in the context of any natural resource of interest.

2.1.5 STORMWATER MANAGMENT

Cape Cod hosts nearly 1,000 ponds and lakes. Of the 57 watersheds draining into the Cape's coastal embayments, 46 have been identified by the U.S. Environmental Protection Agency as being "nitrogen-sensitive," of which half are currently subject to Total Maximum daily Loads

The issue of stormwater runoff was first addressed at the national level in Phase I of the EPA's stormwater program in 1990. Phase I required permit coverage under the National Pollutant Discharge Elimination System (NPDES). Those required to apply for permits included municipal separate sewer systems that serve populations of approximately 100,000 people or more, and construction activity disturbing 5 or more acres of land.

"Storm Water Phase II Final Rule" is the EPA's next step in addressing stormwater runoff pollution. Phase II expands upon those required to hold permits under Phase I to include all of the towns on Cape Cod except Provincetown, Wellfleet and Truro because they are considered to be "operators of MS4s (municipal separate storm sewer systems) in urbanized areas." Phase II also applies to operators of small constructions sites that disturb between 1 and 5 acres of land, and ten categories of industrial activity.

Phase II is anticipated to further reduce adverse impacts to water quality and aquatic habitat by controlling the unregulated sources of storm water discharges that hold the greatest likelihood of significantly contributing to stormwater pollution.

2.1.6 CLIMATE CHANGE

Climate change is a shift in temperature, precipitation, wind and other long-term weather patterns. According to the Massachusetts Department of Environmental Protection, there is broad scientific consensus that our climate is changing - both regionally and globally - largely due to the combustion of fossil fuels and other human activities that increase atmospheric concentrations of greenhouse gases, namely carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Almost all (97%) greenhouse gas emissions in Massachusetts consist of carbon dioxide released in fossil fuel combustion. According to data from the US Energy Information

Administration compiled by Environment Massachusetts, 30% of these energy-related C02 emissions were generated by the transportation sector. Between 1990 and 2004, estimated C02 emissions from the transportation sector in Massachusetts increased 16%, while those due to gasoline consumption increased even faster, rising 19% from 1990 to 2004 (according to the Boston Indicators Project). Rising greenhouse gas emissions from motor vehicles pose a major challenge to the state's ability to meet its goal of reducing greenhouse gas emissions below 1990 levels, as required by the Global Warming Solutions Act (2008). Strategies focused on VMT reduction, fuel-efficient fleets, and implementing Transit Oriented Development and are critical in meeting these goals.

The Commission is currently participating in a federal Interagency Climate Change Scenario Planning Pilot Project. Commission staff assist in bringing together multiple federal agencies and local stakeholders to work toward a shared and practical future development strategy. The strategy will plan for climate change impacts in transportation and land use decision-making while at the same time reducing the region's green house gas (GHG) emissions. A scenario planning process will be used to develop the most desirable development strategy.

Another tool in mitigating potential impacts of Climate Change is the integration of land use planning with transportation planning via the Land Use Vision Mapping (LUVM) efforts. LUVM results are intended to reinforce Transit-Oriented Development and other forms of compact development patterns, thereby reducing VMT (and resulting climate-changing emissions). Conversely, my melding SLOSH/A&V zones in designating Resource Protection Areas, development is discouraged in locating in such areas.

FIGURE 4 - POTENTIAL EFFECTS OF SEA-LEVEL RISE
(Source: www.civilsocietyinstitute.org)

The blue colored areas shown in the figure above are a graphic illustration of the potential effects of sea-level rise on the low-lying regions of Cape Cod. The longer-term effect of sea-level rise permanently disabling important portions of the transportation network is a major cause for concern. In the nearer future, increased weather-based threats from storm surge, flooding, and hurricane wind damage highlight the vulnerability of our transportation system.

The Cape Cod MPO is committed to implementing transportation strategies that will help reduce fossil fuel energy and GHG emissions. The Cape Cod MPO's RTP update demonstrates a commitment to a transportation system that supports environmental quality and Smart Growth strategies.

To address climate change on Cape Cod, the following categories of recommendations are proposed to address causes, improve efficiencies, and strategically protect or construct critical infrastructure to resist the effects of weather-based events and sea-level rise.

Smarter Fleets & Fuels: Reduction of Greenhouse Gases

Clean fuels and efficient vehicles can result in significant reductions in GHG production. The Cape Cod Commission continues to encourage the development of fueling infrastructure for bio-diesel. Biofuels are derived from plant matter that absorbs CO2 in their growth process. This CO2 is sequestered in the biofuel and released when it is burned returning the original CO2 (green house gas) from the plant matter to the atmosphere. Unfortunately, usually energy is expended in the harvesting and production processes that may have been from petroleum. One of the promising sources of feedstock is algae. Using wastewater as a feedstock and free sunlight for the production, algae may be the Cape's closest thing to "free lunch fuel" that doesn't compete against other food sources (e.g., corn-based ethanol). Currently, biodiesel is available to Cape Cod towns through Barnstable County's procurement process.

Efficient vehicles means less emissions from whatever fuel is being used. Through a partnership with the Cape Cod Regional Transit Authority, the Cape Cod MPO has and will continue to support the purchase of fuel-efficient and alternative-fuel vehicles when procuring new or replacement buses.

Smarter Management: Shortening Trips and Avoiding Congestion Ⓛ

The Cape Cod Commission continues to encourage smarter land use patterns through the Cape Cod Regional Policy Plan. By encourage mixed-use and transit-oriented development, and discouraging sprawl, travelers are afforded shorter commute distances or convenient access to commercial areas and municipal services thus reducing vehicle travel distance. Even more beneficial are the trips that can be made by public transit, bicycling, or walking.

See:

www.capecodcommission.org/RPP

The continued deployment of intelligent transportation systems will provide travelers with the tools to avoid congestion. Tailpipe emissions of idling vehicles represent the worst case scenario of air pollution.

See:

www.gocapecod.org/congestion

Smarter Infrastructure: Location & Protection

Construction of new transportation infrastructure in an area threatened by sea-level rise is probably the least desirable strategy. Notwithstanding the expense of repairing storm-damaged roadways following an initial event, there is reason to believe that future events would occur with ever-increasing probability. In effect, we would be “shoveling against the tide.”

A recommended action is to perform an analysis of the transportation infrastructure located in threatened areas. This information will help identify needed upgrades (e.g., raising roadbeds, retaining walls, etc.) and guide new infrastructure away from threatened areas.

2.1.7 DOCUMENTING GREENHOUSE GAS EMISSIONS REDUCTION FOR GREENDOT IMPLEMENTATION

MassDOT, using its statewide travel demand model, has provided the Cape Cod MPO with statewide estimates of CO2 emissions resulting from the collective list of all recommended projects in all the Massachusetts RTPs combined. Emissions are estimated in the same way as the criteria pollutants (volatile organic compounds, nitrogen oxides, and carbon monoxide) whose emissions are required for the air quality conformity determination (for further description, see *Appendix-Air Quality Conformity*. However, the CO2 emissions shown here are part of an effort separate from the conformity analysis and are not part of those federal standards and reporting requirements.

The Global Warming Solutions Act (GWSA) legislation requires reductions by 2020 and further reductions by 2050, relative to the 1990 baseline. The project mix from this RTP (and all other RTPs) was modeled for both 2020 and 2035 using an Action (Build) vs. Baseline (No-Build) analysis to determine the CO2 emissions attributed to the all MPO’s mix of projects and smart-growth land use assumptions. The estimates of the modeled CO2 emissions are provided below:

TABLE 1: MASSACHUSETTS STATEWIDE CO2 EMISSIONS ESTIMATES

Year	CO2 Action Emissions	CO2 Base Emissions	Difference (Action – Base)
2010	101,514.4	101,514.4	n/a
2020	105,747.5	105,856.4	-108.9
2035	115,034.1	115,028.0	6.1

(All emissions in tons per summer day)

As shown above, collectively, all the projects in the RTPs in the 2020 Action scenario provide a statewide reduction of nearly 109 tons of CO_2 per day compared to the base case. However, the 2035 Action scenario estimates an increase of about 6 tons of CO_2 emissions compared to the base case. It should be noted that this current analysis measures only projects that are included in the travel demand model. Many other types of projects that cannot be accounted for in the model (such as bicycle and pedestrian facilities, shuttle services, intersection improvements, etc.) will be further analyzed for CO_2 reductions in the next Transportation Improvement Program development cycle. This information will be updated and reported at that time.

Working closely with MassDOT, the Cape Cod MPO will continue to report on its actions to comply with the GWSA and to help meet the GHG reductions targets. As part of this activity, the MPO will provide further public information on the topic and will advocate for steps needed to accomplish the MPO's and state's goals for greenhouse gas reductions.

2.1.8 CONCLUSION

When planning for the Cape's future transportation system, we ignore the environment at our peril. By focusing on a combination of (1) a thorough understanding of the location and importance of the Cape's environmental resources with, (2) a vision of land use that mitigates impacts to the environment with efficiencies in location such as transit-oriented-development, the RTP will be instrumental in developing a transportation system that maximizes efficiency while addressing the sensitivity of Cape Cod's context.

2.2 ROAD TRANSPORTATION

Roads are an important component of any discussion on Cape Cod transportation. The word "road" is derived from the word "ride" and refers to any surface that has been prepared to make travel easier. For example, a road may have trees removed, surfaces leveled, or pavement laid down. A "right-of-way" is the linear property in which individuals or entities are granted the right to travel. Roads and other transportation infrastructure are generally located within a right-of-way.

Most of Cape Cod is connected by roadways. This section will address issues relating to the roads of Cape Cod. The purpose will be to account for the existing infrastructure of and demands on Cape Cod's roadways.

2.2.1 THE "AVERAGE" CAPE COD ROAD

FIGURE 1 - THE AVERAGE CAPE COD ROAD

There are about 3,900 miles of road on Cape Cod. The "Average Cape Cod Road" is a two-lane road surrounded by woods or houses. According to the MassDOT Roadway inventory, of paved roads on Cape Cod, the mean pavement width is 21.1 feet and a lane width of 10.9 feet. For all roads, the average right of way is 40.9 feet wide.

2.2.2 ROAD INFRASTRUCTURE

Cape Cod's three major routes, Route 6, Route 28, and Route 6A, comprise only 5.7% of Cape Cod's roads by mileage. The majority (78.1%) of Cape Cod roads are designated as Functional Class "0," or local roads. 6.2% of roads are classified as minor or major "Collector" roadways. This means that just over two-tenths of Cape Cod's roadways are used as primary routes of travel, while the remaining nearly eight-tenths are used to access residential and other private areas. There are no interstate highways on Cape Cod.

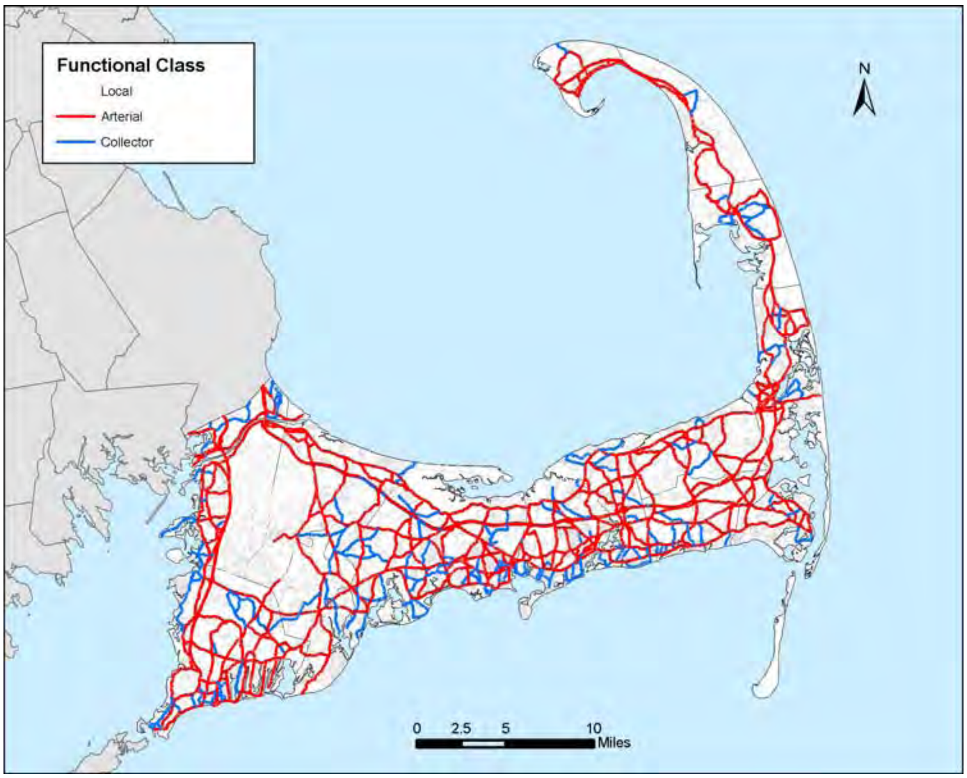


FIGURE 2: FUNCTIONAL CLASSIFICATION
Source: Massachusetts Roadway Inventory File 2008

TABLE 1 - ROAD MILEAGE BY FUNCTIONAL CLASS

Interstate		Local		Arterial		Collector		Total
0	0%	3,018.7	78.1%	608.5	15.7%	238.9	6.2%	3,866.1

Source: Massachusetts Roadway Inventory File 2008

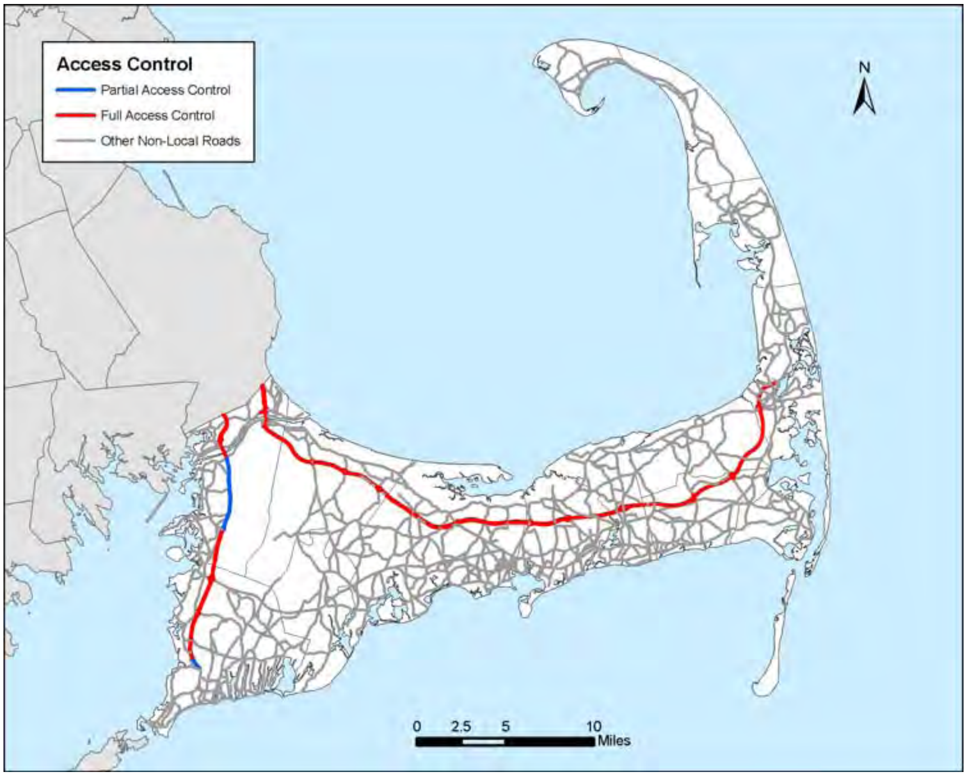


FIGURE 3 - ROADWAY INFRASTRUCTURE
Source: Massachusetts Roadway Inventory File 2008

All limited-access highways south/east of the Cape Cod Canal bridges are portions of either Route 6 or Route 28. The only limited-access portions of Route 28 are located in Bourne and Falmouth. Most of Route 28 (MacArthur Boulevard) in Bourne is partial-access control with sporadic opportunities to change direction in U-turn lanes. The vast majority of Cape Cod's roads do not have access control.

Towns in the Mid- and Upper-Cape have more road mileage than other towns on Cape Cod. Barnstable and Falmouth have the most road mileage in the county, with 647.8 and 474.3 miles, respectively. The Lower and Outer-Cape towns have the fewest road miles. Chatham, Orleans, Eastham, Wellfleet, Truro and Provincetown all have 140 miles of road or less. A smaller population and large amounts of protected land are likely factors in the lesser road mileage.

Looking at who owns Cape Cod's roadways, 44.0% of Cape Cod's roadways by mileage are owned by local towns. MassDOT also owns a significant 285.8 miles of roadway (7.3%), consisting of most of Route 6, Route 28, Route 6A, and portions of other numbered routes and major roadways. Bourne has the most miles of road owned by MassDOT. These 50.5 miles of road consist of Route 6, Route 28, and the Cape Cod

Canal area transportation network. Provincetown has the least amount of roadway owned by MassDOT, with less than three miles. The majority of federally owned roadway is located in Bourne and Sandwich, mostly due to the Massachusetts Military Reservation. The only Barnstable County-owned roadway is located at the County Complex in Barnstable Village. Roadway ownership is important because any roadway changes need to be approved by the roadway owners.

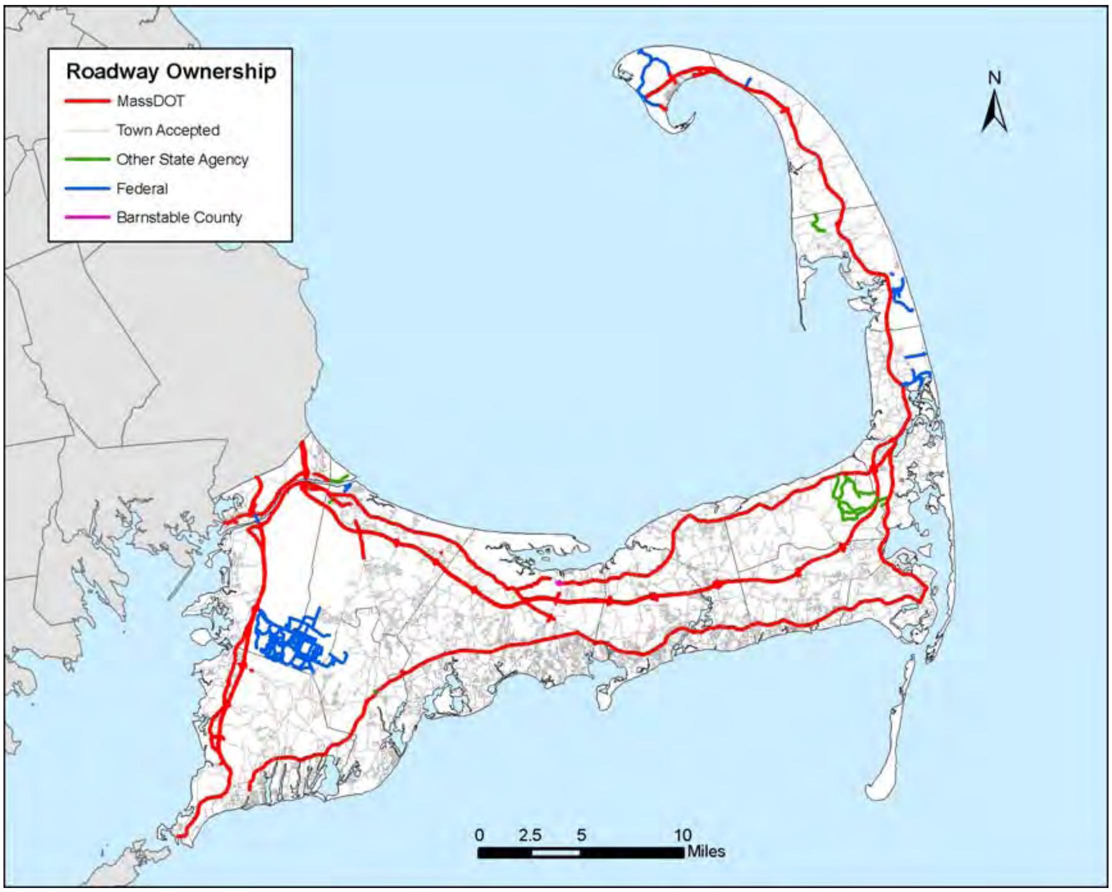


FIGURE 4 - OWNERSHIP OF CAPE COD'S ROADWAYS
Source: Massachusetts Roadway Inventory File 2008

The following table identifies road ownership on Cape Cod by town. Discrepancies with total road mileage from any section of this chapter are a result of differences in rounding.

TABLE 2 - ROAD MILEAGE BY JURISDICTION

Town	MassDOT	Town Accepted	County & Other State	Federal	Un-accepted	n/a	Total
Barnstable	42.2	354.5	0.5		70.3	180.3	**647.8**
Bourne	50.5	96.3	0.1	25.7	40.1	175.2	**387.9**
Brewster	12.5	58.1	10.9		90.6	38.7	**210.8**
Chatham	7.4	66.8			41.3	24.9	**140.4**
Dennis	14.7	147.2			58.2	54.3	**274.4**
Eastham	6.7	51.6		4.6	42.4	32.5	**137.8**
Falmouth	35.2	219.7			105.5	113.9	**474.3**
Harwich	15.2	143.1			16.4	45.8	**220.5**
Mashpee	4.0	118.2	0.1	3.0	10.0	92.6	**227.9**
Orleans	12.2	52.3	0.9		34.8	36.1	**136.3**
Provincetown	n/a*	15.2		8.0	6.0	38.4	**79.0**
Sandwich	28.6	153.0	1.2	27.4	23.7	135.1	**369.0**
Truro	11.8	38.4	0.3	0.5	11.4	74.2	**136.6**
Wellfleet	8.3	55.2	1.5	4.4	2.7	63.3	**135.4**
Yarmouth	25.1	152.8			101.4	56.3	**335.6**
Total	**285.8**	**1722.4**	**15.5**	**73.6**	**654.8**	**1161.6**	**3913.7**

** Since the 2008 Road Inventory Network was created, MassDOT has relinquished ownership of Route 6 in Provincetown to the town.*

Source: Massachusetts Roadway Inventory File 2008

There are thousands of roadway intersections across Cape Cod. Of these intersections, 114 are signalized and 24 are circular. Circular intersections refer to rotaries and roundabouts. Rotaries tend to be larger in diameter, and their interior travel speed is often faster than a modern roundabout. Roundabouts are identified by smaller diameters and approaches that enter at a greater angle than rotaries – encouraging slower speeds. Barnstable has 36 traffic signals, which is the most of any town on Cape Cod. Barnstable and Bourne have 4 circular intersections each, the most of any Cape Cod town. Both Truro and Brewster have no traffic signals or traffic circles (the traffic signals installed at the Route 124/Route 137 intersection are set to flashing mode – effectively making four-way stop control). Maintaining intersection controls is important to ensure safety, especially at busy intersections.

TABLE 3 - INTERSECTION TYPE

Town	Barnstable	Bourne	Brewster	Chatham	Dennis	Eastham	Falmouth	Harwich	Mashpee	Orleans	Provincetown	Sandwich	Truro	Wellfleet	Yarmouth	Total
Signal	36	9	1	2	9	4	11	3	6	6	1	6	0	3	17	114
Circle	4	4	0	1	1	1	2	1	3	0	1	3	0	0	3	24

Source: Cape Cod Commission

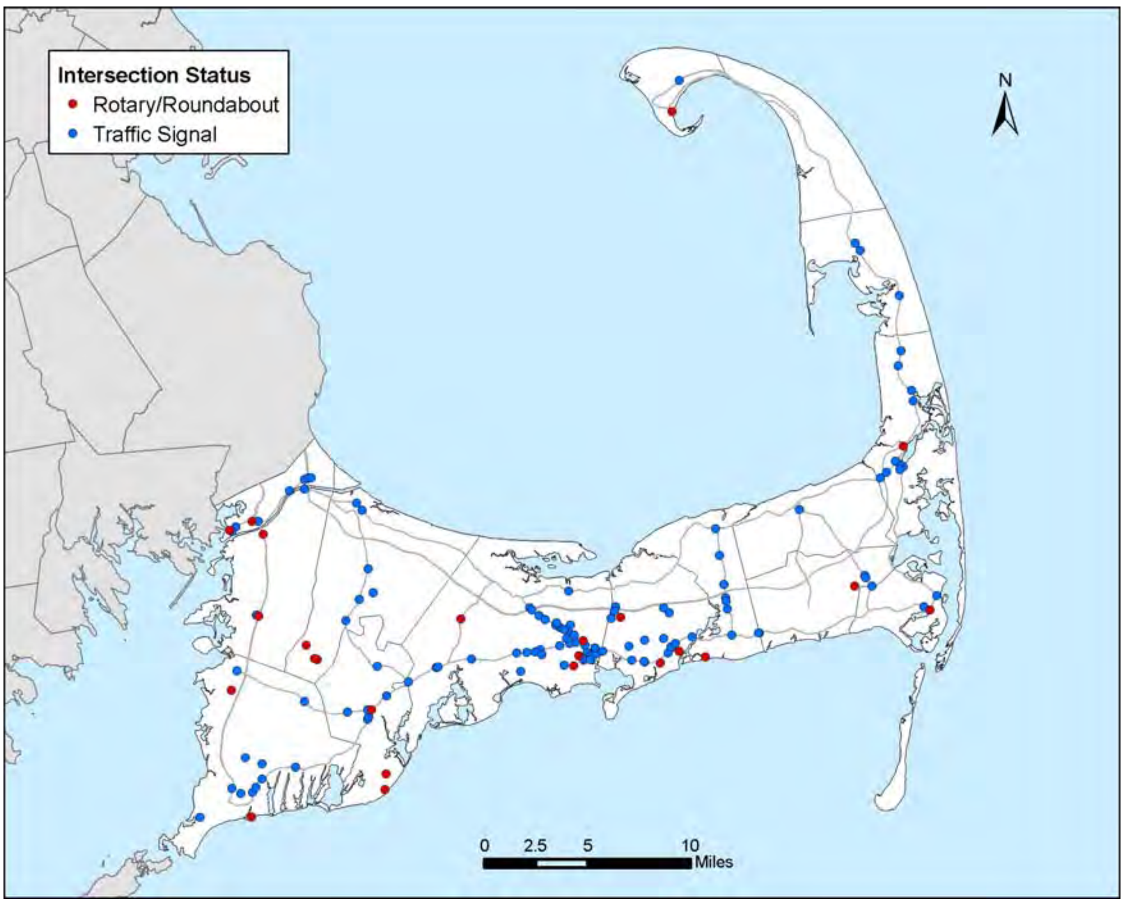


FIGURE 5 - ROADWAY INTERSECTIONS – TRAFFIC CONTROL
Source: Cape Cod Commission

2.2.3 SPEED LIMITS

The maximum legal speed limit on most Cape Cod highways is 55 mph. Exceptions include Route 3 (60 mph) and Route 25 (65 mph) in Bourne.

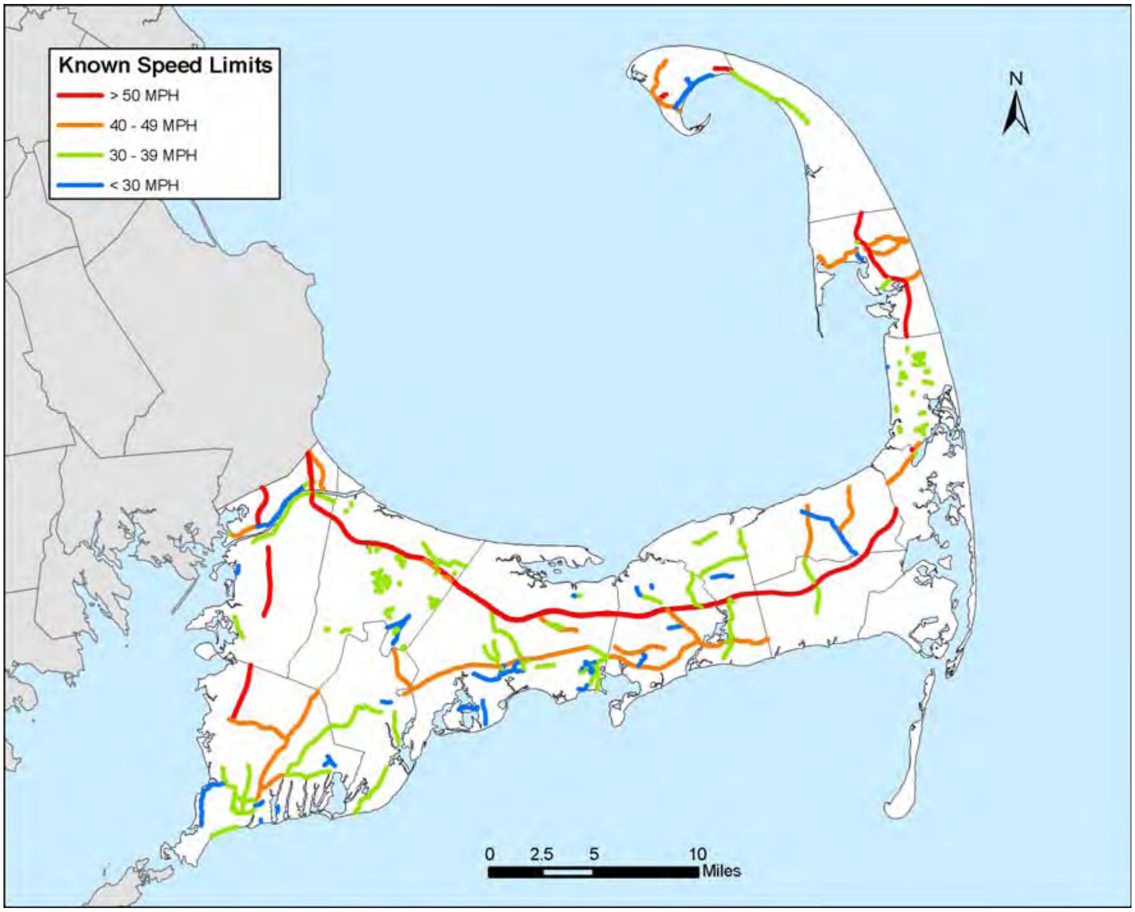


FIGURE 6 - SPEED LIMITS ON CAPE COD ROADWAYS
Source: Massachusetts Roadway Inventory File 2008

2.2.4 ROADWAY VOLUMES

1998-2008 was the first decade since the Cape Cod Commission has been counting traffic to experience an overall negative traffic growth. During this ten-year period, traffic volumes decreased by 4.6%. Although the ten-year period from 1999-2009 also experienced traffic volume decline (9.1%), there was positive growth from 2008 to 2009. Between 2008 and 2009, traffic increased by 4.5%.

Not all road volumes were decreasing during the 1999-2009 decade, though. Main thoroughfares on Cape Cod appeared to be staying fairly level or increasing while local roads were showing decreases. The Massachusetts Department of Transportation (MassDOT) maintains six permanent counter locations on or near Cape Cod on some of the more heavily trafficked roads. The following table displays those six locations with their ten-year growth, ten-year average annual growth, and one-year growth rate (2008-2009).

TABLE 4: PERMANENT COUNTING STATION SUMMER TRAFFIC GROWTH (1999-2009)

Permanent Traffic Counting Station	10 Year Total Growth	10 Year Average Annual Growth Rate	One Year Growth Rate 2008-2009
#15: Route 6 E of 149 (Exit 5)	-1.07%	-.11%	4.06%
#20: Route 3 N of Bourne TL	10.63%	1.01%	2.77%
#707: Bourne Bridge	-1.99%	-0.20%	4.57%
#708: Sagamore Bridge	-1.46%	-0.15%	2.06%
#709: Route 28 E of Higgins Crowell	-13.28%	-1.42%	-0.55%
#7351: Route 28 W of Old Post Rd.	-4.39%*	-0.75%*	1.93%
All MHD Stations	**-0.80%****	**-0.08%****	**2.47**

Source: 2009 Cape Cod Traffic Counting Report

With the exception of Permanent Counter #709, traffic volumes showed minimal decline. Counter #20 was the only site to have positive growth since 1999, with over 10% more traffic.

When including all Cape Cod roads in the analysis, no region in the county experience positive growth between 1999 and 2009. The following table exhibits the ten-year negative traffic growth for each region on Cape Cod.

TABLE 5 - CAPE COD SUMMER TRAFFIC GROWTH (1999-2009)

Region	Number of Comparisons	10 Year Total Growth	10 Year Average Annual Growth Rate
Upper Cape	112	-5.99%	-0.62%
Mid-Cape	86	-10.35%	-1.09%
Lower Cape	76	-11.87%	-1.26%
Outer Cape	56	-13.74%	-1.47%
All Roads	**330**	**-9.05%**	**-0.95%**

"Upper" = Bourne, Sandwich, Falmouth, Mashpee "Lower" = Harwich, Chatham, Brewster, Orleans

"Mid" = Barnstable, Yarmouth, Dennis "Outer" = Eastham, Wellfleet, Truro, Provincetown

Source: 2009 Cape Cod Traffic Counting Report

When analyzing traffic growth by region, it appears that traffic has experienced the least decline near the bridges, and the most decline furthest from the mainland. The following figure depicts the average annual decline in traffic for each region of Cape Cod.

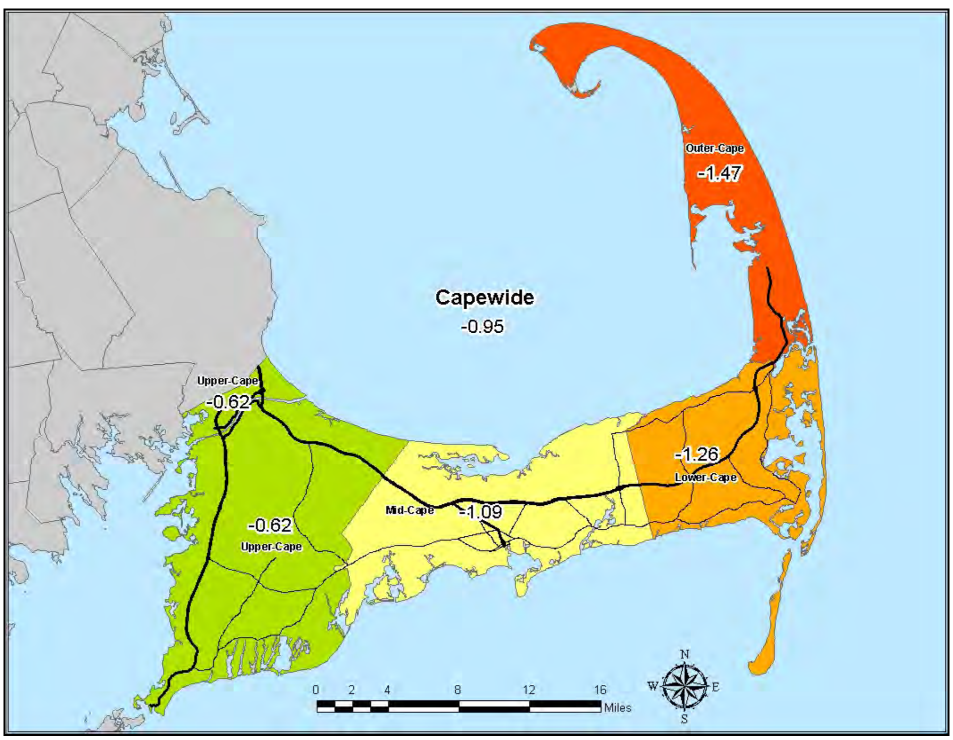


FIGURE 7: AVERAGE ANNUAL GROWTH RATE % (1999-2009)
Source: 2009 Cape Cod Traffic Counting Report

At most traffic counting locations, year-round average daily traffic is estimated using MassDOT Adjustment Factors in combination with summer traffic counts. These adjustment factors are calculated based on continuous traffic counts from MassDOT permanent counters. The Cape Cod MPO has advocated for an expansion of permanent counting stations into more areas of Cape Cod in several editions of the RTP.

The following figure shows year-round average daily traffic volumes on major Cape Cod roads. Heaviest travel occurs on the Cape Cod Canal road and canal bridges and the Mid-Cape Highway.

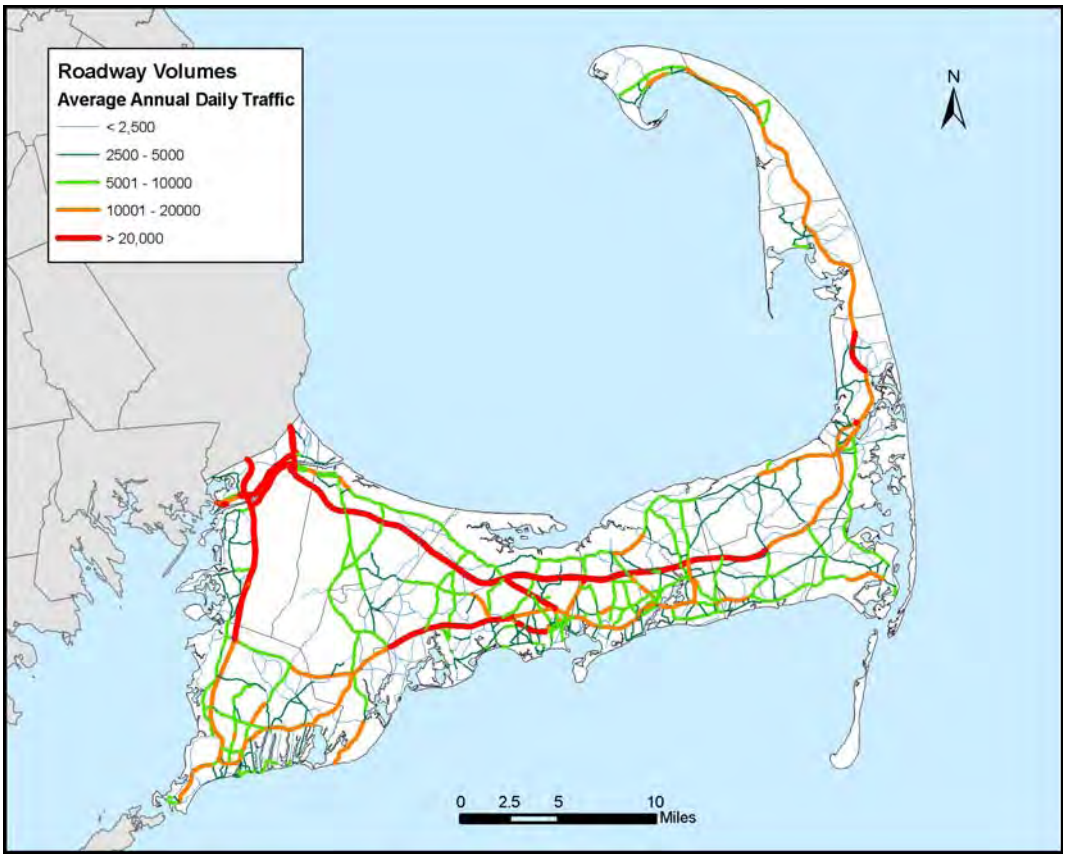


FIGURE 8 –YEAR-ROUND AVERAGE DAILY ROADWAY VOLUMES
Source: MassHighway Road Inventory 2008

2.2.5 LEVEL OF SERVICE

Level of Service is determined by dividing the volume of the roadway by its capacity. The resulting figure represents at what percentage of capacity a roadway is operating. Various ranges of the volume-to-capacity ratio are categorized into letter scores. Level of Service A is the best, while level of Service F is the worst (see following table).

TABLE 6 - LEVEL OF SERVICE DEFINITIONS

Level of Service	Volume-to-Capacity Ratio	Interpretation
A	0.00 – 0.60	Low volumes; primarily free-flowing operations. Density is low, and vehicles can freely maneuver within the traffic stream. Drivers can maintain their desired speeds with little or no delay.
B	0.61 – 0.70	Stable flow with potential for some restriction of operating speeds due to traffic conditions. Maneuvering is only slightly restricted. The stopped delays are not bothersome, and drivers are not subject to appreciable tension.
C	0.71 – 0.80	Stable operations; however, the ability to maneuver is more restricted by the increase in traffic volumes. Relatively satisfactory operating speeds prevail, but adverse signal coordination or longer queues cause delays.
D	0.81 – 0.90	Approaching unstable traffic flow, where small increases in volume could cause substantial delays. Most drivers are restricted in their ability to maneuver and in their selection of travel speeds. Comfort and convenience are low but tolerable.
E	0.91 – 1.00	Operations characterized by significant approach delays and average travel speeds of one-half to one-third the free flow speed. Flow is unstable and potential for stoppages of brief duration.
F	1.01+	Forced-flow operations with high approach delays at critical signalized intersections. Speeds are reduced substantially, and stoppages may occur for short or long periods of time because of downstream congestion.

Source: Highway Capacity Manual

The Cape Cod Travel Demand Model can be used to estimate the level of service of Cape Cod's major roadways. Currently, this model is still under development. Preliminary results of the model are shown in the following two figures. The first figure shows estimated traffic volumes, the second figure shows estimated Level of Service. Both figures represent current average summer p.m. peak hour conditions:

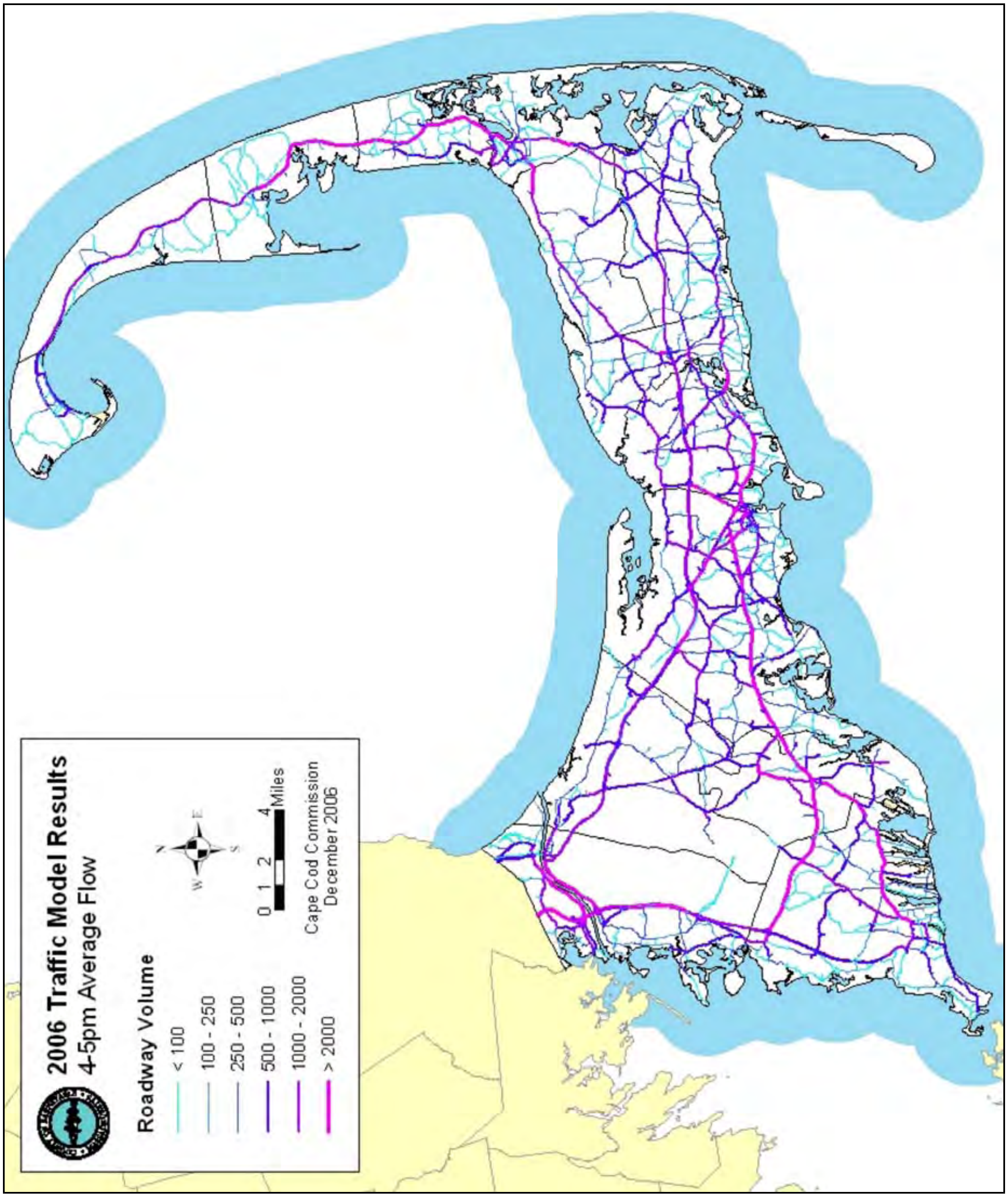


FIGURE 9 - ESTIMATED 2006 TRAFFIC FLOWS

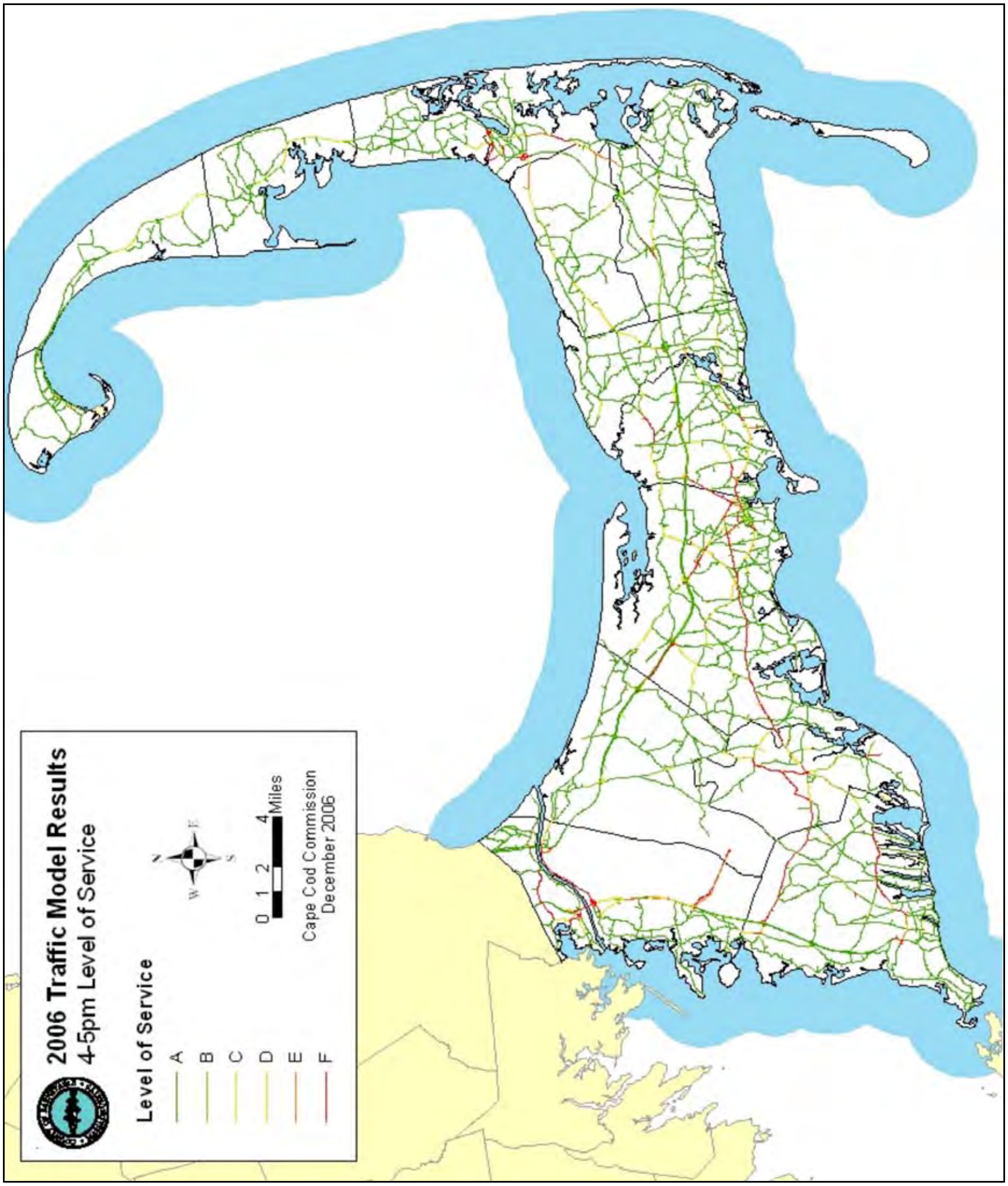


FIGURE 10 - ESTIMATED ROADWAY LEVEL OF SERVICE

2.2.6 PAVEMENT MANAGEMENT

The pavement management process is conducted with the intent to keep the roadway system in the best possible condition with the most efficient use of available funds. There are distinct advantages to managing pavement condition and significant cost savings that can take place with preventative or rehabilitation measures rather than waiting until a road is in need of reconstruction. The goal of the pavement management process is for all federal aid-eligible roads to be maintained in "excellent" condition.

To understand the condition of the regional roadway system, it is necessary to evaluate existing conditions with on-site data collection. Sophisticated programs use specialized vehicles with automated detectors to collect data. A more common, and less expensive, method is a visual "window survey" conducted by an individual trained in pavement condition evaluation. As seen on the following table, the Cape Cod Region possesses 738.98 miles of roadway eligible for federal funding. Of those miles, 541.19 are under the jurisdiction of the Cape's local communities.

		Jurisdiction - Ownership				Available Data for Local Jurisdiction	
	Total Miles	MassDOT	%	Municipal	%	Data Miles	%
Cape Cod	738.98	197.79	26.77%	541.19	73.23%	85.25	15.75%

As seen in the above table, MassDOT evaluated 85.25 miles of Cape Cod's federal aid eligible roads under municipal jurisdiction for pavement condition. 22.51 of those miles are in "excellent" condition, almost 30 miles are in "good" condition, 22.47 miles are in "fair" condition, and about 12 miles of evaluated roads are in "poor" condition. The following chart below depicts the breakdown of road conditions for those 85.25 miles of roadways under municipal jurisdiction that have been evaluated.

MassDOT evaluates roads under their own jurisdiction and a selection of municipally-owned roadways. The following map identifies the 85.25 miles of roadways that have been evaluated (shown in red) and the 455.94 miles that lack evaluation (shown in blue).

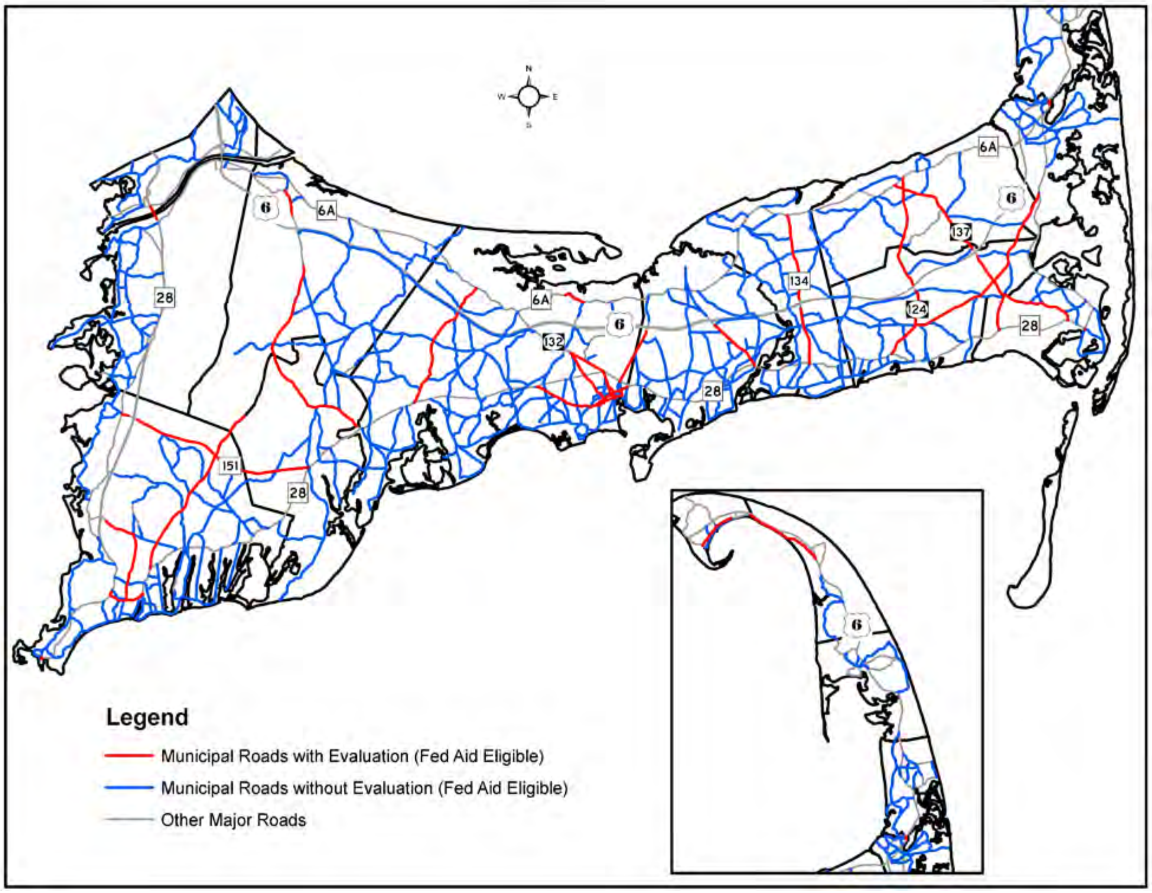


FIGURE 11 - PAVEMENT CONDITION

Elsewhere in the Commonwealth, several Regional Planning Agencies have a more comprehensive Pavement Management System, where they have 100% (or near 100%) of federal aid eligible roads evaluated. With all roads assessed, they have been able to generate a cost estimate to improve all roads within the system.

Based on costs estimated by the Old Colony Planning Council, improving a “Good” road to “Excellent” requires $40,400 per mile; improving from “Fair” requires $405,146 per mile; and improving from “Poor” requires $697,980 per mile. Improving all of Cape Cod’s municipally-owned Federal-Aid roadways to “Excellent” requires $118,944,832. While “Excellent” pavement is the ultimate goal of the MPO, this figure is well in excess of the financial constraints outlined in this RTP.

A strategy is required to responsibly allocate available funding to maintaining and improving pavement condition on Cape Cod. As can be observed by the costs listed above, allowing pavement to deteriorate to the lowest condition requires a significantly magnified cost to improve. To get closer to the MPO's ultimate goal, resources spent on improving "Fair" pavement would result in far more miles of resulting "Excellent" pavement than directing resources to "Poor" pavement. Nevertheless, "Poor" pavement cannot be ignored. Therefore, the strategy of this RTP is to evenly divide investment across the lower two categories. Based on expected resources identified in this RTP, the following table lists the resulting totals of each category:

TABLE 7 – CHANGE IN PAVEMENT CONDITION – IMPROVEMENT STRATEGY

Pavement Condition	Base Percent	Base Miles	Improvement Cost	Miles Improved	New Miles	New Percent
Excellent	26.40%	142.87		-	183.32	33.87%
Good	32.96%	178.38		-	178.38	32.96%
Fair	26.36%	142.66	$ 10,367,772	25.59	117.07	21.63%
Poor	14.28%	77.28	$ 10,367,772	14.85	62.43	11.54%
Totals	100.00%	541.19	$ 20,735,545	40.44	541.19	100%

Implementation of this strategy results in overall improvement of pavement quality. The percentage of "Excellent" municipally-owned Federal-Aid roadways increases from 26 to 34 percent. "Good" roadways are maintained at 33%. "Fair" roadways are reduced from 26 to 22%, and "Poor" roadways are reduced from 14 to 12 percent.

The Cape Cod Commission is currently engaged in an active pavement condition data collection effort. Beginning with the FY 2012 Unified Planning Work Program, a greatly expanded Pavement Management System effort will be underway. Results of these efforts will provide the Cape Cod MPO & Cape Cod towns with more up-to-date and accurate data for improved pavement funding decision-making.

2.2.7 AUTO OWNERSHIP

Based on census reports, over 131,000 vehicles are owned by Cape Cod households. It is important to note that the census is conducted in April and does not represent the peak (nor the annual low) condition. The majority of Cape Cod households, or 62.5%, own more than one vehicle. On average, Cape Cod households own 1.7 vehicles. Only 3% of Cape Cod households do not own a vehicle. According to the Census, this is higher than both the 34.9% of Boston households that do not own a car, and the 12.7% of Massachusetts' households who do not own a car. The dependence of Cape Cod households on automobiles is due to the low density of housing, jobs, and retail land uses and the lack of viable transit alternatives.

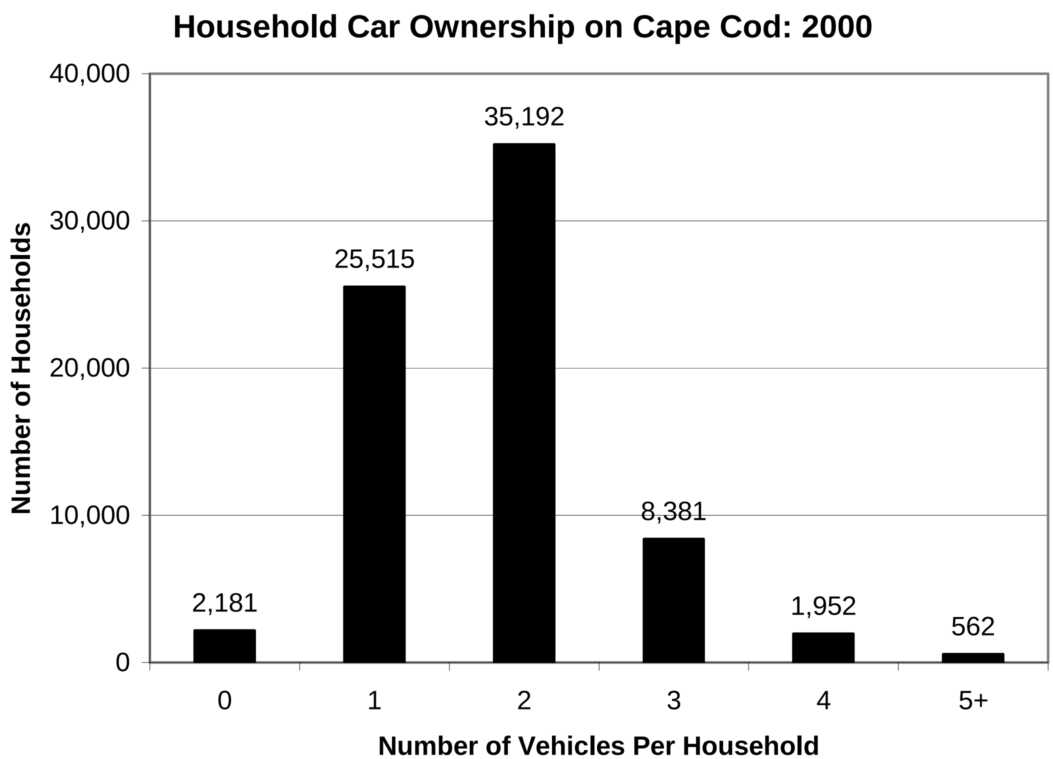


FIGURE 12 - HOUSEHOLD CAR OWNERSHIP ON CAPE COD: 2000

The following figure shows average auto ownership by household. Not that for all areas where data are available (e.g., no data available for portions of the Massachusetts Military Reservation), there is at least one automobile per household. Many areas have more than two automobiles per household on average. No areas had less than one automobile per household on average.

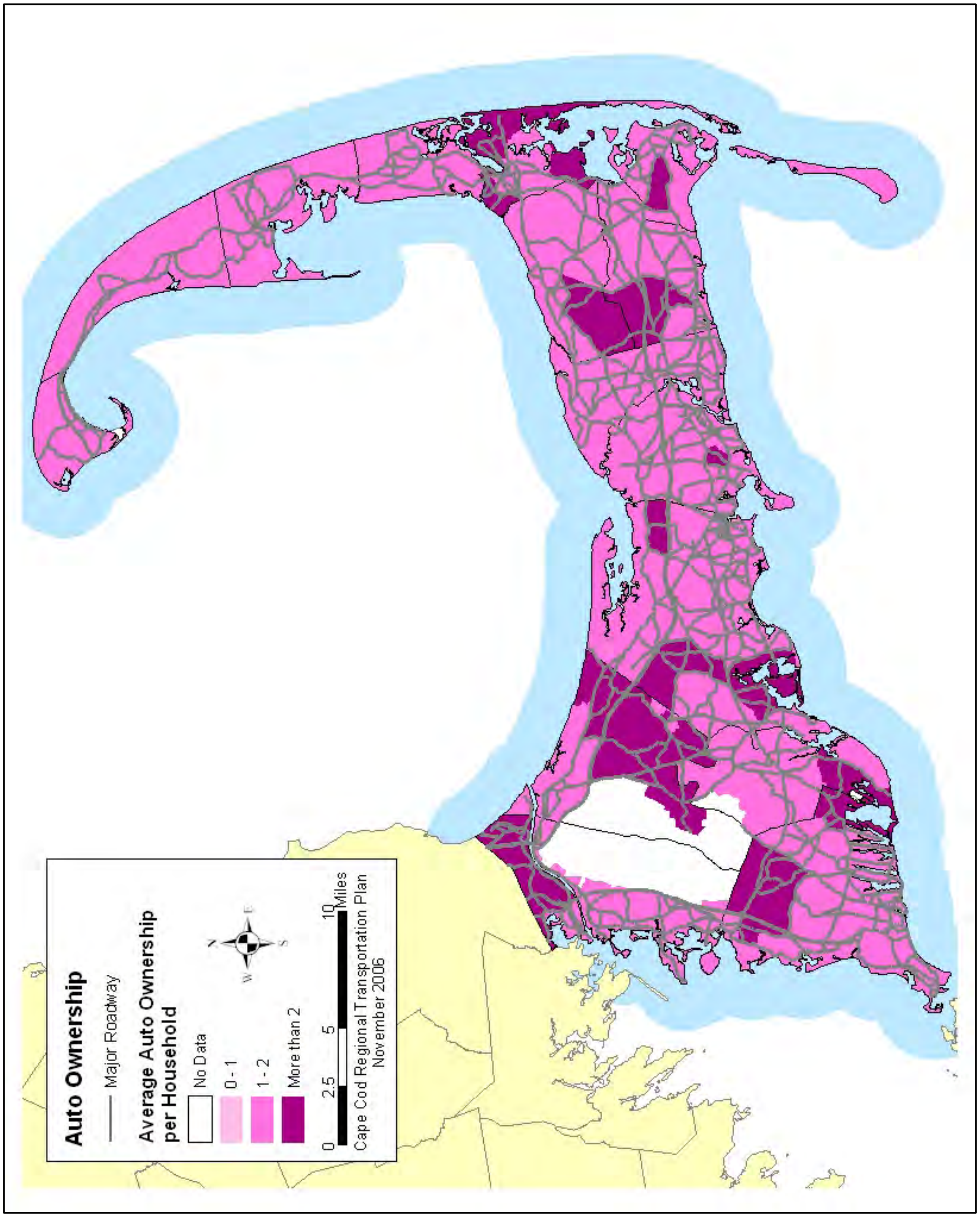


FIGURE 13 - AUTO OWNERSHIP ON CAPE COD

Source: US Census 2000

2.2.8 COMMUTER TRAFFIC

On average 20% of trips made daily by individuals are work-related. According to census data, 90% of Cape Cod residents commute to work in an automobile, either by themselves or in a carpool. Taken together, this means that commuter traffic is an important component of road transportation.

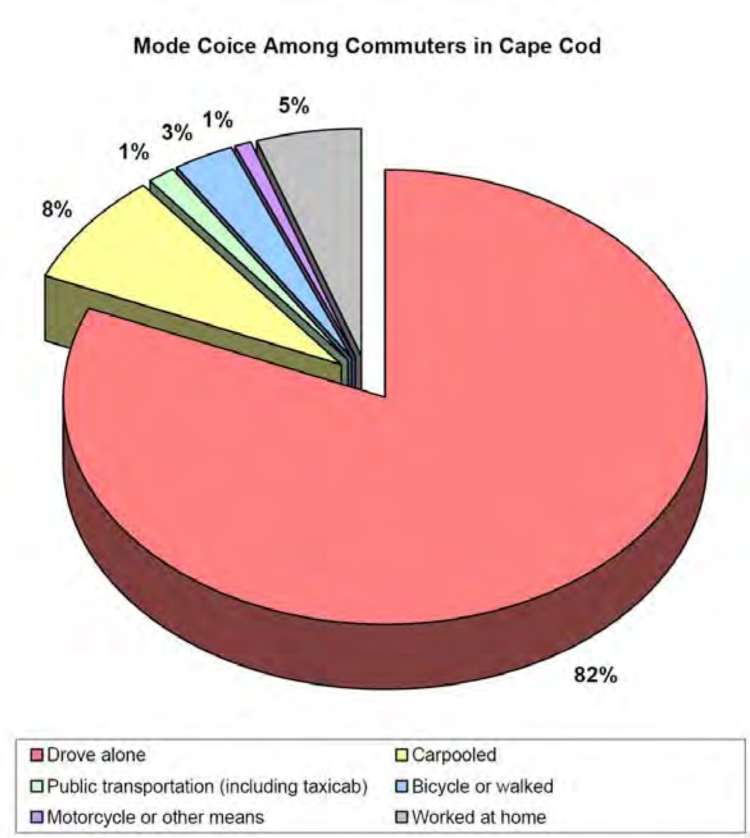
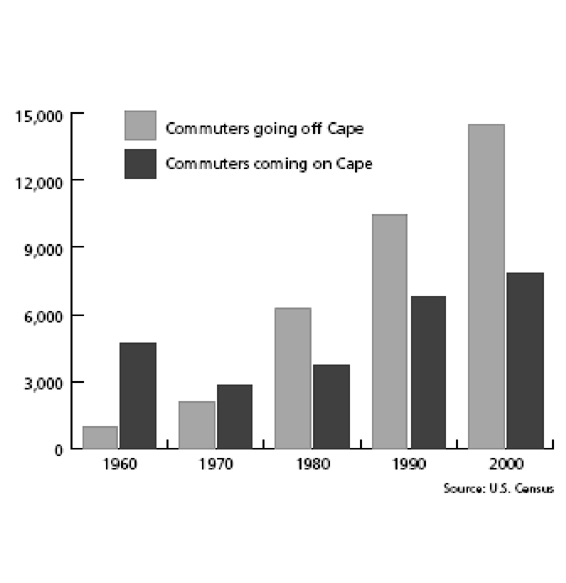


FIGURE 14 - COMMUTER MODE CHOICE AMONG CAPE COD RESIDENTS
Source: Research Triangle Institute, 1991

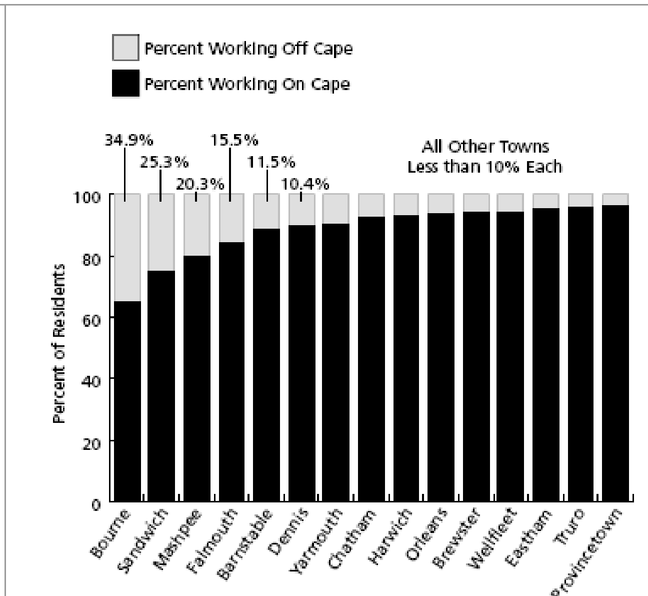
In 2000, 85.4% of employed Cape Cod residents worked on Cape Cod and 49.2% of those live and work in the same town according to the Census. Thus, despite the significant trips generated by long distance commuters, almost half of journey-to-work trips made by Cape Cod residents are local.

Several roads serve as major commuter corridors. Route 6 serves long distance commuters. Traffic at the entrance and exit ramps of the Mid Cape Highway can become congested at peak hours as commuting traffic attempts to transfer from Route 6 to the local road network, or vice versa. Exit 6 to Route 132 in Barnstable, and Exit 7 to Willow Street in Yarmouth can become particularly congested, as well as Exit 10 in Harwich. Route 6 in the Outer Cape can also become congested during peak hours. Route 28 also serves commuter traffic, specifically traffic between Falmouth and Bourne, and Falmouth and the Mid-Cape. Peak hour traffic on Route 28 from downtown Falmouth to Sandwich Road can experience high congestion. Understanding local commuting patterns will help planning efforts to address capacity limitations and peak hour congestion.

Another major area of congestion on Cape Cod is within the Cape Cod Canal transportation network. Given current employment figures, commuting trips accounted for roughly one-third of average daily traffic over the canal roadways in 2000. The majority of those trips are from commuters going off Cape (see figure below).



COMMUTING TRENDS FOR BARNSTABLE COUNTY, 1960-2000



COMMUTING BEHAVIORS FOR BARNSTABLE COUNTY TOWNS, 2000 CENSUS

FIGURE 15 - COMMUTING TRENDS AND PATTERNS
Source: Cape Trends, Cape Cod Commission

The following table lists for each Cape Cod town the number of workers residing in each town along with the location of employment. Bourne had the highest percentage of resident workers traveling to employment outside Barnstable County (34.9 %), in part due to its relative proximity to off-Cape employment centers. In contrast, only 3.7% of Provincetown workers leave the Cape for work in part due to the travel time from the county line.

TABLE 8 - BARNSTABLE COUNTY COMMUTING PATTERNS, BY TOWN, 2000 CENSUS

Town of Residence	All Workers	Place of Work		
		On Cape	Off Cape	% Off Cape
Barnstable	22,161	19,623	2,538	11.4%
Bourne	8,777	5,715	3,062	34.9%
Brewster	4,564	4,285	279	6.1%
Chatham	2,815	2,599	216	7.6%
Dennis	6,844	6,133	711	10.4%
Eastham	2,251	2,148	103	4.6%
Falmouth	14,509	12,266	2,243	15.5%
Harwich	5,160	4,788	372	7.2%
Mashpee	6,074	4,841	1,233	20.3%
Orleans	2,455	2,303	152	6.2%
Provincetown	1,554	1,496	58	3.7%
Sandwich	9,588	7,164	2,424	25.3%
Truro	899	860	39	4.3%
Wellfleet	1,304	1,231	73	5.6%
Yarmouth	10,242	9,252	990	9.7%
Barnstable County	99,197	84,704	14,493	14.6%

The following table lists the most popular cites or towns that employ Cape residents. The city of Boston alone comprises 19% of the off-Cape employment.

TABLE 9 - TOP DESTINATIONS OF RESIDENTS COMMUTING FROM BARNSTABLE COUNTY, APRIL 2000

Top Destinations of Residents Commuting from Barnstable County, April 2000

Boston	2,729	19%
Plymouth	1,151	8%
Wareham	760	5%
Brockton	404	3%
Quincy	323	2%
Cambridge	273	2%
New Bedford	237	2%
Middleboro	232	2%
Kingston	225	2%
Taunton	215	1%
Braintree	202	1%
Newton	172	1%
Canton	162	1%
Providence	154	1%
Lakeville	152	1%
All Other	7,102	49%
TOTAL	14,493	100%

(Source: US Census 2000)

The following figure graphically shows surrounding counties that employ Cape residents as well as provide workers traveling to Barnstable County. The left half of each bar chart, shown in blue, indicates the relative number of Cape Cod residents who are employed in each county. The right half of each bar chart indicated in red, show the relative number of workers from each county who are employed on Cape Cod. As mentioned above, Boston (Suffolk and Norfolk Counties) is a major attractor of Cape workers but does not serve as a large residence-base for employees traveling to Barnstable County. Plymouth County does serve as the largest off-Cape county sending workers and also is a major employer of Cape residents.

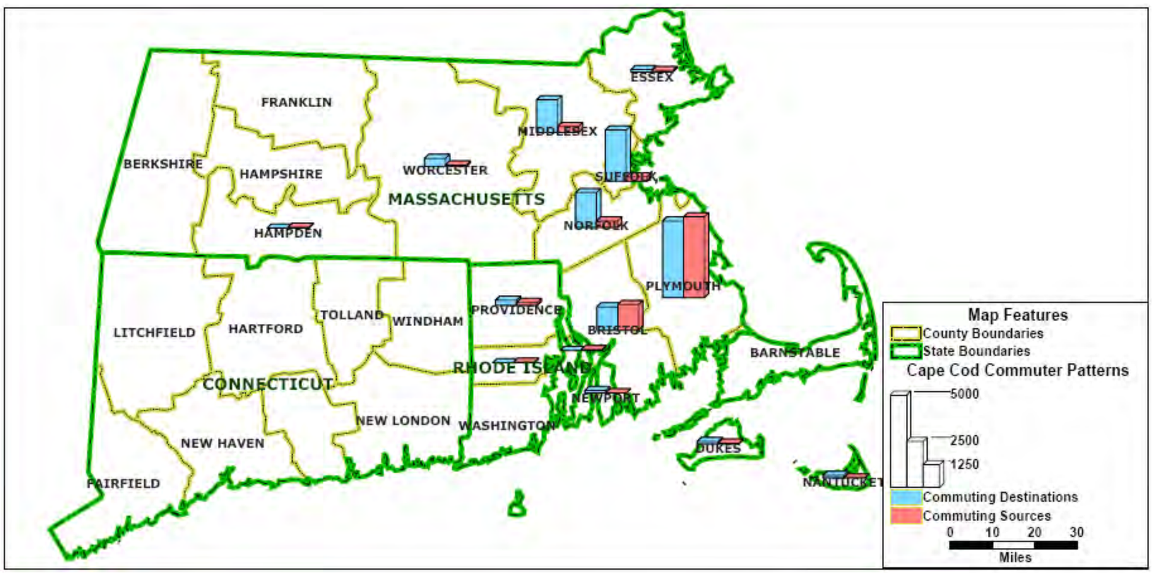


FIGURE 16 - COMMUTING PATTERNS (DESTINATIONS OF CAPE COD RESIDENTS)

2.2.9 VISITOR TRAFFIC

A mainstay of the summer economy is the influx of visitors during the summer season. The figure below illustrates a sample of the geographically-diverse and plentiful selection of attractions. Areas shaded in purple include the many beaches and marinas located throughout the Cape. Green-shaded areas include attractions such as parks, golf courses, etc.

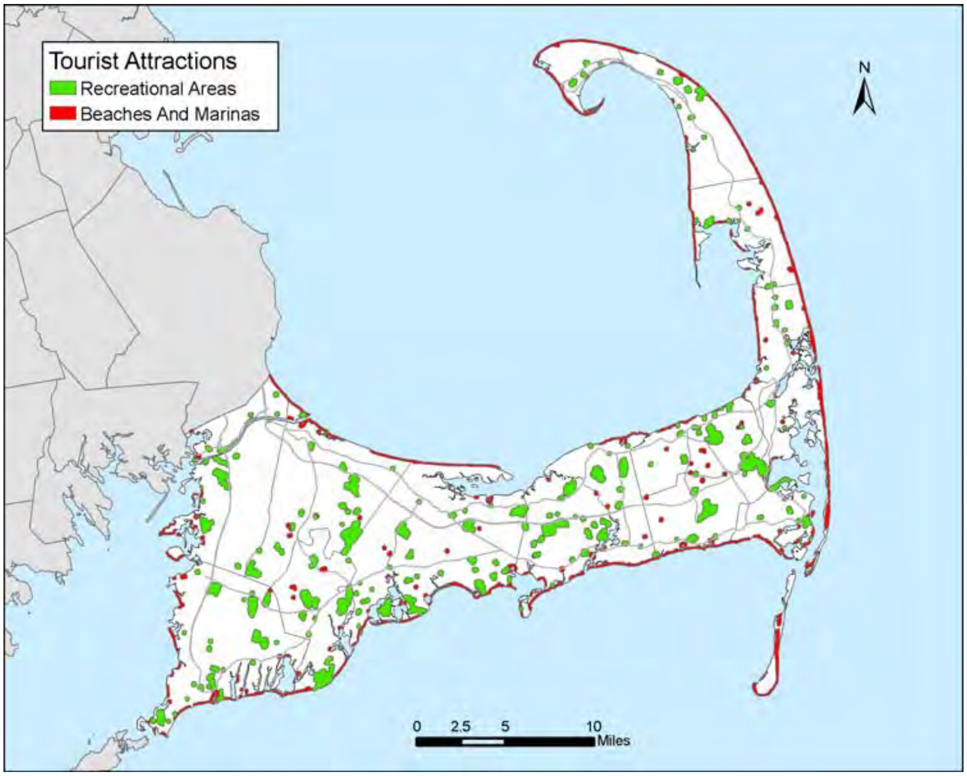


FIGURE 17 - VISITOR ATTRACTIONS ON CAPE COD
Note: Map features have been enlarged with a 0.1 mile buffer to provide better visibility

Route 28 License Plate Survey

The Cape Cod Commission conducted a license plate survey on September 29, 2009 in the towns of Yarmouth and Barnstable. License plates were recorded in an effort to determine route choice for westbound vehicles from Route 28 in West Yarmouth to Route 28 in Centerville (Barnstable). It was possible to locate each vehicle with Massachusetts license plate to a zip code of origin. The following figure depicts the registered location (by zip code) of each matched Massachusetts plate.

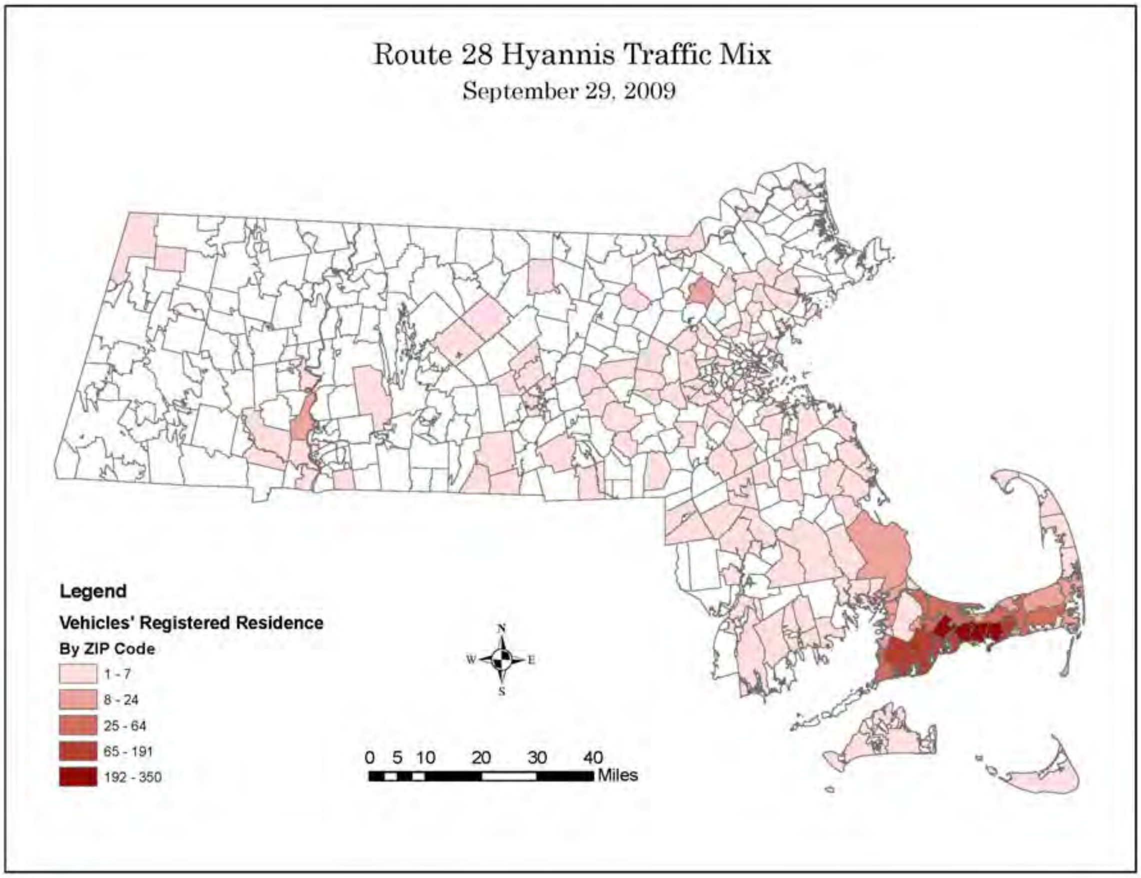


FIGURE 18: LICENSE PLATE STUDY: MA PLATE REGISTERED RESIDENCE (ZIP CODE)
Source: Cape Cod Commission

Out of state visitors recorded during this study were identified by their non-Massachusetts license plate. Of those non-Massachusetts vehicles, the majority were registered in Florida (42 total). It is likely that these vehicles belonged to people who own housing in both states, rather than just temporarily visiting Cape Cod. After Florida, the majority of non-Massachusetts plates hailed from the northeast, with the largest numbers coming from New York (37), Rhode Island (18), Connecticut (14), and New Jersey (7). The following figure shows the registered states from vehicles visiting the study area from outside Massachusetts.

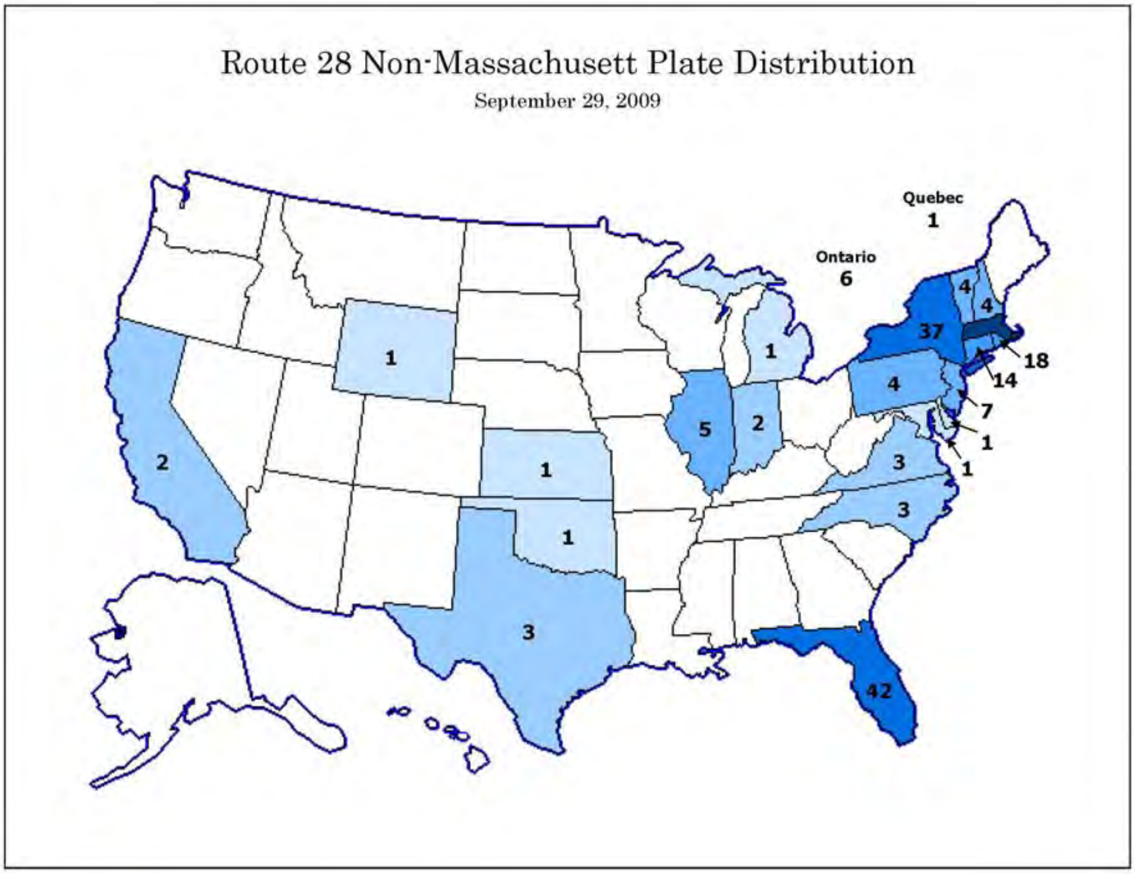


FIGURE 19: LICENSE PLATE STUDY: NON-MASSACHUSETTS STATE OF ORIGIN
Source: Cape Cod Commission

2.2.10 FREIGHT TRAFFIC

This section includes information regarding patterns of freight traffic on Cape Cod, focusing primarily on trucks and their travel patterns. There are over 204 miles of designated truck routes under state authority (shown in the following figure). FHWA estimates that truck traffic will increase on Cape Cod during the next 20 years. Estimates for the years 1998 and 2020 are shown in the two figures on the following pages.

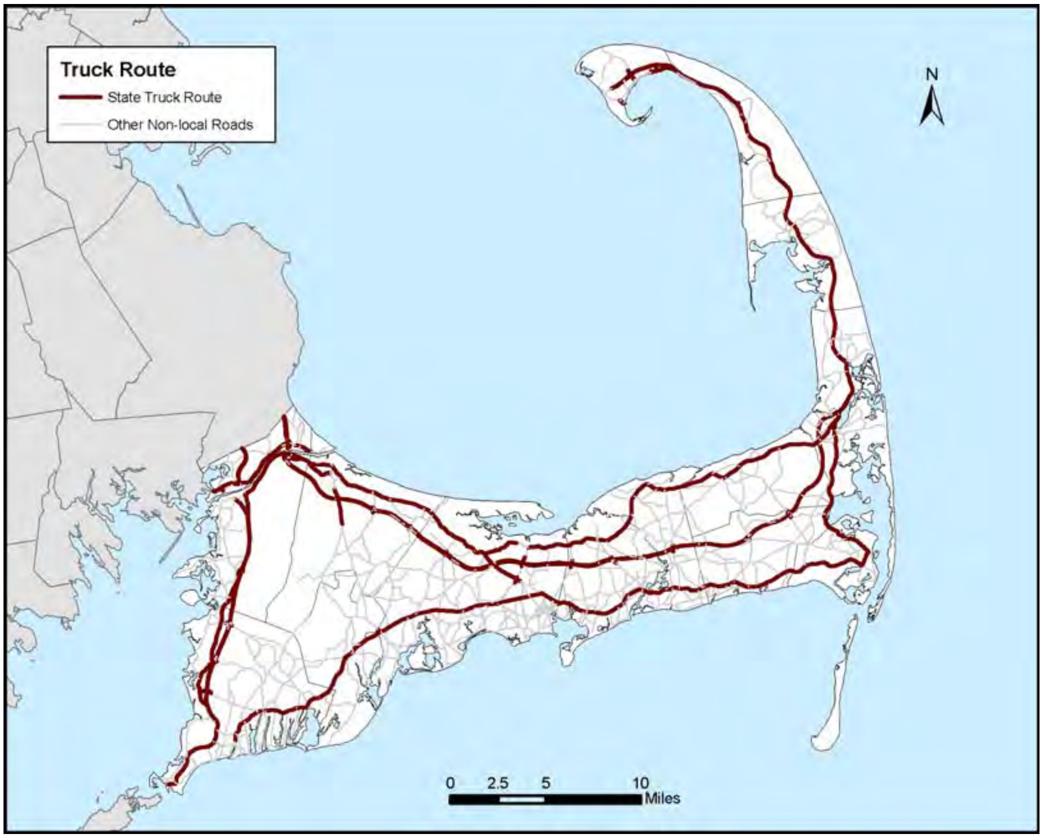


FIGURE 20 - DESIGNATED TRUCK ROUTES UNDER STATE AUTHORITY
Source: Massachusetts Roadway Inventory File 2008

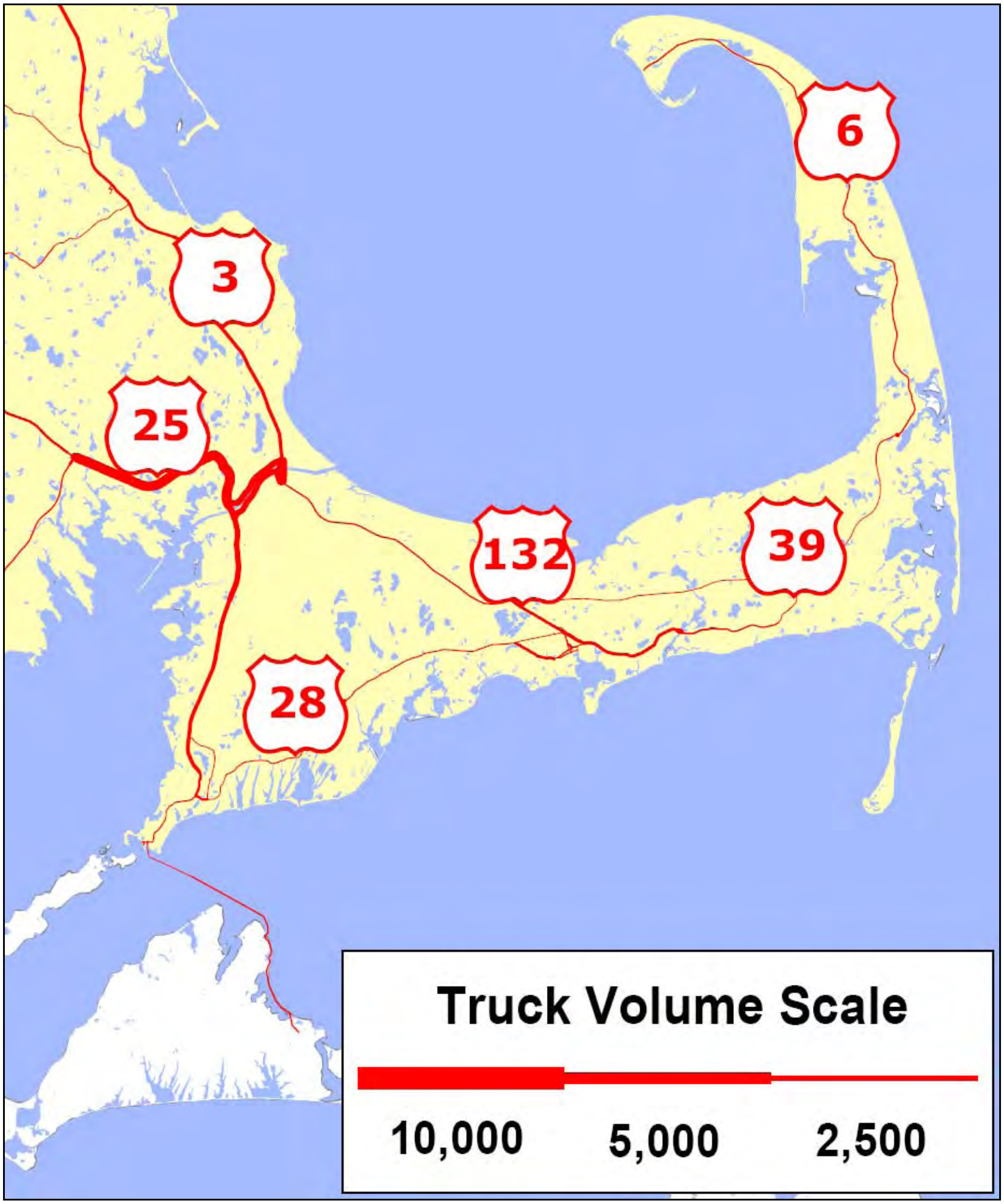


FIGURE 21 - ESTIMATED AVERAGE ANNUAL DAILY TRUCK TRAFFIC: 1998
Source: FHWA

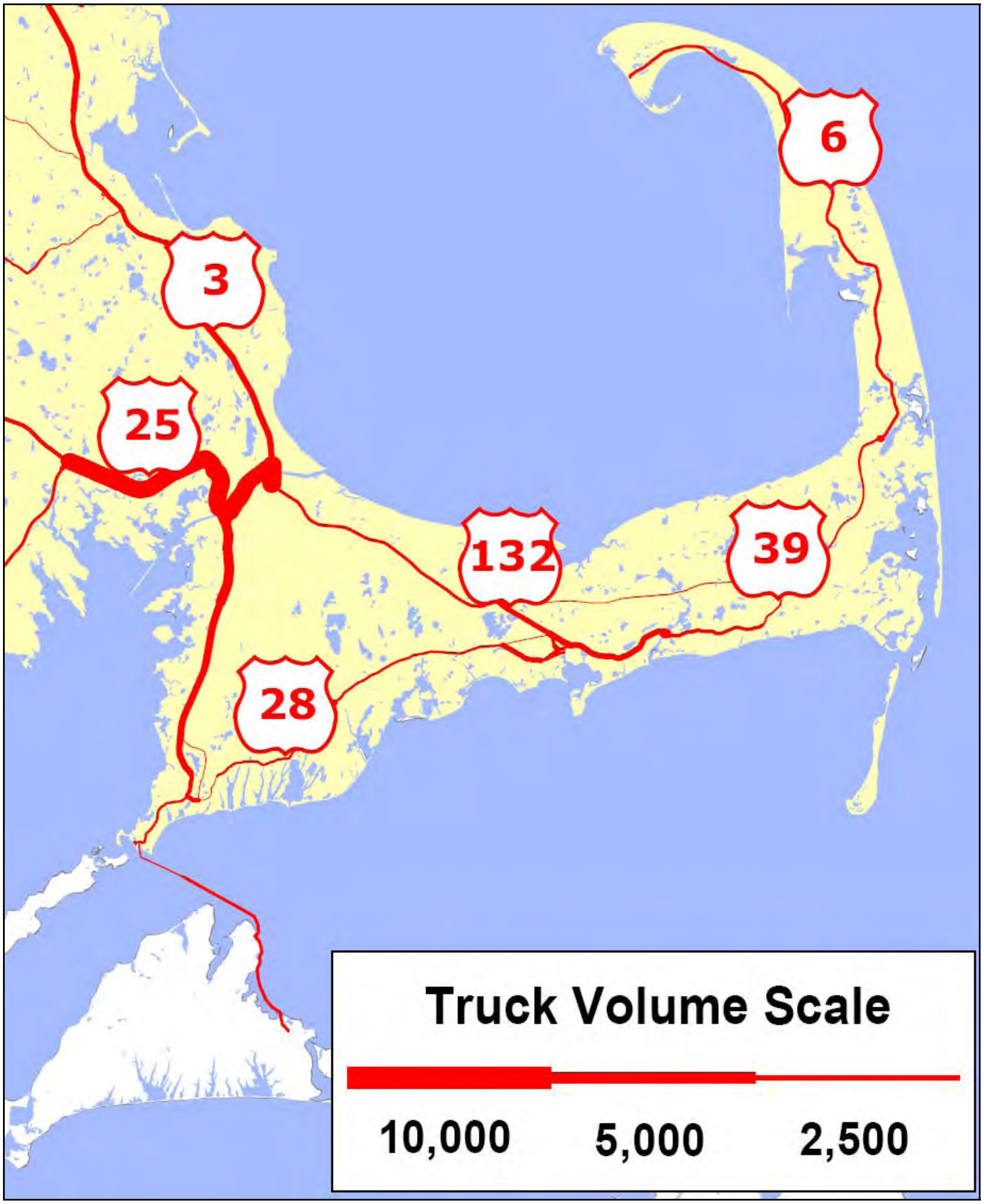


FIGURE 22 - ESTIMATED AVERAGE ANNUAL DAILY TRUCK TRAFFIC: 2020
Source: FHWA

2.2.11 BRIDGES

Cape Cod's bridges serve many important functions, one of which is to permit travel over waterways. The Bourne Bridge and Sagamore Bridge permit vehicular travel over the Cape Cod Canal. If not for the canal bridges, a motorist would have to use a ferry to reach Cape Cod. Due to their significance, the canal bridges are discussed at length in another section of the RTP. Several other bridges connect motorists to places that they would not be able to reach normally by car. The bridges to Osterville Grand Island in Barnstable and to Lieutenant Island in Wellfleet are perfect examples. Other bridges make travel more convenient by connecting two sides of a waterway. The Bass River, Swan Pond River, and Centerville River crossings allow vehicles to travel more directly to their destinations, without having to drive out of their way in order to avoid waterways.

Another function of Cape Cod's bridges is to provide grade separation. At-grade intersections would not work on many roadways, such as Route 6, due to high traffic volumes or safety concerns. Interchanges and overpasses along Route 6 and the access controlled portion of Route 28 help to separate roadway traffic and permit safe travel. Railroad crossings may also present safety concerns. Several bridges on Cape Cod separate roadways from railroad tracks. For all these reasons, bridges play an important role in the Cape Cod transportation system.

Cape Cod has over one hundred bridges, primarily located along coastlines and Route 6 (see following figure). Forty-two bridges are over waterways, including the Cape Cod Canal, Bass River, and other small creeks and inlets. Forty–three of Cape Cod's bridges are overpasses, underpasses, or waterway crossings for Route 6. Sixteen of Cape Cod's bridges are overpasses or waterway crossings for Route 28. Falmouth has the most bridges of any Cape Cod town, given its many bays and inlets and the access-controlled portion of Route 28 (see following table). The oldest bridge on Cape Cod is the northern crossing of Palmer Avenue over the Bay Colony Railroad tracks, which was constructed in 1896 (see following figure). The newest bridges in Barnstable County are the new Route 3 overpasses, built in 2006 as part of the Sagamore Flyover.

TABLE 10 - BRIDGE CONDITIONS OF CAPE COD, BY TOWN

	Total Bridges	Functional Bridges	Functionally Obsolete Bridges	Structurally Deficient Bridges
Bourne	10	6	4	0
Sandwich	9	3	6	1
Falmouth	25	18	7	1
Mashpee	0	0	0	0
Barnstable	16	7	9	0
Yarmouth	9	5	4	0
Dennis	13	5	6	2
Harwich	8	5	3	0
Chatham	1	0	0	1
Brewster	1	1	0	0
Orleans	4	3	1	0
Eastham	1	1	0	0
Wellfleet	3	2	1	0
Truro	2	2	0	0
Provincetown	0	0	0	0
Cape Cod	**102**	**55**	**42**	**5**

Source: AASHTO 2010

The Bourne Bridge and Sagamore Bridge, both under the jurisdiction of the Army Corp of Engineers, are not included in the AASHTO ratings, nor are any of the various rail bridges.

The condition of bridges on Cape Cod is important given their functions. Bridges are rated on a scale of 0 to 100 by the American Association of State Highway and Transportation Officials (AASHTO) according to their type, lane widths, age, structural conditions, and other factors. A higher score indicates a better condition, while a lower score indicates a poorer condition. Scores of 50 or lower qualify for replacement. Of the 102 rated bridges on Cape Cod, only 9 are rated below 50. However, 58 bridges were rated between 50 and 80. As these bridges age, their ratings will decrease. Being mindful of potential bridgework to be completed in the next 30 years will ensure the timely replacement of poorly rated bridges.

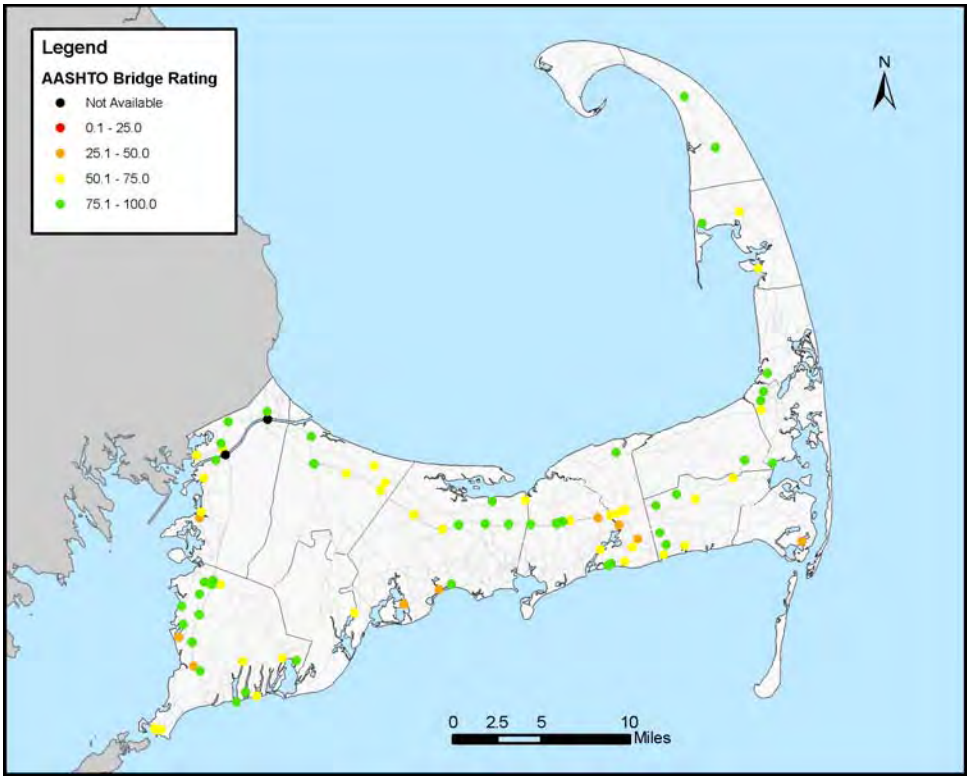


FIGURE 23 - THE BRIDGES OF BARNSTABLE COUNTY

At the time of the last RTP (based on 2006 data), the average bridge rating was 73.6. Four years later, the average is now 72.9 – a decline of less than one. 42 bridges are currently identified as functionally obsolete, which is an increase of five since the last RTP. The number of structurally deficient brings has decreased during that time period – from seven to four.

FIGURE 24 - THE NORTHERN CROSSING OF PALMER AVENUE OVER THE BAY COLONY RAILROAD TRACKS IN FALMOUTH

Bridges are also identified as structurally deficient or functionally obsolete. These classifications identify bridges that are eligible for various federal and state funding. A bridge is considered structurally deficient if it is closed, restricted to light vehicles, or requires immediate rehabilitation to remain open. Cape Cod has seven structurally deficient bridges. Dennis is the town with the most structurally deficient bridges (see previous table). A bridge is considered functionally obsolete if it does not meet the current standards for deck geometry, approach roadway alignment, clearance, or load carrying capacity. Cape Cod has 42 functionally obsolete bridges, with Barnstable having the most of any town (see previous table). Many of Cape Cod's bridges are considered functionally obsolete due to narrow lane widths or a low level of service. Several projects are currently underway through the Transportation Improvement Program (TIP) to address structurally deficient bridges on Cape Cod. Ensuring that Cape Cod's bridges are functional and structurally sufficient will improve safety and traffic flow.

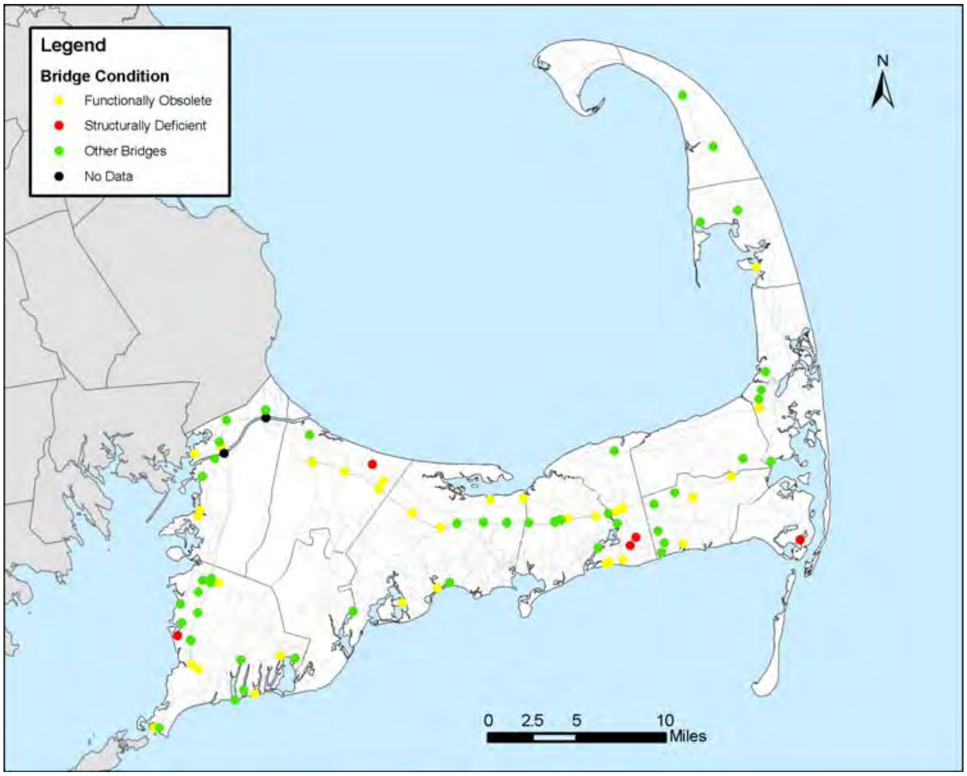


FIGURE 25 - STRUCTURALLY DEFICIENT AND FUNCTIONALLY OBSOLETE BRIDGES ON CAPE COD

2.2.12 U.S. ROUTE 6

U.S. Route 6 runs from Provincetown, Massachusetts all the way to Bishop, California, and is the longest continuous route in the United States. On Cape Cod, Route 6 is the major transportation corridor, particularly for those traveling long distances. From where it enters Barnstable County in Buzzards Bay until its end in Provincetown, it provides a primarily limited-access high-speed means of traveling along the spine of the Cape both for private automobiles and for public transit. The Route 6 corridor in the Outer Cape, where the roadway does not have limited access, also contains segments of the Claire Saltonstall Bikeway, or State Bicycle Route 1. There are four primary sections of Route 6 on Cape Cod that can be identified by their roadway characteristics.

Buzzards Bay to Sagamore Bridge

From where it enters the county in Buzzards Bay to where it crosses the Cape Cod Canal at the Sagamore Bridge Route 6 is a two- to four-lane road with curb cuts on both sides.

The Sagamore Rotary, located north of the Sagamore Bridge, was eliminated by 2006. This new grade separated intersection provides for a direct connection between Route 3 and the Sagamore Bridge and, according to MassDOT, will help relieve the congestion that occurs on either side of the bridge frequently during the summer.

As part of the Canal Area Transportation system, this section of Route 6 is discussed at greater length in a later section of this chapter.

FIGURE 26 - SCENIC HIGHWAY (ROUTE 6), WEST OF BOURNEDALE ROAD

Sagamore Bridge to Exit 9, Dennis

From the Sagamore Bridge to just after Exit 9 in Dennis, Route 6 is a four-lane limited-access highway with a grass shoulder and rest areas.

FIGURE 27 - ROUTE 6 AT EXIT 4 IN SANDWICH

FIGURE 28 - ROUTE 6 BETWEEN EXITS 8 AND 9 (MID-CAPE)

Exit 9, Dennis to Orleans Rotary

From Dennis to the Orleans/Eastham rotary the road narrows to two lanes but remains limited-access, with a raised median and yellow reflective post delineators to reduce crossovers from one direction of traffic to the other. The divider is low enough to allow emergency vehicles to straddle the raised median for emergency access. This section is actually built on what was designed to be one direction of a divided highway.

FIGURE 29 - ROUTE 6 BETWEEN EXITS 9 AND 10 (LOWER CAPE)

Orleans Rotary to Provincetown

Route 6 in the Outer Cape area was generally a consolidation of existing roadways and evolved over time since the 1930s. Short sections of the original Route 6 have been retained for local access for road straightening projects. In northern Truro and Provincetown, the original Route 6 became Route 6A.

Finally, from the Orleans Rotary until the road's end in Provincetown the road is once again a two- to four- lane road with curb cuts on both sides, although a grassed median does limit crossovers on sections of Route 6 in Truro and Provincetown.

FIGURE 30 - ROUTE 6 NORTH OF GOVERNOR PRENCE ROAD, EASTHAM (OUTER CAPE)

TABLE 11 - CONSTRUCTION TIMELINE OF THE MID-CAPE HIGHWAY: 1950-1971

Year Completed	Configuration	Segment Description
1950	2 lanes	Sagamore Bridge to Hyannis (exit 6)
1954	2 more lanes (4 total)	Sagamore Bridge to Hyannis (exit 6)
1955	2 lanes	Hyannis (exit 6) to Dennis (exit 9)
1956	2 lanes	Dennis (exit 9) to Harwich/Brewster (exit 11)
1958	2 lanes	Harwich/Brewster (exit 11) to Orleans (exit 12)
1959	2 lanes	Orleans (exit 12) to Orleans/Eastham Rotary
1967	2 more lanes (4 total)	Hyannis (exit 6) to Yarmouth (exit 7)
1971	2 more lanes (4 total)	Yarmouth (exit 7) to Dennis (exit 9)

Safety

The primary debate surrounding Route 6 has been the balance between safety, capacity, and the environment. Some want to increase capacity through structural improvements to accommodate high levels of traffic safely. The levels of traffic between Dennis and Orleans are lower than those between Sandwich and Dennis, but still above what many consider the capacity of a two-lane highway with limited access and unpaved shoulders. The Route 6 interchanges are among the most dangerous intersections on Cape Cod. On the Outer-Cape, the intersection of Route 6 and Brackett Road is also an intersection of safety concern. Since January of 2007, there have been eleven fatal crashes on Route 6 – six on the limited access portion of the highway, and five on the Outer-Cape. Four of the Outer-Cape crashes occurred in Wellfleet, and the other occurred in Truro.

Similarly, on the Outer Cape, many have sought some way to increase safety for pedestrians and cars along Route 6. In addition, the proliferation of curb cuts along that segment of the road has caused increased congestion and increased the potential for crashes. Also, in the segment along the Canal, traffic tends to travel faster than the roadway geometry design speed. Safety issues are discussed in greater detail in another chapter of the RTP.

Congestion

Traffic flow along the corridor is reasonable in the winter but often operates poorly in the summer. During peak travel periods in the summer it is not unusual for westbound traffic to be stopped for several miles east of the Sagamore Bridge. Average Daily Traffic (ADT) volumes, mileage, and Vehicle Miles Traveled (VMT) are presented in the following table:

TABLE 12 - TRAFFIC VOLUMES & MILEAGE: ROUTE 6

Town	Summer ADT	Annual ADT	Miles	Avg. Daily Vehicle Miles Traveled (VMT)
Bourne*	65,694	49,258	1.71	84,230
Sandwich	60,023	46,818	6.90	323,043
Barnstable	61,449	46,391	8.28	384,120
Yarmouth	56,307	43,920	4.56	200,274
Dennis	44,458	34,678	2.04	70,742
Harwich	33,429	26,075	5.63	146,799
Brewster	22,587	17,618	2.92	51,445
Orleans	20,308	15,840	3.6	57,024
Eastham	28,122	21,936	6.12	134,245
Wellfleet	21,856	17,048	8.56	145,929
Truro	15,542	12,123	9.93	120,383
Provincetown	9,153	7,139	3.8	27,129
Total			**64.05**	**1,745,362**

** south/east of Sagamore Bridge*

Source: MassDOT and Cape Cod Commission 2009 Traffic Volumes
Note: Annual ADT Estimates Based on MassDOT Adjustment Factors

The following figure details the traffic volume between each interchange on the limited access portion of Route 6. This length of road begins at the Sagamore Bridge in the west and ends at the Eastham Rotary in the east. Between the bridge and Exit 9 in Dennis, Route 6 is two lanes in each direction separated by a grassy median. East of Exit 9, the highway is one lane in each direction separated by a narrow paved berm. The heaviest volumes are near the Sagamore Bridge, west of Exit 6 in Barnstable (which leads towards Hyannis), and east of Exit 7 (another Hyannis exit for travelers from the Lower or Outer Cape).

FIGURE 31: ROUTE 6 LIMITED ACCESS VOLUMES

Land Use

Adjacent land uses vary by location. In the limited access sections of the road there is some residential development and some industrial development along the corridor. In the sections with curb cuts there is more commercial development, including retail activity.

In addition to being the main thoroughfare for the Cape as a whole, it also is the "Main Street" of several Cape towns or villages. Buzzards Bay, Eastham, and to a lesser degree, Truro and Wellfleet, all use Route 6 as a downtown thoroughfare. This dual purpose for the road has created some conflicts for this corridor.

2.2.13 STATE ROUTE 28

State Route 28 begins at the New Hampshire border and enters Barnstable County at Cohasset Narrows on the border of Bourne/Wareham. Route 28 runs for almost sixty-five miles crossing the Cape Cod Canal and passing through villages adjacent to Buzzards Bay/Nantucket Sound/the Atlantic Ocean from Bourne to Orleans Center. Route 28 is a regional roadway but it does not provide very direct inter-regional travel options in most cases. Some alternative routes to 28 include Route 151, Buck Island Road, Great Western Road, Upper and Lower County Roads, Route 39 and, for longer trips, Route 6. The cross section of Route 28 varies greatly throughout the Cape. However, there are three primary sections to Route 28, which are identifiable by their roadway characteristics.

Buzzards Bay to Bourne Rotary

Route 28 consists of four lanes from the county line across the Bourne Bridge to the Bourne Rotary.

Bourne Rotary to Palmer Avenue, Falmouth

Route 28 consists of four lanes, divided by a grassy median, from the Bourne Rotary to Saconesset Hills in Falmouth. The western side of Route 28 in Bourne from the Bourne Rotary to the Otis Rotary (MacArthur Boulevard) allows property access. Vehicles can reverse direction via a number of U-turn areas in the median.

FIGURE 32 - ROUTE 28 NORTH, SOUTH OF THE OTIS ROTARY IN BOURNE

Palmer Avenue, Falmouth to Orleans Rotary

From Palmer Avenue in Falmouth, Route 28 is predominately two lanes to the intersection of Old Stage Road in Barnstable. Route 28 then transitions to four Lanes from Old Stage Road to Phinneys Lane in Barnstable and then predominately is two lanes from Phinneys Lane to the Orleans/Eastham Rotary.

FIGURE 33 - ROUTE 28 NORTH OF JONES ROAD/DAVID STRAITS, FALMOUTH (UPPER CAPE)

FIGURE 34 - ROUTE 28, EAST OF ROUTE 149 IN BARNSTABLE (MID-CAPE)

FIGURE 35 - ROUTE 28 IN SOUTH YARMOUTH (MID-CAPE)

FIGURE 36 - ROUTE 28 EAST OF ROUTES 124 AND 39 (LOWER CAPE)

FIGURE 37 - ROUTE 28 NORTH OF ROUTE 39 IN ORLEANS (LOWER CAPE)

Safety

Route 28 has a variety of conditions ranging from a limited access, divided highway to a two lane roadway. Route 28 includes many of Cape Cod's highest crash locations. Based on data from 2006-2008, Route 28's most dense areas of concern are in Buzzards Bay, downtown Falmouth, and from Yarmouth Road in Hyannis to the Harwich town line. Since January 2007, there have been nine fatal crashes on Route 28. Fatal crashes were concentrated on MacArthur Boulevard in Bourne and in Barnstable between the Centerville Mall and the Airport Rotary. Safety issues are discussed in greater detail in another chapter of the RTP.

Congestion

Traffic flow along the corridor is generally heavy during the summer, with gridlock occurring in many locations. However, the level of traffic varies greatly along the corridor. Much of the Route 28 corridor is congested during summer peak hours. Traffic also slows when there is an incident or construction.

One major problem along the Route 28 corridor is providing for modes other than the automobile. Public transit (Cape Cod RTA's *SeaLine* & Hyannis-*Orleans* services) is available for some sections. Sidewalks are available in some village centers. Bicycle accommodation is for the most part non-existent.

TABLE 13 - TRAFFIC VOLUMES & MILEAGE: ROUTE 28

Town	Summer ADT	Annual ADT	Miles	Avg. Daily Vehicle Miles Traveled (VMT)
Bourne	42,848	33,315	8.7	289,843
Falmouth	20,917	16,315	14.6	238,200
Mashpee	24,671	19,244	3.7	71,201
Barnstable	25,717	20,060	10.4	208,619
Yarmouth	22,044	17,195	5.2	89,412
Dennis	15,112	11,787	3.4	40,077
Harwich	13,701	10,687	6.4	68,395
Chatham	12,737	9,935	7.3	72,526
Orleans	13,091	10,211	4.9	50,034
Total			**64.6**	**1,128,306**

Source: Cape Cod Commission 2009 Traffic Volumes
Note: Annual ADT Estimates Based on MassDOT Adjustment Factors

2.2.14 ROUTE 6A

Route 6A on Cape Cod is one of the oldest travel corridors in the country. Originally a path used by Native Americans, it was later adopted by colonists for travel from Plymouth out to Eastham. Later it served as state Route 6 until the construction of the current Route 6 in the 1950s. Today it is also known as the Old Kings Highway and is a state Scenic Byway.

Roadway Characteristics

Route 6A is a narrow and windy two lane road with little or no shoulder. One exception to this is the four-lane cross section in Orleans. Because of the narrow shoulders, passing zones are limited and biking can be difficult. Some segments have sidewalks (for example, in Barnstable Village, Brewster, and Orleans) but often it is difficult to travel along this corridor any way other than by automobile.

FIGURE 38 - ROUTE 6A WEST OF WILLOW STREET (MID-CAPE)

Safety

For the years 2005 and 2006, the town along Route 6A with the most crashes was Brewster with over 120 crashes. This is more than double that of Bourne, which had the second most with just fewer than 60 (however Bourne has only one twelfth the mileage of Brewster). During this time span, Route 6A in Sandwich experienced a fatal crash and Yarmouth experienced two. There have been no fatal crashes on Route 6A since.

Another conflicting issue is the scenic nature of Route 6A and the current process for funding roadway rehabilitation projects which require upgrading the width and alignment to modern standards. An ongoing initiative by the Cape Cod Commission is to develop rural road design guidelines that will provide "footprint roadway" options to preserve the character of scenic roadways such as Route 6A. Safety issues are discussed in greater detail in another chapter of the RTP.

Congestion

Traffic flow along the corridor is generally heavy during the summer but rarely stopped. However, the level of traffic varies greatly along the corridor. Average Daily Traffic (ADT) volumes, mileage, and Vehicle Miles Traveled (VMT) are presented in the following table:

Much of the Route 6A corridor is congested during summer peak hours. In fact, a major problem along the Route 6A corridor is how to provide for modes other than the automobile. Several studies have been conducted on this subject, including a bicycle accommodation study and an Alternate Modes Assessment was conducted for the Commission in 1995. An updated "Route 6A Corridor Management Plan" was produced in 2010. Recommendation from this study was the reduction of speed limits to 35 MPH and accommodation of alternate mode users such as pedestrians, bicyclists and public transportation users.

TABLE 14- TRAFFIC VOLUMES & MILEAGE: ROUTE 6A

Town	Summer ADT	Annual ADT	Miles	Avg. Daily Vehicle Miles Traveled (VMT)
Bourne	13,932	10,867	0.6	6,520
Sandwich	10,439	8,142	7.5	61,068
Barnstable	8,257	6,440	8.4	54,097
Yarmouth	15,048	11,737	3.7	43,428
Dennis	9,790	7,636	4.3	32,835
Brewster	14,546	11,346	7.8	88,499
Orleans	20,432	15,936	1.7	27,092
Total			**34.0**	**313,539**

Source: Cape Cod Commission 2004-2005 Traffic Volumes
Note: Annual ADT Estimates Based on MassDOT Adjustment Factors

Land Use

Adjacent land uses vary by location. Several village centers exist along the corridor, such as Barnstable Village, Yarmouthport, and Brewster. Several "new villages" have also sprung up as strip development in the last 20 years, such as the development in Orleans. In addition, Sandwich Center lies just off 6A to the south. Much of the corridor remains residential, or is undeveloped due to the proximity of wetlands with Sandwich and Orleans the notable exceptions. Bike travel along the corridor is common despite the fact that it is best suited for experienced bicyclists. This is due to the scenic nature of the corridor, relatively low vehicle speeds, and residential and commercial development. With the exception of the portion of the roadway in Orleans from Route 6 Exit 12 to the Eastham Rotary, development along Route 6A is reviewed for appropriateness by committees of the Old King's Highway Historic District.

2.2.15 CONCLUSION

Roadways are the most important element of the Cape's transportation system. While mostly serving automobile traffic, they also provide space for public transit as well as current and potential future corridors for pedestrians and cyclists. The RTP should ensure that maintenance, safety improvements, and needed congestion relief projects and programs are funded and implemented.

2.3 BUS TRANSPORTATION

FIGURE 1: BUS ROUTES AND CONNECTIONS ON CAPE COD
Source: SmartGuide.org

A bus is a motorized form of land transportation intended to carry passengers. Besides luggage, buses also carry some freight. The word bus is a shortened version of omnibus, derived from Latin, which means "for everyone."

On Cape Cod, 1.22% of workers commute to work via public transportation according to the Census. This includes local and interregional bus service. Sandwich Village has the largest percentage of workers commuting by public transportation. This is probably due to the interregional bus service to Boston available at the Sagamore Park-and-Ride Lot. Although the majority of the distance of their commute is by public transportation, most of these workers do drive across the Sagamore Bridge to reach the lot. Orleans, Dennis, Hyannis, Falmouth, and Sandwich also have several areas where workers are using public transportation to commute to work (

Figure 2). It is clear that workers living near local bus routes are not using them in high percentages, nor are public transportation users primarily clustered around Cape Cod's downtown areas.

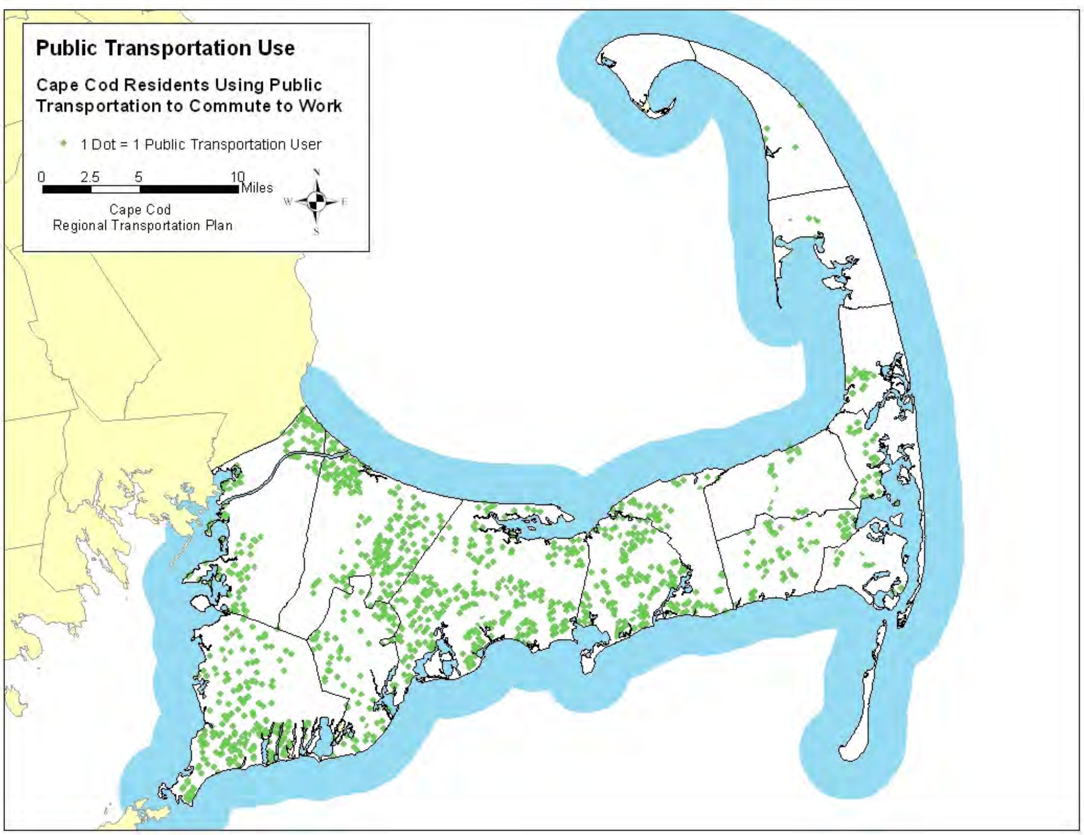


FIGURE 2: PUBLIC TRANSPORTATION USE ON CAPE COD
Source: U.S. Census

2.3.1 HYANNIS TRANSPORTATION CENTER

The Hyannis Transportation Center was built in 2002 as a hub for Cape Cod's transportation needs. The building is a two story, 17,000 square foot facility located near the intersection of Main Street and Center Street in Hyannis at the end of the rail tracks. The property has entrances from Route 28, Center Street, and Ridgewood Avenue. The facility includes a bus terminal and a connection to the Cape Cod Central Railroad terminal. Additionally, there is parking space available for 220 cars on an eight-acre lot.

The building itself is owned and operated by the Cape Cod Regional Transit Authority (CCRTA). The Hyannis Transportation is open 7 days a week, excepting holidays, from early morning to 8:30pm. Inside, travelers are offered several amenities, such as Wi-Fi internet, vending machines, an ATM, and restrooms. Route maps are posted throughout the facility and announcements of arrivals and departures are made over the loud speaker system. Additional travel information is available at the information desk.

FIGURE 3: HYANNIS TRANSPORTATION CENTER, NORTH SIDE

FIGURE 4: HYANNIS TRANSPORTATION CENTER, WEST SIDE

FIGURE 5: BUS TERMINAL AT THE HYANNIS TRANSPORTATION CENTER

FIGURE 6: TAXI PICK-UP AND DROP OFF AT THE HYANNIS TRANSPORTATION CENTER

The Hyannis Transportation Center brings together local and interregional bus services, rail facilities, and connections to air and ferry service. Plymouth and Brockton, Peter Pan, and Bonanza Bus lines all make daily use of the bus terminal facilities. Four RTA bus lines make stops at the Hyannis Transportation Center, as well as two RTA shuttles. These transit lines provide connections to ferry service in Hyannis and air service and rental car service at Barnstable Municipal Airport. Plymouth and Brockton service from Boston and Provincetown, and Peter Pan service from Providence and New York make stops at the Hyannis Transportation Center. There is also an area designated for Taxi service pick-up and drop-off. Nearby ferry service to Martha's Vineyard and Nantucket is accessible by local transit. Given the variety of transportation options available, the Hyannis Transportation Center is sometimes also referred to as the Hyannis Intermodal Center.

2.3.2 OTHER BUS TERMINALS

In addition the Hyannis Transportation Center, several other locations serve as bus terminals and stops throughout Cape Cod.

2.3.2.1 MacMillan Pier and Bus Depot

FIGURE 7: AERIAL VIEW OF THE MACMILLAN PIER IN PROVINCETOWN

MacMillan Pier in Provincetown is located at the intersection of Commercial Street and Ryder Street. The facility is open Monday through Saturday from 9am to 6pm and is closed on Sundays and holidays. MacMillan Pier includes a bus depot, ferry terminal, and a parking facility open seven days a week. The bus depot serves as a terminal for Plymouth and Brockton service from Hyannis and Boston. The Cape Cod Regional Transportation Authority's (CCRTA) seasonal Provincetown Shuttle makes scheduled stops at the facility on its way to Race Point, Provincetown Municipal Airport and North Truro. Ferry service to Plymouth and Boston is also available seasonally. MacMillan Pier is located in the heart of downtown Provincetown, with access to restaurants, hotels and shopping. The site of MacMillan Pier is also being studied as the possible location for a local intermodal center similar to the Hyannis Transportation Center, but smaller in size.

2.3.2.2 Falmouth Bus Depot

The Falmouth Bus Depot is located on Depot Avenue in Falmouth. The building itself used to be a railway station. After rail service to Woods Hole was suspended, the building was converted into a bus terminal. The facility is open 7 days a week, excepting holidays, from 5am to 5pm. Limited parking is available. The Falmouth Bus Depot serves as a destination for local transit and interregional bus service, and provides connections to various ferry terminals. Peter Pan service from Boston to Woods Hole stops at the Falmouth Bus Depot. Additionally, the RTA's Hyannis-Falmouth SeaLine service and the seasonal WHOOSH Trolley will make stops at the Bus Depot upon request. These transit services provide connections to the ferry terminals at Woods Hole and Falmouth Marina. Beyond the available transit services, the Shining Sea Bikepath is located next to the depot along the former rail right-of-way. Given its proximity to downtown, the Falmouth Bus Depot also provides access to restaurants, hotels and shopping.

2.3.2.3 Woods Hole Steamship Authority Piers

The Steamship Authority piers in Woods Hole are also used as a bus terminal. Across from the ferry terminal is a small Peter Pan ticket facility and place for buses to pick-up and drop-off. Peter Pan buses continue from the Steamship Authority Piers to Boston. Due to the demand for ferry service, parking for the bus terminal is extremely limited. Travelers using the bus terminal can make use of amenities at the ferry terminal including restrooms, food service, an ATM, and places to sit. Additionally, the Shining Sea Bikepath terminates at the Steamship Authority Pier, providing bicycle access to downtown Falmouth and points north. Nearby Wood Hole offers restaurants, hotels and shopping.

FIGURE 8: AERIAL VIEW OF THE STEAMSHIP AUTHORITY PIERS IN WOODS HOLE

2.3.2.4 Tedeschi Food Shop in Bourne

Tedeschi Food Shop on Trowbridge Road in Bourne also serves as a stop for interregional bus service. The location was selected due to its proximity to the Bourne Bridge and Route 25. Peter Pan makes stops at Tedeschi on its route from Boston to Woods Hole and on its route from Providence to Hyannis. In this way there is an opportunity for travelers to make a transfer. Tedeschi food Shop is open from 5:30am to 11pm every day, including holidays. Tickets can be purchased inside Tedeschi and a portion of their parking lot is available for commuters.

2.3.3 PARK-AND-RIDE LOTS

Besides bus terminals, there are several parking facilities that serve as stops for local and interregional bus service. Four park-and-ride lots are located across Cape Cod. MassDOT owns the Sagamore, Barnstable, and Harwich Park-and-Ride Lots, while the CCRTA owns the Hyannis Park-and-Ride Lot.

2.3.3.1 Sagamore Park-and-Ride Lot

The Sagamore Park-and-Ride Lot is located by Interchange 1a in Bourne, near Routes 3 and 6. In early 2009, the lot has been expanded to a total of 396 parking spaces replacing a temporary lot capacity of 348 spaces. Sagamore Park-and-Ride Lot is accessed by Plymouth and Brockton on its Boston to Hyannis route. In this way it serves as a commuter stop for those traveling to work in Boston, Logan International Airport and other points north.

Based on 18 observations taken between 2008 and 2010 by the Cape Cod Commission, the average demand of the lot was 72%. The peak parking demand was observed in June of 2008 with 352 parked vehicles (97.5% of the existing capacity of the temporary lot). The most recent observation, in August 2010 shows 292 vehicles (73.7%).

FIGURE 9: AERIAL VIEW OF THE SAGAMORE PARK-AND-RIDE LOT
Source: Google Images.
(Note: current Park-and-Ride Lot is darker new pavement to the left of the image. Temporary Park-and-Ride Lot shown to the right.)

2.3.3.2 Barnstable Park-and-Ride Lot

The Barnstable Park-and-Ride Lot is located off Exit 6 of Route 6 in Barnstable. The lot was expanded to 365 parking spaces in August 2001. As part of the expansion, two new shelters were installed and currently appear to be in good condition. This lot has a ramp directly onto Route 6 westbound, making it convenient for motorists and buses. The Exit 6 facility is adjacent to amenities such as restrooms, food service, a convenience store, ATMs, fuel, and a seating area. The Barnstable Mobil Mart located inside is open 24 hours and sells tickets for interregional bus service. The Barnstable Park-and-Ride Lot is used as a stop for the Plymouth and Brockton route from Hyannis to Boston and for the Peter Pan route from Hyannis to Providence. The CCRTA's Barnstable Villager service provides local bus service to the Route 132 entrance to the Park-and-Ride lot, with connections to Barnstable Village, Route 132, and Hyannis.

FIGURE 10: BUS SHELTERS AT BARNSTABLE PARK-AND-RIDE LOT

FIGURE 11: PARKING AVAILABLE AT BARNSTABLE PARK-AND-RIDE LOT

The lot experiences heavy usage, often near or over-capacity. For the 32 observations taken by the Commission staff in 2008-2010, the average observed demand was 85% of capacity. The peak parking demand was observed in June 2008 with 346 parked vehicles (95% of capacity).

2.3.3.3 Harwich Park-and-Ride Lot

The Harwich Park-and-Ride Lot is located off Exit 10 of Route 6 on Route 124. The lot has 75 parking spaces. The lot is available as a stop (on-demand) for the CCRTA's Flex Service.

Due to its location, size and amount of service, the Harwich Park-and-Ride Lot has limited usage. For the 18 observations taken by the Cape Cod Commission staff in 2008-2010, the average observed demand was 25% of capacity. The peak parking demand was observed in August 2008, with 67 parked vehicles (89% of capacity). However, the number of vehicles parking at the Harwich Park-and-Ride Lot may have increased due to the new Flex service.

2.3.3.4 Hyannis Park-and-Ride Lot

The Hyannis Park-and-Ride Lot is located at the Hyannis Transportation Center. There is room for 225 vehicles. Long-term parking (over 30 minutes) is officially available on a pay-basis. The lot has access to all of the bus services and user amenities at the Hyannis Transportation Center.

2.3.4 INTERREGIONAL BUS SERVICE

Interregional bus service transports travelers to and from Cape Cod. Some examples are bus service from Hyannis to New York City, or Boston to Provincetown. Users of interregional bus service include commuters who work in Boston, Logan Airport users, and those traveling or vacationing. Two bus companies serve Cape Cod's interregional service needs.

2.3.4.1 Plymouth and Brockton Street Railway Company

The Plymouth and Brockton Street Railway (P&B) was established in 1888, as a local service provider for the area. At the time, the Old Colony Railroad was providing passenger service regionally, but not locally. In 1889, founders Charles Stone and Edwin Webster purchased the Plymouth and Kingston Street railway, which had been created just 3 years earlier. According to P&B, the electric trolley cars carried passengers to and from work, and on weekend "joy rides." In 1914, a mile long connection to Sagamore Beach and the Sagamore Depot was made. As part of the project, a wooden rail bridge was built over the first Cape Cod Canal near the location of the current Sagamore Bridge. After suffering losses following World War I, the company reorganized to provide bus service. Street railway tracks were abandoned and replaced by motor coaches throughout the South Shore. Plymouth and Brockton's final electric trolley run was made on June 28, 1928 between Jabez Corner and Kingston. The company was purchased by the Anzuoni family in 1948, who continue to operate and manage the Plymouth and Brockton Street Railway to this day. P&B serves 25 cities and towns from Boston to Cape Cod and is partially subsidized by the Massachusetts Bay Transportation Authority (MBTA), MassPort, and the Cape Cod Regional Transit Authority (CCRTA).

FIGURE 12: PLYMOUTH AND KINGSTON STREET RAILWAY CAR

FIGURE 13: PLYMOUTH AND BROCKTON STREET RAILWAY CAR

FIGURE 14: AN OLDER BUS MODEL FROM PLYMOUTH AND BROCKTON

FIGURE 15: AN OLDER BUS MODEL FROM PLYMOUTH AND BROCKTON

Source: Plymouth & Brockton Street Railway

FIGURE 16: PLYMOUTH AND BROCKTON BUS AT THE HYANNIS TRANSPORTATION CENTER

Source: Plymouth & Brockton Street Railway

Current Plymouth and Brockton service stretches from Logan International Airport to Provincetown. There are two primary routes. The first route is between Hyannis and Provincetown. This route is operated 4 times daily in both directions during the summer. The bus makes several stops along the Outer Cape route (See Table below). Plymouth and Brockton also offers a discounted taxi service for Outer Cape passengers. Passengers can request this service from the bus driver in Hyannis, who will then radio for a taxi to meet passengers at their respective terminal.

TABLE 1: PLYMOUTH AND BROCKTON, OUTER CAPE STOPS

Stop Name	Location
Hyannis	Hyannis Transportation Center
Harwich	Harwich Park-and-Ride Lot
Orleans	CVS @ Main St. & Route 6A
Eastham	Town Hall @ Rt. 6 and Samoset Rd.
North Eastham	Village Green @ Rt. 6 and Brackett Rd.
South Wellfleet	Farrell's Market, Rt. 6
Wellfleet	Town Hall, Main St.
Truro	Post Office and Jam's Store, Route 6A
North Truro	Dutra's Market, Route 6A
Provincetown	Chamber of Commerce, MacMillan Wharf

The second route is between Hyannis and points in Boston. Stops in Boston include Logan International Airport, Park Square & 200 Stuart Street, and South Station Transportation Center. In addition, several stops are made along the way both on and off Cape (See Table below). Generally, morning service is geared towards getting passengers from Hyannis to Boston, while afternoon service focuses on the return tip. During the summer, Plymouth and Brockton makes 23 one-way weekday trips from Hyannis to Logan International Airport. On the weekend, Plymouth and Brockton makes 17 trips. Plymouth and Brockton also makes 27 one-way weekday trips between Hyannis and South Station during the summer. 19 of these trips stop at both Logan and South Station. Additionally, the bus makes 8 one-way weekday stops for commuters at the Transportation Building at Park Square. Total operations are reduced during the fall and winter to reflect the lower demand for travel.

TABLE 2: PLYMOUTH AND BROCKTON, HYANNIS – BOSTON STOPS

Stop Name	Location
Hyannis	Hyannis Transportation Center
Barnstable	Barnstable Park-and-Ride Lot
Sagamore	Sagamore Park-and-Ride Lot
Plymouth	Rt. 3 Exit 5 Info Center Park-and-Ride Lot
Rockland	Rt. 3 & Rt. 228 Park-and-Ride Lot
Boston	South Station Transportation Center
Boston	Park Square & 200 Stuart Street
Boston	Logan International Airport

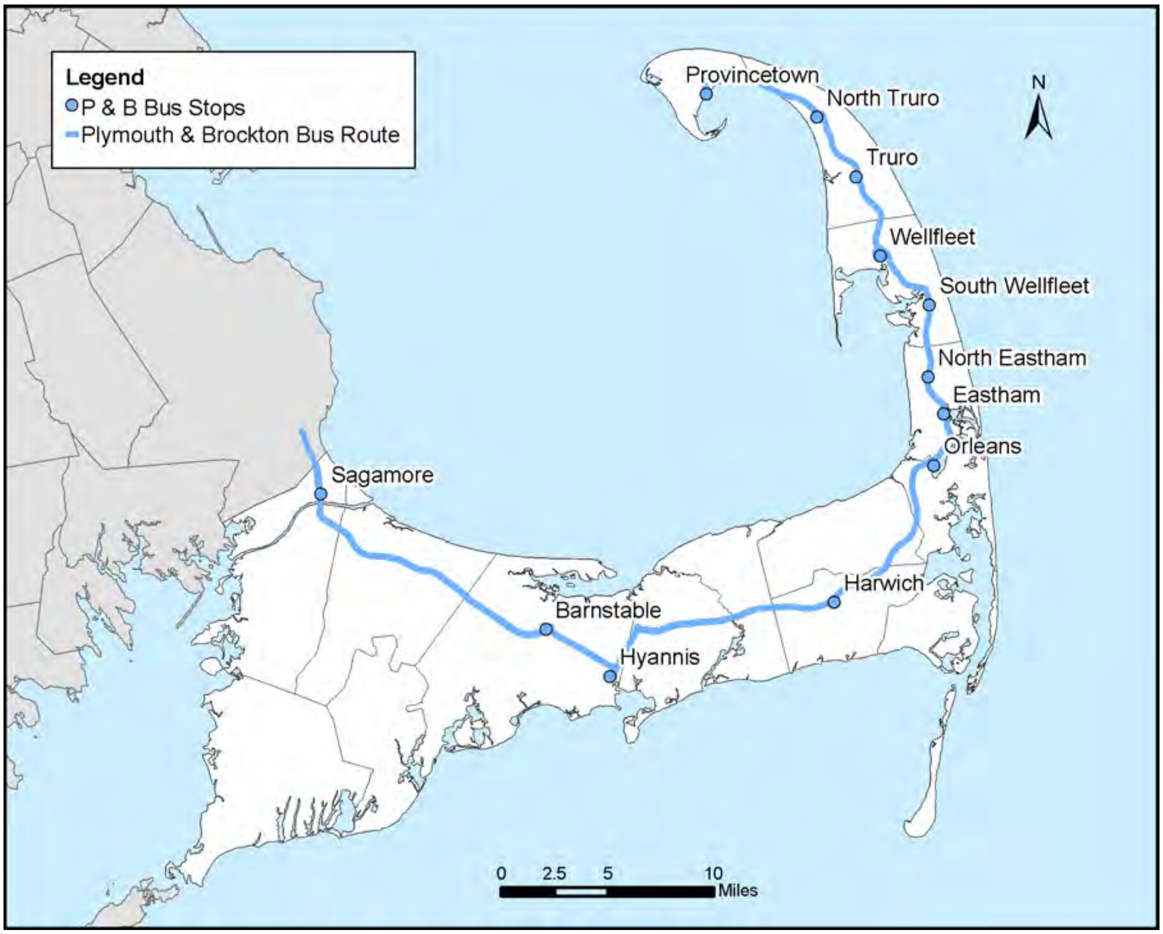


FIGURE 17: PLYMOUTH AND BROCKTON BUS ROUTES

2.3.4.2 Bonanza Bus Lines / Peter Pan Bus Lines

George Sage founded Bonanza Bus Lines in Newport, RI in 1955. Soon after the company began acquiring new bus lines and expanding service beyond its original 50-mile route system between Providence, Newport, and Fall River. Service to Hyannis was added in 1958. By 1965, the "Short Line," as it was then called, had service to Boston, New Bedford, Springfield, and beyond. Bonanza became the largest independent bus line in New England in 1974 when it began service from Hartford, CT to New York City. Service from Boston to Woods Hole, with connections to ferry service, began in 1978. After merging with Coach USA in 1998, the company was purchased by Peter Pan Bus Lines in 2003, along with three other New England affiliates of Coach USA. George Sage, the original founder of the "Short Line" was brought back as a consultant to Peter Pan, bringing the company full circle. Additionally, Peter Pan has partnered with Greyhound to provide ticketing services, more connections and increased service. Currently, the Bonanza Bus network, as operated by Peter Pan, includes a 1,560-mile route system serving New England and beyond.

FIGURE 18: PETER PAN BUS AT THE HYANNIS TRANSPORTATION CENTER

Peter Pan and Bonanza Bus Lines provide two routes serving Cape Cod. The first route is between Woods Hole and Boston. Stops are made in Falmouth and Bourne. A total of 11 round trips are made daily during the summer, as well as an early morning trip from Boston to Woods Hole on weekdays and Saturdays. Service is reduced in the winter to reflect reduced demand.

TABLE 3: PETER PAN / BONANZA, WOODS HOLE – BOSTON ROUTE STOPS

Stop Name	Location
Woods Hole	Steamship Authority Piers
Falmouth	Falmouth Bus Depot, Depot Ave.
Bourne	Tedeschi's Food Shop, Trowbridge Rd.
Boston	South Station Transportation Center

The second route run by Peter Pan and Bonanza on Cape Cod is the Hyannis to Providence, RI bus. Six round trips are made daily in the summer. Stops are made in Barnstable, Bourne, New Bedford, Fall River, and Providence. Of these trips, only two early morning stops are made at Kennedy Plaza in Providence, RI. Service is reduced in the winter in order to accommodate demand.

TABLE 4: PETER PAN / BONANZA, HYANNIS – PROVIDENCE ROUTE STOPS

Stop Name	Location
Hyannis	Hyannis Transportation Center
Barnstable	Barnstable Park-and-Ride Lot
Bourne	Tedeschi's Food Shop, Trowbridge Rd.
New Bedford	SRTA Terminal, Elm Street
Fall River	SRTA Terminal, Second Street
Providence	Bonanza Bus Terminal
Providence	Kennedy Plaza

Connections can be made at a number of stops along each route. For example, bus transportation to New York City is available after a transfer in Providence, RI. Moreover, the stop in Bourne allows a bus connection between Woods Hole and Hyannis. The trip, including transfer, would take anywhere between 1.5 and 2 hours.

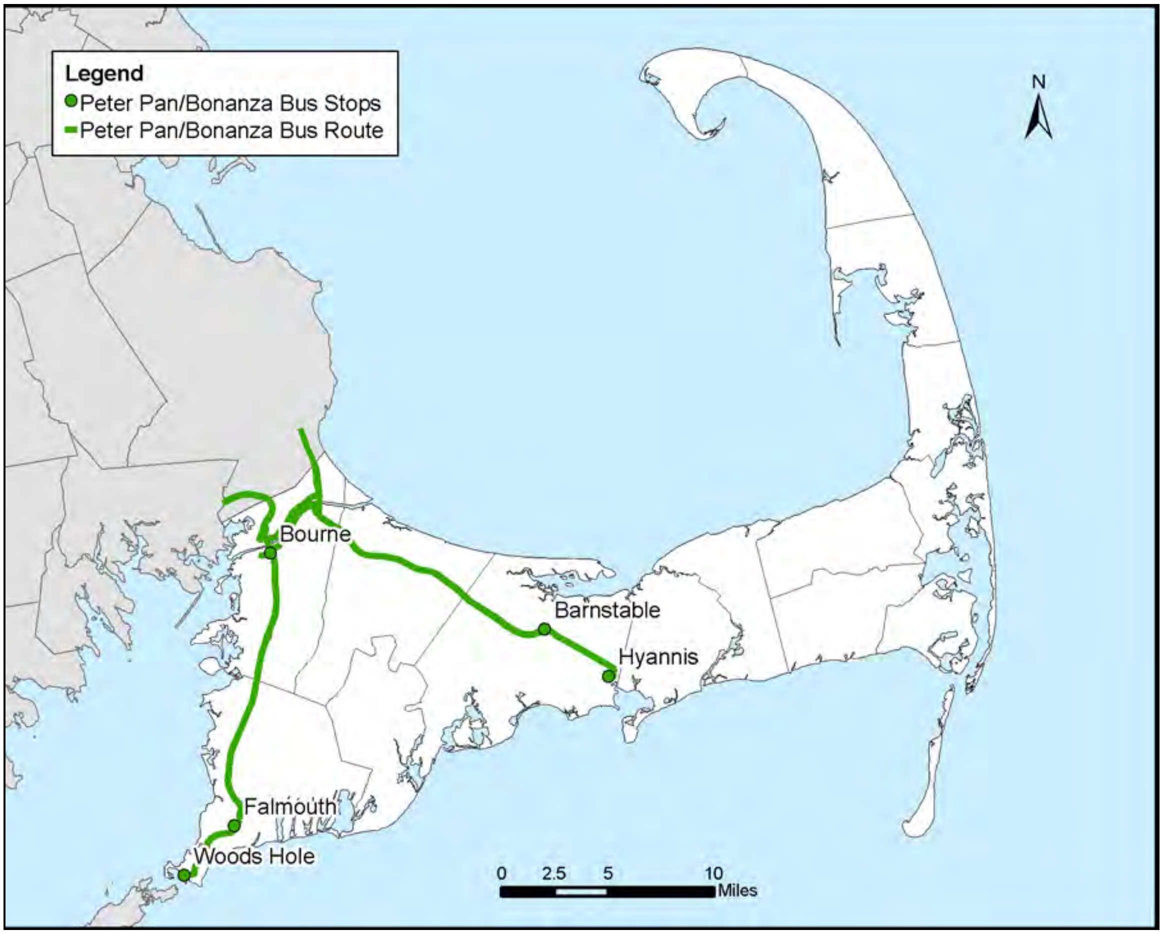


FIGURE 19: PETER PAN / BONANZA BUS ROUTES

2.3.5 CAPE COD REGIONAL TRANSIT AUTHORITY

The Cape Cod Regional Transit Authority (CCRTA) is the agency in charge of operating and maintaining public transit services on Cape Cod. According to the 2008 National Transit Database, the CCRTA service area is 395 square miles, covering the Barnstable urbanized zone and all of Barnstable County. The CCRTA is an independent public agency, governed by a board of directors. The 15 Cape Cod towns each appoint one board member to represent their interests in the CCRTA. The CCRTA offers several types of services, including Fixed Route service, Flexible Route service, and Demand Response or Paratransit service. These services are not operated directly by the CCRTA, but are contracted.

The CCRTA fleet consists of 95 buses and vans, with an average age of 4.6 years. Using this fleet, the CCRTA recorded 797,711 unlinked trips* in 2008. This is an increase from the 778,430 unlinked trips in 2007. These passengers were carried 11,056,780 miles across Cape Cod in 2008. The CCRTA fleet is run at 91% capacity for fixed-route service, and roughly 95% for demand response service, according to the National Transit Database.

TABLE 5: CAPE COD LOCAL BUS SERVICE CONSUMPTION AND SUPPLY, 2008

Service Consumption	
Annual Passenger Miles	11,056,780
Annual Unlinked Trips	797,711
Average Weekday Unlinked Trips	2,837
Average Saturday Unlinked Trips	1,114
Average Sunday Unlinked Trips	804
Service Supplied	
Annual Vehicle Revenue Miles	3,751,678
Annual Vehicle Revenue Hours	221,735
Vehicles Operated in Maximum Service	89
Vehicles Available for Maximum Service	95
Base Period Requirement	31

Source: 2008 National Transit Database

The CCRTA receives funding from multiple sources. Operations are funded by fare revenues, local funds, state funds, federal assistance, and contracts. These funds are then spent on employee salaries and on purchased transportation (See Table on the next page). Ranging from a high of 42.9% in 1998 to a low of 3.5% in 2005, then rising and falling to 9.5% in 2008, fare revenues have fluctuated as a percentage of total operating funds. To keep pace, state, federal, and local funding have increased as a percentage of total operating funds, partly due to subsidies for experimental ticketing services in the Outer Cape. Overall, this means that the CCRTA, as virtually all transit agencies are, continues to be dependent on external sources for its operations. The sudden disappearance of these funding sources may lead to a cutback in services.

In 2006, the RTA released a new, simpler fare structure. A one-way trip cost $1, with discounts for senior citizens. Some transfers are free, while most cost $1. Monthly and Summer Day Passes are also available. Moreover, the fares are now uniform across the RTA system, making it easier for riders to understand and to use public transit. This may encourage more ridership and increase the amount collected in fares.

* When passengers board a transit line without having made a transfer, this is referred to as an unlinked trip. It is a way to measure ridership without double counting.

TABLE 6: FUNDING FOR OPERATIONS BY THE CCRTA, 2008

Total Operating Funds			Total Operating Expenses		
Fare Revenues	$1,050,612	9%	**Salary/Wages/Benefits**	$702,834	6.3%
Local Funds	$1,406,354	13%	**Materials and Supplies**	$21,237	0.2%
State Funds	$3,446,324	31%	**Purchased Transportation**	$9,977,333	90.1%
Federal Funds	$2,122,176	19%	**Other Expenses**	$372,496	3.4%
Other Funds	$3,048,434	28%			
Total	**$11,073,900**		**Total**	**$11,073,900**	

Source: 2008 National Transit Database

TABLE 7: FUNDING FOR CAPITAL IMPROVEMENTS BY THE CCRTA, 2008

Total Capital Funds			Total Capital Expenses		
Local Funds	$0	0%	**Revenue Vehicles**	$3,065,661	80%
State Funds	$1,374,700	36%	**Systems and Guideways**	$0	0%
Federal Funds	$2,479,010	64%	**Facilities and Stations**	$510,531	13%
Other Funds	$0	0%	**Other**	$277,518	7%
Total	**$3,853,710**		**Total**	**$3,853,710**	

Source: 2008 National Transit Database

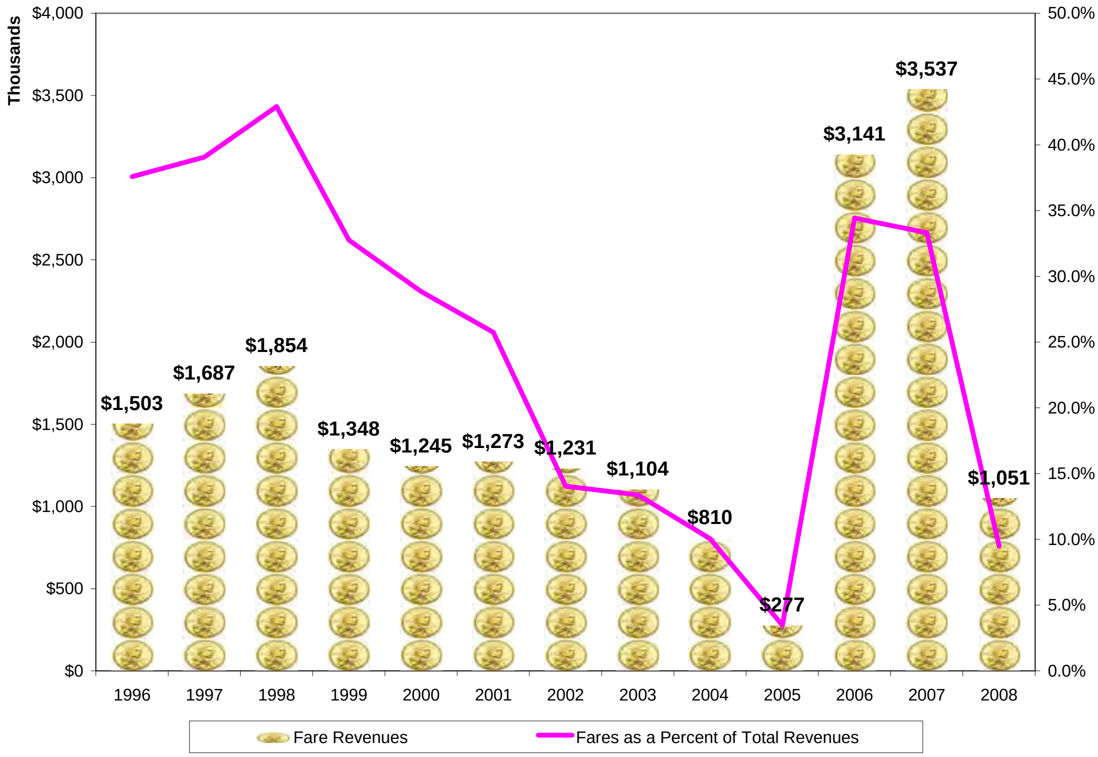


FIGURE 20: CCRTA FARE REVENUES AND FARES AS A PERCENT OF TOTAL REVENUES
Source: 1996-2008 National Transit Database

Funding for capital improvements varies from year to year. For example, the CCRTA received millions of dollars in capital improvement funding from state and federal sources between 2001 and 2003 for the construction of the Hyannis Transportation Center. In 2008, the CCRTA received $3,065,661 from federal sources for capital improvements. That money was used to purchase new vehicles (See previous Table).

The performance of the CCRTA can be measured in several different ways. In terms of service efficiency, it costs $2.95 for every mile the CCRTA travels and $49.94 for every hour that the CCRTA operates. Moreover, the cost of transporting the average passenger has been rising for the past four years. This increase can be partly attributed to the high cost of demand response services (

Figure 22).

TABLE 8: PERFORMANCE MEASURES FOR CAPE COD REGIONAL TRANSIT AUTHORITY, 2008

	CCRTA		
	Bus	**Demand Response**	**Overall**
Service Efficiency			
Operating Expense per Vehicle Revenue Mile	$4.31	$2.43	$2.95
Operating Expense per Vehicle Revenue Hour	$53.73	$47.65	$49.94
Cost Effectiveness			
Operating Expense per Passenger Mile	$0.61	$1.77	$1.00
Operating Expense per Unlinked Passenger Trip	$10.47	$17.84	$13.88
Service Effectiveness			
Unlinked Passenger Trips per Vehicle Revenue Mile	0.41	0.14	0.21
Unlinked Passenger Trips per Vehicle Revenue Hour	5.13	2.67	3.60

Source: 2008 National Transit Database

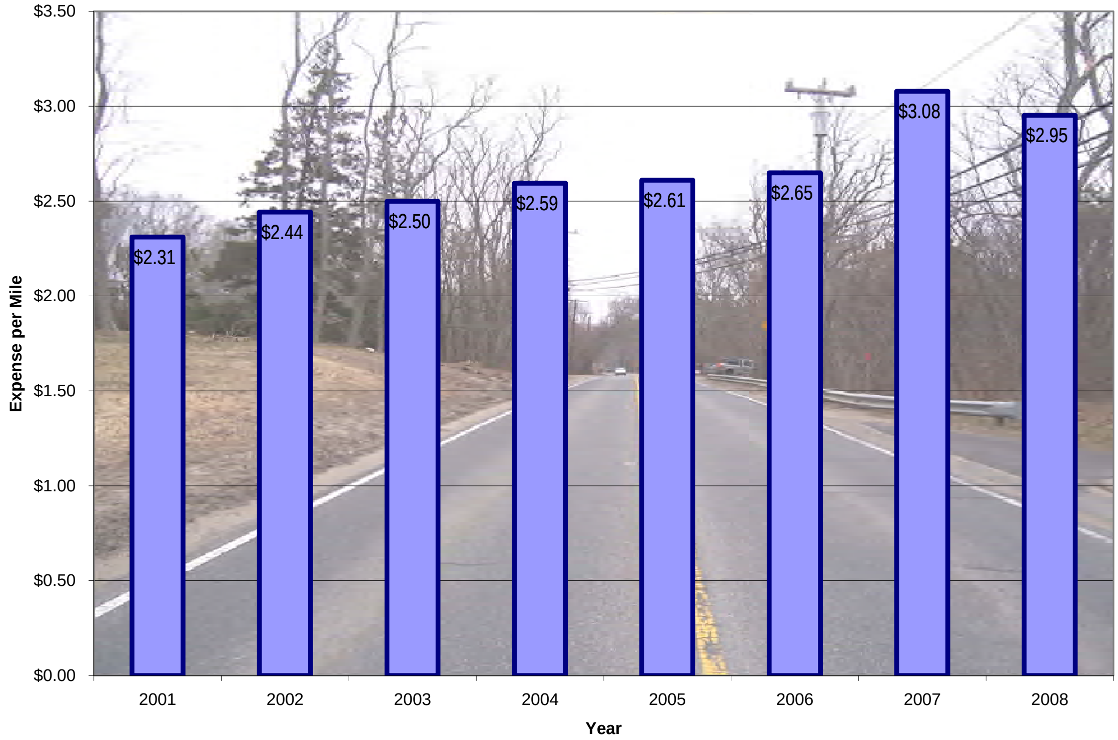


FIGURE 21: OPERATING EXPENSE PER VEHICLE REVENUE MILE

Source: 2001-2008 National Transit Database

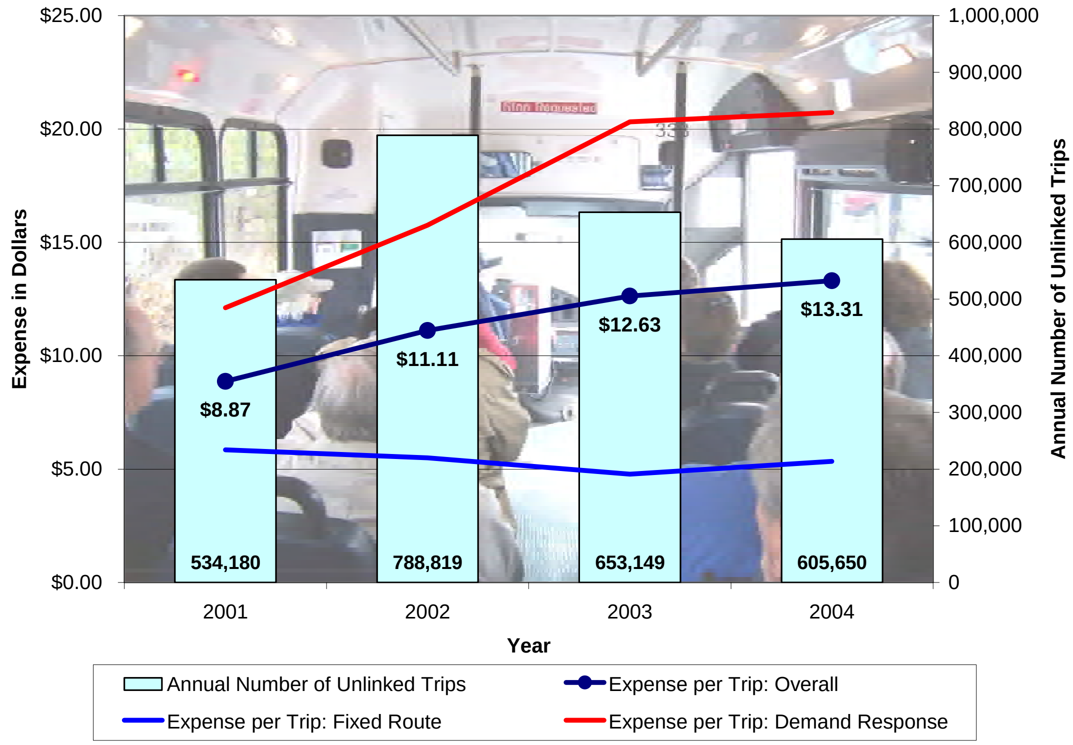


FIGURE 22: OPERATING EXPENSE PER UNLINKED PASSENGER TRIP
Source: 2001-2008 National Transit Database

FIGURE 23: CAPE COD REGIONAL TRANSIT AUTHORITY SYSTEM MAP
Source: Cape Cod Regional Transit Authority

2.3.6 FIXED ROUTE BUS SERVICE

Fixed Route bus service is the traditional form of transit. Vehicles follow specific routes and stop at designated areas. Fixed Route service on Cape Cod is slightly different, in that CCRTA buses (with the exception of the Flex) stop anywhere along their route when flagged. The CCRTA offers several fixed route services. All CCRTA fixed route buses have bicycle racks, designed to carry two bicycles. In addition, all fixed route buses are wheelchair accessible and equipped with low floors, ramps or lifts. Service animals are the only animals allowed to board the buses. The CCRTA offers four year-round and three summer seasonal fixed-route services.

2.3.6.1 Hyannis-Falmouth Service: “SeaLine”

FIGURE 24: SEALINE ROUTE MAP
Source: Cape Cod Regional Transit Authority

TABLE 9: SEALINE RIDERSHIP, FY2009, FY2010

	FY'09	FY'10
July	6,840	7,230
August	7,707	7,465
September	7,930	9,796
October	7,583	9,203
November	6,310	7,969
December	6,593	8,168
January	6,028	7,394
February	6,294	6,680
March	7,033	8,862
April	6,696	8,913
May	7,264	9,234
June	7,368	10,293
Total	**83,646**	**101,207**
Avg. Riders / Day*	558	675

* - *Assuming 250 Days of Operation (No Weekends, No Federal Holidays)*
Source: Cape Cod Regional Transit Authority

FIGURE 25: SEALINE BUS PARKED NEAR JONES ROAD AND ROUTE 28

The Hyannis-Falmouth service known as the SeaLine runs from the Hyannis Transportation Center to the Falmouth Mall on Route 28. Passengers can board the bus at any of the 10 designated stops, or flag the driver anywhere along the route to stop. During the summer, the SeaLine makes 9 round trips, beginning at 5:30am and ending at 7:30pm. Buses are schedule to run every 90 minutes, with a complete one-way trip taking one hour and operating seven days per week. Service is reduced during the winter in order to reflect lower demand. The first two trips, made before 8:00am, skip the Centerville and Osterville stops, continuing straight down Route 28, and ending at the Steamship Authority Docks in Woods Hole. The SeaLine will also stop at the Barnstable Municipal Airport upon request. The SeaLine connects to the WHOOSH Trolley in Woods Hole and to most other lines at the Hyannis Transportation Center. Free transfers are available to the WHOOSH Trolley.

2.3.6.2 Hyannis-Orleans Service: "H2O"

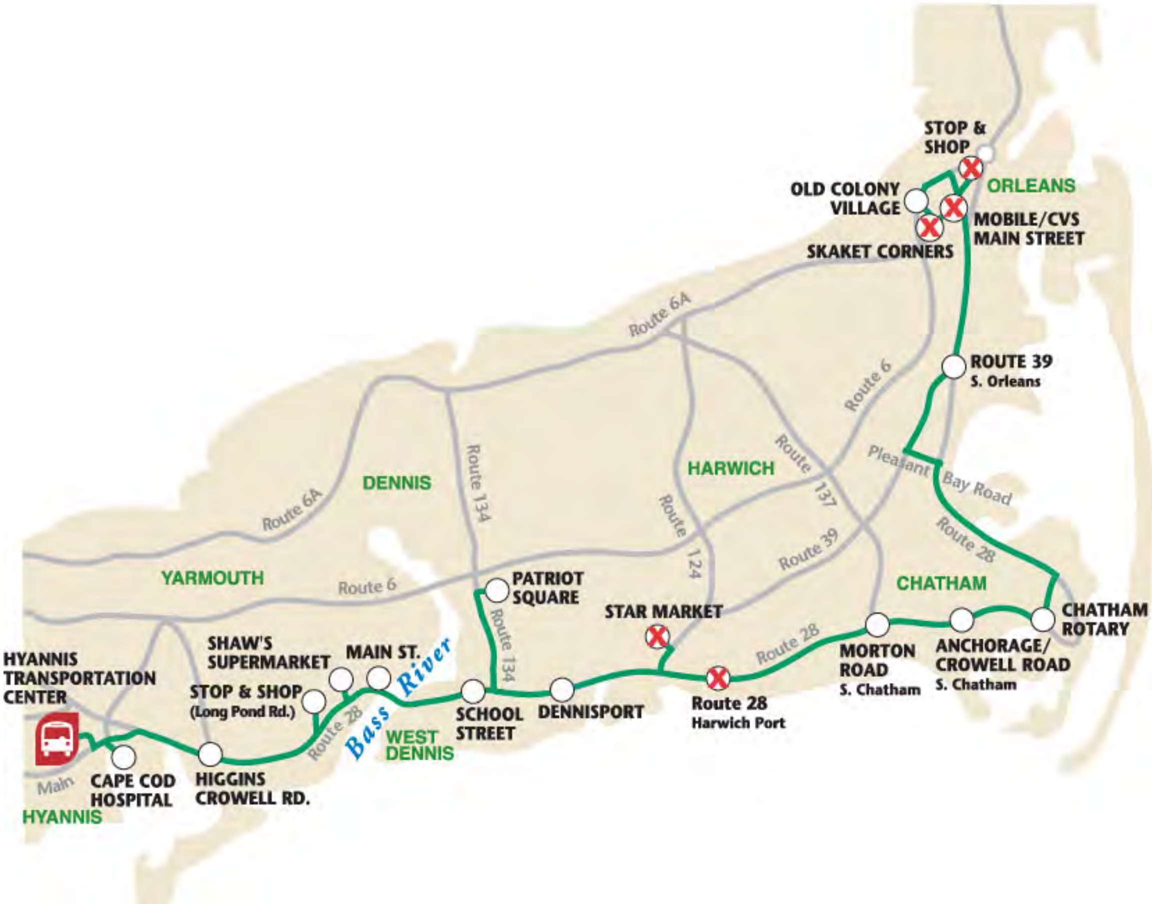


FIGURE 26: HYANNIS TO ORLEANS "H2O" ROUTE MAP
Source: Cape Cod Regional Transit Authority

TABLE 10: H2O RIDERSHIP, FY 2009, FY 2010

	FY'09	FY'10
July	8,832	9,379
August	9,191	9,181
September	8,224	9,247
October	6,771	8,443
November	5,362	6,804
December	5,337	7,052
January	5,176	6,687
February	5,192	6,249
March	5,737	7,694
April	5,870	8,356
May	7,052	9,259
June	9,137	13,731
Total	**81,897**	**102,082**
Avg. Riders / Day*	546	681

* - *Assuming 250 Days of Operation (No Weekends, No Federal Holidays)*
Source: Cape Cod Regional Transit Authority

The Hyannis-Orleans service, also known as the H2O Line, runs from the Hyannis Transportation Center to the Stop and Shop on Routes 28/6A in Orleans. Passengers can board the bus at any of the 17 designated stops, or flag the driver anywhere along the route to stop. During the summer, the Hyannis-Falmouth Breeze makes 8 round trips, beginning at 5:45am and ending at 6:30pm. Buses are scheduled to run about every 2 hours, with the complete one-way trip taking 1 hour and 40 minutes and operate seven days per week including holidays through Labor Day. Service is reduced during the winter in order to reflect lower demand. During the Orleans to Hyannis trip, the bus stops at the Cape Cod Hospital only upon request. Moreover, the bus travels and stops only on Route 28 before 8:00am. Passengers riding the Hyannis-Orleans Breeze can transfer to the Flex at three locations in Harwichport and Orleans, and to most other lines at the Hyannis Transportation Center.

2.3.6.3 Barnstable Villager

FIGURE 28: ROUTE MAP FOR BARNSTABLE VILLAGER

FIGURE 27: BARNSTABLE VILLAGER BUS PARKED IN THE BARNSTABLE COUNTY COMPLEX FIGURE

FIGURE 29: DETAIL OF CCRTA SERVICES IN DOWNTOWN HYANNIS

Source: Cape Cod Regional Transit Authority

TABLE 11: "VILLAGER" RIDERSHIP, FY 2009, FY 2010

	FY'09	FY'10
July	5,286	3,688
August	5,463	3,981
September	3,892	4,339
October	3,431	4,092
November	2,994	3,491
December	2,716	3,806
January	2,531	3,092
February	2,796	3,443
March	2,840	3,552
April	3,215	3,634
May	3,267	3,243
June	3,051	3,370
Total	**41,452**	**43,731**
Avg. Riders / Day*	276	292

** - Assuming 250 Days of Operation (No Weekends, No Federal Holidays)*
Source: Cape Cod Regional Transit Authority

The Barnstable Villager service runs from the Hyannis Transportation Center to the Barnstable County Complex on Route 6A and Barnstable Harbor. Passengers can board the bus at any of the 8 designated stops, or flag the driver anywhere along the route to stop. During the summer, the Barnstable Villager Breeze makes 26 round trips, beginning at 7:30am and ending at 9:30pm. Between 8:00am and 8:00pm, buses are scheduled to run every 30 minutes, with the complete one-way trip scheduled to take 50 minutes seven days per week. Service is reduced during the winter in order to accommodate lower demand. The Barnstable Villager will stop at the Barnstable Municipal Airport upon request. Passengers riding the Villager can transfer to most other lines at the Hyannis Transportation Center.

2.3.6.4 Hyannis Shuttle

The Hyannis Shuttle is the summer service from the Hyannis Transportation Center to several beaches in the Hyannis area. Passengers can board the bus at any of the 6 designated stops, or flag the driver anywhere along the route to stop. The Hyannis Shuttle makes 19 round trips, beginning at 8:00am and ending at 5:30pm. Buses are scheduled to run 30 minutes, with the complete round trip taking 30 minutes, 7 days per week including holidays through Labor Day. Passengers riding the Hyannis Shuttle can transfer to most other lines at the Hyannis Transportation Center.

TABLE 12: HYANNIS SHUTTLE RIDERSHIP, FY 2009, FY 2010

	FY'09	FY'10
July	7,939	3,545
August	7,761	4,248
September	292	693
October - May	-0-	-0-
June	178	440
Total	**16,170**	**8,926**

Source: Cape Cod Regional Transit Authority

2.3.6.5 Provincetown/Truro Shuttle

The Shuttle serves Downtown Provincetown, Provincetown Airport, Race Point Beach, Herring Cove Beach, and North Truro. Three routes comprise the Shuttle service. The North Truro Shuttle travels from MacMillan Pier to Dutra's Market in North Truro. The Airport/Race Point Beach Shuttle runs from MacMillan Pier to Provincetown Municipal Airport and Race Point Beach. The Herring Cove Beach Shuttle runs from MacMillan Pier to Herring Cove Beach and First Pilgrims Park. During the summer, shuttles run every 20 minutes, between 9:00am and 12:45am. From 7:00am to 9:00am, the North Truro Shuttle runs every 60 minutes. The Shuttle runs seven days a week, including holidays. During the off-season, the Shuttle continues operation seven days a week, but beach stops are eliminated and shuttle frequencies are reduced. There is no Shuttle service during the winter months. Passengers riding the North Truro Shuttle may transfer to the Flex bus for free at Dutra's Market in North Truro.

TABLE 13: PROVINCETOWN/TRURO SHUTTLE RIDERSHIP, FY 2009, FY 2010

	FY'09	FY'10
July	20,739	22,819
August	25,873	27,046
September	3,553	6,789
October - April	-0-	-0-
May	1,491	1,422
June	4,856	8,025
Total	**56,512**	**66,098**

Source: Cape Cod Regional Transit Authority

FIGURE 30: PROVINCETOWN SHUTTLE ROUTE MAP
Source: Cape Cod Regional Transit Authority

2.3.6.6 The WHOOSH Trolley

The WHOOSH Trolley, or the Woods Hole Trolley, runs from the Falmouth Mall to the Steamship Authority Docks in Woods Hole. Passengers can board the bus at any of the 10 designated stops, or flag the driver anywhere along the route to stop. During the summer, the WHOOSH Trolley schedule varies by day, making at least 20 trips per day between 9:30am and 7:30pm. Buses are scheduled to run every 30 minutes, with the complete round trip taking 1 hour. Service is available on Saturdays, Sundays, and holidays. There is no winter service due to the lower demand. Service to the Falmouth Bus Depot is available upon request. Free transfers are available to the Hyannis-Falmouth Breeze.

TABLE 14: WHOOSH TROLLEY RIDERSHIP, FY 2009, FY 2010

	FY'09	FY'10
July	8,647	10,187
August	11,289	10,367
September	225	1,594
October - April		
May		
June	1,812	1,837
Total	**21,973**	**23,985**

Source: Cape Cod Regional Transit Authority

FIGURE 31: THE WHOOSH TROLLEY ROUTE MAP
Source: Cape Cod Regional Transit Authority

2.3.7 DEMAND RESPONSE BUS SERVICE

Demand response bus service, also known as paratransit, addresses the needs of passengers who cannot use standard transit services. Demand response buses do not use a route system, but instead pick up passengers at scheduled locations and times, often at their homes or offices.

2.3.7.1 B-Bus Service

The B-Bus operates year round, seven days a week, with the exception of some holidays. In order to use the service, passengers must call the RTA at least one day in advance during normal business hours to schedule a pick up and drop off. A telecommunications device is available for the hearing impaired. Users must be flexible with their pick up and drop off times, in order to allow the driver time to pick up other users. Priority service is given to elderly and disabled users.

The B-Bus fare system operates on a pre-paid account system. B-Bus operators inform users how much their ride will cost, and then deduct it from their account. When the account needs refilling, operators will inform the user. Fares are usually explained when users call to schedule service. Regular users will be advised what their average monthly ride costs are so as to allow them to deposit enough money into their pre-paid account.

Many passengers use the B-Bus to get to work or school, shopping trips, doctor's appointments, and even trips to medical centers in Boston. Each B-Bus can carry up to 19 passengers. Utilizing 60 buses, the B-Bus comprises a major portion of the CCRTA's services and carries over 300,000 passengers a year.

2.3.7.2 ADA Paratransit Service

The Americans with Disabilities Act (ADA) is a federal law passed in 1990, which states that individuals with disabilities are entitled to a comparable level of public transportation service as individuals without disabilities. In order to comply with the ADA, the CCRTA offers a demand response, or paratransit, that is comparable to their fixed route services. This paratransit service operates within ¾ mile of existing routes and runs during the same hours as existing bus services. Trips may be requested during normal business hours. This new service is referred to as ADA Paratransit Service.

The service is available to people with physical, mental, cognitive, and visual impairments that prevent them from boarding or disembarking fixed route services, from recognizing destinations, from understanding bus transfers, or from distinguishing between different buses in different routes. Residents who think they may qualify are encouraged to contact the CCRTA to request an application.

2.3.8 FLEXIBLE ROUTE BUS SERVICE: "THE FLEX"

FIGURE 32: FLEX ROUTE MAP
Source: Cape Cod RTA

TABLE 15: "FLEX" SERVICE RIDERSHIP, FY 2009, FY 2010

	FY'09	FY'10
July	11,317	10,850
August	11,679	11,670
September	4,163	5,761
October	2,764	3,191
November	2,083	2,213
December	1,997	2,143
January	1,813	2,065
February	1,540	1,888
March	1,952	2,424
April	2,364	3,011
May	3,083	3,829
June	5,318	7,519
Total	**50,073**	**56,564**
Avg. Riders / Day*	334	377

* - *Assuming 250 Days of Operation (No Weekends, No Federal Holidays)*
Source: Cape Cod RTA

Flexible route service combines fixed route service and demand response service. A flexible route bus will have an established route, but can also be 'flexible' and make deviations from its route to pick up and drop off passengers. The Flex is the flexible route service offered by the CCRTA.

The Flex route stretches from Harwichport to North Truro. The route is extended to Provincetown during the winter while the Shuttle service is suspended. Along this route, the Flex picks up passengers at any of 18 designated stops. Of these 18 designated stops, 7 are "Main Stops." This means that the Flex bus always makes a stop, usually within five minutes of schedule. The remaining 11 stops are "In-Between Stops," and the Flex only stops when a passenger is waiting, or to drop off a passenger by request. The time of these stops vary.

The bus can also "flex" off its route up to ¾ of a mile to pick up passengers who cannot reach a regular stop. Users must call the RTA at least two hours in advance in order to schedule a Flex bus pick up or drop off. The fare for a one-way "off-route trip" is $2. TTY service is available for the deaf or hearing impaired.

Each Flex Bus is 12 feet wide and 29 feet long, with a seating capacity of 25. Additionally, each bus has bio-diesel capability. Low floors and hydraulic drops provide accessibility to disabled users. Bicycle racks on the front of the Flex bus can carry up to two bicycles.

FIGURE 33: A FLEX BUS PARKED AT THE HYANNIS TRANSPORTATION CENTER

During the summer, the Flex bus is scheduled to make 28 trips per day between 6:00am and 8:00pm. Buses are scheduled to run every 30 minutes, with a one-way trip taking 1 hour and 50 minutes. Service is available seven days a week in the summer. Service is reduced during the winter in order to reflect lower demand. Transfers are available to the Hyannis-Orleans Breeze and Plymouth and Brockton service. Free transfers are available to the North Truro Shuttle.

2.3.9 GREATER ATTLEBORO-TAUNTON REGIONAL TRANSIT AUTHORITY

The Greater Attleboro-Taunton Regional Transit Authority (GATRA) is the agency in charge of operating and maintaining public transit services for 17 member communities in Southeastern Massachusetts. According to the National Transit Database, GATRA's service area is 72 square miles and includes Attleboro, Middleborough, Plymouth, Taunton, and Wareham. GATRA also serves Cape Cod with the Onset-Wareham Link (OWL), with stops in Bourne.

The OWL is a fixed route bus service, comprised of 4 "links" or routes, serving Wareham and Bourne. Link 2 connects Route 6/28, Onset Village, and Bourne. The three stops in Cape Cod are Main Street in Buzzards Bay, Tedeschi's on Trowbridge Road, and Bourne Oaks. Link 2 runs buses every hour from 8:00am to 6:30pm, Monday through Saturday. This amounts to 10 buses daily. There is no service on Sunday. The last two buses of the day do not stop at Bourne Oaks. Like the fixed route RTA services, passengers can board at any point on the route by waving down the driver. Fares are $1 for a one-way trip, with discounts for the elderly, the disabled, students, and children. Monthly passes are also available. Via the OWL service, those living and working in Buzzards Bay are connected to Southeastern Massachusetts and to interregional bus service at Tedeschi's on Trowbridge Road.

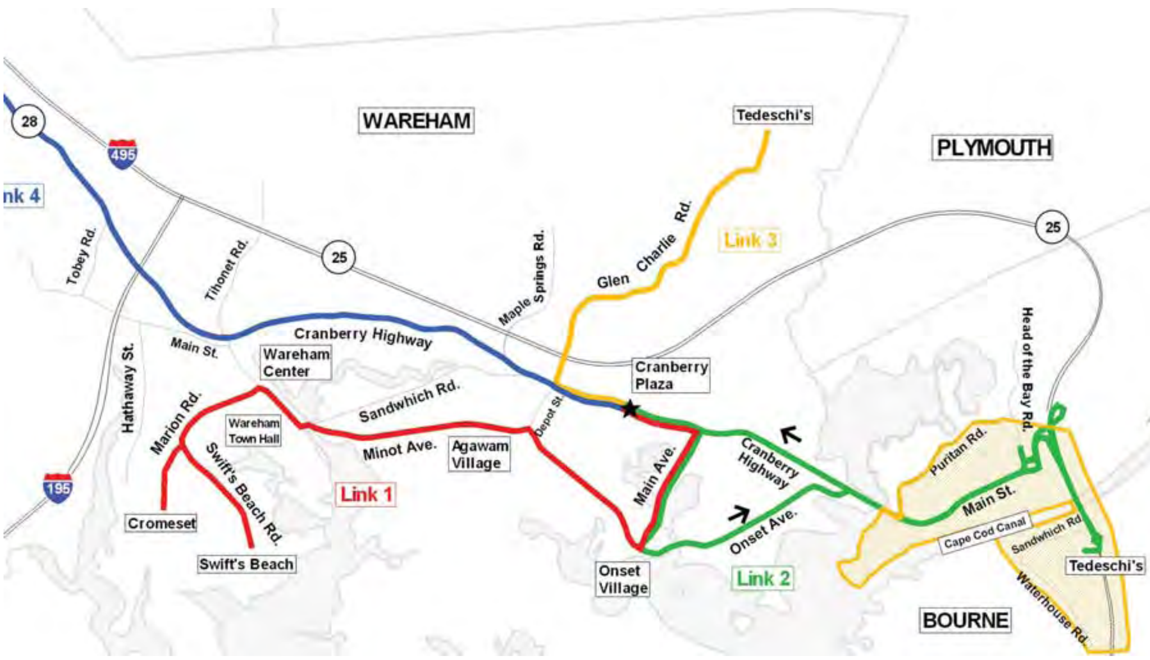


FIGURE 34: GATRA ONSET WAREHAM LINK SERVICE
Source: Greater Attleboro Taunton Regional Transit Authority

2.3.10 BUS TRANSPORTATION ACCESSIBILITY

Bus transportation accessibility refers to how easy it is to reach and to use transit. Accessible transit is located within walking distance (one-half mile or less) or in places that are convenient to other modes of transportation. Moreover, accessible transit accommodates all users, making it easy to understand route and stop information, purchase tickets, board, ride, and get off. There are many different ways in which these concerns are addressed on Cape Cod.

Local bus transit services cover key populations and areas on Cape Cod. According to a detailed analysis performed for the 2007 RTP, of the 412 square miles in Barnstable County, 36.5% are within one-half mile of local bus transit services. As far as population coverage, 45.4% of Barnstable County residents are within one-half mile of local bus transit services. The areas and populations covered are mainly along the Route 28 corridor and Route 6 in the Outer Cape. However, some population centers in Bourne, Falmouth, Dennis, and Sandwich are not being addressed (

Figure 35). Routes along Route 6A and Route 28A could fill these gaps in service. Yet, even though almost half of Cape Cod's population is located near transit services, the 2000 census reports that only 1.22% of residents use transit to commute. Therefore, other factors must be reducing the desirability of transit.

TABLE 16: LAND AND PERSONS NEAR TRANSIT ROUTES, BREAKOUT BY TOWN AND BY REGION

	Population *(2000 Census)*			**Area** *(mi²)*		
	Total	% Within ¼ Mile	% Within ½ Mile	Total	% Within ¼ Mile	% Within ½ Mile
Barnstable	47,821	40.4%	58.2%	62.63	21.5%	35.8%
Bourne	18,721	10.1%	19.7%	41.29	4.4%	8.4%
Brewster	10,094	68.0%	74.0%	25.43	51.6%	61.9%
Chatham	6,625	46.0%	79.1%	17.05	24.9%	45.2%
Dennis	15,973	17.4%	30.6%	21.05	11.4%	22.8%
Eastham	5,453	93.9%	98.1%	14.35	71.2%	85.3%
Falmouth	32,660	20.5%	39.6%	45.93	12.4%	23.6%
Harwich	12,386	74.1%	86.4%	22.58	66.2%	80.4%
Mashpee	12,946	8.3%	16.3%	25.79	7.3%	15.7%
Orleans	6,341	50.0%	68.0%	14.47	36.9%	50.7%
Provincetown	3,431	87.2%	98.5%	9.85	31.2%	54.8%
Sandwich	20,136	0.0%	0.0%	44.01	0.0%	0.0%
Truro	2,087	93.3%	96.4%	21.71	61.0%	76.7%
Wellfleet	2,749	94.8%	97.7%	20.32	64.3%	74.5%
Yarmouth	24,807	21.7%	33.0%	25.32	16.0%	24.6%
Upper Cape	84,463	11.5%	22.2%	157.03	6.0%	11.7%
Mid-Cape	88,601	31.0%	46.2%	109.27	18.2%	30.7%
Lower Cape	35,446	62.8%	78.2%	79.53	47.3%	61.5%
Outer Cape	13,720	92.3%	97.9%	66.24	59.8%	74.6%
All Cape Cod	**222,230**	**32.4%**	**45.4%**	**412.07**	**25.9%**	**36.5%**

Sources: U.S. Census and Cape Cod Regional Transit Authority, 2007 RTP

The transportation needs of some population groups must be considered in particular. Environmental justice populations include low income households, foreign born residents, non-English speaking residents, and minorities. Environmental Justice population areas are determined by the U.S. Census Bureau. On Cape Cod, all environmental justice population centers are served by at least one local bus transit route. However, the connections and destinations of those transit routes may still impede environmental justice populations. For example, the population in Buzzards Bay has access to the OWL service. Yet, that service does not connect to any other local bus service on Cape Cod. Surveys are needed to determine where environmental justice populations want to go, so that transit services can be tailored to their needs.

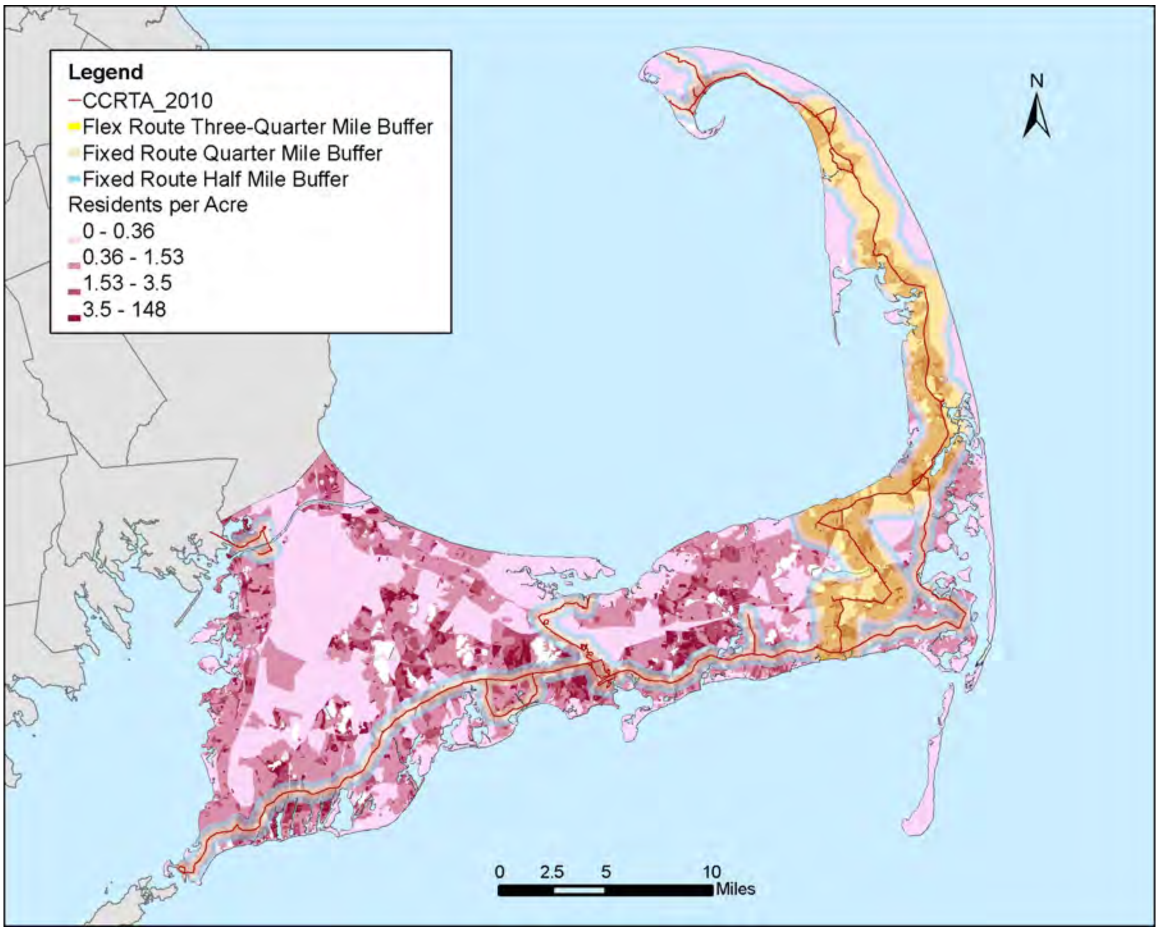


FIGURE 35: LAND AND PERSONS NEAR TRANSIT ROUTES
Sources: U.S. Census and Cape Cod Regional Transit Authority

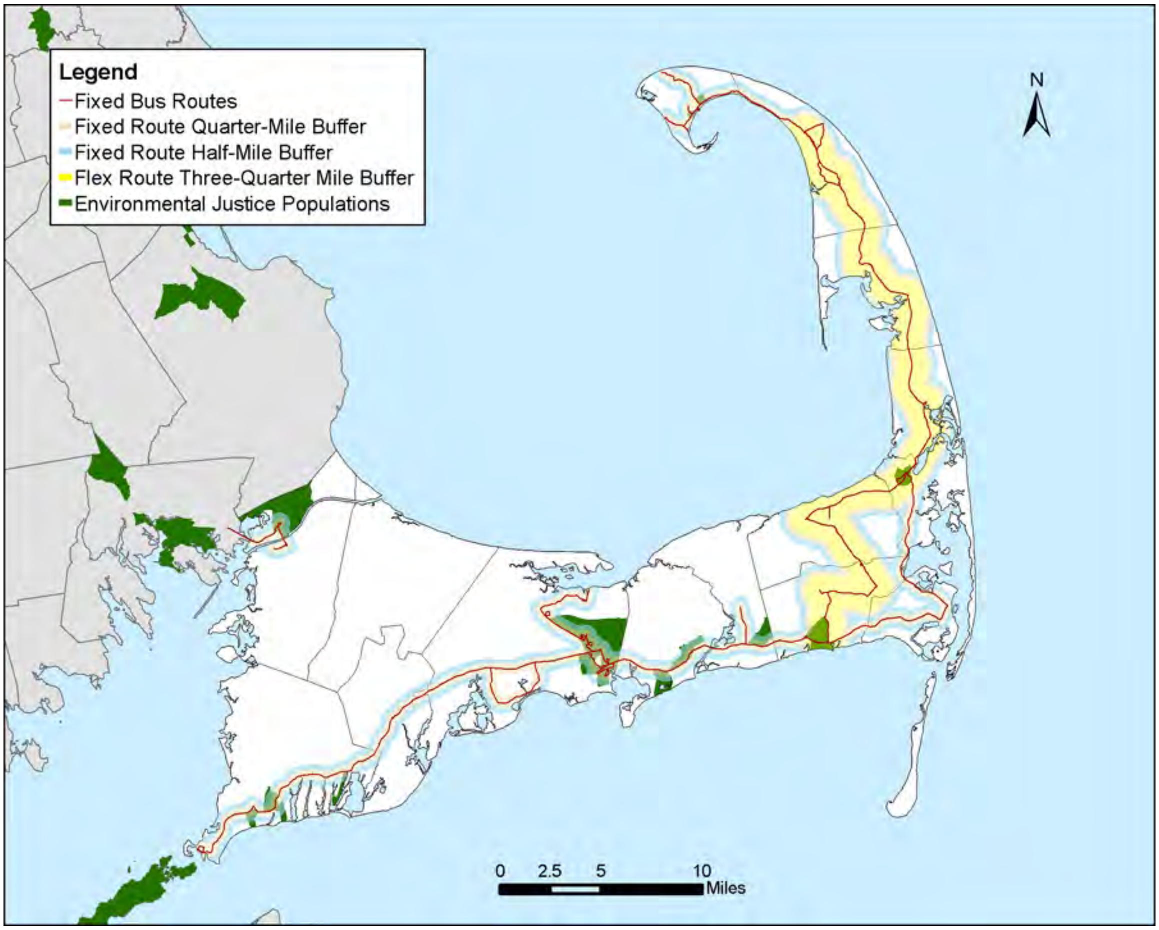


FIGURE 36: ENVIRONMENTAL JUSTICE POPULATIONS NEAR TRANSIT ROUTES
Sources: U.S. Census and Cape Cod Regional Transit Authority

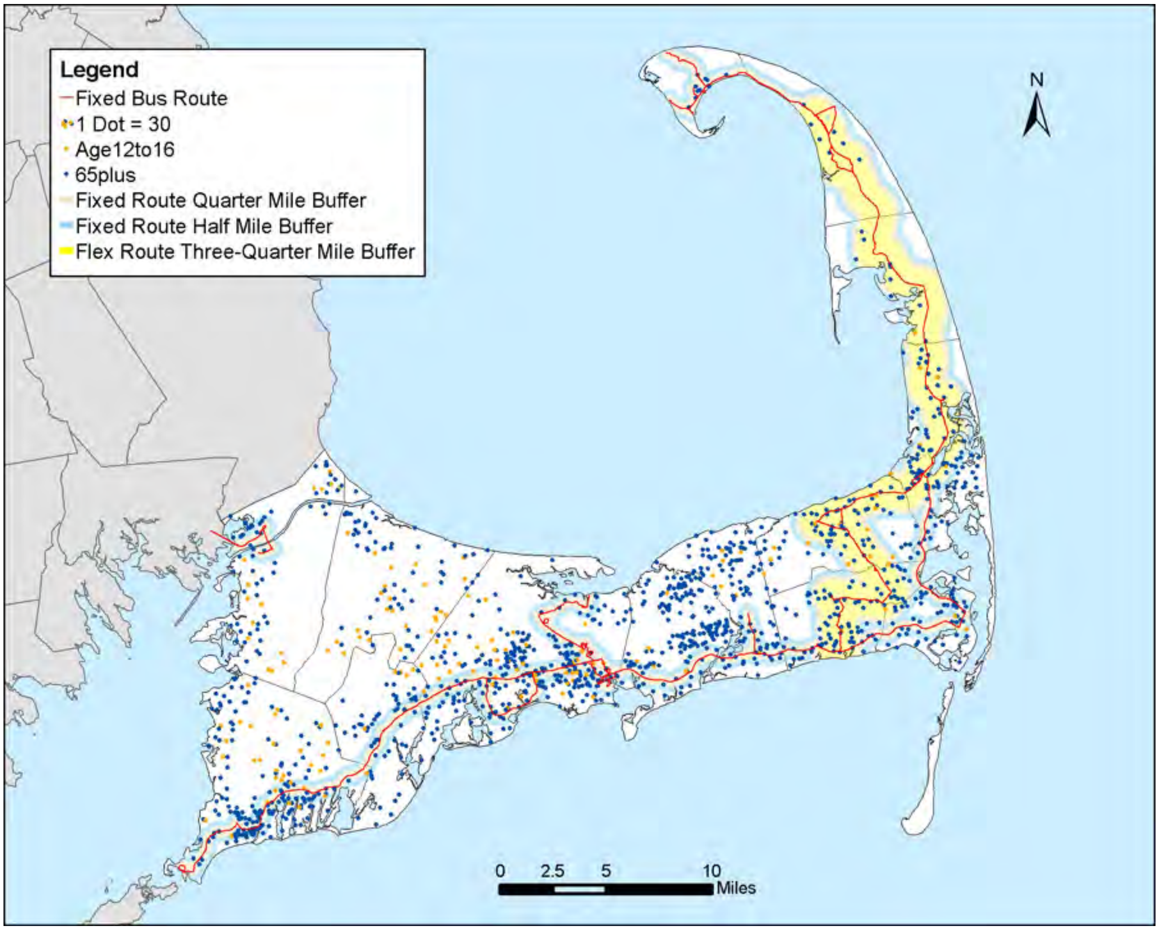


FIGURE 37: ELDERLY AND MINOR POPULATIONS NEAR TRANSIT ROUTES
Sources: U.S. Census and Cape Cod Regional Transit Authority

As a group with no transportation options of their own, teenagers also deserve consideration when discussing transit services. Because they are not yet old enough to drive, children between 12 and 16 years old must rely on parents for transportation. By providing teenagers access to local bus transit services, they are able to travel more independently and more often. Teenagers use transit services to commute to school, work, participate in extra-curricular activities, and to meet with friends. Where transit services are available, parents also have greater flexibility because they will not always need to drive their children to all of these destinations.

Many children aged 12 to 16 are served by local bus services on Cape Cod. In the Outer Cape, the Flex bus provides transit services to students at Nauset High School. In 2006, 35% of all Flex riders were between the ages if 12 and 16. Moreover, many teenagers are located less than one-half mile from a transit route (**Figure 37**). However, some teenagers in areas such as North Dennis and parts of the Upper Cape are not being served. Providing local bus services to these populations will help them to become more independent and more active.

The transit needs of the elderly must also be addressed. Due to their limited mobility, senior citizens must often rely upon transit services to reach shopping centers, doctors' offices, and even employment. In many cases, senior citizens may not be able to walk to a bus stop or may need special assistance to board and ride. According to the U.S. Census, 23.1% of Cape Cod residents are over 65 years of age (compared to the statewide average of 13.5%). Local bus services seek to address these issues. All local buses are wheelchair accessible, as are many of the P&B interregional buses. Additionally, the Flex buses have low floors and a ramp that can be lowered for those who need it. Senior citizens also receive a discounted fare. The transit routes themselves reach many elderly populations and destinations, especially in the Outer and Lower Cape. The Flex bus and B-Bus services can also meet elderly riders at their door. Moreover, because they are given priority, even senior citizens living away from fixed route services have access to transit through the B-Bus. As a result, the elderly on Cape Cod have good access to transit services.

Many of the same issues confronting the elderly also restrict transit access for the disabled. Reduced pricing, wheelchair accessible buses and demand response services are helpful. On the OWL bus, personal care assistants may ride for free if they register with GATRA. Moreover, both the RTA and GATRA have DDT information lines for the hearing impaired. Many improvements can still be made. Signs and other information need to be produced in large print and Braille for the visually impaired. Bus stops and shelters located on major roadways need to have crosswalks and pedestrian signals, with audible and visual crossing cues. This will enable all users to access bus stops safely. By improving access for everyone, more people will be able and willing to ride transit services.

Much of Cape Cod is connected by bus transportation. The Route 28 and Outer Cape Route 6 corridors are well served by local transit. Long distance routes to Boston and Providence are also well covered by interregional service. There is also mobility between population centers such as Hyannis, Falmouth, Orleans and Provincetown. However, local bus services in Bourne have no mobility beyond Buzzards Bay. Much of Bourne, Sandwich and North Dennis are also unserved by transit. Addressing these gaps will connect more users to more destinations and improve mobility.

Examining specific stops on each local bus route shows that bus services are reaching many popular destinations. These destinations include shopping centers, beaches, senior and community centers, town halls, and post offices, and other transportation modes such as air and ferry. Moreover, the number of destinations available to the user is increased by the ability to wave down or stop a bus anywhere on its route. This type of service provides a great deal of mobility in areas where commercial and residential activity is disparate.

Transit services on Cape Cod also connect users to many other forms of transportation. All park-and-ride lots, except Sagamore, also serve as stops for local and interregional service. Moreover, connections to local bus services are available at all interregional bus stops on Cape Cod, except the Sagamore Park-and-Ride Lot. Many bicycle paths and routes, such as the Cape Cod Rail Trail, Shining Sea Bike Path, and Claire Saltonstall Bikeway, are also located near local and interregional transit stops. All ferry terminals are within one-half mile of transit services. Local bus routes are available to all commercial airports offering passenger carrier service. In this way, transit connects and integrates all other forms of transportation on Cape Cod.

While some bus transportation on Cape Cod operates on a regular and frequent basis, some does not. Interregional bus service operates on a regular and well published schedule. Several P&B and Peter Pan buses run daily to Boston and Providence, often every hour. The Flex bus has also met much success, partly due to the regularity of its schedule. However, other local bus services, such as the Hyannis-Falmouth line are not frequent enough for many riders. Traffic on major roadways also delays many local buses, such as the Barnstable Villager, making them less dependable. Offering more buses in a more dependable manner will improve rider mobility and encourage more people to use transit services.

2.3.11 CAPE COD REGIONAL TRANSIT AUTHORITY VISION

During the public outreach for development of the RTP, the Cape Cod Regional Transit Authority shared information on progress made to improve public transportation and proposals to improve it further:

2.3.11.1 Projects Accomplished with Prior Funding

- New hourly service on fixed-route services
- Creation of a Mobility Management Vision
- Created a Multi-Modal Taskforce to improve seamless inter-modal connections
- Launched an upgraded CCRTA website (http://www.capecodrta.org/)
- Simplified the b-bus fare: Created an easier billing structure that eliminates future rides
- Provided 17 Mobility Assistance Program (MAP) vehicles to various towns throughout Cape Cod
- Have begun construction of Cape Cod style bus shelters throughout Cape Cod
- Upgraded paratransit software to provide state-of-the-art optimization of scheduling
- Purchased two Inter-City Bus Replacements (public-private partnerships for inter-regional connections)
- Awarded a contract for electronic fare systems that are interoperable with the MBTA's Charlie Card and parking management systems
- Working with the Volpe National Transportation Systems Center and the Cape Cod National Seashore to improve parking management in the lower cape, using advanced technology.

2.3.11.2 Projects We Must Accomplish through the Long-Range Regional Transportation Plan

- Mobility Management Transportation Call Center

The Cape Cod Regional Transit Authority (CCRTA) will incorporate the latest technology into a one-stop transportation traveler call center to coordinate transportation on all travel modes and to manage eligibility and special transportation requirements for a coordinated human services transportation brokerage. Mobility management is a strategic approach to service coordination and customer service with the CCRTA assuming a broader role in coordinating the full range of mobility services in the Cape Cod tourist economy that promotes greater efficiency and increased service effectiveness using public transportation resources.

- Energy Efficient Paratransit Vehicles

The CCRTA will purchase ten (10) accessible minibuses for a revitalized paratransit service that will coordinate human services transportation and general public dial-a-ride transportation (DART) in underserved or high demand regions of Cape Cod, particularly for elderly individuals and persons with disabilities.

- Expansion of Next-Gen Mobile Data Terminals to Paratransit

The CCRTA will deploy the latest mobile data technology in their paratransit fleet, including state-of-the-art displays, global positioning systems (GPS), automatic vehicle location (AVL) systems, in-vehicle navigation systems, and digital driver manifests and mobile data collection on passenger services. This equipment supports the mobility management call center functions by providing real-time information for dial-a-ride passengers on the location of their scheduled vehicle.

- Next Bus Stop Announcements and Automatic Passenger Counting.

The CCRTA will build on the state-of-the-art mobile data terminals (MDTs) and computer assisted scheduling and dispatching systems (CASD) to add technology to the MDTs to provide next bus stop announcements/displays on board regional and local fixed route services. Automatic passenger counters will also be attached to the MDTs, freeing the driver from manually counting passengers and yielding improved service planning data.

- Web 2.0 Integrated Intermodal Traveler Information over the Web

The CCRTA will provide a number of customer enhancements using the latest internet technology, including intermodal trip planning, displays at malls and intermodal terminals that provide real-time mapping of transit vehicle locations, estimated time of arrival (ETA), real-time displays for major destinations and multimodal terminals, ETA displays at bus shelters, and smartphone applications.

- MBTA-Compatible Electronic Fare Systems on Transit and Inter-City Buses

The CCRTA is deploying an electronic fare system (EFS) on all CCRTA fixed route and paratransit vehicles that will be interoperable with the Massachusetts Bay Transit Authority. Plans are underway at the state-level that will deploy this EFS system on inter-city buses connecting Cape Cod with Boston, Providence and New York City as well as cities throughout Massachusetts. Ultimately, this electronic payment system will include parking as well as transit components, promoting a car-less on Cape Cod experience.

- Construction of Enhanced Bus Shelters

The CCRTA is building and deploying architecturally appropriate Cape Cod style bus shelters that are intelligent, accessible, and energy efficient. These improvements are a part of the Transit Enhancement Initiative on Cape Cod to increase ridership, provide real-time customer information and amenities that make using transit easier and more convenient for the consumer, particularly for individuals with disabilities.

- Operational Assistance for Dial-A-Ride Transportation (DART).

This CCRTA initiative will provide 100% ARRA operating assistance to support new drivers and support staff to drive the ten new vehicles purchase in task 2.02 (above) that will provide dial-a-ride transportation (DART) in underserved and high demand areas of Cape Cod. In particular, this revitalized Cape Cod RTA DART service will benefit the growing population of elderly individuals and persons with disabilities through a coordinated service of human service transportation and general public dial-a-ride transportation.

2.3.12 CONCLUSION

Bus transportation is a major form of public transportation on Cape Cod. Plymouth and Brockton and Peter Pan / Bonanza serve the interregional needs of the Cape, while the CCRTA and GATRA serve the local needs. The Hyannis Transportation Center, Falmouth Bus Depot, MacMillan Wharf, park-and-ride lots, and other locations serve as bus stops and transfer points. Yet, despite the availability of transit, only 1.22% of Cape Cod residents use transit to commute to work. The highest public transportation usage is in Sandwich, where workers use interregional bus service to commute to Boston. With the introduction of new services, such as the Flex, transit use may increase compared to automobile usage. For example, a 2006 survey indicated that 20.7% of Flex riders reported that they were making trips to work. Further improving accessibility and mobility for bus transportation users on Cape Cod will encourage more people to use transit and reduce the number of people driving alone over Cape Cod's roads.

2.4 RAIL TRANSPORTATION

Rail Transportation on Cape Cod has a history of over 150 years. Currently, there are 53.8 miles of track on Cape Cod, with different segments owned by the Massachusetts Department of Transportation and federal agencies.

2.4.1 HISTORY OF RAILROADS ON CAPE COD

In 1848, the first railroad tracks on Cape Cod were laid from Middleboro to Sandwich by the Cape Cod Branch Railroad. After tracks were built as far as Hyannis and Yarmouthport in 1854, the Cape Cod Branch Railroad became the Cape Cod Railroad. In 1865, railroad tracks were built from Yarmouthport to Orleans. These tracks were acquired by the Cape Cod Railroad three years later. As rail service increased during the mid-1800s, sailing packets and stage coaches became less numerous. Tracks reached Woods Hole and Provincetown in 1872 as Cape Cod Railroad merged with Old Colony and Newport to become the Old Colony Railroad. The Harwich and Chatham Spur, which was the final segment of rail track built on Cape Cod, was completed in 1887. The Old Colony Railroad was leased to New York, New Haven, and Hartford Railroad in 1894. In 1910, the Buzzards Bay Railroad Bridge was completed over the first Cape Cod Canal, which was under construction. After the canal was widened in 1933-35, a new railroad bridge was constructed. At the time, the vertical lift railroad bridge was the longest of its kind in the world.

FIGURE 1 - EXISTING RAILROAD BRIDGE SPANNING THE CANAL

After a century of expansion, rail on Cape Cod saw a dramatic decline. The introduction of the automobile, a poor economy, and war led to the decline of rail service on Cape Cod. Regular passenger service to Provincetown was suspended in 1938. Then, between 1950 and 1959, the Mid-Cape Highway was constructed between Sagamore and Orleans. The Mid-Cape Highway allowed automobiles greater access to the Cape than before, and greater competition with rail services. In 1957, rail service to Woods hole was discontinued. Two years later, decreased ridership put an end to year round passenger rail service on Cape Cod. Freight trains continued service until the mid-1960s. Cape Cod railroad tracks were traded to the bankrupt Penn Central in 1969 and purchased by the

Commonwealth of Massachusetts in 1976. According to the Massachusetts Department of Conservation and Recreation (DCR), the station houses were razed or vandalized following the rail's decline in usage. Rail tracks from Provincetown to Route 134 in Dennis were dismantled and a portion of the rail right-of-way was converted into the Cape Cod Rail Trail by the DCR. According to the history provided by the Falmouth Bikeways Committee, tracks from Palmer Avenue in Falmouth to the ferry terminal in Woods Hole were converted into the Shining Sea Bikepath in 1976. In 2009, the Shining Sea Bikepath was extended northward, creating a total of 10.7 miles of paved path. Further segments are slated for conversion to bikepaths including a segment from Dennis to Station Avenue in Yarmouth. Today, The Massachusetts Department of Transportation (MassDOT) owns the majority of rail tracks on Cape Cod, with other sections of track owned by the federal government or Army Corps of Engineers.

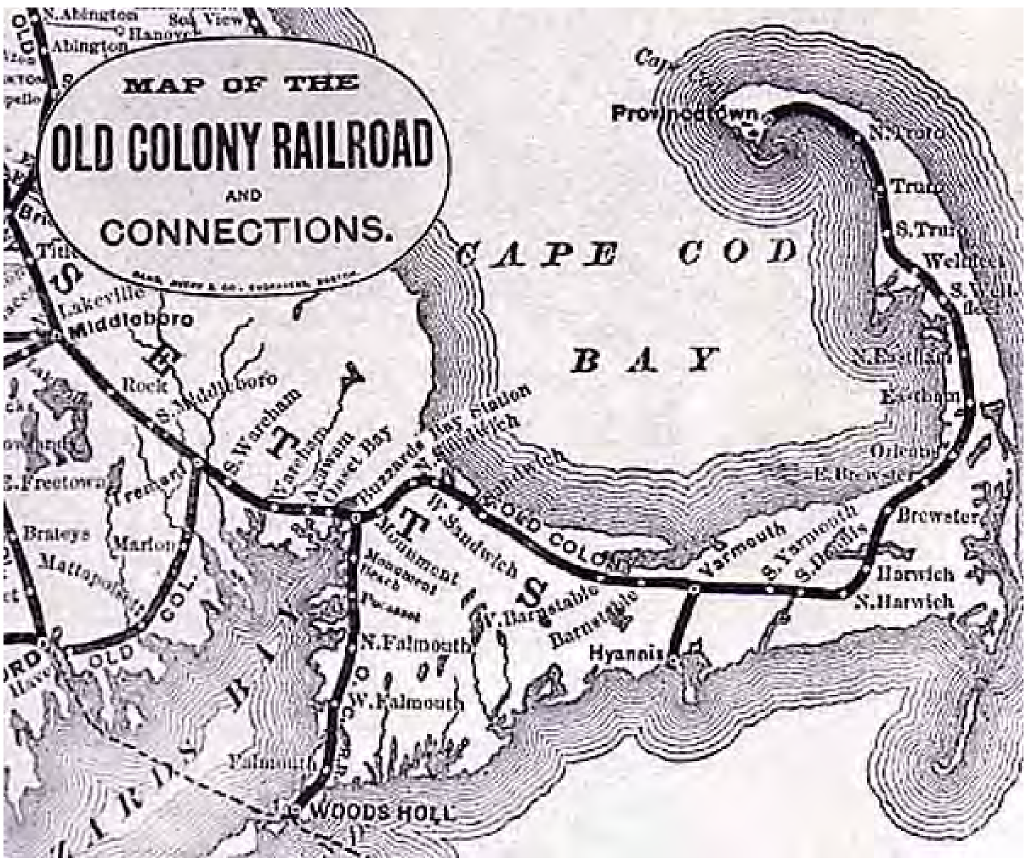


FIGURE 2: MAP SHOWING CAPE COD RAILROADS, CIRCA 1880
Source: www.capetrain.org/history.php

A weekend-only summer train known as the "Cape Codder" was offered by Amtrak from 1986 until 1996 under contract with the Commonwealth of Massachusetts. The service traveled overnight between New York City and Hyannis, with intermediate stops in

Wareham, Buzzards Bay, and Sandwich. During the summer of 1988, Amtrak also offered service from New York City to Falmouth, but discontinued the service when state subsidies were discontinued. Low ridership prevented the continued success of the "Cape Codder" service. In 1995, Amtrak forced passengers to transfer in Providence, leading to a drop in ridership of almost three-quarters. The Cape Cod Transit Task Force's Five-Year Public Transportation Plan states the "Cape Codder" service was discontinued in 1996. According that report, resumption of this service is not economically feasible for the foreseeable future due to financial and equipment constraints, as well as a lack of subsidy.

The Commonwealth had contracted with the Cape Cod & Hyannis Railroad to provide service to Boston from Hyannis and Falmouth for approximately 3-5 years in the 1980s. Service was discontinued when the state went into recession.

2.4.2 RAIL INFRASTRUCTURE

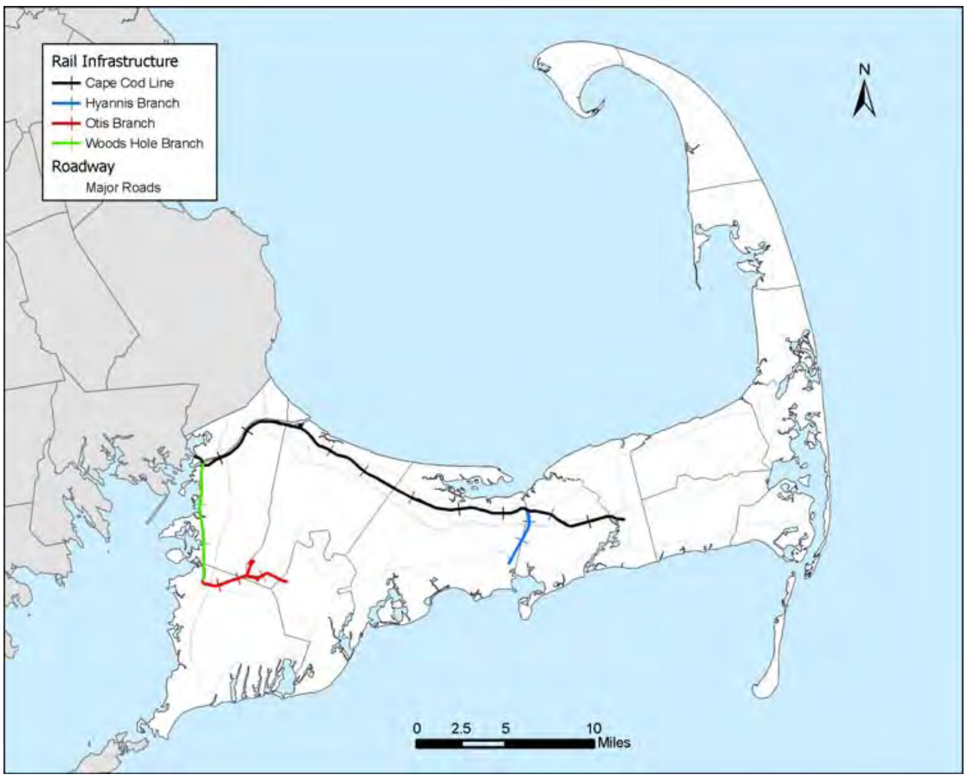


FIGURE 3: CAPE COD RAIL LINE AND BRANCHES

There are many ways to consider rail infrastructure on Cape Cod. One way is to think of rail tracks as a series of lines and branches. Much like the way the roots of a tree feed the trunk with nutrients and water, the branches of a railroad feed the mainline with rail traffic. Cape Cod has a single rail line, the Cape Cod Line, with three branches.

Together, they form a network of rail infrastructure which serves the freight and recreational needs of Cape Cod residents and visitors.

TABLE 1: RAIL TRACKS ON CAPE COD

		Total Mi.	Percent of Total
	Cape Cod Total	53.8	
By Rail Line	Cape Cod Line	32.0	59.5%
	Hyannis Branch	4.4	8.2%
	Otis Branch	10.4	19.3%
	Woods Hole Branch	7.0	13.0%
By Owner	Federally Owned	9.8	18.2%
	Army Corps of Engineers	0.2	0.3%
	MassDOT	43.8	81.4%
By Town	Barnstable	11.2	20.8%
	Bourne	14.4	26.8%
	Dennis	1.2	2.2%
	Falmouth	4.0	7.4%
	Mashpee	0.4	0.8%
	Sandwich	14.8	27.5%
	Yarmouth	7.8	14.5%

2.4.2.1 Cape Cod Line

Waterways and railroad branches divide the Cape Cod Line into four segments. The first segment is located in Buzzards Bay in Bourne. Tracks start at a bridge over the Cohasset Narrows and run to the foot of the Cape Cod Canal Railroad Bridge (Figure 4 and Figure 5). This segment is owned by the Massachusetts Department of Transportation (MassDOT) and leased to Cape Rail, Inc. According to a study done for the Cape Cod Transit Task Force, these tracks are rated for 30 MPH travel. The Bourne Chamber of Commerce currently occupies the former Buzzards Bay Station building south of Main Street (Figure 6). The rail platform at this station is still in existence, as well as a switch leading to an out of service side track. Formerly, a short spur ran east into what is now Bridge Park. In total, the segment is 0.71 miles long, has two bridges over the Cohasset Narrows and Cape Cod Canal, and one road crossing at Academy Ave.

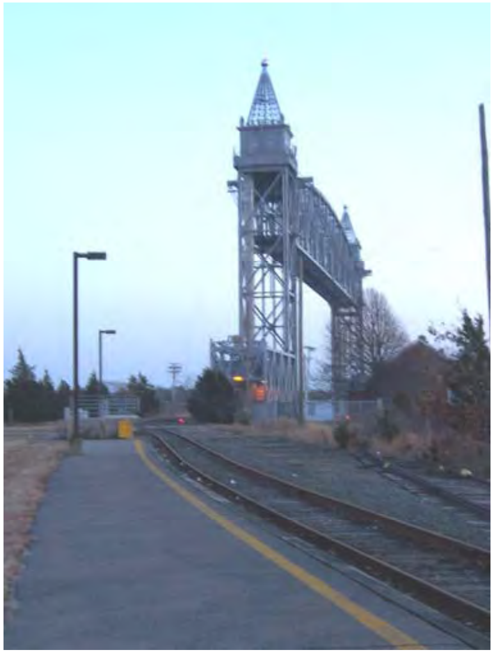


FIGURE 4: RAIL TRACKS LEADING SOUTH TO THE CAPE COD CANAL BRIDGE

FIGURE 5: RAIL TRACKS LEADING NORTH TO THE COHASSET NARROWS

FIGURE 6: OLD DEPOT STATION, CURRENTLY BOURNE CHAMBER OF COMMERCE

The Cape Cod Line continues over the Cape Cod Canal Railroad Bridge to the Canal Junction where the Woods Hole Branch splits off the south. It is here that the second segment of the Cape Cod Line continues, following the Cape Cod Canal and then running alongside Route 6A through Sandwich and Barnstable. Out of service side tracks and former stations can be seen in West Barnstable. Only a platform remains in Sandwich Station, located off of Jarves Street. West Barnstable Station, located on Route 149 in Barnstable, has been preserved even though it is no longer in use. The Cape Cod Line continues to the Yarmouth wye at Willow Street in Yarmouth. Here, the Hyannis Branch turns south, while the Cape Cod Line continues to the east. An out of service and disconnected segment of track sits to the north of the main line and stretches several hundred feet on either side of Willow Street (**Figure 11**). MassDOT owns this segment of the Cape Cod Line, from the Cape Cod Canal to Yarmouthport, and leases it to Cape Rail, Inc. The Transit Task Force study also rated this segment for 30 MPH travel. In total, the segment contains 23.31 miles of track, one bridge over Mill Creek in Sandwich, 4 grade separated roadway crossings, and 40 total roadway crossings.

FIGURE 7: RAIL TRACKS WEST OF THE SAGAMORE BRIDGE

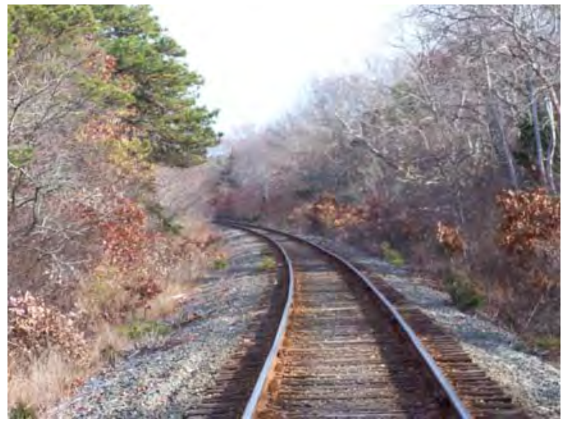


FIGURE 8: RAIL TRACKS EAST OF MARY DUNN RD. IN BARNSTABLE

FIGURE 9: RAIL TRACKS AND SWITCH WEST OF WILLOW STREET IN YARMOUTH

FIGURE 10: RAIL CROSSING AT WILLOW STREET IN YARMOUTH, FACING EAST

East of Willow Street, the Cape Cod Line continues towards Dennis on its third segment. This is the easternmost section of railroad still in use on Cape Cod. It extends from Willow Street in Yarmouth to the Yarmouth Waste Management Facility just west of Station Avenue. The connection to the Waste Management Facility can be made from the mainline in either direction. As with the rest of the Cape Cod Line, MassDOT owns this entire segment and leases it to Cape Rail, Inc. In total, the segment contains 3.38 miles of track, the grade separated crossing of Route 6, and 23 total roadway crossings.

FIGURE 11: AN OUT OF SERVICE TRACK RUNS SEVERAL HUNDRED FEET ON EITHER SIDE OF WILLOW STREET IN YARMOUTH

FIGURE 12: RAIL TRACKS EAST OF WILLOW STREET IN YARMOUTH

FIGURE 13: RAIL TRACKS IN YARMOUTH, FACING WEST.
THE SHINY METAL SURFACE OF THE RAIL TRACKS INDICATES THEIR CONTINUED USE.

FIGURE 14: RAIL TRACKS IN YARMOUTH WEST OF STATION AVENUE.
ALONG WITH THE STOP SIGN, STOPPERS ON THE TRACKS PREVENT TRAINS FROM GOING TOO FAR.

The last segment of the Cape Cod line, starts at the Yarmouth Waste Management Facility east of Station Avenue and crosses the Bass River via a bridge. The Cape Cod Line used to continue all the way to Provincetown, with the Chatham Branch starting west of Route 124 in Harwich. However, the tracks were dismantled and a portion of the right-of-way was converted into the Cape Cod Rail Trail, which serves bicycle users and recreational purposes. Currently, however, the Cape Cod Line extends as far as Route 134 in Dennis. This final segment of track is out of service, abandoned, and not usable by train. Vegetation has encroached upon the rail tracks, crossing signals have been left in disrepair, and road crossings have been paved over (**Figure 16**). MassDOT owns the right-of-way and is negotiating a lease with the towns of Yarmouth and Dennis. Plans for the westerly extension of the Rail Trail through Yarmouth to Willow Street are currently under design.

FIGURE 15: RAIL TRACKS EAST OF STATION AVENUE IN YARMOUTH

FIGURE 16: RAIL TRACKS EAST OF GREAT WESTERN ROAD, YARMOUTH.
THE RAIL TRACKS HAVE BEEN PAVED OVER, WHILE VEGETATION AND A BOULDER BLOCK THE WAY.

FIGURE 17: BASS RIVER RAIL BRIDGE, FACING WEST

FIGURE 18: OUT OF SERVICE RAIL TRACKS WEST OF ROUTE 134 IN DENNIS

In sum, the Cape Cod Line is the backbone of rail service on Cape Cod. It stretches 31.09 miles, and includes 3 bridges over waterways, 8 grade separated roadway crossings, and 51 total roadway crossings. The Cape Cod Line forms the majority of regional rail infrastructure. It serves as the only access to Cape Cod by rail, and is used by both Mass Coastal freight services and Cape Cod Central Railroad.

2.4.2.2 Hyannis Branch

The Hyannis Branch begins at the Yarmouth wye at Willow Street in Yarmouth and travels south. The historic Hyannis Roundhouse, located between Route 28 and Main Street in Barnstable, has been converted into a nightclub and warehouses. The rail yard is now used for the Hyannis Transportation Center and as a rail yard for CCCRR. A restaurant and a furniture store now occupy part of the site. The terminus of the Hyannis Branch is a station for the CCCRR. Originally, the Hyannis Branch continued from the rail yard south to a port facility in the Outer Harbor of Hyannis Harbor. The port and rail connection were dismantled however, and the right of way converted into Old Colony Road. MassDOT owns the Hyannis Branch and leases it to Cape Rail, Inc. This segment has also been rated for 30 MPH travel. In total, the Hyannis Branch contains 4.39 miles of track, 2 grade separated crossings under Route 6, and 6 total roadway crossings.

FIGURE 19: RAIL TRACKS WEST OF WILLOW STREET, FACING NORTH

FIGURE 20: THE HYANNIS RAIL YARD, WITH CCCRR CARS PARKED ON THE SIDE TRACKS

FIGURE 21: THE TERMINUS OF THE HYANNIS BRANCH AT THE CCCRR STATION

2.4.2.3 Woods Hole Branch

The Woods Hole Branch begins at the Canal Junction, splitting off from the Cape Cod Line and traveling south through Bourne and Falmouth. Three depot stations along the route, in Monument Beach, Pocasset, and Cataumet, have been converted to other uses. The tracks continue south to the Otis Junction just south of Old County Road in Falmouth (Figure 22). An out of service side track, runs from Old Main Road to the Otis Junction (Figure 23). MassDOT owns this entire segment and leases it to Cape Rail, Inc. Moreover, this portion of the Woods Hole Branch has been rated for 30 MPH travel. In total, the segment contains 8.43 miles of track, 2 bridges over waterways, 5 grade separated roadway crossings, and 17 total road crossings.

FIGURE 22: RAIL TRACKS AT THE OTIS JUNCTION.
THE LEFT TRACK RUNS EAST TO THE OTIS AIR FORCE BASE. THE RIGHT TRACK RUNS SOUTH TO PALMER AVENUE AND THE END OF THE SHINING SEA BIKE PATH.

FIGURE 23: RAIL TRACKS NORTH OF OLD COUNTY ROAD IN FALMOUTH

The final segment of the Woods Hole Branch runs from the Otis Junction to the overpass at the southern crossing of Palmer Avenue. These tracks are out of service and not usable by train. Vegetation has encroached upon the rail tracks, crossing signals have been left in disrepair, and road crossings have been paved over (**Figure 24**, **Figure 25** and **Figure 26**). MassDOT has sold the right-of-way to the Town of Falmouth to be converted to an extension of the Shining Sea Bike Path. In total, the segment contains 5.82 miles of track, a bog sluiceway north of Fox Lane, 4 grade separated roadway crossings, and 14 road crossings.

Originally, the Woods Hole Line continued south with stations at Depot Street and the current Steamship Authority port at Woods Hole. Originally built in 1872, this section of the Woods Hole line has been dismantled. The station at Depot Street now serves as a bus terminal, while the right-of-way has been converted into the Shining Sea Bikepath.

FIGURE 24: A BUSH GROWS IN THE MIDDLE OF THE WOODS HOLE LINE

FIGURE 25: A CROSSING SIGNAL AT OLD DOCK ROAD OVERGROWN WITH VEGETATION

FIGURE 26: THE WOODS HOLE LINE HAS BEEN PAVED OVER AT OLD DOCK ROAD

FIGURE 27: OTIS BRANCH RAIL TRACKS, EAST OF ROUTE 28A

2.4.2.4 Otis Branch

From the Otis Junction, the Otis Branch runs east into the Otis Air Force Base (**Figure 27**). Inside the base, the track splits into several terminals, with one track running as far east as Mashpee. The entire set of track is federally owned, with use by Cape Rail, Inc. In total, the segment contains 10.51 miles of track, 3 grade separated roadway crossings, and 15 total roadway crossings.

2.4.2.5 Cape Cod Canal Railroad Bridge

In order to enter Cape Cod, trains must cross the Cape Cod Railroad Bridge (Figure 28). In 1910, the Buzzards Bay Railroad Bridge was completed over the first Cape Cod Canal, which was under construction at the time. When the canal was reconstructed in 1933, a new railroad bridge had to be built over the widened waterway. Since the railroad grade could not be easily raised, the Army Corps of Engineers constructed a vertical lift railroad bridge. The new bridge was completed in December of 1935 and was the longest bridge of its kind at the time. Recently, the Cape Cod Railroad Bridge underwent a major rehabilitation effort, in large part through $25 million in Federal funds. Normally the bridge remains in the "up" position (

Figure 30), allowing marine traffic access through the canal, and is lowered for rail service as needed. Marine traffic has statutory right-of-way over rail traffic. A panel in the bridge's control room allows the controller to raise and lower the bridge. The mechanisms to control the interlocking rail, however, are located within the Buzzards Bay Tower in Buzzards Bay, Bourne (Figure 29). The bridge is 806 feet long, 297 feet high and has a high water clearance of 136 feet.

FIGURE 28: AERIAL VIEW OF THE CAPE COD RAILROAD BRIDGE

FIGURE 29: BUZZARDS BAY TOWER HOUSING RAIL CONTROL MECHANISMS

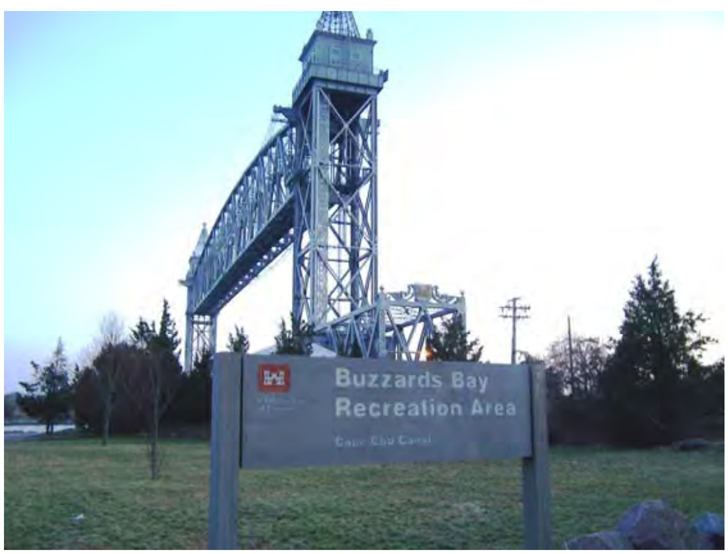


FIGURE 30: CAPE COD RAILROAD BRIDGE FROM BRIDGE PARK, IN THE "UP" POSITION

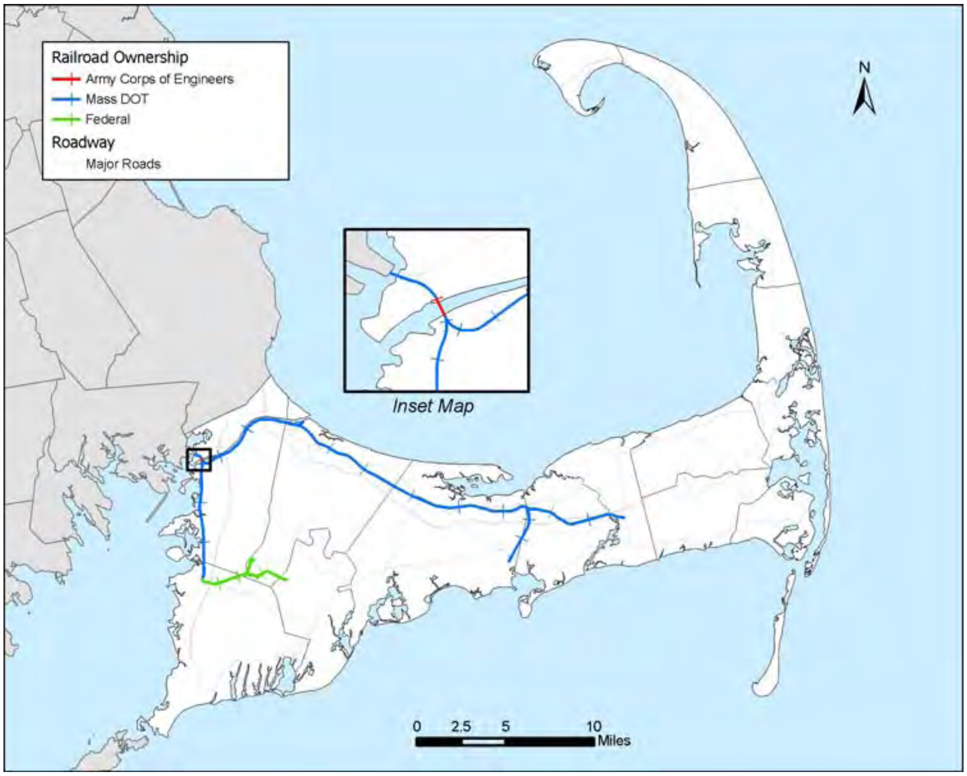


FIGURE 31: RAIL INFRASTRUCTURE AND OWNERSHIP ON CAPE COD

2.4.3 SIGNALS AND CROSSINGS

TABLE 2: RAIL INFRASTRUCTURE THROUGHOUT CAPE COD

	Railroad Crossings at Cape Cod Roads					
	Total	**Grade Separated**	**Gated**	**Signalized**	**Signed**	**Other\ None**
Cape Cod Total	102	22	4	26	19	31
Cape Cod Line	62	10	3	20	11	18
Hyannis Branch	6	2	1	-	1	2
Otis Branch	15	3	-	-	2	10
Woods Hole Branch	19	7	-	6	5	1
Locally Owned	13	4	-	5	3	1
Federally Owned	15	3	-	2	-	10
MassDOT	73	15	4	27	13	14
Barnstable	18	1	3	8	4	2
Bourne	27	11	-	6	5	5
Dennis	3	-	-	-	-	3
Falmouth	6	4	-	1	-	1
Sandwich	33	2	1	11	3	16
Yarmouth	15	4	-	1	6	4

Exclusive rights-of-way can limit the interaction of rail and other modes, making rail transportation safer and faster. However, crossing at roadways can pose problems if the intersection is not properly signed and designed. Currently on Cape Cod, there are 66 at-grade roadway intersections along active rail lines. Some, such as the railroad crossing at Route 28 in Barnstable, can actually interfere with roadway traffic and cause congestion and delays. Of those, 21 are not gated, signalized or signed. Although most of these are minor roadways, they do represent a potential for mishap. Moreover, there are 18 grade separated roadway crossings, as well as 5 bridges over waterways along active rail lines. These bridges and overpasses must be maintained in order to ensure continued use. If rail service on Cape Cod is to be increased, further study of railroad crossings may be necessary to ensure safety and prevent interruptions to roadway traffic.

2.4.4 FREIGHT SERVICE

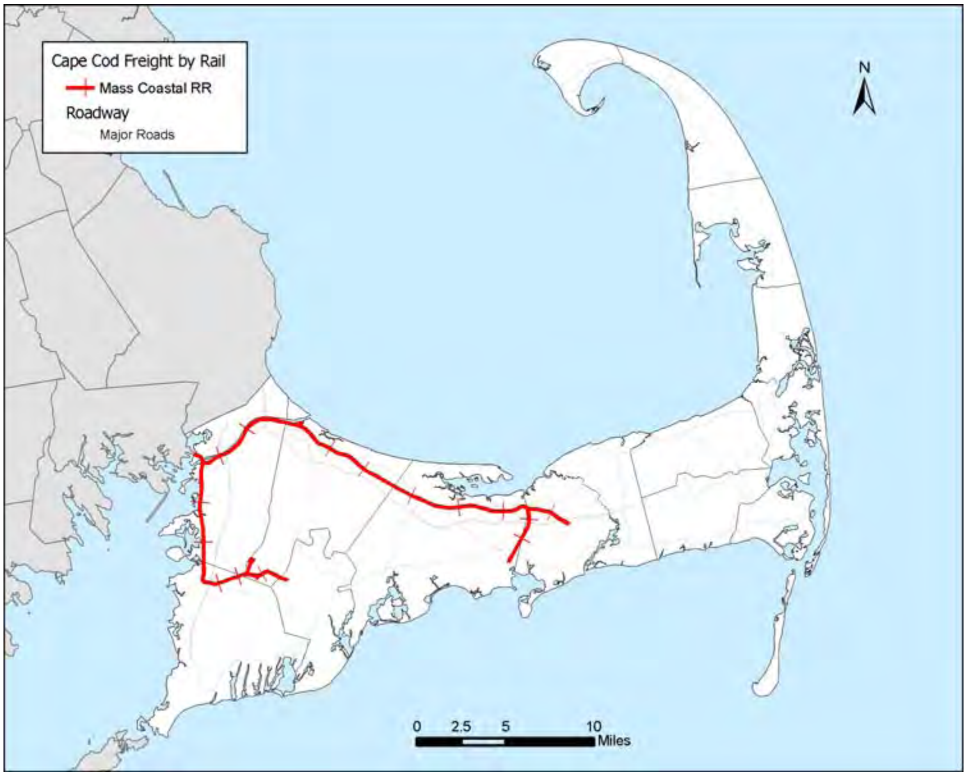


FIGURE 32: MASS COASTAL RAILROAD CAPE COD SERVICE

Freight service is the primary use of Cape Cod's rails. After many years of suspended rail service, CONRAIL formed in 1976 to provide freight service. CONRAIL owned the rail tracks on the Cape Cod Line as far as Sandwich and worked under contract with the Commonwealth of Massachusetts for tracks beyond that point. After CONRAIL announced plans to suspend Cape Cod freight service in 1981, the Commonwealth of Massachusetts purchased the affected lines. It then contracted Bay Colony Railroad to take over freight service in 1982. The Commonwealth of Massachusetts, through MassDOT, still owns most railroad tracks on Cape Cod today, with Massachusetts Coastal Railroad (a company of Cape Rail, Inc.) operating under contract to provide freight service.

Currently, the primary use of Cape Cod's rails is for freight transportation by Mass Coastal. Mass Coastal is a short line freight railroad serving Cape Cod and southeastern Massachusetts between Middleboro, Otis Air Force Base, Hyannis, and South Yarmouth. The majority of Cape Cod's solid waste is transported to the SEMASS trash-to-energy plant in Rochester, MA via Mass Coastal's Energy Train. Other freight Mass Coastal carries includes food, construction materials, chemicals, heavy equipment amongst many other things.

FIGURE 33: MASS COASTAL ENERGY TRAIN

Source: www.masscoastal.com/train-energy.php

2.4.5 PASSENGER SERVICE

Currently, the only passenger service on Cape Cod is a scenic/dinner train offered by Cape Cod Central Railroad – a subsidiary of Cape Rail, Inc. There is, however, plans for offering a commuter line from Buzzards Bay to Middleboro, where passengers could then cross a platform and board a train to Boston. The ride from Buzzards Bay to Boston is expected to take one hour and twenty-five minutes. The plan proposes eight connecting trains, including two morning and two evening peak period trains. The initiation of this plan will require coordination between Cape Rail, Inc. and the MBTA.

Tourist/Dinner Trains

Cape Cod Central Railroad (CCCRR) formed in 1999 to provide recreational train service to Cape Cod. Today the CCCRR still provides a variety of Dinner and Scenic train services. The Hyannis Station is currently used by the CCCRR for selling tickets, dispensing information, and administrative offices. Adjacent to the single main track station is the Hyannis rail yard and maintenance facility (

Figure 21). The CCCRR owns three engines (Table 3). Engines 1501 and 1502 were built by General Motors' Electro-Motive Division (EMD) in 1952 and serve as CCCRR's primary motive power (Figure 35). Engine 1201, nicknamed "Lulubell," was built in 1951 by American Locomotive Company (ALCo) and serves CCCRR as a backup engine (Figure 36). These three engines move the various excursion trains offered by CCCRR.

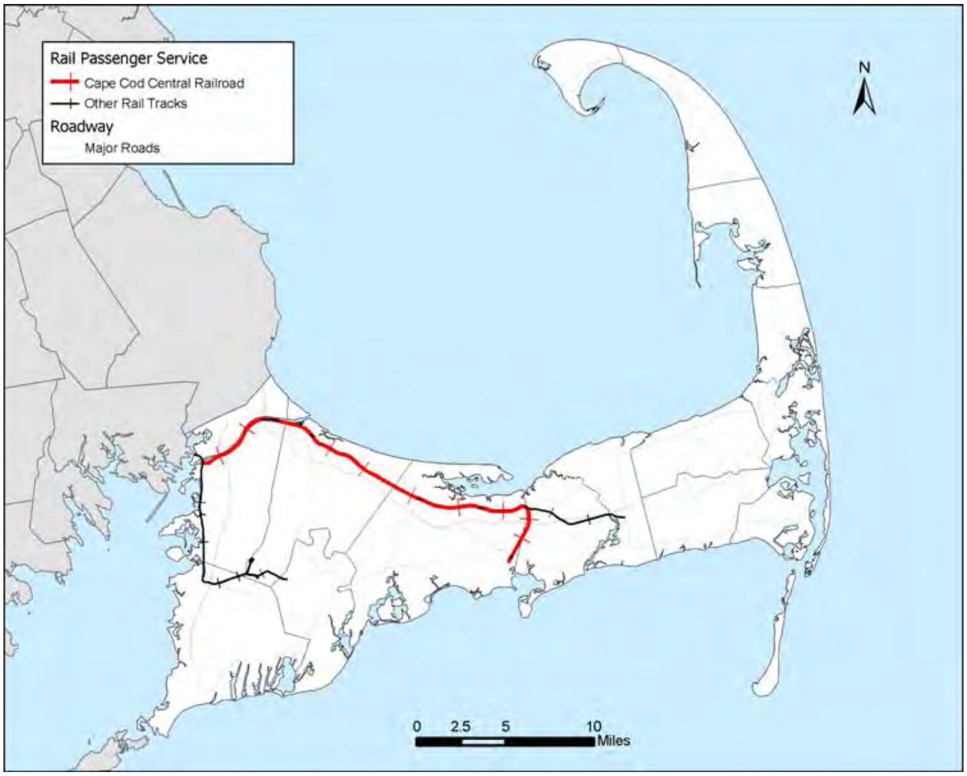


FIGURE 34: CAPE COD CENTRAL RAILROAD SERVICE

Cape Cod Central Railroad offers Scenic Excursion Train service from the Hyannis Transportation Center to Canal Junction and Sandwich stations. On occasion, the train will also stop at the West Barnstable station on the corner of Routes 149 and 6A. Hyannis and Sandwich stations are the only passenger stops. Scenic Excursion, Lunch and Dinner Train service begins in May and lasts until the end of October. During June and July, train service runs with greater frequency. Scenic excursion trains consist of one of CCCRR's engines and three coach cars. The coach cars are 82' long and 10'4" wide. Each of the former Long Island Railroad 2700 Series Commuter Cars seats approximately 60 people. They are named "Barnstable," "Sandwich," and "Bourne," the towns where the train makes stops. A variety of different cars are used for the Lunch and Dinner Trains (see Table 4). In addition to the engine and the cars, the dining excursions utilize a Kitchen / Generator Car. This car powers all of the electric lamps on board the passenger cars and provides a kitchen for the cooking staff to prepare meals. Tickets vary in cost from $17 to $60 depending on the type of rail service.

TABLE 3: ENGINES IN THE CAPE COD CENTRAL RAILROAD FLEET

Engine No.:	Engine	Horsepower	Dimensions (L x W x H)	Weight (Tons)	Date Built
1501	EMD 567B diesel 16 cylinder, 2 cycle	1,500	55’9” x 10’3” x 14’6”	120	1952
1502	EMD 567B diesel 16 cylinder, 2 cycle	1,500	55’9” x 10’3” x 14’6”	120	1952
1201	EMD 645BC diesel 12 cylinder, 2 cycle	1,200	56’ x 10’2” x 14’6”	120	1951

Source: www.capetrain.com/roster

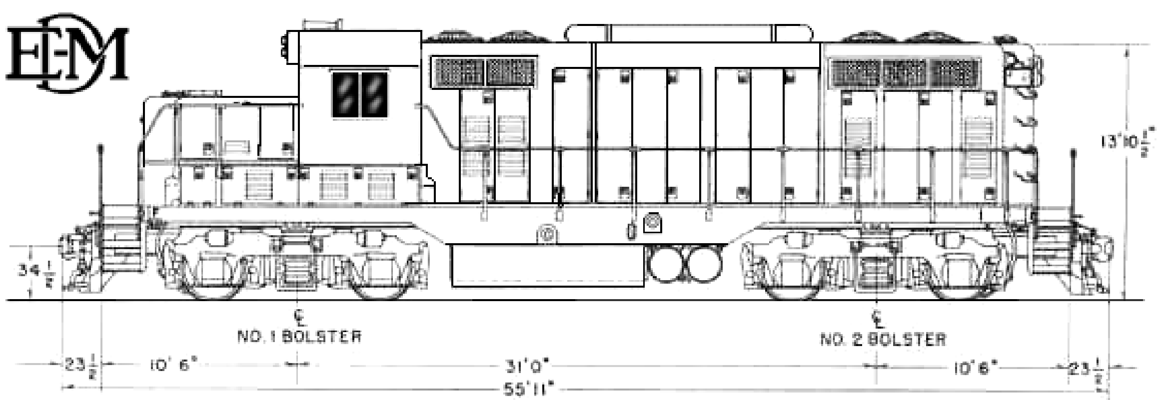


FIGURE 35: DIAGRAM FOR ENGINES 1501 AND 1502

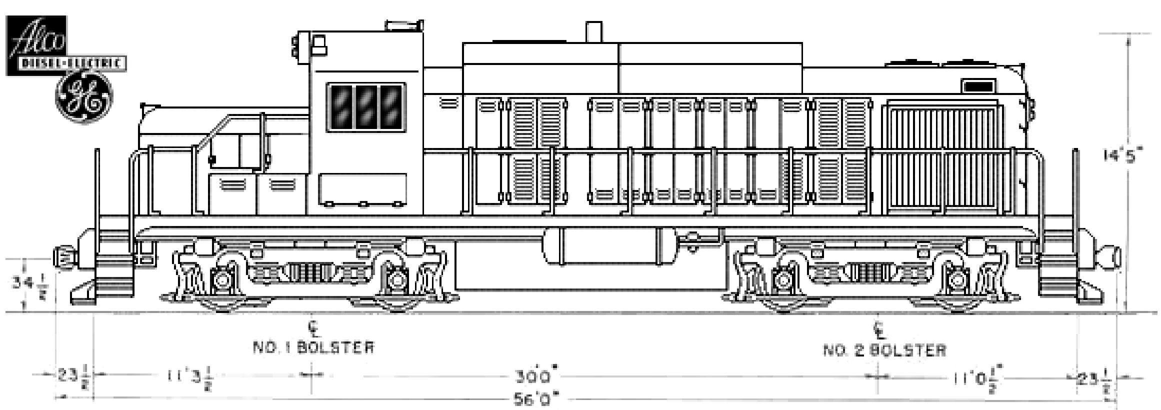


FIGURE 36: DIAGRAM FOR ENGINE 1201

TABLE 4: RAIL CARS IN THE CAPE COD CENTRAL RAILROAD FLEET

Name	Car No.	Passenger Capacity	History	Service
"Cape-Codder" Lounge Car	200	16 at tables, 24 at lounge seats	Former IL Central Lounge Car	Dinner Train
"Sandy Neck" Dining Car	201	64 seated at tables	Built by CC&F in 1937	Lunch and Dinner Trains
"Great Island" Dining Car	202	64 seated at tables	Built by CC&F in 1937	Lunch and Dinner Trains
"Race Point" Dining Car	203	64 seated at tables	Built by CC&F in 1942.	Lunch and Dinner Trains
Kitchen / Generator Car	250	None	Built by Chicago, Burlington, and Quincy in 1957.	Lunch and Dinner Trains

Source: www.capetrain.com/roster

Due to the limited number of scheduled trips and stops, as well as the cost of a ticket, CCCRR service is not practical for use by commuters. Instead, the CCCRR train service is geared primarily for tourists. During the 2000 season, 50,000 passengers rode the rails, representing a 300 percent increase from the 16,000 passengers in 1999 (Cape Cod Transit Task Force).

2.4.6 RAIL ACCESSIBILITY, MOBILITY AND CONNECTIVITY

Currently, the accessibility and mobility of rail service is limited. Sandwich and West Barnstable Stations are both accessible only by road, with on-site parking facilities. Of the three active passenger stations, only the Hyannis Station is accessible by public transportation. From the Hyannis Transportation Center, rail passengers can transfer to local and interregional bus service, as well as make connections to air and ferry service. If passenger rail service on Cape Cod is expanded, improved access and connections to other transportation modes may need to be provided at rail stations.

The disabled and elderly are not wholly accommodated by rail service. All rail stations include shelters, benches, and handicapped parking. The Hyannis Transportation Center, recently constructed, was built to meet the Americans with Disabilities Act (ADA) specifications. Difficulty occurs when boarding trains. Raised platforms and ramps help, in addition to assistance offered by conductors and railroad staff. In addition, large print and Braille signage are necessary at stations and in train cars.

Based on a review of the existing rail network it is clear that much of Cape Cod is not connected by rail. Rail connections exist only in the Upper and Mid-Cape. Increasing the number of rail connections will be limited to whether rights-of-way can be acquired for the construction of rail tracks. Given the current rails-to-trails trend, further expansion seems unlikely at the current time. In this case, connectivity and mobility issues will have to be addressed by improving rail service and connections to other modes of travel. Rail mobility is limited by the current scenic train service, which is designed for tourism, not commuting. A passenger can only use the service to travel between Sandwich and Hyannis Stations. Destinations and passenger mobility will need to be addressed in any plan to expand rail service.

2.4.7 CONCLUSION

Rail service has a long and rich history on Cape Cod. The region's early growth was in part brought about by the railroad. Many miles of usable track still exist on Cape Cod, intersecting the roads and waterways. MassDOT owns the majority of rail tracks on Cape Cod, but some tracks are owned by federal agencies. Currently though, only the Mass Coastal freight service and the CCCRR scenic train service operate on Cape Cod. Proposals currently exist to connect Buzzards Bay to Middleboro, which would give Cape passengers access to Boston. If passenger rail service were to be resumed, upgrades would be necessary to the tracks, stations, and signals. Moreover, issues of accessibility, mobility and connectivity would need to be addressed. Funding for these improvements would need to be identified and secured. As many tracks are converted in bicycle paths, the future of rail on Cape Cod is still uncertain.

2.5 WATER TRANSPORTATION

The primary form of public water transportation on Cape Cod is ferry service, carrying passengers between the mainland and the islands of Martha's Vineyard and Nantucket. A significant amount of freight is carried by water transportation as well. As a result, the region's seaports and channels are vital in addressing the economic and transportation needs of Cape Cod.

2.5.1 CAPE COD SEAPORTS

Cape Cod has 586 miles of tidal coastline, with many inlets and bays that provide marine access to the land. Seaports have been constructed along several of these bays and inlets to facilitate the transfer of people and goods from water to land transportation. Significant Cape Cod seaports are recognized in reports by the Army Corps of Engineers, the agency that maintains many of them. These and other seaports are discussed in this section.

2.5.1.1 Woods Hole Harbor

Woods Hole Harbor, located in Falmouth, is a primary seaport for Cape Cod. It is split into two harbors by Juniper Point: Great Harbor and Little Harbor (Figure 2 and Figure 3). Little Harbor is located in the 550,000 square feet of water between Juniper and Nobska Points. In 1906, the Army Corps of Engineers completed a 1,600 foot-long channel from the Little Harbor to Vineyard Sound, as well as a turning basin. The Coast Guard widened and deepened both projects in the 1960s to a depth of 17 feet and a width of 200 and 400 feet respectively. Located on the western side of Little Harbor is a Coast Guard station, which is also used for recreational purposes. Great Harbor is located between Penzance Point and Juniper Point. A bascule drawbridge separates Great Harbor from Eel Pond to the north. Woods Hole Channel, which leads west to Buzzards Bay, connects at the southern end of Great Harbor. Many piers are located throughout the harbor, each with their own anchorages. Of the more significant ones are the 15-foot deep anchorage for the Steamship Authority ferries and the 22-foot deep anchorage for the Woods Hole Oceanographic Institute. Great Harbor is home to ferry passenger service, charter and sport fishing services, research vessels, and recreational boats. Charts of various ports shown in the following figures were produced by the National Oceanic and Atmospheric Administration's *Coast and Geodetic Survey*.

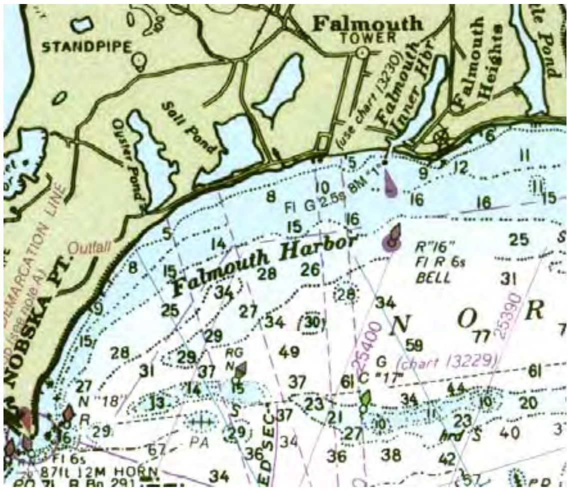


FIGURE 1: FALMOUTH HARBOR

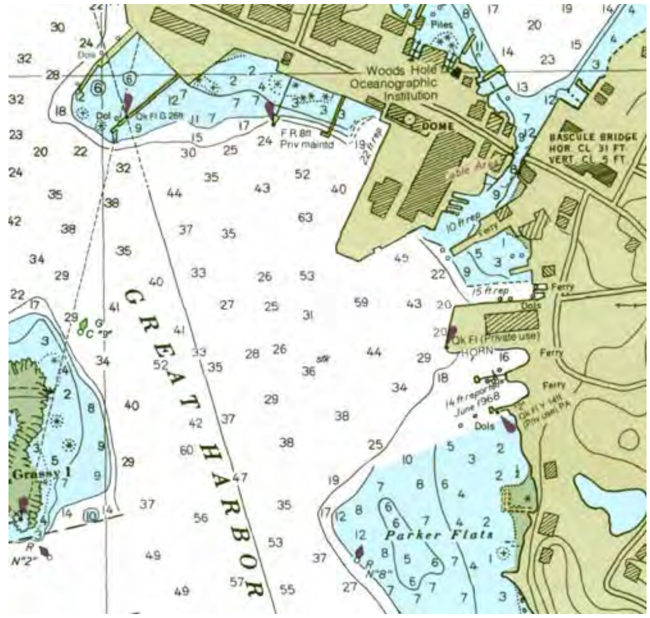


FIGURE 2: A SECTION OF GREAT HARBOR, WOODS HOLE IN FALMOUTH

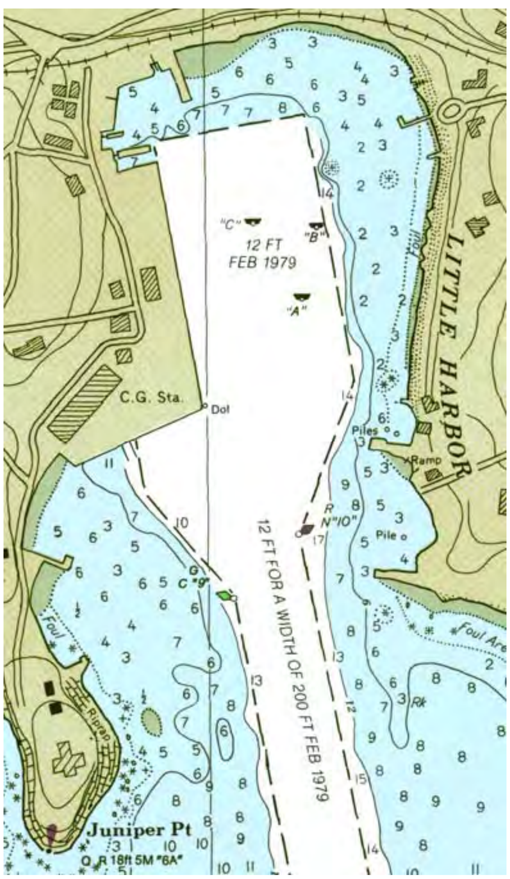


FIGURE 3: LITTLE HARBOR, WOODS HOLE IN FALMOUTH

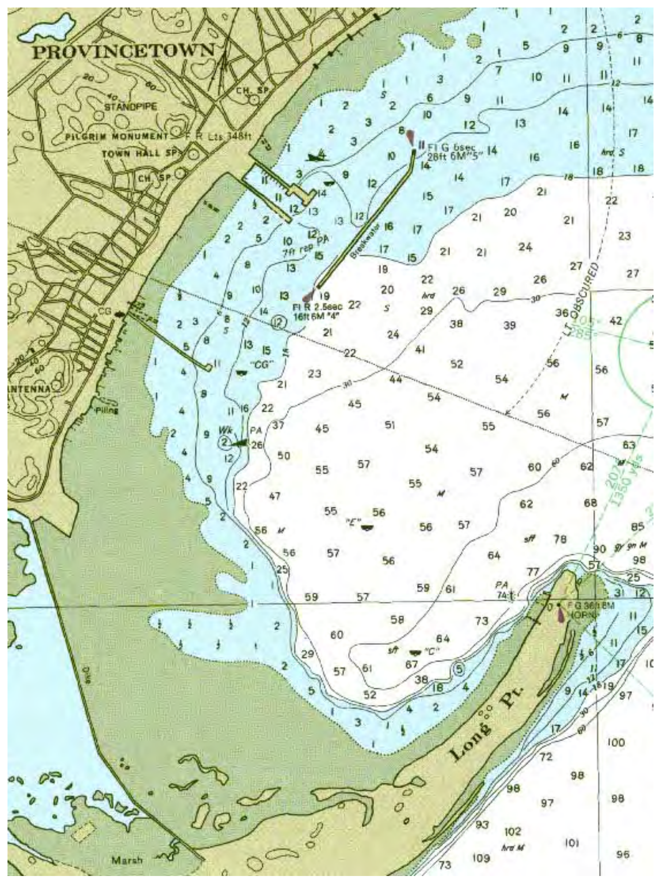


FIGURE 4: PROVINCETOWN HARBOR

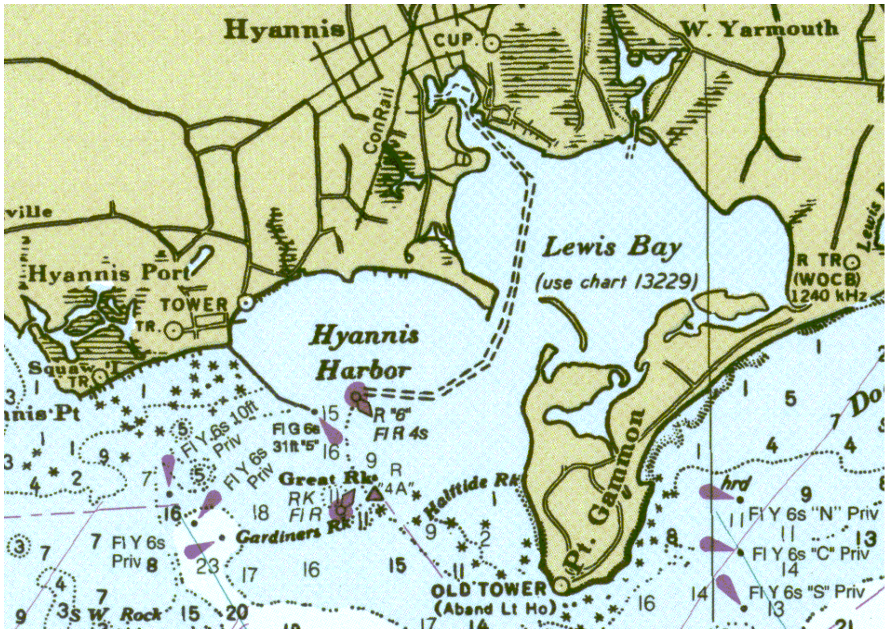


FIGURE 5: HYANNIS HARBOR

2.5.1.2 Hyannis Harbor

HYANNIS HARBOR IN BARNSTABLE IS CAPE COD'S OTHER PRIMARY SEAPORT. IT CONSISTS OF AN OUTER HARBOR, A MIDDLE HARBOR (KNOWN AS LEWIS BAY), AND AN INNER HARBOR (

Figure 5). Dunbar Point, a 1,000-foot stone jetty, and the Kalmus Park Beach separate the Outer Harbor and Lewis Bay. Major boat terminals and piers are located within the Inner Harbor. The Army Corps of Engineers began construction projects in the harbor in 1882. Currently, Hyannis Harbor includes a 12-foot deep anchorage at the eastern end of the Inner Harbor. In Lewis Bay, there is a 15.5-foot deep anchorage of about 55 acres behind a 1,170-foot long breakwater at Dunbar Point. A 6,000-foot long channel, 12 feet deep and 100 feet wide, extends from the Inner Harbor into the deep water in Lewis Bay. From there, a 7,200-foot long channel extends to the Outer Harbor. Hyannis Harbor is used as a terminal for ferry service, freight service, charter, and sport fishing services, as well as for recreational purposes.

2.5.1.3 Provincetown Harbor

Provincetown Harbor was initially constructed during the nineteenth century. In 1914, the Army Corps of Engineers completed improvements to the harbor, including a 6,150-foot dike from Stevens Point across the House Point Island Flats to the sandy spit at Wood End. A stone breakwater, built in 1972, runs parallel to the shore about 835 feet from the end of MacMillan Wharf. The breakwater is 15.5 feet high and 2,500 feet long. Currently, the harbor is used as a terminal for ferries, whale watching tours, and as a base of operations for fishing boats (Figure 4). Local and state officials have discussed and rejected the expansion of the harbor to include a freight pier. According to a

MassDOT report ("Identification of Massachusetts Freight Issues and Priorities," 1999), the narrow streets in Provincetown's historic district and the traffic congestion during peak hours make such a proposal unfeasible.

2.5.1.4 Falmouth Harbor

Falmouth Harbor is located three miles east of Woods Hole, on the waterway between Falmouth Heights Road and Scranton Avenue (Figure 1). The Army Corps of Engineers began construction work in the harbor in 1957. Falmouth Harbor is 17 acres in area and 10 feet deep, with a 100-foot wide entrance channel. It is currently used as a terminal for ferries and charter tours, as well as for fishing and recreation.

2.5.1.5 Saquatucket Harbor (Harwichport)

Saquatucket Harbor in Harwich serves the Lower Cape (Figure 6). The harbor has a 12-foot deep, 200-foot long channel leading to a 12-foot deep anchorage. The Coast Guard maintains a station at this facility. Accessible from Route 28 in Harwichport, the harbor is a terminal for ferry service, tour boats, commercial fishing and recreational use.

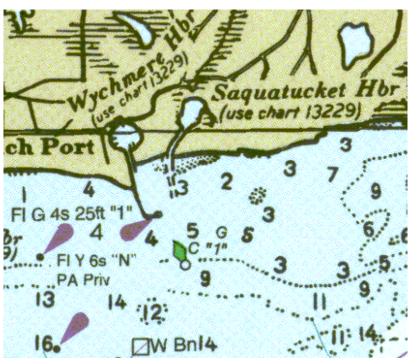


FIGURE 6: SAQUATUCKET HARBOR

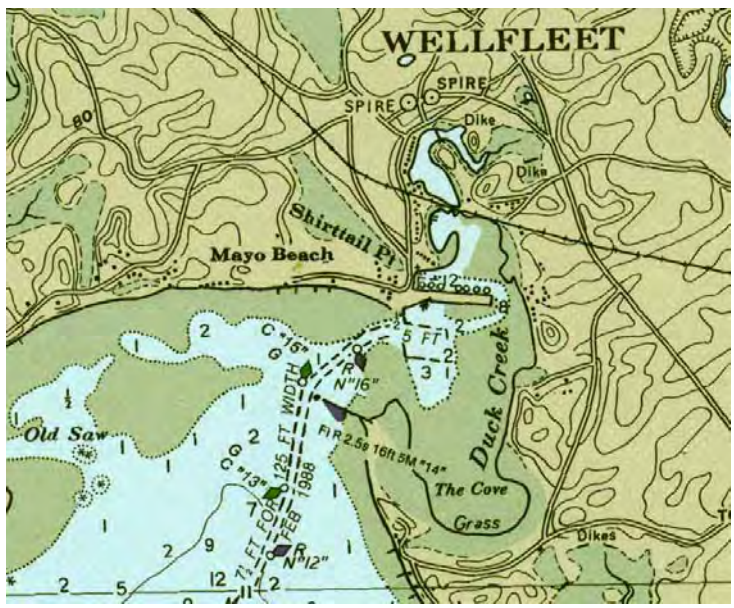


FIGURE 7: WELLFLEET HARBOR

2.5.1.6 Wellfleet Harbor

Wellfleet Harbor is located at the mouth of Duck Creek, just south of Wellfleet Center (Figure 7). Work on the harbor dates back to 1899 when a 4-foot deep channel was constructed between deep water and the town wharves at Duck Creek. The state dredged the channel in 1916 and deepened it by two feet. The Army Corps of Engineers later improved the harbor by creating a 10-foot deep, 125 foot-wide, 0.8-mile long channel from the middle of Wellfleet Harbor to the town landing, as well as a 10-foot deep, 500-foot long, 800-foot wide anchorage area. Currently, Wellfleet Harbor serves recreational boating, boat tours, commercial fishing, and sport fishing charter boats.

2.5.1.7 Stage Harbor (Chatham)

STAGE HARBOR, LOCATED IN CHATHAM, IS ONE OF THE MAJOR SEAPORTS IN THE LOWER CAPE (

Figure 8). The harbor is divided into two parts: the Upper Harbor and Stage Harbor. The Upper Harbor extends from Bridge Street to Morris Island, and Stage Harbor extends from Morris Island to the Harding Beach bars. Original work in Chatham Harbor, including the construction of a channel through the Harding Beach bars, was completed in 1901. In the late-1950s, the Army Corps of Engineers constructed a new 2.1-mile channel from Chatham Roads through Harding Beach and into the Upper Harbor. Other harbor features include a 500-foot long stone jetty at the southwestern corner of the channel, a 2,500-foot long sand dike from Harbor Beach to Morris Island, and an adjacent 1,500-foot long timber jetty that has been partially removed. Additionally, a boathouse facility and dock in the Upper Harbor are maintained by the Chatham Coast Guard Station. Stage Harbor is used as a base for boat tours, recreational boats and a small local fishing fleet.

FIGURE 8: STAGE HARBOR

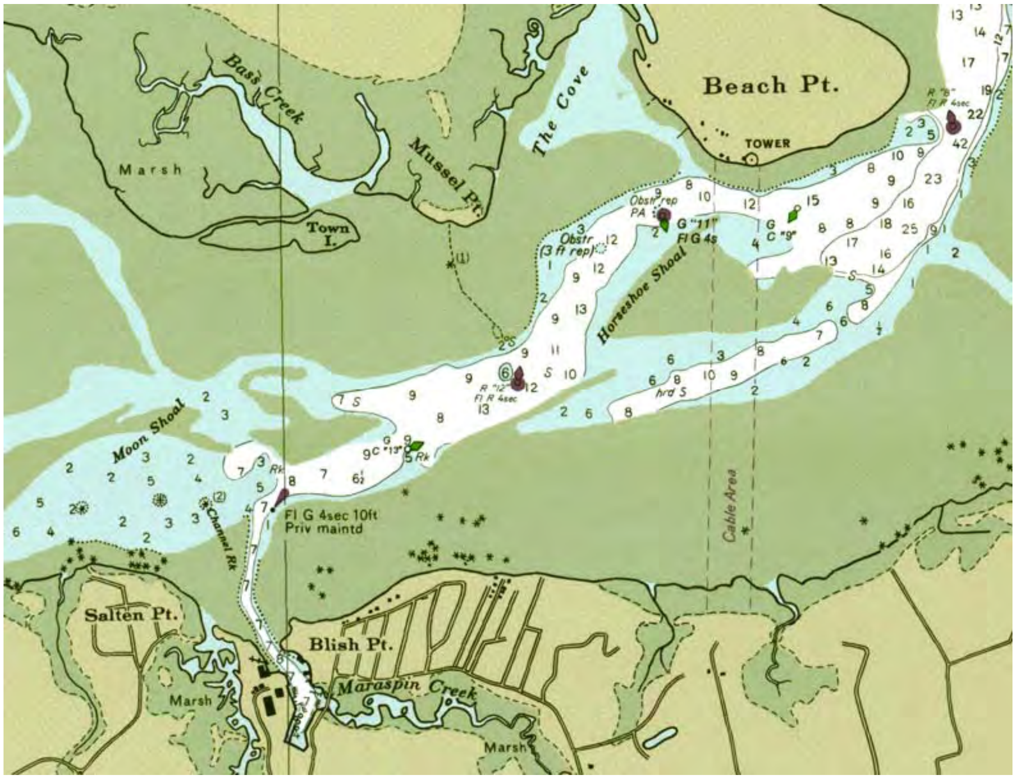


FIGURE 9: BARNSTABLE HARBOR AND MARINA

2.5.1.8 Barnstable Harbor

BARNSTABLE HARBOR LIES BETWEEN SANDY NECK AND THE MAINLAND OF CAPE COD (

Figure 9). The marina and landing in Barnstable Village serves as the primary seaport for Barnstable Harbor. A small channel, 7 feet deep, provides access to the marina from the entrance of the Harbor at Beach Point. Barnstable Harbor is the terminal for recreational and whale watching tours, as well as fishing vessels.

2.5.1.9 Sandwich Marina

Sandwich Marina is located on the eastern end of Cape Cod Canal in Sandwich. The marina has an anchorage of 8 feet, serving as a home to many fishing and recreational vessels (Figure 11). With its proximity to road, rail tracks, and canal access, Sandwich Marina has the potential to be a ferry terminal for service from Boston and Plymouth.

2.5.1.10 Red Brook Harbor

Red Brook Harbor in Bourne is one of Cape Cod's seaports on Buzzards Bay. The harbor is located behind Bassetts Island between Handy and Long Points (Figure 10). The boat docks are separated into two sections. The first, exposed to the harbor, provides an anchorage of 8 feet. The second is 7.5 feet deep and is connected to the harbor by a short channel. Red Brook Harbor serves as a base for fishing and recreational boats.

FIGURE 11: SANDWICH MARINA

FIGURE 12: SESUIT HARBOR, DENNIS

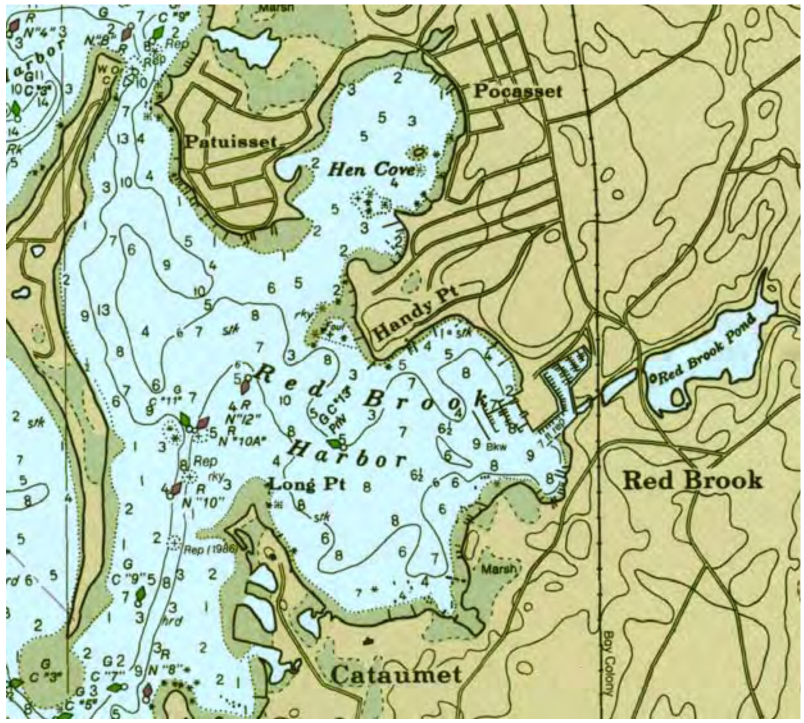


FIGURE 10: RED BROOK HARBOR, BOURNE

2.5.1.11 Sesuit Harbor

Sesuit Harbor is located in the Town of Dennis. It is accessible by Sesuit Neck Road and Harbor Road on the west, and Cold Storage Road and Salt Works Road on the east. The channel entering the harbor is 100 feet wide, narrowing to 80-90 feet, and approaching an anchorage of 6-7 feet (Figure 12). With a yacht club located on the western side of the harbor, and a boat ramp on the eastern side, Sesuit Harbor is used for fishing and recreational use.

2.5.2 CAPE COD CANAL

Cape Cod possesses many channels that permit boat access to local seaports and waterways. Many of these channels are monitored and maintained in order to ensure their continued usability. One of the most important of these channels is the Cape Cod Canal.

The Cape Cod Canal connects Buzzards Bay to Cape Cod Bay through the towns of Bourne and Sandwich. The channel itself stretches 17.4 miles in length, extending from the outer end of the northerly breakwater in Cape Cod Bay to a point in Buzzards Bay near Cleveland Ledge about 5 miles southwest of the Wings Neck Light. It provides a shorter route for vessels traveling along the Atlantic Coast, reducing trip length by 65-150 miles depending on origin and destination. Additionally, the route is a safer path, allowing vessels to avoid the shoals and shipwrecks scattered along the Outer Cape route.

A canal was envisioned as early as 1623 by Myles Standish of the Plymouth Colony. Studies and surveys were produced over the next 250 years recommending the construction of a canal, until a charter was finally granted to the Cape Cod Canal Company in 1880. Unfortunately, work lapsed and so did the charter. Several more charters were granted and more attempts at digging were made over the next 25 years, without success. Although Cape Cod and the region stood to benefit from the canal, none were willing to risk investing in such a venture.

Finally, in 1907, August Belmont purchased the charter to build the canal. Belmont was a New York investment banker who had built the City's first subway. Unlike previous builders, he was able to secure the financial backing necessary to complete the Cape Cod Canal. Work began in June of 1909, and was completed in 1914. The new toll seaway opened with great celebration.

Unfortunately, the original canal had many problems. First, it was relatively small: 100 feet wide and 25 feet deep. These dimensions permitted only one-way travel, resulting in delays for vessels. Additionally, strong tidal currents caused several accidents and lent the canal a poor reputation. Toll revenues fell as a result, making the canal a commercial disaster.

In 1918, the U.S. Government assumed control of the canal after a German U-boat attacked five vessels just three miles off Cape Cod. Control was returned to Belmont's company after World War I in 1920. However, the company was not interested and the waterway was closed. Massachusetts Governor Calvin Coolidge urged Belmont's company to reopen the canal, which it did for three days. After much negotiating, the

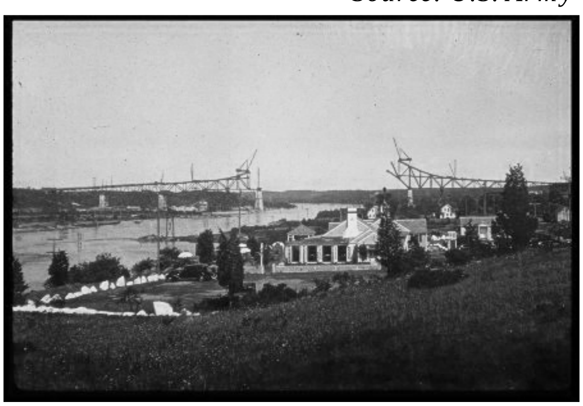
Cape Cod Canal was sold to the federal government for $11.5 million in 1921. However, the government did not acquire the title until March 30, 1928.

FIGURE 13: THE ORIGINAL BOURNE BRIDGE COMPLETED IN 1911

FIGURE 14: FIRST CAPE COD CANAL, 1914-1935

FIGURE 15: THE ORIGINAL RAILROAD BRIDGE OVER THE CAPE COD CANAL, 1914-1935

Source: U.S. Army Corps of Engineers



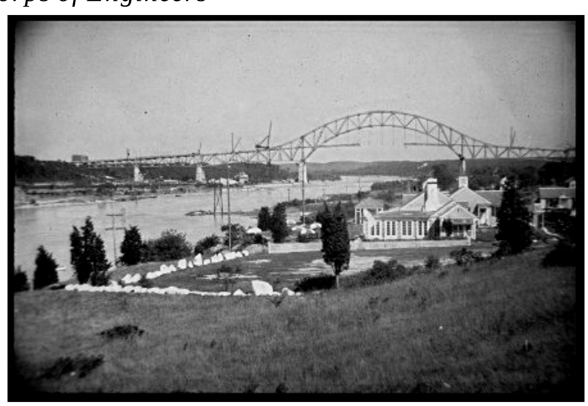


FIGURE 16: CONSTRUCTION OF THE BOURNE BRIDGE

FIGURE 17: CONSTRUCTION OF THE BOURNE BRIDGE

Source: U.S. Army Corps of Engineers

Responsibility for the Cape Cod Canal was passed to the Army Corps of Engineers, who subsequently set out to improve it. The Corps began construction on an expanded canal in 1935 and completed the work by 1940. The existing canal is the result of this work.

The current Cape Cod Canal has a width of 480 feet and a 32-foot deep channel, allowing two-way travel. At that size, the Cape Cod Canal is the world's widest sea-level canal. The old canal drawbridges were replaced in 1935 by the Bourne, Sagamore, and Railroad bridges. The architect Ralph Adams Cram designed the Sagamore and Bourne bridges. Built simultaneously with Work Progress Administration funds, construction provided about 700 jobs. The existing bridges have larger spans of 616 feet each and provide an overhead clearance of 135 feet. A 32-foot deep approach channel was also constructed to facilitate movement of ships from Buzzards Bay into the canal. The channel is 700 feet wide from Cleveland Ledge to Wings Neck and 500 feet from Wings Neck to the canal entrance. Other improvements to the canal include two mooring basins, two basins for small boats, an improved lighting system, a 600-foot and a 3,000-foot stone jetty at the entrance to canal from Cape Cod Bay, and a dike between Hog Island and Rocky Point in Bourne.

The Army Corps of Engineers continues to operate and maintain the Canal and its bridges today. The highway bridges now carry over 34 million vehicles to and from the isthmus of Cape Cod annually. Over six thousand ships, tug and barge combinations and other large commercial vessels pass through the canal annually. In 2009 they carried over 8 million tons of cargo to ports along the east coast including 1.9 billion gallons of petroleum products and 380 million gallons of bio fuels. Marine traffic is monitored and regulated 24 hours a day, 365 days a year. Moreover, Corps patrol boats stand by to assist vessels in distress. As a result, the Cape Cod Canal is a safe shortcut for marine traffic from Cape Cod Bay to Buzzards Bay. Recreational boaters take advantage of this fact as well with over seven thousand small boat canal transits each year.

FIGURE 18: A SMALL BOAT TRAVELS THROUGH THE CAPE COD CANAL

FIGURE 19: CAPE COD CANAL AND RAILROAD BRIDGE IN THE DISTANCE, FACING WEST

2.5.3 OTHER CHANNELS

Other channels serve the water transportation needs of Cape Cod. These waterways connect harbors and major water routes, providing safe travel through otherwise dangerous waters.

2.5.3.1 Woods Hole Channel

The Woods Hole Channel is the most heavily traveled Cape Cod waterway (**Table 2**). It is located between Penzance Point on the mainland and the northernmost of the Elizabeth Islands. The channel connects Buzzards Bay with Great Harbor in Woods Hole.

The Army Corps of Engineers has performed work on the Woods Hole Channel since 1870. Major works include the dredging of the channel and the removal of dangerous shoals and boulders from the main channel. By 1913, the Corps completed the current dimensions of the channel.

The Woods Hole Channel is comprised of a main channel and two branches (

Figure 20). The main channel, referred to as "The Strait," is 2,500 feet long, 13 feet deep and 300 feet wide. It connects an inlet of Buzzards Bay to Woods Hole between Grassy Island and Red Ledge. The larger branch, called "Broadway," separates from the Strait at Middle Ledge and travels south of Red Ledge to Vineyard Sound. Broadway is 1,300 feet long, 13 feet deep and 300 feet wide. The final branch simply provides a route into Buzzards Bay that is aimed towards the north. The smaller branch is also 13 feet deep and 300 feet wide.

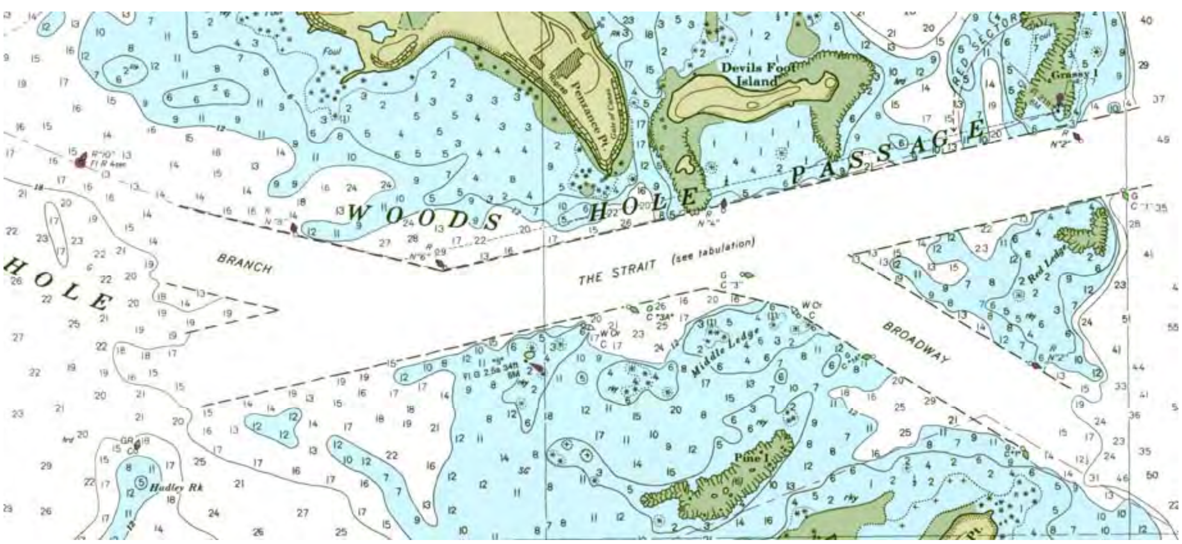


FIGURE 20: WOODS HOLE CHANNEL

Woods Hole Channel connects ports and ferry terminals in Woods Hole Harbor to seaports in Buzzards Bay and Vineyard Sound. Vessels traveling to Boston and points north can also use the Channel on their way to the Cape Cod Canal. As a result, the channel is heavily traveled.

2.5.3.2 Channels of Nantucket Sound

Nantucket Sound also contains several channels that serve Cape Cod's water traffic. The Cross Rip Shoals mark the point, about 14 miles south of Hyannis Harbor, where several of these channels meet. From this point, vessels can travel to Buzzards Bay, Martha's Vineyard, Nantucket, Cape Cod, and the Atlantic Ocean. The channel at the Cross Rip Shoals was created by the Army Corps of Engineers and is 30 feet deep, 4,000 feet wide, and 1.7 miles long (Table 1). The Pollack Rip Shoals are located about three miles to the east of Monomoy Island. The Army Corps of Engineers constructed a channel extending six miles through the Pollack Rip Shoals in 1925. The Pollack Rip Channel is 30 feet deep and 2,000 feet wide. It serves as the entrance to Nantucket Sound from the Atlantic Ocean. Taken together, the Wood Hole Channel, Cross Rip Channel, the Pollack Rip Channel, and the Main Channel create a thoroughfare for water traffic within Nantucket Sound (Figure 21).

TABLE 1: ESTIMATED DISTANCES THROUGH NANTUCKET SOUND CHANNELS

Woods Hole Channel to Martha's Vineyard Branch	7 miles
Martha's Vineyard Branch to Cross Rip Channel	13.5 miles
Cross Rip Channel	1.7 miles
Cross Rip Channel to Pollack Rip Channel	15 miles
Pollack Rip Channel	6 miles
Cross Rip Channel to Nantucket Harbor	12 miles

TABLE 2: TRIPS OF VESSELS FOR CAPE COD PORTS AND CHANNELS FOR 2004 AND 2008; NEW BEDFORD ALSO SHOWN FOR INFORMATION

Facility	**2004 Total Up/ Inbound**	**2004 Total Down/ Outbound**	**2004 Total**	**2008 Total Up/ Inbound**	**2008 Total Down/ Outbound**	**2008 Total**
Cape Cod Canal	1,207	1,205	**2,412**	1,509	1,429	**2,938**
Cross Rip Shoals	945	945	**1,890**	939	951	**1,890**
Falmouth Harbor	3,011	3,011	**6,022**	715	715	**1,430**
Hyannis Harbor	5,846	5,858	**11,704**	7,883	7,105	**14,988**
Provincetown	0	0	**0**	1	1	**2**
Woods Hole Channel	8,398	8,393	**16,791**	9,683	9,716	**19,399**
Total	**19,407**	**19,412**	**38,819**	**20,730**	**19,917**	**40,647**
New Bedford	1,549	1,560	**3,109**	1,183	1,149	**2,332**

Source: 2008 Waterborne Commerce of the United States, Part 1 Atlantic Coast

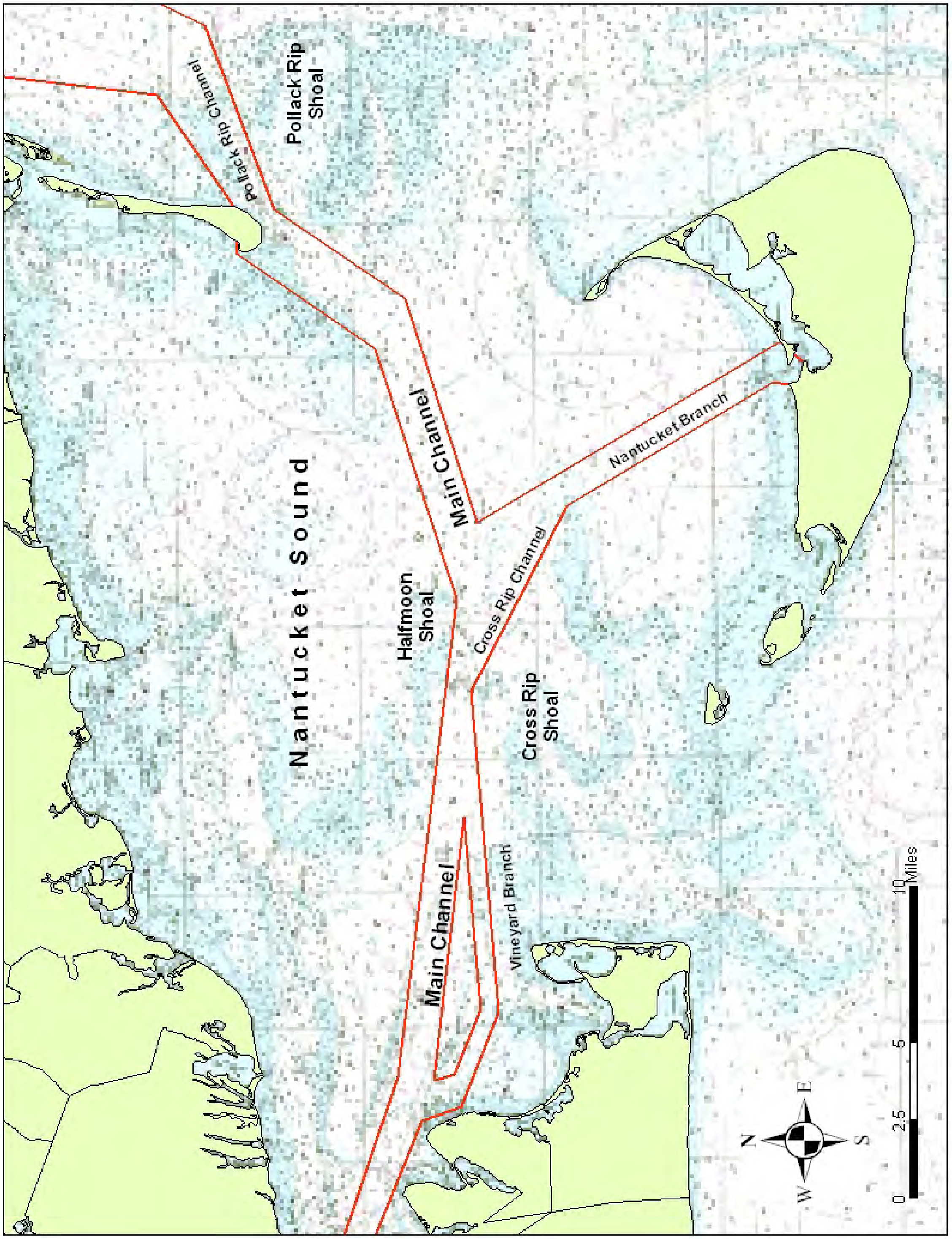


FIGURE 21: NANTUCKET SOUND CHANNELS

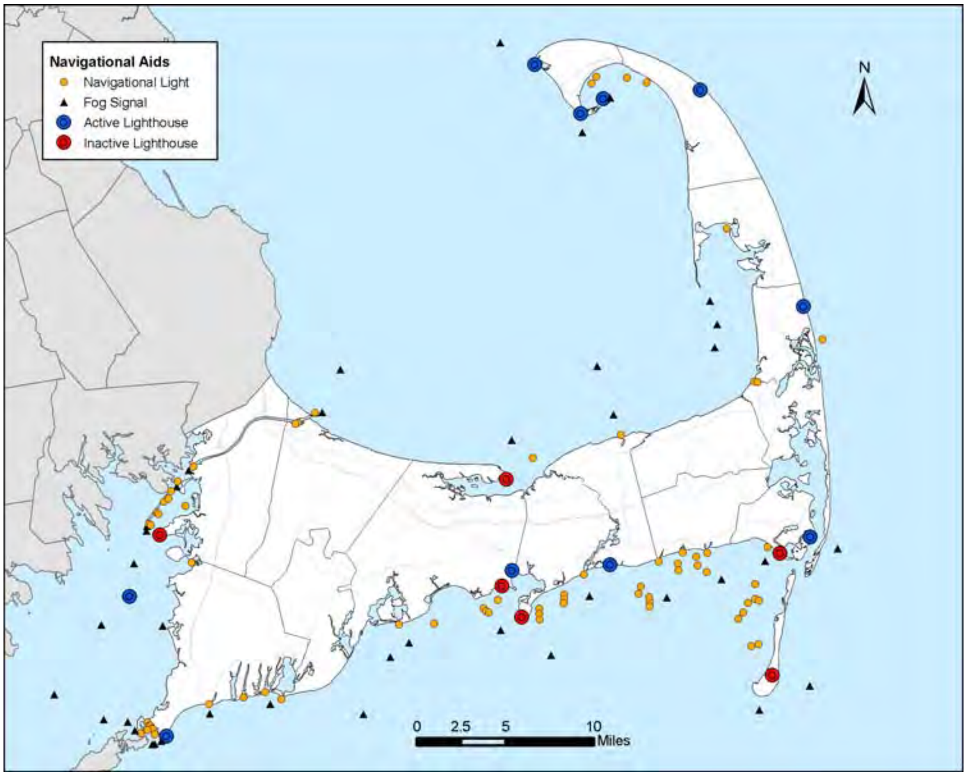


FIGURE 22: NAVIGATIONAL AIDS WITHIN THREE MILES OF CAPE COD

A lighthouse is a structure, such as a tower, that gives a continuous or intermittent light signal to navigators. Cape Cod is famous for its many lighthouses and their unique towers. However, in addition to being aesthetically pleasing, these lights serve a vital purpose. Along with other navigational lights and aids, they form the infrastructure that keeps water traffic on course and out of danger. There are ten active lighthouses on Cape Cod (Table 3). Most are located in the Outer Cape region. Additionally, there are six inactive lighthouse structures still in their original locations. Navigational lights and fog signals (bells, whistles, gongs, and horns) are generally located along the perimeter of channels and at dangerous areas. Due to its shoals and other hazards, the majority of Cape Cod's navigational aids are located in Nantucket Sound (

Table 4). Cape Cod has 43 fog signals and 72 navigational lights in total.

TABLE 3: ACTIVE CAPE COD LIGHTHOUSES

Lighthouse Name	Town
Nobska Light	Falmouth
Cleveland Ledge Light	In Buzzards Bay
Lewis Bay Light	Barnstable
West Dennis Light	Dennis
Chatham Lighthouse	Chatham
Nauset Light	Eastham
Highland Light	Truro
Race Point Light	Provincetown
Wood End Light	Provincetown
Long Point Light	Provincetown

TABLE 4: NAVIGATIONAL LIGHTS AND FOG SIGNALS BY LOCATION

	Navigational Lights	Fog Signals
Atlantic Ocean	1	4
Buzzards Bay	13	13
Cape Cod Bay	12	11
Nantucket Sound	46	15
Total	72	43

2.5.5 WATER FREIGHT SERVICE

Goods are transported by water via ferries, barges, and tankers. The busiest Cape Cod water facility in terms of freight transportation is the Cape Cod Canal. Although more vessels may pass through the Woods Hole Channel per year, more tons of freight pass through the Cape Cod Canal (**Table 5**). Petroleum and petroleum products constitute the majority of freight traveling through the Canal. Other products include coal, chemicals, crude materials (i.e. wood, gravel, ore), food and manufactured goods, and equipment. In total, roughly 8.5 million tons were transported through the Cape Cod Canal in 2003. This figure is higher than the previous year, but lower than that of ten years previous (

Table 6). By way of comparison, the Port of Boston handled 24.8 million tons of freight in 2003 and Providence Harbor handled 9.2 million tons according to the U.S. Army Corps of Engineers. Understandably, the Cape Cod Canal is listed as one of the major waterways of New England by the Corps of Engineers.

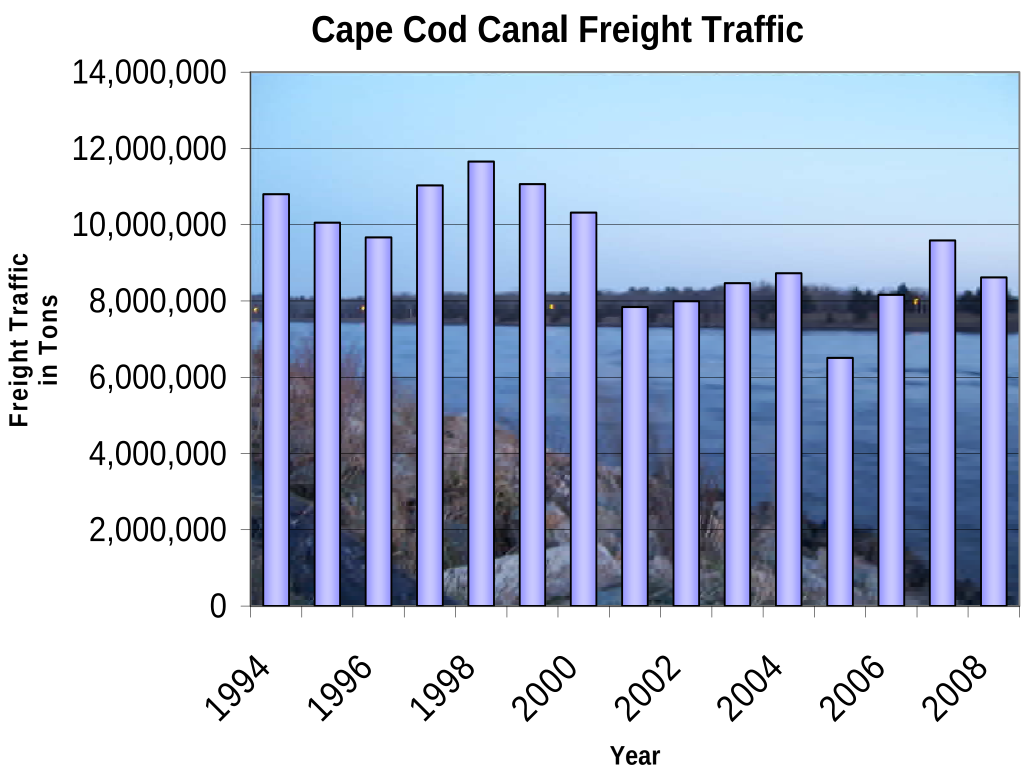
Falmouth Harbor is the only Cape Cod Harbor for which freight traffic is reported. In 2003, one thousand tons of manufactured equipment and machinery were processed by the port facility. This means that Falmouth Harbor is the Cape Cod seaport handling the most of a single category of freight. However, the data on freight movement is rounded to the nearest thousand tons. With hundreds of different categories, it is possible that a port can process thousands of tons of freight that go unreported. Therefore, although Falmouth Harbor is listed as the Cape Cod seaport handling the most freight, there may be other facilities that have higher total amounts of freight.

TABLE 5: FREIGHT TRAFFIC THROUGH CAPE COD PORTS AND CHANNELS ROUNDED TO THE NEAREST THOUSAND TONS, 2003

Note: Figures are only those reported.	Coal	Petroleum and Petroleum Products	Chemicals and Related Products	Crude Materials, Inedible Except Fuels	Primary Manufactured Goods	Food and Farm Products	All Manufactured Equipment, Machinery and Products	**Total**	Ton-Miles
Cape Cod Canal	57	6,570	120	601	733	31	353	**8,464**	146,706
Cross Rip Shoals	-	25	-	18	-	-	2	**45**	45
Falmouth Harbor	-	-	-	-	-	-	1	**1**	1
Woods Hole Channel	-	31	-	77	-	-	5	**114**	113

Source: U.S. Army Corps of Engineers

TABLE 6: COMPARATIVE STATEMENT OF TRAFFIC THROUGH CAPE COD PORTS AND CHANNEL IN TONS, 1994-2008



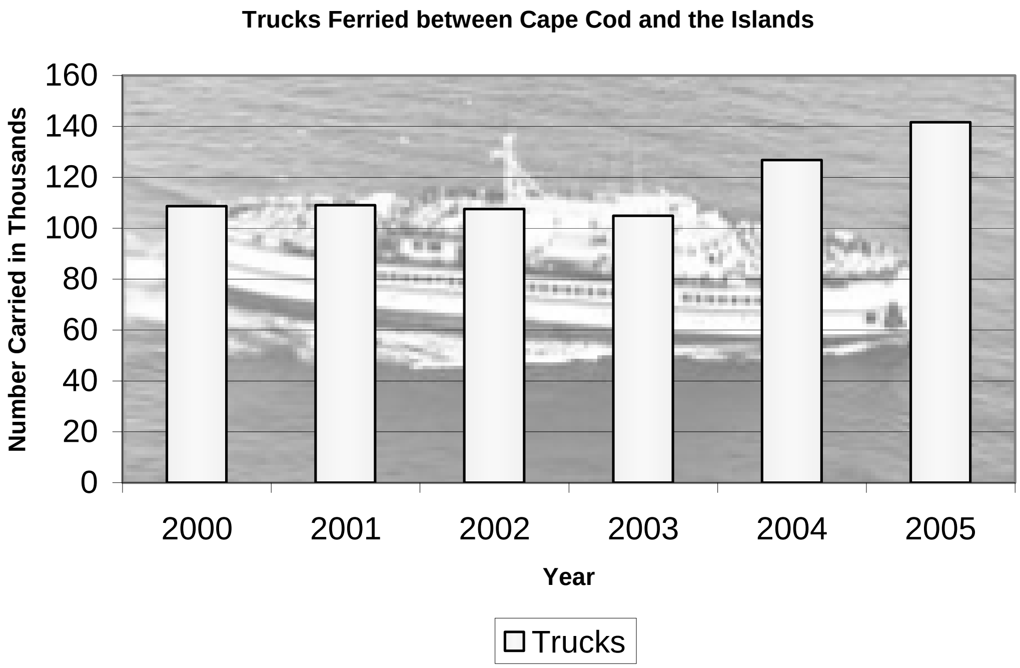


FIGURE 23: COMBINED VEHICULAR TRAFFIC BETWEEN CAPE COD AND THE ISLANDS, 2000-05

TABLE 7: TRUCKS CARRIED BY STEAMSHIP AUTHORITY VESSELS

	Woods Hole to Martha's Vineyard and Return	Hyannis to Nantucket and Return	Combined
2009	95,062	38,113	133,175
2008	98,393	44,537	142,930
2007	98,257	48,187	146,444
2006	103,939	49,547	153,486
2005	97,595	44,025	141,620
2004	87,166	39,657	126,823
2003	70,546	34,329	104,875
2002	72,451	35,046	107,497
2001	73,271	35,782	109,053
2000	72,542	36,118	108,660

Source: Steamship Authority

The Steamship Authority also records movements of trucks between Cape Cod and the Islands. Generally, these trucks are transporting goods from the mainland to the Islands. In 2009, truck movements increased to over 140,000 vehicles. The total number of trucks carried includes pick-up trucks, vans, and other commercial vehicles under 20’ in overall length. In 2004, the Steamship Authority started classifying certain vehicles under 20’ as trucks rather than automobiles. Some pick-up trucks and vans that were previously classified as automobiles are now being classified more consistently as trucks based on the make and model of the vehicle. SUVs, however, are still classified and counted as automobiles. This resulted in more trucks and fewer automobiles being carried starting in 2004. Also, the number of trucks in this category of under 20’ represented 53% of the total trucks carried on the Woods Hole – Martha’s Vineyard route and 36% of the total trucks carried on the Hyannis – Nantucket route during 2005. The numbers of trucks, automobiles, or passengers are reported as one-way segments or movements. A truck carried round trip is reported as two trucks carried. Roughly two-thirds of these shipments are made between Woods Hole and Martha’s Vineyard. The remainder is made between Hyannis and Nantucket. This makes Hyannis Harbor and Woods Hole important freight handling facilities.

2.5.6 FERRY SERVICE

Ferry service links passengers from Cape Cod to the Islands, Boston, and Plymouth. A survey of Provincetown ferry passengers revealed that most people (92%) ride to reach recreational facilities. Passengers choose to ride the ferry, as opposed to other modes because it is more convenient, less hassle than driving, recommended by friends, and their own personal preference. According to a 1999 Marine Transportation Study by the Cape Cod Commission, people are unlikely to take the ferry because it is inconvenient, not going where they want, or because they prefer to drive.

The typical ferry rider varies by boat. For example, people riding the ferry from Boston to Provincetown are generally young, male, and single. They typically take the ferry to reach Cape Cod for a short vacation. People riding on the Plymouth to Provincetown ferry are more likely to be women traveling in large groups. Accommodating passengers of different types is important to maintaining ridership and attracting new ridership as well.

The most effective message to promote ferry use is that a ferry can travel from Provincetown to Boston in less time and avoid road traffic. 63% of the public is likely to respond to this sort of message. In advertising existing and potential services, the message of “less time, no traffic” is important to remember. Additionally, passengers are interested in package deals, including hotels, buses, and recreational facilities. Advertising ferry services in this manner will be more successful.

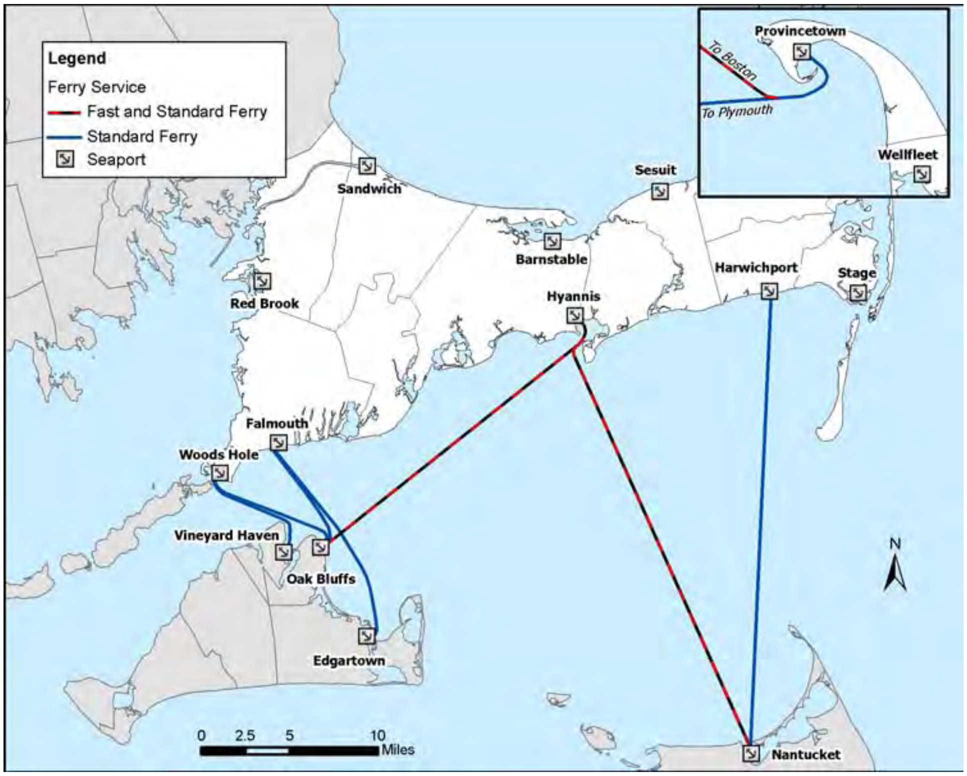


FIGURE 24: CAPE COD FERRY SERVICE

2.5.6.1 Massachusetts Steamship Authority

The largest provider of ferry service between Cape Cod and the Islands is the Woods Hole, Martha's Vineyard, and Nantucket Steamship Authority (Steamship Authority). It is also the only ferry service that carries both passengers and vehicles. The Massachusetts legislature created the Steamship Authority as the "Lifeline to the Islands," empowering it to acquire, maintain and operate ferry service from Hyannis and Woods Hole to the Islands. The enabling legislation also gives the Steamship Authority the power to license and regulate vessels carrying freight or more than forty passengers, except for those "grandfathered" services operating prior to May 1973. With an annual operating budget of about $65 million, the Steamship Authority has operated within budget since 1963. A five-member board governs the Steamship Authority, consisting of representatives of Nantucket County, Dukes County, Falmouth, Barnstable, and New Bedford. Additionally, a seven-member Port Council acts as an advisory board and consists of representatives from each of the towns served by the Steamship Authority.

TABLE 8: STEAMSHIP AUTHORITY FLEET

Vessel Name	Year Built	Year Acq.	Length x Beam	Passenger Capacity	Speed (knots)	Service Type
Flying Cloud	2000	2000	135’ x 35’	300	34	High-Speed
Martha’s Vineyard	1993	1974	230’ x 60’	1,376	14	Standard
Eagle	1987	1987	235’ x 60’	799	14	Standard
Nantucket	1974	1974	230’ x 60’	784	14	Standard
Islander	1950	1950	201’x 58’	771	11.5	Standard
Governor	1954	1998	242’ x 65’	250	12	Back-up
Katama	1981	1988	235’ x 52’	143	13.5	Standard
Gay Head	1981	1981	235’ x 52’	139	13.5	Standard
Sankaty	1981	1994	235’ x 52’	290	13	Standard

Source: Steamship Authority

The Steamship Authority operates a fleet of nine vessels, including a high-speed passenger-only ferry (Table 8). Using this fleet, it provides service from Hyannis to Nantucket, and from Woods Hole to Vineyard Haven and Oak Bluffs, as well as inter-island and off-Cape service. It has a record of nearly 100% on-time performance, with interruptions to service caused generally by weather. One-way tickets for passengers are $6.50 for the Martha’s Vineyard ferry, $14.00 for the Nantucket ferry, and $29.50 for the Fast-Ferry to Nantucket. One-way tickets for vehicles vary in price by season and by vehicle size, but generally range between $100 and $200.

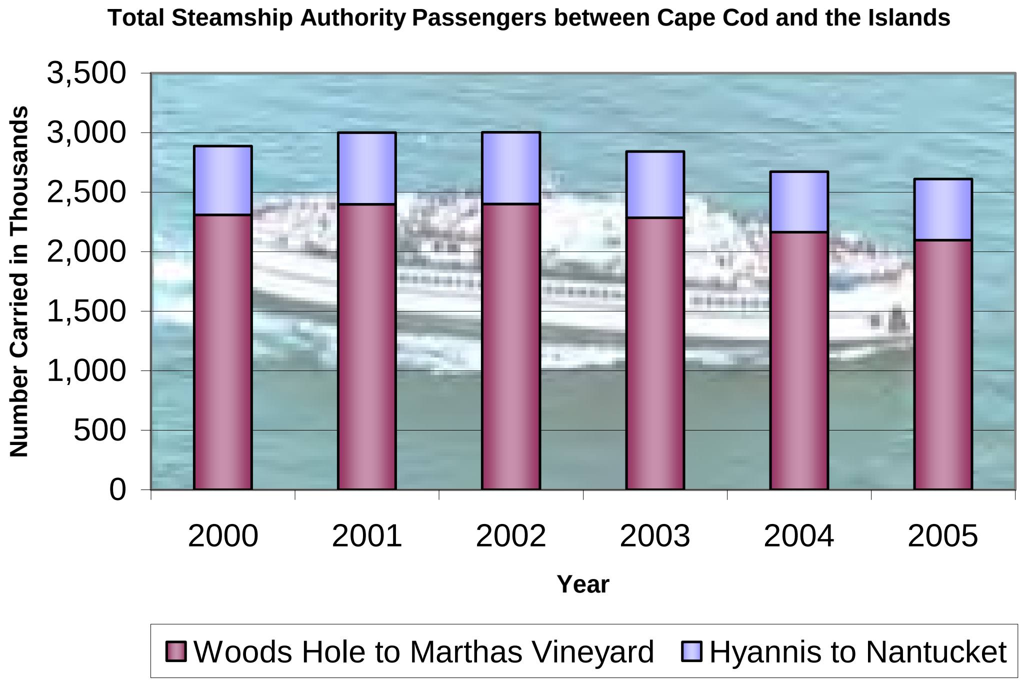


FIGURE 25: STEAMSHIP AUTHORITY PASSENGERS, 2000-2005
Source: Steamship Authority

TABLE 9: PASSENGERS CARRIED BY THE STEAMSHIP AUTHORITY

	Woods Hole to Martha's Vineyard and Return	Hyannis to Nantucket and Return	Combined
2009	2,179,567	513,611	2,693,178
2008	2,174,185	517,846	2,692,031
2007	2,143,160	549,206	2,692,366
2006	2,105,128	515,437	2,620,565
2005	2,098,037	511,798	2,609,835
2004	2,164,169	508,990	2,673,159
2003	2,283,627	558,690	2,842,317
2002	2,401,286	600,513	3,001,799
2001	2,396,759	604,025	3,000,784
2000	2,309,181	578,560	2,887,741

Source: Steamship Authority

TABLE 10: AUTOMOBILES CARRIED BY THE STEAMSHIP AUTHORITY

	Woods Hole to Martha's Vineyard and Return	Hyannis to Nantucket and Return	Combined
2009	389,242	67,236	456,478
2008	383,188	68,632	451,820
2007	381,930	70,827	452,757
2006	379,927	69,975	449,902
2005	385,305	70,352	455,657
2004	391,260	70,635	461,895
2003	412,823	81,163	493,986
2002	416,024	82,769	498,793
2001	417,453	81,771	499,224
2000	409,516	82,894	492,410

Source: Steamship Authority

Year-round parking lots in Hyannis and Woods Hole, as well as seasonal parking lots in Falmouth, Bourne, and Hyannis serve passengers coming from the mainland. The Steamship Authority charges a parking fee and runs shuttles between the lots and the ferries. Some lots also serve as a stop for local and interregional bus service. The Cataumet lot is located on Route 28A in Bourne and has 900 parking spaces. The Palmer Avenue Lot, located off Route 28 in Falmouth has 1,400 parking spaces. The High School Lot, on Gifford Street Extension off Brick Kiln Road in Falmouth, has 300 parking spaces. The Gifford Street Lot, just off Brick Kiln Road in Falmouth, has 350 parking spaces. Lastly, the Sun Lot, on Gifford Street just off Brick Kiln Road in Falmouth, has 600 parking spaces.

In addition to its vessels and parking facilities, the Steamship Authority owns and operates multiple other facilities. This includes terminals in Hyannis, Woods Hole, and on the Islands, a vessel maintenance facility in Fairhaven, and a receiving warehouse in Falmouth. The Steamship Authority operates out of offices in Woods Hole and rents space for reservation offices in Edgartown and Mashpee. During the peak season, the Steamship authority employs 750 people, most of which are unionized.

2.5.6.2 Hy-Line Cruises

Hy-Line Cruises, owned by Hyannis Harbor Tours, Inc., is another major provider of ferry service for Cape Cod and the Islands (Table 11). Richard and Robert Scudder founded Hyannis Harbor Tours in 1962 as a marine sightseeing business, adding deep sea fishing operations in 1966. A parcel of land owned by the Scudder family on the Hyannis Inner Harbor became the docking and parking facility. Ferry service began in 1971 with a newly constructed 400-passenger island ferry operating between Hyannis and Oak Bluffs. A year later Hyannis Harbor Tours purchased the Nantucket Boat Line, who had decided to sell their operations rather than compete with the new Steamship Authority Service out of Hyannis. Hyannis Harbor Tours received three vessels, their docking facility, and the trade name of Hy-Line. Under this new management, Hy-Line Cruises added touring vessels and high-speed catamarans and worked with motor coach companies to package local itineraries for tourists. Today, Hyannis Harbor Tours is still owned and operated by the Scudder family, and employs 90 full-time and 300 seasonal employees.

Hy-Line Cruises serves Nantucket and Oak Bluffs out of their facilities in Hyannis. Hy-Line offers both standard and high-speed passenger service between the mainland and the Island, as well as a first class passenger service to Nantucket. One-way ticket prices range from $15 to $36 depending on the destination and the speed of the ferry.

2.5.6.3 Other Ferry Service Providers

Many other companies provide ferry service between Cape Cod and the Islands. Bay State Cruise Company provides fast ferry service from Provincetown to Boston with a fleet of three high-speed catamarans. Boston Harbor Cruises also provides service between Provincetown and Boston aboard the *Salacia*, a 600 passenger high-speed catamaran. Both Bay State Cruise Company and Boston Harbor Cruises provide only seasonal service. A third company, Captain John Boats, provides seasonal high-speed service from Provincetown to the State Pier in Plymouth. From Falmouth Harbor, the Island Queen and Falmouth-Edgartown Ferry provide seasonal passenger service to Martha's Vineyard. Lastly, Freedom Cruise Line sails seasonally from Saquatucket Harbor in Harwich. Their high-speed ferry operates between Nantucket Harbor and their port facility on Route 28.

TABLE 11: WEEKDAY SUMMER FERRY SERVICE (INCLUDES RETURN TRIP)

Origin	Destination	Bay State Cruise Co.	Boston Harbor Cruises	Captain John Boats	Falmouth-Edgartown Ferry	Freedom Cruise Line	Hy-Line Cruises	Island Queen	Steamship Authority	**Total**
Hyannis	Nantucket (HS)	-	-	-	-	-	6	-	5	**11**
	Nantucket (1st)	-	-	-	-	-	3	-	-	**3**
	Nantucket	-	-	-	-	-	3	-	6	**9**
	Oak Bluffs, MV (HS)	-	-	-	-	-	5	-	-	**5**
	Oak Bluffs, MV	-	-	-	-	-	1	-	-	**1**
Woods Hole	Vineyard Haven, MV	-	-	-	-	-	-	-	9	**9**
	Oak Bluffs, MV	-	-	-	-	-	-	-	5	**5**
Falmouth Harbor	Oak Bluffs, MV	-	-	-	-	-	-	7	-	**7**
	Edgartown, MV	-	-	-	5	-	-	-	-	**5**
Provincetown	Boston		1							**1**
	Boston (HS)	3	1	-	-	-	-	-	-	**4**
	Plymouth (HS)	-	-	1	-	-	-	-		**1**
Harwich	Nantucket	-	-	-	-	3	-	-	-	**3**
	Total	**3**	**2**	**1**	**5**	**3**	**18**	**7**	**25**	**64**

HS – High Speed Ferry; 1st – First Class Ferry

Some routes are currently un-served by ferry service. 39% of Cape Cod residents are interested in a ferry service to Logan Airport. 63% of Upper and Mid-Cape residents are somewhat interested in such a service from Hyannis, while 63% of Outer Cape residents are likely to use such a service from Provincetown. Barnstable, Woods Hole and Sandwich remain attractive options for people as well according to a 1999 Marine Transportation study by the Cape Cod Commission. Addressing these gaps in service may be a way to reduce automobile congestion and encourage alternative transportation.

2.5.7 FERRY SERVICE ACCESSIBILITY AND MOBILITY

Since ferry service is one of the primary connections to the Islands, it is extremely important to ensure that seaports are accessible to users. Moreover, if that accessibility is via public transportation, Cape Cod stands to reduce automobile traffic by thousands of trips per year. Travelers can also be encouraged to use ferry service to reach destinations accessible by automobile if there are convenient connections on both ends. For example, ferry users have reported an interest in a ferry connection between Hyannis and Boston because it is more convenient than driving to the ferry in Provincetown. Yet, ferry users said they were discouraged from taking the ferry to Boston because of how difficult it is to get from the Boston Pier to public transportation according to a 1999 Marine Transportation study by the Cape Cod Commission. This attitude may have changed since the Massachusetts Bay Transit Authority (MBTA) introduced the Silver Line rapid transit service. Addressing these concerns could lead to greater use of ferry service and less automobile use on Cape Cod's roads.

2.5.7.1 Road Accessibility and Parking

All ferry ports are accessible by major roads, which means that ferry terminals must accommodate traffic and parking needs. Although thousands of cars travel between the mainland and Islands each year, most users park their cars before using the ferry. The Steamship Authority operates four parking lots at their Hyannis facility and five lots at their Woods Hole facility. Parking fees are up to $12 during the peak season and $8 during the off-season. The Steamship Authority provides shuttle bus service between their parking lots and the terminals. Additionally, the shuttle buses have bicycle racks capable of accommodating two bicycles. The availability of parking space at these lots is posted online and reported on 1610AM. Other ferry service providers maintain their own parking lots at their respective terminals. Parking fees, if any, vary by season and by the amount of time parked. Given the current parking price structure, 39% of the public says they are more likely to ride the ferry, while only 18% say they are less likely to ride according to a 1999 Marine Transportation study by the Cape Cod Commission. Thus, the existing parking price structure acts as an incentive, making ferry service affordable and accessible to the public. Public automobile transportation is also generally available. Ferry users can arrange pick up by taxi service and rental car service on request.

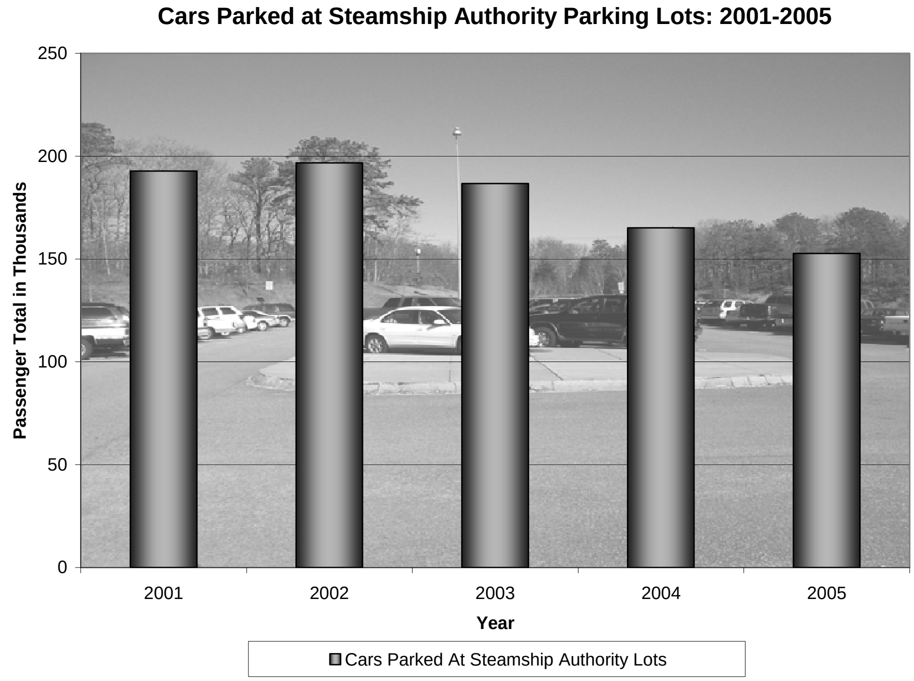


FIGURE 26: FERRY PARKING DEMAND
Source: Steamship Authority

2.5.7.2 Local Bus Accessibility

Four of the five Cape Cod ferry ports are accessible via local bus. The SeaLine of the Cape Cod Regional Transit Authority (RTA) makes its final stop at the Woods Hole docks several times daily. The SeaLine connects ferry passengers in Woods Hole to downtown Falmouth and Hyannis. In Provincetown, the RTA's Flex service makes regular stops at MacMillan Wharf providing connections throughout the Lower/Outer Cape. Lastly, the RTA's Hyannis-Orleans (H2O) service passes Saquatucket Harbor on its way from Hyannis to Orleans and back. The only harbor not directly accessible by local bus service is Falmouth Harbor. Although the SeaLine passes within several blocks, there is no direct access. Variable route bus service, the B-Bus (soon to be renamed as "DART"), can be arranged in advance to any ferry port.

2.5.7.3 Local Bus Coordination

Despite the local bus connections, there is little coordination. Examining local bus and ferry departure schedules reveals that ferry users must arrive at least 30 minutes early if they want to catch their boat. Many bus stop times are either too early or do not leave enough time for passengers to transfer to the ferry. The best location to transfer between ferry and bus service is MacMillan Wharf in Provincetown, where the regularity of local bus service provides a convenient connection. The worst coordinated transfer location is Harwichport. Clearly, increasing coordination between bus and ferry schedules will provide greater access to travelers.

2.5.7.4 Interregional Bus Accessibility

Interregional bus service takes passengers to Woods Hole, Provincetown, Falmouth, and Hyannis. However, connections from the Falmouth and Hyannis bus depots must be made by local bus, taxi, automobile, bicycle, or walking. For example, Hyannis ferry users must walk or take the Red Line two blocks from the Hyannis Transportation Center. Ferry users stopping at the Falmouth Bus Depot must take a taxi or take the Blue Line roughly one mile to Falmouth Harbor. Only the Woods Hole and Provincetown stops are at the ferry terminals. These connections allow users from elsewhere on Cape Cod and beyond to access ferry service. Addressing the missing connections, or lack of coordination, between interregional bus service and ferry service will improve accessibility.

2.5.7.5 Air Transportation Coordination

Passenger service to Martha's Vineyard and Nantucket is by air and by ferry. During adverse weather conditions, such as fog or wind, only one mode may be available. Moreover, last minute scheduling changes may force travelers to take a different mode than they originally planned. Tickets, good for a round trip on either water or air transportation, would allow people to adapt their plans to changing weather and schedules. Surcharges or credits could help to deal with the difference in price between the two tickets. In addition to a flexible ticket system, a regular, convenient, and coordinated shuttle system between airports and seaports would allow people to use parking and transit facilities at both terminals. Currently no such system exists. Flexibility to use air and water transportation modes interchangeably would therefore increase travelers' mobility.

2.5.7.6 Ferry Service Mobility

Mobility is limited by ferry service destinations. The primary destinations for Cape Cod ferries are Martha's Vineyard and Nantucket. Multiple access points and schedules provide great mobility for users traveling to and between the Islands. However, mobility beyond and within the Cape is limited. Besides service to and from the Islands, the only other Cape service is three ferries from Provincetown to Boston and one from Provincetown to Plymouth. No ferry service exists between Cape Cod ports or over the Cape Cod Canal. An increase in such connections would increase mobility by providing alternative routes, such as from Barnstable to Provincetown.

2.5.7.7 Accessibility to Passengers

The disabled and elderly are not wholly accommodated by ferry service. All ferry terminals include shelters, benches, and handicapped parking. Some ferries are handicapped accessible, but not all. Ferry staff can offer assistance to those having difficulty boarding or disembarking. In addition, large print and Braille signage are necessary at terminals and on ferries. Further study of disabled and elderly accessibility to ferry services may be necessary.

2.5.8 CONCLUSION

Cape Cod has several seaports and channels that provide a network for water transportation. Many of these are the result of Army Corps of Engineers projects. Navigational aids such as lighthouses and fog signals mark the edges of safe channels and the location of dangerous waters. Woods Hole Harbor and the Woods Hole Channel are the busiest passenger facilities. Water transportation is primarily offered from Cape Cod to the Islands, but also Boston and Plymouth. In 2005, the Steamship Authority was Cape Cod's largest ferry service provider with over 2.6 million passengers. In terms of freight service, the Cape Cod Canal handles almost all freight traffic, much of which is petroleum and petroleum products. Ferry service is accessible by many modes, with great mobility between the mainland and the Islands. However, coordination with bus schedules, coordination with air service, better connections, and more routes would increase accessibility and mobility.

2.6 AIR TRANSPORTATION

Air transportation on Cape Cod is provided primarily by airplane out of six airports. Other air transportation modes, such as helicopter and glider, serve either non-civilian or recreational purposes. Public air transportation consists mostly of shuttle service by small aircraft from Hyannis and Provincetown airports. For Cape Cod travelers, air service provides an important link from Cape Cod to the Islands, Boston, and the world beyond.

2.6.1 CAPE COD AIRPORTS

Six airfields and airports serve Cape Cod as a base for air transportation (Table 1). An airfield is an area of land from which aircraft operate. An airport is specifically defined as an airfield with paved runways and maintenance facilities that often serves as a terminal. However, many people use the term airport to refer to any airfield. An airpark is a small airport that is usually near an industrial area.

TABLE 1: AIRPORTS AND AIRFIELDS OF CAPE COD

Name	FAA Identifier	Facility Type	Aircraft Based at the Field
Barnstable Municipal Airport	HYA	Scheduled Air Carrier Service	Single Engine: 56 Multi Engine: 15 Jet Engine: 1
Provincetown Municipal Airport	PVC	Scheduled Air Carrier Service	Single Engine: 5 Multi Engine: 1
Chatham Municipal Airport	CQX	General Aviation	Single Engine: 34 Multi Engine: 5
Falmouth Airpark	5B6	General Aviation	Single Engine: 40 Multi Engine: 3
Cape Cod Airfield	2B1	General Aviation	Single Engine: 10 Multi Engine: 1 Ultralights: 1
Otis Air Force Base	FMH	Military	-

Source: AirNav, LLC.

2.6.1.1 Barnstable Municipal Airport

The primary airport on Cape Cod is Barnstable Municipal Airport, Boardman-Polando Field located in Hyannis. It is one of only two airports on Cape Cod to provide scheduled air carrier service. According to the Town of Barnstable's website, the history of the airport goes back to 1928, when Charles Ayling and his son Robertson formed the Hyannis Airport Corporation. Amelia Earhart served as an early stockholder and the first director of the company. The corporation cleared 57 acres at Tip Top Farm in the village of Hyannis for the construction of a single turf runway, the fourth in Massachusetts. The first landing at the Hyannis Airport occurred on June 17, 1928 and was made by Alton Shermon in a Waco 9. Soon, service out of the airport grew, with daily scheduled flights between Boston, Hyannis, and the Islands. During World War II, the Works Progress Administration funded the construction of three paved 4,000-foot runways, while the Army and then the Navy assumed control of the airport. In November 1943, Former President George H.W. Bush received flying lessons during his time stationed at "Naval Air Station Hyannis." After the war ended, the navy turned over control of the Hyannis Airport to the Town of Barnstable. The advent of larger planes and increased passenger service required the construction of a larger, 5,400-foot runway in the mid-1950s, new terminals in 1957, and a control tower in 1961. A variety of airlines such as Air New England, Provincetown Boston Airlines, Delta Airlines, Gull Air, and Wills Air operated out of the expanded facilities, flying aircraft such as the DC-9, Martin 404, YS-11, and Cessna 402. In 1981, the airport was renamed the Barnstable Municipal Airport, Boardman-Polando Field. Russell Boardman and John Polando were two Bay State pioneers who flew a record nonstop distance of 5,011 miles from the United States to Istanbul in 1931. Today, Barnstable Municipal Airport continues to provide service to Boston, the Islands, and beyond as the third largest and busiest airport in the Commonwealth (behind Boston and Nantucket airports). J3 Piper Cubs, Cessna 402s, Falcon 50s, and Boeing 727s are some of the aircraft operating from its two runways (Table 2). A total of 58 aircraft are based out of Barnstable Municipal Airport, including one jet. The airport employs 27 full-time employees and leases space to 43 tenant businesses that employ 1,143 personnel (Town of Barnstable website). The airport is currently undergoing construction as its terminal is expanded and several other facilities are relocated.

2.6.1.2 Provincetown Municipal Airport

The Provincetown Municipal Airport also has scheduled air carrier service, primarily to Logan Airport in Boston. The airport is located at the end of Race Point Road. Five single engine airplanes and two multi-engine planes are based out of the airport, and operate from a single runway. Provincetown Municipal Airport is the least active airport to provide scheduled air carrier service in the Commonwealth of Massachusetts.

2.6.1.3 Other General Aviation Airports

Several other airports are open to the public and offer general aviation service. Chatham Airport, located on George Ryder Road, offers a variety of tours around Monomoy Island and the Outer Cape One asphalt runway provides service for the 34 aircraft based on the field. The airport is owned by the Town of Chatham and managed by C.C.F.C., Inc. Another general aviation airport is the Falmouth Airpark, located near Route 28 and Fresh Pond Road. The airpark has a single asphalt runway, which serves 53 aircrafts. A nearby "Fly-In Community," with aircraft access from the homes to the runway, offers shares of the Falmouth Airpark with residence. Lastly, the Cape Cod Airfield on Route 149 and Race Lane in Marstons Mills provides tours and glider rides from three turf runways. The length of the runways, the height of the nearby trees and the absence of a fence restrict the type of airplanes that can use the airfield. It opened as the Cape Cod Airport on July 4, 1929 with an air circus, stunt flights, parachute jumps, and other spectacles. Amelia Earhart flights, automobile and motorcycle racing, Massachusetts Army National Guard maneuvers, and polo matches all took place at the airport. The property was sold to Wilma and William H. Danforth in 1935 as the Great Depression set in, and went largely unused during World War II. The field became active again in 1946 when it was leased to John Van Arsdale who offered flight lessons as part of the G.I. Bill. Services at Cape Cod Airport continued until 2003 when the Danforth family lease was not renewed. After much debate of what to do with the property, it was purchased by the Town of Barnstable for $11.2 million and reopened as Cape Cod Airfield in 2004. Currently, the airfield is operated by Cape Cod Flying Service and serves as a base for 14 aircrafts.

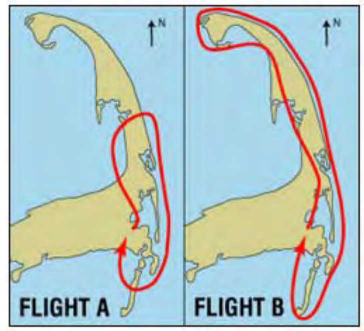


FIGURE 1 - CHATHAM AIRPORT AND FLIGHT PATHS

FIGURE 2 - CAPE COD AIRFIELD

2.6.1.4 Otis Air Force Base

The Otis Air Force Base (A.F.B), located between Mashpee and Sandwich, is owned by the United States Air Force. Its two runways are used exclusively for military purposes. According to Federal Aviation Administration (FAA) records, Otis A.F.B. conducts an average of 89 aircraft operations per day.

TABLE 2: CAPE COD RUNWAY INFORMATION

Airport FAA ID and Name	**Runway No.**	**Size** (feet)	**Surface**	**Runway Markings***	**Condition** (Surface: Markings)	**Runway Edge Lights**	**Weight Capacity** (wheels: tons)
FMH Otis A.F.B.	14/32	9500' x 200'	Asphalt / Concrete	Precision	Good: Good	High Intensity	Single: 32.5 Double: 80 Tandem: 165
	5/23	8000' x 200'	Asphalt / Concrete	Precision	Good: Good	High Intensity	Single: 32.5 Double: 80 Tandem: 165
HYA Barnstable Municipal	6/24	5425' x 150'	Asphalt / Grooved	Precision	Good: Good	High Intensity	Single: 15 Double: 54
	15/33	5252' x 150'	Asphalt / Grooved	Precision	Good: Good	High Intensity	Single: 15 Double: 54
PVC Provincetown	7/25	3500' x 100'	Asphalt	Precision	Good: Good	High Intensity	Single: 12.5
CQX Chatham	6/24	3001' x 100'	Asphalt	Basic	Good: Fair	Medium Intensity	Single: 15
5B6 Falmouth	7/25	2298' x 40'	Asphalt	Basic	Good: Good	Low Intensity	Single: 2
2B1 Cape Cod Airfield	9/27	2700' x 60'	Turf	-	Good: -	-	-
	17/35	2060' x 60'	Turf	-	Good: -	-	-

	5/23	2035' x 50'	Turf	-	Good: -	-	-

Source: AirNav, LLC.

** Note: Runway markings provide landing information and instrument guidance for aircraft. Precision markings provide the maximum level, while basic markings provide a medium level;*

2.6.2 AIR SERVICE

Air service on Cape Cod is primarily commercial passenger service, with a negligible amount of airfreight service. Passenger service is provided through Barnstable Municipal Airport in Hyannis and Provincetown Municipal Airport. Based on the 2002 Five-Year Public Transportation Plan, only 16% of Cape Cod residents use the airports on Cape Cod for their air service needs (Figure 3). For Cape Cod residents, Logan International Airport in Boston is by far the most popular air transportation terminal. More residents are also flying out of Barnstable Municipal Airport than out of T.F. Green International Airport in Warwick, RI. However, the length and destination of these trips are very different. Air service from T.F. Green is generally provided by larger planes making longer trips, whereas 70% of air service out of Barnstable Municipal Airport is between Hyannis and Nantucket. As a result, "the primary role of the Barnstable Municipal Airport is as a park-and-ride facility, serving passengers who are flying to and from Nantucket."

TABLE 3: ANNUAL ENPLANEMENTS BY AIRPORT 2008 & 2009

	Enplanements		
Airport	CY 08	CY 09	% Change
Barnstable Municipal Airport	191,837	138,451	-27.83%
Provincetown Municipal Airport	11,468	10,747	-6.29%

Source: Barnstable Municipal Airport and FAA Enplanement Statistics

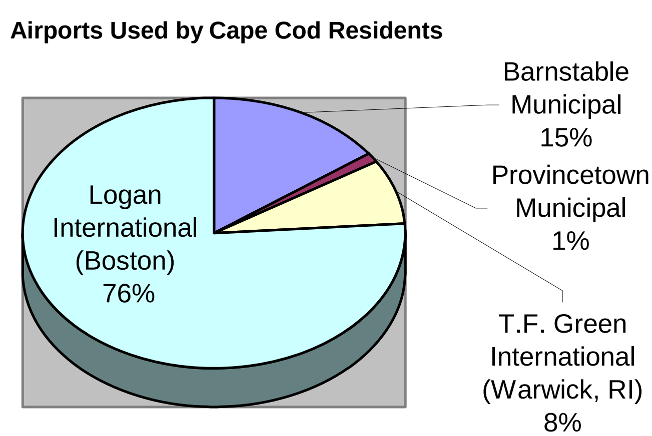


FIGURE 3: AIRPORTS USED BY CAPE COD RESIDENTS
Source: Cape Cod Transit Task Force Five-Year Public Transportation Plan, 2002

Four carriers provide scheduled air service to Cape Cod. Cape Air, which has provided air service since 1989, is Cape Cod's and America's largest independent regional airline. With a fleet of over 50 Cessna 402's, Cape Air provides service from Hyannis to Boston, Martha's Vineyard, and Providence, and from Provincetown to Boston. In February 1998, Cape Air partnered with Nantucket Airlines to provide service between Hyannis and Nantucket. Nantucket Airlines offers flights almost every half-hour, as well as charter and air freight service.

Another air service provider is Island Airlines. Island Airlines provides passenger service almost every half-hour to Nantucket, along with charter flights. In addition, the Cape & Islands Air Freight division provides airfreight service to the region.

Lastly, U.S. Airways Express has scheduled flights from Hyannis to Nantucket, Boston, and LaGuardia International Airport in New York City. Colgan Air operates this service using a 34-passenger SAAB 340 and a 19-passenger Beech 1900.

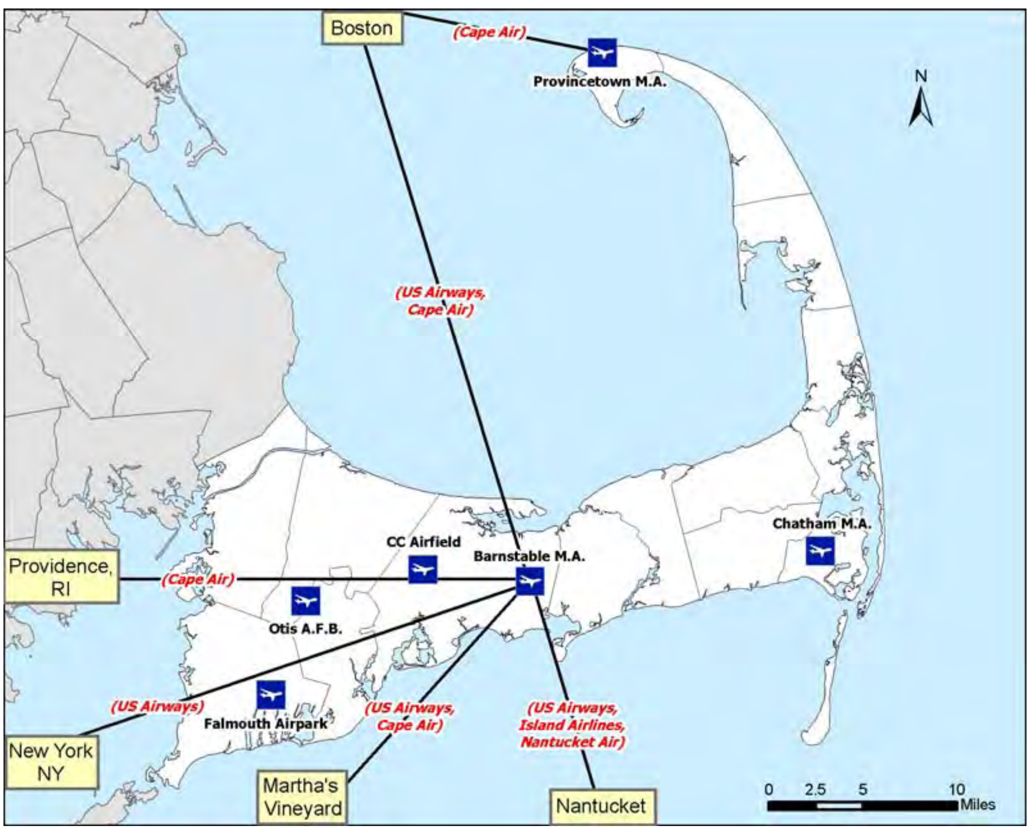


FIGURE 4: AIR SERVICE ON CAPE COD

2.6.3 AIR SERVICE ACCESSIBILITY AND MOBILITY

Barnstable Municipal Airport is accessible by various means. According to the Cape Cod Transit Task Force Report, 69% of airport users arrive by automobile. Limited parking is available. Rental car service is provided by over a dozen rental car agencies, with taxi service available as well. Moreover, the Villager Line of the Cape Cod Regional Transit Authority provides local bus service to the airport upon request, carrying passengers to the Hyannis Transportation Center and Barnstable Park-and-Ride lot. B-bus/DART paratransit service to the airport can also be arranged. However, less than 1% arrives by bus.

Provincetown Municipal Airport is primarily accessible by road. The Provincetown Shuttle service makes a stop at the airport, and connects air service passengers with interregional bus service and ferry service in downtown Provincetown. Provincetown Municipal Airport is also located along a bicycle path, which serves users that are traveling light. However, the majority of users access the Provincetown Municipal Airport via automobile, including taxi.

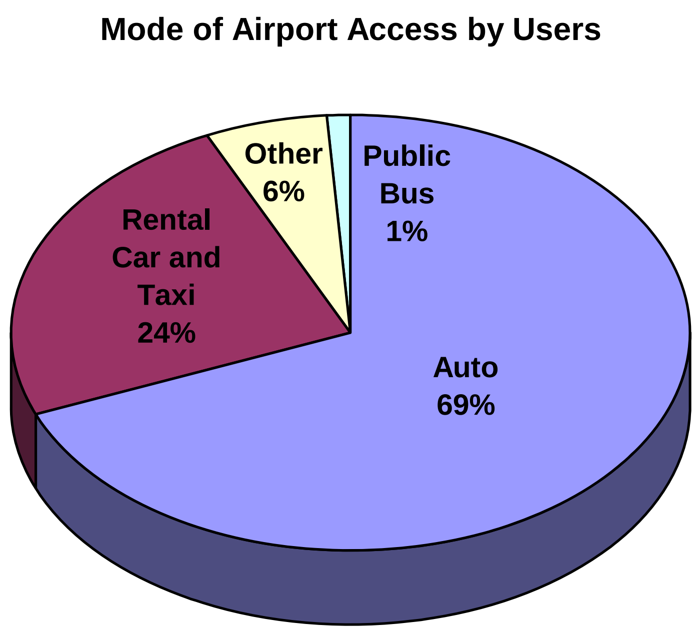


FIGURE 5: MODE OF BARNSTABLE MUNICIPAL AIRPORT ACCESS BY USERS
Source: Cape Cod Transit Task Force Five-Year Public Transportation Plan, 2002

Interregional bus service also links travelers on Cape Cod to air service in Boston. Plymouth and Brockton Street Railway Company runs 16 buses each weekday from the Hyannis Transportation Center to the terminals at Logan International Airport and 15 per day on weekends and holidays. This route includes stops at the Barnstable and

Sagamore Park-and-Ride lots. By providing direct service to Logan International Airport, Plymouth and Brockton provides travelers with increased access to domestic and international air services. Peter Pan Bus Lines currently offer six daily buses from Bourne to T.F. Green Airport in Providence, RI.

Air service on Cape Cod offers users the potential of global mobility. With service to major air transportation hubs such as New York City, Boston, and Providence, a user can transfer to domestic and international flights. Ironically, however, no scheduled flights exist between Cape Cod airports. Thus, there is a great deal of air service mobility between on-Cape and off-Cape sites, but no intraregional mobility.

2.6.4 CONCLUSION

Cape Cod has several airports that serve its various needs. Only two, Barnstable Municipal Airport and Provincetown Municipal Airport offer scheduled air carrier service. This service is provided by four carriers who connect Cape Cod residents to the Islands, Boston, and the world beyond. Although accounting for only a small percentage of Cape Cod transportation, air transportation provides a quick, road-free mode of travel to users. Encouraging travelers to fly to Cape Cod would reduce strain on roadways and lead to more efficient use of this underutilized mode. In the next 25 years, Cape Cod's airports may see an increase in air traffic as carriers switch from the increasingly congested major airports to smaller regional ones. To prepare for this, it may be advantageous to assess the current state of the Cape's major air facilities and study their potential future usage.

2.7 CANAL AREA TRANSPORTATION

Almost everyone who has driven to Cape Cod has used one of the two highway bridges spanning the Cape Cod Canal. In addition to the highway bridges, the Cape Cod Canal Railway Bridge presents the potential to transport people onto Cape Cod by rail. These three bridges are each owned and maintained by the U.S. Army Corps of Engineers. Given that the canal effectively makes Cape Cod an island, the three canal bridges serve as the only means, excluding ferries, to transport vehicles to and from the Cape. Moreover, most people traveling to Martha's Vineyard and Nantucket rely on the canal bridges to reach their respective seaports by roadway. The history, use, maintenance, and future of these bridges are of vital importance to the residents, businesses, and visitors of Cape Cod and the Islands.

2.7.1 CANAL HIGHWAY BRIDGES' HISTORY

In 1928, Congress directed the Army Corps of Engineers to make improvements to the narrow Cape Cod Canal (as configured by 1915). These improvements resulted in the canal we have today – and result in highway bridges that provide a vertical clearance of 135 feet above mean high water and a horizontal clearance of 480 feet. The bridges were built from 1933 to1935 in land areas that were naturally elevated.

THE SAGAMORE BRIDGE, UNDER CONSTRUCTION, IN 1934. SOURCE: U.S. ARMY CORPS OF ENGINEERS

2.7.2 CANAL BRIDGE CONDITIONS

Currently, the Canal Bridges are owned and maintained by the Army Corps of Engineers (ACOE). As the bridges age and the average daily traffic volumes continue to rise, the ACOE maintenance efforts are nearly continuous. Based on recent bridge inspection reports, the Cape Cod Canal Highway bridges qualify for replacement under federal guidelines. The ACOE inspects and maintains both highway bridges over the Cape Cod Canal in safe condition; however, discussions about bridge replacement or another Canal crossing have begun informally.

In addition to the strategies for maintenance recommended by the Metropolitan Planning Organization (MPO) in this Regional Transportation Plan (RTP), there is a need to consider the future Canal crossing. The Bourne and Sagamore bridges are increasingly undergoing maintenance efforts that constrain mobility between Cape Cod and the mainland. While the cost and frequency of repairs increase, so does the inconvenience and economic detriment for residents, businesses, and visitors.

This RTP therefore recommends a study by the Cape Cod Commission and its consultant(s) with the Army Corps of Engineers, stakeholders, and the public to focus on the future Canal crossing. The study will include:

- Options for a new crossing, e.g., bridge, tunnel, ferry...
- Traffic flow capacity (vehicles per hour)
- Bicycle and pedestrian facilities included or as a separate crossing
- Consistency with emergency management plans

The result of this proposed study would be a recommendation for the future Canal crossing concept, along with assignment of the design proponent(s). It is desirable to have the stakeholders group and public process continue through the design process.

During certain maintenance activities (roadbed resurfacing or reconstruction) and structural repairs, lane closures may be required during parts of the day or continuously until completion. The effects of maintenance-related lane closures are discussed later in this document.

FIGURE 1 - BOURNE BRIDGE

FIGURE 2 - SAGAMORE BRIDGE

FIGURE 3 - ROADWAY OVER SAGAMORE BRIDGE


FIGURE 4 - SAGAMORE BRIDGE STRUCTURE

2.7.3 HIGHWAY BRIDGE CAPACITY

According to MassDOT's *Canal Area Traffic Study* (August 2006), each bridge has a theoretical directional peak capacity of approximately 3,400 vehicles per hour. Due to the narrow lanes and the absence of a median, the capacity of the two bridge lanes opposing the peak direction is estimated to be approximately 30% less than the peak flow, or 2,400 vehicles per hour. This results in a two-way capacity of approximately 5,800 vehicles per hour on each of the canal bridges.

2.7.4 TRAFFIC VOLUMES

Traffic over the bridges has continued to increase over the last 35 years (see following figure). However, traffic has decreased slightly since 2002. In 2009, the average daily traffic (ADT) of both directions of travel on both highway bridges was over 95,000, with a summer ADT of over 127,000. Of the two bridges, the Sagamore Bridge is more heavily traveled. The difference in average year-round bridge traffic volumes in 2009 is 5,000, as compared to the year 2000 when there were approximately 12,000 more vehicles crossing the Sagamore Bridge than the Bourne Bridge.

Comparing annual volumes to summer volumes, it is clear that the difference between the two has remained similar over the last decade (see following figure). Therefore, any traffic growth must be a result of year-round traffic, and not seasonal traffic. When compared to thirty years prior, bridge traffic volumes show significant change (see following figure). Eight months of the year now exceed the peak volumes from 1975. Moreover, the peak volumes from 1975 are now similar to current off-peak volumes.

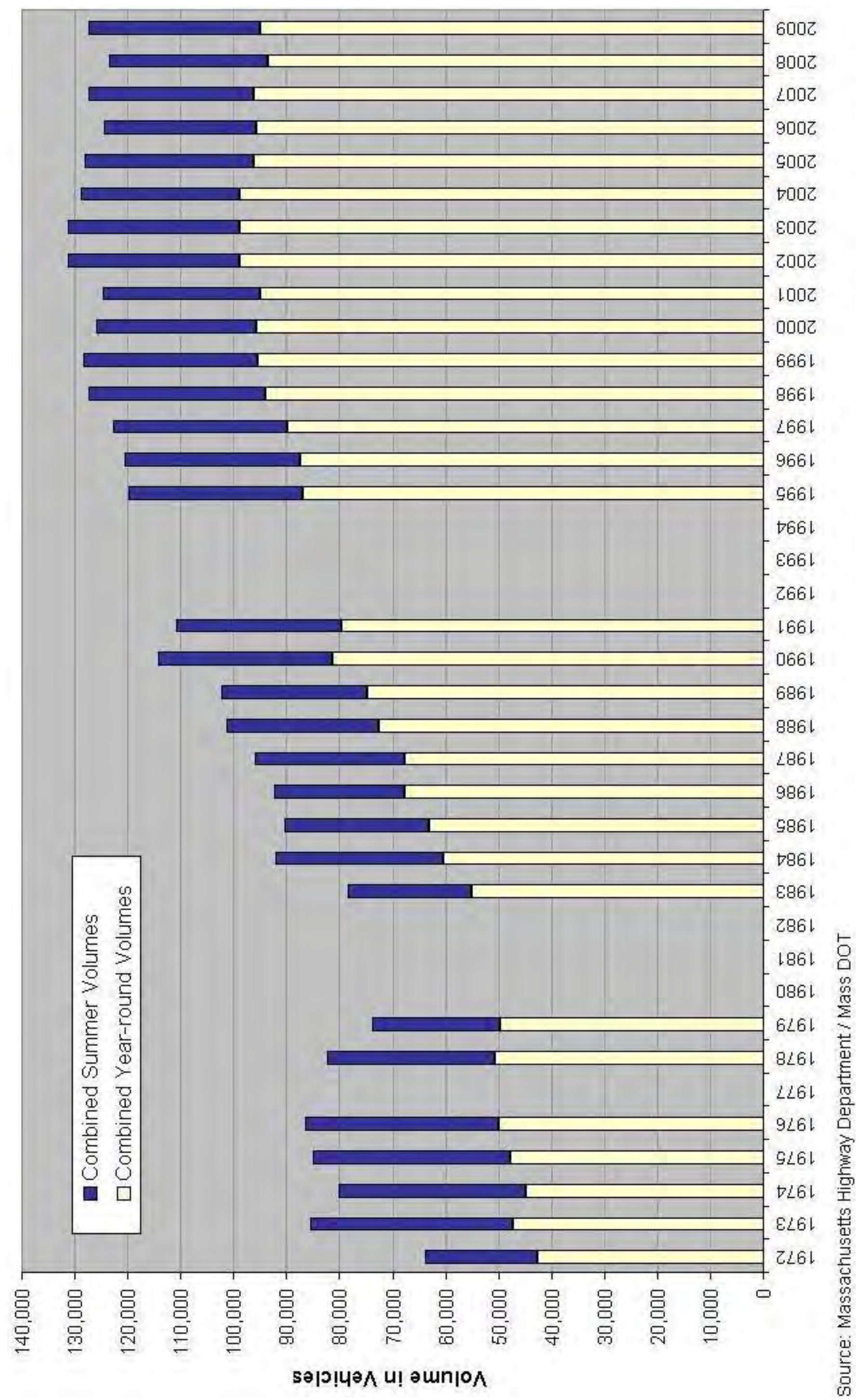


FIGURE 5 - COMBINED AVERAGE DAILY TRAFFIC OVER BOURNE AND SAGAMORE BRIDGES
(Source: MassDOT)

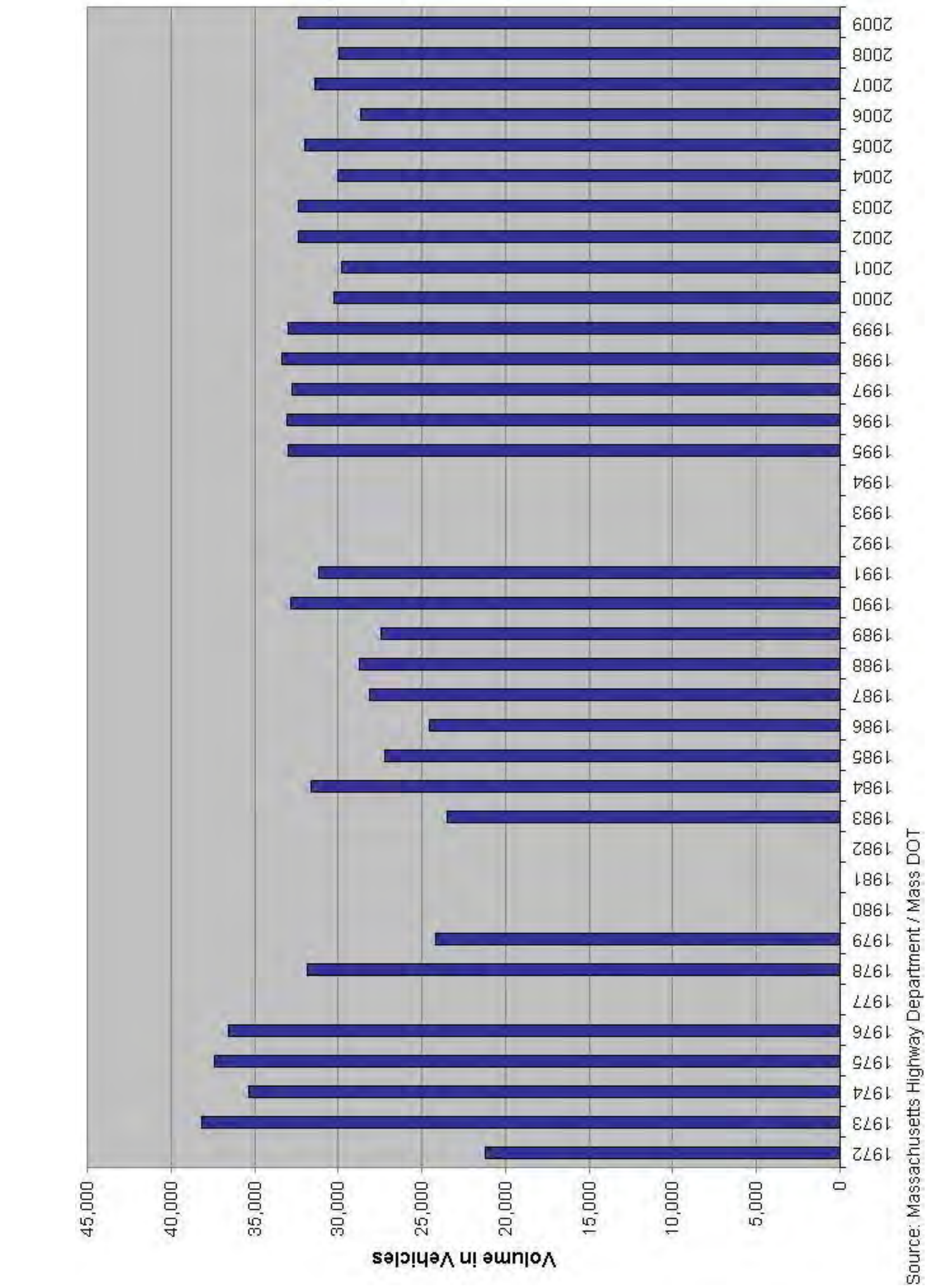


FIGURE 6 - DIFFERENCE BETWEEN SUMMER AND ANNUAL AVERAGE DAILY TRAFFIC OVER BOTH THE BOURNE AND SAGAMORE BRIDGES
(Source: MassDOT)

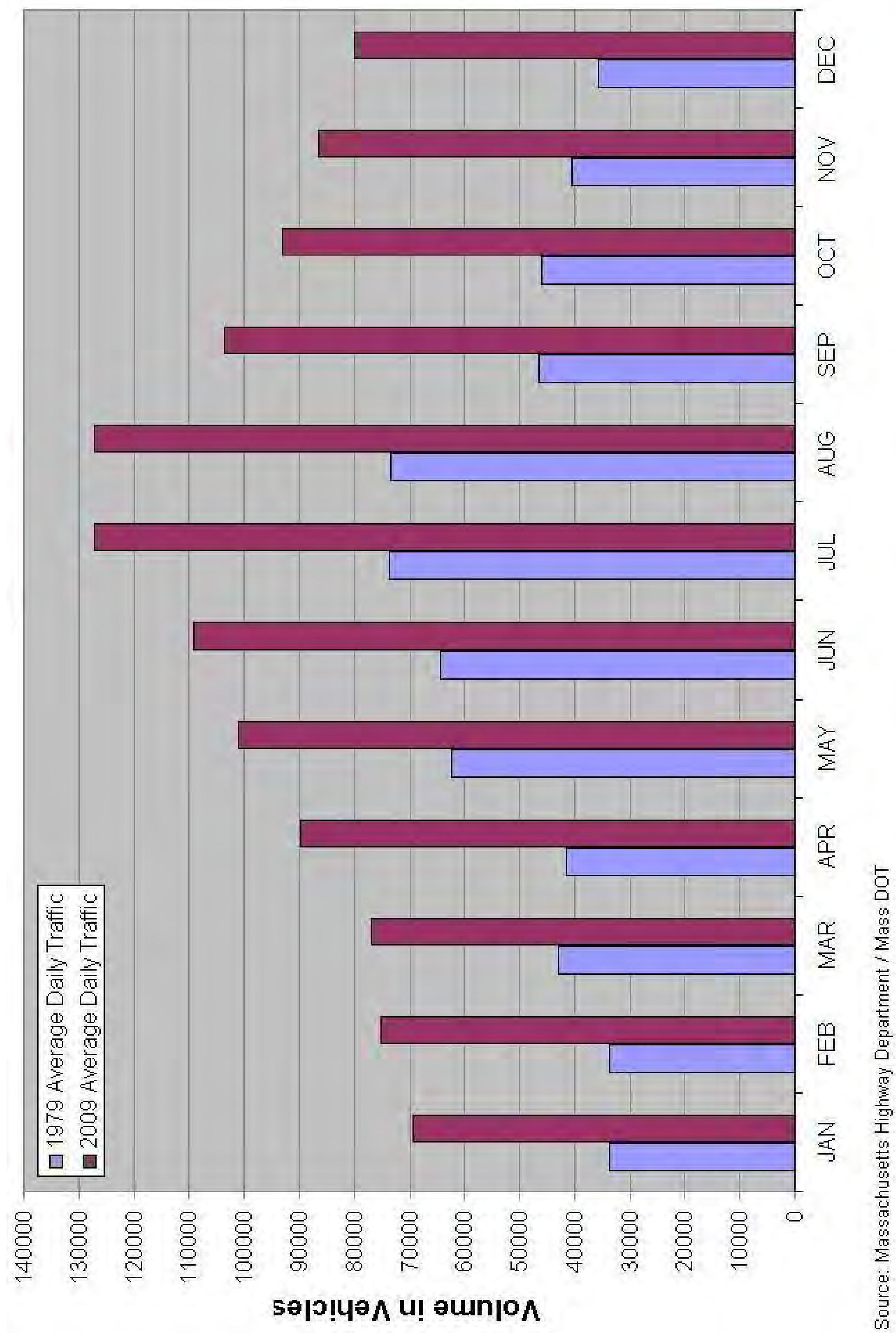


FIGURE 7 - THIRTY-YEAR COMPARISON OF COMBINED AVERAGE DAILY TRAFFIC OVER THE BOURNE AND SAGAMORE BRIDGES

TABLE 1 - CAPE COD CANAL BRIDGES TRAFFIC VOLUMES 1971-2009
(Source: MassDOT)

	#707 Bourne Bridge		#708 Sagamore Br.		Combined (both bridges)	
	Yr.Round	Summer	Yr.Round	Summer	Yr.Round	Summer
2009	44,839	58,031	50,052	69,256	94,890	127,287
2008	42,396	55,492	51,019	67,854	93,415	123,346
2007	43,506	57,042	52,559	70,407	96,065	127,449
2006	43,909	57,411	51,916	67,020	95,824	124,431
2005	43,873	58,858	52,282	69,279	96,155	128,137
2004	44,688	59,615	54,143	69,274	98,832	128,889
2003	44,635	60,430	54,114	70,716	98,749	131,146
2002	43,981	60,059	54,905	71,207	98,886	131,266
2001	40,561	54,639	54,309	70,025	94,869	124,664
2000	41,805	56,892	53,832	68,997	95,637	125,889
1999	43,013	59,595	52,434	68,833	95,447	128,428
1998	42,427	58,063	51,490	69,195	93,918	127,258
1997	40,216	56,204	49,716	66,513	89,932	122,717
1996	39,304	54,195	48,071	66,277	87,375	120,472
1995	38,885	52,503	47,994	67,385	86,879	119,888
1994	36,406	52,078				
1993	35,413	49,753				
1992	34,899	49,120				
1991	33,926	48,194	45,667	62,564	79,593	110,758
1990	34,818	49,010	46,571	65,240	81,388	114,250
1989	33,936	49,137	40,814	53,024	74,751	102,161
1988	32,735	46,709	39,822	54,556	72,557	101,265
1987	29,675	39,300	38,078	56,575	67,753	95,875
1986	26,858	35,035	40,870	57,224	67,728	92,259
1985	26,136	36,800	36,877	53,441	63,014	90,241
1984	26,179	41,571	34,244	50,441	60,423	92,012
1983	23,276	29,685	31,695	48,788	54,971	78,473
1982						
1981	15,223	25,427				
1980						
1979	19,480	29,930	30,090	43,792	49,570	73,722
1978	22,256	31,823	28,310	50,557	50,566	82,380
1977	23,113	41,307				
1976	23,173	41,130	26,693	45,260	49,866	86,390
1975	23,484	41,900	24,140	43,095	47,623	84,995
1974	20,971	41,087	23,728	38,979	44,699	80,066
1973	21,635	40,682	25,691	44,824	47,327	85,506
1972	19,479	30,964	23,034	32,742	42,513	63,706
1971	19,280		22,050		41,330	

2.7.5 CAPE COD CANAL HIGHWAY BRIDGE MAINTENANCE

The Bourne and Sagamore bridges provide the only crossings of the Cape Cod Canal for motorists, pedestrians and cyclists. Maintained by the U.S. Army Corps of Engineers, the geometric design of each bridge includes a roadway width of 40 feet (four 10 foot wide lanes) flanked by a 6-foot wide sidewalk on one side and a 2-foot wide safety curb on the other. The roadways are separated from the sidewalks and safety curbs by 16-inch high vertical granite curbing.

The bridges first opened to traffic in 1935. Historic records indicate a general upward trend in the annual bridge crossings and this traffic is currently approaching 100,000 vehicles per average day. Over the decades, the bridges have been exposed to deicing salts, the effects of which include progressive deterioration of the concrete deck and some steel members of the bridges. These effects are compounded by the fact that the bridges are located near salt water. An additional maintenance activity is the periodic painting of the exposed steel portions of the bridges.

For certain maintenance activities, including repairs to the concrete deck, the worksite requires the closures of two lanes. For a bridge undergoing maintenance, the four lanes are reduced to two. Depending on the duration of the closure and the seasonal demand, significant delays and backups may occur. The ACOE is committed to minimizing these conditions by avoiding daytime lane reductions during the summer months and limiting work to one bridge at a time. Please see the introduction for a discussion on the bridges regarding long-range planning issues.

Estimates for delay at the Sagamore and Bourne Bridges

This section is intended to help identify critical “windows of opportunity” for scheduling maintenance activities that require lane closures. Daytime during the July 4th holiday weekend would be a bad time for such activity, whereas midnight in February would have minimal impact. This analysis should help identify other time periods that may also be acceptable.

Bridge volumes observed during recent work on the Sagamore and Bourne Bridges were compared to volumes observed in April and October 1999. Volumes observed on the Sagamore and Bourne Bridges during recent closures led to an identification of the one-lane capacity of the bridges. A review of the hourly MassDOT traffic counts during the lane closures indicates that a sustained flow of about 1,250 vehicles per hour can cross the bridge in each direction. It is logical that some vehicles in the theoretical backup would divert to the other bridge (for analysis purposes, assume 20%) and some trips observed in 1999 would not be made (again, for analysis, assume 10%).

In calculating the backups and delays, the cumulative number of cars that could not be accommodated was divided by the bridge capacity to get the maximum theoretical delay for an average weekday (this is the amount of time required for the peak demand to dissipate). The results are shown in the following table:

TABLE 2 - THEORETICAL DAILY VEHICULAR DELAYS DURING BRIDGE LANE CLOSURES

		April	October
Sagamore Bridge	Northbound	1.7 hours	4.4 hours
	Southbound	2.4 hours	2.3 hours
Bourne Bridge	Northbound	0.3 hours	0.4 hours
	Southbound	0.3 hours	1.8 hours

Impacts to traffic will be most severe in the Fall during maintenance on the Sagamore Bridge. Encouraging the use of the alternate bridge would be an important element of any mitigation strategy. Impacts to the areas on bypass routes, (e.g., diversion from Route 6 westbound at Exit 2 through Sandwich), will be significant and some planning to minimize these impacts must also be done.

Strategies related to Bridge Maintenance

Several strategies are suggested for addressing the impacts of maintenance-related lane closures. In all cases, adequate public notification is recommended. In 2009, the Army Corps of Engineers established a website and email notification system for major maintenance efforts on the bridges. The Cape Cod Commission is committed to providing access to updates through the internet traveler information system (www.gocapecod.org). By providing timely warnings of impending closures, travelers may adjust travel mode, choice of bridge crossing and approach routes, or timing. The bridges do need to be maintained in order to continue to provide safe passage to and from the region. Foul weather may interfere sometimes in the maintenance efforts, and as a result the schedule prolonged. The ACOE seems to now include this aspect in consideration of the estimated maintenance schedule, and that has provided for improved public expectations.

• *Scheduling Maintenance Activities for Off-Peak Periods:* minimizes disruptions to traffic during heavy travel periods. The Army Corps is already making efforts to achieve this - and should continue to do so. To the greatest extent possible, lane closures should avoid summer months and daytime periods during the spring and fall.

• *Intelligent Transportation Systems (ITS)* is collection and dissemination of real-time information through means such as cameras and/or cell phone data collection. The information is available on the state traffic information website and 511 telephone system. This allows for travelers to check online or via cell phones on current traffic conditions at the bridges. Radio stations also look up and provide updates on bridge traffic. The Cape Cod Commission staff has included announcements of upcoming maintenance activities and links to transportation providers on the Cape Cod Commission Transportation Information Center (www.gocapecod.org). Included is a link to the ACOE website to provide travelers with the latest information on lane closures. Working together, the MassDOT and Cape Cod Commission (CCC) staff outlined ITS improvements for the Cape Cod Canal bridge area. MassDOT then hired a consultant to design ITS improvements, and the project was bid for construction in September 2010.

• *Improve Transportation Alternatives to Offset Automobile Crossings by increasing express bus service, and improving marketing of bus and other alternatives.* The marketing should inform travelers of the advantages of using alternatives and the disadvantages of driving during the lane closures. An additional strategy to enhance the attractiveness of buses and high-occupancy vehicles would be to allow travel on the shoulders (currently nonexistent on Route 6) of Routes 3, 6, 25, and 28 to bypass the queues (under police supervision). This concept would include construction of shoulders/breakdown lanes that could be used as a bus lane during peak times.

This would encourage a shift from single-occupant vehicles and would likely result in an overall reduction of vehicles traveling through the lane closures.

• *Traffic Management:* reduces traffic conflicts. During periods of traffic congestion at the Canal crossings, motorists seek alternate routes - regardless of whether or not such routes actually save travel time. In addition, such routings have effect on the capacity of the bridges, and may actually create bottlenecks in other locations such as the Exit One on-ramp at the approach of the Mid-Cape Highway westbound at the Sagamore Bridge. Techniques to be considered should include police officer traffic control, signage, and turn restrictions.

2.7.6 CANAL AREA TRAFFIC MOVEMENTS

Using the Cape Cod Transportation Demand Model, an analysis of cross-canal traffic patterns can be made. Cape Cod was separated into four quadrants, based on the location's primary approach to the Canal. For example, Route 6 is the primary point of access to the Canal of people from Hyannis and easterly points in the region. The primary point of access to the canal for people in Boston is Route 3. Using the model, the levels of traffic between the 4 quadrants can be determined. These traffic flows are illustrated in the following figure.

This analysis does not give specific traffic volumes over the bridges or supporting roadways. What it shows is that 56,000 vehicles per day have a choice of what bridge to take. Therefore, if traffic needed to be diverted to avoid congestion, 56,000 vehicles could be potentially diverted based on a modeled average summer day.

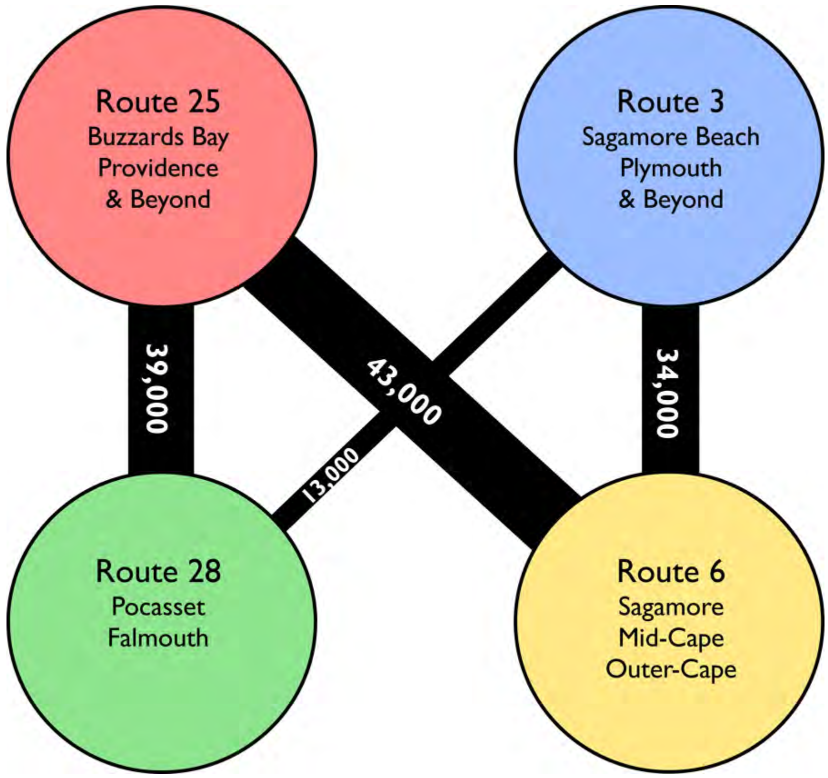


FIGURE 8 - CROSS-CANAL TRAFFIC, ESTIMATED 2004 SUMMER ADT

2.7.7 SUPPORTING ROAD NETWORK

In addition to the two highway bridges, there are several roadways that support movement over the Canal. These include the Scenic Highway, Sandwich Road, Belmont Circle, and the Sagamore Interchange. The Sagamore Interchange replaced the Sagamore Rotary and area connections, beginning with the project advertising in 2004. The before-and-after diagrams are shown in the figures below.

FIGURE 9 - SAGAMORE CROSSING
(note: Sagamore Rotary has been eliminated – see following figure)

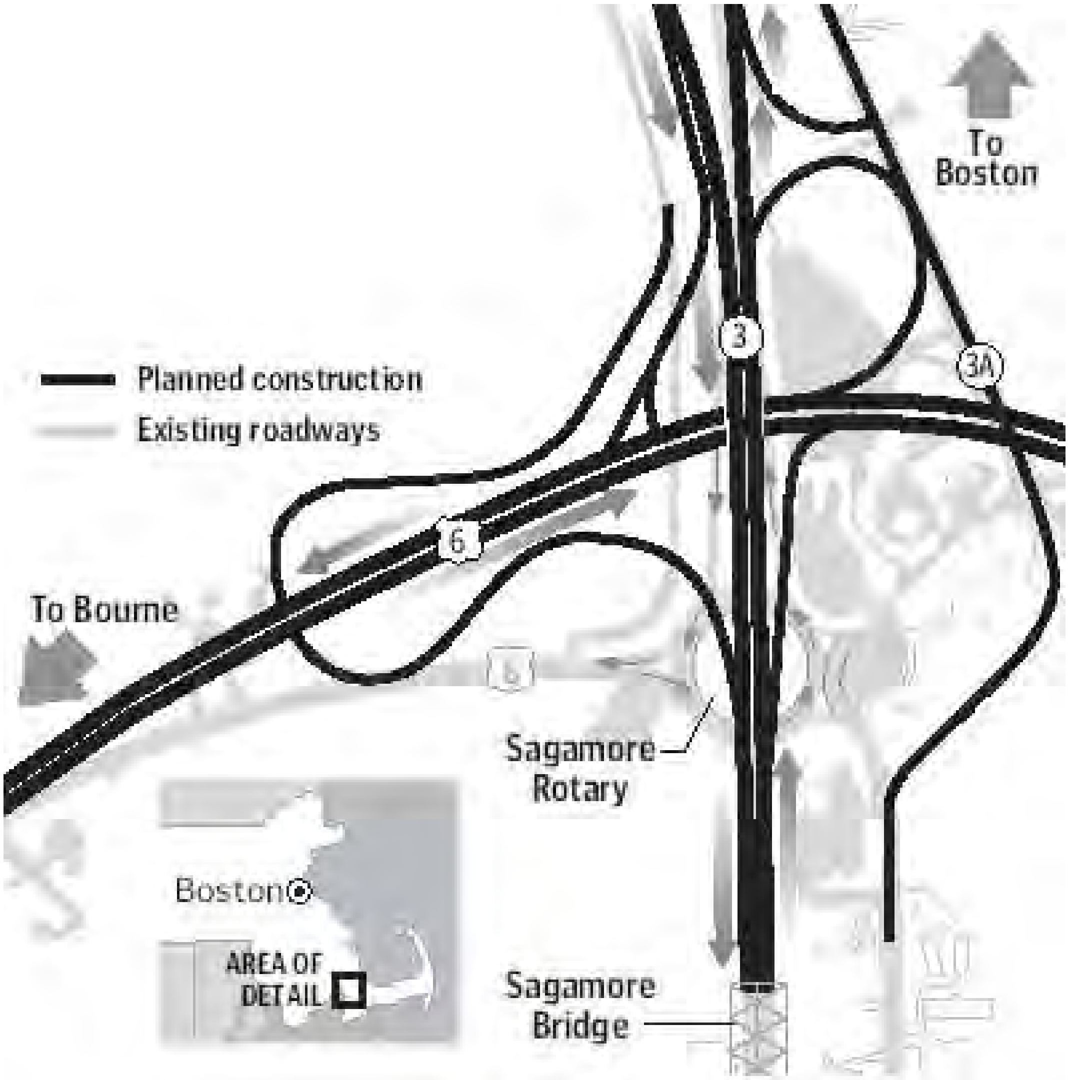


FIGURE 10 - SAGAMORE INTERCHANGE DIAGRAM

FIGURE 11 - BOURNE CROSSING

2.7.7.1 Scenic Highway

Scenic Highway (U.S. Route 6) stretches approximately 3 miles from the Belmont Circle to the Sagamore Interchange on the mainland side of the Cape Cod Canal. The roadway is generally undivided four lanes, two in either direction, with a posted speed limit of 50 MPH. As sections of this roadway have been improved, there have been median installations. The improvements at the Sagamore Interchange have extended a raised median from the traffic signal at Bournedale Road to the Route 3 interchange near the Sagamore Bridge. Another section of raised median is included with the new traffic signal at Edgehill Road.

In addition to being an important connection between the Bourne and Sagamore Bridges, The Scenic Highway also provides access to Buzzards Bay, Bournedale and Sagamore. Most of the land along Scenic Highway is undeveloped but there are several local businesses, a shopping plaza and a camping area along the roadway.

FIGURE 12 - SCENIC HIGHWAY (U.S. ROUTE 6), FACING EAST

FIGURE 13 - SCENIC HIGHWAY, FACING EAST

FIGURE 14 - SCENIC HIGHWAY AT THE BOURNEDALE ROAD INTERSECTION

2.7.7.2 Sandwich Road

Sandwich Road connects the Bourne and Sagamore Bridge on the Cape Cod side of the canal. The roadway stretches approximately three miles from the Bourne Rotary to Interchange 1 of Route 6. The roadway has two undivided lanes, one in either direction, and a posted speed limit of 45 MPH. Sandwich Road also provides access to Route 28, Route 6A and Sagamore Village. The Upper Cape Cod Regional Technical School, John Gallo Ice Arena, several residences, and a recreation area are located on Sandwich Road.

FIGURE 15 - SANDWICH ROAD FACING EAST

2.7.7.3 Belmont Circle

The Belmont Circle is a rotary named after August Belmont who was the developer of the original Cape Cod Canal. The circle is located at the intersection of Route 25 Interchange 2, Scenic Highway (U.S. 6), Buzzards Bay Bypass (U.S. 6), Head of the Bay Road, and Main Street (Route 28) in Buzzards Bay. The rotary is shaped roughly like a trapezoid about 1,990 feet in circumference. The longest side (from Main Street to Scenic Highway) is approximately 650 feet long; the shortest side (from the Route 6 Bypass to Main Street) is approximately 265 feet long. It was configured during the creation of the Route 25 extension to the Bourne Bridge in 1987. The roadway has three lanes, traveling counter-clockwise, and a posted speed limit of 45 MPH. Rotary traffic has the right-of-way. Several businesses also have access points within the rotary.

FIGURE 16 - THE BELMONT CIRCLE, FACING EAST TOWARDS THE SCENIC HIGHWAY

FIGURE 17 - SIGNS DIRECTING MOTORISTS THROUGH THE BELMONT CIRCLE

2.7.7.4 Sagamore Interchange (formerly Sagamore Rotary)

The Sagamore Interchange is located at the base of the Sagamore Bridge on the mainland side. It is located at the intersection of Route 3 Interchange 1, Scenic Highway, Route 6 and Route 3A. The intersection was previously the Sagamore Rotary. On September 10, 2006, the rotary was officially removed, and replaced by an interchange. The interchange includes a series of ramps for direct service to Route 3. Route 6 Scenic Highway passes beneath newly constructed Route 3 bridges. The project includes signalization at three intersections and will include a replacement Park-and-Ride lot adjacent to the interchange.

FIGURE 18 - THE FORMER SAGAMORE ROTARY AND CONGESTION

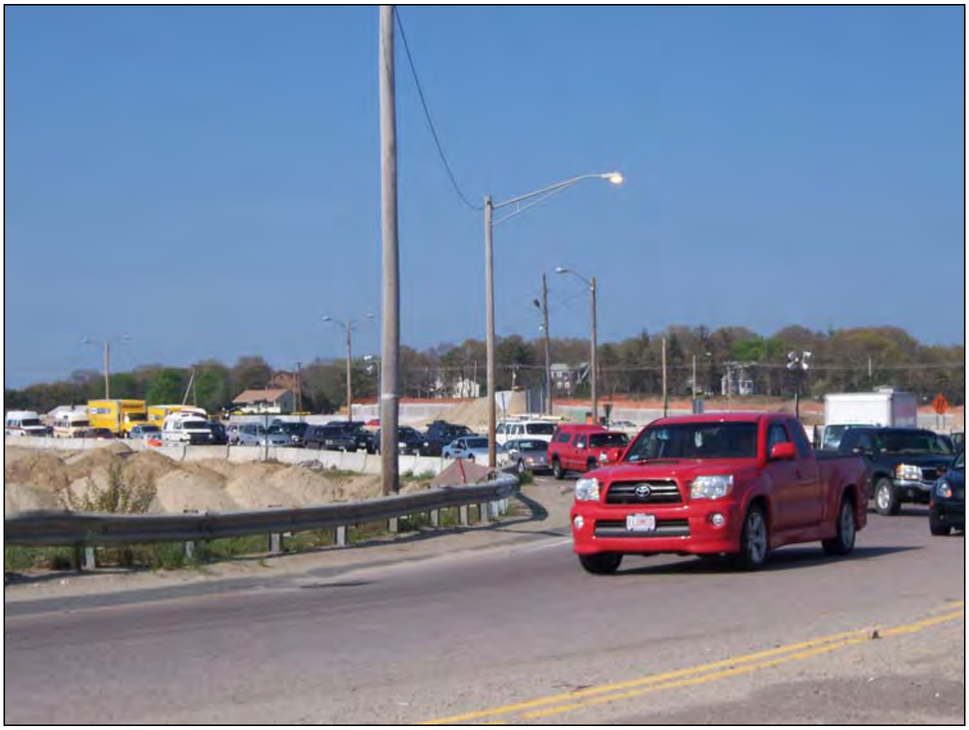


FIGURE 19 - ROUTE 3 CONGESTION AT THE FORMER SAGAMORE ROTARY, FROM SCENIC HIGHWAY

FIGURE 20 - THE SAGAMORE INTERCHANGE OVERPASS, DURING CONSTRUCTION

2.7.7.5 Route 6 Interchange 1

Route 6 Interchange 1 is located at the base of the Sagamore Bridge on the Cape side. It allows access to Route 6 from Route 6A and Sandwich Village. Westbound access ramps have direct access from Route 6A. The westbound on-ramp is within close proximity to the upgrade of the Sagamore Bridge and is a source of significant queuing during heavy off-Cape traffic. Service to and from Route 6 eastbound is via the "Mid-Cape Connector" road from Sandwich Road. The Mid-Cape Connector is a two-way ramp system that includes local unsignalized intersection access to a factory outlet center and the U.S. military's PAVE PAWS radar installation.

FIGURE 21 - THE MID-CAPE CONNECTOR (INTERCHANGE 1) NORTH OF THE OUTLET STORE ENTRANCE

2.7.7.6 Bourne Rotary

The Bourne Rotary connects Route 28 and Cape Cod to the Bourne Bridge. It is located at the intersection of Route 28 (MacArthur Boulevard), Trowbridge Road, Sandwich Road, and the Bourne Bridge. The rotary is approximately 400 feet in diameter, and approximately 1,250 feet in circumference. The roadway has two unmarked lanes, traveling counter clockwise, and a posted speed limit of 25 MPH. Rotary traffic has the right of way.

2.7.8 RAILROAD BRIDGE

The third bridge over the Cape Cod Canal is also an United States Army Corps of Engineers (ACOE) owned bridge, and is the vertical lift railroad bridge.

This bridge was substantially upgraded in 2001-2003 through a two-phase effort that was coordinated by the Army Corps of Engineers with the Commonwealth of Massachusetts Executive Office of Transportation (EOT), and cost approximately $27,000,000. Please note that EOT is now the Massachusetts Department of Transportation (MassDOT).

Rail information is contained in sub-chapter 2.4 of this Plan.

2.7.9 CONCLUSION

The Cape Cod Canal area highway system provides transportation infrastructure for thousands of motorists and many truckers each day. The heavily-traveled and aging highway bridges are becoming a continuing source of concern due to their narrow lanes and frequent need for maintenance. Historic traffic growth now results in increases throughout the year, resulting in off-season traffic of current years exceeding that of peak summer conditions of a couple of decades ago. The railroad bridge serves an important function in the transport of regional solid waste, and may have opportunities for other uses such as passenger rail.

Because of the close relationship of the two highway bridges in the center of the Town of Bourne with the connecting roadways for both local and intraregional traffic, the Canal Area needs to be studied as a sub-system both in the region and connecting Cape Cod with the rest of the world. This sub-system data collection and analysis approach will allow for proposed transportation and access improvements to be analyzed in relation to each other and overall, and will provide the most coherent effort to date. This is a critical planning need and area for the region.

2.8 SUB-REGIONAL ISSUES

Each town, village, business district, and even each neighborhood will have a slightly different (and in a handful of cases a drastically different) set of options and conditions that affect, and are affected by, travel. For a document of this scope it would be impossible, and imprudent, to provide such detail. Some comparisons and evaluation can be made at a larger scale. Therefore, transportation at the "local" scale is discussed for Sub-Regions identified in the following figure and described in the following sections.

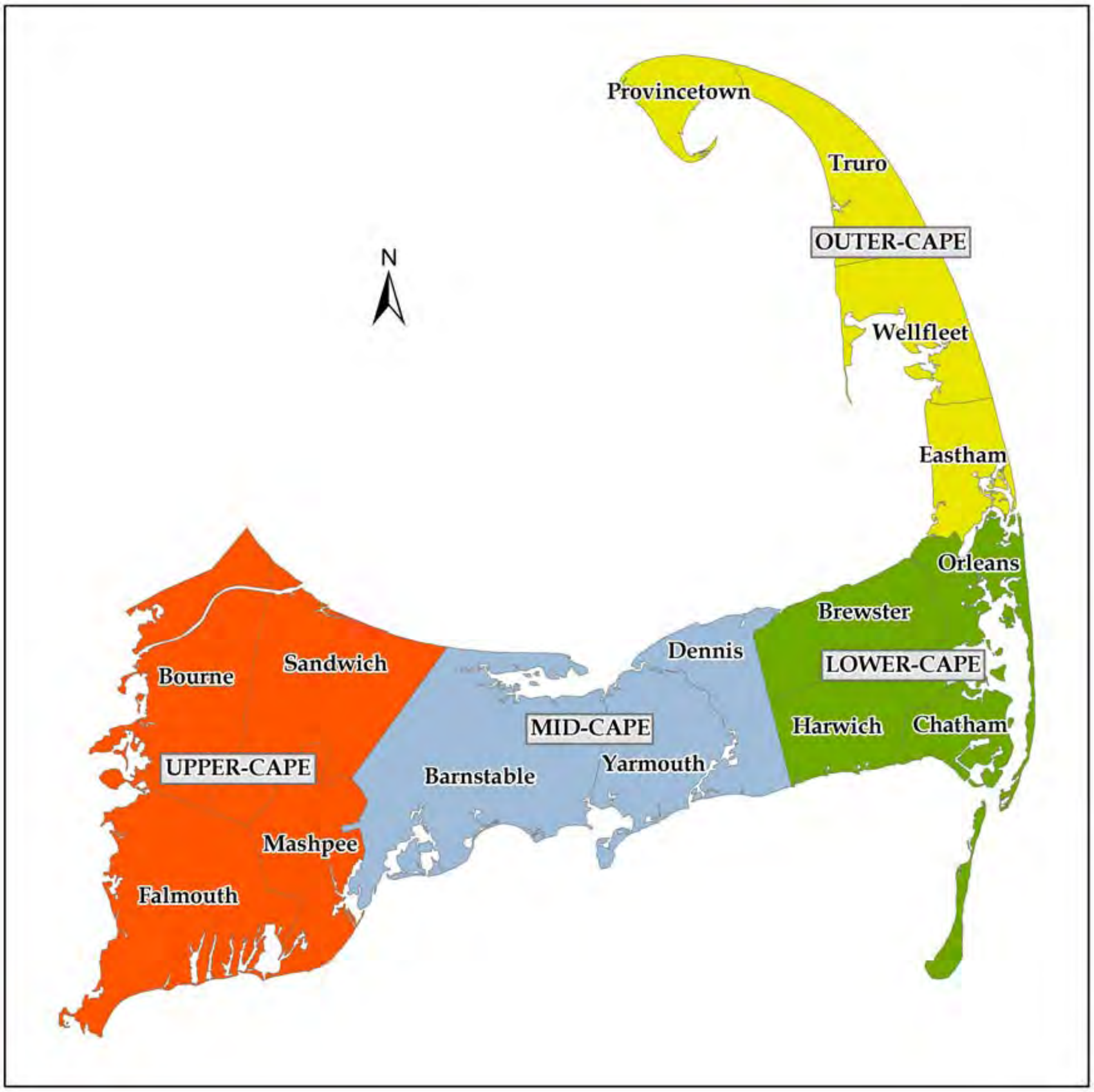
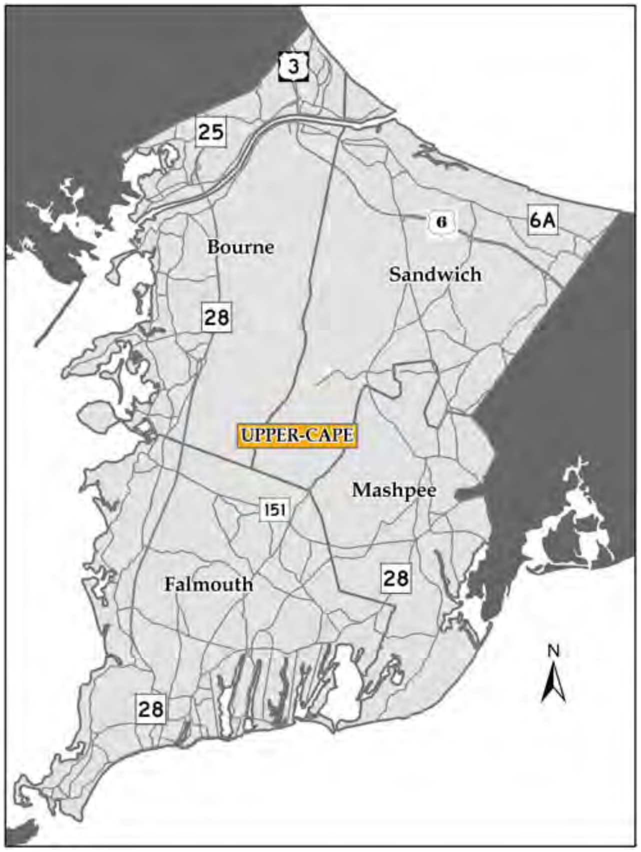


FIGURE 1 - CAPE COD SUB-REGIONS

2.8.1 UPPER CAPE



The Upper Cape includes the towns of Bourne, Sandwich, Falmouth, and Mashpee. The Upper Cape is also dominated by the Massachusetts Military Reservation (MMR). There is a portion of the MMR in all four Upper Cape towns. Transportation facilities are located within the MMR, including freight rail service, connections between Sandwich and Bourne, and the Otis Air Force Base. In addition, schools and jobs are located within the base.

The Upper Cape towns make up the mainland gateway to the Cape. They consist of 38% of the land area of Cape Cod, and contain 86,526 (2009 Census estimates) residents or 39.1% of the Cape's population. For Cape residents, they also contain 35.1% (31,051 of 88,409) of the jobs in the county. The Upper Cape area includes regional and local services, such as the transportation connections, shopping centers, and Falmouth Hospital.

This area is identified as the Upper Cape (despite its compass-orientation compared to other sub-regions) since it is the closest to the mainland (and rising elevations).

2.8.1.1 Transportation Facilities

The transportation infrastructure in this sub-region includes approximately 1,200 miles of roadway, intercity and local bus services, limited rail service, and ferry service.

Roadway Network

The Cape Cod Canal bisects the towns of Bourne and Sandwich and is bridged in just three places, two for vehicular traffic and one for rail. The three major corridors that connect this sub-region to other parts of Cape Cod are Route 6A, Route 6, and Route 28. Regarding both Falmouth and Mashpee, both Route 6A and Route 6 have functions distinct from roadways such as Route 28. Since Route 6 and Route 6A provide only provide service well beyond the boundaries of these towns, their function is limited to longer-distance regional travel for travelers to or from Falmouth or Mashpee. Additional regional corridors serve as a network for the sub region. Route 151 from Route 28 in Falmouth near the Bourne town line crosses through North Falmouth and connects to Route 28 in Mashpee. Route 130 from Route 6A to Route 6 in Sandwich and on to Route 28 in Barnstable just east of Mashpee/Barnstable town line connects Mashpee with Sandwich and allows access to Route 6.

Transit Service

Bonanza Bus Lines/Peter Pan provides intercity service from this sub-region to Boston and Logan Airport and Providence, Rhode Island. The CCRTA operates the SeaLine; a regional year-round fixed route bus service that travels from Falmouth through Mashpee primarily on Route 28 to the Hyannis Transportation Center. The Park-and-Ride commuter lot in Sagamore is serviced by P&B for trips to and from Boston. The CCRTA operates the "WHOOSH," a summer trolley shuttle, between downtown Falmouth Mall and Woods Hole. Additionally, the Greater Attleboro Regional Transit Authority (GATRA) operates the "OWL" (Onset-Wareham Link) with service to the Massachusetts Maritime Academy, Main Street in Buzzards Bay, and across the Bourne Bridge to Tedeschi's (convenience store) near the Bourne Rotary. The Cape Cod RTA b-bus/Dial-A-Ride Transportation (DART) service is a paratransit service operating seven days a week for any resident in the upper Cape.

Ferry Service

This sub-region also has links by water between Falmouth and Martha's Vineyard. The Steamship Authority ferries operate between Woods Hole and the Vineyard carrying passengers, bicycles, automobiles, and trucks. In the summer of 2010, the SSA operated close to 30 round trips per summer weekday (some of these trips were freight deliveries, and would only take passengers if space was available). In addition, two private ferry operators provide passenger service between Falmouth Harbor and Martha's Vineyard during the summer season.

Bike Facilities

The Boston to Cape Cod Bikeway, also known as State Bicycle Route 1 and the Claire Saltonstall Bikeway reach the Cape Cod region on Route 3A in Bourne and follows Route 3A to Meetinghouse Road that connects to the Sagamore Bridge. Once over the Bridge, this bicycle route connects with Route 6A to the intersection with Route 130 in Sandwich. State Bicycle Route 1 proceeds south on Route 130 to its junction with the Service Road in Sandwich. The bike route continues on the Service Road in Sandwich and into the Town of Barnstable. Other bicycle trails include the bike paths along both sides of the Canal in Bourne and the Shining Sea Bike Path which connects North Falmouth to Woods Hole passing the downtown.

Rail Service

The third bridge across the Cape Cod Canal is the railroad bridge. Typical Cape Cod freight shipments by rail are made three to four times per day year round; this is primarily to transport trash to the SEMASS waste-to-energy plant in Rochester. The Cape Cod Central Railroad operates excursion train service between Hyannis and Sandwich (typically four round trips during the tourist season).

2.8.1.2 Transportation Issues and Problems

- Under-utilized third (rail) bridge over the Cape Cod Canal;
- Most of freight shipment is by trucks;
- Recent land development which is auto-oriented;
- A need for more local transit service;
- Motor vehicle traffic congestion on highway bridges;
- Improved ferry service from off-Cape locations to the islands; and
- Maintenance of Bridges

Cape Cod Canal Area

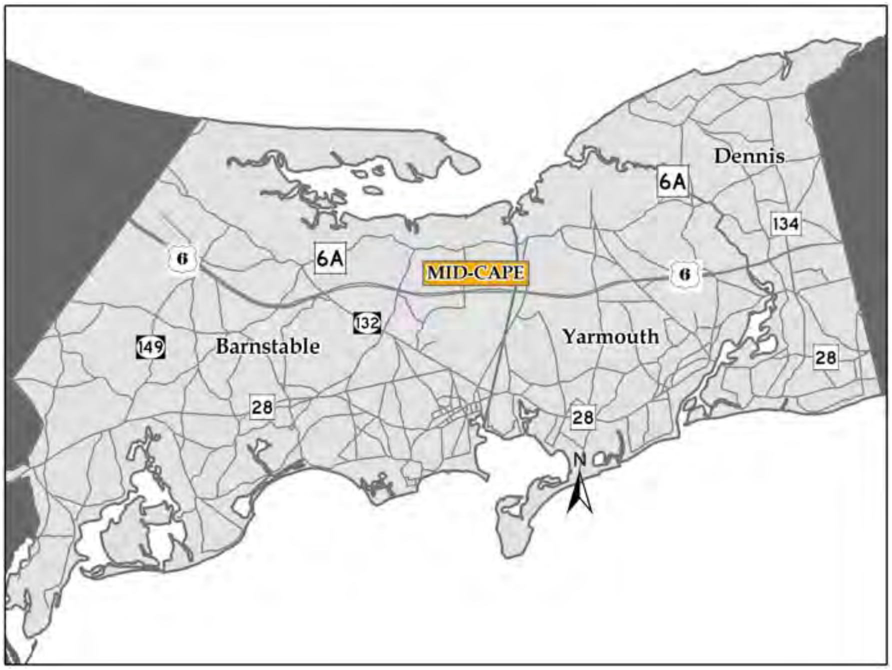
An important transportation subset of the Upper Cape contains the roads and bridges along and over the Cape Cod Canal. The Canal Area includes the approaches to the Sagamore and Bourne Bridges and the roadway systems that serve the area. This area has been the subject of a number of studies that have looked at improvements and major new construction such the replacement of the old Sagamore Rotary.

A number of promising projects have been developed by the Canal Area preliminary planning study which includes:

- Sandwich Road Parkway
- Relocation of Interchange 1
  - Interim closures of the westbound Exit 1 on-ramp to help improve traffic flow over the Sagamore Bridge in the off-Cape direction
- Median Barrier for the Scenic Highway
- Scenic Highway/Route 25 Ramp
- Canal Area Intelligent Transportation Systems (ITS)

Two of these projects (Sandwich Road Parkway and the Scenic Highway/Route 25 Ramp) have been adopted by the Bourne Planning Board. These promising projects need to be pursued further as they appear to have significant potential benefits. The Cape Cod Canal area transportation system is discussed in greater detail in the previous sub-chapter (2.7).

2.8.2 MID-CAPE



The Mid-Cape includes the towns of Barnstable, Yarmouth, and Dennis and form the "urban core" of the Cape. They include 27% of the land area of Cape Cod, and contain 85,550 residents or 38.7% of the Cape's population. They also contain 44.1% (38,956 of 88,409) of the jobs in the county.

2.8.2.1 Transportation Facilities

The transportation infrastructure for this sub-region includes approximately 800 miles of roadways, intercity and local bus services, limited rail service, commercial airline service and ferry service. An intermodal transportation center to coordinate these different transportation services in Hyannis was opened in 2002 near the existing bus and railroad stations. Mobility to and within this "urban core" is beneficial for access to regional and local services, such as the transportation connections, the Cape Cod Hospital, Route 132 retail areas and downtown Hyannis. Other facilities in the Barnstable/Yarmouth area include Cape Cod Community College, located on Route 132, the YMCA, the Cape Cod Conservatory, and the Barnstable County Complex on Route 6A.

The major west-east corridors (Route 6, Route 6A, and Route 28) link the towns of Barnstable, Yarmouth, and Dennis both amongst each other and the other sub-regions of Cape Cod. Rail right-of-way comes into the Town of Barnstable from the west and forks with one section heading through Yarmouth and Dennis to Route 134 and the other turning south, terminating in Hyannis. This sub-region also has links by air and water in the Hyannis area of Barnstable. Commercial air services are available at the Barnstable Municipal Airport and ferries operate from Hyannis Harbor to the islands.

Roadway Network

The three primary roadway corridors are Route 6, Route 28, and Route 6A. Route 6 is a four-lane freeway divided by a vegetated median. Route 28 is mostly a two-lane roadway with occasional turning lanes, with a short, four-lane section in Centerville. Route 6A is an historic/scenic byway with two narrow lanes and roadside features such as stone walls and large trees.

The limited-access, four-lane, median-divided, Mid-Cape Highway, or Route 6, has five access points through this section of Cape Cod. Major regional roadways emanate in both northerly and southerly directions from the Route 6 exits. Commercial areas have developed on four of these north/south connectors increasing travel demand and leading to sections of widened four-lane roadway on Route 132 and three lanes on Union Street/Station Avenue.

Transit Service

Scheduled Plymouth & Brockton Street Railway Co. bus service operates from Boston into Hyannis on Route 6 stopping at the Park-and-Ride commuter lot in Barnstable and continuing down Route 132 and Barnstable Road to the transportation center in downtown Hyannis. The Cape Cod RTA operates a regional year-round fixed route bus service called the SeaLine from Falmouth to the Hyannis Transportation Center. Along Route 28 from Hyannis to Orleans, the Cape Cod RTA operates the H2O Line, a year-round bus service. The Cape Cod RTA also operates a paratransit service called the b-bus/Dial-A-Ride Transportation (DART). The b-bus/DART operates in all towns of the mid-Cape, 7 days a week, year round.

Bike Facilities

The State Bicycle Route 1 or Claire Saltonstall Bike Route follows the Service/Access Road in Barnstable from the Sandwich town line across Route 149 to Route 132, Route 132 to Phinneys Lane, Phinneys Lane/Hyannis Road to Route 6A, and east to Setucket Road in Yarmouth. This route continues along Setucket Road as a bike path into Dennis and Brewster. The western trailhead of the Cape Cod Rail Trail is located on Route 134.

A north/south bicycle path branches from the Claire Saltonstall route at Route 149 and heads south along Old Stage Road leading to a path along the south side of Route 28 which runs east to Bearses Way in Hyannis. Many bicyclists are making trips in the sub-region though few roadways comfortably accommodate bicycle use.

Air Service

This region contains the major commercial airport on Cape Cod, Barnstable Municipal Airport. Air service is available several times each day on several different carriers between the Barnstable Municipal Airport and other destinations including the Islands and Boston.

Rail Service

The Cape Cod Central Railroad operates excursion train service between Hyannis and Sandwich. Service includes four round trips of various types of excursions on Tuesdays through Sundays during the tourist season.

Ferry Service

The Steamship Authority operates passenger, automobile, and truck ferry service between Hyannis and Nantucket year-round. Private companies operate passenger service between Hyannis and Nantucket year-round and passenger service between Hyannis and Martha's Vineyard during the summer.

North/South Transportation Links

There are five areas within the Mid-Cape that provide north/south transportation connections from the transportation "spine" of Route 6:

Roadway Links

- In the western part of Barnstable, Route 149 (a two lane roadway) connects Route 6A and 28 as well as providing access to Route 6 at exit 5.

- Route 132 in Barnstable/Hyannis provides a link from Route 6A and Route 6 at Exit 6 to the Barnstable Municipal Airport and Route 28 at the Airport Rotary where Route 132 terminates. Route 132, the Cape's largest commercial and retail corridor, is two lanes from Route 6A to just before the signalized intersection at Phinneys Lane where it widens to an undivided four lane roadway. The four lane roadway continues through three more signalized intersections to the Capetown Plaza and the Cape Cod Mall entrances where a small median barrier exists. Route 132 narrows as it approaches and connects with Route 28 at the Airport Rotary.

- Willow Street in Yarmouth at Route 6, exit 7 connects with Route 6A to the north and Yarmouth Road at the Barnstable town line which leads to Route 28 and into Hyannis for an alternative to 132 for access to the downtown area.   This access to Main Street, Hyannis passes the new Steamship Authority parking lot at the corner of Yarmouth Road and Main Street; this lot is just east of the railroad tracks and the Hyannis Transportation Center. In addition, this exit is the primary access route to the Cape Cod Hospital from Route 6. From Willow Street near the Route 6 exit ramps, Higgins Crowell Road provides a connection to Route 28 in West Yarmouth. Higgins Crowell Road also intersects with Buck Island Road, an alternative to Route

28 for east-west traffic in the area and may be realigned at the Willow Street end to improve traffic flow at Exit 7. Further south from Route 6 down Willow Street is Camp Street which also connects both to Buck Island Road and Route 28. Though travel demand is high in this area, few alternative provisions are present. The Town of Yarmouth has recently constructed improvements for Buck Island Road which include bicycle accommodation. Route 28 has bicycle traffic, especially in the summer season when seasonal workers commute via bicycle, yet the roadway has many access points and no markings for bicyclists.

- Union Street/Station Avenue at Exit 8 in Yarmouth is a main connector between Route 6A and Route 28 for destinations in Yarmouth and Dennis. This corridor includes an undivided roadway and offers few alternatives to the automobile.

- Route 134 in Dennis provides a link form Route 6A in the north and Route 28 in the south to Route 6. Local road connections at either end serve neighborhoods and beaches. This roadway is two lanes except for a four-lane section between Route 6 and Upper County Road. This section, near the Patriot Square shopping center also includes a center lane for turning. Traffic signals are located at Route 6A, Setucket Road, Bob Crowell Road, Patriot Square, T.F. Smith Road, Upper County Road, and at Route 28. Adjacent to Route 134 is the parking lot for the western end of the Cape Cod Rail Trail. The interchange at Route 6 and 134 is the first full-cloverleaf (directional ramps at all four quadrants) on Cape Cod.

Transit Service

- A year round bus service connecting the villages of Cotuit, Marstons Mills, and West Barnstable via Route 149 was tried from November 1995 through June 1996 and had little ridership. The area is primarily low-density housing north of Route 6.

- The Cape Cod Regional Transit Authority operates a local bus service called the Villager. The *Villager* service begins at the Barnstable County complex, travels along Route 6A to Route 132 and connects with each of the Malls and to the Barnstable Municipal Airport and terminates at the Hyannis Transportation Center. The bus operates eleven daily round-trips, Monday through Friday, and seven round-trips on Saturdays.

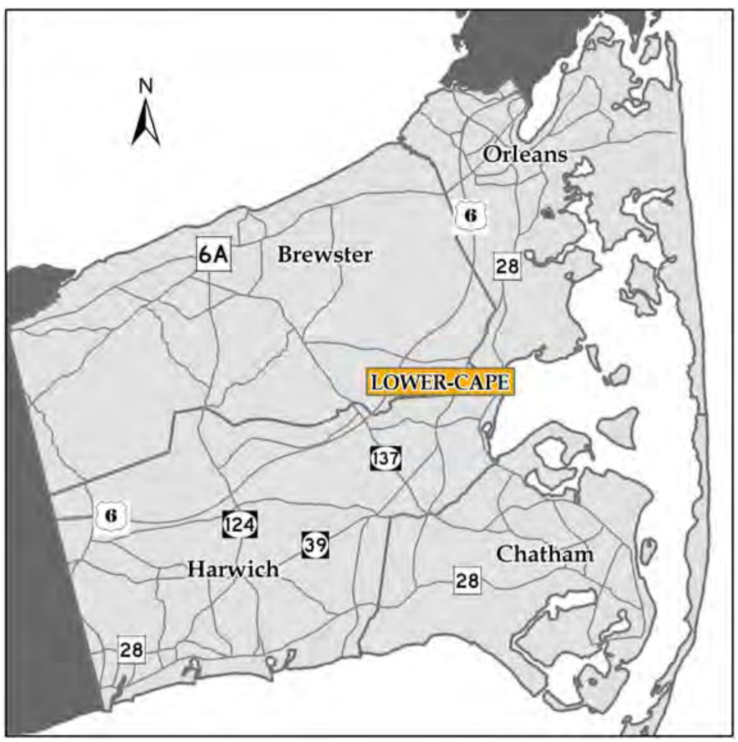
2.8.2.2 Transportation Issues and Problems

Geography, environmental constraints, cost, character issues, and policy restraints generally make it difficult to building additional highway systems or add capacity to the existing roadways. Many in the area have expressed a strong desire to find alternatives to widening roadways.

Development of a more balanced and coordinated system will improve the efficiency of the Barnstable/Yarmouth area infrastructure in a cost-effective and environmentally friendly manner thereby improving the quality of life. Town-level policy and land use decisions affect the operation of the transportation assets and must include consideration of the transportation implications. Growth centers must be chosen which provide for efficient transit connections to encourage this alternative. With redevelopment or new development along major routes, the responsible agencies should require a transit oriented connection to the major roadways and require parking to be located at the back or side of the development. To support development of these alternate modes in the Barnstable/Yarmouth area, some alternatives have been identified:

- The intermodal center in Hyannis has the potential to create a more efficient, connected system for transfers between modes which will aid in allowing for more trips without an automobile. In addition, increased trips by pedestrians and bicyclists will be encouraged with improvements for safety of these trip types.
- Accommodation of bicycles with the addition of lanes for this mode should be considered for major routes such as Routes 28 and 132.
- A bicycle connection to the intermodal center site as a spur from the westerly extension of the Cape Cod Rail Trail into Yarmouth and Barnstable will provide additional alternative mode benefits for the region.

2.8.3 LOWER CAPE



The Lower Cape includes the towns of Harwich, Chatham, Brewster, and Orleans and lies east of the heavily developed Mid-Cape and south of the Outer Cape. These towns make up the “elbow” of Cape Cod. This sub-region is approximately 19% of the land area of the Cape. In 2000, these towns contained 35,231 residents (15.9% of the Cape) and 15% (13,241 of 88,409) Cape Cod’s jobs.

2.8.3.1 Transportation Facilities

This region has an extensive network of roads; 63 miles of state highways and over 400 miles of local roads. However, it has a limited transit system. It does, however, contain several bikeways and roads appropriate for biking. Mobility across this region is important because it provides the only land connection to the Outer Cape. It also contains several regional destinations such as Nickerson State Park, Cape Cod National Seashore sites, and the commercial center of Orleans.

Roadway Network

Routes 6, 6A, and 28 all traverse the region from the Dennis boundary to the Orleans rotary, where they all meet. In addition, Routes 134, 124, and 137 cross the sub-region from north to south, Route 39 also cuts across Harwich and Chatham, providing a shorter route than Route 28 across the southern part of the sub-region. In 1996 a Park-and-Ride lot with room for 77 cars opened at the Route 6/Route 124 interchange in Harwich (exit 10).

It is interesting to note that the directional signs on some state routes in this sub-region are confusing due to the geography of the sub-region. For example, Route 28 is signed as Route 28 South as it heads from Dennis to Orleans despite the fact that it travels first east, then north before ending at the Orleans Rotary.

Transit Service

P&B operates 6 round-trips per day along Route 6 from Hyannis to Provincetown during the summer. The Cape Cod RTA runs six trips per day on the H2O Line along Route 28 from Hyannis to Orleans. Introduced in 2006, the *Flex* service provided fixed-schedule service with deviations of up to ¾ mile from its main route. *Flex* service included major corridors and destinations in the towns of Harwich, Brewster, Orleans, Eastham, Wellfleet, and Truro, in addition to coordination with Provincetown shuttle service.

Rail Service

Tracks coming from the west have been abandoned east of the Yarmouth transfer station. There is no longer any rail service in this sub-region. The tracks that formerly crossed into the region have now been replaced by the Cape Cod Rail Trail.

Bike Facilities

The main bike facility in this sub-region is the Cape Cod Rail Trail, built on the old rail right-of-way from Dennis to Wellfleet. This route provides a major east-west corridor for (mostly recreational) bike traffic across the elbow of Cape Cod. This bike path is uninterrupted and serves many villages, beaches, and Nickerson State Park where additional bike facilities exist. The Harwich-Chatham Spur connects downtown Chatham to the Rail Trail near Harwich center.

Air Service

There is only one airport in this region, Chatham Airfield, and no scheduled commercial traffic uses this airfield.

Ferry Service

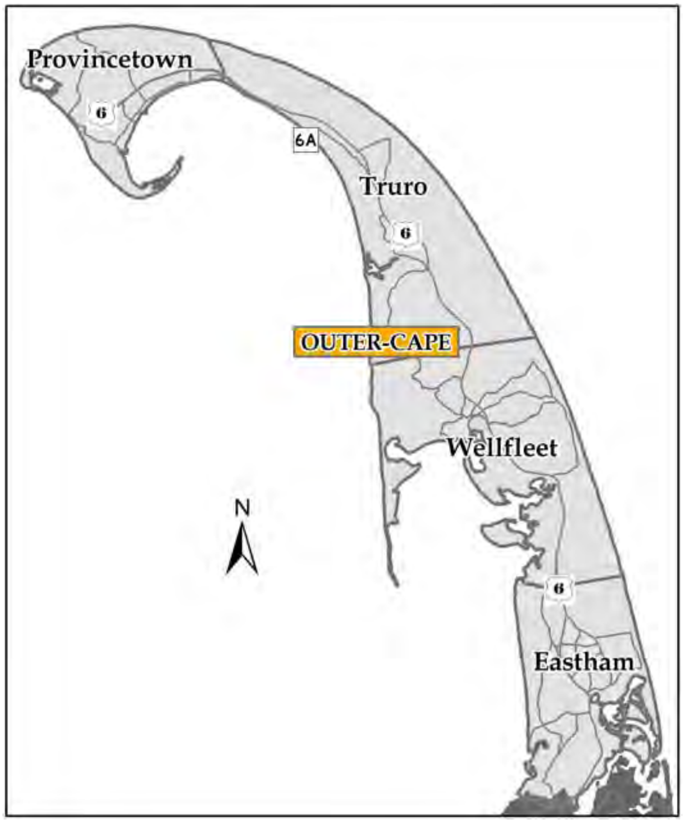
High speed passenger ferry service, which accommodates bicycles, operates from Harwich to Nantucket during the summer. This service operates from late May until Columbus Day and includes 3 round trips per day.

2.8.3.2 Transportation Issues and Problems

This area is generally less congested than other areas of the Cape, although certain road segments such as Main Street in Chatham, west of downtown, operate well over capacity during peak hours. However, as noted in the Monomoy Capacity Study, the roads of this region are predicted to become considerably more congested in the next ten years if current land use patterns and growth rates continue. If the current trend of converting seasonal housing to year-round use continues, congestion could continue to worsen, and may persist for longer portions of the year.

The Lower -Cape region is also where Route 6 becomes a limited access highway with one lane in each direction (between exit 9 in Dennis and exit 10 in Harwich). This is an unusual configuration, particularly because an entire section of the highway is built along only half of the right-of-way. The right-of-way was acquired as part of the original plan to build a four lane highway all the way to the Orleans rotary from the Cape Cod Canal. Lane separation, a center berm, and delineation improvements were installed in the late 1980s and early 1990s to improve safety for two-lane operation.

2.8.4 OUTER CAPE



The Outer Cape includes the towns Eastham, Wellfleet, Truro, and Provincetown. Much of the Outer Cape is protected from development by the National Seashore. The Outer Cape towns include 16% of the land area of Cape Cod, and contain an estimated 13,844 year round residents (6.3% of the Cape). They also possess 5.8% (5,161 of 88,409) of the jobs in the county.

2.8.4.1 Transportation Facilities

Transportation infrastructure includes over 430 miles of state and town maintained roadway, limited intercity and local bus services, commercial airline service, and passenger ferry service. Various bicycle paths exist through the area; pedestrian facilities are primarily located in village centers.

Route 6 is the major north-south corridor that links the Outer Cape towns - both to each other and the other sub-regions of Cape Cod. Small-scale commercial air services are available at the Provincetown Airport. Passenger ferries between Provincetown and Plymouth or Boston operate 6 round trips during the summer.

Roadway Network

The main road in the region, Route 6, includes a four lane undivided cross-section through most of Eastham without shoulders. From South Wellfleet to Truro, Route 6 is restricted to two lanes with shoulders and occasional turning and through lanes at intersections. In North Truro to Provincetown, Route 6 is four lanes with a vegetated median in some sections.

Transit Service

Scheduled Plymouth & Brockton Street Railway Co. bus service operates from Provincetown to Hyannis. Currently the service operates 5 round trips per day, including stops in Provincetown, North Truro, Truro, Wellfleet, South Wellfleet, North Eastham, and Eastham. A paratransit service called the b-bus/Dial-A-Ride Transportation (DART) is available in these towns and is provided by the Cape Cod Regional Transit Authority (Cape Cod RTA) on an "on call" basis. Introduced in 2006, the *Flex* service provided fixed-schedule service with deviations up to 3/4 mile from its main route. *Flex* service included major corridors and destinations in the towns of Harwich, Brewster, Orleans, Eastham, Wellfleet, and Truro, as well as in coordination with the Truro-Provincetown shuttle service.

Bike Facilities

The Cape Cod Rail Trail connects the area from other parts of the Cape. The original route used Rock Harbor Road; the bicycle bridge in Orleans allows the trail to follow former railroad right-of-way all the way through Eastham to LeCount Hollow Road in Wellfleet. The State Bicycle Route 1 or Claire Saltonstall Bikeway (which uses the trail) continues along side roads and bike path segments until North Truro and Provincetown where it follows Route 6A.

Air Service

This region contains Provincetown Airport. Typical air service from and to Boston runs between 5 and 8 trips in each direction per day in the summer and 6 trips per day in the winter.

Ferry Service

Passenger ferry service operates from Provincetown to Boston and Plymouth during the summer. For 2010, there are 3 round trips per day scheduled between Provincetown and Boston with an additional excursion trip on summer Saturdays. One roundtrip is scheduled to and from Plymouth. These services operate in the tourist season. The Cape Cod Commission Strategic Plan for Expanded Water Transportation to Provincetown had several recommendations for expanding the service to the "shoulder seasons" due to increasing demand for service.

2.8.4.2 Transportation Issues and Problems

Some Outer Cape roadways are operating near design capacities, due to the rise in tourism and year-round populations in the region and an increased reliance on single-occupant vehicles. However, geographic, cost, character issues, and policy restraints largely preclude building additional highway systems or adding capacity to the existing roadways. In other parts of the country where roadway widening has been possible, mobility was generally not enhanced for the long term. Public consensus indicates a strong desire to find alternatives to widening roadways.

Some alternatives have been identified. Creation of a convenient trolley shuttle system and facilities to encourage use of bicycles for commuting will help by providing alternatives to driving alone.

2.8.5 CONCLUSION

Transportation to, from, and within Cape Cod is in many ways unique. Each its own microcosm – the Cape's sub-regions are faced with their own limitations and opportunities. The roughly linear geography of the Cape means that transportation decisions in one sub-region will affect its neighbors to varying degrees. Therefore, decisions made for a particular sub-region are usually not amenable to a "one-size fits alls" approach.

The Upper Cape transportation system serves as a gateway to all fifteen Barnstable County towns, and decisions should respect the needs of local travelers in addition to inter-regional travel. The Mid-Cape area includes many of the regional services (e.g., Airport, Hospital, etc.) and is a major employment center. The Lower Cape communities mark a transition to more seasonal activity. Home to most of the Cape Cod National Seashore's attractions, the Outer Cape's relative remoteness from urban centers corresponds to the largest annual cycle of low-to-high levels of traffic.

CAPE COD COMMISSION

2012 REGIONAL TRANSPORTATION PLAN

Chapter 3: Safety

Endorsed
August 22, 2011

COUNTY OF BARNSTABLE
MASSACHUSETTS

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3. Safety

The concern over safety is made clear in the first goal of the Regional Transportation Plan:

"*Create a transportation system that provides safe travel options for people and freight, and protects users from natural and external threats.*"

Transportation users have a right to a transportation system where their person and possessions will arrive at their destinations unharmed and undamaged. Moreover, protecting the value of freight traveling over the transportation network is essential to the economy of Cape Cod. Therefore, it is important that transportation infrastructure be designed to minimize the possibility of hazardous situations or accidents. Existing traffic laws must also be enforced to prevent the improper use of the transportation system. For all of these reasons, the Regional Transportation Plan sets the goal of providing safety for people and goods.

This chapter includes sections describing the seasonal and year-round issues affecting traffic safety including a description of the Cape demographics and some information about how they will change over time. Summaries of important safety studies are presented as well.

3.1 SAFETY PROBLEM AREAS

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

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

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

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

(Responses as of 8/23/2010)

3.1.1 INTERSECTIONS OF CRITICAL SAFETY CONCERN

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

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

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

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

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

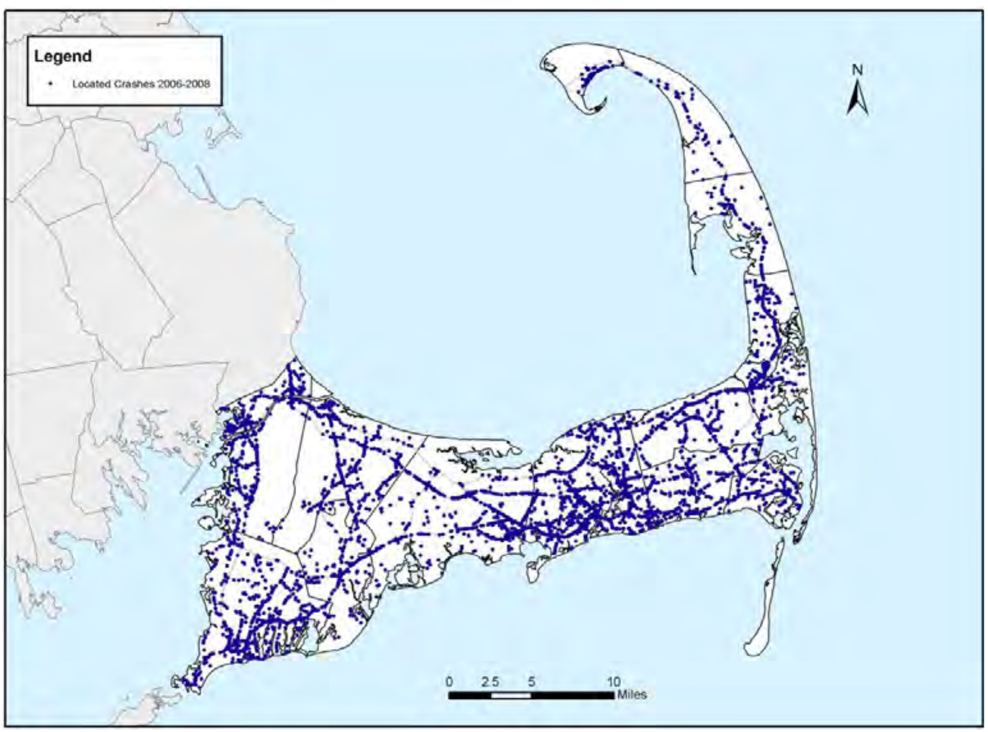

FIGURE 1 - CAPE COD LOCATED CRASHES 2006-2008
(Source: MassDOT Crash Records 2006-2008)

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

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

TABLE 2 - TOP LOCATIONS BASED ON NUMBER OF CRASHES

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

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

TABLE 3 - TOP LOCATIONS BASED ON EQUIVALENT PROPERTY DAMAGE ONLY

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

Source: MassDOT 2006-2008 Crash Data

TABLE 4 - TOP LOCATIONS BASED ON CRASH RATE

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

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

TABLE 5 - TOP LOCATIONS BASED ON EPDO RATE

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

Source: MassDOT 2006-2008 Crash Data

TABLE 6 - INDEX OF NOTES

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

3.2 CAPE COD DRIVERS

The demographics of Cape Cod depict a typical year-round resident that is older than the average population in the United States. Nearly 50% of Cape Cod's population as reported in the 2000 census was aged 45 or older. This trend is continuing. The migration of retirees to Cape Cod and a stable aging population is not being offset by new younger residents or births. With the trend toward an older population in America, the Federal Highway Administration (FHWA) has recognized that older drivers require special consideration. This recognition is demonstrated in the publication of several recent documents and a special address to Congress by the National Highway Traffic and Safety Administration (NHTSA). The focus in both cases was on the behavior of older drivers with respect to the "typical" driver. The NHTSA address also included issues related to younger drivers. Recommended guidelines for design standards that will help accommodate the needs of an older driver are also included in the literature.

Another dimension defining the unique character of Cape Cod drivers is their seasonal nature. The Cape is inundated with visitors, many of whom are not familiar with Cape Cod roads. Drivers that are used to city streets or parkways are also subjected to the scenic rural roads that compose a significant part of the Cape's character. The physical nature of these roadways may be somewhat unfamiliar to off-Cape drivers, leading to safety concerns.

Among the many drivers that visit to the Cape in the summer are a large number of younger motorists. These drivers have less experience in familiar surroundings and even less in the Cape driving environment. This coupled with a "vacation attitude" requires more considerations for roadway design and planning. These considerations must also be balanced with the natural qualities that bring people to Cape Cod.

3.2.1 THE SENIOR DRIVER

A large and increasing percentage of Cape drivers are 65 and older. According to the 2000 census, 23% or 51,399 residents of Barnstable County are aged 65 or older (see following table). This steadily increasing proportion of drivers will experience declining vision, slowed decision making and reaction times, additional difficulty in dividing attention between potential conflicts and traffic information, and reductions in strength, flexibility, and overall fitness. In many cases, these difficulties will outweigh the additional experience that older drivers have operating an automobile. The large majority of drivers who suffer from age-related driving deficiencies are not aware that a problem exists.

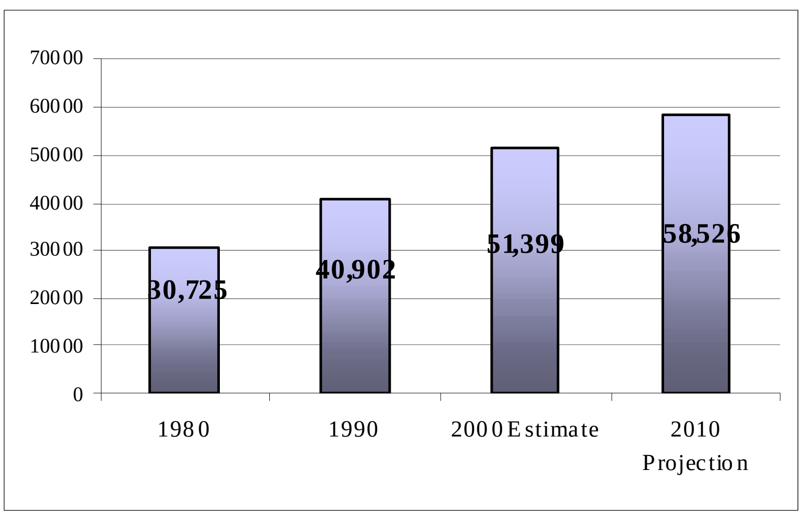

FIGURE 2 - CAPE POPULATION OVER 65

The overwhelming majority of Cape intersections are at grade. Based on FHWA crash statistics for drivers, 80 years and older, more than 50% of fatal crashes occur at intersections. This is compared with 24% or less for drivers up to age 50. According to studies referenced in the FHWA *Older Driver Highway Design Handbook* (1998), as driver age increases, involvement in intersection crashes increase as well. Older drivers typically experience two types of at-grade intersection difficulties. Left turn difficulties result from lack of sufficient caution and poor positioning on the road during the turn. Stopping difficulties result from a failure to stop, a failure to make complete stops at stop signs, and stops that were abrupt. Comparing survey responses of drivers aged 66 to 68 with those aged 77 and older, showed that the older group had more difficulty following pavement markings, finding the beginning of left hand turn lanes, and driving across intersections. Another study of older drivers indicated that the most challenging aspect of intersection negotiation is making left turns during the green, left turn permitted signal phase. The protected "green arrow" left hand turn has been identified as an important improvement for older drivers.

Nighttime driving is associated with a higher crash risk for all drivers; however the effect of aging on vision is particularly compounded by the effect of darkness. The aging process causes gradual declines in a variety of ways; acuity, contrast sensitivity, glare recovery, and peripheral vision. These declining functions make night driving particularly difficult for older drivers. The ability to notice and recognize objects at night and in low-light conditions such as dawn, dusk, rain, fog, haze, and snow is a chief concern. According to studies referenced in the FHWA handbook show that between age 20 and age 70, contrast sensitivity is reduced by a factor of three. This places the typical older driver at a relative disadvantage in low-light conditions. As expected, older drivers require significantly larger letters to read unfamiliar signs. Current sign standards are based on an assumed vision of 20/25 (as opposed to "perfect" 20/20 vision). Older drivers require a standard of 20/46.

3.2.2 OLDER DRIVER RECOMMENDATIONS

Based on the issues associated with the older driving population on Cape Cod the following suggestions are recommended as considerations for Cape Cod roadway improvements. Many of these recommendations are from FHWA's *Older Driver Highway Design Handbook* (1998). This resource should be consulted for more details. The Older Driver Handbook includes other recommendations and guidelines that should be considered in Cape roadway design but their use should also be tempered to maintain the character of Cape Cod's roadways.

Recommendations to accommodate older drivers include:

- Considering protected left turn phases into signalized intersections;
- Maintaining delineation through more frequent restriping and street cleaning;
- Improving signage standards to include larger lettering;
- Improving lighting level standards, in particular at intersections. Consider placing utilities underground and installing breakaway safety poles for lighting;
- Considering "all red" phases for signalized intersections;
- Establishing driver education programs for older drivers; and
- Providing education on other options for mobility.

Mobility programs to provide alternatives to driving also need to be improved. This was a major topic at Cape Cod's February 2000 Transit Summit. The recommendations from the Summit included a "dual challenge" of reducing auto dependency and meeting the needs of the transit dependent and those in need of human services. By improving mobility options, significant safety improvements may be realized. A short-term public transportation plan by the Cape Cod Transit Task Force has been developed with an emphasis on human service needs.

3.2.3 YOUNG DRIVERS

Safety and age-related crash statistics indicate that younger drivers' (under age 25) problems exceed those of any other age group. The shorter average trip length of older drivers is accompanied by a higher frequency of fatal crashes. Young drivers outnumber, out-travel, out-crash, and die more frequently by any other measure. There are slight differences between younger and older drivers in the types of crashes they experience. For example, young drivers have more speeding and alcohol-related crashes. Younger drivers' crashes are frequently caused by inexperience, poor judgment, and risk taking, while older drivers' crashes are more often related to reduced physical and cognitive capabilities.

Although most crashes occur at intersections, young drivers show a greater tendency than other age groups to be involved in non-intersection crashes. According to NHTSA statistics, 43% of crashes by drivers age 15 to 24 are at non-intersection locations. That number reduces to 41% for drivers age 25 to 64 and 31% for drivers age 65 to 74.

Younger drivers are more prone to risk-taking behavior and are subject to influences of youth culture and peer pressure. Many of these characteristics are evident in young visitors to Cape Cod.

3.2.4 YOUNGER DRIVER RECOMMENDATIONS

Recommendations to accommodate younger driver safety issues are divided between residents and visitors:

- Increased education for local young drivers.
- Additional enforcement and warnings during the busy traffic season to reach out to young visitor drivers.
- Develop and implement an advertising campaign and roadside signage reminding drivers that traffic and drunk driving laws are strictly enforced on Cape Cod.

3.2.5 ADDITIONAL RECOMMENDATIONS

Additional recommendations include:

- Better signage for visitors directing them to popular destinations (e.g., larger, well-located signs to direct patrons of the Hyannis Transportation Center may improve safety at the driveway on Route 28).
- Signage explaining the rotary "rules of the road" and similar information to be included in visitor brochures and Cape-related websites such as 'Go Cape Cod:

www.gocapecod.org

3.3 THE CAPE COD ROADWAY

There are nearly 3,900 miles of roadways in Barnstable County. These include 608.5 miles of Arterials and 238.9 miles of Collectors. The remaining 3,018.5 miles included local roads and the many miles of unimproved ways. The typical posted speed limit on the Cape is less than 40 miles per hour (mph) and, on average, the roadways carry 175% more traffic in July and August than they do in January and February.

The character of Cape Cod's rural roads includes narrow lanes and a typical speed limit of 35 mph. Most roads do not have shoulders and bicycles must often share the lanes with motorists. Many of the older roads evolved from Indian trails and stagecoach routes. Roadway geometry is therefore less accommodating than current state and federal standards. Included in the goals of this Plan is the preservation of the scenic and rural character of Cape Cod's narrow, winding roads. However, this must be accompanied by a program of enforcement and education especially for the drivers that visit the Cape in the summer. The following tables list crash rates for Routes 6, 6A, and 28, respectively. For comparison purposes, the latest available three years' data were from 2006-2008.

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

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

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

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

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

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

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

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

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

3.3.1 SAFETY IMPROVEMENTS THROUGH INTERSECTION MODIFICATION

To help quantify the benefits of various safety treatments, several resources were consulted including *The Traffic Safety Toolbox: A Primer on Traffic Safety*, Chapter 28, Institute of Transportation Engineers, 2000; and *Prediction of the Expected Safety Performance of Rural Two-Lane Highways*, Chapter 5, Federal Highway Administration, 2000. These reports include discussions on various vehicular access treatments and predictions of "Accident Reduction."

3.3.1.1 Modern Roundabouts v. Four-Way Intersections

A roundabout is a type of circular intersection with specific design and traffic control features. These features include yield control of all entering traffic, channelized approaches, and appropriate geometric curvature to ensure that travel speeds on the circulatory roadway are typically less than 20 mph. The decision to install a roundabout as a safety improvement should be based on a demonstrated safety problem of a type susceptible to correction by a roundabout. FHWA's *Roundabouts: an Informational Guide*, (FHWA –RD-00-067, June 2000) provides a review of the safety improvements afforded by roundabouts. For example, safety problems that could be improved by a roundabout include:

- High rates of crashes such as right angle, head-on, left/through, U-turns, etc.
- High crash severity that could be reduced by slower speeds
- Site visibility problems that reduce the effectiveness of stop sign control
- Inadequate separation of movements, especially on single-lane approaches

The following figure shows that roundabouts have fewer annual injury crashes than rural two-way stop-controlled (TWSC) intersections, and the total number of crashes at roundabouts is relatively insensitive to minor street demand volumes.

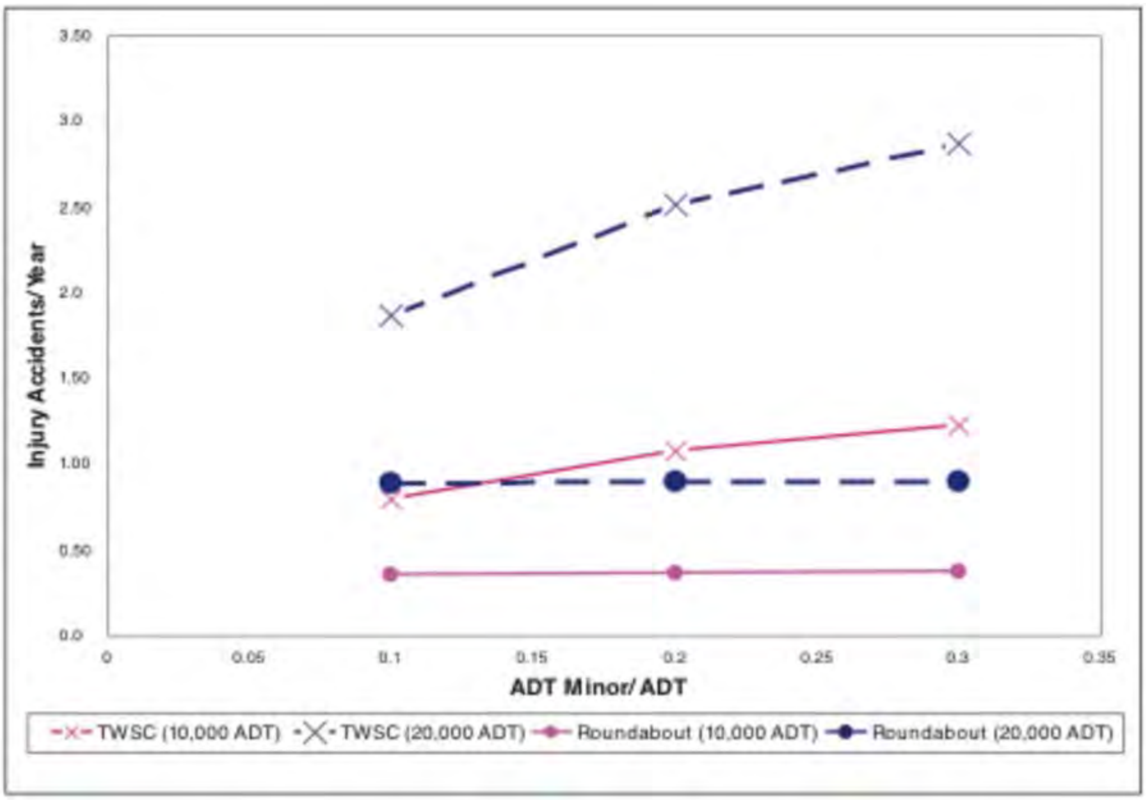

FIGURE 3 - COMPARISON OF PREDICTED ROUNDABOUT INJURY CRASHES WITH RURAL 2-WAY STOP -CONTROLLED INTERSECTIONS.
(Source: FHWA)

The Roundabout guide also includes information to compare roundabouts to signalized intersections. The following figure shows that roundabouts have fewer injury accidents per year than signalized intersections, particularly in rural areas. At volumes greater than 50,000 vehicles per day (shown on the figure as “ADT” – average daily traffic), urban roundabout safety may be comparable to that of urban signalized intersections.

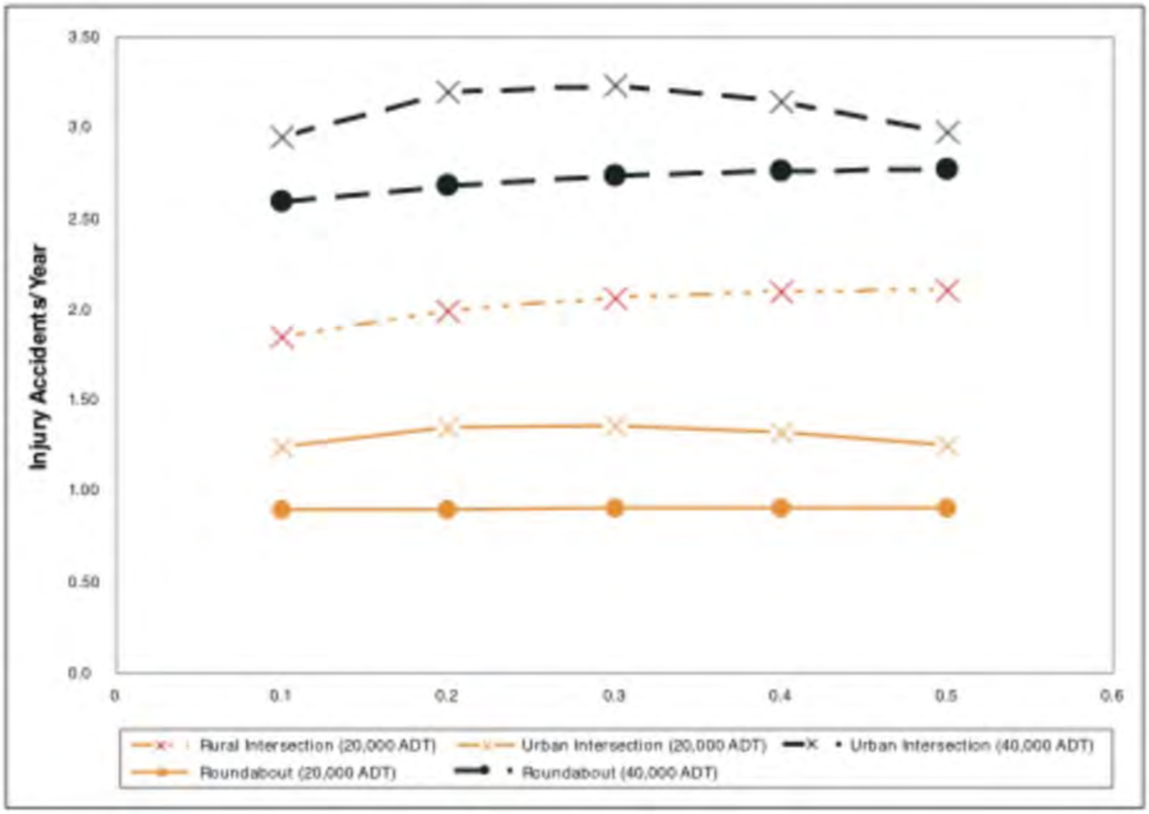

FIGURE 4 - COMPARISON OF PREDICTED INJURY CRASHES FOR SINGLE-LANE AND DOUBLE-LANE ROUNDABOUTS WITH RURAL OR URBAN SIGNALIZED INTERSECTIONS.
(Source: FHWA)

3.3.2 SAFETY-RELATED TECHNOLOGY

Improved technology provides new options for the enforcement of traffic laws and speed control. The Insurance Institute for Highway Safety (IIHS) and the FHWA have favorable reviews of applications such as red-light enforcement and photo radar. These techniques should be coupled with education as well, since a goal is to improve safety by deterring unsafe driving. The greatest benefit of these techniques has been a “halo effect” whereby drivers are complying with traffic laws in un-monitored locations as well as those where the technology has been installed.

3.3.2.1 Red Light Enforcement

According to IIHS, nationwide, drivers who run red lights are responsible for 260,000 crashes each year. Of these, approximately 750 are fatal. Motorists are more likely to be injured in crashes involving red light running than in other types of crashes: occupant injuries occurred in 45% of red light running crashes compared with 30% for other crash types. Enforcing red light laws by traditional means poses special difficulties for police, who in most cases must follow a violating vehicle through a red light to stop it. This poses a danger to motorists, pedestrians, as well as the officers. Red light running violations typically decrease by as much as 60% at intersections where cameras automatically enforce the law.

In areas where red light cameras have been installed as well as areas without cameras, most drivers have supported the use of red light cameras, 80% in cities with cameras and 76% in cities without.

3.3.2.2 Opticom System

Many of the Cape's signalized intersections are equipped with the Opticom priority-based pre-emption system. Opticom includes infrared detection equipment installed adjacent to the signal heads. When an emergency vehicle (ambulance, fire engine, etc.) equipped with an Opticom infrared emitter approaches the intersection, the detector notifies the signal controller and a green phase is maintained for the emergency vehicle (other approaches are held under a red phase). Signal pre-emption is vital for emergency responders to safely and quickly travel to incident sites. Agencies responsible for intersection signal maintenance should also ensure continuous operation of the Opticom system.   Upgrades to existing signals and new signal installations should be equipped with Opticom.

3.3.3 COORDINATION WITH MASSACHUSETTS' STRATEGIC HIGHWAY SAFETY PLAN

MassDOT, the Governor's Highway Safety Bureau, and many other agencies have participated in developing the state's 2006 "Strategic Highway Safety Plan" (SHSP). The overall goal of the plan is to reverse the increasing trend of traffic-related fatalities and injuries – towards zero fatalities and injuries. It is understandable that "zero fatalities or injuries" may not be achievable; however, any progress made toward this goal is worthwhile. In the short-term, the draft safety plan includes two "measurable goals:"

1. Achieve a 20% statewide annual reduction from 476 (year 2004) lives lost in traffic-related fatal crashes.
2. Achieve a 20% statewide annual reduction from 5,554 (year 2004) in non-fatal traffic-related injuries requiring hospitalizations.

The purpose of the SHSP is to identify the key safety needs in the Commonwealth and guide investment decisions to achieve significant reductions in highway fatalities and serious injuries on all public roads. The SHSP brings together all highway safety partners in the Commonwealth and draws on their strengths to align and leverage resources to collectively address the Commonwealth's safety challenges. The most important benefit of the SHSP is that statewide goals and safety programs are coordinated to most effectively reduce highway fatalities and serious injuries on all public roads.

The SHSP provides a comprehensive framework, and specific goals and objectives, for reducing highway fatalities and serious injuries on all public roads.

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

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

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

More information on the Strategic Highway Safety Plan is available online at:

<http://www.mhd.state.ma.us/default.asp?pgid=content/traffic/shsp&sid=level2>

Higher Risk Transportation System Users

The SHSP has identified "higher risk transportation system users" and potential strategies to improve their safety.

Pedestrian Safety

The safety plan promotes a vision that:

"*Increasing numbers of people throughout Massachusetts, residents and visitors alike, will be able to walk safely and conveniently to their destinations. Pedestrians,* *bicyclists, and drivers will be aware of each other's needs, and will act appropriately for the situation in which they are walking, riding, or driving. Walking will increase, while accidents involving pedestrians will decrease.*"

To support this vision, the safety plan includes a goal to "raise the awareness of pedestrian safety to motorists, the general public, visitors, and state legislators ultimately leading to a decrease in the number of crashes involving pedestrians."

Strategies suggested in the draft safety plan include:

- Publicize Pedestrian Safety resources
- Provide input to the Safety Chapter of the updated *Massachusetts Pedestrian Transportation Plan*
- Provide expert advice to communities that are trying to mitigate pedestrian risk

<u>Young Driver Safety</u>

The safety plan includes a goal to "reduce the number of crashes involving young drivers and encourage greater compliance with the Massachusetts Junior Operator Law." Strategies suggested in the draft safety plan include:

- Evaluating before and after Junior Operator Law data for crashes involving teen drivers;
- Educating parents of Junior Operator Law responsibilities; and
- Conducting literature /program review to determine best practices in prevention and driver behavior modification methods.

The safety plan will also include discussions on bicycle safety and older driver safety.

Infrastructure Safety

In the development of the draft safety plan, a need to better prioritize improvement projects was identified. An overall goal emerged to: "Encourage greater compliance with the *Manual on Uniform Traffic Control Devices* (MUTCD) and the MassDOT *Project Development and Design Guidebook*; and expedite safety-related infrastructure projects." Strategies suggested in the draft safety plan include:

- Institute Safety Project Prioritization Process
- Provide technical assistance to local communities
- Develop a draft Statewide Access Management Plan

Safety Project Selection Process

Through the development of the safety plan, participants noted the need to develop a process for prioritizing and funding safety projects. The following figure provides an overview of this process:

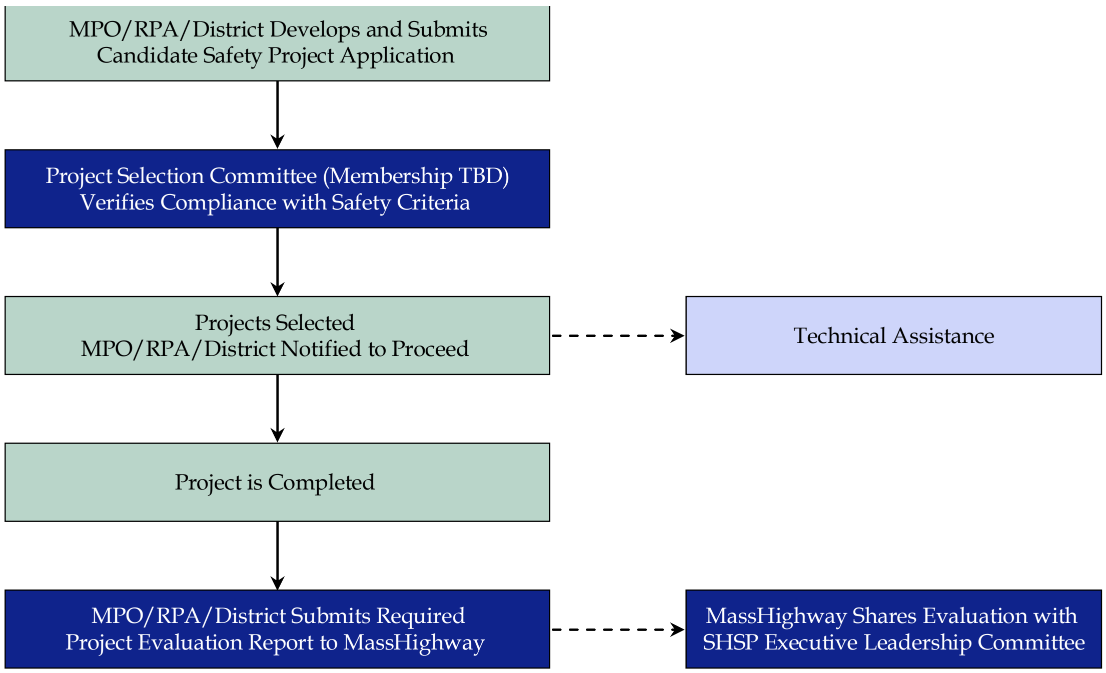

FIGURE 5 - INFRASTRUCTURE SAFETY PROJECT SELECTION PROCESS
Source: MassDOT Highway Division

At-Risk Driver Behavior

The safety plan includes a goal to "reduce the number of fatal crashes involving unbelted drivers and passengers, speeding, and alcohol-impaired driving." Strategies include:

- Tailor Messages Regarding Speed, Alcohol-impaired Driving, and Occupant Protection to Specific Audiences, particularly in locations or communities of high risk;
- Support the passing, education, and subsequent enforcement of primary seat belt legislation;
- Develop a web-based Statewide Safety Calendar;
- Increase enforcement, particularly high visibility checkpoints, and penalties for speeding and alcohol impaired driving; and
- Institute a Massachusetts Safety Report Card.

Public Education and Media

The safety plan includes a goal to: "Broaden the awareness of safety issues through dissemination of messages to the public and elected officials; assist other Emphasis Area Teams with implementation of their education- or media-related strategies; and assist the Executive Leadership Committee with roll-out of the SHSP." Strategies include:

- Encourage the reporting of standard safety-related information in any article or story regarding a motor vehicle crash;
- Disseminate messages regarding legislative changes that impact drivers or licensing; and
- Develop and maintain a web-based Safety Calendar.

3.3.4 POLICIES & STRATEGIES

In the interest of preserving the character of Cape Cod and achieving safer roads, non-traditional methods of improving safety must be explored. The following recommendations for improving safety will not substantially change the character of the roadways on Cape Cod. Recommendations consistent with the Massachusetts' *Strategic Highway Safety Plan's* (SHSP) "Emphasis Areas" are indicated with an asterisk.

- Consider Traffic Calming measures such as 4-way stop signs and roundabouts.*
- Improve striping maintenance and use of more reflective treatments.*
- Increase enforcement and police presence on rural roads such as 6A.*
- Investigate photo enforcement of red light running and speeding.*
- Make physical improvements that improve the safety and security of the transportation network a priority.*
- Continuously monitor the condition of the transportation system to ensure that it is safe to travel on all modes throughout Cape Cod.*
- Continue to identify the high priority safety locations throughout Cape Cod and then determine measures to increase safety at those locations.*
- Separate high and low speed travel modes, so that those traveling at slower speeds, such as bicycles and pedestrians, do not conflict with those traveling at higher speeds, such as rail and automobile traffic.*
- Encourage safe use of the transportation network through public awareness campaigns, promoting such things as seatbelts for motorists and helmet use for bicyclists.*

**Supports Massachusetts' Strategic Highway Improvement Program "Emphasis Areas"*

3.3.5 COMMUNITY CHARACTER/SAFETY ISSUES

The following recommendations are intended to preserve community character while addressing safety issues.

- Use alternative guardrail treatments, such as steel Corten or steel backed timber - all on wood posts, where guardrail is necessary.
- Consider roundabouts as an alternative to signalized intersections.
- Continue policies that disallow business logo signs on state highways in Barnstable County.
- Preserve all state owned/town owned land along roads and other transportation rights-of-way, for transportation uses and/or conservation.
- Prohibit pruning and clearing within state rights-of-way except for safety purposes, such as making sight distance improvements.
- Encourage ornamental signal posts and mast arms.
- Develop design guidelines for Cape Cod to document preferred treatments in design concepts and details.
- Encourage use of simulated brick crosswalks and other contrasting materials in order to provide drivers with better visual identification. Crosswalks should be considered for all projects to accommodate walking as a viable mode of travel.
- Promote “Share the Road” and other bicycle education programs.

3.4 ROADWAY SAFETY AUDITS

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

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

3.4.1 BARNSTABLE ROAD SAFETY AUDITS

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

3.4.1.1 Route 28 in Barnstable – Lane Departure Safety Audit

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

Short Term Recommendations:

• An initial recommendation is to inspect sight distance for vehicles exiting all driveways along the corridor as some locations have vegetation which significantly inhibits sight distance of vehicles as well as pedestrians and bicycles. There is a need to maintain landscaping so that the sight distance will not be obstructed. Similarly, there was a recommendation for necessary tree-trimming along the north side of the roadway closer to the Phinneys Lane intersection.

• Enforcement was identified by the RSA team as one countermeasure which could address several of the existing safety problems along Route 28, including enforcement centered upon speeding, aggressive driving, and red-light running (specifically at Old Stage Road). It is also recommended that speed data collection be completed by the state, Cape Cod Commission, or the Town of Barnstable to track current operating speeds throughout the year; this may also prove useful in the establishment of enforcement thresholds.

• The gas station under development at Phinneys Lane has a curb cut located within the intersection. Consistent with the previous operation of the gas station, it is critical that this driveway remain an "entrance only."

• One recommendation suggested at the RSA meeting was to explore the possibility of converting the existing lane usage at the intersection of Phinneys Lane. For consideration would be the designation of an exclusive right turn lane, which once reconfigured would make the center lane a shared left/through lane. This request was based upon a perceived dominant movement and would better utilize the existing slip lane. At a minimum this idea warrants further consideration.

• Pedestrian concerns at the intersection of Old Stage Road and Route 28 should be addressed. One recommendation was the inclusion of pedestrian placards, which explain the meaning of pedestrian indications. It was also noted that the time allocated to pedestrians at this intersection was inadequate and/or not functioning properly. The resulting recommendation is to verify current field timing versus phase plans, and adjust as necessary.

• It is recommended that the intersection of Old Stage Road and Route 28 be further analyzed. Of specific concern from a safety perspective would be the demand associated with justification of an EB left-turn phase to allow protected-permissive left-turn signal phasing (PPLT). An additional consideration would be the reconfiguration of existing lane usage, based upon the resulting signal phasing changes. It is also recommended the adjacent intersection of Old Stage Road and Camp Opechee Road be studied in a similar fashion and at the same time.

• The merge at each end of the corridor was mentioned as a concern. At the intersection of Phinneys Road the taper on the east side of the intersection was reportedly short because of the adjacent herring run. Although potential redesign options should be considered (e.g. lengthen existing taper if possible) the existing markings and signage could be improved to alert drivers of the merge condition. Specifically, there appears to be an EB merge ahead warning sign missing from this location. Similar recommendations would be beneficial for the merge and existing taper on the west side of Old Stage Road, and should be addressed during any intersection study (see previous bullet).

• Utility poles are in close proximity to the traveled way along Route 28, which is in part negated by the presence of curbing. Nevertheless, it is recommended that the poles be reflectorized to add conspicuity. Although, it may be a longer-term solution, it is also recommended that plans to relocate the utility pole from the center of the shared pedestrian/bicycle route (see Figure 5 – located near intersection with Old Stage) be initiated in the near future.

• Maintenance along Route 28 appeared to be adequate at the time of the RSA meeting; however, given the prevalence of pedestrian and bicycles, it is recommended that pavement markings remain visible. Although most markings, also including all longitudinal markings, the crosswalk markings across the Centerville Plaza site drive were faded and should be refreshed. A similar, sustained approach is suggested for signage in the area as well. Routine maintenance of drainage features in the area is also recommended.

• Although the safety impacts resulting from the number of existing curb cuts and their respective volumes are better addressed through long-term solutions; it is recommended that short-term strategies resulting in the consolidation of curb cuts be further explored.

• The next section discusses longer-term strategies based in part on the time required to implement; however a short-term recommendation is to consider these alternatives as some of them could prove effective for a relatively low cost (e.g. conversion from 4 to 3 lanes).

Additional Route 28 Countermeasures:

• *Consolidation of access drives*: It is important to note that many of the strategies discussed at the RSA meeting and described below are either predicated on the need for consolidation of existing access point, or will result in safer and improved flow based upon consolidation of access points. The notion is that traffic will move within the plazas and will be processed at a fixed number of access points at Route 28. For example, there is currently no access between the two main plazas (Centerville Plaza and Bell Tower Mall) on the north side of Route 28; however, access between them could be useful in implementing several of the countermeasures discussed.

• *Addition of a center median*: The addition of a divided median would not only separate the major flows of traffic, which will prevent cross-over the centerline crashes, but will also eliminate crashes at all plaza drives between left-turning vehicles. As a result of a center median all plaza drives would become right-in / right-out movements only. Several variations of a median approach were discussed including the application of curbed islands as well as the possibility of guard rail.

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

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

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

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

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

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

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

• *Creation of northern access road:* An idea that had been considered previously was discussed again at the RSA meeting. Specifically, the plan called for the creation of an access road that would provide connection to both Old Stage Road and Phinneys Lane. This plan would eliminate the need for left-turn maneuvers from Route 28 to Phinneys Lane and would eliminate the overall burden on the various plaza access points. As noted, this was discussed previously and was deemed not feasible given requirements associated with acquiring right-of way.

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

3.4.1.2 Route 28 (Falmouth Road)/Bearses Way

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

Safety Issue #1. Access Control

Enhancements:

1. Due to the high proportion of crashes associated with the access points for adjacent commercial uses, restrict access movements by signage and/or barriers. A median could be constructed in the site driveway to allow right-in/right-out-only movements and designed so as to deter left-in/left-out movements. Additionally, signage could be posted restricting the left-in/left-out turning movements from driveways. Enforcement of the restrictions would be necessary.

2. Increase enforcement of existing regulatory signs to prevent vehicles taking illegal turns out of adjacent commercial uses.

3. Increase enforcement of vehicles cutting through adjacent commercial uses to avoid the traffic signal.

4. Reduce the number of travel lanes on Falmouth Road (Route 28) and Bearses Way near the site driveways to decrease the number of travel lanes vehicles entering or exiting the adjacent site driveways need to cross.

Safety Issue #2. Lane Configuration

Enhancements:

1. Consider changing the right-most through lane to an exclusive right-turn lane for the Falmouth Road (Route 28) approaches.

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

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

Safety Issue #3. Pavement Markings

Enhancements:

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

Safety Issue #4. Pedestrian Accommodations

Enhancements:

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

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

Safety Issue #5. Bicycle Accommodations

Enhancements:

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

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

Safety Issue #6. Bus Accommodations

Enhancements:

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

Safety Issue #7. Traffic Signal Timing

Enhancements:

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

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

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

Safety Issue #8. Emergency Access

Enhancements:

1. Install pre-emption system for emergency vehicles.

Safety Issue #9. Presence of Utility Poles

Enhancements:

1. Install reflectors on utility poles located within the clear zone.

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

Safety Issue #10. Signage Improvements

Enhancements:

1. Merge warning signs (W4-2R) should be installed on Falmouth Road (Route 28) eastbound after the intersection where the roadway narrows from two travel lanes to one travel lane. A larger sign may be considered for both Falmouth Road (Route 28) approaches.

2. Install “Junction Route 28” signs on Bearses Way to inform driveways of the upcoming state highway.

3. Install “Left Lane Must Turn Left” signs and pavement markings on Bearses Way northbound.

4. Relocate “No Left Turn” signs located near Corporation Street to be visible from the gas station driveway.

Safety Issue #11. Drainage Issues

Enhancements:

1. Clean out and maintain existing catch basins.

2. Redesign intersection and approaches to improve drainage and reduce standing water.

3.4.1.3 Meetinghouse Way (Route 149)/Route 6 Ramps

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

Safety Issue #1. Intersection Control

Enhancements:

1. Change the control of the intersection, utilizing either a traffic signal or a roundabout, to reduce angle crashes and clarify control.

2. Include emergency pre-emption if a traffic signal is installed.

View approaching the STOP sign on the Service Road westbound

approach.

Safety Issue #2. Intersection Geometry

Enhancements:

1. Consider incorporating the Service Road EB approach into the intersection control (see Safety Issues #1) or modify the geometry of the eastbound ramp to increase conspicuity of vehicles entering the intersection from the Service Road EB approach. Consideration should be given to redesigning the Route 6 EB right-turn ramp to force vehicles to make a 90° turn and to increase the separation between the Route 6 EB and Service Road EB approaches. The intersection could also be redesigned as a 5-leg roundabout, incorporating both Service Road approaches. A change in traffic control will also reduce the number of conflicts a motorist must look for; a signal or a roundabout could accomplish this.

2. Any redesign should provide adequate turning radii to accommodate emergency vehicle and truck access through the intersection. The West Barnstable Fire Department's water trucks are of particular concern for the Town, since firefighters must use water tankers to fight fires because there is no water source north of Route 6 in West Barnstable. Include apron for emergency and truck access if a roundabout is installed.

Safety Issue #3. Sight Distance

Enhancements:

1. Trim trees and shrubs adjacent to the roadways to provide adequate sight distance.

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

Safety Issue #4. Pavement Markings

Enhancements:

1. Re-stripe and maintain durable pavement markings at the intersection.

2. Delineate the Meetinghouse Way northbound through and right-turn lane at the intersection with the Route 6 WB ramps.

Safety Issue #5. Signage

Enhancements:

1. Provide guide signs with messages consistent with those on the Route 6 mainline at the ramp termini.

2. Remove or relocate local organizations' signs to improve sign clutter.

3. Relocate Route 6 guide signs on the Meetinghouse Way northbound approach in advance of the utility pole.

4. Ensure that all Route 6 guide signs are visible; trim trees and/or relocate signage as appropriate.

Safety Issue #6. Pedestrian Accommodations

Enhancements:

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

Safety Issue #7. Bicycle Accommodations

Enhancements:

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

Safety Issue #8. Speed

Enhancements:

1. Conduct a speed study to determine the prevailing speeds and adjust speed regulation as necessary based on findings.

2. Increase enforcement in the vicinity of the intersection through the use of either speed trailers or uniformed officers.

3. Reconfiguration of the intersection into a 5-leg roundabout will reduce speeds through the intersection area.

3.4.2 DENNIS ROADWAY SAFETY AUDIT

3.4.2.1 Route 134 at the Route 6 Ramps

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

Safety Issue #1. Interchange Geometry

Enhancements:

1. Review operations and the feasibility of adding adequate acceleration and deceleration lanes at the interchange of Route 134/Route 6.

2. At the Route 6 eastbound off-ramp to Route 134 southbound, lengthen the solid white channelization line from the end of the delta island to reinforce the separation between the ramp and Route 134 southbound, and to delineate the additional lane. Replace the merge sign with an “add lane” warning sign. In conjunction, review the distance between the Route 6 eastbound ramps and the mall signal for appropriate weave distance.

3. Provide adequate turning radii to accommodate larger vehicles in a single lane on the Route 6 eastbound ramp to Route 134 southbound and on the Route 6 westbound ramp to Route 134 northbound.

Safety Issue #2. Pavement Markings

Enhancements:

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

Safety Issue #3. Sign Improvements

Enhancements:

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

2. Upgrade existing signage with new reflectorized signs.

Safety Issue #4. Maintenance

Enhancements:

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

Safety Issue #5. Pedestrian Accommodations

Enhancements:

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

Safety Issue #6. Bicycle Accommodations

Enhancements:

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

3.4.3 MASHPEE ROADWAY SAFETY AUDITS

Mashpee has had three audits completed since 2007:

3.4.3.1 Route 130 Lane Departure Road Safety Audit

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

Short Term Recommendations

• Install “Curve Ahead” warning signs for each direction of the two horizontal curves. Signs should be placed in advance of the curve to allow adequate response time for motorists. To further enhance the delineation (given the lack of lighting) roadside reflectors and/or chevrons should be considered as budget permits.

• Given the reported prevalence of high speeds among the lane departure crashes, it is recommended that Route 130 continue to remain a high speed enforcement area. It is also recommended that speed data collection be completed by the Town of Mashpee to track current operating speeds throughout the year; this may also prove useful in the establishment of enforcement thresholds. Installation of solar powered radar detector signs at key locations to bring awareness to the operator though the instant message "YOUR SPEED IS "__"" may assist in reducing in speed violations.

• It is recommended that advance yield lines (see MUTCD Figure 3B-14) and accompanying sign (R5-1 – Yield Here to Pedestrians) be installed on both approaches to the existing mid-block crosswalk along Route 130.

• There are several signs (see Figure 8) located near the Mashpee-Barnstable line adjacent to the bike path which feature a nearly illegible message based upon the small font size. It is recommended that these signs be revised or removed as drivers may spend an increased amount of time fixated away from the roadway attempting to read the signs.

• Utility poles are in close proximity to the traveled way along Route 130. While longer term strategies are considered for possible relocation of the most hazardous poles, it is recommended that the poles be reflectorized to add conspicuity. Specific locations may include the utility poles at the following addresses 84 (struck 3 times), 223, 520, 544, and 621 Route 130. All utility poles along the corridor, however, should be considered.

• Continue to maintain level surface along roadside edges. At the time of the audit several spots of edge drop-off were observed north and west of the Great Neck Road North intersection which may in turn accelerate the impacts of lane departure crashes as motorists are unable to return to the roadway.

Additional Route 130 Countermeasures

Speed-related issues along entire Route 130 corridor:

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

Distracted or drowsy drivers

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

Pavement markings

- Maintain pavement markings for continued visibility.

Horizontal curve delineation

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

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

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

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

<u>Cross over the centerline crashes resulting from passing vehicles</u>

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

<u>Sight distance turning from Dunkin Donuts site drive</u>

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

<u>Presence of utility poles within the roadway clear zone</u>

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

<u>Edge drop-off at roadside</u>

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

<u>Safe crossing opportunities for pedestrians</u>

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

<u>Guard rail opportunities</u>

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

<u>Sign efficiency</u>

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

<u>Illumination and supports for runway crossing at Otis Air Force Base</u>

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

<u>Dark stretches of Roadway</u>

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

<u>Continued maintenance</u>

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

<u>Herring observation area where vehicles and pedestrians conflict</u>

- Consider warning sign and additional parking restrictions.

3.4.3.2 Great Neck Road North/Old Barnstable Road

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

Safety Issue #1. Intersection Geometry

Enhancements:

1. Increase corner radii to accommodate larger vehicles.

2. Narrow the Old Barnstable Road westbound approach and align it with the departure lane on the other side of the intersection to the extent possible within the right-of-way.

Safety Issue #2. Grading Issues

Enhancements:

1. Change the crown line on Great Neck Road North to facilitate crossing and turning movements from Old Barnstable Road.

2. Re-grade the Old Barnstable Road westbound approach to eliminate the low spot.

Safety Issue #3. Limited Sight Distance

Enhancements:

1. Measure the sight distances from the Old Barnstable Road westbound approach and compare them to the required sight distances for the existing conditions. Based on these results, the following additional enhancements may be appropriate:

2. Relocate signs and fence on the southeast corner to increase visibility for vehicles exiting Old Barnstable Road westbound.

3. Re-align both the horizontal and vertical geometry of Great Neck Road North to provide adequate sight distance for all approaches.

4. Re-grade the slope on the eastern side of the Great Neck Road North northbound approach to provide adequate sight distance for the Old Barnstable Road westbound approach.

5. Study closing the Old Barnstable Road westbound approach to vehicle traffic. This would include traffic analysis of the Route 28/Great Neck Road/Route 151 rotary to ensure that the closure would not create undue traffic delay there.

Safety Issue #4. Pavement Markings

Enhancements:

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

Safety Issue #5. Sign Improvements

Enhancements:

1. Install new double-sided one-way signs on both sides of the roadway on the Old Barnstable Road westbound approach to improve their visibility to vehicles traveling northbound and southbound on Great Neck Road North.

2. Replace the worn Intersection Ahead warning sign for the Great Neck Road North northbound approach.

3. Install an Intersection Ahead warning sign for the Great Neck Road North southbound approach.

4. Relocate the 45 mph speed limit sign for Great Neck Road North northbound traffic farther beyond the intersection with Old Barnstable Road. This may require modifications to the speed regulations.

5. Adjust sign locations, sizes, and heights to conform to MUTCD requirements and not to impair sight distance.

6. Remove the CCRTA bus stop sign located on the eastern side of Great Neck Road North just north of Old Barnstable Road.

Safety Issue #6. Limited Pedestrian Accommodations

Enhancements:

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

3.4.4 SANDWICH ROAD SAFETY AUDITS

Since 2007, two safety audits were completed in Sandwich:

3.4.4.1 Cotuit Road/Harlow Road/South Sandwich Road

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

Safety Issue #1. Intersection Skew

Enhancements:

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

Safety Issue #2. Intersection Offset

Enhancements:

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

2. Relocate the utility pole located on the southeast corner across from South Sandwich Road.

Safety Issue #3. Asa Meiggs Road

Enhancements:

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

Safety Issue #4. Vertical Alignment of Cotuit Road

Enhancements:

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

Safety Issue #5. Horizontal Alignments of Side Streets

Enhancements:

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

Safety Issue #6. Grading Issues

Enhancements:

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

Safety Issue #7. Restricted Sight Distance

Enhancements:

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

Safety Issue #8. Sign Locations and Conformance

Enhancements:

1. Verify that the locations of the "Stop Ahead" warning signs and pavement markings on Harlow Road and South Sandwich Road conform to MUTCD guidelines for size, location, and mounting height.

2. Verify that the locations of the "Intersection Ahead" warning signs on Cotuit Road conform to MUTCD guidelines for size, location, and mounting height.

3. Replace street name signs to conform to MUTCD guidelines for letter height.

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

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

Areas of open, crossable median

Risk Rating "E"

- Install barrier in open areas (1.3miles total)

Lack of shoulders (both inside and outside) with berms
Risk Rating "E" –

- Create 4 foot inside shoulders

High speeds
Risk Rating "D"

- Increase enforcement

"Authorized Vehicle Only" turnaround locations and misuse
Risk Rating "C"

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

Drainage problem – ponding occur in several areas
Risk Rating "D"

- Rehabilitate surface

Short acceleration/deceleration lanes and inadequate signage
Risk Rating "D"

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

Driver guidance – signs worn and obstructed
Risk Rating "C"

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

3.4.5 YARMOUTH ROAD SAFETY AUDIT

There has been one audit completed since 2007 in Yarmouth.

3.4.5.1 - Old Townhouse Road/Forest Road

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

Safety Issue #1. Intersection Geometry

Enhancements:

1. Reconstruct the intersection to remove the offset alignment of Forest Road and to simplify the movements (i.e., consolidate two Forest Road intersections into one) and clarify control (i.e., signalization).

2. Consider vehicular movements to/from the shopping plaza driveway southbound onto Old Town House Road to right-in/right-out only.

3. Consider vehicular movements to/from Constance Avenue in the redesign.

4. Provide adequate turning radii to accommodate emergency vehicle (e.g., fire truck) access through the intersection and to the shopping plaza.

5. Introduce a traffic signal to reduce angle crashes, clarify control, and better serve concentrated peak demand generated by the transfer station.

6. New traffic signal should include emergency pre-emption.

Safety Issue #2. Pavement Markings

Enhancements:

1. Re-stripe and maintain durable pavement markings at the intersection.

2. Fill pot-holes and consider a more durable street print product rather than traditional paint or thermoplastic pavement markings.

Safety Issue #3. Sign Improvements Enhancements:

1. Provide advance intersection warning signage on the Old Town House Road eastbound and westbound approaches in the short-term (unsignalized condition).

2. Install pedestrian crossing warning signage on the Old Town House Road westbound approach in the short-term (unsignalized condition).

3. Replace signage on the Forest Road northbound approach at Constance Avenue with W2-2L installed on right side of Forest Road northbound in advance of intersection with Constance Avenue.

4. Upgrade all existing signage with new reflectorized signs to meet standards of consistency with the MUTCD.

Safety Issue #4. Sight Distance

Enhancements:

1. Trees located along the edge of Old Town House Road in the vicinity of the intersection should be relocated or removed. In the short-term, all trees in the vicinity of the intersection should be trimmed to improve sight lines.

2. The Garden Club planting area should be relocated to a location that will not block sight lines.

3. The wood guard rail posts along the south side of Old Town House Road should be removed.

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

Safety Issue #5. Pedestrian Accommodations

Enhancements:

1. Consider installing a crosswalk across the eastern leg of the intersection if signalized.

2. Install sidewalk along the north side of Old Town House Road between the shopping plaza and the Old Town House Road Park and Recreation area entrance.

Safety Issue #6. Bicycle Accommodations

Enhancements:

1. Redesign of the intersection should incorporate a bicycle connection between the two existing bicycle paths. Installation of a traffic signal, and a bike lane or path, would provide a safe connection

2. The alignment of the bicycle path across Forest Road near the transfer facility on the north side of Old Town House Road should be modified to minimize conflicts with transfer facility traffic. In the short-term, the transfer facility signage posted on the fence should be relocated to improve cyclist and pedestrian visibility.

Safety Issue #7. Speed

Enhancements:

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

2. Post speed limits.

3.5 MULTIMODAL TRANSPORTATION SAFETY

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

3.5.1 PUBLIC TRANSIT SAFETY

Public transit vehicles are generally considered to operate at a higher level of safety in comparison to private automobiles. Drivers are required to have higher qualifications and are subject to strict safety guidelines. The Cape Cod Regional Transit Authority has provided safety data for the years 2007-2009 as shown in the following table:

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

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

(Source: Cape Cod Regional Transit Authority)

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

3.5.2 BICYCLIST SAFETY

Bicycling on Cape Cod roadways can be a challenge. The mixture of narrow roadways, high traffic volumes, and pleasant summer weather creates a great deal of difficult vehicle-bicycle interaction. Cape Cod's pleasant summer weather brings bicyclists onto roadways at the time when vehicular traffic is at its peak. As a mode that can efficiently transport travelers pollution-free, it is worthy of our attention in providing facilities that are safe for cyclists, pedestrians, and other transportation users.

The following table includes a town-by-town breakdown of bicycle-vehicle crashes for the years 2006-2008. With 39 reported crashes over the three-year period, Yarmouth had the greatest number of bicyclist-vehicle crashes (Dennis was second with 25 crashes). Staff has observed numerous cyclists along Route 28 (where many of the identifiable crashes occurred) during the summer season. Comments at public meetings indicate that many summer workers in Yarmouth use bicycling to commute to work; the many motels in the area appear to be the origin of vacationers that are biking to the various Route 28 attractions (e.g., mini-golf, ice cream, gift shops, etc.).

TABLE 11 - BICYCLIST-VEHICLE CRASH HISTORY (2006-2008)

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

(Source: MassDOT)

Bicyclists are often categorized into three subsets: (A) Experienced, long-distance riders, (B) Occasional riders, and (C) beginners and children. For the type-A rider, most of their travel is made along roadways because of the higher travel speed available and the fewer obstacles (driveways etc.) encountered on alternative routes. Type B riders prefer off-road opportunities such as bike paths, but can be comfortable in bike lanes or wide shoulders. Type C riders seek out the least busy sections of bike paths and sidewalks; these riders generally do not use biking for transportation purposes.

3.5.3 PEDESTRIAN SAFETY

Pedestrians are among the most vulnerable users of the transportation system, and yet it is important to remember that almost all travelers become pedestrians for at least part of every trip. Safe accommodations for walking can encourage a reduction in traffic congestion and air pollution and encourage a healthier alternate mode. The figures shown in the following table list the number of vehicle-pedestrian crashes for each town. Yarmouth had the highest number (22) of crashes reported from 2006 to 2008. This number represents two sides of an issue: the high number of pedestrians observed along Route 28 in the summer, representing peoples' willingness to walk for transportation, however it also shows the deficiencies in pedestrian accommodation (e.g., pedestrian crossings at intersections) resulting in the high crash history.

TABLE 12 – PEDESTRIAN-VEHICLE CRASH HISTORY (2006-2008)

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

(Source: MassDOT)

Separate sidewalks and pathways are important to accommodate pedestrians. At intersection crossings, installation and maintenance of call buttons will provide for better compliance and safety of pedestrians. Research published by the Institute of Transportation Engineers ("Pedestrian Countdown Signals: Experience with an Extensive Pilot Installation," *ITE Journal*, January 2006) reports that the number of pedestrian injury crashes declined by 52 percent after the introduction of countdown signals. At the time when the pedestrian phase begins the flashing hand-symbol (i.e., flashing "Don't Walk") a numeric countdown signal shows the remaining number of seconds until the steady hand-symbol (i.e., steady "Don't Walk") is displayed. This provides the pedestrians with information necessary to determine whether they should start crossing or speed up their crossing.

3.5.4 AIR TRAVEL SAFETY

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

TABLE 13 - AIR TRAVEL SAFETY INCIDENTS

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

(Source: Federal Aviation Administration)

3.5.5 SUMMARY OF GENERAL TRANSPORTATION SAFETY RECOMMENDATIONS

- Work with state and local agencies to improve the accuracy and timeliness (e.g., within 12 months of the end of each year) of crash data
- Consider protected left turn phases into signalized intersections
- Maintain delineation through more frequent restriping and street cleaning
- Improve signage standards to include larger lettering
- Improve lighting level standards, in particular at intersections. Consider placing utilities underground and installing breakaway safety poles for lighting
- Consider extension of "all red" phases for signalized intersections
- Establish driver education programs for older drivers
- Provide education on other options for mobility
- Increase education for local young drivers

- Support additional enforcement and warnings during busy traffic season to reach out to young visitor drivers
- Develop and implement an advertising campaign and roadside signage reminding drivers that traffic and drunk driving laws are strictly enforced on Cape Cod.
- Provide better signage for visitors directing them to popular destinations
- Install signage explaining the rotary "rules of the road" and disseminate similar information to be included in visitor brochures and Cape related websites such as 'Go Cape Cod:'

www.gocapecod.org

- Consider conversion of conventional intersections (signalized or unsignalized) which have high crash rates to roundabouts
- Promote the use of red-light cameras at high crash rate signalized intersections
- Support road designs which are estimated to reduce crashes and improve safety for all users

3.6 INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems (ITS) are applications of advanced technology in the field of transportation, with the goals of increasing operation efficiency and capacity, improving safety, reducing environmental costs, and enhancing personal mobility. A policy of Cape Cod MPO is to advocate and endorse the consideration of Intelligent Transportation Systems solutions for transportation problems as a routine part of the transportation planning process. As a stakeholder in the Southeastern Massachusetts Regional ITS Architecture, the Cape Cod MPO is committed to continuing an active role in these ITS systems. This includes maintaining channels of communication between the Cape Cod Commission and other stakeholders, including but not limited to: the MassDOT; the Southeastern Regional Planning and Economic Development District (SRPEDD); the Old Colony Planning Council (OCPC), and the Cape Cod Regional Transit Authority (CCRTA). A regional ITS architecture is a framework that defines component systems and their interconnections. Successful ITS deployment requires an approach to planning, implementation, and operations that emphasizes collaboration between relevant entities and compatibility of individual systems. The regional architecture is a mechanism design to ensure this collaboration and compatibility occurs. Inputs into ITS systems can involve any variety of a range of collection devices, including:

• Loop detectors in the pavement and sophisticated ground level radar systems are able to collect real time traffic volume and speed data.

• Video equipment is often used to monitor the transportation system, which is useful in allowing system operators to immediately detect areas of congestion that may be forming. It is also used to detect incidents such as crashes and disabled vehicles, in turn accelerating emergency dispatch and the overall incident management process. Video surveillance is also a useful tool for security and incident management in transit vehicles and around stops and terminals.

• Automatic vehicle locators (AVL) on board transit vehicles, emergency response vehicles, and roadside assistance vehicles allow operators to know where vehicles are in real time that allows for more efficient dispatch and adjustment of traffic controls if necessary.

• Automated Fare Payment Systems that allow riders on transit systems to pay electronically using a "smart card" (prepaid balance) or in the future conventional credit/debit cards rather than cash.

• Transmitters onboard transit and emergency vehicles alike are used to pre-empt traffic signals ahead or to alert travelers at a transit stop that the vehicle is approaching.

• Remote weather stations and Doppler radar provide real time weather conditions occurring throughout the transportation network, and provide alerts regarding events such as icing or flooding that may be occurring. These are some of the technological applications that can be utilized for managing the regional transportation network. All of this information travels over both hard-wired and wireless communication systems to systems that manipulate the data and distribute it to users of the transportation system. End users of ITS system and the output media include:

• Transit Operation Centers that monitor the transit system through video feed, radio communications, and AVL signals, allowing operators to make improved decisions regarding security, dispatch, and incident management.

• Traffic Operation Centers that monitor the roadway system through reports from systems like loop detection and video feed, allowing operators to make improved decisions regarding congestion management, incident management, security, and maintenance management.

• Traveler Information Services such as the national 511 System or SmarTraveler locally, which receive traffic data from traffic and transit operations centers and distribute it to users via hard line and wireless communications.

• Variable Message Signage that allows operators from traffic and transit operation centers to instantly relay messages to users on the system.

• Kiosks that receive information from transit operation centers and transit vehicles, relaying it to users of the transit system.

MassDOT owns and operates several permanent variable message signs and a large fleet of portable variable message signs throughout the Commonwealth. Permanent stations are used to alert drivers to major events affecting locations such as the Route 128 belt and Interstate 93, as well as the tunnels. Portable variable message sign trailers are located throughout the state and are able to be dispatched to locations wherever and whenever needed. Often they are used for a major local event, such as a road race or sidewalk carnival. They can also be dispatched for major unplanned events, such as a chemical spill that forces an extended closure of a highway. All variable message signs are controlled from the MassDOT Traffic Operations Center in South Boston. MassDOT is using automated vehicle locators on their snow removal and highway maintenance fleet, increasing the efficiency of dispatch of resources to where they are needed. Travelers are able to obtain real time traffic conditions for highways in the Commonwealth, including highway approaches to the Cape such as Routes 3 and 495 as well as the Cape Cod Canal bridges, through SmartRoutes phone and web links, and will soon be available through a statewide 511 system and MassDOT website.

3.7 CAPE COD COMMISSION'S LOCATION-SPECIFIC SAFETY STUDIES

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

www.gocapecod.org/safety

3.7.1 BOURNE: OTIS ROTARY

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

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

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

3.7.2 EASTHAM: EASTHAM/ORLEANS ROTARY

In 2009, a Transportation Safety Report was completed featuring this and two other locations. The Cape Cod Commission Transportation Staff identified both short-term and long-term recommendations for the Eastham Rotary. Short-term recommendations include looking at signage and ideas for safe pedestrian connections. Long-term recommendations include redesigning the rotary to incorporate elements of a modern roundabout.

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

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

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

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

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

Town officials have cited a number of concerns related to the Smith Lane approach to the rotary. First, while the approach is indeed located in Eastham on Smith Lane, the road’s name causes confusion to drivers who are not aware the road becomes Rock Harbor Road in Orleans in less than 150 feet of driving. Secondly, motorists traveling eastbound on Rock Harbor Road have no warning of the upcoming, sharp, right-hand turn towards the rotary. This condition results in drivers missing their turns, then stopping short in a conflict zone once their mistakes are realized. Lastly, there is an unnecessarily wide turn from the off ramp at this approach onto Smith Lane eastbound. The size of the turning radius creates a large expanse of unmarked asphalt. This study recommends that Smith Lane be considered for improvements related to signage and traffic flow (which may or may not include roadway reconfigurations and restrictions in turning movements).

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

3.7.3 EASTHAM: ROUTE 6/BRACKETT ROAD

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

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

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

3.7.4 HARWICH: ROUTE 137/ROUTE 39

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

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

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

3.7.5 ORLEANS: ROUTE 6A/ROUTE 28

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

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

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

3.7.6 PROVINCETOWN: ROUTE 6/SHANK PAINTER ROAD

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

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

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

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

3.7.7 SANDWICH: ROUTE 6/ROUTE 130 RAMPS

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

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

3.7.8 TRURO: ROUTE 6 SCHOOL ZONE

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

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

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

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

3.8 CONCLUSION

Safety is the highest priority goal of the Regional Transportation Plan. The Cape's transportation system should ensure that travelers and their possessions will arrive at their destinations unharmed and undamaged. Travelers should be educated regarding transportation regulations and traffic laws, and these must also be enforced to prevent the improper use of the transportation system.

The importance of safety requires a spectrum of strategies including education, enforcement, and engineering. Specific programs and projects, such as roadway and intersection improvements, will be further refined in the alternatives analysis chapter of this RTP.

CAPE COD
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2012 REGIONAL TRANSPORTATION PLAN
Chapter 4: Security

Endorsed
August 22, 2011

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4. Security

Concern over security is made clear in the first goal of the Regional Transportation Plan:

> *"Create a transportation system that provides safe travel options for people and freight, and protects users from natural and external threats."*

The transportation system must prepare for natural disasters, such as hurricanes or flood. Moreover, post-September 11th, protecting users from external threats is also a priority, as indicated by the increased emphasis on security in federal and state transportation regulations and guidelines. For these reasons, the 2010 Regional Transportation Plan sets the goal of providing security to people and goods as they travel.

Transportation security includes that of the "users" (i.e., passengers and goods) as well as that of the infrastructure itself (e.g., bus stations, bridges, etc.).

4.1 EMERGENCY TRAFFIC PLANNING

The most frequently identified security concern is the threat of a weather-related event such as a hurricane. In many cases, the threatened population is a relatively small percentage overall and should seek local shelters per the direction of emergency safety officials. Most residents and visitors should seek "shelter in place," a term that refers to staying in homes or local shelters that are supplied with food, water, etc. The number of people in threatened areas is a small percentage of most towns' population. Regardless, people should heed warnings of public safety officials and evacuate accordingly.

A danger occurs out of panic when vast numbers of people get into their automobiles with the idea that they should "evacuate," clogging up the roadway network. These traffic jams pose a threat to those who truly need to access the network (persons with health problems, injuries, etc.). In the event of a mass exodus from Cape Cod (due to major weather-related, radiation event, etc.), planning is underway by the Barnstable County Emergency Planning Committee, in coordination with the Massachusetts Emergency Management Agency and implementation organizations such as the Massachusetts State Police and MassDOT.

Planning for large-scale traffic flows leaving Cape Cod requires coordination with neighboring regions. For example, routing Cape Cod traffic to I-195 West during an impending hurricane may bring motorists closer to the hurricane's landfall. Landfall predictions always include some uncertainty, such as the exact time and path of impact. When the path of a storm is projected in a wide, imprecise area it can make the evacuation route itself a potentially hazardous area.

One of the most difficult variables in planning for evacuations is human behavior, which can have the greatest impact on the availability of transportation capacity. The figure below illustrates this concept. The chart shows three curves representing the effect of different response rates versus the percentage of evacuation completed over time. This chart was developed for an Alabama evacuation study and is meant to be illustrative of the issues facing emergency responders during the hours leading up to and during this type of event.

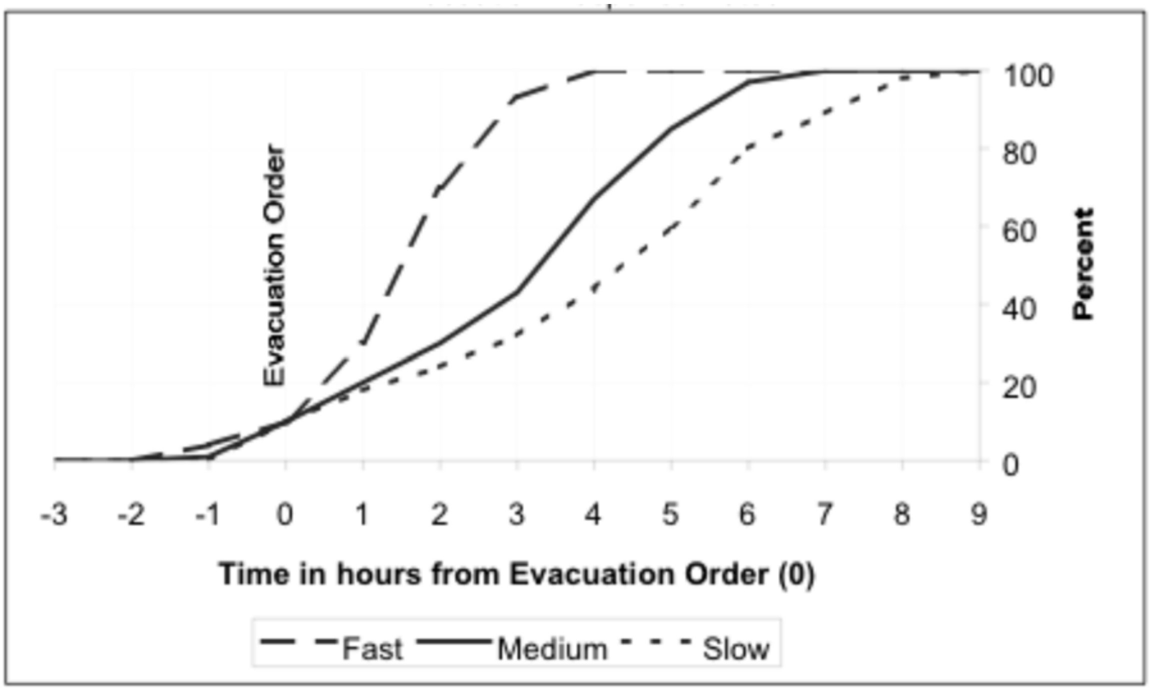

FIGURE 1 - EVACUATION BEHAVIOR RESPONSE CURVES
(Source: Alabama Hurricane Evacuation Study - U.S. Army Corps of Engineers, May 2001)

Emergency events requiring evacuation can be terrifying experiences, causing a range of emotions and reactions from confusion to total panic. Reactions vary depending on many different factors such as age, gender, and socioeconomic conditions. This varied reaction can influence the departure timing and loading levels of evacuation during an emergency event. This in turn impacts the design and implementation of policies and procedures for effective evacuation (Source: "Heuristic Prioritization of Emergency Evacuation Staging to Reduce Clearance Time," Mitchell & Radwan, Transportation Research Board 2006 Annual Meeting CD).

One method that can be used to improve efficiency is staged evacuation. Staged evacuation is best used where different parts of the road network may suffer different levels of severity over different time windows. By evacuating those populations in the network as part of an optimized sequence, a staged evacuation strategy can best utilize available roadway capacity, optimally distribute the total demand over the evacuation time horizon, and thus minimize the network congestion level. A properly designed staged evacuation strategy will significantly reduce congestion on the evacuation network via a more uniform demand distribution over the allowable safety time window. It also allows responsible agencies to prioritize their limited resources in those areas that have or will suffer the most severe damage (Source: "A Cell-Based Network Optimization Model for Staged evacuation Planning Under Emergencies," Liu, Lai, & Chang, Transportation Research Board 2006 Annual Meeting CD).

The above-mentioned research has shown that an optimized staged evacuation strategy can effectively mitigate network congestion under various demand patterns, which is reflected in a shorter average travel time for evacuees. This is in comparison with a "simultaneous" – or uncontrolled evacuation.

A "Cape Cod Emergency Traffic Plan" (ETP) has been developed by the Massachusetts State Police in cooperation with the Massachusetts Emergency Management Agency (MEMA) and several other agencies to facilitate the egress of a high volume of traffic from Cape Cod in the event of a hurricane, particularly during peak tourist season. The design of the ETP is based upon the need to eliminate the causes of congestion in the area of the Bourne and Sagamore Bridges and the main arteries leading up to them, Routes 6 and 28. Specific details of the plan may be included in the RTP following consultation with state officials. The following is a general outline of the plan's implementation:

- As traffic levels build before the hurricane arrives, direct access to and from off-Cape locations will be restricted at the bridges in order to allow vehicles to continue north from the bridges unimpeded.

- At higher traffic levels, and as bridge flows warrant (e.g., lower demand at Bourne Bridge than at Sagamore Bridge), traffic on Route 6 destined for Routes 25 & 495 would be diverted through the Massachusetts Military Reservation (MMR).

- When sustained winds reach 80 mph, the bridges will be closed and the motorists will have the option of going to designated emergency parking areas in the MMR and to be shuttled to shelter in the MMR.

The ready availability of advance information to the public is a vital component necessary to maximize the efficiency of the ETP. Traffic will flow only as fast as the slowest vehicles are traveling. The following measures are planned in order to provide a high level of public knowledge regarding the various aspects and the changes in traffic patterns that will be encountered during the ETP:

Signage
MassDOT will erect ETP signs giving advance notice of all detours and changes in traffic flow. The signs will include a radio frequency for ETP information

FM Radio Broadcast
Changes in traffic patterns will be announced on WQRC (99.9 MHz). WQRC will continually play a variety of pre-recorded instructions geared to address the various phases of the ETP.

Internet
Detour instructions and maps will be available on the Internet from the state police web site: <www.state.ma.us/msp>

It is extremely important that the public is informed of the need to evacuate only under a set of specific scenarios. For example, Hurricane events may only threaten certain coastal areas. For those residents in the affected areas, public safety officials would likely direct evacuees to local or regional shelters. By 'sheltering in place' or relocating to the nearest emergency shelter, impacts on the roadway network are minimized, freeing up capacity for emergency responders. The map in the following figure indicates local and regional shelters throughout the County. Updated and higher-resolution maps are available on the Cape Cod Commission's "Project Impact" website at the address listed here:

<www.capecodcommission.org/projectimpact/handbook.htm>

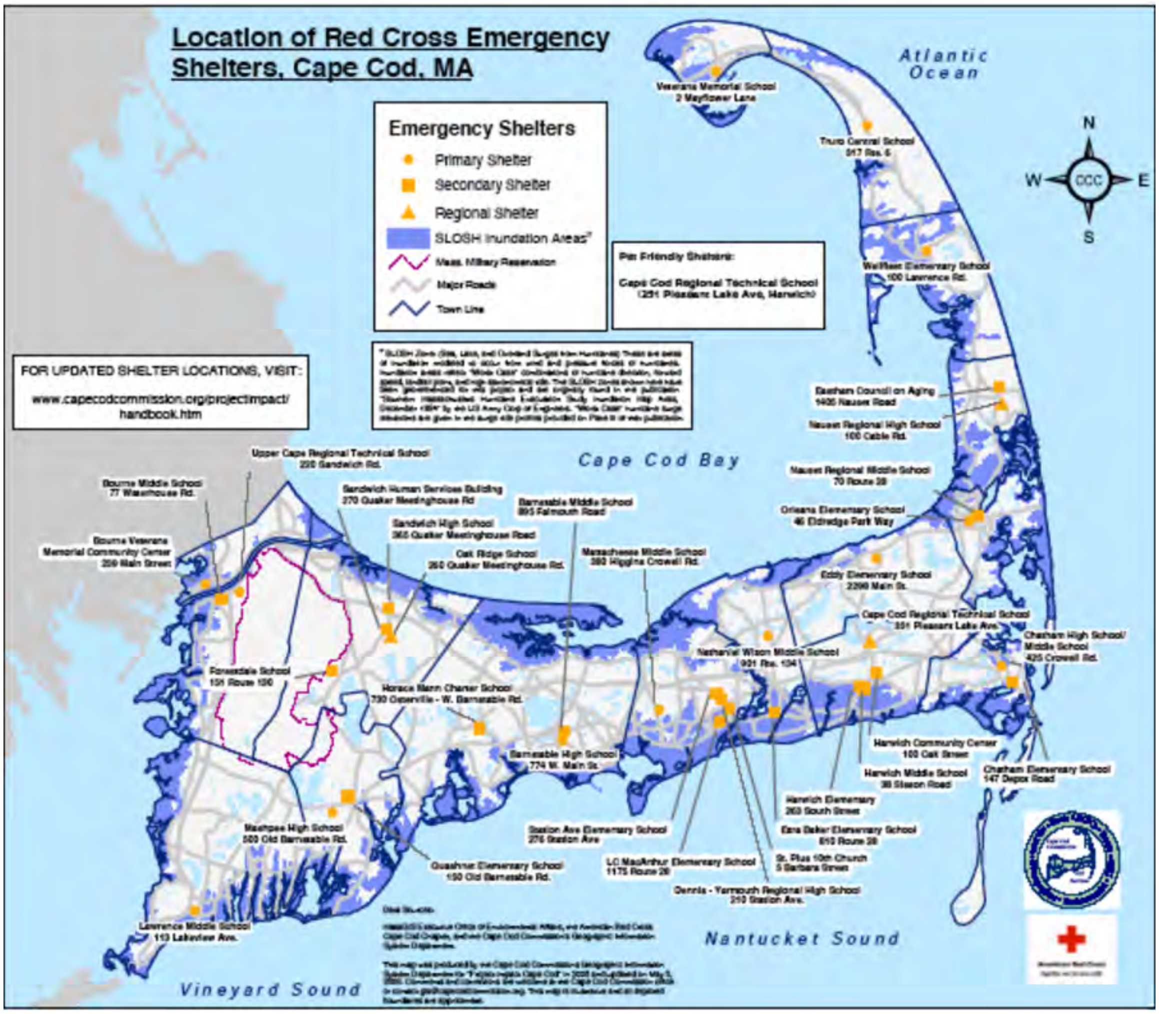

FIGURE 2 - LOCATION OF EMERGENCY SHELTERS

4.2 PUBLIC TRANSPORTATION SECURITY

Security of public transportation systems has been regarded with greater importance in recent years. The Federal Transit Administration (FTA) provides guidance and a wide variety of strategies to maintain and improve security. It is also important to note that public transit may serve an important role in evacuation (e.g., moving residents from nursing homes etc. to shelters). Also, verification and certification of public transit employees in security procedures is important to assure response capability.

Furthering its commitment to assist public transportation agencies in their efforts, FTA released its “Top 20 Security Program Action Items for Transit Agencies” in January 2003. This list contains measures recommended by FTA for immediate consideration and implementation by transit agencies to improve both security and emergency preparedness. The goal of this program is to ensure that the nation's public transportation systems:

- Are prepared for and well-protected against attacks;
- Respond rapidly and effectively to natural and human-caused threats and disasters;
- Appropriately support the needs of emergency management and public safety agencies; and
- Can be quickly and efficiently restored to full capability.

The "Top 20" are divided into several categories as listed below. The Cape Cod RTA's actions are listed in [brackets] for each item.

Management and Accountability

1. Written security program and emergency management plans are established. [The CCRTA has established its Safety and Security Plan, in coordination with experts and the Barnstable County Regional Emergency Planning Committee.]
2. The security and emergency management plans are updated to reflect anti-terrorist measures and any current threat conditions. [Over the past ten (10) years, the CCRTA has implemented and approved security on a number of fronts, including but not limited to secure door access, surveillance cameras, security guards, and implementing policies and procedures. In addition, the CCRTA is presently working with Anchor Group to update the security and emergency management plan to reflect current threat conditions.]
3. The security and emergency management plans are an integrated system program, including regional coordination with other agencies, security design criteria in procurements and organizational charts for incident command and management systems. [The CCRTA is an active member and participant of the Barnstable County Regional Emergency Planning Committee, which supplies emergency transportation services to the region and agencies.]
4. The security and emergency management plans are signed, endorsed and approved by top management. [The security and emergency management plans are signed, endorsed, and approved by the CCRTA Administrator, Thomas S. Cahir.]
5. The security and emergency management programs are assigned to a senior level manager. [The security and emergency management programs are assigned to Paula George, Deputy Administrator and Matt Kolva, Facilities Project Manager.]
6. Security responsibilities are defined and delegated from management through to the front line employees. [Security responsibilities are defined and delegated from management to the front line employees. Specifically, our management company will ensure that employees will take Terrorist Activity Recognition and Reaction courses, as part of their general training.]
7. All operations and maintenance supervisors, forepersons, and managers are held accountable for security and emergency management issues under their control. [All aforementioned personnel are held accountable for security and emergency management issues, as outlined in the CCRTA Safety and Security Plan.]

Security Problem Identification

8. A threat and vulnerability assessment resolution process is established and used. [A threat and vulnerability assessment resolution process is established and used, as outlined in CCRTA's Safety and Security Plan.]
9. Security sensitive intelligence information sharing is improved by joining the FBI Joint Terrorism Task Force (JTTF) or other regional anti-terrorism task force; the Surface Transportation Intelligence Sharing & Analysis Center (ISAC); and security information is reported through the National Transit Database (NTD). [The CCRTA has contracted with Be Safe through the Town of Barnstable's Police Department, as well as the Town of Dennis's Police Department to fulfill joining the FBI JTTF. In addition, security sensitive data is reported through NTD.]

Employee Selection

10. Background investigations are conducted on all new front-line operations and maintenance employees. [The CCRTA performs Massachusetts CORI investigations on all CCRTA employees and contracted employees.]
11. Criteria for background investigations are established. [The CCRTA performs Massachusetts CORI investigations, as established by the CCRTA New Hire Polices.]

Training

12. Security orientation or awareness materials are provided to all front-line employees. [CCRTA operator provides all new employees with pre-service training that includes Terrorist Activity Recognition and Reaction.]
13. Ongoing training programs on safety, security and emergency procedures by work area are provided. [The CCRTA is in the process of updating all policies and procedures for all other personnel.
14. Public awareness materials are developed and distributed on a system wide basis. [The CCRTA does maintain and distribute public awareness materials, such as signage and pamphlets (See Something? Say Something. Transit Watch) in the Hyannis Transportation Center].

Audits and Drills

15. Periodic audits of security and emergency management policies and procedures are conducted. [The CCRTA periodically audits the security and emergency management policies and procedures.]
16. Tabletop and functional drills are conducted at least once every six months and full-scale exercises, coordinated with regional emergency response providers, are performed at least annually. [The CCRTA's participation in the Barnstable County Regional Emergency Planning Committee fulfills this requirement and our management company has incorporated functional drills and exercises into its policies and procedures.]

Document Control

17. Access to documents of security critical systems and facilities are controlled. [The CCRTA does regulate access to documents of security critical systems through secure door access, a recent implementation of a secure software system, and its COOP/Disaster recovery plan.]

18. Access to security sensitive documents is controlled. [The CCRTA does regulate access to security sensitive documents, as required by HIPAA requirements.]

Access Control

19. Background investigations are conducted of contractors or others who require access to security critical facilities, and ID badges are used for all visitors, employees and contractors to control access to key critical facilities.

Homeland Security

20. Protocols have been established to respond to the Office of Homeland Security Threat Advisory Levels.

More information on public transportation security is available from FTA at:

<http://transit-safety.volpe.dot.gov>

4.3 AIR TRAVEL SECURITY

Security for travel by air is a primary function of the Transportation Security Administration (TSA). The TSA has been required to make a number of improvements to aviation security. The improvements included that by November 19, 2002, screening of individuals and property in the United States would be conducted by TSA employees and companies under contract with TSA. Federal law also requires enhanced qualifications training and testing of individuals who perform screening functions. It requires that Federal law enforcement officers be present at screening locations. More information is available at:

<http://www.tsa.gov>

4.4 INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems (ITS) technologies are applied to vehicles and roadways that perform communications, data processing, traffic control, surveillance, navigation, sensing, and various other functions that aid in the management of the security process. ITS elements, such as traffic cameras, signal preemption devices and Variable Message Boards (VMB), would provide timely responses for emergency vehicles and the ability to monitor evacuations during times of natural, or other disasters.

The Massachusetts Department of Transportation's Traffic Operations Center (TOC) is located in South Boston. The TOC's primary mission is traffic incident management throughout the Commonwealth of Massachusetts. The MTOC is the headquarters for the application of Intelligent Transportation Systems (ITS) around the state. From the MTOC, reports on traffic incidents are relayed to the involved MassDOT district office, which assigns the necessary personnel and equipment, required to abate the incident. The TOC will be integrating information from the Cape Cod Canal Area Intelligent

Transportation System (under design). The Cape's system will include about 10 adjustable (point-tilt-zoom) high definition cameras and supplemental speed detectors and fixed-view webcams. This system will yield travel time and incident data to travelers and emergency responders.

4.5 SUMMARY OF TRANSPORTATION SECURITY RECOMMENDATIONS

Recommendations for transportation security may include:

- Incorporating intelligent transportation systems, such as real-time incident detection and dissemination via variable message signs and the internet, into the emergency response system;
- Fostering communication and cooperation between federal, state, and local agencies for the planning, practice, and implementation of emergency scenario plans;
- Designating and indicate, through road signs, emergency evacuation routes, and shelters;
- Supporting enforcement of state and local traffic laws; and
- Increasing surveillance and security efforts at transportation facilities throughout Cape Cod, such as the Hyannis Transportation Center, Falmouth Bus Depot, Woods Hole's port facilities, park-and-ride lots, and Cape Cod Canal Bridges.

4.6 CONCLUSION

Security is a high priority goal of the Regional Transportation Plan. The transportation system must be prepared for natural disasters, such as hurricanes. This RTP also adds emphasis on security from federal and state transportation regulations and guidelines.

The most pressing security issue facing Cape Cod is the heavy volume of traffic departing during weather events, such as impending hurricanes. The alternatives analysis chapter of this Plan will include the strategies needed (e.g., traffic flow improvements, travel demand management) to address such a scenario.

CAPE COD COMMISSION

2012 REGIONAL TRANSPORTATION PLAN

Chapter 5: Bicycle & Pedestrian Issues

Endorsed
August 22, 2011

COUNTY OF BARNSTABLE • MASSACHUSETTS •

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5. Bicycling and Pedestrian Planning

Bicycles are a low cost, non-motorized form of transportation. Bicycle infrastructure and facilities require smaller right-of-ways and less overall investment than roadways. There are three basic types of bicycle infrastructure: paths, lanes, and routes. Paths generally have their own separated right-of-way and follow certain standards for width, grade, and accessibility. Bicycle lanes are separate lanes within roadways marked for bicycle use. There are currently no bicycle lanes on Cape Cod. Bicycle routes are roadways with wide shoulders that have been designated for bicycle use. Pedestrians can access shared use paths and sidewalks. Pedestrian facilities support village centers and local businesses, and encourage travelers to walk instead of driving. According to the Rails to Trails Conservancy, bicycle and pedestrian facilities can increase property values and make areas more attractive to new residents, businesses, and tourists.

FIGURE 1 - CAPE COD BIKEWAYS LOGO

Bicycle planning efforts on Cape Cod have grown to such a degree that this RTP is dedicating a stand-alone chapter to the topic of Bicycle and Pedestrian issues – colloquially known as the Cape Cod Bike Plan. In 2010, the Cape Cod Commission re-initiated the program known as "Cape Cod Bikeways." A cooperative effort including the Cape Cod National Seashore, the Commission is working with citizens and organizations from across Cape Cod to create a Cape-wide network of bicycling routes. When complete, Cape Cod Bikeways will extend from Provincetown to Falmouth and Bourne and provide connections between the Seashore and the Cape's interior, between the peninsula's historic landscapes and vibrant downtowns.

Cape Cod Bikeways was initiated in the early 1990s and given a new focus in 2010 as part of the effort to update Cape Cod's Regional Transportation Plan. The creation of a Cape-wide bicycling network is an ambitious undertaking that requires planning, mapping, community organizing, fundraising, special events, publicity, negotiation of land and easements, clearing, and construction work.

Further information is available on the internet:

www.gocapecod.org/bikeways

This chapter includes descriptions of the Cape's existing bicycle and pedestrian infrastructure, introduces tools for bike route planning, and a section of strategies to improve biking on Cape Cod.

The Commission is currently involved in bicycle/pedestrian planning efforts with the towns of Sandwich and Harwich and other communities. It is anticipated that recommendations from these studies will yield projects for inclusion in the Regional Transportation Plan. Summaries of some of these efforts are included in this chapter.

A major transportation planning effort was undertaken by the Cape Cod National Seashore in partnership with the Cape Cod Commission. The effort included outreach throughout Barnstable County to key stakeholders. The result is an "Integrated Bicycle Plan for Cape Cod/Bicycle Feasibility Study" released in 2010 and forms the basis of recommended projects included in this chapter.

As an overall framework, the following figure represents an overall vision for bicycle path connections to and within Cape Cod. The segments shown in green represent existing bicycle paths. Orange line segments represent generalized routes; detailed alignments are to be defined. This figure represents the Cape Cod Commission's vision for expansion of the Cape's bicycle path infrastructure.

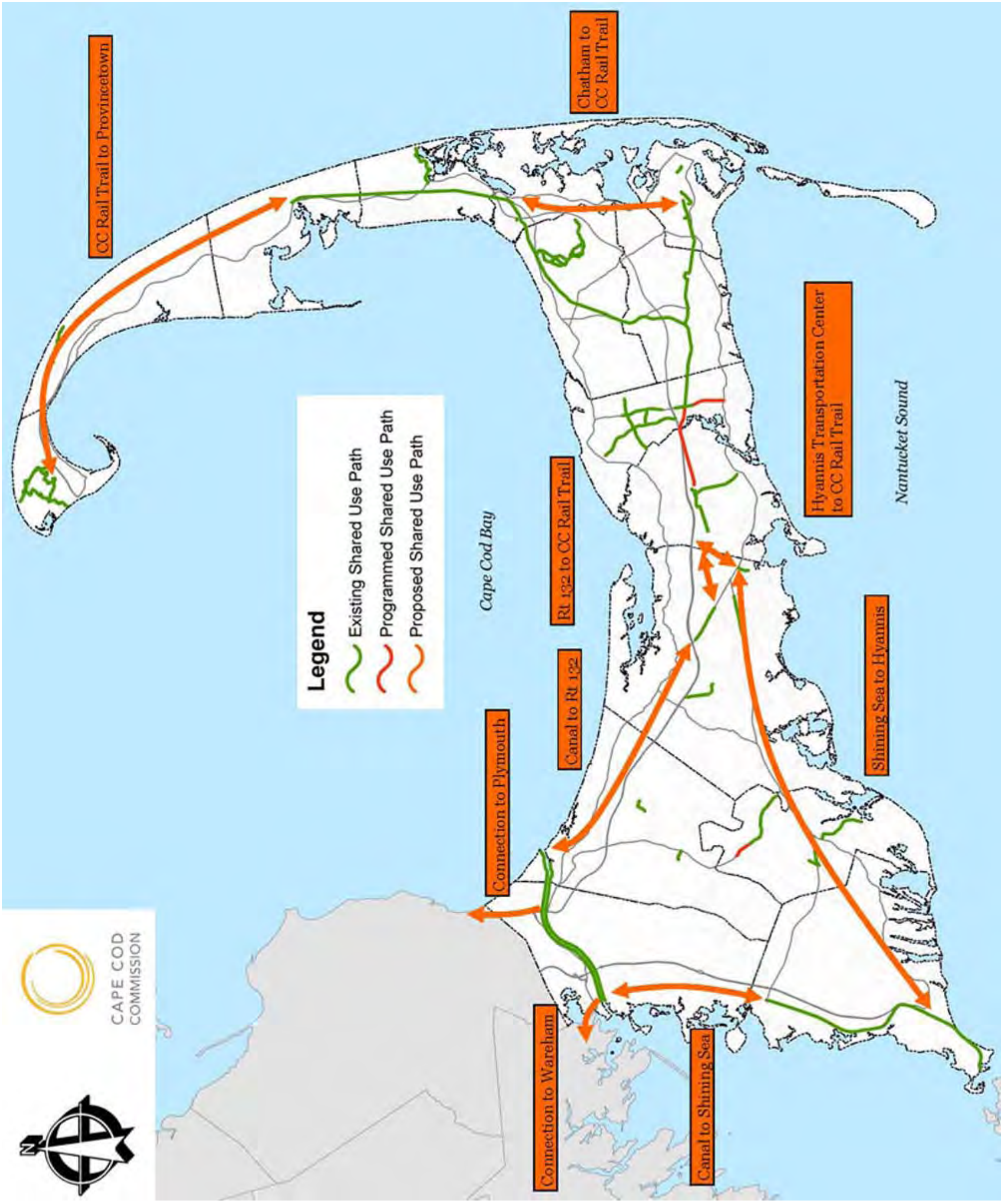

FIGURE 2 - SHARED USE PATH VISION MAP

5.1 BICYCLE AND PEDESTRIAN TRANSPORTATION

The following subsections include text, figures and tables that define and describe the bicycle and pedestrian infrastructure of Cape Cod. This information forms the baseline of the existing system and helps planners identify gaps and opportunities to improve bicycling and walking on Cape Cod. Since this analysis was performed for the 2007 RTP, Multi-Use Path mileage increased Cape-wide by 16.2% and Bike Route mileage increased by 4.2%.

5.1.1 MULTI-USE PATHS

TABLE 1 – MULTI-USE PATH AND ROUTE MILEAGE BY TOWN AND REGION

	LENGTH IN MILES	
Town / Region	**Multi-Use Paths**	**Bike Routes**
All Cape	97.4	347.1
Upper Cape	30.9	173.9
Mid Cape	19.8	78.4
Lower Cape	27.3	55.5
Outer Cape	19.4	39.3
Bourne	11.5	27.7
Sandwich	3.1	24.5
Falmouth	10.7	96.3
Mashpee	5.6	25.4
Barnstable	6.0	48.9
Yarmouth	3.9	15.3
Dennis	9.9	14.2
Harwich	8.7	20.0
Chatham	3.3	13.0
Brewster	13.4	11.3
Orleans	1.9	11.2
Eastham	7.2	0.4
Wellfleet	2.8	10.2
Truro	1.9	20.6
Provincetown	7.5	8.1

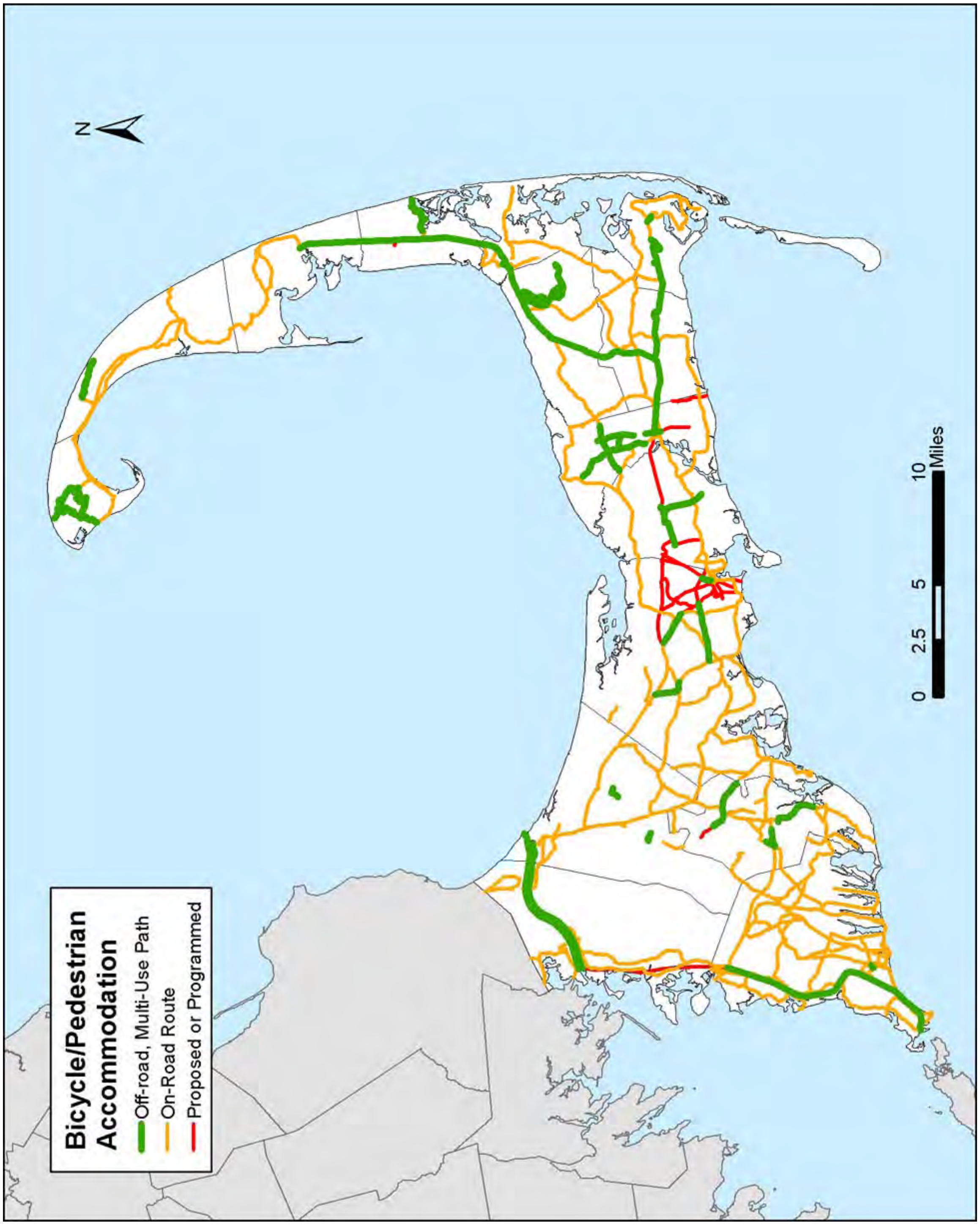

FIGURE 3 – MULTI-USE PATHS AND ROUTES ON CAPE COD

A multi-use path is a paved right of way, separate from roadways. A multi-use path (sometimes referred to as a bicycle path) is not a sidewalk. According to the American Association of State Highway and Transportation Officials (AASHTO), bicycle paths should have a paved surface 8-10 feet wide, with a 4 inch wide center line. Shoulders of 2-feet should be placed on either side of the path, with signage placed no closer than 3 feet from the pavement. The cross slope of a bicycle path should be no more than 2%. Bicycle paths must also meet other standards for grading, accessibility, and roadway crossings that conform to AASHTO guidelines. There are many bicycle paths throughout Cape Cod. Some serve recreational needs, while others serve transportation needs.

5.1.1.1 Cape Cod Rail Trail

The Cape Cod Rail Trail was constructed in the 1970s from the out of service Cape Cod Line rail right-of-way. Since 1991, an extension, two bridges over Route 6, and a tunnel have been constructed. The Massachusetts Department of Conservation and Recreation (DCR) owns and maintains the Rail Trail.

The Rail Trail runs from Route 134 in Dennis, just north of Great Western Road, to LeCount Hollow Road in Wellfleet. All along the trail are seating areas and trash cans. An extension of the trail, from Harwich to Chatham, was recently completed along the out-of-service Chatham Branch rail right-of-way. A bicycle roundabout was constructed at the intersection of the Rail Trail and the Harwich-Chatham extension. Currently, the main line of the Rail Trail is under renovation. The trail is being repaved and widened, with a grassy shoulder and more amenities. Phase 1 construction began in September 2005 on the section from Dennis to Nickerson State Park in Brewster. This portion of the Rail Trail was completed and officially reopened on June 17, 2006. The section of the trail from Nickerson State Park to Wellfleet was completed in 2007. A further extension of the Rail Trail from Route 134 to Willow Street in Yarmouth is currently being studied by the towns of Yarmouth and Dennis in consultation with Barnstable town officials. The project would include several grade separated crossings and would incorporate the Old Townhouse Path. A further extension to the Hyannis Transportation Center is also under consideration and is a key recommendation of the Yarmouth Road Corridor Study Task Force.

The trail is currently 10 feet wide in the new section and 8.5 feet wide in the old sections. The main line is 21.9 miles long, with 45 roadway crossings. The Harwich-Chatham Extension is 6.2 miles long with 15 roadway crossings. DCR estimates that 400,000 people use the rail trail annually. In addition, the rail trail is occasionally used for emergency vehicles. Given its length and location, the Cape Cod Rail Trail can be used to commute within the Lower and Outer Cape.

FIGURE 4 - CAPE COD RAIL TRAIL CROSSING AT MAIN STREET, HARWICHPORT

FIGURE 5 - CAPE COD RAIL TRAIL AT BRACKETT ROAD, EASTHAM

FIGURE 6 - HARWICH-CHATHAM RAIL TRAIL EXTENSION AT THE HARWICH-CHATHAM TOWN LINE

FIGURE 7 - END OF THE HARWICH-CHATHAM RAIL TRAIL EXTENSION AT CROWELL RD., CHATHAM

FIGURE 8 - BICYCLE ROUNDABOUT ON THE CAPE COD RAIL TRAIL, HARWICH

5.1.1.2 Cape Cod Canal Bike Paths

The Cape Cod Canal Bike Paths run along both sides of the Cape Cod Canal. The Army Corps of Engineers owns and maintains the paths as frontage roads for the Cape Cod Canal. Both sides have benches and sitting areas, and are lit at night. The southern-side path is 6.5 miles long, 8 feet wide and has 2 roadway crossings. The mainland-side path is 7 miles long, 8 feet wide and has 7 roadway crossings.

FIGURE 9 - SOUTHERN-SIDE OF THE CANAL BICYCLE PATH, EAST OF SAGAMORE BRIDGE

FIGURE 10 - MAINLAND-SIDE OF THE CANAL BICYCLE PATH, EAST OF RAILROAD BRIDGE

FIGURE 11 - SHINING SEA BICYCLE PATH AT TER HUEN DRIVE, FALMOUTH

FIGURE 12 - SHINING SEA BICYCLE PATH AT PALMER AVE., FALMOUTH

5.1.1.3 Shining Sea Bike Path

The Shining Sea Bike Path, located in Falmouth, was constructed from a portion of the out-of-service Woods Hole Branch rail right-of-way. The first phase of construction, which runs from the Steamship Authority terminal in Woods Hole to the Falmouth Bus Depot on Depot Street, was completed in 1976. The second phase, from Depot Street to the southern crossing of Palmer Avenue, was recently completed. Phase 3 will extend the bike path from Palmer Avenue to just south of Old County Road. The trail is currently 4.6 miles long, 8.5 feet wide, with 11 roadway crossings.

5.1.1.4 Provincelands Trails and Herring Cove Beach Path

The Provincelands Trails are the set of trails at Race Point in Provincetown. They provide a path from near Route 6 to the Provincetown beaches and the Provincetown Municipal Airport. Travelers primarily use the Provincelands Trails for recreation and not to commute. The paths were built in the 1960s before bicycle path standards were developed. As a result they have many steep slopes, sharp curves and other hazards. Bicycle traffic is restricted to 10 MPH travel for safety. The Provincelands Trails are owned by the Cape Cod National Seashore. There are a total of 7.6 miles of bicycle paths, with a paved surface 8 feet wide, and 4 roadway crossings.

The Herring Cove Beach Path serves as a connection between the Herring Cove Beach parking lot and Province Land Road in Provincetown. There is also a connection to the Provincelands Trails through the parking lot. The Herring Cove Beach Path is 0.1 miles long, 8 feet wide, and has no roadway crossings.

FIGURE 13 - PROVINCELANDS TRAIL AT THE RACE POINT VISITORS CENTER, FACING WEST

5.1.1.5 Setucket Road and Dennis Paths

Several paths exist in Dennis, creating a network for bicyclists and pedestrians. The longest path runs along Old Bass River Road from just south of Bob Crowell Road. The portion south of Mayfair Street is designated as Bicycle Route 1, part of the Claire Saltonstall Bikeway. The Old Bass River Road Path is 3.1 miles long, 8.5 feet wide, and contains 18 roadway crossings. Another nearby path is the Setucket Road Path, which begins in Yarmouth at Route 6A and ends west of Airline Road. The path crosses Route 134 and Old Bass River Road. The western section of path, until Mayfair Road, is also designated as Bicycle Route 1. The Setucket Road Path is 3.2 miles long, 8.5 feet wide, and contains 19 roadway crossings. The third path in Dennis is located on Old Chatham Road between Old Bass River Road and Route 134. The Old Chatham Road Path is 0.7 miles long, 8.5 feet wide, and contains 1 roadway crossing. All of these paths are owned and maintain by the Town of Dennis except for the section of path in Yarmouth, which is owned and maintained by that town. They provide a network of bicycle transportation for residents of Dennis. In total, these three paths are 7.0 miles long, and contain 38 roadway crossings.

FIGURE 14 - SETUCKET ROAD PATH EAST OF NORTH DENNIS ROAD, LOOKING EAST

FIGURE 15 - SETUCKET ROAD PATH EAST OF NORTH DENNIS ROAD, LOOKING WEST

5.1.1.6 Nickerson State Park Trails

Several bicycle paths are located within Nickerson State Park in Brewster. These paths are used for recreation, offering a scenic ride through the park. They are owned by the Massachusetts Department of Environmental Management. There are a total of 6.8 miles of bicycle path, with six roadway crossings.

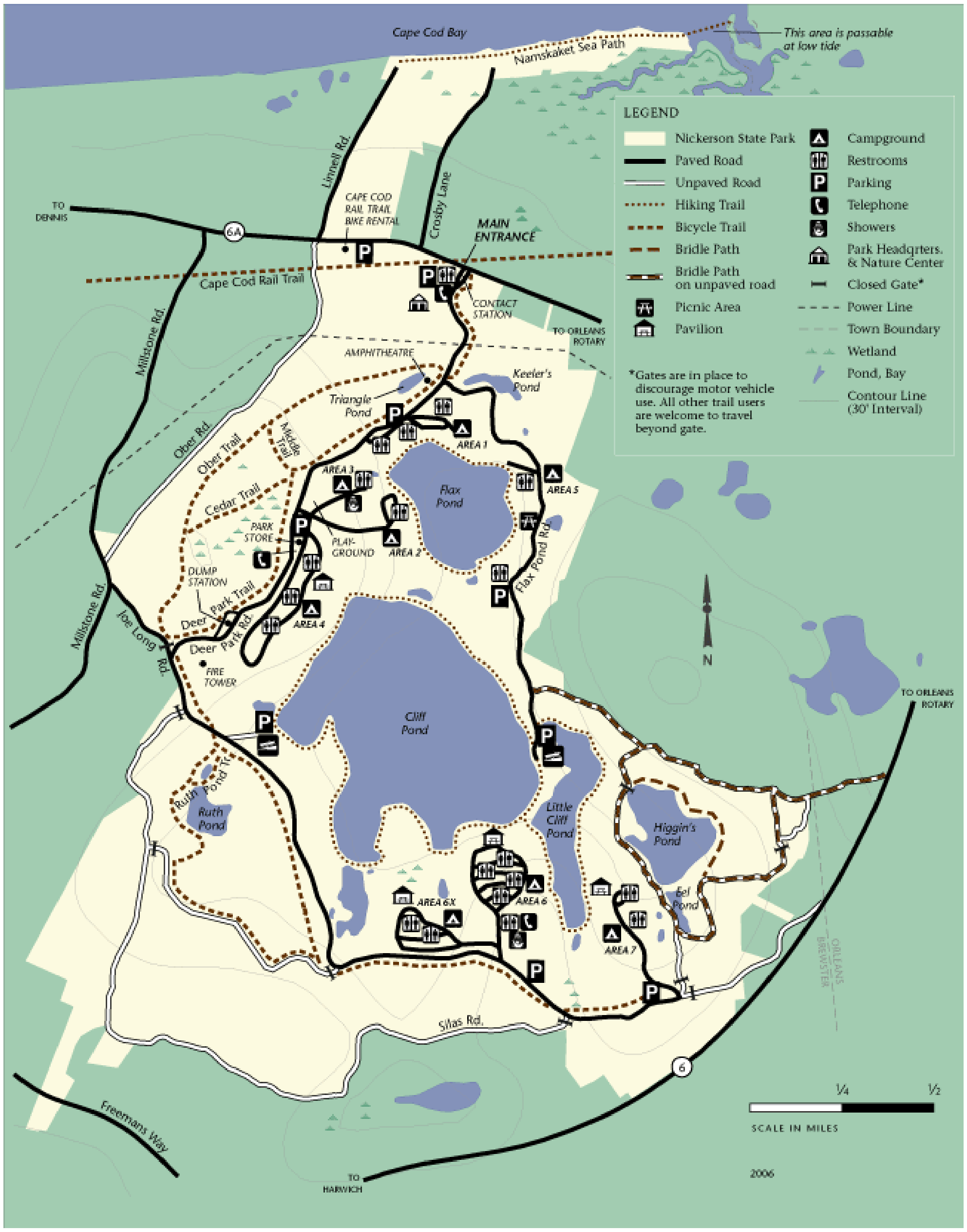

FIGURE 16 - MAP OF NICKERSON STATE PARK TRAILS
(Source: Massachusetts Department of Conservation and Recreation)

5.1.1.7 Nauset Trail

The Nauset Trail is located at the Cape Cod National Seashore in Eastham. It begins at Route 6 and the Salt Pond Visitors Center and runs to Coastguard Beach. A connection to the Cape Cod Rail Trail can be made via Bicycle Route 1. The Nauset Trail is owned by the Cape Cod National Seashore and used primarily for recreation. The Nauset Trail is 1.9 miles long, 8 feet wide, and has six roadway crossings.

FIGURE 17 - NAUSET TRAIL FROM THE SALT POND VISITOR'S CENTER LOOKING EAST

FIGURE 18 - NAUSET TRAIL FROM COASTGUARD BEACH PARKING LOT IN EASTHAM

5.1.1.8 Head of the Meadow Trail

The Head of the Meadow Trail is located in Truro in the Cape Cod National Seashore. It runs from Head of the Meadow Road to High Head Road in Pilgrim Heights. The trail is owned by the Cape Cod National Seashore. It is used primarily for recreational purposes. The Head of the Meadow Trail is 1.9 miles long, 8.5 feet wide, and has no roadway crossings.

FIGURE 19 - HEAD OF THE MEADOW TRAIL AT HEAD OF THE MEADOW ROAD, TRURO

5.1.1.9 Route 28 Path

The Route 28 Path runs along Route 28 in Barnstable from Bearses Way to Old Stage Road. The path was constructed in 1980 by the Town of Barnstable as a safe route to the middle and high schools. However, some sections of the path have not been designed to bicycle path standards, with narrow pavement, insufficient shoulders, and inadequate roadway crossings. The path is used primarily for commuting, as it connects residences, businesses, schools and other points of interest. The Route 28 Path is 2.5 miles long, 8 feet wide, and has 28 roadway crossings.

5.1.1.10 Route 130 Path

The Route 130 Path runs along Route 130 from Heritage Memorial Park to just north of Route 28 in Mashpee. The path is owned by the town of Mashpee. The Route 130 Path is 2.4 miles long and has 11 roadway crossings.

FIGURE 20 - LOOKING NORTH ON ROUTE 130 BICYCLE PATH AT LOVELL'S LANE, MASHPEE

FIGURE 21 - LOOKING SOUTH ON ROUTE 130 BICYCLE PATH AT LOVELL'S LANE, MASHPEE

5.1.1.11 Old Townhouse Road Trail

The Old Townhouse Road Trail runs from near Station Avenue, along Old Townhouse Road, behind the Bayberry Hills Golf Course, to Higgins Crowell Road in Yarmouth. Currently, the Rail Trail Extension Feasibility Study being performed by the towns of Yarmouth and Dennis is looking at using the Old Townhouse Road Trail right-of-way to connect the Rail Trail to Hyannis and the Claire Saltonstall Bikeway. The Old Townhouse Road Trail is 2 miles long, 8 feet wide, and has three roadway crossings.

FIGURE 22 - OLD TOWNHOUSE ROAD PATH EAST OF WEST YARMOUTH RD., YARMOUTH

FIGURE 23 - OLD TOWNHOUSE ROAD PATH WEST OF WEST YARMOUTH RD., YARMOUTH

FIGURE 24 - OLD TOWNHOUSE ROAD PATH AT THE BAYBERRY GOLF COURSE IN YARMOUTH

FIGURE 25 - OLD STAGE ROAD PATH AT THE SERVICE ROAD IN BARNSTABLE

5.1.1.12 Old Stage Road Path

The Old Stage Road Path begins at Route 149 in Barnstable, continues along the Service Road, and then turns down Old Stage Road. The path ends at Oak Street, where travelers can continue by sidewalk to Route 28 and Centerville shopping areas. The path was constructed in the early 1980s and is owned by the Town of Barnstable. It is used for both recreation and commuting, connecting West Barnstable and Centerville. The Old Stage Road Path is 1.9 miles long, and has six roadway crossings.

5.1.1.13 Forest Road Path

The Forest Road Path was built alongside Forest Road in 2006. It runs from Old Townhouse Road to Winslow Gray Road in Yarmouth. Continuing south on Forest Road, users can reach South Yarmouth and Route 28. Although terminating at Old Townhouse Road, the Forest Road Path does not directly connect with the trail there. The Forest Road Path is 1.4 miles long, 8.5 feet wide, and has 8 roadway crossings.

FIGURE 26 - FOREST ROAD PATH, LOOKING NORTH

FIGURE 27 - FOREST ROAD PATH, LOOKING SOUTH

5.1.1.14 Route 151 Path

The Route 151 Path runs along Route 151 from Mashpee Commons to Old Barnstable Road in Mashpee. At Old Barnstable Road, 2 forks turn south to access Mashpee High School. A third fork turns north and provides a connection to the Golf Club at Southport. The Route 151 Path is owned by the Town of Mashpee. The path is 1.1 miles long and has 1 roadway crossing.

TABLE 2 - BICYCLE PATH MILEAGE BY PATH

Path Name		Length in Miles	Width in Feet	Number of Roadway Crossings
Cape Cod Canal Bike Path	*Mainland*	7.04	8	7
	Cape Cod	6.52	8	2
	Total	13.57	8	9
Cape Cod Rail Trail	*Main Path*	21.9	8.5 / 10	45
	Harwich-Chatham Ext.	6.2	8.5	15
	Total	28.1	8.5 / 10	60
Downtown Falmouth Path		0.2	-	0
Forest Road Path		1.4	8.5	8
Forestdale School Path		0.4	10	
Head of the Meadow Trail		1.9	8.5	0
Hyannis Transportation Center Path		0.4	-	3
Nauset Trail		1.9	8	6
Nickerson State Park Trails		6.8	-	6
Old Stage Road Path		1.9	-	6
Old Townhouse Road Path		2.0	8	3
Provincelands Trail		7.6	8	4
	Herring Cove Beach Path	0.1	8	0
Route 130 Path		2.4	-	11
Route 151 Path		1.1	-	1
Route 28 Path		2.5	8	28
Setucket Road and Dennis Paths		7.0	8.5	38
Shining Sea Bikeway		4.6	8.5	11

5.1.1.15 Hyannis Transportation Center Path

The Hyannis Transportation Center Path runs from Route 28 in Barnstable to Main Street Hyannis. The trail was built during the construction of the Hyannis Transportation Center in 2002. The Hyannis Transportation Center Path is 0.4 miles long and has three roadway crossings.

5.1.1.16 Forestdale School Path

The Forestdale School Path is located in Sandwich. It connects Route 130 to the Forestdale School. Given that one can walk or bicycle from the nearby neighborhoods, the shared-use path serves the needs of students traveling to and from the school. The Forestdale School Path is 0.4 miles long, 10 feet wide, and has two roadway crossings.

5.1.1.17 Downtown Falmouth Path

The Downtown Falmouth Path is located on Hamlin Street in Falmouth, between Dillingham Avenue and Katherine Lee Bates Road. The bicycle path is owned by the Town of Falmouth. As a connection to downtown Falmouth, the path is used to access town hall, the library, and businesses. The Downtown Falmouth Path is 0.2 miles long and has no roadway crossings.

5.1.2 BICYCLE ROUTES

A bicycle route is any road, path, or trail that has been designated for bicycle use. In many cases, these are side streets with a low volume of traffic, or roads with wide shoulders. In the context of this section, only those bicycle routes located on roadways are discussed. Roadways designated for bicycle usage have the ability to link paths where bicycle rights-of-way are limited or unavailable. Many bicycle routes exist on Cape Cod, some of which are better signed than others. They allow bicycle users a wide network of travel across Cape Cod.

5.1.2.1 Claire Saltonstall Bikeway

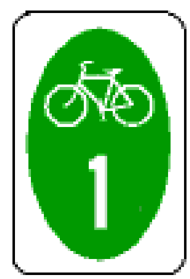

FIGURE 28 - SIGNAGE ON STATE BICYCLE ROUTE 1

The Claire Saltonstall Bikeway, or State Bicycle Route 1, is a series of bicycle paths and on-street routes that travel from Boston to both Provincetown and Woods Hole. The bikeway starts on Cape Cod at Route 3A in Bourne. It travels across the Sagamore Bridge, utilizing the bridge's sidewalk. After the Sagamore Bridge, the bikeway splits. One branch travels south, parallel to Route 28 and eventually joining with the Shining Sea Bikepath, until reaching Woods Hole. The main branch travels parallel to Route 6, joins with the Cape Cod Rail Trail, and then continues north to Provincetown. According to MassBike, the bikeway was mapped and established in 1978 by the Massachusetts General Court as a memorial to Claire Saltonstall, who died in a bicycle-motor vehicle accident. The Claire Saltonstall Bikeway, indicated by a green oval, is one of the best signed bicycle routes on Cape Cod. According to MassBike, however, many signs have disappeared and the route is impossible to follow without a map. The Cape Cod section of the Claire Saltonstall Bikeway is 98.3 miles in length. The Bourne to Provincetown portion is about 75.4 miles long, while the Bourne to Woods Hole portion is 22.9 miles long. Overall, the Claire Saltonstall Bikeway is about 165 miles long.

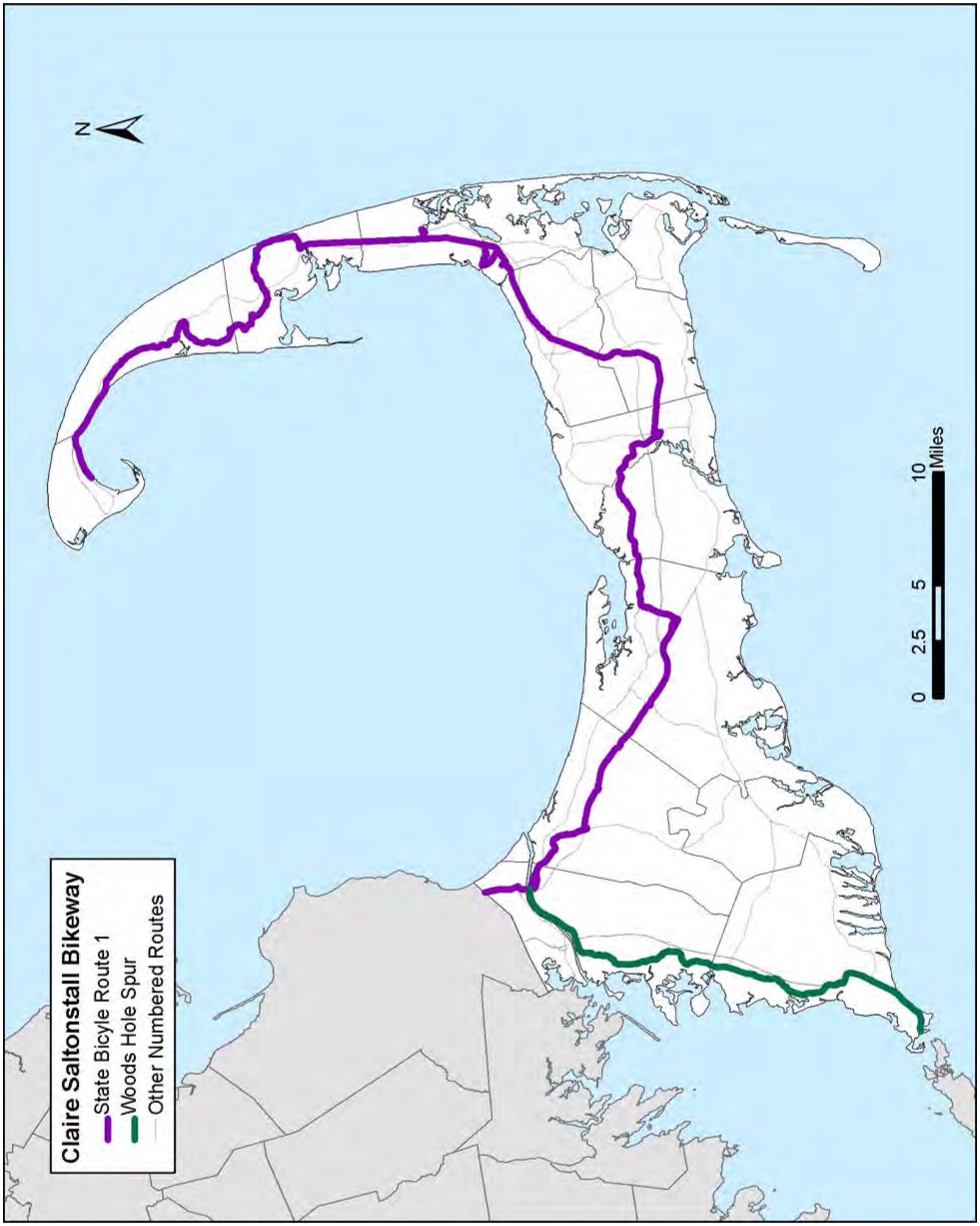

FIGURE 29 - CLAIRE SALTONSTALL BIKEWAY

5.1.2.2 State Bicycle Routes

MassGIS has also identified other bicycle routes throughout Cape Cod. Some examples are Buck Island Road in Yarmouth, Great Western Road in Dennis and Harwich, or Great Neck Road in. The Cape Cod Commission and AmeriCorps performed a survey of many of these roads in 2006. According to the survey, many of these roads are unsigned and some have sharp turns, no shoulders, or high traffic volumes. Evaluating existing bicycle routes, maintaining proper signage, and identifying possible new routes will help to encourage more bicycle use on Cape Cod, both commuter and recreational. In total, there are 172.6 miles of roadway on Cape Cod designated as bicycle routes by the Commonwealth of Massachusetts.

5.1.2.3 Falmouth Bicycle Routes

The Town of Falmouth has designated many of their roads to be bicycle routes. Some examples are Gifford Street, Sippewisset Road, Route 151, and Menauhant Road. According to a survey conducted by the Cape Cod Commission and AmeriCorps performed in 2006, many of these routes are signed and have sidewalks. In total, there are 101.8 miles of roadway in Falmouth designated as bicycle routes.

FIGURE 30 - ROUTE 28 NORTH OF THE DAVIS STRAITS INTERSECTION, A DESIGNATED BICYCLE ROUTE IN FALMOUTH

5.1.2.4 Low Volume Roads

Bicyclists and pedestrians can utilize low volume roads with minimal automobile conflicts. Cape Cod has 462.8 miles of major roads with summer average daily volumes (ADT) of 5,000 vehicles per day or less, and 91.2 miles of major roads with 1,000 vehicles per day or less. For reference, an ADT of 5,000 is equivalent to about one vehicle every seven seconds during daylight hours. An ADT of 1,000 is equivalent to about 1 vehicle every 35 seconds during daylight hours. Cape Cod also has about 1,803.4 miles of local paved roads that are suitable for safe bicycle and pedestrian traffic. These roads must be considered as part of the bicycle and pedestrian network, since trips usually begin or end on side streets or in low traffic residential neighborhoods.

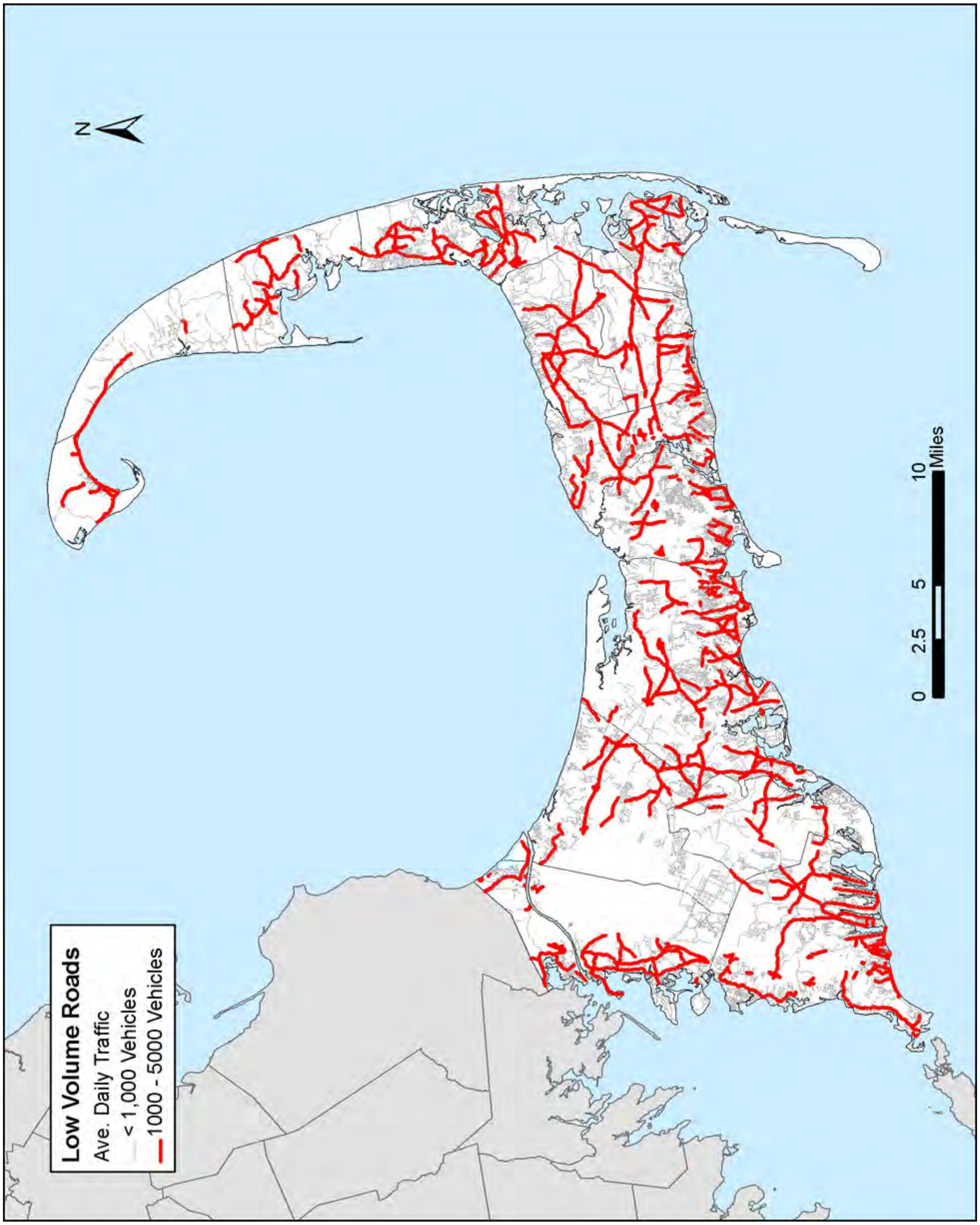

FIGURE 31 - LOW VOLUME ROADS

5.1.3 SIDEWALK NETWORK

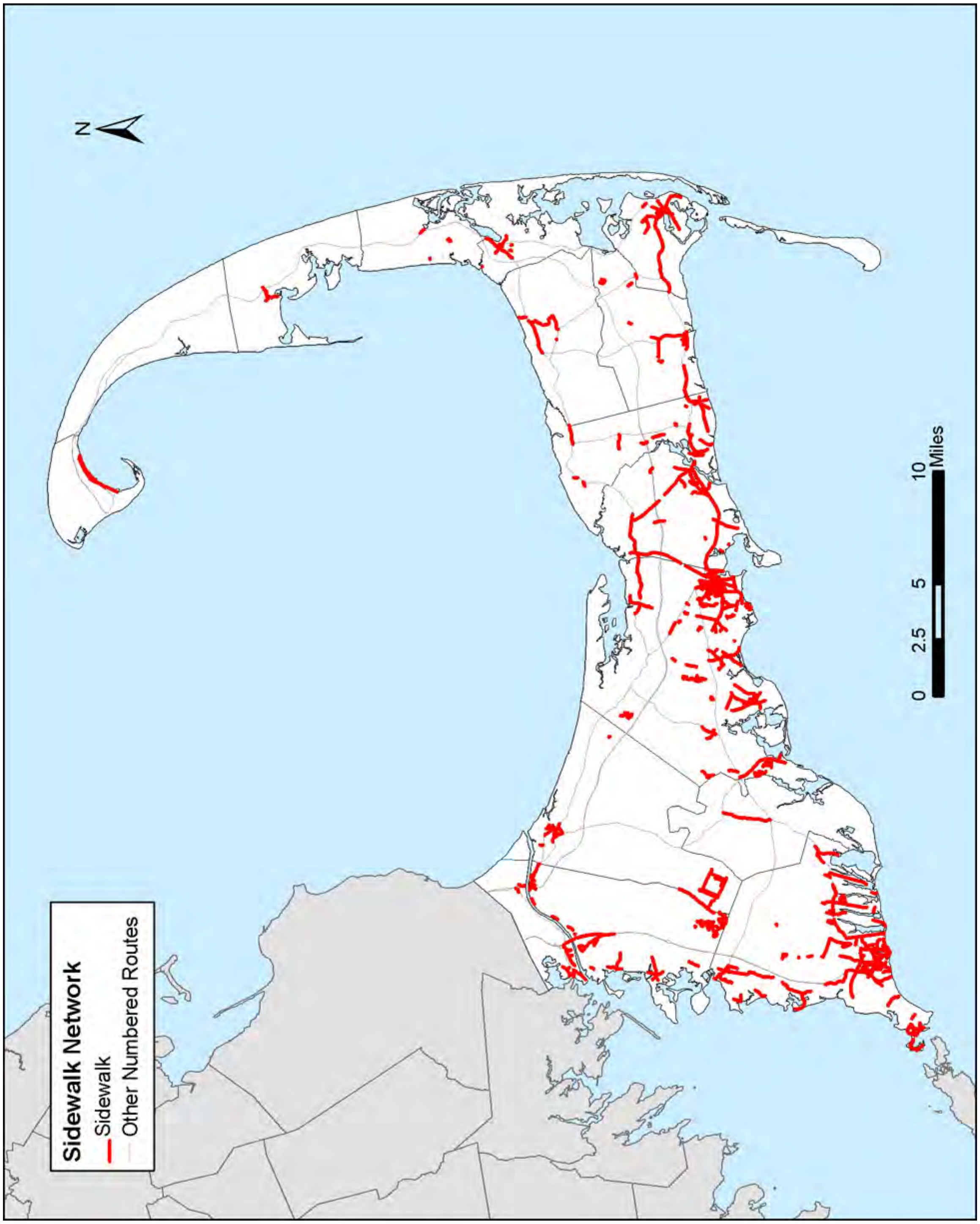

FIGURE 32 - SIDEWALK NETWORK

Sidewalks are paved surfaces, usually adjacent to roadways, which are designed primarily for pedestrian usage. Sidewalks are typically 4 to 6 feet wide, made with slabs of concrete, paved asphalt, bricks, or other hard substances. The Americans with Disabilities Act requires sidewalk curb cuts to be large enough and shallow enough for wheelchair usage. Telephone poles, road signs, and other architectural barriers must also be removed in order to create an unobstructed path for walking. In Massachusetts, bicyclists may ride on sidewalks outside business districts unless otherwise prohibited by local ordinances.

According to the 2008 Massachusetts Statewide Roadway Inventory File, there are 198.3 miles of sidewalk located on Cape Cod. In addition, 26.42 miles of road have sidewalks on either side. These roads are concentrated primarily in Hyannis and downtown Falmouth. Of all paved roadways on Cape Cod, 5.1% have a sidewalk on at least one side. The average sidewalk width on Cape Cod by mileage is 4.4 feet.

All of these figures illustrate pedestrian issues that must be addressed by any review of bicycle and pedestrian transportation. Over 90% of Cape Cod roadways do not have sidewalks. While many of these streets are low volume and residential, some are not and do warrant sidewalks. On a street without sidewalks, pedestrians must walk in the shoulders or on private property. This is not only less safe, but it restricts access for the elderly and disabled. Moreover, some sidewalks on Cape Cod have architectural barriers, such as telephone poles, located within the sidewalk. Obstructions like these make sidewalk navigation more difficult, especially for the disabled. Expanding the existing sidewalk network and correcting improperly designed sidewalks will help to encourage pedestrian usage in, around, and between business and population centers.

The sidewalk network also includes crosswalks. Crosswalks provide a safe means for pedestrians and other sidewalk users to cross roadways. All crosswalks are marked on the roadway surface by white paint. Generally, crosswalks located on lower volume roads have no traffic control devices, or a sign telling motorists to yield to pedestrians. However, many crosswalks have crossing signals that stop traffic, allow pedestrians to cross, and warn pedestrians when traffic is about to resume. Typically, crossing signals are located with traffic signals at roadway intersections. However there are four pedestrian signals on Cape Cod that are not located at a roadway intersection. Ensuring that crosswalks are located at high pedestrian areas throughout Cape Cod will help to improve safety as well as access. Access can also be improved by ensuring that crosswalks accommodate all users, including the elderly and disabled. Properly designed curb cuts that are usable by wheelchairs, tones at crosswalk signals for the blind, and other amenities can significantly improve sidewalk access for the disabled.

5.1.4 CAPE COD PATHWAYS

The Barnstable County Commissioners and the Cape Cod Commission are working with citizens and organizations from across Cape Cod to create a Cape-wide network of walking trails. This network is called Cape Cod Pathways. When complete, Cape Cod Pathways will extend from Provincetown to Falmouth and Bourne and provide a connection between the Seashore and the Cape's wooded interior, between the peninsula's historic villages and remaining backcountry. Through the work of many volunteers and civic and environmental leaders, the Pathways east-west trail between Provincetown and the upper Cape is approximately now one-third dedicated.

Cape Cod Pathways was initiated in November 1993. Since then the project has garnered widespread support from the Barnstable County Assembly of Delegates, Cape Cod National Seashore, town officials, conservation organizations, businesses, and other groups. Trail planning currently under way in Cape Communities will result in newly dedicated trails in the years ahead.

The creation of a Cape-wide trail network is an ambitious undertaking that requires planning, mapping, community organizing, fundraising, special events, publicity, negotiation of land and easements, clearing, and construction work. More information about Cape Cod Pathways is available on the internet:

www.capecodcommission.org/pathways

Many of the trailheads have been mapped using Google mapping as shown in the following figure. The green trailhead symbols represent Cape Cod pathways that are accessible via public transportation. In addition to the larger goal of connecting trails throughout the Cape, natural attractions such as rivers, lakes and ponds are recognized as important features for the Pathways program to provide access.

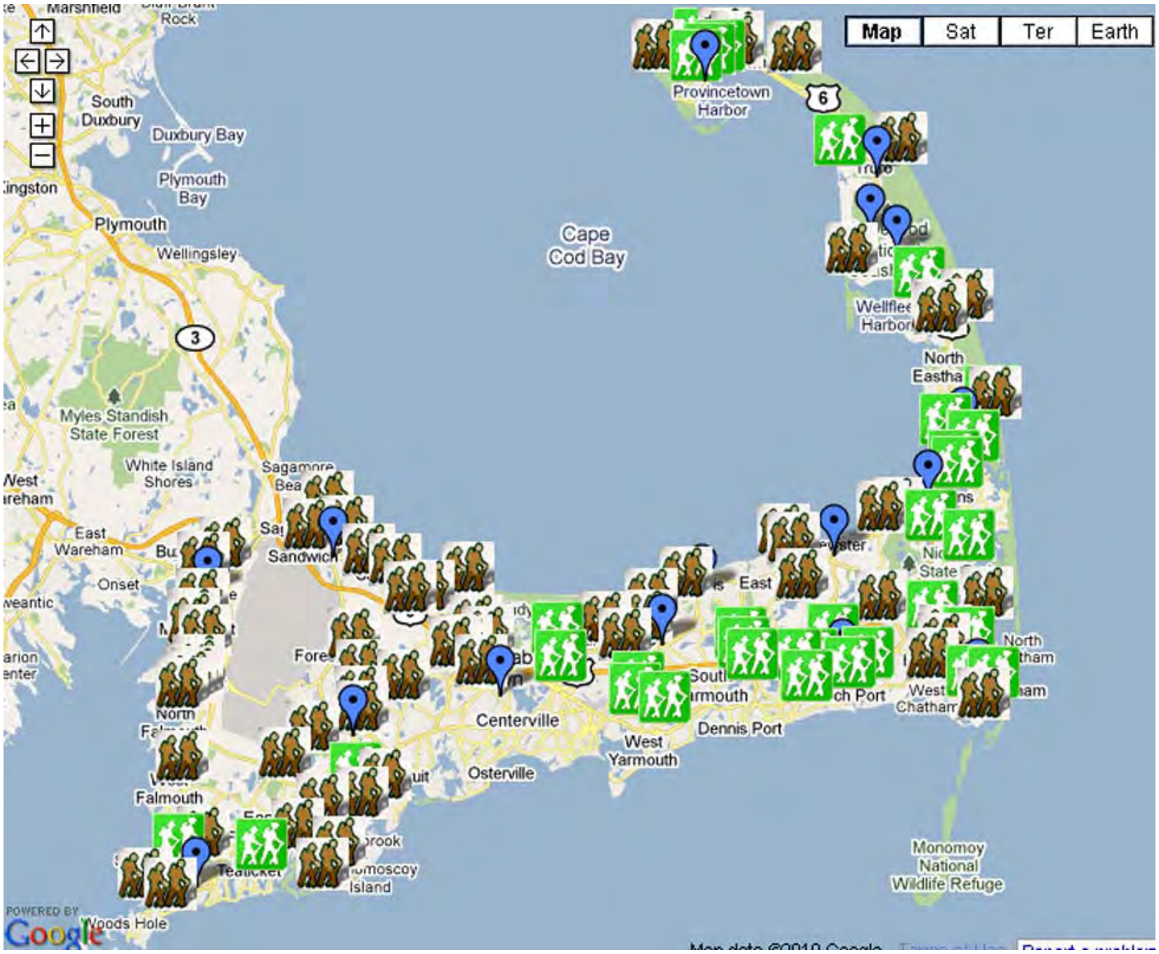

FIGURE 33 - CAPE COD PATHWAYS

5.1.5 BICYCLE AND PEDESTRIAN AMENITIES

Beyond bicycle and pedestrian infrastructure, there are various amenities that address the needs of the traveler. Employers and businesses almost always have enough automobile parking. The same does not always hold true for bicycles. Bicycle racks allow the traveler to securely park their property without fearing that it will be stolen or damaged. Water fountains, vending machines or nearby cafes provide the traveler with nourishment after their ride or walk. Public restrooms are also useful to both pedestrians and bicyclists. Showers and locker facilities allow employees to change into clean clothes. All of these amenities help to encourage non-motorized transportation.

There are many amenities available to bicyclists and pedestrians on Cape Cod. The Hyannis Transportation Center has bicycle racks, public restrooms, water fountains, vending machines and other user amenities. In addition, the Cape Cod Regional Transit Authority (CCRTA) offers bicycle racks with space for two bicycles on each CCRTA bus. Bicycle racks, restrooms, food, and other amenities are also available at the Exit 6 Rest

Area near the Barnstable Park-and-Ride Lot. The Steamship Authority Piers in Hyannis and Woods Hole offer restrooms and vending machines to customers who arrive by bicycle. Moreover, some employers offer bicycle and pedestrian amenities to their employees. According to the Massachusetts State Bicycle Plan, all such amenities address the "destination barriers" that bicyclists and pedestrians perceive, such as not being able to safely park their bicycle, showing up to work sweaty, or arriving at their workplace hungry and thirsty. By making non-motorized travel more attractive to potential users, more people will be inclined to ride a bicycle and walk to work.

5.1.6 BICYCLE AND PEDESTRIAN FACILITY ACCESSIBILITY AND MOBILITY

Not everyone can ride a bicycle or walk as their primary mode of transportation. Users must live relatively close to where they work and shop in order to ensure a reasonable travel time. The low density of Cape Cod development is in this way not conducive to bicycle travel. Moreover, a certain level of fitness is necessary to deal with the physical exertion. On Cape Cod, where many residents are elderly, bicycling or walking may not be practical for some travelers. Despite these barriers, there are many potential users who can be targeted and encouraged to travel by bicycling or walking for its positive environmental, physical, and economic benefits.

Bicycle paths and routes can be made more accessible by ensuring that there are adequate entry points, safe roadway crossings, and proper signage. There is a tradeoff between entry points and roadway crossings, since roadways are often the place where bicyclists enter a bicycle path. As the number of entry points increase, so do the number of roadways bicyclists must cross in order to travel the path. Most Cape Cod bicycle path-roadway crossings have yellow stanchions or gates that encourage bicyclists to stop and watch for vehicles before crossing. Two roadway crossings of the Cape Cod Rail Trail in Harwich and Brewster have signals which warn oncoming vehicles when bicyclists or pedestrians are approaching the intersection. Signage is also important to accessibility, since it directs users to and along the path. Posted maps, street signs, and signs listing local points of interest also help to direct travelers to their destinations. By implementing safety and signage measures such as these, bicycle and pedestrian facilities can become more accessible to both first time and frequent users.

FIGURE 34 - WEST YARMOUTH ROAD CROSSING OF THE OLD TOWNHOUSE ROAD TRAIL

FIGURE 35 - MEETINGHOUSE ROAD CROSSING OF THE HARWICH-CHATHAM EXTENSION OF THE CAPE COD RAIL TRAIL

Bicycle paths on Cape Cod, with the exception of the Rail Trail and Shining Sea Bikepath, are generally too short, or the wrong location, to facilitate commuting. For example, the Nauset Trail only conducts travelers from Route 6 to the Cape Cod National Seashore. The Forest Road Path does not continue all the way to the commercial activity on Route 28. The key is to construct and connect paths in such a way as to link areas with residential, commercial, and recreational uses. Otherwise, bicyclists will only be able to use bicycle paths as part of a larger bicycle route or for recreational purposes.

Because bicycles are small and lightweight, they are very portable and easy to transfer from mode to mode. Bus services, such as the CCRTA, Plymouth and Brockton, and Peter Pan / Bonanza Bus Lines, can accommodate cyclists with racks and storage areas. The Steamship Authority and other ferry services allow passengers to bring their bicycles for a fee. Special reservations can also be made with air carriers in order to transport bicycles. For this reason, bicycle transportation can help to connect users to other modes of transportation.

5.2 BICYCLE AND PEDESTRIAN ROUTE PLANNING TOOLS

A key component of Cape Cod Bikeways is to involve the public in identifying the “best” bicycle routes. The bikeways website includes links showing potential on-road bicycle routes connecting major destinations on Cape Cod using Google's mapping service. Some non-roadway alternatives (such as the Cape Cod Canal multi-use path are not shown). The goal of establishing these routes is to provide for the "best" bicycle travel within, among, and through the attractive areas of the Cape while avoiding narrow and busy roads such as Route 6A or Route 28.

These alternatives provides direct access to major roads and do not require cyclists to travel more than about one and a half times the distance that would be traveled if the cyclist stayed on the major road. Additionally, the alternate route still provides a showcase for the scenic and historic qualities of the area.

Town planning officials and concerned citizens are invited to comment and provide suggestions on specific routing. The mid-term goal is to provide online maps and on-road signage to inform the public (both to help cyclists with way-finding and to alert motorists of potential bicyclists). Longer-term, those segments of the routes that pose the greatest difficulty in safely biking then will be considered for improvements or for the development of other alternatives. Two basic regional routes are explored: a northside bike route complementary to Route 6A connecting the Cape Cod Canal in Bourne to Rock Harbor Road in Orleans (the so-called “Route 6B”); and, a southside bike route complementary to Route 28 connecting Woods Hole in Falmouth to Chatham Light (the so-called “Route 28B”).

5.2.1 “ROUTE 6B” – NORTHSIDE BICYCLE ROUTE

FIGURE 36 - ROUTE "6B" LOGO

The following figure shows a potential on-road bicycle route from the Cape Cod Canal area in Sandwich to the area including the Eastham Rotary and Rock Harbor at the Orleans/Eastham town line. Some non-roadway alternatives (such as the Cape Cod Canal multi-use path are not shown). The goal of establishing the Northside Route is to provide for the "best" bicycle travel within, among, and through the areas north of Route 6 in the towns from Sandwich to Orleans - and to generally avoid the narrow and busy Route 6A.

This alternative provides direct access to Route 6A and does not require cyclists to travel more than about one and a half times the distance that would be traveled if the cyclist stayed on Route 6A. Additionally, the alternate route still provides a showcase for the scenic and historic qualities of the district.

This figure was developed as part of the Route 6A Corridor Management Plan update, released by the Commission in 2010. The maps indicate useful alternatives to Route 6A as well as connector routes. The sections of Route 6A identified in red indicate road segments where no viable alternative exists.

Town-by-town maps showing the main “Route 6B” route are shown in subsequent figures.

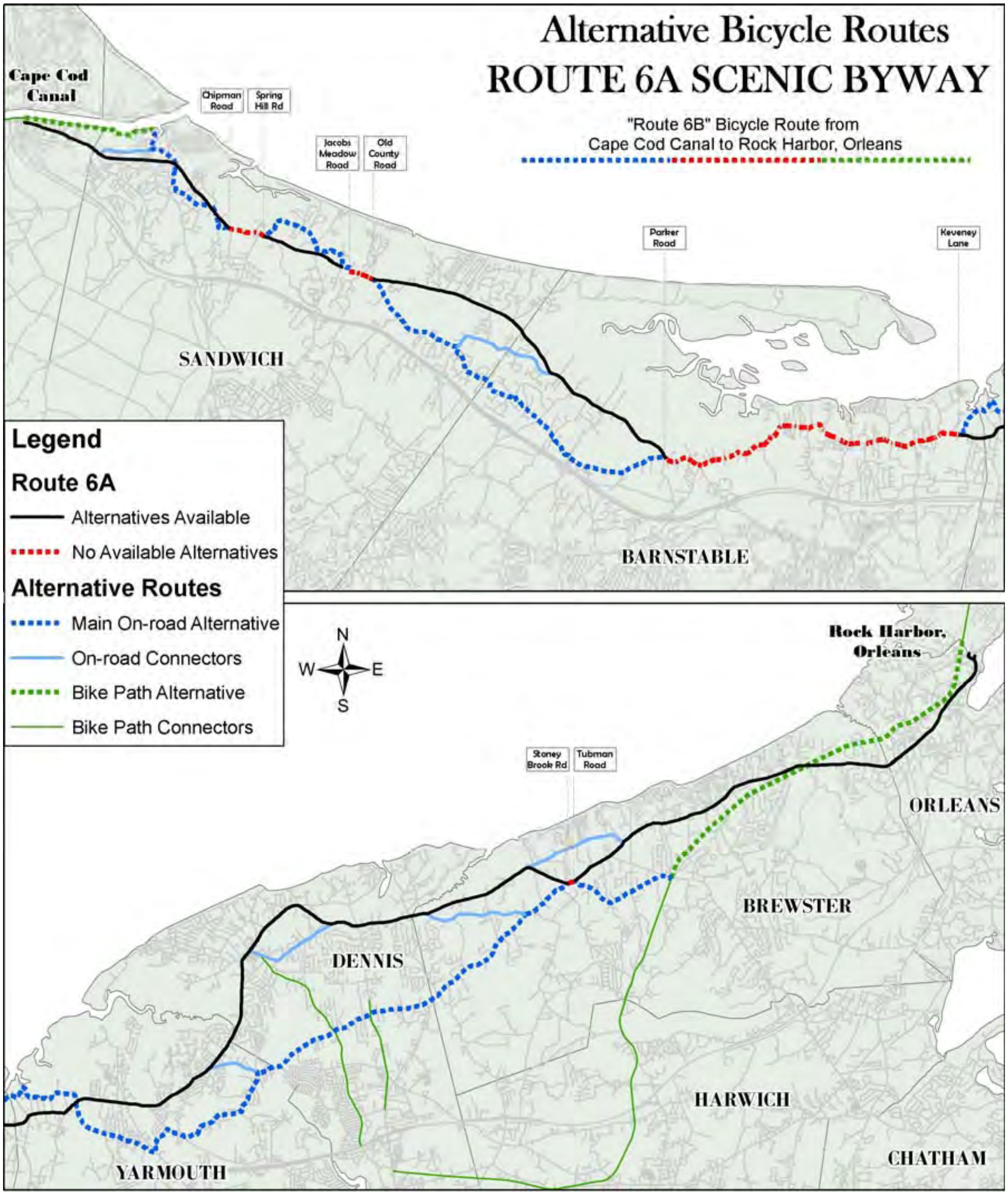

FIGURE 37 - ROUTE "6B" – NORTHSIDE BICYCLE ROUTE

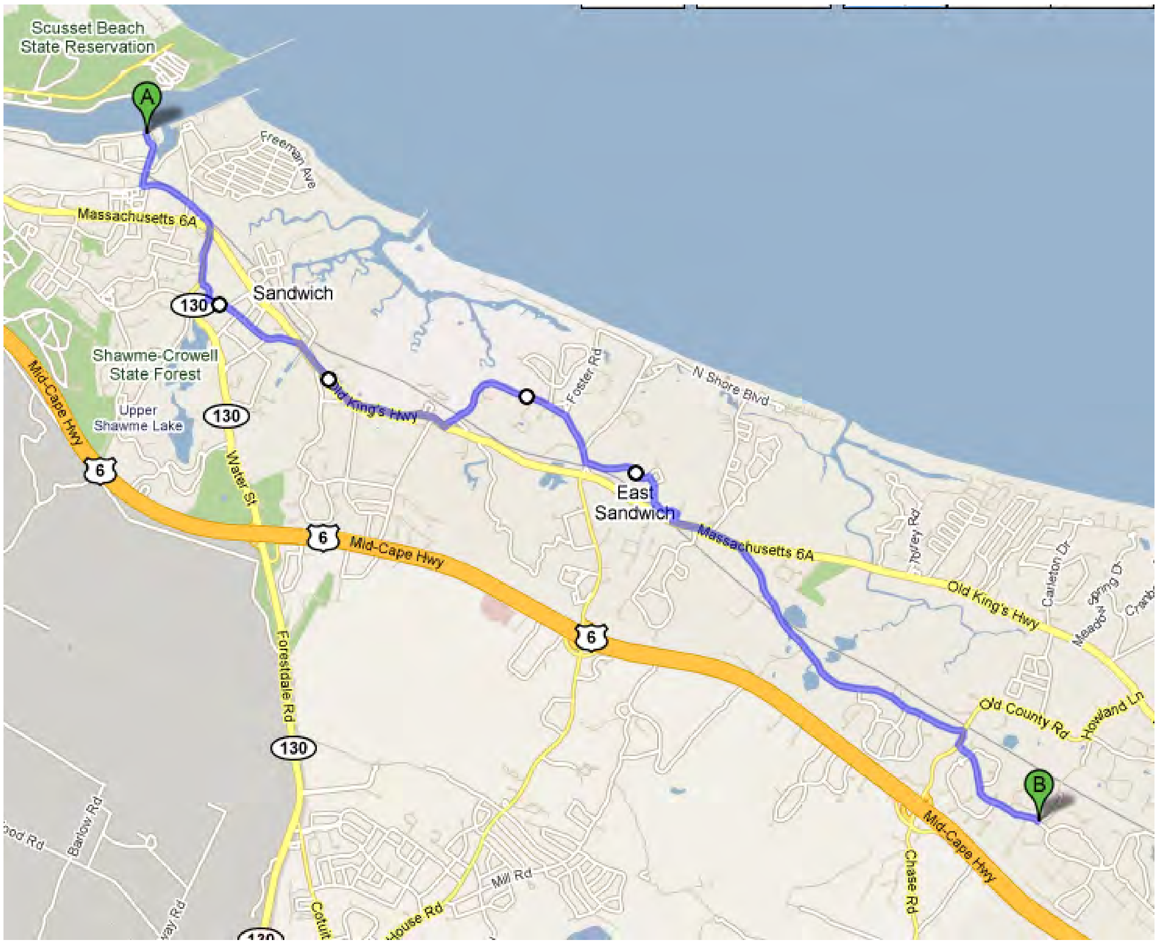

FIGURE 38 - POTENTIAL ROUTE "6B" IN SANDWICH
(Source: Cape Cod Commission, Google Maps)

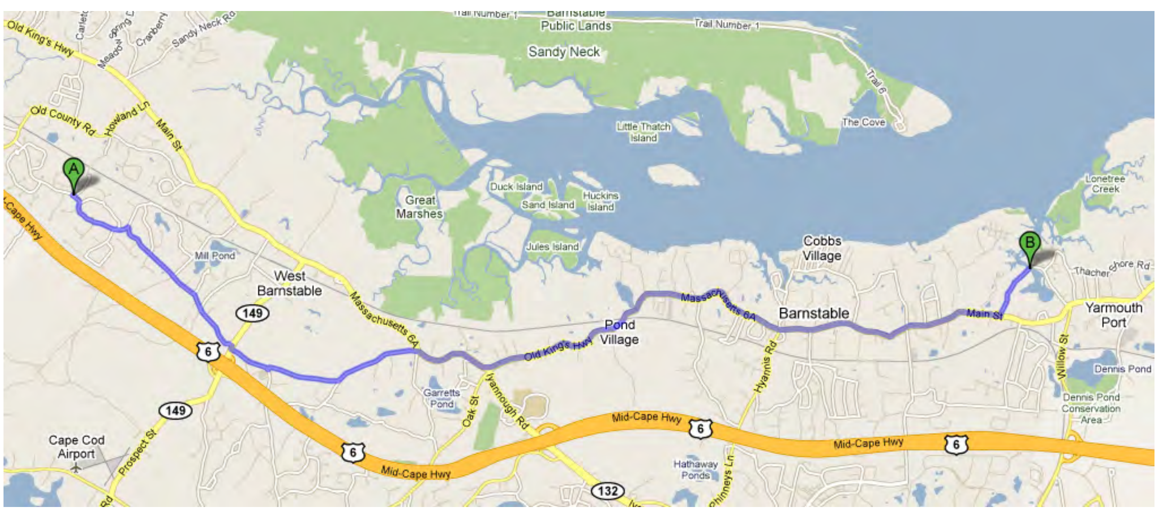

FIGURE 39 - POTENTIAL ROUTE "6B" IN BARNSTABLE
(Source: Cape Cod Commission, Google Maps)

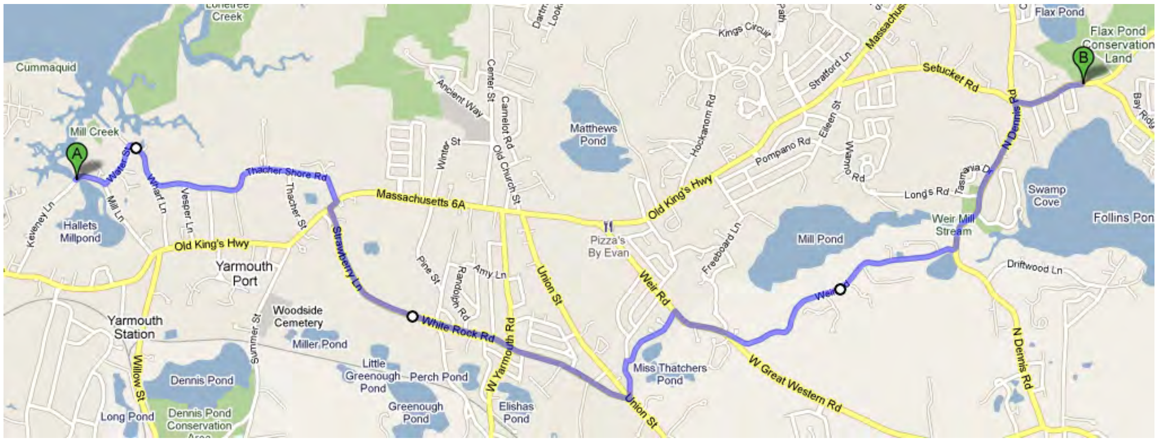

FIGURE 40 - POTENTIAL ROUTE "6B" IN YARMOUTH
(Source: Cape Cod Commission, Google Maps)

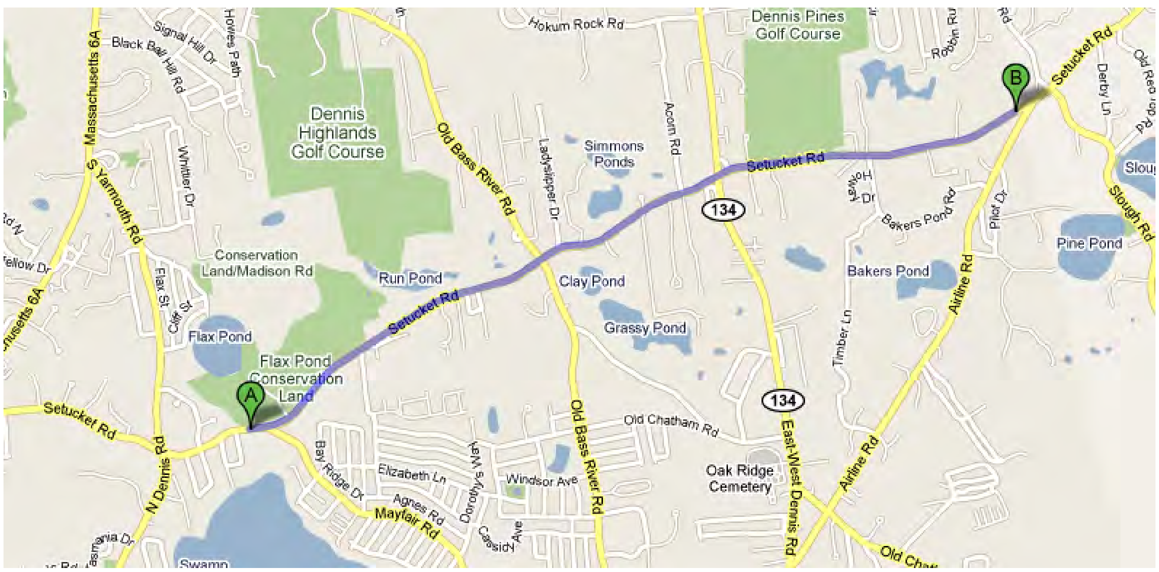

FIGURE 41 - POTENTIAL ROUTE "6B" IN DENNIS
(Source: Cape Cod Commission, Google Maps)

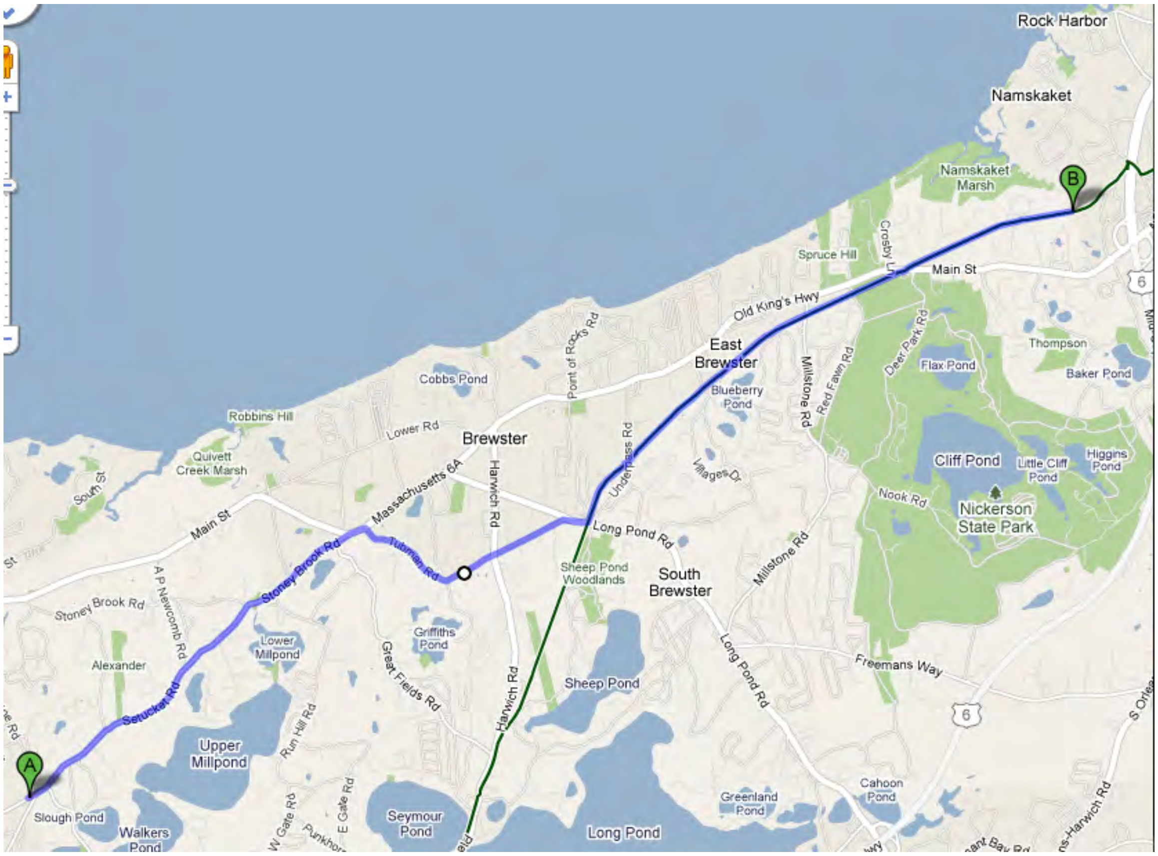

FIGURE 42 - POTENTIAL ROUTE "6B" IN BREWSTER
(Source: Cape Cod Commission, Google Maps)

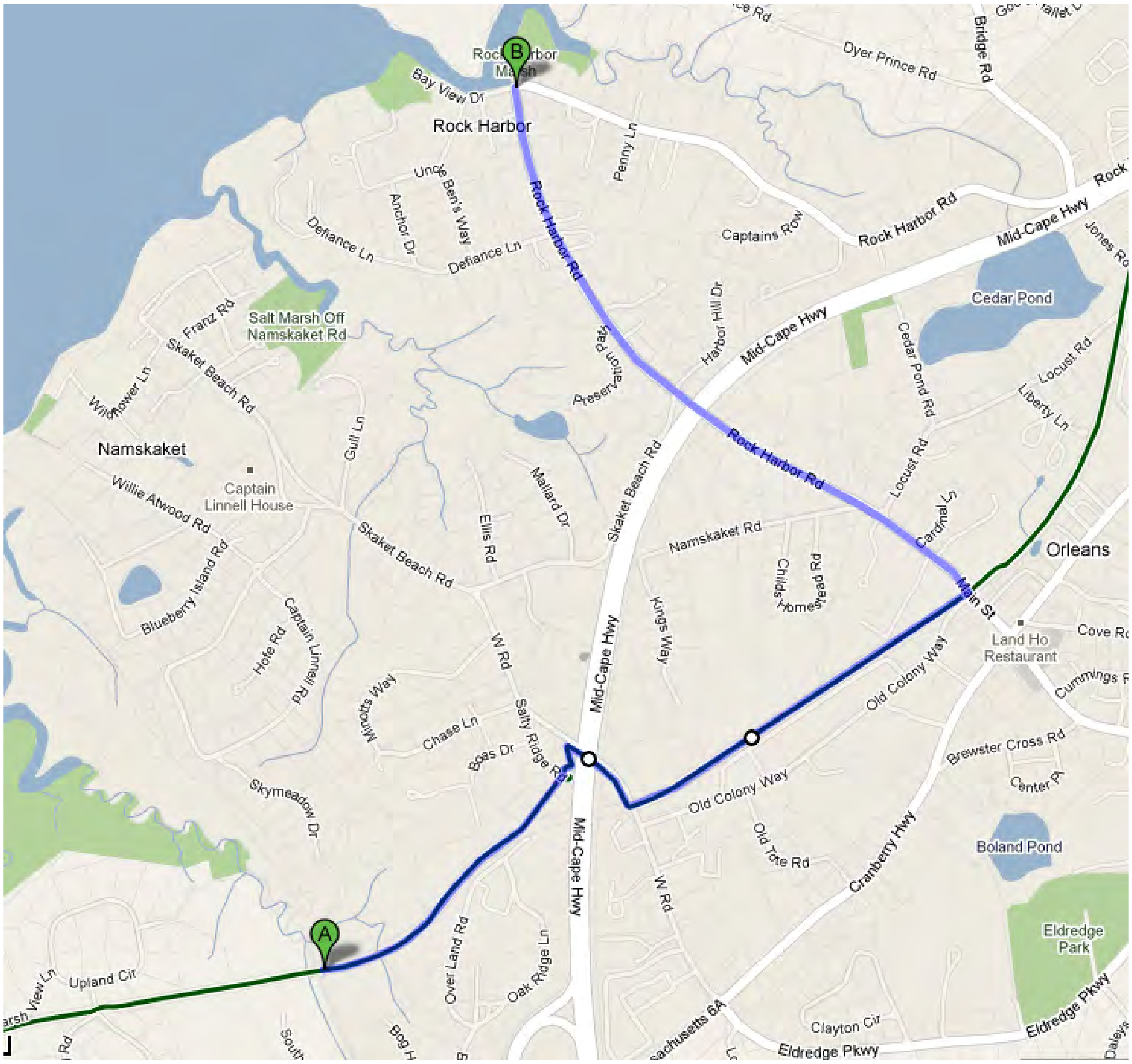

FIGURE 43 - POTENTIAL ROUTE "6B" IN ORLEANS
(Source: Cape Cod Commission, Google Maps)

5.2.2 "ROUTE 28B" – SOUTHSIDE BICYCLE ROUTE

FIGURE 44 - ROUTE "28B" LOGO

The following figures show a potential on-road bicycle route from the Woods Hole in Falmouth to Chatham Light. The goal of establishing the Southside Route is to provide for the "best" bicycle travel within, among, and through the areas south of Route 6 in the towns from Falmouth to Chatham - and to generally avoid the narrow and busy Route 28.

This alternative provides direct access to Route 28 and does not require cyclists to travel more than about one and a half times the distance that would be traveled if the cyclist stayed on Route 28. Additionally, the alternate route still provides a showcase for the scenic and historic qualities of the area.

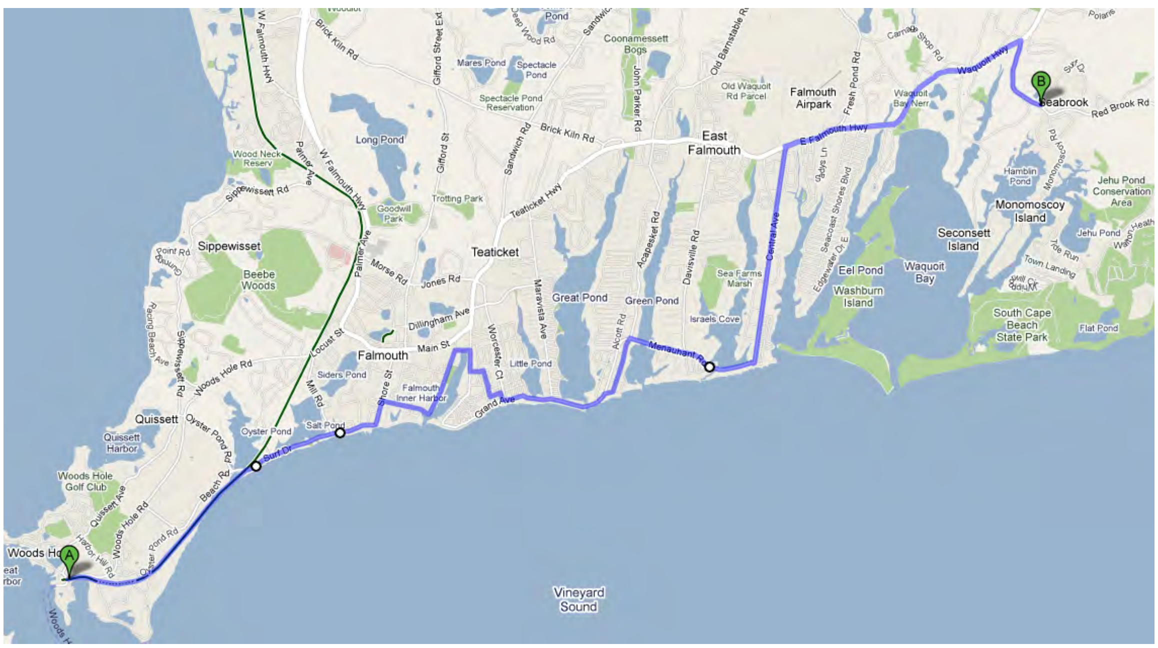

FIGURE 45 - POTENTIAL ROUTE "28B" IN FALMOUTH
(Source: Cape Cod Commission, Google Maps)

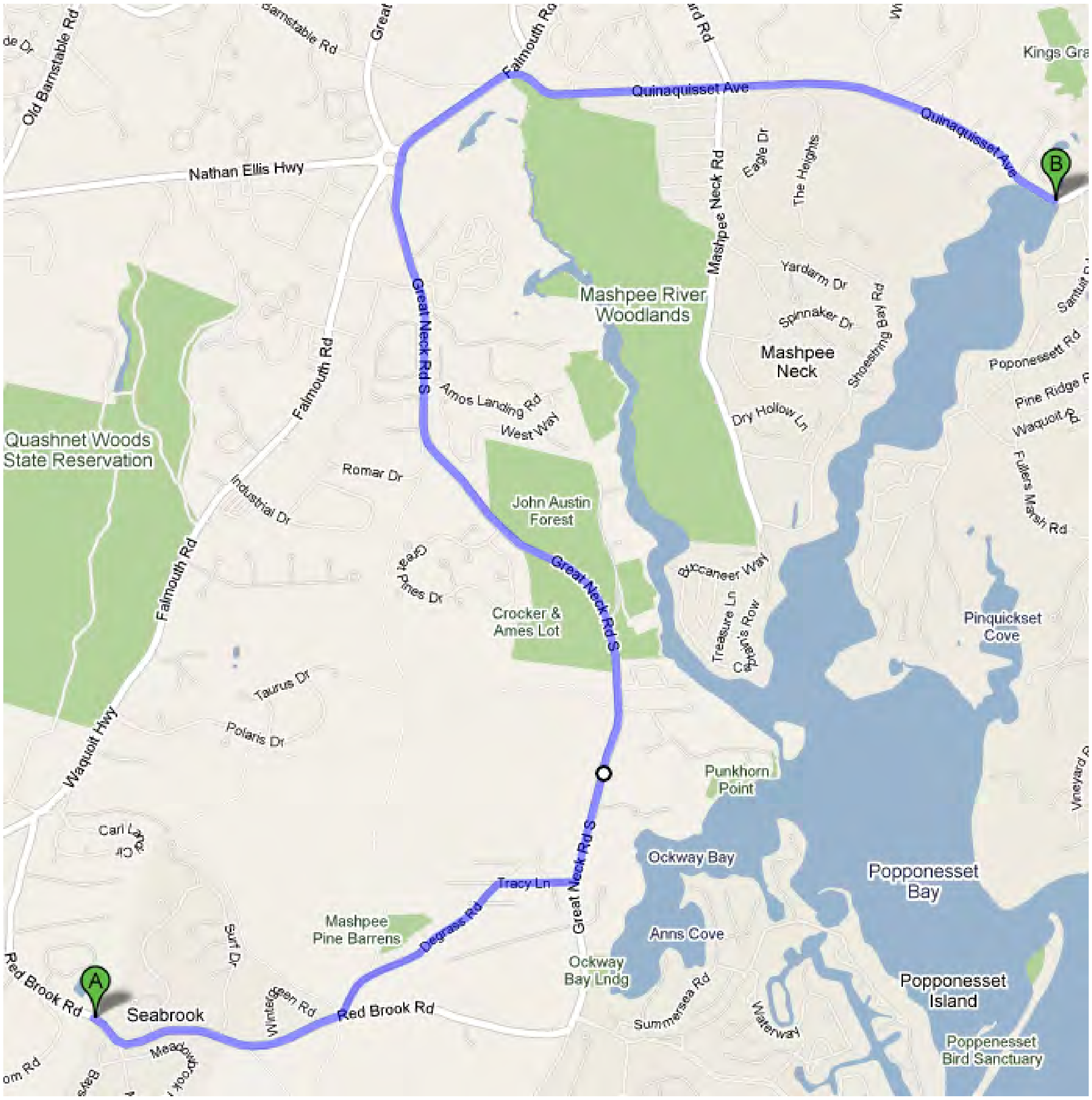

FIGURE 46 - POTENTIAL ROUTE "28B" IN MASHPEE
(Source: Cape Cod Commission, Google Maps)

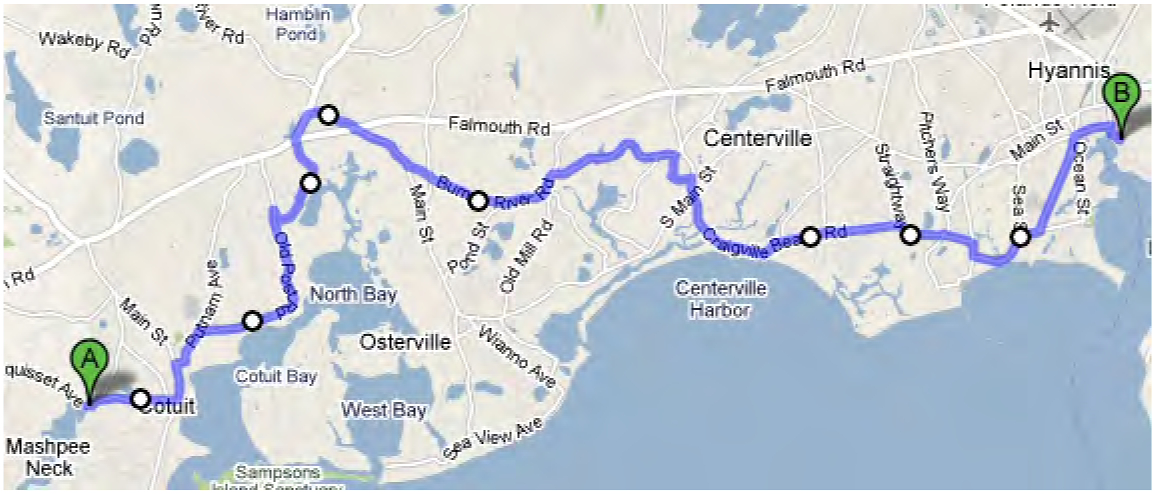

FIGURE 47 - POTENTIAL ROUTE "28B" IN BARNSTABLE
(Source: Cape Cod Commission, Google Maps)

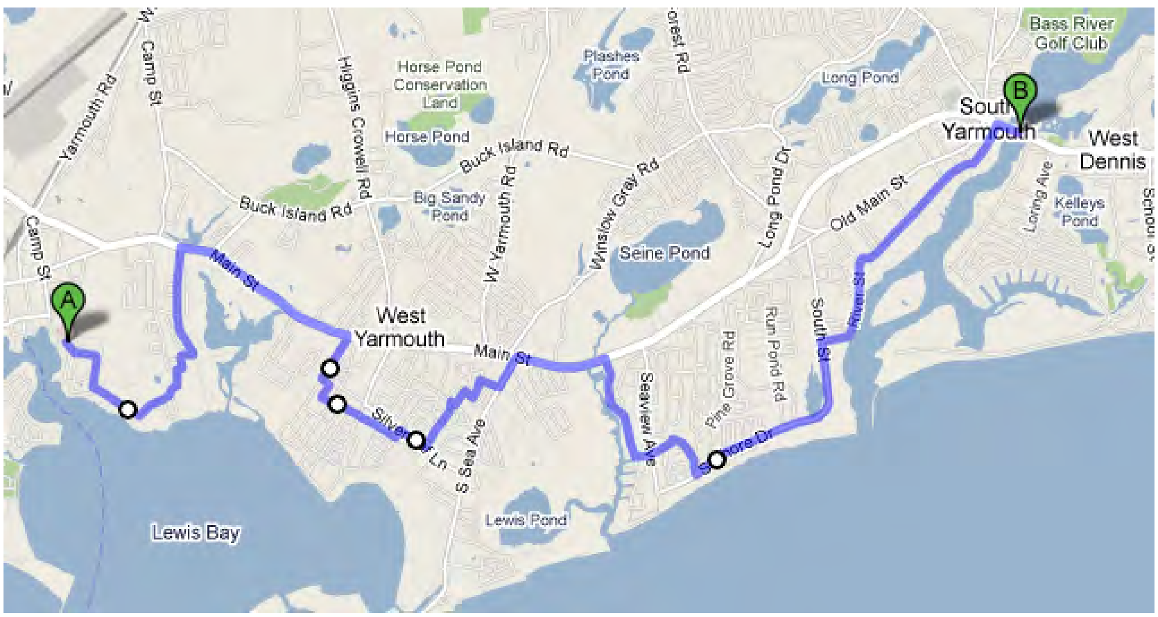

FIGURE 48 - POTENTIAL ROUTE "28B" IN YARMOUTH
(Source: Cape Cod Commission, Google Maps)

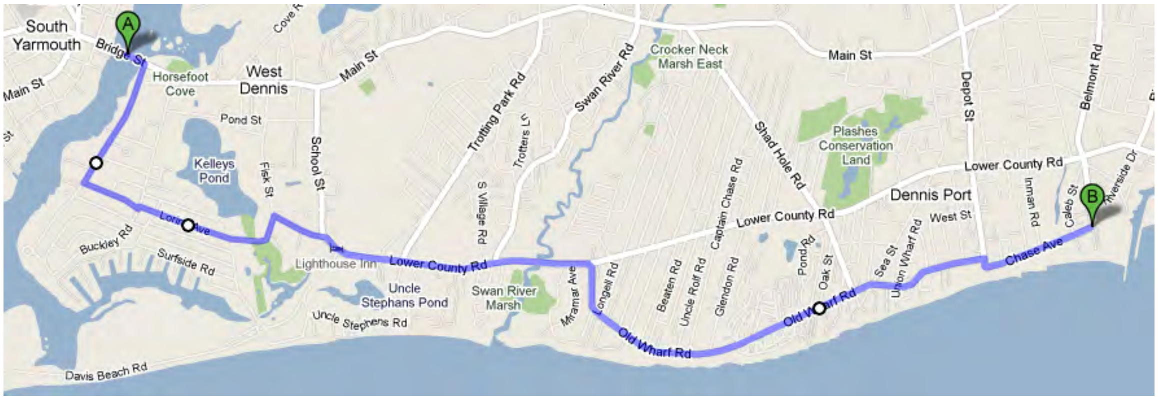

FIGURE 49 - POTENTIAL ROUTE "28B" IN DENNIS
(Source: Cape Cod Commission, Google Maps)

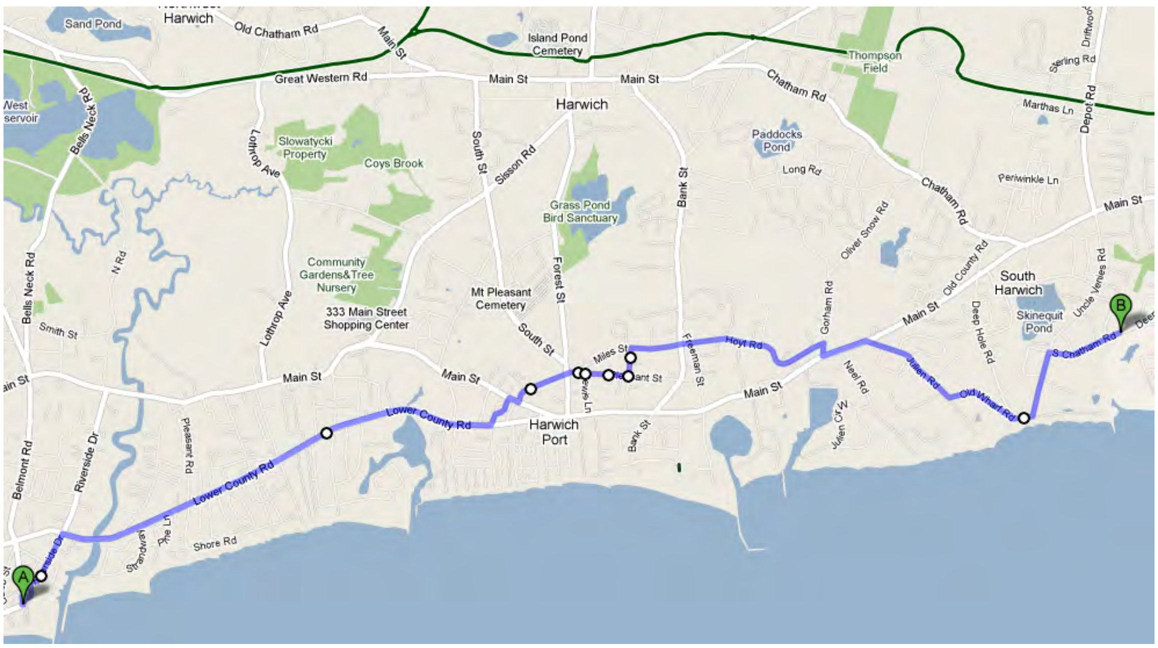

FIGURE 50 - POTENTIAL ROUTE "28B" IN HARWICH
(Source: Cape Cod Commission, Google Maps)

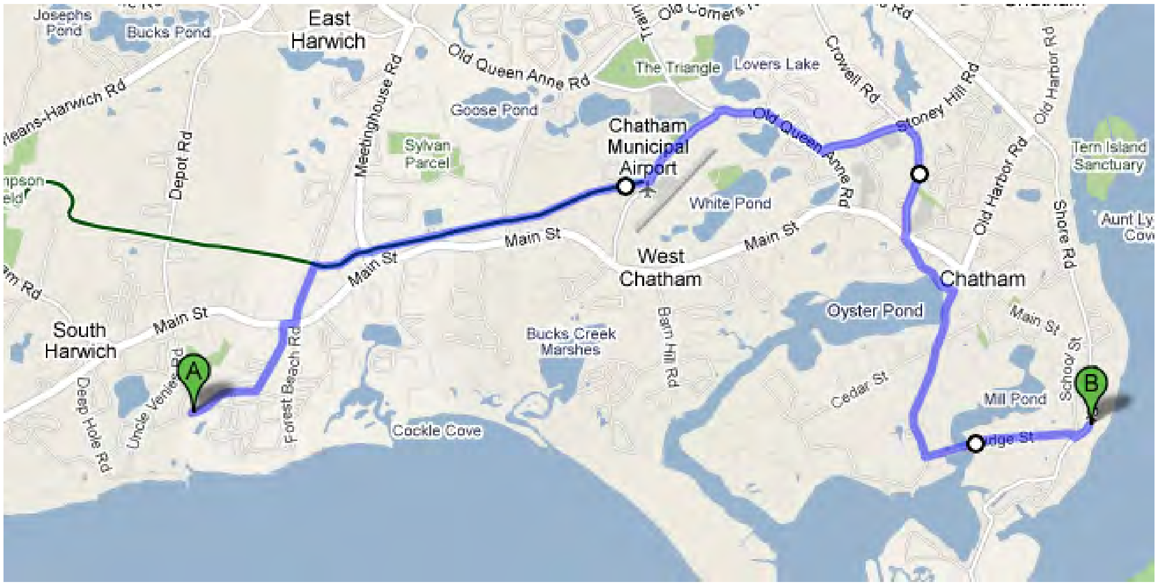

FIGURE 51 - POTENTIAL ROUTE "28B" IN CHATHAM
(Source: Cape Cod Commission, Google Maps)

5.3 RECENT & ONGOING BICYCLE/PEDESTRIAN PLANNING EFFORTS

This section summarizes recent and ongoing bicycle & pedestrian planning efforts underway by the Cape Cod Commission and/or bicycle planning groups in or adjacent to Barnstable County. More information is available for many of these efforts at:

www.gocapecod.org/bikeways

5.3.1 YARMOUTH ROAD CORRIDOR STUDY

Yarmouth Road in Barnstable experiences significant vehicle queues during peak hours of operation. The corridor is the primary access for some Cape towns to the Cape Cod Hospital. Seasonal and peak hour congestion often cause delays for emergency vehicles en route to the Hospital. The intersection of Yarmouth Road and Route 28 in Barnstable is a known high crash location and is identified in the Hyannis Access Study as an intersection in need of improvements. Yarmouth Road serves as an important access road into Hyannis Center, which accommodates both commercial and business development. Hyannis Center was recently approved as a Growth Incentive Zone. A viable Yarmouth Road corridor is significant for many modes of transportation, including walking, biking, automobile, transit and rail. The Hyannis Transportation Center is located off Route 28, a short distance from the Yarmouth Road/Route 28 intersection. The Yarmouth Road Corridor Study will examine each mode of transportation (walking, biking, automobile, transit and rail). Information on the study is available at:

www.gocapecod.org/yarmouthroad

After many months of review and public input, one concept has been recommended: Concept 1a. This concept includes a multi-use path (bike path) connecting the Hyannis Transportation Center to a point just south of Route 6. The towns of Yarmouth and Dennis are currently planning to extend the existing Cape Cod Rail Trail just east of Willow Street (south of Route 6).

Concept 1a is a continuation of the four-lane divided Willow Street roadway that currently exists near Route 6 Interchange 7 to the Route 28/Yarmouth Road intersection in Barnstable and uses a westerly alignment at the Route 28/Yarmouth Road intersection. The cross section and concept plan are shown in the following figures:

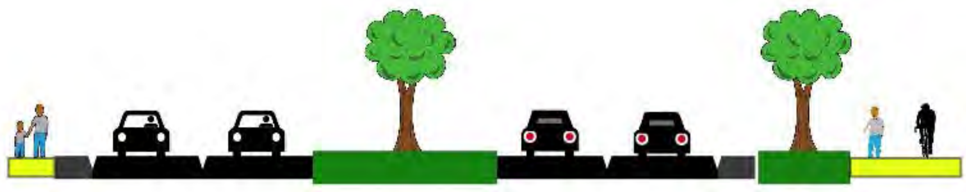

FIGURE 52 - YARMOUTH ROAD PROPOSED CROSS SECTION (LOOKING SOUTHERLY)

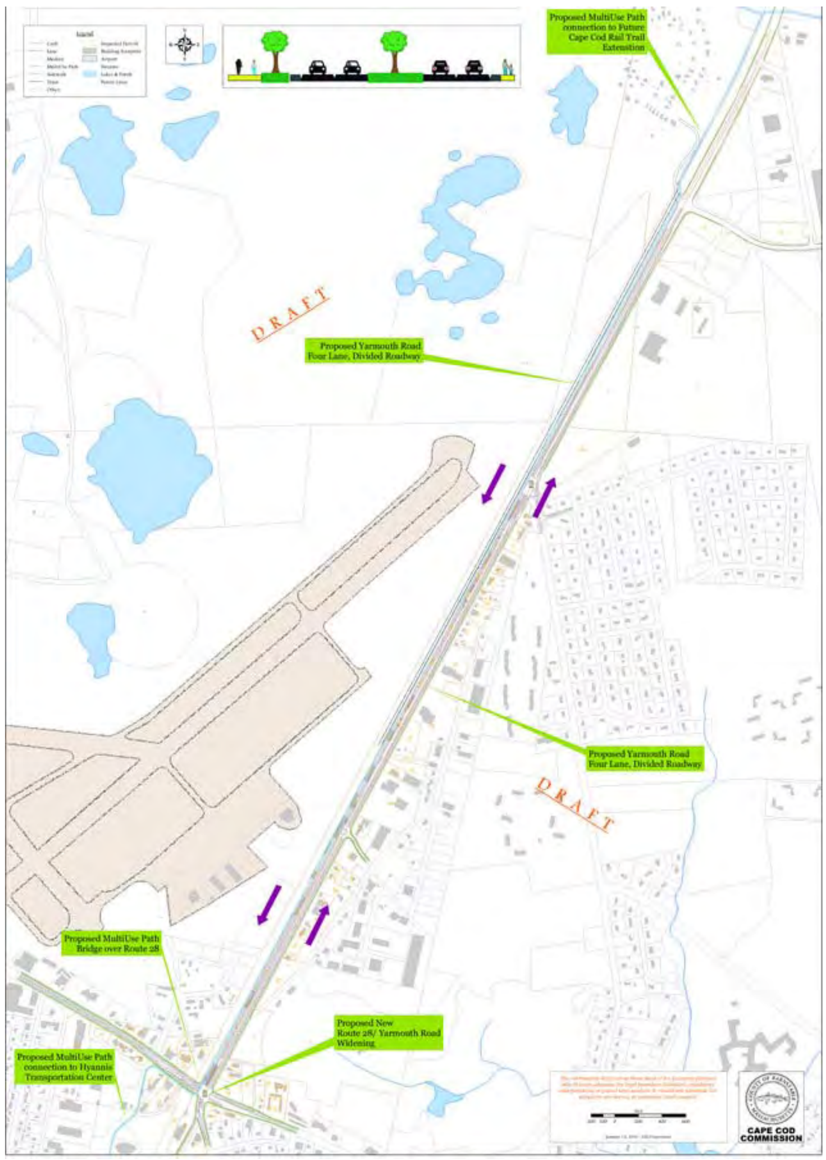

FIGURE 53 - YARMOUTH ROAD RECOMMENDED CONCEPT PLAN

5.3.2 HARWICH BICYCLE/PEDESTRIAN/TRANSIT

As part of an effort to enhance the economic development of Saquatucket Harbor in Harwich Port, the Town of Harwich is seeking to provide safe and effective pedestrian and bicycle facilities between the Cape Cod Rail Trail/Old Colony Rail Trail and Route 28, with a specific focus on a connection between Harwich Center and Harwich Port. In addition, the Town of Harwich is looking to provide safe pedestrian and bicycle connections as well as shuttle bus service between Wychmere Harbor and Saquatucket Harbor. A Cape Cod Commission/Town of Harwich effort is underway to meet the following goals:

- Identify safe and effective pedestrian and bicycle access between the Cape Cod Rail Trail/Old Colony Rail Trail and Route 28, with a specific focus on a connection between Harwich Center and Harwich Port.
- Identify safe and effective pedestrian and bicycle access between Wychmere and Saquatucket Harbors along Route 28 that would intersect with a connection to Harwich Center.
- Identify the potential for shuttle bus service between Wychmere and Saquatucket Harbors.
- Coordinate with the Regional Transportation Plan/Cape Cod Bike Plan. A goal of this effort is to construct new bicycle/pedestrian facilities using available funding sources source is the Cape Cod Transportation Improvement Program (TIP) administered by the Cape Cod Commission and funded by the Massachusetts Department of Transportation and Federal Highway Administration.
- Commission staff will work with the Town of Harwich to integrate these bicycle/pedestrian efforts into the current update of the RTP.

From public outreach to concerned citizens and input from town of Harwich officials, the following figure includes a summary of recommended bicycle and pedestrian enhancements in the study area:

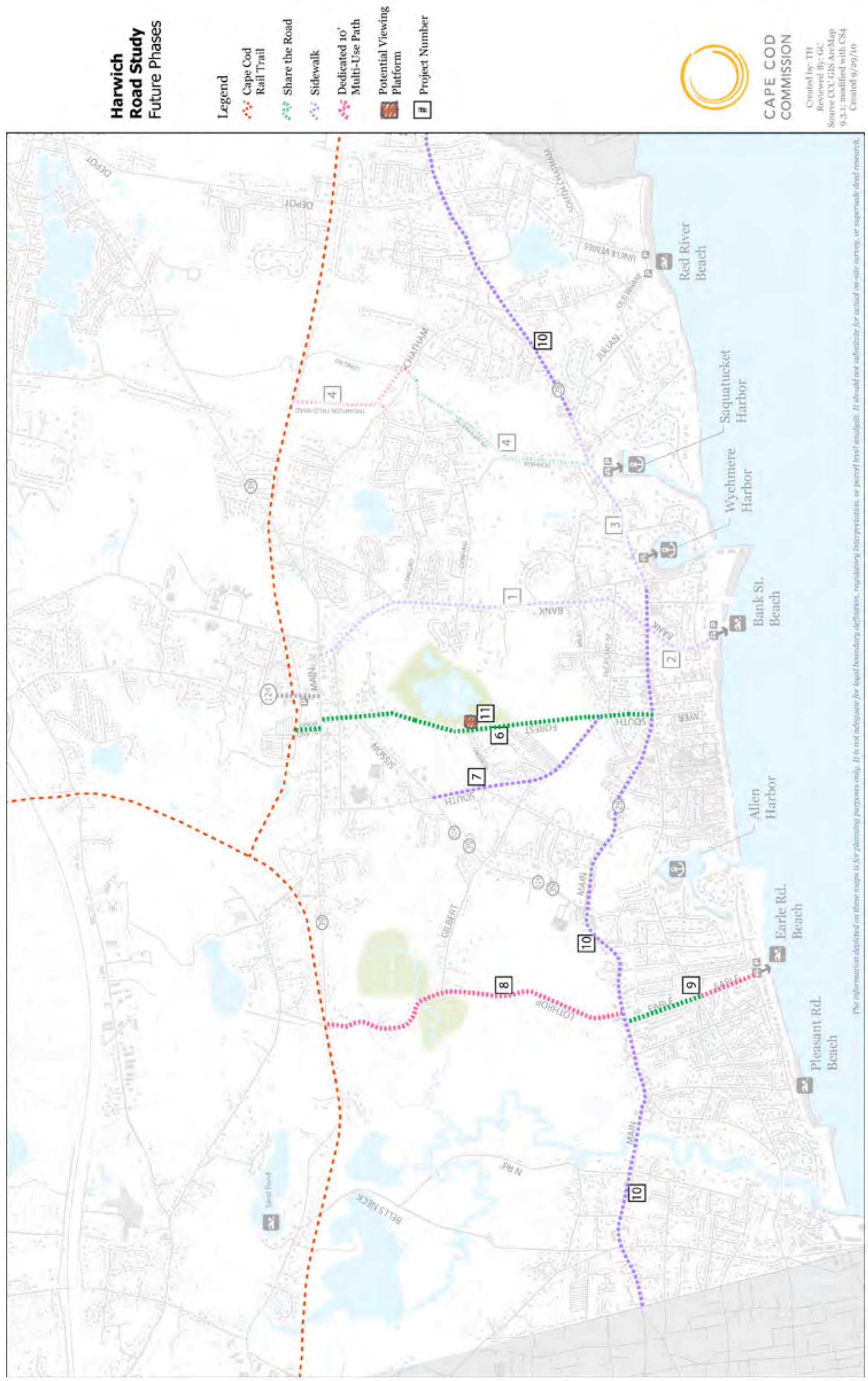

FIGURE 54 - HARWICH BICYCLE/PEDESTRIAN/TRANSIT STUDY RECOMMENDATIONS

5.3.3 BARNSTABLE

The town of Barnstable has a comprehensive Open Space and Recreation Plan. The plan is available from the Town of Barnstable's website at:

http://town.barnstable.ma.us/GrowthManagement/ComprehensivePlanning/OSRP/default.asp

As part of this effort, town-wide mapping of existing and proposed improvements for bicycling & pedestrian accommodation are shown in the following figure:

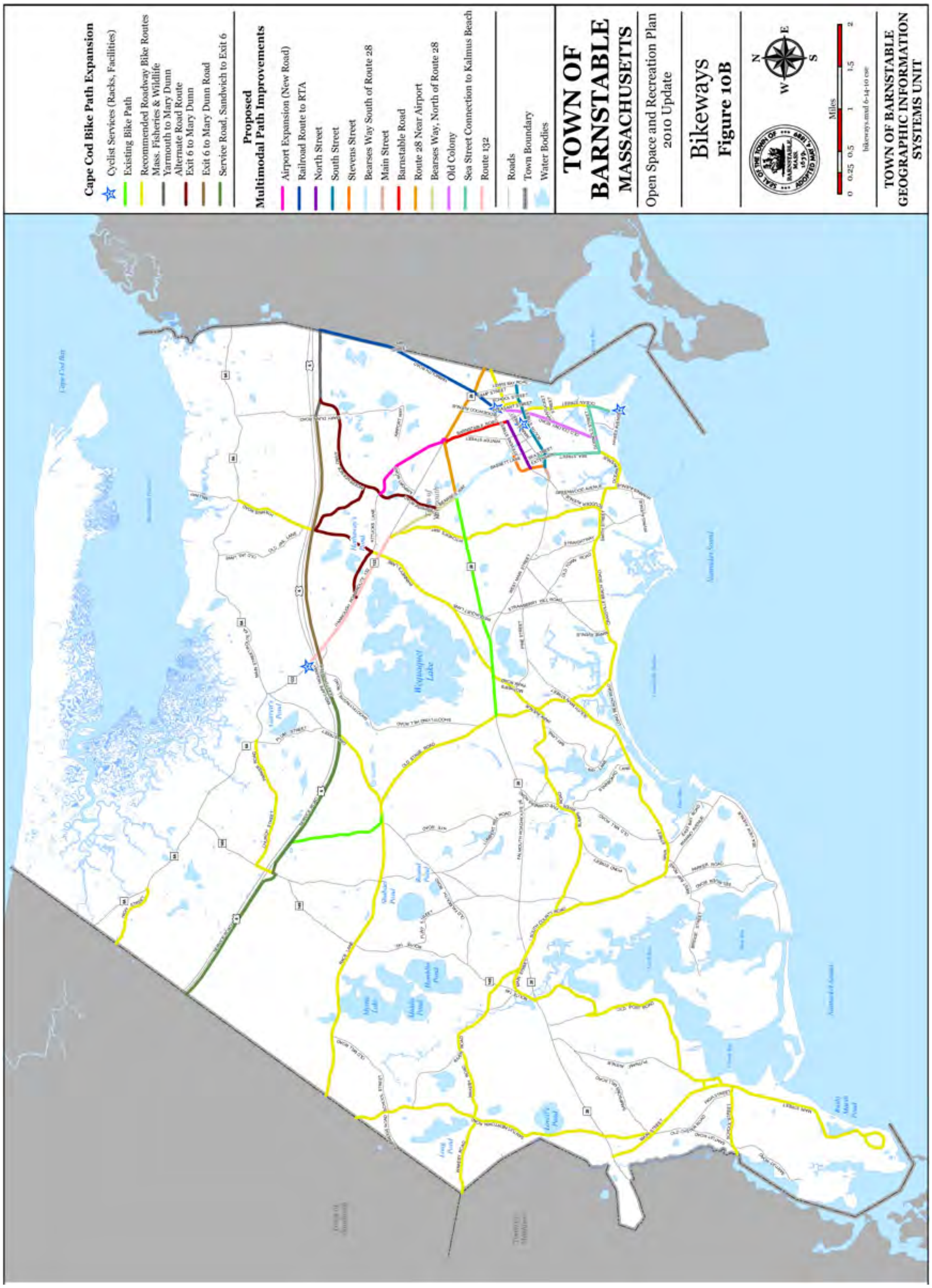

FIGURE 55 - BARNSTABLE BICYCLING & PEDESTRIAN PLANNING

5.3.4 DENNISPORT REVITALIZATION MASTER PLAN

The Dennis Port Revitalization Master Plan reflects the cumulative efforts of over two hundred individuals and over two years of effort. Looking forward 50 years, this plan is a road map and a critical resource for directing growth and rebuilding the heart of the community. Under the leadership of the Dennis Port Revitalization Committee, and with needed support from the Town of Dennis, this plan has taken shape. The Revitalization Master Plan illustrates physical solutions to Dennis Port's existing challenges, as related to the ten topic areas:

- transportation
- public safety
- economic development
- social services
- land use
- housing
- historic heritage
- arts & culture
- alternative energy
- stormwater & wastewater

Where possible, physical solutions have been incorporated into the Master Plan. A link to the Dennis Port planning website is available from:

www.gocapecod.org/bikeways

Implementation Strategies.

The Dennis Port revitalization planning effort focused on three primary nodes:

- the historic Village Center
- the hotel resort area along Chase Avenue
- the cottage colony resort area along Old Wharf Road

The design team also looked at the Route 28 corridor, to suggest interventions that could improve the character of this important gateway. While the provision of bikeways is the most visible element in any bikeway network, bicyclists must also have safe and convenient places to store their bicycles at a trip's end. Thus, providing bicycle parking and other "end-of trip" facilities is critically important in supporting bicycling as a viable mode of transportation. While parking solutions range from the basic bicycle rack to semi-enclosed bicycle shelters to full bicycle stations all bicycle parking facilities should be attractive and identifiable, space efficient and as close, if not closer, to the associated destination than any automobile parking. The Bike Way Plan also outlines several locations where the expansion of bicycle parking is needed for recreational and utilitarian use and is shown in the following figures:

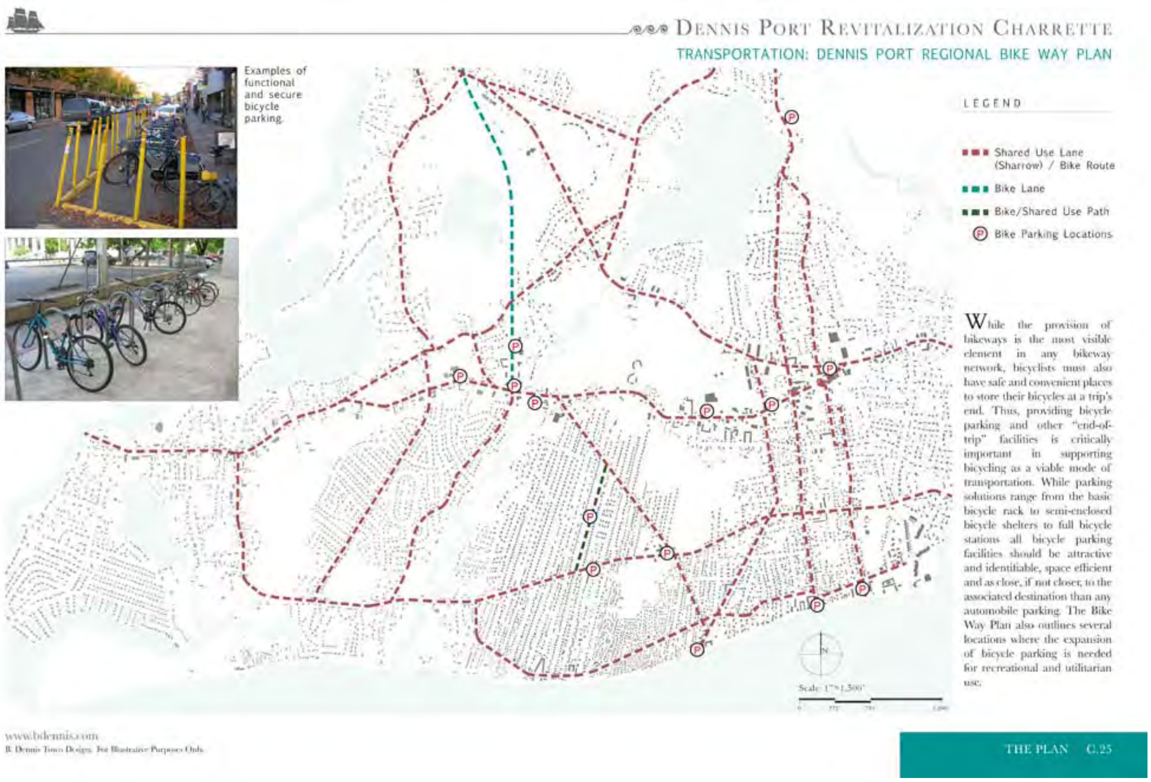

FIGURE 56 - DENNIS PORT REGIONAL BIKE WAY PLAN

5.3.5 ORLEANS ROUTE 28 BIKE PATH

The Town of Orleans recently completed a feasibility study for the creation of a safe and continuous bike and pedestrian facility that connects South Orleans to Orleans Center. Fay, Spofford, and Thorndike (FST) helped evaluate the Route 28 corridor and its potential to host such a facility. They met with members of the District 5 office to fully understand the challenges of constructing a facility of this type. At the completion of the study and after review and consideration of several off-road alternatives, the Town believes that the Route 28 corridor is the best option to connect the two villages. The study found that a Route 28 facility would be the most accessible bike and pedestrian facility and therefore serve the greatest number of residents and visitors. The following figure is a locus map showing select areas along the route that were examined closely. For each location, a conceptual cross section is included in the report showing both a shared use path and a side walk (some on either side of the road) to illustrate how it may work within the context of the road and its layout. A complete version of the report is available here:

www.town.orleans.ma.us/Pages/OrleansMA_Planning/bikefinal

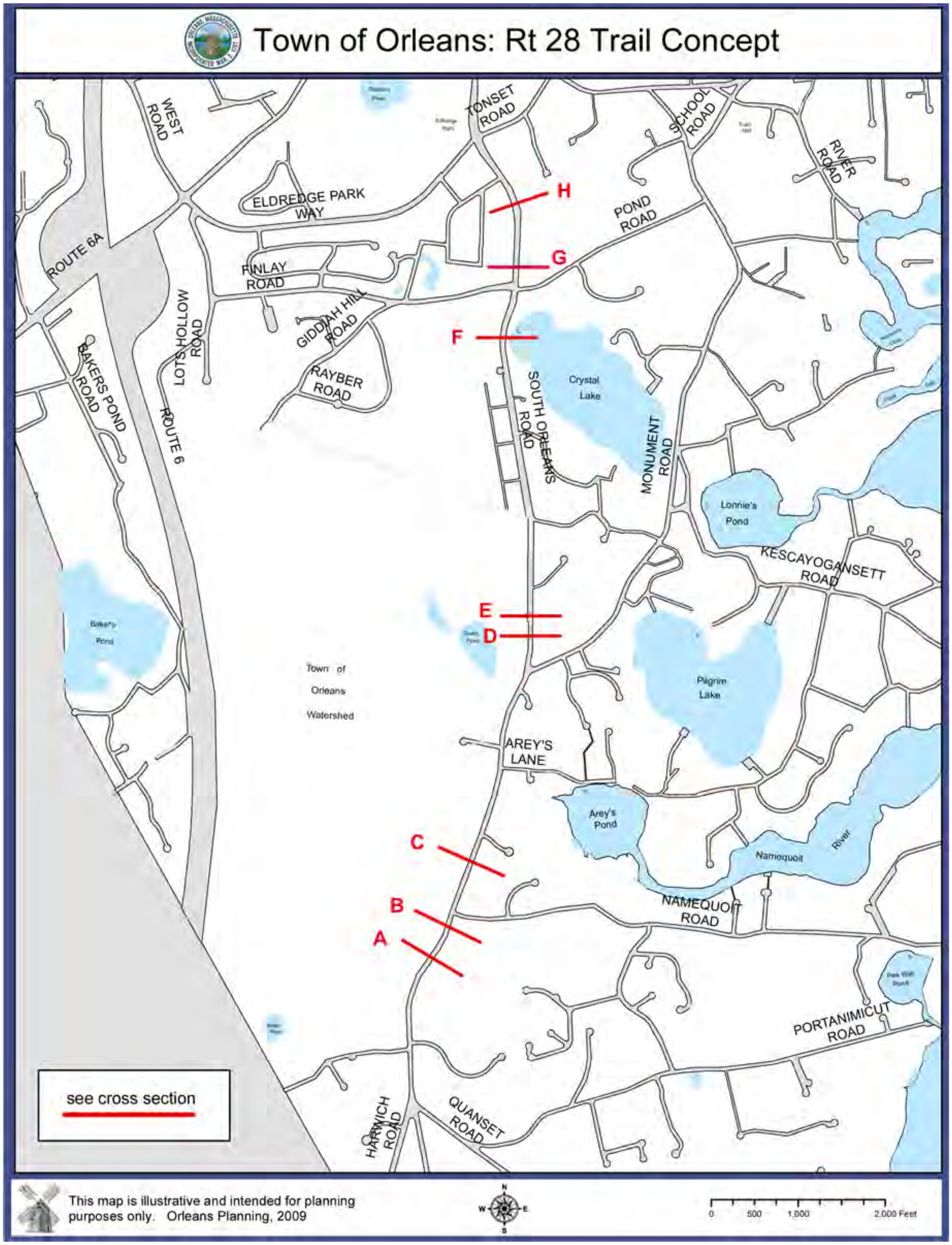

FIGURE 57 - ORLEANS ROUTE 28 BIKEWAY PROPOSAL

5.3.6 WAREHAM BICYCLE CONNECTIONS TO CAPE COD

A Bicycle planning committee for Wareham is proposing a connection from downtown Wareham to Buzzards Bay at the Route 6/28 crossing of Cohasset narrows. Information is available from the Wareham Community Pathway website:

http://www.warehambikepath.com

The following figure shows the potential alignment from Wareham to Buzzards' Bay:

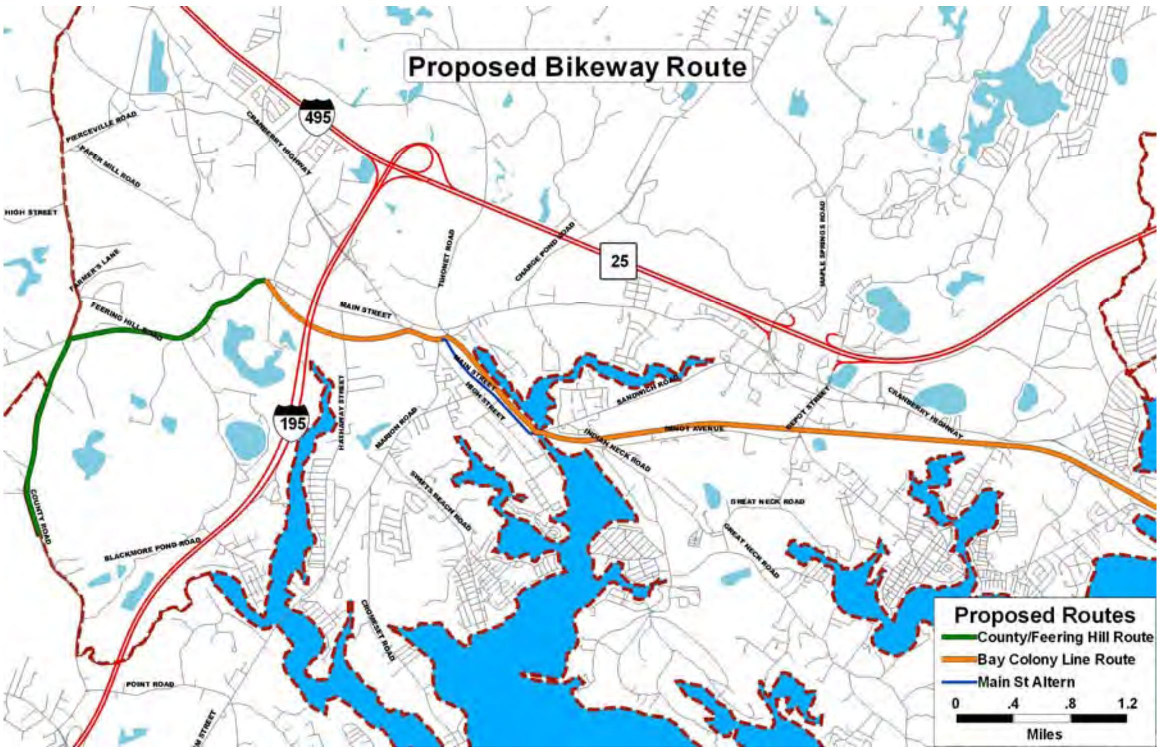

FIGURE 58 - POTENTIAL WAREHAM TO CAPE COD ROUTE

5.4 CCNS INTEGRATED BICYCLE PLAN FOR CAPE COD

In 2010, the Cape Cod National Seashore (CCNS) completed an Integrated Bicycle Plan ("Bicycle Feasibility Study") for Cape Cod. This feasibility study was undertaken by the National Park Service in partnership with the Cape Cod Commission to identify improvements necessary to develop an integrated bicycle network throughout Cape Cod. This approach will help to ensure an efficient, coordinated approach to addressing needed bicycle network improvements.

With active participation of Cape Cod Commission staff and many other stakeholders, the study helps lay the groundwork needed to improve bicycling conditions on Cape Cod by developing a comprehensive and connected bicycle network. Included are a list of both infrastructure improvements and programmatic initiatives to promote bicycling, enhance bicycle access and improve safety. This will help establish bicycling as a viable transportation option while reducing dependence on automobile transportation. This is to be accomplished by creating an integrated, multimodal transportation environment throughout Cape Cod. The study established an approach to identifying opportunities for projects and initiatives, and provides guidance on implementing them in an efficient and coordinated manner.

The three primary goals of the CCNS study are:

- To integrate regional planning and the regional bicycle network with Cape Cod bicycle facilities and CCNS attractions.
- To identify projects to improve Cape Cod bicycle facilities and facilitate integration with the regional bicycle trail network.
- To identify projects that would improve bicycle access to and within Cape Cod National Seashore (Seashore).

Projects and CCNS priority corridors are presented in maps at the end of this section. Links to the complete text of the CCNS report will be made available at:

http://www.nps.gov/caco

5.4.1 DESCRIPTION OF PROJECT TYPES

The projects proposed to enhance the bicycling environment on Cape Cod were extremely varied in nature, ranging from programmatic initiatives such as education and outreach efforts and maintenance plans to infrastructure projects providing improvements to existing routes, as well as the construction of new facilities. The physical improvements themselves covered a broad spectrum of projects. They included improved signage, enhanced trail crossings at roadways, the creation of connector trails, and new facilities in corridors not currently served by bicycle routes or facilities. Three primary classifications were developed to categorize the proposed projects; improvements to existing facilities; new facilities; and other initiatives. These categories are described in more detail, as are the individual projects that were selected for inclusion in the study. Maps depicting the locations of the selected projects are included in this chapter along with a table for cross reference. Projects proposing regional corridor improvements have been mapped, however short corridor improvements with an undefined route have not been mapped. Several projects proposed development of routes following general corridors. Such routes have been depicted on the maps using broad arrows and do not indicate specific or preferred alignments, nor do they reflect environmental constraints or sensitive areas that may need to be avoided.

5.4.1.1 Improvements to Existing Facilities

The bicycling network on Cape Cod is comprised of many types of facilities of varying conditions. Though many miles of bicycling routes and paths exist many have deficient conditions relating to safety or usability by less experienced bicyclists such as basic wayfinding and signage, especially for visitors that may not be familiar with the Cape. Additionally, access to trip generators such as neighborhoods, major destinations, town centers, or commercial areas are often lacking. These elements would facilitate greater utilization of the bicycling network for travel throughout Cape Cod and less reliance on automobile travel. A number of proposed projects aim to improve the existing facilities on the Cape and to make uniform the conditions experienced by bicyclists, whether in the form of improved wayfinding signage, consistent pavement markings, improving on-roadway conditions along existing bike routes, or upgrading facility designs to current standards.

5.4.1.2 New Facility Construction

In order to provide for complete mobility for nonmotorized users a variety of new construction projects are needed to extend existing facilities, connect existing facilities to destinations and localities, close gaps in the bicycle network on Cape Cod, and enhance safety. This process has resulted in identifying many needed routes or facilities that will provide safer, more comfortable bicycling conditions for on-roadway routes, extend or connect facilities such as the Cape Cod Rail Trail extension and proposed spurs linking towns and destinations, and close gaps within the network by linking existing routes or facilities.

5.4.1.3 Other Initiatives – maintenance plans, new or revised programs and policies, outreach and education

Though a number of physical improvements have been identified to enhance and expand the network of bicycle routes throughout the Cape, many opportunities exist to improve bicyclist safety and to encourage the use of bicycling both for recreation and as a viable transportation option. Developing programmatic and policy elements will ensure a comfortable and consistent bicycling environment across the Cape for bicyclists of varying skills, abilities, and bicycling interests. Such programmatic elements will serve to address human factors, thereby creating a safer, more inviting bicycling environment, while also encouraging the use of a continually improving bicycle network as a means of routine travel throughout Cape Cod by both tourists and residents alike. Many of these proposed projects will work in tandem with projects aimed at improving infrastructure by ensuring awareness of bicycling transportation and recreation options, enhancing operational safety of bikeways and enhancing the utility of the bicycle network on Cape Cod. This will make the bicycle network more useable by a variety of visitors and residents, thereby alleviating the existing burden on the transportation network resulting from over-reliance on automobiles.

5.4.1.4 Selected Projects

The following lists of projects reflect those selected through the process described in Chapter 4 of the Feasibility Study. The sorting process did not assign a ranking or priority, but rather categorized them according to the level of benefit and the barriers to implementation. All proposed projects should be viewed as valid and potential projects that may be pursued for funding. Coordination between Cape Cod National Seashore, the Cape Cod Commission, and/or the respective municipality will need to coordinate selection and implementation of individual projects. A consolidated list of all proposed projects is included in the full report available that will be available at:

http://www.nps.gov/caco

Each of the 47 recommended projects listed here includes a basic project description, preliminary design concepts, a planning-level cost estimate, and recommendations for implementation. Some projects have more detailed cost estimates as a result of greater levels of detail relating to alignments, the type of facility, proposed configurations, and total distance. However many projects are merely conceptual, identifying only a corridor or general route in need of improvement without specifying the project length, type or level of accommodation to be provided. Estimates for general conceptual projects only include unit costs for the different types of possible accommodations and alignments that may be utilized.

The cost estimates were prepared in 2009/2010, based upon typical project costs in the Cape Cod region. Due to the variability of construction and materials costs over time, an appropriate inflation factor should be determined and applied when using these estimates in future years.

Each project will require varying levels of environmental compliance dependent upon the agency undertaking it and the scope of the project. An NPS Environmental Screening Form would be completed for any project arising from this study to determine the level of environmental compliance required. Projects undertaken within Cape Cod National Seashore would require NEPA (National Environmental Policy Act) and possibly MEPA (Massachusetts Environmental Policy Act) documents for environmental clearance; however the specific level of required compliance would be determined through the individual project scoping process. Projects developed by localities would comply with applicable environmental clearance requirements, also to be determined during the project scoping process.

The individual project descriptions included in this chapter are intended to provide stakeholders with a resource to be used in developing project proposals and funding requests through a variety of sources. Conceptual details and planning level cost estimates will provide a basis for further development of individual project scopes and proposals. A variety of funding opportunities exist, largely via state and federal grant programs. Some of the funding sources available include the NPS Park Roads and Parkways Program, Transportation Enhancement grants, Recreational Trails Program, Congestion Mitigation Air Quality, and several Federal Transit Administration programs, among others.

5.4.2 IMPROVEMENTS TO EXISTING FACILITIES

The following is a list of sixteen projects proposing improvements to existing facilities. This list was developed through an extensive public participation process involving all 15 Cape Cod towns and stakeholders including MassDOT. These projects are numbered 5.2.1 through 5.2.16.

Project 5.2.1: Design Alternatives for Cape Cod Rail Trail Extension to Provincetown

Project Description – The existing Cape Cod Rail Trail (CCRT), which is maintained by the Massachusetts Department of Conservation and Recreation, currently terminates in South Wellfleet, just north of the National Seashore Park headquarters. Bicycle and pedestrian access to the remainder of the Outer Cape is largely limited to US Route 6, the principal arterial providing motor vehicle (and motor freight) access to this region of the Cape. The estimated 400,000 annual users of the CCRT therefore have no access to the Outer Cape and many of the attractions within the National Seashore. Extending the CCRT to Provincetown would provide the following benefits:

- Continuity in access to over 40 miles of the Outer Cape by bicyclists and pedestrians
- Bicycle and pedestrian access to virtually all destinations and attractions within Cape Cod National Seashore
- Enhanced safety by eliminating the need for bicyclists and pedestrians to travel along Route 6 which has no accommodations for bikes or pedestrians.
- Provision of a transportation alternative that would facilitate nonmotorized mobility and access to a significant number of Outer Cape destinations, thereby reducing congestion, parking demand, and the associated environmental and sensitive lands impacts.

This project would include preparation of an environmental assessment (EA) in accordance with the National Environmental Policy Act (NEPA) process that includes a description of the proposed project; the reasonable alternatives under consideration; the social, economic and environmental impacts of the alternatives; mitigation measures and a section on comments and coordination. The project will evaluate alternative alignments and their respective costs, impacts, and connections/ accessibility provided.

Preliminary Design Concepts – The three alternative alignments and design concepts include:

- Eastern alignment
  - approximately 20 miles
  - largely through the National Seashore
  - consisting of both on-roadway and shared-use path segments
  - primarily undeveloped and natural environments
- Interior, or Bay alignment
  - mostly on secondary roadway alignments
  - via the towns and neighborhoods of Wellfleet, Truro, and Provincetown
  - primarily developed and largely residential) environments
- Abandoned railroad alignment
  - located along the western side of the Outer Cape
  - shared-use path with occasional road segments
  - a mix of natural landscapes in the National Seashore and developed areas of North Truro and Provincetown

Cost Estimate – Costs for 3 conceptual alignments

- Eastern Shore alignment: design cost $3,385,000
- Interior, or Bay alignment: design cost $1,100,000
- Rail alignment $2,911,000

Design cost estimates at 17% of NET construction costs

Recommendations for Implementation – The EA should be undertaken to fully determine the extent of all impacts associated with the three alternatives. A subsequent analysis of the alternatives to determine which, if any of the three options are feasible along with costs associated with possible right of way acquisitions, and public input should be undertaken to establish a preferred alignment. Mass DCR's maintenance responsibility for the CCRT requires close coordination between the state and CCNS.

Project 5.2.2: Wayfinding Signage and Pavement Markings on CCRT

Project Description – With an estimated 400,000 users annually the Cape Cod Rail Trail (CCRT) has the potential to serve as a significant alternative transportation facility, not merely a recreational route. Installation of consistent signage along the Cape Cod Rail Trail to include interpretive, directional, informational, and other wayfinding signage is needed to both enhance the trail user experience as well as facilitate use of the trail as a bicycle transportation corridor, especially by those that are not familiar with areas served by the facility. Additionally, improved pavement markings are needed, primarily at the 45 roadway crossings to enhance safety and communicate expected behaviors by both trail users and motorists at these conflict points. Motorist and trail user expectations and actions are not consistent, in part due to trail and roadway crossing designs that are inadequate and design treatments that are inconsistent and often don't comply with the MUTCD (the Manual on Uniform Traffic Control Devices) regulations or AASHTO guidelines.

Preliminary Design Concepts – The specific signage design and placement has to be determined, and avoidance of visual clutter is needed, however the primary information that needs to be considered for signage includes:

- Trail amenities including rest rooms & emergency services
- Historic resources
- Beaches
- National Seashore attractions
- Town centers and commercial destinations including restaurants, lodging, retail shopping, bike shops
- Distance signage (to destinations)
- Connections to intermodal transportation facilities including bus and ferry terminals
- Connections to other bicycle facilities & bike routes
- Communicating mobility issues for access by different users (including ADA issues)
- Safety information such as sand and other surface hazards

Cost Estimate – Complete signage at $18,400 per mile:
- $405,000.00 for the existing CCRT
- $129,000.00 for the Old Colony extension

Recommendations for Implementation – This approach will facilitate addressing the multiple locations that will be enhanced or addressed over time and in a phased manner, but this project provides a uniform protocol and design standards so that consistency is ensured.

Sign design, content, placement standards, measures to avoid visual clutter, installation and maintenance polices, and other considerations need to be established and agreed upon by stakeholders and responsible parties prior to implementation. The parties responsible for installation and maintenance need to be apprised of protocols including coordination of responsibilities when multiple agencies are involved. This needs to include entities with roadway construction authority so that roadway projects impacting trail crossings and intersections include appropriate and uniform design treatments and standards, regardless of locality. As development and implementation of Intelligent Transportation Systems occurs wayfinding resources could be added such as location-specific information via cell phone (based upon mile posts along bicycle routes and rail trails).

Project 5.2.3: Intersection Improvements on Setucket Road Path

Project Description – Intersection treatments along the Setucket Road and Old Chatham Road Paths are inconsistent and lacking in conspicuous pavement markings that comply with national standards and design guidelines. Designed primarily as a side path, there is a resultant 38 roadway crossings in only 7 miles, and as a result a need for high visibility crosswalks and other pavement markings to communicate to motorists and path users the presence of conflict points. Pavement markings and signage also communicate appropriate actions at intersections for both motorists and path users. Additionally, access to the paths needs to be upgraded to provide curb ramps and ADA-compliant detectable warning surfaces.

Preliminary Design Concepts – High visibility crosswalks and improved signage and intersection treatments that are consistent with MUTCD and ADA standards and AASHTO design guidelines need to be selected to be applied uniformly along the facility. Consideration should also be given to evaluating the existing configuration and geometrics for each of the intersections and changes made that will enhance safety. This review should include issues such as sight distance, bollard placement, path width, angle of approach/crossing (skewed crossings), etc.

Cost Estimate – Costs vary subject to existing conditions and improvements needed at individual locations. Unit costs for typical crossing improvements are provided.

- Residential Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection on two-lane roadway with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A complete review of the existing conditions should be conducted and documented and feedback from users should be collected to identify deficient conditions and desired improvements. Existing elements that are not consistent with MUTCD standards, AASHTO guidelines, and current best practices should be considered for retrofits and improvements. Regulatory and advisory signage should also be consistent with state law (such as the existing signage instructing bicyclists to dismount to cross intersections). A policy by which the selected improvements are installed and maintained needs to be established. Uniform design treatments need to be consistently applied throughout the length of the facility.

Project 5.2.4: Enhance Bicycling Conditions by Providing Paved Shoulders

Project Description – Multiple locations were proposed for shoulder widening or the addition of paved shoulders throughout Cape Cod along roads appropriate for on-road bicycling in order to provide safer, more comfortable bicycling conditions while also reducing conflicts with motor vehicles. Routes favored by bicyclists and those roadways that serve as connections to destinations, neighborhoods, and existing bicycle facilities should be considered for shoulder improvements when traffic conditions merit. Adding paved shoulders has additional benefits including pavement edge stabilization, the addition of a recovery area which reduces roadway departure crashes, and a breakdown area that allows disabled vehicles to be moved out of the travel lane, thereby mitigating congestion impacts from such incidents. These all result in safety, operational, and maintenance benefits which yield long-term cost savings.

Preliminary Design Concepts – Widening or the addition of paved shoulders should consider the existing roadway geometrics. In order to be useful for bicycle travel shoulders and the adjacent travel lane need to be of adequate widths to provide a degree of separation between the two modes; otherwise safety can be impaired by inviting motorists to pass too closely to bicyclists that attempt to hug the outside edge of the roadway. In general a four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. On roads with curb and gutter, the gutter pan and the longitudinal joint effectively reduces the useable width of the shoulder and consideration needs to be given to the paved width of the shoulder exclusive of the gutter pan.

Cost Estimate – On-road improvements, unit costs per mile:

- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders along both sides of the road.

Recommendations for Implementation – A protocol for identifying and prioritizing roads that will receive shoulder improvements needs to first be established. Limited resources dictate that shoulder improvements need to be made to roads where the benefits are the most significant and needed. Conditions to be considered should include:

- Roads already heavily used by bicyclists
- Designated bike routes with unimproved conditions
- Roads connecting to destinations or bicycle facilities
- Roads that establish a network or close a network gap
- Motor vehicle and truck traffic volumes

- Possible alternate routes (that are more suitable or which can be improved at a lower cost)
- Existing right of way
- Need for relocation of ditches (trench widening or wedging)
- Concurrency (opportunities to include shoulders as part of planned or programmed road projects)
- Coordination across jurisdictions for route continuity

Following the identification of candidate roads opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Policies and procedures should be established to ensure that construction and maintenance projects determine whether a road is listed as a priority route for paved shoulders and then scoped to include the improvements. Routine pavement overlay and resurfacing projects should include shoulder paving for the identified routes. Consideration should be given to establishing a goal of spending a set percentage of maintenance and/or paving funds on adding shoulders for bicycle improvements. Maintenance needs to be considered so that the functionality of shoulders for bicycling purposes is retained as the natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder.

Project 5.2.5: Identify Possible Sidewalks and Pedestrian Crossings near Brackett Road & Route 6

Project Description – Brackett Road in Eastham intersects with the Cape Cod Rail Trail and connects a largely residential area east of the trail to a commercial center at the intersection with Route 6, approximately ¼ mile to the west of the trail. Some pedestrian improvements are partially constructed, however further funding is needed for completion. Additional sidewalks and pedestrian crossings need to be identified and designed to develop a complete network of pedestrian facilities to provide access and improve safety within this corridor.

Preliminary Design Concepts – Sidewalks should be provided to establish linkages between the commercial trip generators along Route 6 with the Cape Cod Rail Trail and the residential neighborhoods accessed via Brackett Road. Depending upon traffic volumes, speeds, and location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

Cost Estimate – Sidewalks and crossing improvements, unit costs:
- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A gap analysis should be undertaken to identify and prioritize sidewalks and crossings needed to develop a complete network which integrates the existing pedestrian infrastructure (such as the CCRT) with the surrounding pedestrian trip generators including both residential and commercial origins and destinations. Safety countermeasures should be considered for locations where potential exists for vehicle/pedestrian collisions, primarily at the intersection with the CCRT and along Route 6 where pedestrian travel may present multiple conflict points with vehicle ingress and egress. Access management should be considered at these locations, and improvements along Route 6 should also seek to improve access to transit stops.

Project 5.2.6: Western Extension of CCRT through Independence Park

Project Description – Located along Route 6 in Barnstable, Independence Park, a commercial and industrial business center, lies just to the north of the Hyannis Transportation Center and the Barnstable Municipal Airport. Providing a connection to the CCRT would facilitate greater utilization of the trail for bicycle commuting trips, especially if coordinated with access to the Hyannis Transportation Center. Multimodal commute options would be greatly expanded as a result.

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic. The proposed western extension of the CCRT linking the existing terminus in South Dennis to the Hyannis Transportation Center would likely utilize an alignment to the east of the regional airport that is proximate to Independence Park. A short spur, likely passing to the north of the airport would be needed to provide a connection between the business park and the extension of the CCRT. The actual alignment needs to be determined.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00

Recommendations for Implementation – This connection needs to be coordinated with planning or construction related to the western extension of the Cape Cod Rail Trail, most notably the extension to the Hyannis Transportation Center (Project 5.2.7) which would result in a CCRT alignment that is proximate to this location. Additionally, Project 5.2.13 should be considered for coordination since it may facilitate a logical termini for either a future extension of an off-roadway alignment linking the CCRT to the Cape Cod Canal Bikeway, or at least serving to access an on-roadway route.

Project 5.2.7: Western Extension of CCRT to Hyannis Transportation Center

Project Description – The current terminus of the Cape Cod Rail Trail in South Dennis lies approximately 8 miles to the east of the Hyannis Transportation Center. Connecting the CCRT to Hyannis is significant in that it is an urban center of Cape Cod with considerable population and commercial activity, and also the site of the Cape's primary multimodal center providing rail, air, bus, and ferry service. The CCRT serves as one of Cape Cod's primary bicycle facilities and by providing direct access to the transportation center bicycling can become a more integrated mode in the Cape's transportation network and linking the center and Hyannis to multiple communities and destinations in the Mid and Lower Cape.

Approximately 3.3 miles of the proposed extension are currently programmed, continuing along the existing abandoned rail bed. The proposed alignment could utilize the existing two mile long Old Townhouse Road Trail needing only to close a small .15 mile gap between those two alignments. Another 1.25 mile section of the Old Townhouse Road Trail is currently programmed, which would extend the CCRT to Higgins Crowell Road leaving approximately a 2.5 mile gap to connect to the Hyannis Transportation Center. The most likely alignment from that point would continue along the Old Townhouse Road corridor and then in the proximity of Yarmouth Road which provides access the Hyannis Transportation Center. The proposed extension runs primarily through Yarmouth, with short segments at either termini in Dennis and Barnstable.

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic. Utilization of any existing path segments should consider retrofitting to ensure continuity in design, including intersection treatments.

Cost Estimate – Shared-use path cost:
- utilizing combination of alignments noted – $5,200,800.00

Recommendations for Implementation –The proposed corridor and specific alignments have undergone conceptual design but it may be necessary to determine potential gaps, notably if any existing facilities are to be used. Further, if existing facilities are to be utilized and integrated into the extension they need to be evaluated for retrofits or improvements to provide consistency and continuity with the design standards employed for the remainder of the CCRT. An environmental assessment is needed before final design and construction can proceed. The extension should also be coordinated with planning or construction related to Projects 5.2.6 and 5.2.13.

Project 5.2.8: Connect Chatham Municipal Parking Lot and Old Colony Rail Trail and Old Queen Anne Road via Route 137 Improvements

Project Description – The Old Colony Rail Trail in Chatham lies along the north side of Route 28 with a trailhead located near the intersection of Route 28 (Main Street) and Route 137 (Meetinghouse Road). Access north to East Chatham and Brewster is needed and is proposed via roadway improvements including the addition of 4' paved shoulders along approximately 1.25 miles of Meetinghouse Road between Main Street and Queen Anne Road.

Preliminary Design Concepts – Roadway improvements along Route 137 to provide 11' travel lanes and 4' paved shoulders. On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures would provide a convenient and comfortable route for cyclists of varying abilities. Specific design treatments should be sensitive to the particular needs and context of each road where improvements are made.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Routine pavement overlay and resurfacing projects should include shoulder paving for this route if adequate right of way exists or can be obtained. Maintenance needs to be considered so that the functionality of shoulders for bicycling purposes is retained since the natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder.

Project 5.2.9: Extension of the Old Colony Rail Trail from Volunteer Park to Schoolhouse Pond

Project Description – The existing Bicycle Spur from Volunteer Park is called the Old Colony Rail Trail and also the Chatham Spur. Currently the Chatham Spur ends in Chatham and utilizes a brief on-road alignment in the vicinity of the airport. In order to connect this trail to Schoolhouse Pond, an extension of the multi-use trail is required for a distance of approximately 3000 feet. Also, a "Share the Road" bike route or bike lane is required on Old Queen Anne Road for a distance of 4000 feet to make final connections to Sam Ryder Road, the access road to Schoolhouse Pond.

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Recommendations for Implementation – Landowner issues may present difficulty in acquiring the needed right of way for a trail alignment. Alternative alignments should be investigated to determine the most feasible connection.

Project 5.2.10: Connect Shining Sea Bikeway to Gifford Street

Project Description – This proposed connection has been conceived by the Falmouth Bikeways Committee. The goal is to provide bicycle access to Gifford Street, a major north/south local collector connection Brick Kiln Road to Main Street (Route 28). There are a number of local roads that can be used as a bike route to facilitate this connection including Pumping Station Road, Jones Road and Kathleen Lee Bates Road; the preferred alternative. The most challenging constrain is the crossing of State Highway Route 28. The Falmouth Bikeways Committee has made inquiries to MassDOT regarding this location to in hopes to having a pedestrian bridge constructed to facilitate a safe and convenient crossing.

Preliminary Design Concepts – The connection is envisioned to utilize local roads with several possible options including Pumping Station Road, Jones Road, and Katherine Lee Bates Road which is the preferred alternative. Two primary design issues entail identifying and designing a suitable crossing of Route 28, and access from the bikeway to Route 28 which may involve private property. Few streets provide a direct route from the bike way across Route 28 due to offset intersections. As a result a short shared-use path spur may be necessary to provide a connection between the bikeway and Route 28. Wayfinding signage should be installed along the selected route.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

Crossing improvements, unit costs:

- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – Some have advocated for a pedestrian bridge for the Route 28 crossing, however such structures require significant right of way and are very costly. Crossing improvements will be needed at the location chosen and specialized pedestrian crossing signals should be considered such as a HAWK or the rectangular rapid flash beacon (RRFB)both of which are only activated when a pedestrian or bicycle is present, otherwise allowing the uninterrupted flow of traffic. The preferred alignment along surface streets will dictate where the crossing of Route 28 will need to occur and an evaluation will be needed to determine the appropriate type and level of crossing accommodation and countermeasures needed. The alignment options should also consider the potential need for a path connection and related expenses.

Project 5.2.11: Extend Shining Sea Bikeway through Bourne to Cape Cod Canal Bikeway

Project Description – This proposed connection has been conceived by the Falmouth Bikeways Committee. The Route 28 state highway layout is approximately 200 feet wide and contains a very wide, wooded median separating the northbound road from the southbound road. The Committee envisions bridging the southbound road way and construction of a multi-use path through the wooded median for a distance of approximately 6 miles to make a final connection to the Cape Cod Canal Bikeway. This will provide an alternate route to a branch of Bike Route #1, located on County Road in Bourne.

It is important to note that the Town of Bourne is in support of an alternate concept for the connection to the Canal which utilizes a 'rails-with-trails' design along the Old Colony tracks. (See Project 5.3.8)

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A spur linking the existing bikeway with the proposed alignment via the media will need to be identified, either within existing road right of way or along an independent alignment.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

Bike/pedestrian bridge, unit costs:

- Survey, design, geo-tech, permitting, etc. – $240,000.00
- Total lump sum (LS) construction – $1,200,000.00

Recommendations for Implementation – Due to the unique alignment through the Route 28 median Mass Highway Department will need to be consulted for approval of both the concept and specific design elements. Because of the cost of a flyover access to the median it will be important to indicate that this segment of the bikeway would have limited access points. Conceptual plans should incorporate at least a couple proposed access points to facilitate wider use of the corridor by bicyclists seeking to access nearby destinations. Routing of a shared-use path through an interchange can prove difficult and access to the median will also prove challenging. Opportunities such as utilizing the existing rail alignment south of Route 151 should be investigated to deem whether access could to the median could be achieved, mitigating the need for a flyover.

Project 5.2.12: Parking Improvements at Trailheads

Project Description – Significant usage of the trail facilities on Cape Cod results in inadequate parking capacity. Both existing and proposed facilities need to plan for and construct parking facilities for visitors accessing trailheads by car. Opportunities to utilize existing, but underused parking capacity should also be investigated.

Project Location Map – NA

Preliminary Design Concepts – Designs will be specific to individual trailheads, parking facilities, and parking demands.

Cost Estimate – Construction of parking lot at trailhead:

- $50,000.00

Recommendations for Implementation – Existing trailheads need to be identified which currently experience excessive parking demand and opportunities for expansion investigated. Possible locations of new trailheads where adequate right of way exists for parking should be identified. Opportunities for joint-use or facility sharing should be investigated. Cape Cod localities should investigate adoption of local ordinances to facilitate use of shared parking facilities. Model agreements and ordinances should be developed that can be shared among Cape Cod localities to facilitate use of shared facilities. This approach provides an opportunity for facility sharing which increases the utilization of existing infrastructure while reducing the need for construction of additional parking facilities, many of which will be unutilized much of the year.

Project 5.2.13: Connect Cape Cod Canal Bikeway to Hyannis Transportation Center

Project Description – Linking the developed areas of Bourne and Sandwich to the Hyannis Transportation Center, approximately 22 miles away would provide multimodal transportation options to the Upper Cape. Route 6 serves as the primary corridor facilitating travel between the Upper and Mid-Cape, though it is largely unsuitable to bicycle travel. Ultimately an extension of the Cape Cod Rail Trail along the entire length of Cape Cod is envisioned, though at this time that is not feasible due to costs and logistics. This project should identify off-roadway alignments to develop some shared-use path segments while utilizing secondary roads for other segments.

Preliminary Design Concepts – The design concepts are subject to determination of a feasible alignment, whether on-roadway or for share-use path segments. Since conditions will vary considerably throughout the region connections should consist of both on-road and shared-use path connections. The designs will need to consider the appropriate elements for the context in which the routing takes place. Secondary streets with low traffic speeds and volumes can provide adequate connections with minimal enhancements such as improved signage and/or pavement markings. Shared-use path sections should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Recommendations for Implementation – Due to the length and multiple jurisdictions a coordinated planning effort will be required to identify a proposed route and facilities needed. A corridor approach should be adopted to identify potential shared-use path alignments throughout the region to ensure connectivity as the segments can be built in phases, perhaps by different agencies or municipalities. The desired conditions and accommodations to be provided along on-roadway segments need to be established and agreed upon by stakeholders so that conditions are consistent for bicyclists traveling between jurisdictions. Planning and construction should be coordinated with Projects 5.2.6 & 5.2.7 in order to link proposed projects and develop a wider bicycle network.

Project 5.2.14: Develop Plan for Intermodal Center in Falmouth

Project Description – This proposed connection has been conceived by the Falmouth Bikeways Committee. The intermodal center is proposed to be located at the former North Falmouth railroad station at the intersection of County Street with the Bay Colony Rail/ Commonwealth of Massachusetts Executive Office of Transportation Railroad right-of-way. At the present time this site is at the northern terminus of the Shining Sea Bike trail. This lot is unpaved and is currently used as a parking lot for trail users. The site supports an active section of Bay Colony Rail operations.

Preliminary Design Concepts – This lot is large enough to support a paved parking lot and bus stop operations. The improvement could include formal curb cuts, a paved parking field with internal circulation, a 'kiosk' type bus shelter mounted on a raised pedestrian island, and bike racks.

Cost Estimate – Multiple facility improvements:

- Parking lot – $50,000.00
- Bus shelters – $20,000.00
- Secure bicycle parking (unit cost)– $1,500.00

Recommendations for Implementation – Multiple entities need to coordinate efforts and agree upon the scope of the facility and operations proposed for the intermodal center. The specific configuration and ingress and egress to the facility would need to be evaluated and a possibly a traffic study conducted to determine traffic impacts. It has been proposed that the railroad could provide some level of funding for a shared facility.

Project 5.2.15: Improve Bicycle Facilities on Tupper Road South of Route 6A

Project Description – Tupper Road in Sandwich provides access to the terminus of the Cape Cod Canal Bikeway, paralleling much busier Route 6A which also serves as Mass Bike Route 1. Tupper Road then provides a north/south connection between Route 6A and Route 130, Main Street, but lacks any bicycle accommodations. Adding paved shoulders or other bicycle improvements would provide safer, more comfortable bicycling conditions while also reducing conflicts with motor vehicles. Adding paved shoulders has additional benefits including pavement edge stabilization, the addition of a recovery area which reduces roadway departure crashes, and a breakdown area that allows disabled vehicles to be moved out of the travel lane, thereby mitigating congestion impacts from such incidents. These all result in safety, operational, and maintenance benefits which yield long-term cost savings.

Preliminary Design Concepts – Road widening or the addition of paved shoulders should consider the existing roadway geometrics. In order to be useful for bicycle travel shoulders and the adjacent travel lane need to be of adequate widths to provide a degree of separation between the two modes, otherwise safety can be impaired by inviting motorists to pass too closely to bicyclists that attempt to hug the outside edge of the roadway. In general a four-foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. On roads with curb and gutter, the gutter pan and the longitudinal joint effectively reduces the useable width of the shoulder and consideration needs to be given to the paved width of the shoulder exclusive of the gutter pan. Realignment of Mass Bike Route 1 (the Claire Saltonstall Bikeway) onto this improved route, complete with appropriate signage would offer a more appealing route for long-distance bicyclists.

Cost Estimate – On-road improvements, unit costs per mile:

- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders along both sides of the road.

Recommendations for Implementation – Opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Routine pavement overlay and resurfacing projects should include shoulder paving for this route if adequate right of way exists or can be obtained. Maintenance needs to be considered so that the functionality of shoulders for bicycling purposes is retained since the natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder. In order to further develop an improved corridor and continuous route, and perhaps a resultant realignment of the Claire Saltonstall Bikeway, any improvements should be coordinated with Projects 5.3.15 and 5.3.17.

Project 5.2.16: Evaluate Use of Unpaved Roads for Bike Path Connections in Cape Cod National Seashore

Project Description – Within the National Seashore a number of unpaved roads currently exist which could be utilized to provide bicyclists with access to several popular bicycle trails. This would result in establishment of a unified network without having to travel on the more heavily traveled roadways, particularly Route 6, and which could be accomplished with minimal improvements, resulting in a low cost enhancement to the existing, but fragmented bicycle network in the Seashore.

Preliminary Design Concepts – Design issues would largely be limited to providing adequate wayfinding signage to direct bicyclists through the Seashore to popular destinations and trails. Such signage should follow the standards and protocol established via Project 5.2.2 (if implemented) to maintain consistency with bicycle wayfinding signage throughout the region.

Cost Estimate – NA

Recommendations for Implementation –Possible connector routes via existing unpaved roads should be identified, especially those that are likely to have the least impact to sensitive environmental or historical features within the Seashore. Existing conditions should be evaluated for compatibility with bicycle use and any needed improvements should be documented for consideration in the planning process including grading and additional loads of surface material. Should unpaved roads be used for this purpose a maintenance policy will be needed to ensure conditions suitable for bicycling are maintained and wayfinding signage will be needed to direct bicyclists to destinations and trails within the Seashore.

5.4.3 NEW FACILITIES

The following is a list of twenty two projects proposing construction of new facilities. These projects are number 5.3.1 through 5.3.22.

Project 5.3.1: Evaluate Local Roads and Establish Bicycle Connections between Cape Cod National Seashore and Neighboring Communities

Project Description – A two-phase project proposing to develop planning alternatives to improve bicyclist safety and access by providing connections between Cape Cod National Seashore and six neighboring communities followed by a pilot project implementation component.

Component A – Feasibility Study to include

- General overview, project purpose and need, local and regional perspectives;
- Project Description, including locus map, major constraints and opportunities;
- Corridor Right of Way: public vs. private property;
- Resources: GIS level environmental resources such as waterways, wetlands, vernal pools, wildlife habitat, management/refuge areas, historic areas/districts/sites, contaminated sites;
- Trail or route design criteria;
- Structures required; and
- Route and trail amenities: parking, access to attractions, wayfinding & interpretive signing.

Component B – Implementation of pilot project on 1 roadway

Preliminary Design Concepts – Conceptual design would include typical sections, alignment, road/water crossings, structures, trail amenities, impacts & mitigation, ROW actions, permitting requirements, and construction. Final design would include construction plans, specifications, right-of-way plans, and bidding documents for advertising by MassDOT or the municipality.

This project proposal assumes a 2 mile pilot project for cost estimating purposes consisting of minor roadway widening, and intersection and traffic signal improvements.

Cost Estimate –

- Feasibility Study – $20,000
- Pilot project design and construction – $3,471,046.66

Recommendations for Implementation – Prior to evaluating local roads for suitable bicycling conditions it will be necessary to establish evaluation criteria and metrics. Roadway geometrics, traffic volumes, prevailing speeds, the presence of trip generators including residential origins, and directness of travel should be considered. Subsequently, selection of neighboring communities and potential connector routes or corridors is needed before any feasibility study and analysis can proceed. The list of potential routes should be inclusive of a variety of roadways and conditions so that alternatives can be established and evaluated to determine opportunities and barriers to implementation of improvements and connections. Off-roadway alignments should be considered and evaluated as well including abandoned rail lines, utility line easements, conservation lands, or other possible alignments. Demonstration of the improvements resulting from the pilot project requires the collection of baseline (current conditions) data for comparison after implementation. Data to be collected will need to be determined specific to the community and route selected, however the following should be considered:

- Route / facility usage (bike/pedestrian trips)
- Type of trips made via corridor / route
- Crash data
- Perceived level of safety among facility users
- Perceived level safety among motorists encountering bicyclists and pedestrians
- Ease of wayfinding

Project 5.3.2: Feasibility Study and Design of Bike Path along Route 6 from Herring Cove Parking Lot to Race Point Road

Project Description – A two-phase project to develop a bicycle path connecting the CCNS parking facilities at Herring Cove to other National Seashore facilities, including the Province Lands Bicycle Trail at Race Point Road. The first phase is to conduct a Feasibility Study coordinated between the Cape Cod Commission, the State of Massachusetts, the National Park Service, and the town of Provincetown to identify dedicated alignment within the existing right of way along the north Side of Route 6 from Herring Cove to Race Point Road.

Route 6 is a principal arterial that provides direct access between Herring Cove and the National Seashore attractions at Race Point, including the Province Lands Bicycle Trail. Completely lacking in bicycle and pedestrian accommodations, Route 6 has only minimally paved shoulders, significant traffic volume, truck traffic, and posted speed limits varying between 35 MPH and 45 MPH. Though Herring Cove and Race Point are connected via the Province Lands Bicycle Trail, it is a circuitous path and doesn't facilitate convenient and expedient bicycle and pedestrian mobility between the two points. Additionally, bicycle access to these two locations from the commercial center and the neighborhoods of Provincetown is not available. As a result nonmotorized modes cannot be comfortably utilized to reach these nearby destinations, resulting in greater reliance on automobile travel within this region of Cape Cod.

Component A – Feasibility Study to include

- General overview, project purpose and need, local and regional perspectives;
- Project Description, including locus map, major constraints and opportunities;
- Corridor Right of Way: public vs. private property;
- Resources: GIS level environmental resources such as waterways, wetlands, vernal pools, wildlife habitat, management/refuge areas, historic areas/districts/sites, contaminated sites;
- Trail or route design criteria;
- Structures required;
- Trail amenities: parking, access to attractions, wayfinding & interpretive signing;
- Trail access points providing connections to on-roadway bicycle and pedestrian routes in Provincetown;
- Needed facilities and retrofits to connecting bicycle and pedestrian routes within Provincetown;
- Conceptual Design including typical sections, alignment, road/water crossings, impacts & mitigation, permitting requirements, construction costs; and
- Operations & Maintenance requirements.

Component B – Class III design and construction plans

Design cost estimates at 17% of NET construction costs

Preliminary Design Concepts – Conceptual design would include typical sections, alignment, road/water crossings including trail access points at intersections that provide connections to neighborhoods and the commercial center of Provincetown, structures, trail amenities, impacts & mitigation, ROW actions, permitting requirements, and construction. Final design would include construction plans, specifications, right-of-way plans, and bidding documents for advertising by MassDOT or the municipality. The envisioned project would be approximately 2 miles long.

Cost Estimate –

- Feasibility Study – $20,000
- Class III Design & Construction – $3,456,085

Recommendations for Implementation – Coordination of stakeholder interests is needed to fully develop the scope of the feasibility study component. Existing plans should be consulted to determine how related projects can contribute to the overall development of a facility that is integrated into the existing bicycle and pedestrian network in Provincetown. Planned or programmed projects that have the potential to impact concurrency issues, notably those on connector routes providing access to the proposed path should be investigated to determine possible synergies and cost savings with minimal changes to scopes of work. Specifically any improvements should be coordinated with Project 5.3.12 to integrate efforts at developing linkages throughout Provincetown and the Province Lands attractions within the Seashore.

Project 5.3.3: Identify Possible Connections between the Cape Cod Rail Trail and Cape Cod National Seashore Trails

Project Description – Envisioned primarily in Eastham where the Nauset Trail is proximate, but not connected to the Cape Cod Rail Trail, connections between the CCRT and trails within the Seashore are needed. The CCRT, located to the west of Route 6 is approximately ½ mile from the Salt Pond Visitor's Center but requires crossing Route 6 to facilitate a direct connection. Just north of the Salt Pond Visitor's Center (site of the trailhead) the CCRT passes underneath Route 6 and on-roadway routes could be designated without the need to cross Route 6 at-grade, though they would provide less direct access.

Preliminary Design Concepts – The design concepts are subject to determination of a feasible alignment to connect Seashore trails to the Cape Cod Rail Trail. Since conditions will vary considerably at each location the connections could consist of both on-road and shared-use path connections the designs will need to consider the appropriate elements for the context in which the routing takes place. Secondary streets with low traffic speeds and volumes can provide adequate connections with minimal enhancements such as improved signage and/or pavement markings. Shared-use path sections could utilize a paved surface, or a natural surface. Unpaved roads should also be considered to establish connections.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Locust Road provides the most direct access between the visitor's center and the rail-trail, however access via this route requires and at-grade crossing of Route 6. The intersection is controlled by a signal however, and if chosen as the alignment the signal operation should be evaluated for compatibility with bicycles (bicycle detection, appropriate timing and clearance intervals). An alternative route would utilize the CCRT underpass beneath Route 6 to access the neighborhood streets to the east via Old Orchard Road and School House Road. This option would avoid an at-grade crossing of Route 6 but would result in a longer, more circuitous route. Existing conditions on all potential roadway segments should be evaluated to determine the most feasible routing requiring the least infrastructure improvements to keep costs low.

Project 5.3.4: Regional and local Pedestrian and Bikeway connectivity to Dennis Port

Project Description – The Town of Dennis, through its Dennis Port Revitalization Committee, has established a prime objective of making pedestrian and bikeway connections to key destinations in the region surrounding the Dennis Port Village. These connections include (among others); providing links to the hotel / motel district located on Lower County Road; the playgrounds and historic sites located in South Dennis; the Cottage Colony located between Lower County Road and the beach / waterfront area; and a combination of shared routes and/or multi-use paths to provide connections to the Cape Cod Rail Trail at Route 134, and the Old Colony Rail Trail in Harwich. The various desired connections are identified and illustrated in the Dennis Port Master Plan which may be found online at:

www.dennisportrevitalization.org

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes and safe roadway crossings to access the rail trails. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures would provide a convenient and comfortable route for cyclists of varying abilities. Sidewalks and improved crossings are needed at various locations to establish pedestrian routes and connections. Specific design treatments should be sensitive to the particular needs and context of each road where improvements are made.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – The feasibility of adding paved shoulders or bicycle lanes and improving conditions to one or more roads needs to be determined. Multiple connections should be considered to provide for access to both rail trails and destinations along the potential routes should be considered when selecting alignments. Routes that serve to connect multiple trip generators would serve to increase the utilization of bicycling for utility trips and multiple connections would establish a more complete route network in the region. A four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane.

Project 5.3.5: Identify Regional Connections between Existing Paths and Locations with High Pedestrian Traffic

Project Description – Sidewalks or shared-use paths should be provided to establish connected and contiguous pedestrian access routes between the commercial trip generators, residential neighborhoods, and existing pedestrian facilities where pedestrian traffic is currently high or for which there is significant latent demand. Pedestrian networks should be established on a regional basis to connect villages and towns when density and proximity warrant.

Preliminary Design Concepts – Depending upon traffic volumes, speeds, and location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A gap analysis should be undertaken to identify and prioritize sidewalks and crossings needed to develop a complete network which integrates the existing pedestrian infrastructure including sidewalks, paths, and neighborhood streets with the surrounding pedestrian trip generators including both residential and commercial origins and destinations. Safety countermeasures should be considered for locations where potential exists for vehicle/pedestrian collisions, primarily at the intersections with arterial and collector roadways and where commercial entrances or lack of access management results in frequent conflict points. Access management should be considered at these locations, and improvements should also seek to improve access to transit stops when appropriate.

Project 5.3.6: Identify a "Shore Route" South of Route 28 from Woods Hole in Falmouth to Stage Harbor in Chatham

Project Description – Identification of a "Shore Route" of approximately 45 miles providing bicycle access and connectivity across a region comprised of eight localities would link the many destinations and villages of this heavily developed region of the Cape. Proposed as an on-roadway route, it would closely follow the coastline along Nantucket Sound. Limited route options in many locations result from a fragmented road network that would require use of Rte 28 in many locations. In developed areas where Route 28 lies farther from the coast, more route permeability typically exists, allowing for more routing options, though this is intermittent throughout the corridor from Falmouth to Chatham.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide a relatively direct, comfortable, and connected bicycle route south of the Route 28 corridor. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures should be utilized consistent with the context and conditions of the specific roadways where improvements are implemented. Because of the circuitous routing that would be required wayfinding is an essential element. Where the use of Route 28 is required careful consideration needs to be given to providing bicycle accommodations and countermeasures that facilitate bicyclists safely entering and departing this heavily traveled roadway.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to the regional nature of the proposed project, coordination among the eight localities and the Cape Cod Commission is needed. The large area and the lack of a connected network of candidate roadways pose significant barriers to implementation. Uniformity in accommodations through the corridor should be sought so that cyclists utilizing the route for travel across the Cape will encounter a unified and integrated route from one jurisdiction to the next. Local comprehensive plans and other local and regional plans should be reviewed and amended to reflect the proposed project, the desired level of accommodations, and means by which individual localities can implement improvements. The project should be coordinated with other proposed improvements where new routes might utilize Route 28 or parallel corridors such as the proposed improvement and designation of Route 28 as a bicycle route (Project 5.3.10) and the proposed "OBHC Triangle Route" (Project 5.3.18). Additionally, the improvements should be coordinated with the proposed connections between the Old Colony Rail Trail and Harwich Port and Dennis Port (Projects 5.3.9 & 5.3.4) in order to ensure linkages that will establish a connected network of bicycle routes.

<u>Project 5.3.7: Identify a "Bay Route" from the Cape Cod Canal in Bourne to Orleans</u>

Project Description – A "Shore Route" of approximately 30 miles is envisioned to provide continuous bicycle access and connectivity across the six localities along Cape Cod Bay. The route would link the villages and destinations of this developed region of the Cape similar to the proposed "Shore Route" paralleling it along the southern coast of the Cape. Likewise, the "Bay Route" is envisioned as an on-roadway route following the coastline along Cape Cod Bay, north of Route 6 and traversing the popular destinations along the coast. Limited route options in many locations result from a road network fragmented by both manmade and natural features, and which would require use of

Route 6A in many locations. In developed areas where Route 6 lies farther from the coast more route options exist, most notably in West Barnstable and Dennis. Unlike the Rte 28 corridor of the "Shore Route" Route 6A parallels Route 6, providing a largely continuous route option with slower speeds and traffic volumes than the principal arterial Route 6, though it would still need infrastructure improvements to be a suitable route.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide a relatively direct, comfortable, and connected bicycle route north of Route 6. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures should be utilized consistent with the context and conditions of the specific roadways where improvements are implemented. Because of the circuitous routing that might be utilized along secondary and residential streets wayfinding is an essential element.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to the regional nature of the proposed project, coordination among the six localities and the Cape Cod Regional Commission is needed. The large area and the limited network of connected candidate roadways pose significant barriers to implementation. Uniformity in accommodations through the corridor should be sought so that cyclists utilizing the route for travel across the Cape will encounter a unified and integrated route from one jurisdiction to the next. Local comprehensive plans and other local and regional plans should be reviewed and amended to reflect the proposed project, the desired level of accommodations, and means by which individual localities can implement improvements. The project should be coordinated with other proposed improvements within or adjacent to the Route 6 corridor such as the proposed route through the Sandwich Historic District (Project 5.3.27) and the "OBHC Triangle Route" (Project 5.3.18).

Project 5.3.8: Relocation of Existing Rail Line and Conversion to Trail

Project Description – This 6 mile project in the Town of Bourne proposes to create a rails-with-trail facility from the northern terminus of the Shining Sea Bike Path to the Cape Cod Canal Bikeway via the existing MassDOT/Bay Colony railroad right-of-way (ROW). This existing rail corridor parallels Shore Road in Bourne. Although the title suggests that the tracks require relocation, it is possible that the railroad ROW maintains sufficient width to support a new multi-use trail without the need to move the tracks.

It is important to note that the Town of Falmouth is in support of an alternate concept for the connection to the Canal which utilizes the Route 28 median for construction of a multi-use path to make the connection from the Shining Sea bike path to the Cape Cod Canal. (See Project 5.2.11)

Preliminary Design Concepts – The trail should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. A number of at grade crossings will require individual consideration based upon the conditions present and safety countermeasures required.

Cost Estimate – Shared-use path, unit costs per mile:

- Along abandoned RR bed – $660,000.00

Crossing improvements, unit costs:

- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Rail relocation costs:

- TBD, if necessary

Recommendations for Implementation – Additional research is required to confirm the layout width of the railroad ROW. The project will also require the design of numerous at grade crossings at the various intersection with public and private streets. This would likely be a mega-project requiring significant funding and a phased approach. The initial phase should include linkages to existing trail or on-road routes to be an integrated facility, not a stand-alone facility.

Project 5.3.9: Connect Harwich Port to Old Colony Rail Trail

Project Description – Harwich Port is located approximately 1½ miles south of the center of Harwich and the Old Colony Rail Trail. Currently there are no bicycle routes or accommodations linking Harwich Port to the trail. Several potential routes exist, notably along Bank, Forest, and South Streets, that could be improved and designated by adding shoulders or bike lanes along with signage, including wayfinding aids.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes and safe roadway crossings to access the rail trails. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures will provide a convenient and comfortable route for cyclists of varying abilities. Specific design treatments should be sensitive to the particular needs and context of each road where improvements are made.

Cost Estimate – On-roadway improvements (1.5 miles):

- Signing and striping – $15,840.00
- Widening to add shoulders/bike lanes – $752,400.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – The feasibility of adding paved shoulders or bicycle lanes to one or more of the three likely candidate streets needs to be determined. Existing right-of-way, utilities, and/or the existence of undeveloped properties along the candidate routes will largely determine the preferred alignment of an improved bike route. A four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. Coordination with Project 5.3.4 and 5.3.6 seeking to improve bicycling conditions in the Route 28 corridor will help to ensure connectivity.

Project 5.3.10 Designate Route 28 as a Bike Route and Improve Conditions

Project Description – Though Route 28 is mainly a secondary highway it serves as the primary corridor along Nantucket Sound linking 8 towns through the Upper, Mid, and Lower Cape. Approximately sixty miles of Route 28 provides access to a number of destinations across the Cape including villages, town centers, the Hyannis Transportation Center, and the Cape Cod/Old Colony Rail Trail. Despite being the primary route through this heavily developed area of Cape Cod the road is mostly a two-lane, undivided road, often lacking paved shoulders, and is heavily congested during peak season. Improvements would provide bicyclists with a convenient and comfortable route linking the many towns, villages, and destinations along Nantucket Sound. Improvements would also reduce conflicts between bicyclists and motorists and reduce congestion, both by encouraging greater use of bicycling for transportation and by reducing vehicle where passing opportunities don't currently exist.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide a direct, comfortable bicycle route through the Route 28 corridor. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures should be utilized consistent with the context and conditions of the specific roadways where improvements are implemented. In some locations a shared-use path design may be appropriate or desirable if children and less experience adult bicyclists are intended users of the route.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Existing corridor (minor grading/clearing) – $792,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Due to the regional nature of the proposed project, coordination among the eight localities and the Cape Cod Regional Commission is needed. The large geographic area and the limited right of way in many locations pose many challenges to implementation. Uniformity in accommodations through the corridor should be considered so that cyclists utilizing the route for travel across the Cape will encounter a unified and integrated route from one jurisdiction to the next. Local comprehensive plans and other local and regional plans should be reviewed and amended to reflect the proposed project, the desired level of accommodations, and means by which individual localities can implement improvements. The project should be coordinated with other proposed improvements where new routes might utilize Route 28 or parallel corridors such as the proposed "Shore Route" (Project 5.3.6) and the proposed "OBHC Triangle Route" (Project 5.3.18).

Project 5.3.11 Establish Bicycle & Pedestrian Connections between Orleans Villages

Project Description – Sidewalks or shared-use paths providing connected and contiguous pedestrian access routes between the villages of Orleans and their respective trip generators will enhance mobility and increase safety. Bicycle connections also will facilitate greater mobility and less reliance on automobile travel, and the addition of on-road accommodations and shared-use path facilities should be considered based upon context and intended users. The Village Center, South Orleans, East Orleans, Rock Harbor, and Skaket need to be considered for both bicycle and pedestrian connections as called for in the Orleans Comprehensive Plan (OS22).

Preliminary Design Concepts – Depending upon traffic volumes, speeds, and the location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

On-roadway accommodations, shared-use paths and linkages, bike route signage, and roadway widening and striping should be considered to provide enhanced conditions for bicyclists. Due to right of way concerns, on-roadway alignments will likely prove the most feasible options and can utilize secondary and neighborhood streets with lower speeds and moderate traffic with minimal improvements while still providing an adequate level of accommodation for most bicyclists.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A gap analysis should be undertaken to identify and prioritize sidewalks, crossings, shared-use paths, and on-roadway improvements needed to develop a complete bicycle and pedestrian network which links the villages of Orleans to one another and to existing bicycle and pedestrian trip generators. Safety countermeasures should be considered for locations where potential exists for conflict points with the addition of bicycle and pedestrian facilities.

Project 5.3.12 Connect MacMillan Pier to Cape Cod National Seashore Bicycle Paths

Project Description – MacMillan Pier in the heart of Provincetown serves as a multimodal center with local and regional bus service as well as ferry service to Plymouth and Boston. Bicycle travel on the commercial and residential streets of Provincetown is manageable with lower traffic speeds; however access to the National Seashore becomes more difficult requiring riding along and crossing collectors and arterials since limited routes exist to link the two destinations. Enhancing the ability to access the National Seashore bike paths from Provincetown, and specifically MacMillan pier will improve multimodal options and facilitate greater use of bicycling to access the Seashore without requiring reliance on automobiles.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes and safe roadway crossings. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures will provide bicyclists with wayfinding along a convenient and comfortable route for cyclists of varying abilities.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to the limited roads that will provide access to the Province Lands Bicycle Trail via Race Point Road several routing options should be established and existing conditions evaluated. Needed improvements should be determined and the most feasible route chosen for improvements. Coordination with Project 5.3.2, the proposed path linking Herring Cove's parking facilities with Race Point Road, will ensure that intersection improvements and logical connections between this on-road route and the proposed provide a continuous and integrated network linking Provincetown with the Seashore destinations. Coordination with Provincetown will be needed.

Project 5.3.13 Connect Province Lands Bicycle Trail and Head of the Meadow Trail

Project Description – The 7.6-mile Province Lands Bicycle Trail and the 2-mile Head of the Meadow Trail, two of the Seashore's most popular trails, lie approximately four miles apart on the Outer Cape. Currently the trails are not accessible from one another other than by transiting along Route 6. Though an alignment for a separate trail linking these two trails is desirable the dunes and other sensitive features make that difficult to achieve. Use of existing roads, paved or unpaved, is likely needed for at least part of the alignment. Connection of the two trails would reduce the need to access both trails by automobile, thereby helping to ease congestion and parking demand. If done in conjunction with proposed improvements to link the Province Lands Bicycle Trail with the commercial and residential center of Provincetown access throughout this region of the Seashore has the potential to significantly reduce reliance on automobiles for access to these Seashore trails.

Preliminary Design Concepts – The design concepts are subject to determination of a feasible alignment to connect the two trails. Likely consisting of both on-road and shared-use path connections, the designs will need to consider the appropriate elements for the context in which the routing takes place. If Route 6 is chosen appropriate accommodations and safety countermeasures will be needed due to the volume and speeds of traffic. Shared-use path sections could utilize a paved surface, or a natural surface, but any design chosen should provide a firm, stable surface that is compatible with bicycle use while also providing access to disabled visitors and complying with ADA.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Several existing unpaved trails located between the beach and the dunes, primarily in Truro, should be considered for enhancements to be made compatible with bicycle travel. However, the parabolic dunes and other sensitive natural features are of concern and impacts need to be avoided or mitigated. The paths could retain natural surfaces to avoid both visual and environmental impacts associated with hardening, though the environmental impacts of such use would need to be evaluated. Route 6 provides the only roadway alignment to connect the two trails and options to avoid an on-roadway facility should be considered since it would not be inviting to many less experienced bicyclists.

Project 5.3.14 Connect Truro Village Center to Truro Destinations

Project Description – Connecting the two villages and the destinations of Truro via a bicycle network is needed to facilitate nonmotorized mobility while also enhancing the visitor experience to this popular summer destination. Largely rural and comprised primarily of the National Seashore, Truro has a number of popular seasonal destinations including Head of the Meadow Trail, Coast Guard Beach, the Highlands Center, Hostel International, and three campgrounds. Truro's population and developed areas are largely located in two village centers; Truro and North Truro, both on Cape Cod Bay, and which are connected primarily via Routes 6 and 6A. Like many other parts of the Cape the developed areas are not well connected through a network of secondary roads suitable for bicycling, often requiring use of collectors and arterials for transit between destinations. Aside from destinations within the two village centers most of Truro's attractions are in the National Seashore and require access along and across Routes 6 and 6A. The village centers are currently connected via Mass Bike Route 1, primarily along Route 6A and Castle Road, both of which have minimal signage but no physical accommodations for bicycles.

Preliminary Design Concepts – Bicycle connections would largely consist of on-road improvements with some off-roadway alignments where needed, based upon the needs and bicycling experience of intended users. A number of unpaved roads within the Seashore could be utilized for connections with very low traffic volumes making bicycling comfortable for a variety of users; however hardening would be needed in some locations to provide an adequate surface, although annual grading would likely provide an acceptable surface on unpaved roads that experience very low vehicle use. Wayfinding signage should be added consistent with the protocols and designs developed elsewhere on the Cape.

Adequate shoulders exist on much of Route 6 in Truro, including the short section that is utilized for the Claire Saltonstall Bikeway (Mass Bike Route 1), but the shoulder with is reduced at the junction with Route 6A northward in North Truro. Though Mass Bike Route 1 diverts onto Route 6A at this point many bicyclists still use Route 6. Interchange improvements such as bike lane pockets and/or signage should be considered along Route 6 to mitigate potential for conflicts at these weave movements, including at this location which requires north-bound bicyclists to make a left turn at an uncontrolled intersection.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Coordination between Truro and the National Park Service will be needed to identify desired routes and to develop plans for connecting destinations within the village centers and the National Seashore. An Environmental Screening Form would need to be completed for the elements within the Seashore to determine the level of environmental compliance required. Because hunting is allowed in some parts of the Seashore consideration needs to be given to routing of bicyclists through those areas. Habitat fragmentation is also of concern to CCNS and needs to be considered. Coordination with Project 5.3.13 is needed to develop continuity between Truro destinations and the linkages that are proposed to provide access within the National Seashore and between the existing Seashore trails.

Project 5.3.15: Connect Shawme-Crowell State Forest to the Cape Cod Canal Bikeway

Project Description – Located in Sandwich, the Shawme-Crowell State Forest is proximate to the Cape Cod Canal Bikeway but lacks an improved route or facility to connect them. The forest has a variety of park and camping facilities and lies between Routes 6 and 6A with the main entrance off of Rte 130 (Main Street). The Claire Saltonstall Bikeway does pass the entrance to the forest though there are no bicycle accommodations or facilities.

Preliminary Design Concepts – The short linkage needed to connect the Cape Cod Canal Bikeway with the state forest allows for several design alternatives to be utilized. An unused alignment for Bayview Rd near the intersection of Route 6A and 130 could allow for a shared-use path that would access the back of the state forest. The alignment is currently cleared almost to the Cape Cod Canal Bikeway, though it would require access across a rail line. An on-road route could be established using secondary roadways, preferably with bicycle accommodations provided. The most likely alignment would utilize Tupper Road and Main Street although shoulders or bike lanes should be considered to improve the existing conditions to increase safety and reduce conflicts with automobiles on these narrow roads that lack paved shoulders. Other possible on-road routes could be utilized, but would be less direct. Any route established should utilize wayfinding signage to direct bicyclists to these two facilities.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Several improvements in or adjacent to this general area have been proposed and should be coordinated to develop a connected and integrated network of bicycle routes and facilities. Projects 5.2.15 (improvements on Tupper Rd. south of Rte 6A) and 5.3.17 (bicycle improvements through the Sandwich Historic District) propose improved bicycle facilities in this immediate area and could be combined into a larger project, especially if this proposed connection to the forest utilizes a route along Tupper Road. Data collected during this feasibility study also indicate that existing proposed improvements call for a shared-use path or on-road improvements on Route 6A which could also facilitate this needed connection. The

Claire Saltonstall Bikeway should be realigned to utilize an improved route through this corridor if bicycle accommodations are provided as a result of these proposed projects.

Project 5.3.16: Connect Wellfleet Bay Wildlife Sanctuary to Cape Cod Rail Trail

Project Description – Mass Audubon's Wellfleet Bay Wildlife Sanctuary is located on Wellfleet Harbor and is a popular destination with 5 miles of natural walking trails. The sanctuary is approximately one mile due west of the Cape Cod Rail Trail at the point where the CCRT passes through the National Seashore, however the trail is located on the opposite side of Route 6. Further complicating connection of the CCRT to the sanctuary is the need for a connection across private property. Entrance Road provides access to the sanctuary and intersects Route 6 across from the Wellfleet Lodge and the Wellfleet Motel where the most direct connection could take place. However, the CCRT parallels Route 6 behind the hotels and access from the CCRT to Route 6 would require crossing private property.

Preliminary Design Concepts – A shared-use path design typical should be utilized to provide a short, approximately ¼-mile spur linking the CCRT to Route 6. More significantly consideration and installation the appropriate crossing treatments and countermeasures are needed at the intersection with Route 6. Route 6 is a 2-lane cross section with a posted speed of 45 MPH at this location. With the traffic volumes experienced during peak season and the bicycle and pedestrian access from the CCRT, significant bicycle/pedestrian conflicts with motor vehicles would likely result. Minor improvements might be needed along Entrance Road to include directional signage and possibly pavement markings to create awareness of a shared-road environment.

Cost Estimate – Shared-use path connection (0.25 miles):

- Path along new alignment – $217,800.00

On-roadway improvements (.35 miles):

- Signing and striping – $3,696.00

Improved crossing at Route 6:

- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – Construction costs associated with the short spur would be minimal, however access across private property (one of the two hotel properties) could potentially increase the costs significantly. A trail easement would allow access without the need for costly right of way acquisition and the adjacent properties of the two lodging properties would provide an alignment directly across from Entrance Road. The somewhat remote location of this proposed spur and the trail traffic generated by the sanctuary would likely minimize any potentially undesirable traffic across the properties. Additionally, some businesses have welcomed access to regional trail facilities, recognizing that it has the potential to serve to attract patrons. Pending development of the connection, an engineering study should be conducted to determine the appropriate level of accommodations needed to facilitate safe crossing of Route 6.

Project 5.3.17: Identify Potential Bikeway Alignment through Sandwich Historic District

Project Description – The Sandwich Historic District lies just to the east of the terminus of the Cape Cod Canal Bikeway, though there are no designated bike routes through Sandwich. A shared-use path through the district likely holds appeal to many, however such an alignment would prove difficult due to lacking right of way. Old King's Highway (Route 6A) borders the district to the south and is the primary route through Sandwich. Roadways along Cape Cod Bay are discontinuous and limit the availability of alternate routes through town.

Preliminary Design Concepts – Largely consisting of on-road bike routes the alignment should consider the existing conditions and whether shared-road conditions and geometrics are adequate or in need of improvements. At the least wayfinding signage is needed, especially for any alignment along secondary roads. Cul-de-sacs and dead-end residential streets may present challenges in identifying a route, however short connections between these types of streets should be considered where appropriate to facilitate bicycle and pedestrian route connections while still preventing automobile through traffic.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation –The route alignment should consider directness, ability to access destinations, and the possibility of short connections between streets that are not currently linked. The Claire Saltonstall Bikeway, also known as Mass Bike Route 1 follows Route 6 to the south of the Sandwich Historic District. Due to the existing conditions along Route 6 any improved alignment through Sandwich should consider the realignment of this long-distance bike route along an improved route. Coordination with Projects 5.2.15, 5.3.15, and particularly 5.3.7 (the proposed "Bay Route") will help to ensure continuity and establishment of a connected bicycle network. Projects providing regional connections may also be viewed more favorably with regards to obtaining funding and can be implemented by multiple localities.

Project 5.3.18: Identify and Implement "OBHC Triangle" Route

Project Description – Orleans, Brewster, Harwich, Chatham constitute a roughly triangular area that occupies the region where the Outer Cape begins. Limited route availability due to a lack of a network of secondary roads that connect these towns will make difficult the development of a suitable bicycle route of approximately 30 miles constituting the "OBHC Triangle". The towns are largely interconnected via routes 6A, 39, 28, 137, and 124; all of which have little to no accommodations for bicycles and which have considerable vehicular traffic, especially during peak season. Nickerson State Park lies in the center of the region further contributing to the traffic in the region.

Preliminary Design Concepts – Envisioned as an on-roadway route linking the four towns, a designated route will need to consider roadway improvements in order to adequately accommodate bicycle travel, especially by cyclists other than experienced cyclists comfortably riding in a shared-roadway environment. Some paved shoulders exist, though in most instances they are inadequate to serve as a bicycle accommodation and are discontinuous. Addition of paved shoulders or traffic control devices highlighting a shared-roadway condition should be considered. Such measures could include "share the road" signage or use of "sharrows" officially known as shared lane markings. Along roadway segments where adequate paved width exists or may be easily added, designated bike lanes may be considered as appropriate.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to limited routing options implementation will require selection of a route and evaluation of existing conditions to determine needed improvements and countermeasures. Coordination with Projects 5.3.6, 5.3.7 (the proposed "Shore" and "Bay" routes respectively), and 5.3.10 will ensure that proposed improvements are consistent throughout the region. Since those proposed routes are of a regional nature segments of the "OBHC" route that are coordinated with these projects will likely receive greater priority for funding. Emphasis of the efforts to integrate these proposed routes into a cohesive network linking towns and destinations would likely increase the potential for funding.

Project 5.3.19 Improve Bicycling Conditions on Route 130 in Sandwich

Project Description – Bicycling conditions along Route 130 (Forestdale Road/Water Street/Main Street) in Sandwich are currently challenging with little or no paved shoulder, significant traffic volume, and a posted speed limit of 40 MPH. Adding paved shoulders or other bicycle improvements would provide safer, more comfortable bicycling conditions while also reducing conflicts with motor vehicles. Route 130 provides connections to destinations, neighborhoods and the adjacent town of Mashpee. Adding paved shoulders has additional benefits including pavement edge stabilization, the addition of a recovery area which reduces roadway departure crashes, and a breakdown area that allows disabled vehicles to be moved out of the travel lane, thereby mitigating congestion impacts from such incidents. These all result in safety, operational, and maintenance benefits which yield long-term cost savings.

Preliminary Design Concepts – Widening or the addition of paved shoulders should consider the existing roadway geometrics. In order to be useful for bicycle travel shoulders and the adjacent travel lane need to be of adequate widths to provide a degree of separation between the two modes, otherwise safety can be impaired by inviting motorists to pass too closely to bicyclists that attempt to hug the outside edge of the roadway. In general a four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. On roads with curb and gutter, the gutter pan and the longitudinal joint effectively reduces the useable width of the shoulder and consideration needs to be given to the paved width of the shoulder exclusive of the gutter pan.

Cost Estimate – On-road improvements, unit costs per mile:

- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders along both sides of the road.

Recommendations for Implementation – Opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Routine pavement overlay and resurfacing projects should include shoulder paving for this route. Maintenance needs to be considered so that the functionality of shoulders for bicycling purposes is retained since the natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder.

Project 5.3.20: Improve Bicycling Conditions on Quaker Meeting House Road in Sandwich

Project Description – Sandwich Quaker Meeting House Road is located in a heavy residential area and the roadway currently has intermittent facilities with short segments of shared-use paths connecting some subdivision developments. The roadway geometrics consist of a two-lane secondary roadway with minimal paved shoulders. As a result, the discontinuous nature of the infrastructure makes travel by bicycle difficult for anyone not comfortable with riding in a shared travel lane with automobile traffic. There are numerous points of destination along Quaker Meeting House Road including Sandwich High School, Oak Ridge School, and a municipal complex that justify the need for bicycle accommodations. The town is currently constructing a continuous sidewalk along the entire length of Quaker Meeting House Road from Route 6A to Route 130. The Town desires to widen the existing roadway to provide 11' lanes and 4' shoulders in both directions in conformance to state requirements for bicycle accommodations. The proposed projects are fully designed and are "shovel ready" but are unfunded.

Preliminary Design Concepts – Roadway improvements along Quaker Meeting House Road to provide 11' travel lanes and 4' paved shoulders. On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle access to the many destinations in this residential area. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures would provide a convenient and comfortable route for cyclists of varying abilities.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00

Recommendations for Implementation – Identification of funding sources and programming of funds is needed to facilitate implementation since the projects are fully designed. Final designs should be reviewed for appropriate integration with the existing bicycle infrastructure on Quaker Meeting House Road and improvements to the existing infrastructure, if needed, should be considered in order to provide continuity in the accommodations.

Project 5.3.21: Establish a Bicycle & Pedestrian Connection from Fort Hill Area Trails to Governor Prence Road

Project Description – The Town of Eastham, through its Planning and Economic Development Department, has identified the Governor Prence Road, a major access to the Red Maple Swamp and Fort Hill Trail, as the only major crossing of Route 6 that does not have a traffic signal. The Eastham Visitor's Center is also located at this intersection which maintains high traffic volumes, has significant left turns, and is a high crash location. As a result warrants should be easily met to justify a traffic signal. A pedestrian actuated traffic signal at this intersection will encourage residents and vacationers, who now drive to Fort Hill or Hemenway Beach to bike or walk to these popular destinations. Sidewalks or shared-use paths are needed to establish a connected and contiguous pedestrian access route between the Fort Hill trails and Governor Prence Road which intersects the Cape Cod Rail Trail less than one mile west of this intersection. Improved bicycle conditions linking the CCRT with Fort Hill are also needed.

Preliminary Design Concepts – Depending upon traffic volumes, speeds, and location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – Gaps within the existing pedestrian and bicycle network should be identified for improvements concurrent with the installation of a traffic signal. Appropriate safety countermeasures should be considered for locations where potential exists for vehicle/pedestrian collisions, primarily at the intersection of Governor Prence and Route 6, as well as along Governor Prence if a connection to the CCRT is desired. Improvements should also seek to improve access to transit stops when appropriate.

Project 5.3.22: Define Loops and Connections to Develop a "Grand Cape Tour" Along the Cape Cod Rail Trail

Project Description – The Cape Cod Rail Trail currently serves as a major bicycle facility stretching twenty two miles across six of Cape Cod's municipalities. Proposed extensions to the north and west would provide access to four additional localities. A

Grand Cape Tour would provide visitors to Cape Cod with bicycle access to towns and Seashore destinations with the CCRT serving as the spine route. Loop routes and spurs that provide direct bicycle access would also result in a connected bicycle network throughout much of the lower and outer Cape that could be used for utility trips as well.

Preliminary Design Concepts – Loop routes and access routes would likely consist of on-road bike routes and shared-use paths depending upon the specific conditions. Each proposed alignment should consider the existing conditions and whether shared-road conditions and geometrics are adequate or in need of improvements, or whether a shared-use path would be most appropriate for the intended and likely user. Wayfinding signage is needed, especially for any alignment along secondary roads.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation –The route alignments should consider directness, ability to access destinations, and the potential to integrate with the larger bicycle network envisioned for Cape Cod. Though intended to serve as a contiguous route throughout the entire area of the existing and proposed CCRT, such a network would facilitate bicycle use for commuting and routine utility trips in addition to recreation and tourism. Linkages therefore should consider popular tourism sites as well as town centers and commercial areas. Coordination with projects that are proximate to the existing CCRT, as well as future extensions would ensure development of a connected network of bicycle routes and facilities. Coordination of multiple localities, the Cape Cod Commission, and Massachusetts Department of Conservation and Recreation will be required.

5.4.4 OTHER INITIATIVES

The following is a list of nine projects proposing various initiatives to support and improve bicycling on Cape Cod. These projects are number 5.4.1 through 5.2.9.

Project 5.4.1: Bike Route Brochure & Wayfinding Map

Project Description – A multi-phase project proposing to develop and maintain a brochure, including a wayfinding map that describes the primary destinations accessible by bicycle including recreation features of pocket parks, beaches, town landings, shopping districts, hiking areas, bike paths, and other facilities and attractions followed by a subsequent implementation phase with wayfinding improvements along a pilot route.

Currently inconsistent signage and pavement markings throughout the Cape results in impaired safety and a poor visitor experience. Destination access is difficult due to the lack of wayfinding and directional signage which contributes to low use of bicycling and bicycle facilities for basic mobility and transportation to access destinations, resulting in over-reliance on autos, especially by visitors not familiar with Cape Cod. This in turn contributes to congestion and excessive parking demand. By encouraging and facilitating the use of bicycling as an alternative transportation mode improvements to air quality (all of Cape Cod is a non-attainment area), reduced congestion, and reduced impacts to sensitive lands and natural features resulting from illegal spillover parking, especially in the National Seashore, can be achieved.

The project will also yield safety improvements by addressing existing conditions which include lacking or inconsistent signage, pavement markings, and inadequate design treatments at intersections. Motorist and bicyclist/pedestrian expectations and actions are not uniform, crossings are often inadequate, and design treatments are inconsistent and often don't comply with MUTCD (the Manual on Uniform Traffic Control Devices) standards.

<u>Component A</u> – Conduct a Pilot Study to apply signage to one connector route. This proposed element is a follow-on to Project 5.2.2 and would utilize the wayfinding standards and protocols established via that project.

This component would require the following steps:

- Identify candidate routes that facilitate mobility and connection to multiple destinations
- Identify the pilot route for implementation
- Establish baseline data collection needs for comparison after pilot implementation
- Collect baseline data

<u>Component B</u> – Implement signage and pavement markings along pilot route

<u>Component C</u> – Develop six wayfinding itineraries with maps for bicycling experiences on Cape Cod to facilitate connection via bike or walking to destinations and attractions within Seashore and local communities, to include:

- Cape historic resources
- trail amenities including restaurants, rest rooms, accommodations, retail shopping area, bike repair/rental shops and emergency services
- connections to intermodal transportation facilities including bus and ferry terminals/connections

- Sand (surface hazard) and other cautionary items
- connections to other bicycle facilities including the Pan Mass Challenge Route and the Mass Bike Route 1 (Claire Saltonstall Bike Route)
- connections to primary destinations (Seashore attractions, town centers)
- communicating mobility issues for access by different users (ADA issues)
- coordination of all 6 regions to create larger overall "regional experience"

The data collection needed for Component A should also consider surveying bicyclists and users of bicycle routes and facilities regarding needed or desired content and the ease with which they can currently navigate the bicycle network on Cape Cod.

Preliminary Design Concepts – Installation of signage and wayfinding amenities should follow the protocols and guidance established as a result of Project 5.2.2 for existing facilities, relating to signage and wayfinding on the CCRT. Wayfinding itineraries and maps should be printed on water resistant stock and be either pocket-sized allowing use by bicyclists or pedestrians. Maps and related print documents should be made available in electronic format as well and updated regularly. Electronic versions have the added benefit of being able to provide more current content, and even real-time information such as trail closings and conditions, and links to transit schedules.

Cost Estimate –

- Signage installation on pilot route – $18,400 per mile
- Maps and wayfinding itineraries – $120,000

Recommendations for Implementation – Signage, wayfinding, and pavement marking guidelines and protocol need to be established prior to implementation, either via Project 5.2.2 associated with signage of the CCRT, or as a separate effort. Pilot route selection should follow the implementation guidance established in Project 5.3.2 by identifying potential connector routes or corridors, evaluating the alternative, and determining the specific pilot route. It will also be necessary to determine the baseline data that needs to be captured or collected, and the process by which that will be accomplished before the second phase involving signage installation can proceed. Additionally, data collection should include bicyclist's perception of current wayfinding resources and their needs or desires for content in the printed product. An opportunity for feedback on the printed product should be included such as a survey or an online form that can capture impressions of the quality of the guide/map and needed changes or suggested improvements. Due to the regional focus and the implications for towns, coordination is needed between towns as well as with the Massachusetts Office of Travel and Tourism (MOTT). Coordination with Intelligent Transportation Systems could provide real-time information and enhance wayfinding and transit service integration.

Project 5.4.2: Establish Nonprofit for Stewardship of the Cape Cod Rail Trail

Project Description – Form a nonprofit 501(c)3 alliance for stewardship of the entire & future Cape Cod Rail Trail. The CCRT currently provides a continuous 22 mile facility that serves as bike and pedestrian corridor through the Outer and Lower Cape, providing access to communities and attractions on Cape Cod, including the National Seashore. However visions exist for a facility that will extend throughout the entire length of the Outer and Lower Cape, connecting Hyannis to Provincetown, and providing multimodal access to much of Cape Cod. A facility of this size would benefit from the guidance and stewardship of a nonprofit organization to ensure proper care and maintenance, address operational and safety considerations, especially those related to improvements and physical extensions to service new locations, and to help remove or reduce barriers within the community to expanding the facility to serve additional towns and destinations on Cape Cod via advocacy and generating support for the expansion of the facility.

Preliminary Design Concepts – NA

Cost Estimate –
- $70,000.00

Recommendations for Implementation – The primary focus of the no-profit needs to be established and a commensurate framework for the organization developed. Similar organizations have been developed for other trail facilities with widely varying missions, from safety patrols, to routine maintenance and caretaking efforts such as "adopt a trail" efforts, to broader advocacy and stewardship endeavors aimed at enhancing and expanding a facility and serving to raise funds and support from the local community, including elected officials and business leaders.

The scope of the organization needs to be determined along with establishment of a governing body to ensure proper management of both the organization as well as to provide direction for a course of action to be taken and sustained. A board or other body that is assembled for this purpose should consider carefully the makeup (members) needed to adequately address the and achieve the desired functions.

Project 5.4.3: Cape Cod Nonmotorized Master Plan

Project Description – Develop a nonmotorized transportation master plan for Cape Cod that consolidates and integrates facilities, routes, and accommodations for bicyclists and pedestrians, including those owned or managed by localities, the National Park Service, and nonprofit organizations (such as conservation groups) into a single coherent network. Existing route and network plans, proposed facilities, identified gaps and gap analyses, policies for addressing the needs of bicyclists and pedestrians, and a prioritized list of projects and supporting initiatives across jurisdictions and stakeholder agencies needs to be established in order to adequately integrate and coordinate bicycle accommodations throughout Cape Cod.

Preliminary Design Concepts –The development of a master plan should seek to establish uniformity in standards and design guidelines, as well as consistency of policies and approaches to providing bicycle and pedestrian accommodations across Cape Cod. The plan should ensure continuity both in developing and connecting bicycle and pedestrian networks and in the actual design and construction of facilities, especially when they cross jurisdictional boundaries in order to facilitate mobility and access by bicyclists and pedestrians as well as to provide a consistent level of service.

Cost Estimate – Subject to scoping details

Recommendations for Implementation – Of primary importance is coordination across municipalities, including funding requests and applications and regional prioritizing of projects. Existing plans should be evaluated for shared visions and desired projects, as well as to establish consistency in facility design especially at jurisdictional boundaries to ensure continuity of infrastructure and accommodations along bicycle routes.

Project 5.4.4: Development of Trail Access Parking Agreements

Project Description – Develop agreements with schools to use school parking lots during off-times for trail parking to in order to alleviate parking demands resulting from trail use. With limited parking available and thousands of daily users of trail facilities on Cape Cod during peak summer season, parking demand can create problems with finding adequate parking at or near trailheads. The use of public parking infrastructure at schools during non-school hours will mitigate excessive parking demand while also utilizing existing parking facilities, thereby eliminating the need to construct additional capacity specifically for trail access. Shared parking efforts similar to this have eliminated added expenses while also increasing the utilization of an existing public resource.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – A model agreement should be developed that can be shared among Cape Cod localities. Standard signage and policies should be developed to ease implementation and retain uniformity at multiple locations. Local political issues will need to be addressed, however this approach provides an opportunity for facility sharing which increases the utilization of existing infrastructure while reducing the need for construction of additional parking facilities, many of which will be unutilized much of the year. Use of school facilities could be limited to time of day and/or time of year to provide additional parking capacity during peak season which coincides with school closures for summer break.

Project 5.4.5: Safety Education & Outreach

Project Description – Develop and implement an education and outreach initiative aimed at bicyclists and motorists with the intent of improving safety for bicyclists. With bicycling on Cape Cod being popular for both recreation and transportation there is a significant need to ensure safety is improved by addressing the human factors related to bicycle crashes, bicycle/motor vehicle collisions, and interactions between roadway users. Since human factors are a major contributor to bicycle/motor vehicle crashes this is a low cost/high value project.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – Education and outreach initiatives can comprise a broad range of strategies. Cape Cod stakeholders should develop a strategic approach to developing and deploying resources by identifying the primary issues that need to be addressed, target populations, and the commensurate strategies that should be investigated. Overly broad approaches are likely to be less effective than those aimed at addressing specific challenges and problems that currently exist. A number of safety and educational initiatives and corresponding materials currently exist around Massachusetts and the U.S. Existing resources should be evaluated to determine which, if any can serve as a template for the materials and initiative to be utilized by Cape Cod communities.

Project 5.4.6: Maintenance Program Development & Implementation

Project Description – Develop and implement a maintenance program to ensure appropriate and routine maintenance is provided for bicycle facilities and accommodations. Because bicycle facilities and accommodations are often outside of the road right of way or at the least are located along the margins of transportation facilities, they often do not receive the maintenance that is provided to roadway networks. Additionally, bicycle facilities will have maintenance needs that are different than those of roadways by virtue of their use and operation. On-roadway facilities such as bike lanes and shoulders often accumulate debris as a result of the natural sweeping action of motor vehicles pushing debris outward from the travel lanes, but not beyond the shoulder or bike lane. On roads with shoulder typical sections debris, notably loose soils and sand, tends to encroach and collect on the shoulder as well. As a result the bicycle accommodation can become virtually impassable while also constituting a crash or tire puncture hazard.

Drainage grates also pose a significant hazard to bicyclists as a result of raised vertical edges which can damage tires and wheels or deflect a wheel sideways causing a crash. Worse are grates with longitudinal openings that can trap a bicycle wheel, throwing the rider from the bike. Grate installation, repair, and replacement policies and practices should utilize bicycle-friendly grate designs, location outside of the bicycle path of travel if possible, and maintenance which maintains a smooth, flush transition from pavement to grate.

Shared-use paths and rail-trails outside of road rights of way often do not receive routine maintenance. As a result conditions often deteriorate to the point that the facility is not inviting or perhaps even results in compromised safety. A routine maintenance program and budgeting enhances the utility of a facility and can serve to expand the service life through preventive maintenance.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – The many bicycle accommodations on Cape Cod are the responsibility of a variety of entities, including state and local government. Coordination between stakeholders, memorandums of understanding, and identification of funding sources will be needed in addition to the development of the policies and programmatic elements. If development of a 501(c)3 nonprofit trail advocacy group proceeds their role in maintenance should be incorporated into these efforts. Routine evaluation of conditions and planning for maintenance should be incorporated into other infrastructure maintenance policies, activities, and budgets.

Project 5.4.7: Interpretive Film Promoting Cape-Wide Bicycle Network and Bicycle Safety

Project Description – Many of the attributes that make Cape Cod a popular destination are accessible and enjoyable by bicycle. As efforts to expand the bicycle network on Cape Cod continue, bicycling as both recreation and a transportation mode on the Cape will continue to grow in popularity. Currently many of the bicycling resources on the Cape are not widely known and an interpretive film could serve to both increase awareness of bicycling options on the Cape, as well as aiding people navigate the Cape's bicycle network and utilize it for accessing destinations and increasing their mobility on the cape without reliance on automobiles. Additionally, interactions with pedestrians on shared-use paths and motorists on shared roadways results in unsafe conditions at times. Incorporating bicycle safety content into the film provides an opportunity to present safety information in a medium that would likely be better received than that of a stand-alone safety message.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – The proposed film should be available as an online resource and opportunities should be identified to publicize links to the website. MassBike, other bicycle advocacy or safety organizations, and bicycle clubs could assist in disseminating information on the availability of this resource once it is developed and available.

Project 5.4.8: Enhance Bicycle Shuttling Opportunities

Project Description – As a result of the many gaps in the existing bicycle infrastructure on the Cape, there is a need for convenient and widely accessible bicycle shuttling between destinations. Currently there are a number of transit services on Cape Cod and most buses and transit vans are outfitted with bicycle racks that can accommodate up to two bicycles. Long headways, infrequent service, and occasionally heavy demand during peak season however can significantly reduce the utility of these transit services, especially when considering the need for a family or group of bicyclists to use shuttle services. Increased capacity and more frequent service, especially in the areas of greatest demand is needed.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – This project would assume that bicycle shuttling is limited to bus services. The Cape Cod Regional Transit Authority should work with localities and the National Park Service to identify destinations, routes, and service times that are in need of augmentation. Options for outfitting shuttle vehicles with increased bicycle capacity should be investigated.

Project 5.4.9: Utilize Utility Easements and Infrastructure projects to Establish Bicycle Routes and Corridors

Project Description – Use of utility rights of way and easements for bicycle routes and corridors has the potential to both increase the options for bicycle routes, while also reducing costs related to acquisition of right of way. Existing utility corridors are also already free of many of the physical barriers that can make difficult the development of a bicycle network. Such corridors are often already cleared and may also have some degree of access, often in the form of unpaved roads or trails that are used for utility maintenance. Use of theses corridors also have the benefit of providing bicycle facilities that are largely free of conflicting vehicle movements as occur at intersections with roadways and commercial entrances when a path is located beside a roadway. In some instances utility corridors are the only feasible connections between communities and existing or proposed bicycle facilities, such as the proposed route across Harwich. There are numerous examples of co-use of utility corridors for transmission and recreational use including several in Massachusetts. Many utility corridors are currently used informally for recreational activities, however in most cases they are private property owned by the respective utility company or utility easements on private property. Several factors need to be considered when evaluating co-use of these corridors including:

- Public exposure- State and federal laws govern the separation distance between people, equipment and some utilities especially electrical transmission lines.

Recreational use cannot create additional risk of damage to utility structures or transmission facilities. Activities cannot preclude future construction or expansion of the utilities within the right-of-way. Access to/from, and along the right-of-way for maintenance, emergency repairs or future expansion cannot be impeded by recreational use. Recreational use must include a management plan that addresses trash collection and prevention/repair of erosion. Additional impacts to sensitive environmental resources will be viewed as a negative.

Preliminary Design Concepts – NA

Cost Estimate – variable

Recommendations for Implementation – Use of utility corridors can require complex legal agreements. Additionally, in some instances the utility has an easement but does not own the right of way, requiring the involvement of multiple parties to include the actual land owner. Conservation easements should also be investigated to determine if these can be used to encourage dedication of right of way in the existing utility corridors, whether from the utility company or a third part landowner. Paved trails may enhance maintenance access in some corridors, thereby yielding a positive benefit to the utility company. The 48-mile W&OD Trail in northern Virginia is a prime example of a long-distance bike path that can be facilitated through the use of a utility corridor.

TABLE 3 - LIST OF MAPPED PROJECTS

Project	Project Description
5.2.1	Proposed shared-use path corridor for CCRT Extension to Provincetown
5.2.3	Setucket Road Path intersection improvements
5.2.5	Brackett Rd & Rte 6 sidewalks and improved crossings
5.2.6	Cape Cod Rail Trail extension to Independence Park
5.2.7	Cape Cod Rail Trail extension to Hyannis Transportation Center
5.2.8	Connect Old Colony Rail Trail and Old Queen Anne Road via Route 137
5.2.9	Old Colony Rail Trail extension from Volunteer Park and access to Schoolhouse Pond
5.2.10	Connect Shining Sea Bikeway to Gifford Street via on-road route
5.2.11	Extend Shining Sea Bikeway through Bourne to Cape Cod Canal Bikeway
5.2.13	Connect Cape Cod Canal Bikeway to Hyannis Transportation Center
5.2.14	Develop Plan for Intermodal Center in Falmouth
5.2.15	Improve Bicycle Facilities on Tupper Road South of Route 6A
5.3.2	Feasibility Study & Design of Bike Path along Route 6 from Herring Cove Parking to Race Point Road
5.3.3	Identify Possible Connections between the Cape Cod Rail Trail and National Seashore Trails
5.3.6	Identify a “Shore Route” South of Route 28 from Woods Hole in Falmouth to Stage Harbor in Chatham
5.3.7	Identify a “Bay Route” from the Cape Cod Canal in Bourne to Orleans
5.3.8	Relocation of Existing Rail Line and Conversion to Trail
5.3.9	Connect Harwich Port to Old Colony Rail Trail
5.3.10	Designate Route 28 as a Bike Route and Improve Conditions
5.3.12	Connect MacMillan Pier to National Seashore Bicycle Paths
5.3.13	Connect Province Lands Bicycle Trail and Head of the Meadow Trail
5.3.16	Connect Wellfleet Bay Wildlife Sanctuary to Cape Cod Rail Trail
5.3.17	Identify Potential Bikeway Alignment through Sandwich Historic District
5.3.18	Identify and Implement “OBHC Triangle” Route
5.3.19	Improve Bicycling Conditions on Route 130 in Sandwich
5.3.20	Improve Bicycling Conditions on Quaker Meeting House Road in Sandwich
5.3.21	Establish a Bicycle & Pedestrian Connection from Fort Hill Trails to Governor Prence Road

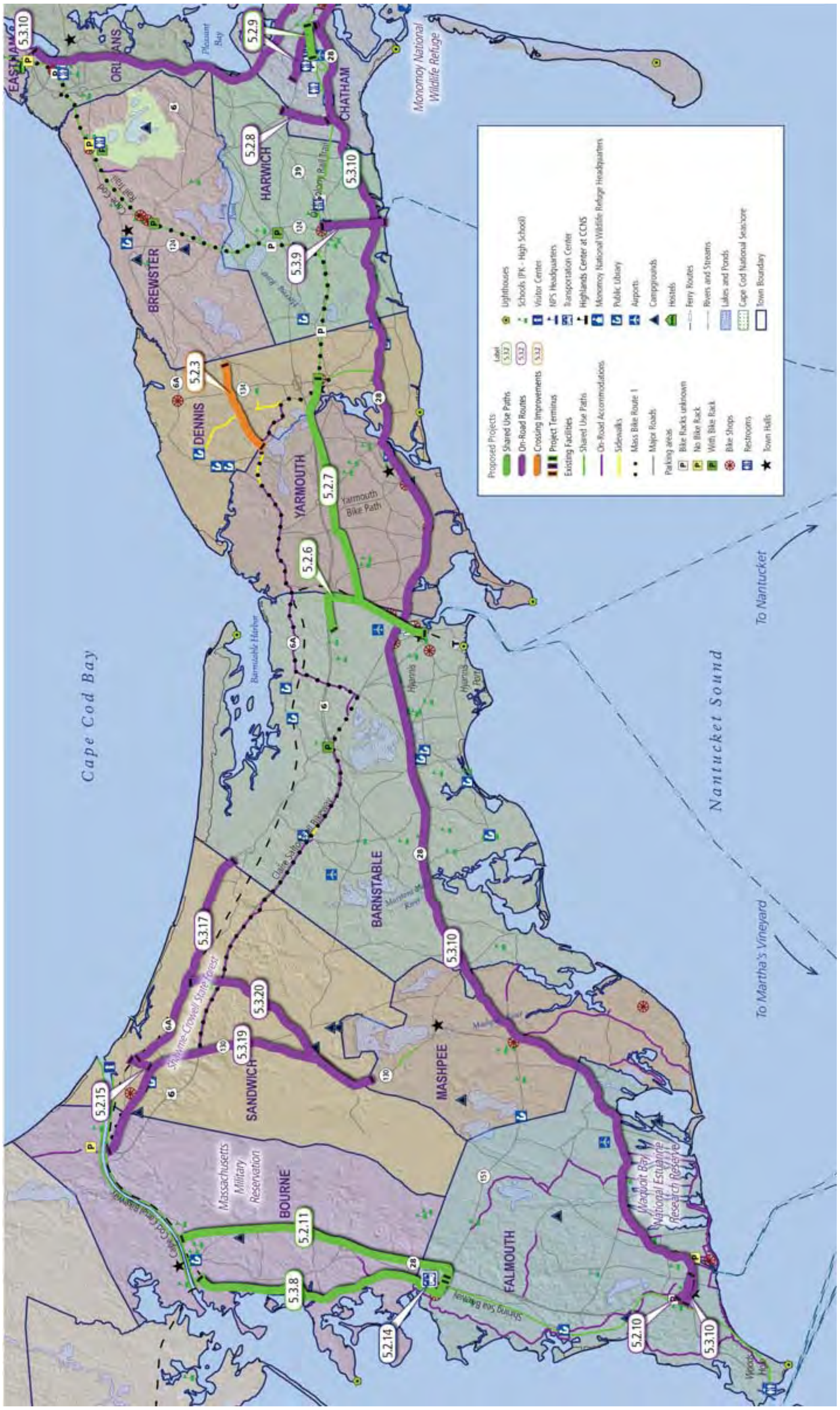

FIGURE 59 – CCNS UPPER/MID-CAPE MAPPED PROJECTS

FIGURE 60 - CCNS LOWER/OUTER-CAPE MAPPED PROJECTS

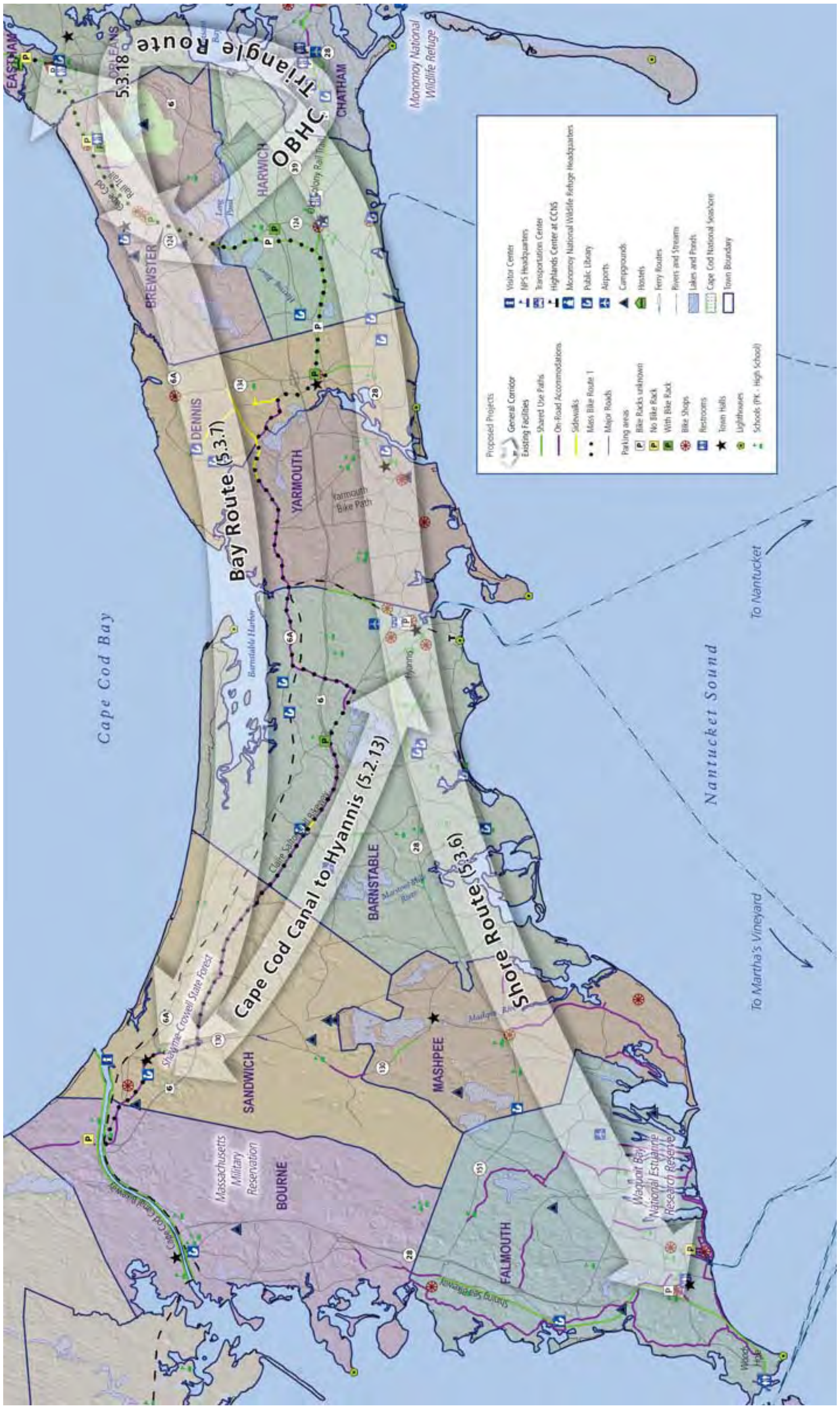

FIGURE 61 - CCNS UPPER/MID-CAPE PRIORITY CORRIDORS

FIGURE 62 – CCNS LOWER/OUTER-CAPE PRIORITY CORRIDORS

5.5 CONCLUSION

Bicycle and pedestrian transportation are non-motorized forms of transportation. The infrastructure for bicycles and pedestrians, such as bicycle paths, bicycle routes, and sidewalks, must follow federal, state, and local design standards in order to ensure safety and accessibility. There are 83.8 miles of bicycle paths on Cape Cod, and 333 miles of bicycle routes. Among these are the Cape Cod Rail Trail, Shining Sea Bike Path, and the Claire Saltonstall Bikeway. For all paved roads on Cape Cod, 8.5% have a sidewalk. Low volume roads can also be used by bicyclists and pedestrians. Beyond the actual infrastructure, amenities such as bicycle racks, benches, restrooms, showers, and lockers help to encourage bicycle and pedestrian use. By connecting and extending bicycle paths, ensuring proper safety and signage on bicycle routes, and providing travelers with the proper amenities, bicycle and pedestrian transportation will continue to play an important role in the Cape Cod transportation system.

CAPE COD COMMISSION

2012 REGIONAL TRANSPORTATION PLAN
Chapter 6: Congestion Management

Endorsed
August 22, 2011

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6. Congestion Management

Any urban area with a population over 200,000 is considered a Transportation Management Area, which subjects it to additional planning requirements under the Surface Transportation Program. The Cape Cod Region has been designated as a Transportation Management Area (TMA) based on the 2000 Census and is in a non-attainment area for air quality with excessive ozone levels. Under the federal statutes that define the MPO processes and requirements, these conditions make the establishment of a Congestion Management Program (CMP) a requirement of the Cape Cod Metropolitan Planning Organization (MPO).

6.1. CONGESTION MANAGEMENT PROGRAMS - BACKGROUND

Congestion Management Programs are intended to be a systematic way of:

- Monitoring, measuring, and diagnosing the causes of congestion on a region's multi-modal transportation system;
- Evaluating and recommending alternative strategies to manage or mitigate regional congestion; and
- Monitoring and evaluating the performance of strategies implemented to manage or mitigate congestion.

The CMP is also intended to be a planning tool to help reduce mobile source emissions and improve regional air quality. To support this planning tool, monitoring of transportation system performance is an ongoing activity for the Cape Cod region.

"Congestion" is defined as travel time or delay in excess of that normally incurred under light or free-flow travel conditions. There are two primary types identified for congestion and a successful congestion management program should address both types of congestion. The two types of congestion are:

1. Recurring congestion that tends to be concentrated into short time periods, such as "rush hours" and is caused from excessive traffic volumes resulting in reduced speed and flow rate within the system, and

2. Non-recurring congestion caused from unforeseen incidents (road accidents, spills, and stalls) which affect the driver behavior to a considerable extent.

Critical to the concept of congestion management is the understanding that the acceptable system performance may vary by type of transportation modes and systems, geographic location, season, and/or time of day. The CMP must reflect parameters that identify the degree to which travel time and/or delays are within locally acceptable standards of mobility to meet the needs of individual states or metropolitan areas.

Significant Legislative Elements:

The CMP shall be developed, established, and implemented as part of the metropolitan planning process in accordance with 23 CFR 450.320(c). The statute includes the following requirements:

1. Methods to monitor and evaluate the performance of the multimodal transportation system, identify the causes of congestion, identify and evaluate alternative actions, provide information supporting the implementation of actions, and evaluate the efficiency and effectiveness of implemented actions.

2. Definition of parameters for measuring the extent of congestion and for supporting the evaluation of the effectiveness of congestion-reduction and mobility-enhancement strategies for the movement of people and goods. Since levels of acceptable system performance may vary among local communities, performance measures and service thresholds should be tailored to the specific needs of the area and established cooperatively by the State, affected MPO(s), and local officials in consultation with the operators of major modes of transportation in the coverage area.

3. Establishment of a program for data collection and system performance monitoring to define the extent and duration of congestion, to help determine the causes of congestion, and to evaluate the efficiency and effectiveness of implemented actions. To the extent possible, existing data sources should be used, as well as appropriate application of the real-time system performance monitoring capabilities available through Intelligent Transportation Systems (ITS) technologies.

4. Identification and evaluation of the anticipated performance and expected benefits of appropriate traditional and nontraditional congestion management strategies that will contribute to the more efficient use of existing and future transportation systems based on the established performance measures. The following categories of strategies, or combinations of strategies, should be appropriately considered for each area:
    - Transportation demand management measures, including growth management and congestion pricing;
    - Traffic operational improvements;
    - Public transportation improvements;
    - ITS technologies; and,
    - Where necessary, additional system capacity.

5. Identification of an implementation schedule, implementation responsibilities, and possible funding sources for each strategy (or combination of strategies) proposed for implementation.

6. Implementation of a process for periodic assessment of the efficiency and effectiveness of implemented strategies, in terms of the area's established performance measures. The results of this evaluation shall be provided to decision makers to provide guidance on the selection of effective strategies for future implementation.

Air Quality Non-attainment Areas

In a Transportation Management Area (TMA), such as the Cape Cod region which is designated as being a non-attainment area for ozone, the federal statute also requires that the CMP perform an analysis of all reasonable travel demand reduction and operational management strategies for a corridor in which a proposed project will result in a significant increase in capacity for single-occupant vehicles (SOVs). This includes adding general purpose lanes to an existing highway or constructing a new highway and should consider multimodal strategies. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully satisfy the need for additional capacity in the corridor and additional SOV capacity is warranted, then the CMP shall identify all reasonable strategies to manage the SOV facility effectively, or to facilitate its management in the future.

Other travel demand reduction and operational management strategies appropriate for the corridor, but not appropriate for incorporation into the SOV facility itself shall also be identified through the CMP. All identified reasonable travel demand reduction and operational management strategies shall be incorporated into the SOV project or committed to by the State and MPO for implementation.

6.2. SYSTEM MONITORING AND DATA COLLECTION

A number of tasks are being performed annually to monitor traffic on Cape Cod.

The data collected in the monitoring process will be continually compared to the measures developed to define congestion. The comparison will be used to identify congested areas and trigger an investigation into the nature of the demand problems. These demand issues are expected to include regional traffic flows, local traffic generators, geometric problems, and access problems.

The following programs are currently underway and will continue. These existing programs are anticipated to provide the bulk of the data for the CMP.

Traffic Counting Program

The Cape Cod Commission, funded by MassDOT, has been collecting traffic data since 1984. This data includes traffic volumes on key roadway segments around Cape Cod and turning movement counts collected at key intersections. The traffic counting program is established in a systematic way to provide historic data at key locations as resources allow. Counts are also made to support traffic studies and, in areas of concern, to identify congested situations. Development of the annual traffic counting program is done in consultation with the Cape Cod Joint Transportation Committee. The principal product of this effort is the annual traffic counting report.

The traffic counting program will continue to provide data for the CMP. Examination of changes in traffic volume will be done and trends will guide further investigation of traffic problems as part of the CMP. As the traffic counting program is defined each spring, counts to investigate suspected or identified congestion areas will be included. In addition, counts will be programmed to monitor congestion in areas where CMP initiatives are in place.

Travel Time Analysis

Travel time has been monitored on a limited basis. Recently, GPS technology has made developing and recording travel time studies easier. Opportunities to use data provided by the automatic vehicle locators on all CCRTA vehicles is currently being explored. It is expected that this data will be useful in identifying congested areas and congested travel time periods on many of the Cape's major traffic corridors. The Cape Cod Commission is developing this procedure along with Bridgewater State College's GeoGraphics Lab and the CCRTA. Seasonal and weather related traffic trends are to be identified with this data and potentially develop strategies to address them. Additional GPS travel time studies will be recommended to support the CMP investigations especially in identifying problem areas within a corridor.

Park-and-Ride Usage

Park and Ride lot counts are conducted routinely at the three MHD lots in the Cape Cod region and occupancy developed in terms of capacity. A detailed study was performed to determine use of the two primary lots in Barnstable and Sagamore including determining overnight use and use by the day of week and time of year. The use and occupancy of the Cape's park-and-ride lots will continue to be monitored.

Transit Usage

Ridership data is collected routinely by the mobile data computers linked to the fare boxes on the entire fixed route CCRTA system. The ridership on the demand response services (B-Bus) is also recorded by the CCRTA. This data has not been studied by the Cape Cod Commission and development of detailed transit use and patterns of travel will be incorporated into the CMP.

6.3. CRITERIA FOR MEASURING CONGESTION

Criteria, measures of congestion, and the CMP are currently under development and these must be designed to respect the Regional Transportation Plan (RTP) goals and the philosophy designed to preserve the valued aspects of Cape Cod. This will likely make the standards adopted in many other regions unacceptable for Cape Cod.

Cape Cod is a unique place with extreme fluctuations in traffic over the course of a year due to the recreational nature of the region. The sensitive ecologic and aesthetic nature of the region have long been cherished and this has been reflected in the goals developed for the RTP.

The philosophy of the Cape Cod RTP is not to build to accommodate the peak season demand but to provide adequate transportation for year-round travel and to provide and promote alternatives to the automobile. This philosophy is different from the majority of the regions in Massachusetts and across the nation. The philosophy of the Plan places much more emphasis on management of traffic and providing alternatives to the automobile for transportation rather than accommodating traffic demand.

The development of congestion criteria will be done initially as a separate exercise along with a public process to develop measures consistent with the philosophies in the RTP. The measures will be included in the RTP to allow review of these measures and potential updates on a periodic basis in conjunction with the review of the RTP goals and objectives.

Measures of seasonal as well as year round congestion need to be developed through the traffic counting program in addition to monitoring of the travel times as well as transit usage. Development of relative conditions and trends between seasonal demand and winter demand periods must also occur to help determine appropriate strategies for addressing congestion

Develop Measures of Roadway Congestion

Thresholds for determining acceptable levels of service will be proposed on the basis of volume to capacity ratios and reviewed in terms of defining the extent of congestion or to what extent these levels of service are exceeded on the Cape. Additional measures of congestion are to be defined in terms of delay. Travel time analysis and intersection studies will be used to identify the locations and corridors that exceed these thresholds.

In addition to the levels of traffic, measures of scenic and ecologic value will be included in the criteria for defining congestion. These criteria will help guide the solutions proposed to resolve identified congestion.

Develop Measures of Public Transportation Congestion

Public transportation is becoming increasingly important for Cape Cod. More than half (51 percent) of Cape households are considered “low income” according to the *Barnstable County Affordable Housing Needs Analysis* (Barnstable County Human Services Department, 1999) and alternatives to owning cars is becoming more important. The percentage of the population over 65 was 23.1% in the 2000 census and this segment of the population is growing. Many elders have difficulty driving and are becoming reliant on alternative forms of transportation.

Development of measures of congestion and effectiveness for various modes of public transportation on Cape Cod and related solutions to identified problems must be consistent with the goals (shown in the following table) developed by the Cape Cod Transit Task Force in the 5-Year Plan for public Transportation developed in 2002.

TABLE 1 - CAPE COD TRANSIT TASK FORCE GOALS

Goal	Description
1.	Reduce automobile dependency by providing mobility options.
2.	Mitigate seasonal traffic by promoting travel to the region without cars, and by providing seasonal public transportation options.
3.	Meet the needs of the year-round population for public transportation, especially the needs of those who are "transit dependant" and in need of human services.
4.	Develop coordination, communication, and cooperation between regional public transportation providers.
5.	Incorporate smart growth and land use planning decisions into the development of public transportation.

6.4. ANALYSIS

The data collected in the monitoring process will be continually compared to the measures developed to define congestion. The comparison will be used to identify congested areas and trigger an investigation into the nature of the demand problems.

These demand issues are expected to include regional traffic flows, local traffic generators, geometric problems, and access problems. The annual traffic studies pursued by the Cape Cod MPO staff will be guided by the CMP and target areas for further study.

- Identify Areas of Roadway Congestion
- Identify Areas of Transit Congestion

To further facilitate public comment, a five-page RTP questionnaire was distributed at public meetings. The questionnaire was also announced in the Cape Cod Commission *Reporter* newsletter, and on the Cape Cod Commission Transportation Information Center included an on-line option for respondents to use at this address:

www.gocapecod.org/rtp

The questionnaire included questions on goals and priorities, identification of local and regional safety problems, and regional congestion problems. There were also a number of example projects for respondents to indicate their support (or opposition).

Twenty-eight comment forms were submitted electronically or collected at public meetings. One of the most valuable benefits of this input was the generation of potential solutions. These are discussed at length in a later chapter of the RTP (Analysis of Alternatives). The questionnaire was also used to gauge respondents' views regarding congestion. When considering the region as a whole, common congestion themes emerged including locations such as:

- Cape Cod Canal Bridges
- Yarmouth Road/Willow Street in Barnstable
- Route 28 from Falmouth to Yarmouth, especially in the Hyannis area.

The respondents were also asked to "*...list the top three areas that have the worst LOCAL TRAFFIC DELAY problems*" for the town that they resided in or spent the most time in. The following table presents a list of the top two locations identified from the questionnaire:

TABLE 2 - RTP LOCAL TRAFFIC DELAY AREAS (FROM PUBLIC COMMENT FORM)
(Responses as of 8/23/2010)

Town	Location #1	Location #2
Barnstable	Route 132 signals	Yarmouth Road/Willow Street
Bourne	Bourne Rotary	Sandwich Road
Eastham	Route 6 southbound to Eastham Rotary	Route 6 northbound @ Wellfleet town line
Falmouth	Teaticket Highway (Route 28)	Route 28 @ Jones Road/Ter Heun Drive
Harwich	Main Street (Route 39) @ Route 124	Route 6 Exit 11 off ramp
Mashpee	Mashpee Rotary	Route 151 @ Old Barnstable Road
Orleans	Route 6A @ Main Street	Main Street @ Old Colony Way
Truro	Left turns onto Route 6	
Yarmouth	Route 28 in West Yarmouth	Route 28 @ Station Avenue

6.5. DEVELOP STRATEGIES TO ADDRESS IDENTIFIED PROBLEMS

The following subsections include descriptions of the process to be used to produce CMP strategies.

6.5.1. RECOMMENDATIONS

The results of the CMP will include the generation of studies to address issues that exceed the criteria developed to define transportation congestion for the region. These studies will produce recommendations that will be included in the RTP and TIP processes to be considered for construction or implementation.

Proposed Products

Develop CMP projects from the CMP Study recommendations and include them in the evaluation process for the region's RTP and TIP.

6.5.2. RECOMMENDATIONS FOR LOCATION SPECIFIC ACTIONS/STUDIES

Recommendations to the MPO to address issues that exceed the criteria developed to define transportation congestion for the region will generally come from studies conducted by the Cape Cod Commission transportation staff. Recommendations may also be developed by the towns and the CCRTA. All recommended projects and strategies will be evaluated by the Commission and the Cape Cod Joint Transportation Committee using the MassDOT evaluation criteria and with the RTP goals. Based on these evaluations, the CMP projects will be considered by the MPO for inclusion in the RTP and compete for funding within the TIP.

6.5.3. RECOMMENDATIONS FOR REGIONAL ACTIONS/STUDIES

Some congestion problems will need to be addressed on a corridor-wide or system basis or require significant investments. Studies or remedial actions will be recommended to the MPO for their consideration and potential inclusion in the TIP or the UPWP. Projects with regional significance may become an initiative of the Statewide Transportation Program. These proposed projects may require a more extensive evaluation with regard to conformity with the Massachusetts State Implementation Plan (SIP). These projects may also become Transportation Control Measures (TCMs) and included as such in the SIP submitted to EPA.

6.6. CONGESTION MANAGEMENT REPORTING

The CMP is an ongoing program that documents the region's mobility concerns. The CMP contains the most recent performance monitoring information for the regional transportation system. The information and general analysis of the system, using the criteria defined in the CMP and RTP processes, will provide the basis for the Cape Cod Commission Transportation staff and the Cape Cod Joint Transportation Committee to make recommendations. These recommendations will be made to the Cape Cod MPO as congestion reducing and mobility enhancing actions to be considered in the MPO planning and programming processes. The main means of providing congestions information is via the Cape Cod Commission's Transportation Information Center on the internet:

www.gocapecod.org/congestion

The following figure is a screen capture of the main Congestion Management webpage on the website. Users have access to traffic cameras, speed maps, automated bus locators, trip planners and a number of other tools to identify and avoid congestion.

FIGURE 1 – CONGESTION MANAGEMENT WEBSITE MAIN PAGE

6.7. SUMMARY OF 2009 TRAFFIC COUNTING ACTIVITIES

The traffic counting program is the base data source for developing trends in traffic growth and potential for growth in traffic congestion. The following information is from the *Cape Cod 2009 Traffic Counting Report* published in December 2009. The full report and access to mapped traffic counts are available at:

www.gocapecod.org/counts

According to Cape Cod Commission and MassDOT traffic counting data, Cape-wide traffic increased 4.51% from 2008 to 2009.

The information presented in the following tables and figures includes calculated traffic growth rates for sub-regions and major roads in Barnstable County.

TABLE 3 - CAPE COD SUMMER TRAFFIC GROWTH: 1999-2009

Region	Number of Comparisons	10 Year Total Growth	10 Year Average Annual Growth Rate
Upper Cape	112	-5.99%	-0.62%
Mid-Cape	86	-10.35%	-1.09%
Lower Cape	76	-11.87%	-1.26%
Outer Cape	56	-13.74%	-1.47%
All Roads	**330**	**-9.05%**	**-0.95%**

"Upper" = Bourne, Sandwich, Falmouth, Mashpee "Lower" = Harwich, Chatham, Brewster, Orleans

"Mid" = Barnstable, Yarmouth, Dennis "Outer" = Eastham, Wellfleet, Truro, Provincetown

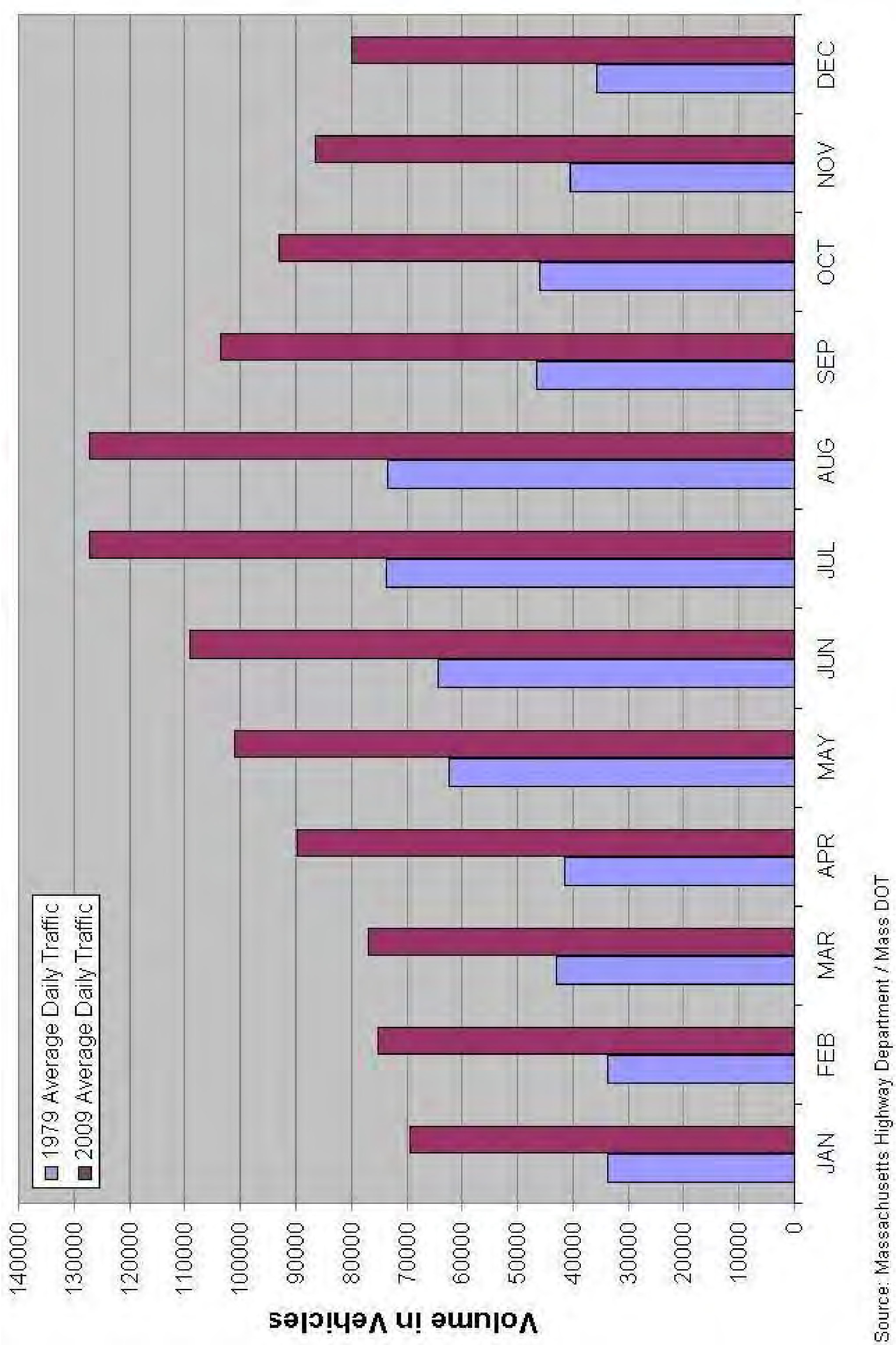

FIGURE 2 - 30 YEAR COMPARISON OF CAPE COD CANAL BRIDGE VOLUMES

6.8. EXISTING CONGESTION INDICATORS

The Cape Cod Center for Sustainability in their *Cod Sustainability Indicators Report* has developed a number of factors that bring together social, economic, and environmental indicators to be tracked over time. While no single indicator is able to give the entire picture, tracking representative indicators in many areas provides an overall sense of trends and of the Cape's progress toward becoming a sustainable region. This report has developed the following indicators for traffic and transit.

6.8.1. TRAFFIC

The Cape Cod Center for Sustainability traffic congestion indicator is based on average annual daily bridge crossings over the Sagamore and Bourne bridges for and data is available over the past 32 years. While there are many possible indicators of congestion, the bridge traffic is easy to measure, provides data on long-term trends, and has significant implications for traffic Cape wide, as many who bring their cars across the bridge use them for virtually all local or regional trips.

Bridge crossings have been rising steadily for most of the past 32 years. Starting in 1972 with 41,513 daily bridge crossings, the figures had more than doubled to 93,648 by 1998. There was a gradual increase in crossings between 1972 and 1979. At the beginning of the 1980s, the numbers continued to rise, with the most dramatic increase of 10% occurring between 1983 and 1984. Overall, there was an increase of 60% in bridge crossings from 1980 to 1990. The annual rate of increase has ranged from 0.5% to 4% during the 1990s. There are no signs indicating that these numbers will decrease in the future. The graph in the previous figure shows a 30 year comparison of monthly combined average daily traffic from 1979 and 2009.

6.8.2. GAS PRICES

Gas prices have varied significantly and affect the use of the automobile and transit. The following Massachusetts retail price/gallon data (as of November 2009) is from www.gasbuddy.com.

FIGURE 3 - HISTORIC GAS PRICES

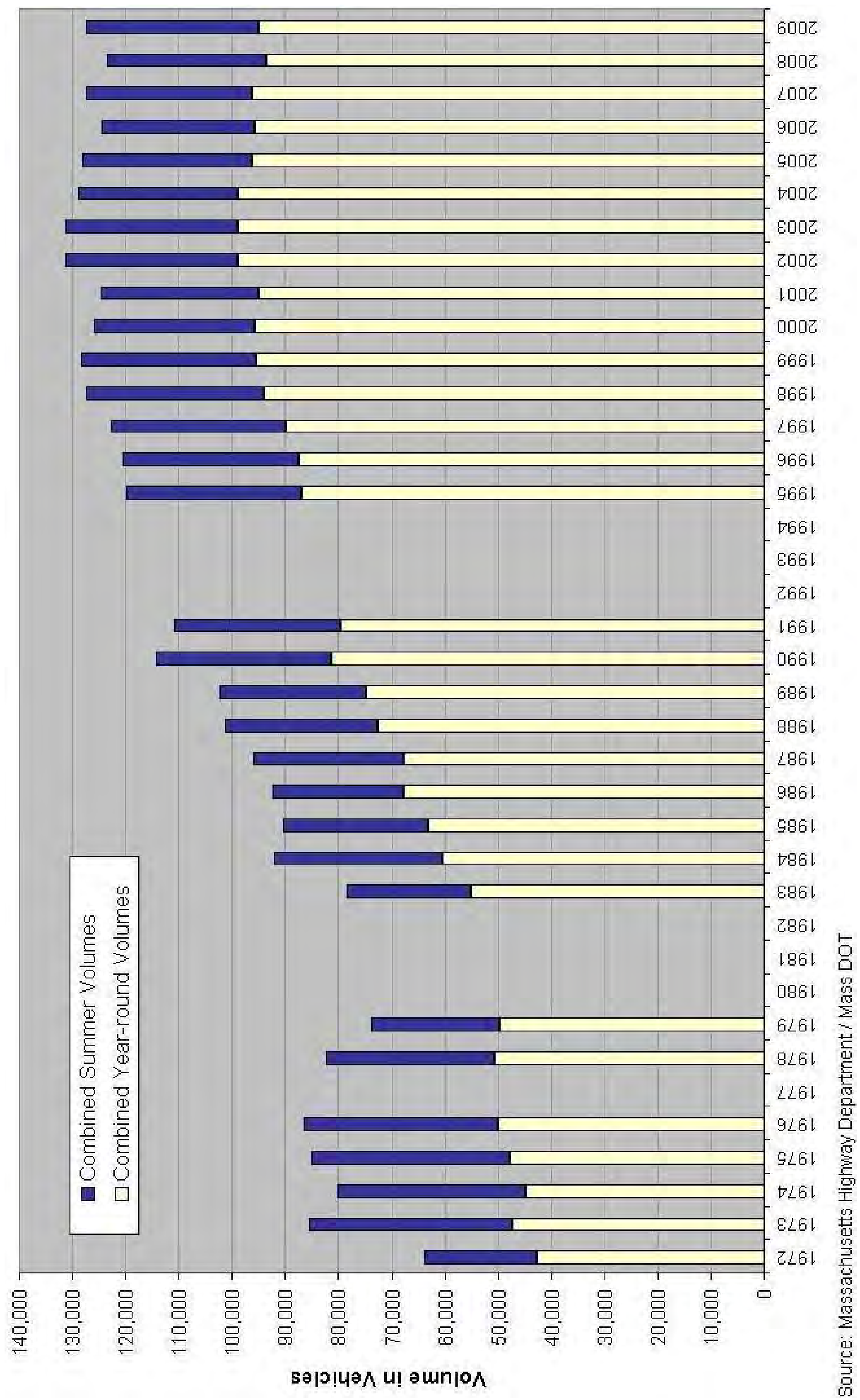

FIGURE 4 - ANNUAL AVERAGE DAILY TRAFFIC: CANAL BRIDGES

6.8.3. VOLUME TO CAPACITY RATIO OF CAPE COD ROADS

The following figures present Level of Service information for many Cape Cod locations based on the volume to capacity ratio. The thresholds for these ratios are shown in the following table:

Symbol	V/C Ratio Threshold	Level of Service (LOS)
● (green)	0.8	C or Better
● (yellow)	0.9	D
● (orange)	1.0	E
● (red)	>1.0	F

The Level of Service (LOS) calculations are performed for locations where the CCC has collected summer traffic counting data. The traffic volumes used represent a consistent summer weekday 4-5 p.m. peak hour. Roadway capacities were extracted from the Cape Cod travel demand forecasting model and originated from the Office of Transportation Planning at MassDOT.

Roadway LOS only shows part of the congestion picture. In many cases traffic congestion bottlenecks occur at intersections. Intersection analyses are more complicated and performed on a case-by-case basis. Such locations are often identified through public input and consultations with local traffic officials such as CCJTC members.

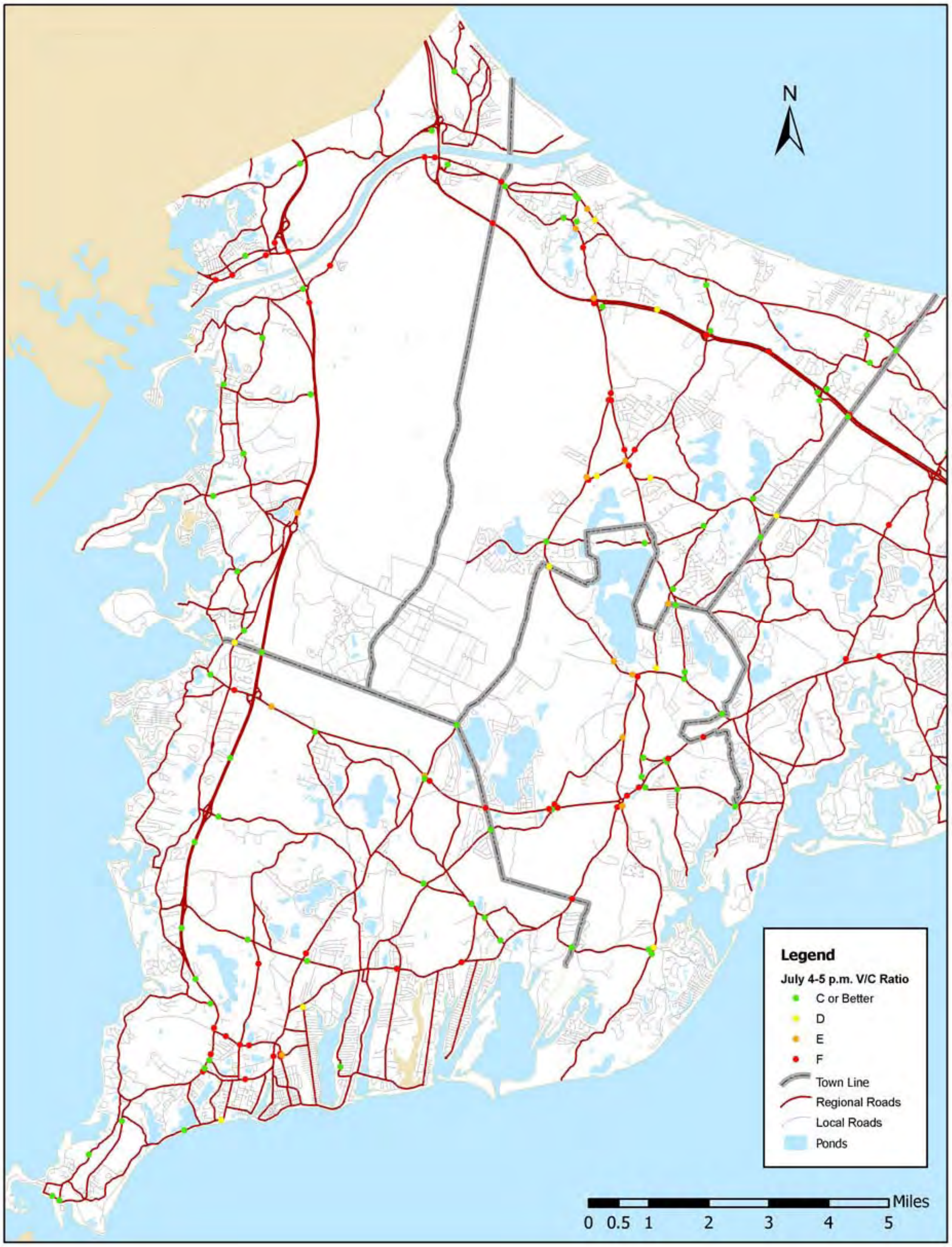

FIGURE 5 - UPPER CAPE COD V/C RATIOS

FIGURE 6 - MID-CAPE COD V/C RATIOS

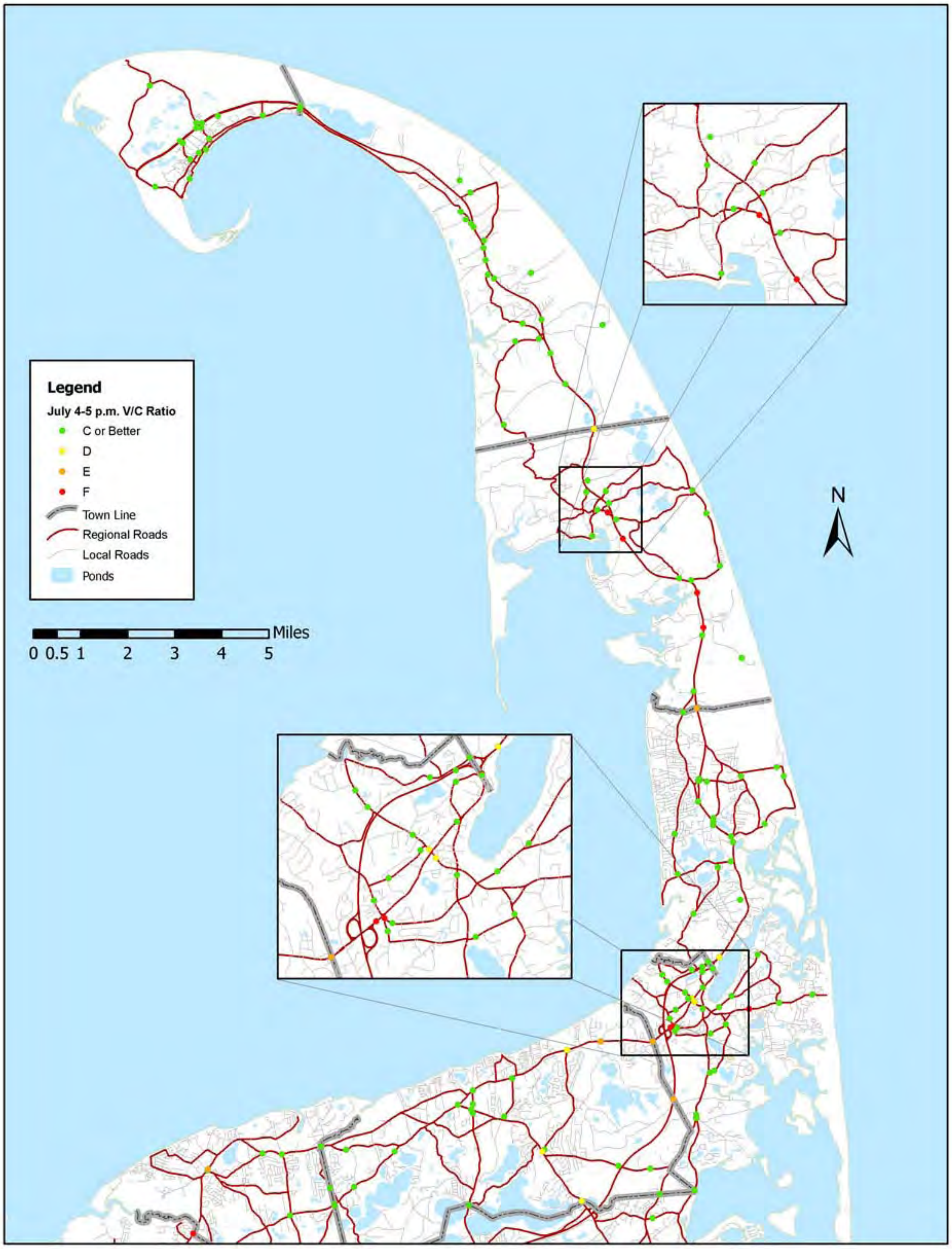

FIGURE 7 - OUTER CAPE COD V/C RATIOS

6.8.4. TRAVEL TIME CORRIDORS

The following figure shows travel time information on selected major corridors on Cape Cod (e.g., Route 28, Route 6A, and Route 6 in the Outer Cape). The CCC has collected speed data on the color-coded segments. The above graphic shows the observed speed divided by the speed limit of each road segment. (Observed speeds were collected at various times of the day during summer weekdays). Road segments color coded green include a ratio of 1.0 – this represents travel speeds matching the speed limit. Heavily congested roadways are represented in red (speed/speed limit ranges from 0.11-0.50).

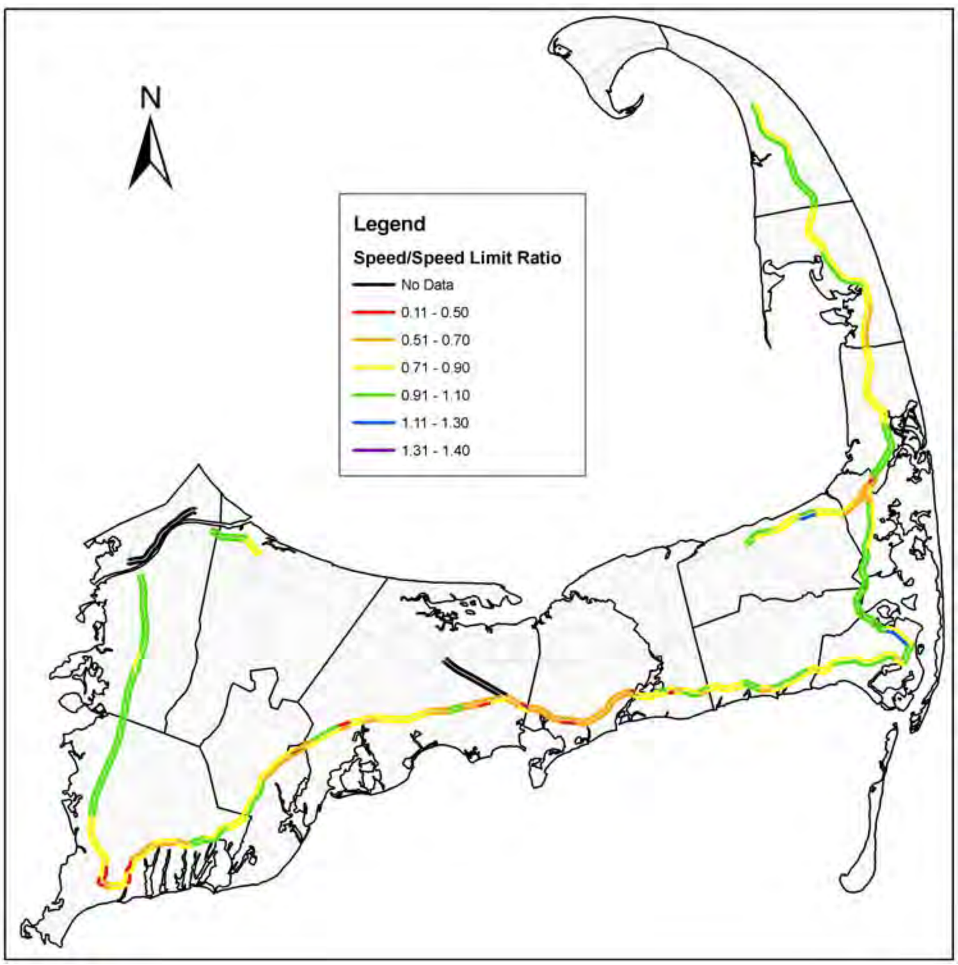

FIGURE 8 - RATIO OF SPEED/SPEED LIMIT ON SELECTED CAPE COD ROADS

6.8.5. TRANSIT GROWTH

The indicator used by the Cape Cod Center for Sustainability to monitor transit, measures the total number of riders using public transit annually. This indicator measures local and regional (on-Cape) ridership on public transit systems, but does not measure the ridership on private carriers or commuters to Boston.

This measure of annual ridership documents one aspect of the alternatives to the automobile. The Outer Cape *Flex* service was introduced on June 1, 2006 and was more successful than anticipated and will be monitored for trends in future years.

<u>System-wide Ridership</u>

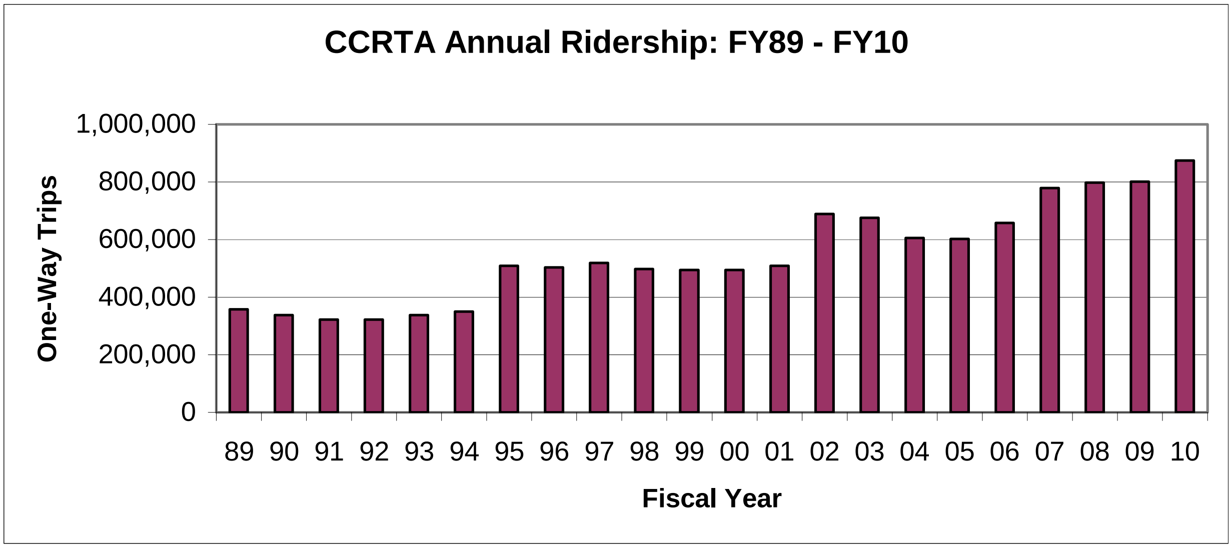

FIGURE 9 - CAPE COD RTA RIDERSHIP
Source: Cape Cod Regional Transit Authority

FY 2010 ridership increased 8.7% from 2009 following a more modest increase of 0.3 % for the year before. Growth has varied but continued a positive trend since 2006. The Cape Cod Regional Transit Authority (CCRTA) has implemented a major new service in May 2006 (The *Flex*) on the Outer Cape that has increased their annual ridership significantly.

For reference, the following table from the 2000 Census show the numbers of reported commuters from other Counties to employment in Barnstable County.

TABLE 4 - JOURNEY TO WORK ORIGINS & DESTINATIONS

Residence County to Workplace County Flows for Massachusetts Sorted by Workplace State and County

Res State	Res County	Res (C)MSA	Res PMSA	Residence State-County Name	Work State	Work County	Work (C)MSA	Work PMSA	Workplace State-County Name	Count
25	001	*	*	Barnstable Co. MA	025	001	*	*	Barnstable Co. MA	84,704
25	005	*	*	Bristol Co. MA	025	001	*	*	Barnstable Co. MA	1,390
25	007	9999	9999	Dukes Co. MA	025	001	*	*	Barnstable Co. MA	43
25	009	*	*	Essex Co. MA	025	001	*	*	Barnstable Co. MA	90
25	011	*	*	Franklin Co. MA	025	001	*	*	Barnstable Co. MA	16
25	013	*	*	Hampden Co. MA	025	001	*	*	Barnstable Co. MA	55
25	015	*	*	Hampshire Co. MA	025	001	*	*	Barnstable Co. MA	12
25	017	*	*	Middlesex Co. MA	025	001	*	*	Barnstable Co. MA	325
25	019	9999	9999	Nantucket Co. MA	025	001	*	*	Barnstable Co. MA	8
25	021	*	*	Norfolk Co. MA	025	001	*	*	Barnstable Co. MA	355
25	023	*	*	Plymouth Co. MA	025	001	*	*	Barnstable Co. MA	4,371
25	025	1122	1120	Suffolk Co. MA	025	001	*	*	Barnstable Co. MA	237
25	027	*	*	Worcester Co. MA	025	001	*	*	Barnstable Co. MA	82
26	125	2162	2160	Oakland Co. MI	025	001	*	*	Barnstable Co. MA	6
44	001	6480	9999	Bristol Co. RI	025	001	*	*	Barnstable Co. MA	50
44	003	6480	9999	Kent Co. RI	025	001	*	*	Barnstable Co. MA	38
44	005	*	*	Newport Co. RI	025	001	*	*	Barnstable Co. MA	32
44	007	6480	9999	Providence Co. RI	025	001	*	*	Barnstable Co. MA	159

CAPE COD
COMMISSION

2012 REGIONAL TRANSPORTATION PLAN

Chapter 7: Analysis of Alternatives

Endorsed
August 22, 2011

COUNTY OF BARNSTABLE
MASSACHUSETTS

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7. Analysis of Alternatives

In the previous chapters of the Regional Transportation Plan (RTP), many existing and potential future problems have been identified, as well as potential solutions. Specifically, detailed information on many of the safety improvements is available in Chapter 3 (Safety). Detailed information on many of the bicycle/pedestrian alternatives is available in Chapter 5 (Cape Cod Bike Plan). This chapter includes information on the many potential solutions, analysis methods used, and descriptions of alternatives. Summaries of recent CCC transportation planning efforts and additional regional efforts are included in this chapter. The results of these analyses are used in the financially-constrained prioritization listing in the following chapter – Chapter 8 (Financial Plan and Recommended Projects).

7.1 TYPES OF TRANSPORTATION ALTERNATIVES

For purposes of organization, each alternative has been placed in one of four categories:

- Transportation Programs
- Transportation Projects
- Smart Solutions
- Transportation Studies

These categories are described in detail in the following sections. The final section on this chapter includes a detailed summary analysis of each alternative.

7.1.1 TRANSPORTATION PROGRAMS

The RTP, as a long-range transportation planning document, covers a time-span beyond our ability to define every specific project to be implemented up to the year 2035. It is therefore important to reserve resources (funds) over the life of the plan for specific transportation categories that support the RTP goals. The following "Programs" are examples proposed to meet the requirements of the RTP goals:

- Roadway resurfacing
- Bridge replacement/reconstruction
- Transit operating assistance & capital needs
- Intersection improvements
- Bicycle/pedestrian projects
- Regional bike network
- Intelligent Transportation Systems
- Land conservation

A full listing of all Programs is available in the section at the end of this chapter.

7.1.2 TRANSPORTATION PROJECTS

The second, and most specific category of transportation alternatives, is the listing of transportation "projects." Examples that fall into the "projects" category include:

- Signalization of a specific intersection
- Construction of additional travel lanes along a specific road segment
- Operation of new transit service in a specific area
- New bicycle path construction between specific end points

Specific projects are individually discussed in the listing at the end of this chapter.

7.1.3 "SMART" SOLUTIONS

This category of alternatives includes solutions that do not require major investments in capital or operations. These are called "Smart" Solutions because they do require thoughtful promotion and coordination of transportation services that for the most part already exist. The following are examples of Smart Solutions:

- Encourage people to take the ferry from New Bedford instead of Woods Hole to Martha's Vineyard to reduce vehicle congestion over the canal bridges.
- Coordinate Cape Cod RTA and Ferry Schedules with each other
- Develop, Sign, and Publish a Cape-wide Bicycle Route System

Smart Solutions are fully listed at the end of this chapter.

7.1.4 TRANSPORTATION STUDIES

This fourth and final category of alternatives encompasses ideas that have not been fully realized. From the public participation process, there have been many occasions on which a clear course of action is not revealed. In these cases, there may be many conflicting (and potentially infeasible) "solutions" proposed. Perhaps the only consensus is that there is in fact a problem worthy of further review. Therefore, this final category forms the basis for future planning efforts. These Transportation Studies provide the vehicle for generating programs, projects, and smart solutions. Examples of Transportation Studies may include the following types of activities:

- Analyze the need for improvements of highway crossings of the Cape Cod Canal.
- Analyze the safety impacts of changes to the Route 3 approach to the Sagamore Bridge.
- Analyze usage patterns and survey passengers for suggested improvements to the Outer Cape *Flex* service.

Transportation Studies are individually discussed in the section at the end of this chapter.

7.2 POPULATION AND EMPLOYMENT GROWTH

The Massachusetts Department of Transportation (MassDOT) has consulted with Cape Cod Commission staff on the potential growth of Barnstable County.

MASS DOT 2035 MUNICIPAL PROJECTION METHODS

MassDOT's projections pivot around trends established in the existing municipal demographic projections done by the RPA's in collaboration with MassDOT. Resulting from both RPA staff comments and newly available information, the following major changes have been made to MassDOT's original draft population and employment projections (February 2010):

Statewide and regional totals adjusted to latest available 2010 estimates.

2009 U.S. Census population estimates by municipality, as well as 2009 DET municipal employment figures (and 2010 state unemployment rates), were not yet available during development of the original forecasts. These new estimates have provided a better gauge of regional population growth, and a more accurate accounting of how the current recession has affected total employment. Many of these changes have been carried through to future forecast years (due to starting with a significantly larger or smaller base in 2010). 2010 Census results became available in time for inclusion in this RTP and are reflected in the tables listed in this section.

Improved relationships between labor force size, participation rates, jobs, and unemployment rates.

The revised 2020 estimates for total employment are now more consistent with the projected size of the available labor force. Although all regions are expected to add jobs this decade, 2020 unemployment rates will still be slightly higher than the pre-recession levels due to the growth of the labor force (many economists predict that unemployment rates will remain high for several years – or more). Massachusetts state unemployment rates assumed for these forecasts are as follows:

2010 (actual)	2017	2020	2025	2030	2035
9.2%	7.9%	6.7%	5.8%	5.3%	5.0%

By 2020, all regions are forecast to at least return to their 2000 employment level, with some experiencing further growth over and above those levels. While in general, a quicker recovery from the recession is now forecast, the job growth from 2020 to 2035 will be at a significantly slower pace.

Adjustments to regional shares and ratios.

Each region's shares of population and employment compared to statewide totals have been smoothed across forecast years to eliminate unlikely spikes or dips from (forecast) year to year. Similarly, the employment-to-population ratios are now slightly more consistent across historical and forecast years, with 2010 being treated as a dip (fewer jobs per person) due to the lingering recession

Based on the methods outlined above, the following table presents the estimated increases in population and employment in Barnstable County as well as the Commonwealth.

TABLE 1 - ESTIMATED EMPLOYMENT, POPULATION & HOUSEHOLDS

	2010	2017	2020	2025	2030	2035
Cape Cod						
Employment	88,900	94,000	98,000	100,000	102,000	104,000
Population	215,888	230,000	236,000	245,010	256,000	266,000
Households	95,755	103,000	106,000	112,000	117,000	122,000
Massachusetts						
Employment	3,111,600	3,258,900	3,331,500	3,362,400	3,395,400	3,418,800
Population	6,547,629	6,762,900	6,840,800	6,980,900	7,131,600	7,282,100
Households	2,547,075	2,704,000	2,751,100	2,832,600	2,912,700	2,980,500

Source: Massachusetts Department of Transportation

Distribution of Forecasts by Municipality

Using anticipated remaining growth in employment, population, and households from a 2000 EOEA build-out study as a guide for distribution, the MassDOT County totals were distributed on a town-by-town basis for the year 2035. Town numbers for intervening years were developed through interpolation and factoring to meet the MassDOT control totals for each year.

The following three tables include breakdowns for population and employment for each of the Cape's fifteen towns.

TABLE 2 - POPULATION FORECASTS BY TOWN

	POPULATION					
Town	**2010**	**2017**	**2020**	**2025**	**2030**	**2035**
Barnstable	45,193	47,840	48,970	50,640	52,720	54,600
Bourne	19,754	20,940	21,440	22,190	23,110	23,950
Brewster	9,820	10,820	11,240	11,900	12,660	13,370
Chatham	6,125	6,570	6,770	7,050	7,400	7,720
Dennis	14,207	14,720	14,930	15,230	15,650	16,010
Eastham	4,956	5,200	5,300	5,450	5,650	5,820
Falmouth	31,531	33,730	34,660	36,080	37,780	39,340
Harwich	12,243	13,270	13,700	14,370	15,150	15,880
Mashpee	14,006	15,560	16,220	17,250	18,420	19,520
Orleans	5,890	6,240	6,390	6,610	6,890	7,140
Provincetown	2,942	3,240	3,370	3,570	3,800	4,010
Sandwich	20,675	21,630	22,040	22,620	23,390	24,060
Truro	2,003	2,390	2,560	2,830	3,120	3,400
Wellfleet	2,750	3,230	3,430	3,760	4,110	4,450
Yarmouth	23,793	24,620	24,980	25,460	26,150	26,730
Grand Total	**215,888**	**230,000**	**236,000**	**245,010**	**256,000**	**266,000**

Source: Massachusetts Department of Transportation

TABLE 3 - EMPLOYMENT FORECASTS BY TOWN

	EMPLOYMENT					
Town	**2010**	**2017**	**2020**	**2025**	**2030**	**2035**
Barnstable	26,090	26,940	27,830	27,960	28,110	28,260
Bourne	7,300	8,800	9,620	10,550	11,460	12,360
Brewster	2,640	2,790	2,900	2,960	3,010	3,070
Chatham	2,920	3,000	3,080	3,090	3,090	3,090
Dennis	4,580	4,930	5,180	5,340	5,510	5,670
Eastham	1,160	1,220	1,270	1,290	1,320	1,340
Falmouth	14,250	14,690	15,160	15,220	15,280	15,350
Harwich	3,680	3,950	4,140	4,270	4,390	4,510
Mashpee	4,590	5,050	5,350	5,590	5,830	6,060
Orleans	4,070	4,250	4,410	4,470	4,520	4,580
Provincetown	2,420	2,440	2,500	2,470	2,440	2,420
Sandwich	5,090	5,280	5,460	5,500	5,540	5,580
Truro	540	600	630	660	690	720
Wellfleet	1,070	1,220	1,320	1,400	1,490	1,580
Yarmouth	8,500	8,840	9,150	9,230	9,320	9,410
Grand Total	**88,900**	**94,000**	**98,000**	**100,000**	**102,000**	**104,000**

Source: Massachusetts Department of Transportation

TABLE 4 - HOUSEHOLD FORECASTS BY TOWN

	Households					
Town	**2010**	**2017**	**2020**	**2025**	**2030**	**2035**
Barnstable	19,225	20,510	21,040	22,120	23,000	23,890
Bourne	7,866	8,470	8,720	9,220	9,630	10,050
Brewster	4,383	5,020	5,280	5,770	6,220	6,660
Chatham	3,085	3,320	3,420	3,610	3,770	3,930
Dennis	6,928	7,020	7,060	7,180	7,240	7,300
Eastham	2,388	2,480	2,510	2,600	2,660	2,720
Falmouth	14,069	15,240	15,730	16,690	17,500	18,310
Harwich	5,623	6,220	6,470	6,940	7,360	7,770
Mashpee	6,118	7,130	7,560	8,350	9,060	9,770
Orleans	2,950	3,110	3,170	3,310	3,420	3,530
Provincetown	1,765	1,940	2,010	2,160	2,280	2,400
Sandwich	7,776	8,180	8,350	8,700	8,970	9,250
Truro	984	1,270	1,390	1,610	1,810	2,010
Wellfleet	1,366	1,710	1,850	2,110	2,350	2,590
Yarmouth	11,229	11,380	11,440	11,630	11,730	11,820
Grand Total	**95,755**	**103,000**	**106,000**	**112,000**	**117,000**	**122,000**

Source: Massachusetts Department of Transportation

7.3 EVALUATION CRITERIA

The evaluation of transportation alternatives is ultimately based on the goals of the Regional Transportation Plan (RTP). For an alternative to be eligible for recommendation, it must be consistent with, or avoid inconsistencies with any of the goals of the RTP. These goals, discussed in the first chapter, are summarized as follows:

1. Safety and Security
2. Congestion Relief
3. Multimodal Accessibility
4. System Maintenance
5. Environmental Protection
6. Community Orientation
7. Equitability
8. Cooperation among Stakeholders

MassDOT's Project Design and Development Guide provides some guidance on performing evaluations.

For example, Highway System Preservation Projects may be evaluated according to:

- Condition
    - Pavement Condition (in consideration of pavement management principles)
    - Pavement structural adequacy (as available)
    - Bridge condition
    - Condition of other bridge infrastructure elements
    - Degree and severity of deterioration of other infrastructure
    - Compliance with minimum access standards
- Usage
    - Traffic volumes and truck usage
    - Pedestrian and bicycle usage and/or connectivity (as it is sometimes difficult to provide good pedestrian and bicycle data, connectivity to other trails, downtown areas, neighborhoods, schools, etc., should also be considered)
    - Effect on connectivity for the closure or restriction of bridges
    - Effect on safety and congestion
- Cost Effectiveness (as applicable)
    - Cost per daily traffic (average daily traffic or ADT) and/or pedestrian/bicycle user, as available
    - Cost per lane mile
    - Cost per ADT/lane mile

MassDOT's guide suggests that System Improvement/Expansion Projects should be evaluated according to:

- Condition and Service Quality
- Mobility
    - Magnitude and duration of congestion
    - Travel time and connectivity/access
    - Number of new pedestrians, bicycles, or transit riders that will use the facility (if available) or other measure of project's potential to encourage non-automobile oriented travel (influenced by the project's proximity to activity centers and destinations--downtowns, neighborhoods, schools, parks, etc., as well as by its connectivity to other existing or planned bicycle and pedestrian routes).
- Safety and Security
    - Crash rate compared to state average (if crash rate is not available, a general assessment of anticipated safety impacts can be substituted)
    - Transportation security and evacuation routes
    - Bicycle and pedestrian safety
    - Bicycle comfort index (as described in Chapter 3)
- Community Effects and Environmental Justice
    - Residential
    - Environmental justice for low income and minority neighborhoods, including residents that have English as a second language.
    - Public support
- Land Use and Economic Development
    - Business
    - Sustainable development (including compact & mixed-use development)
    - Consistency with local and regional plans (including Land Use Vision Maps)
- Environmental and Air Quality/Climate Effects
    - Air and water quality
    - Historical and cultural resources
    - Wildlife habitat and endangered species
- Cost Effectiveness
    - Cost per ADT and/or pedestrian/bicycle user, as available
    - Cost per lane mile
    - Cost per ADT/lane mile

Recent Cape Cod Regional Transportation Plans included other criteria for evaluation:

- Travel Miles (1 benefit = 10,000 VMT reduced)
- Travel Hours (1 benefit = 1,000 VHT reduced)
- Safety ("Equivalent Property Damage Only" Method)
- Air Quality (1 benefit = 100kg of VOC or 100 kg of NOx reduced)

The Cape Cod Commission maintains a database of implemented, currently approved, proposed, and potential projects. The database includes summary information such as a description of the project as well as estimates of the costs associated with it. A "Goal

Compatibility Analysis" is used as a screening of the project. Should the project detract from an RTP Goal, a finding of "Incompatible" may be noted. If one or more "Incompatible" statements occur, the project is considered incompatible and no further analysis is warranted. In addition, a determination is made regarding the amount that a project contributes to advancing the goal. These scores are numerical values based on qualitative evaluations.

Several specific criteria may used in the analysis of projects. Such criteria include:

Travel Miles:

The benefits quantified for this criterion are based on the output of the regional transportation model when available. 1 Benefit = 10,000 modeled VMT reduced. If a project is expected to have automobile travel mileage reduction but does not lend itself to modeling, the best estimates of the benefits will be used.

Travel Hours:

The benefits quantified for this criterion are based on the output of the regional transportation model when available. 1 Benefit = 1,000 modeled VHT reduced. If a project is expected to have regional travel time reduction but does not lend itself to modeling, the best estimates of the benefits will be used.

Safety:

Solutions for areas with the largest safety problems are likely to have the greatest benefit. Safety evaluations may be based on the “EPDO” method where the EPDO, or “Equivalent Property Damage Only” is calculated by assigning a value of 5 to each injury crash and 10 to each fatality crash. For intersections EPDO is adjusted by Million Entering Vehicles (MEV) and for road segments is adjusted by Million Vehicle Miles Traveled (MVMT). These figures are expected to be used in future improvements to the projects database.

Air Quality:

Benefits are related to reductions in the precursors of ozone as determined from output of the regional transportation model air quality programs (when available). 1 Benefit = reduction of 100 kg of VOC or 100 kg of NOx.

Goal Benefit:

Based on scores developed under the compatibility analysis, the scores are multiplied by weighting factors (currently 1) and added together to equal the goal benefit.

A transportation project may have benefits under several criteria. The magnitude of these benefits is comparable between projects. This means that a large project when compared to a smaller one (e.g., a multi-town transit service vs. a smaller service in a single village) would have greater quantified benefits (e.g., more reduced automobile mileage). All the criteria benefits may be totaled together into a "Benefit Level."

The Benefit Level can then be divided into the RTP Projected Cost (in millions of dollars) to come up with a "Score." This method allows the relative benefits of large and small projects to be compared on a benefit/cost basis.

7.3.1.1 Cape Cod Regional Transit Authority Priorities

The Cape Cod Regional Transit Authority (CCRTA) is both an important member of the Cape's transportation planning organization and a provider of essential transportation services. In the development of priorities for the RTP, the CCRTA supports the following broad categories:

- Transit Enhancements
- Transit Service Expansion
- Transit Capital Improvements to all CCRTA parcels of land
- Transit Energy Efficient projects and programs
- Rail Operating Assistance
- Transit ITS Improvements
- Transit Operating Assistance
- Transit Capital Needs
- Rerouting/Redirecting Current Transit Routes

7.4 RECENT CCC TRANSPORTATION PLANNING EFFORTS

This section includes summaries of transportation recommendations from efforts undertaken since the 2007 RTP.

7.4.1 YARMOUTH ROAD CORRIDOR STUDY/HYANNIS ACCESS STUDY IMPLEMENTATION

Yarmouth Road in Barnstable experiences significant vehicle queues during peak hours of operation. The corridor is the primary access for some Cape towns to the Cape Cod Hospital. Seasonal and peak hour congestion often delay emergency vehicles access to the Hospital. The intersection of Yarmouth Road and Route 28 in Barnstable is a known high crash location and is identified in the Hyannis Access Study as an intersection in need of improvements. Yarmouth Road serves as an important access road into Hyannis Center, which accommodates both commercial and business development. Hyannis Center was recently approved as a Growth Incentive Zone. A viable Yarmouth Road corridor is significant for many modes of transportation, including walking, biking, automobile, transit and rail. The Hyannis Transportation Center is located off Route 28, a short distance from the Yarmouth Road/Route 28 intersection. The Yarmouth Road Corridor Study has examined each mode of transportation (walking, biking, automobile, transit and rail). After many months of review and public input, "Concept 1a" has been recommended (see figure below). Concept 1a and 1b are continuations of the four-lane divided Willow Street roadway that currently exists near Route 6 Interchange 7. Concepts 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.

Concept 1a and all other considered concepts include a multi-use path. These concepts are available for viewing by at:

www.gocapecod.org/yarmouthroad

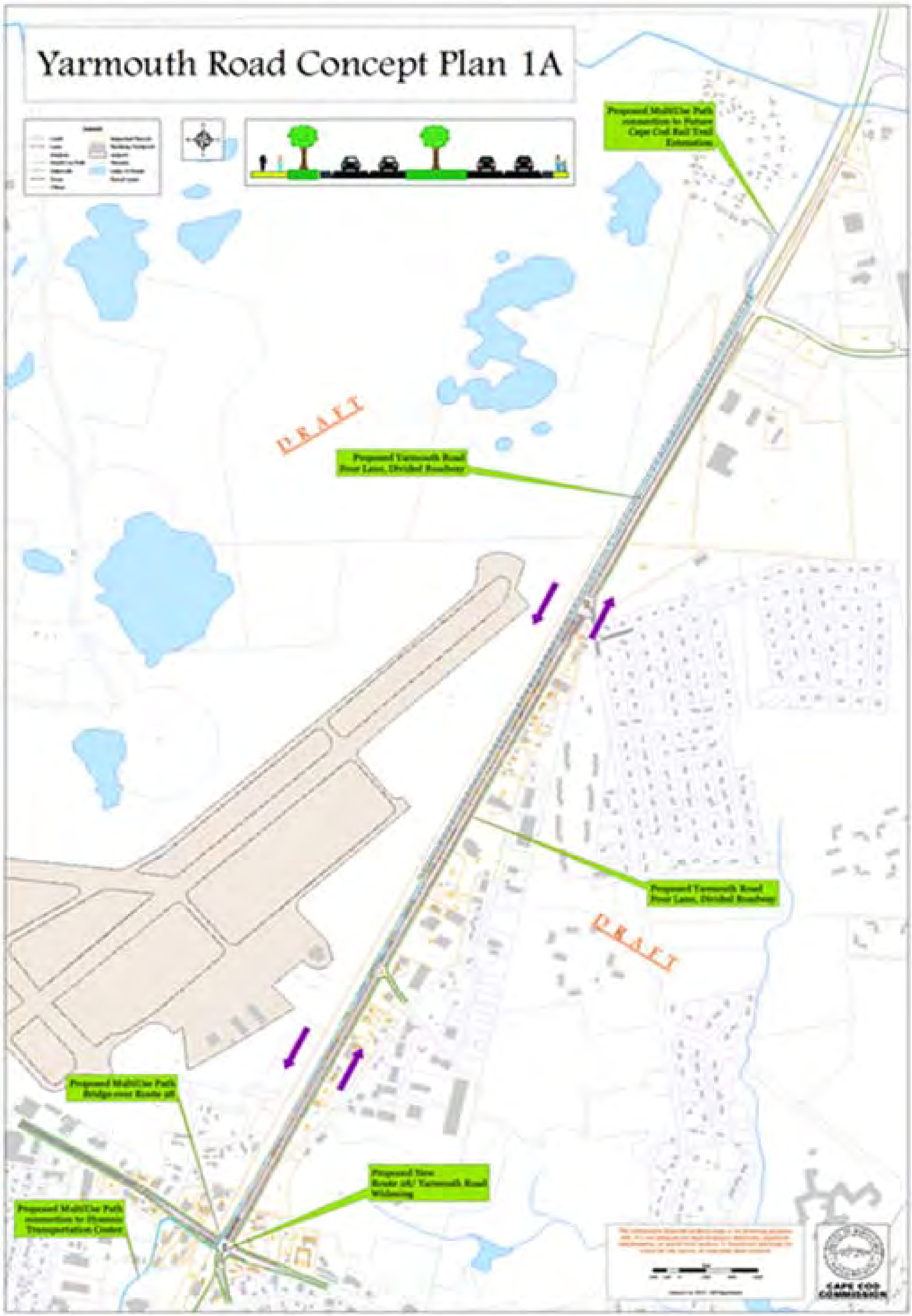

FIGURE 1 - YARMOUTH ROAD CONCEPT 1A

Planning for improvements recommended by MassDOT's Hyannis Access Study include a potential grade-separation of the Airport Rotary. The following figure shows a redesign of the rotary as a modern roundabout with the two approaches of Route 28 connected via an underpass.

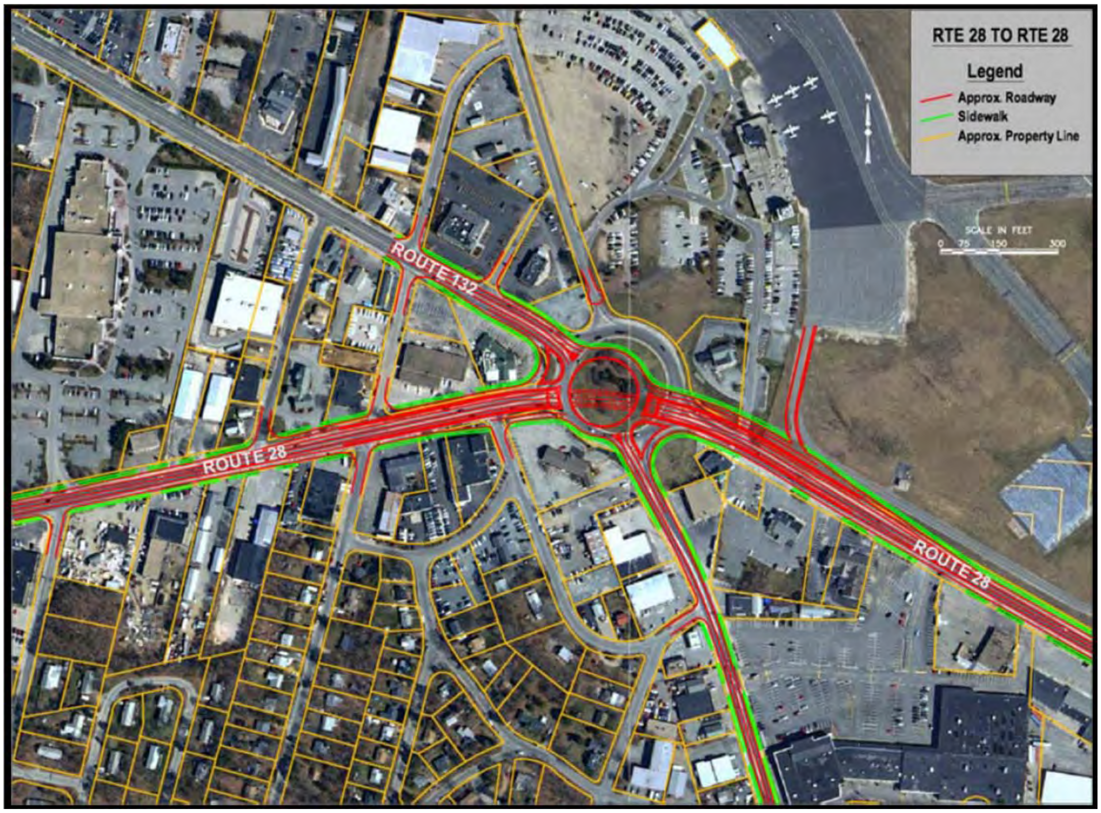

FIGURE 2 - HYANNIS ACCESS STUDY IMPLEMENTATION - AIRPORT ROTARY GRADE SEPARATION

7.4.2 ROUTE 6A CORRIDOR MANAGEMENT PLAN UPDATE

Route 6A consists of approximately 34 miles of state highway that extends along the Cape Cod Bay shoreline, traversing seven communities from the village of Sagamore in the town of Bourne to the U.S. Highway Route 6 Rotary at the Eastham/Orleans border. The Massachusetts state legislature designated the roadway as a “Scenic Byway” in 1992, in recognition of its distinctive scenic and historic character. In 1995, the Cape Cod Commission (CCC) issued the Route 6A Corridor Management Plan (CMP) through a grant provided by the state’s Interim Scenic Byways program. The main purpose of the plan was to focus on resource protection along the corridor while addressing traffic and safety needs. A secondary purpose was to inform MassDOT policy on management of scenic roads and to assist in the development of the state’s Scenic Byways program. The purpose of the Route 6A Corridor Management Plan Update is to continue the same mission as the original plan, using current data. The full text of the CMP Update is available online:

www.gocapecod.org/6Away

Transportation Recommendations from the CMP update include:

General Transportation Improvement Strategies:

The following strategies advance the goals of the CMP and serve as the basis for the transportation implementation recommendations:

- **Improve access management.** By combining driveways, constructing inter-connections between adjacent parcels, or eliminating excess driveways and unnecessary "wide-open" pavement, traffic flow and safety is improved.
- **Encourage non-automobile travel of the corridor.** Alternate travel modes should be supported by development of non-automobile transportation facilities, education, and marketing. Using alternate transportation such as biking and walking reduces the impacts on air quality, safety, and energy use associated with automobile travel and enhances the Route 6A experience by reducing traffic.
- **Develop flexible roadway standards.** Allowing for narrower travel lanes can encourage lower travel speeds and enhance the safety of non-motorized travel such as walking or biking.

Transportation Implementation Recommendations

The following recommendations for implementation advance strategies to address traffic flow and safety along Route 6A, as well as support other CMP goals.

IMPLEMENTATION RECOMMENDATION:

Speed-management techniques

The 1995 CMP recommended exploring "speed zoning" to address safety concerns on Route 6A. Speed zoning is the process of (1) recording the speeds of vehicles on a segment of roadway and (2) setting the "appropriate" speed limits. Determination of the speed limit usually is based on the speed at which 85 percent or few motorists travel along that given segment of the road. The current speed zones on Route 6A vary, with changes occurring over relatively short distances. Drivers frequently exceed the speed limit; in many of the higher speed zones (speed limit 45 mph) this impacts the comfort and safety of pedestrians and bicyclists.

The traditional method of establishing speed limits would likely result in higher speed limits throughout the corridor, which would be inappropriate with the scenic byways program goals of accommodating a variety of roadway users (including pedestrians and bicyclists). Establishing greater uniformity in the corridor's speed limits and lowering them in areas where speed limits are high to better serve the various types of users would improve safety along the corridor.

The greatest potential benefit of speed management for Route 6A is to bring uniformity and reduce the variability of average travel speeds. Higher travel speeds generally are not as great a concern for safety as differences in speeds and the resulting conflicts. It is important to keep in mind that compliance is necessary for speed limits to be effective. The Institute of Transportation Engineers has issued the following reasons for using caution when establishing speed limits:

What realistic speed limits do:

- Encourage compliance from the majority of drivers;
- Give a clear reminder of reasonable and prudent speeds;
- Provide an effective enforcement tool to the police;
- Minimize public antagonism toward police enforcement, which results from obviously unreasonable regulations; and
- Encourage drivers to travel at the speed where the risk of crash involvement is the lowest.

What unrealistic speed limits do:

- Discourage voluntary compliance;
- Create the perception of "speed traps;"
- Cause public antagonism toward the police;
- Create a bad image for a community in the eyes of tourists; and
- May increase the potential for crashes.

"Traffic calming" techniques such as geometric and visual cues can also be used to encourage motorists to travel at safer speeds. This approach involves reducing the perceived width or straightness of the travel lane through changes in pavement texture along the shoulders; pavement markings; strategic use of curbing; and other techniques to give motorists cues to drive slower. For information on traffic-calming techniques, see:

http://www.gocapecod.org/calming.htm

<u>Educational and enforcement programs:</u>

Lower speed limit signs alone generally are ineffective for reducing speed. New signage (e.g., "High Traffic Enforcement Area") may have an immediate effect on motorist behavior, but absent other factors (such as constant police attention), the signage over time may be ignored. Traditional speed enforcement has limited "educational" value since it is usually intermittent or only in effect in a few ideal locations (due to visibility, officers' safety etc).

In some states, speed enforcement is accomplished via speed cameras coupled with traffic radar equipment. When a vehicle is measured to be traveling over the speed limit, digital cameras record images of the driver and the license plate, along with data such as travel speed, time and date, etc. The information is reviewed for accuracy and then a citation is mailed to the motorist. Massachusetts laws do not explicitly support enforcement through speed cameras. However, in recent years legislation has supported the Massachusetts Turnpike Authority's use of camera-based automated enforcement of electronic toll lanes. For a review of state laws that affect implementation of strategies such as "photo radar," see the Governors Highway Safety Association:

http://www.statehighwaysafety.org/html/stateinfo/laws/auto_enforce.html

In summary, speed management for the Route 6A corridor should include the following elements:

- Establish 35 miles per hour speed limits for the entire scenic byway;
- Establish 25 miles per hour speed limits within village centers along the scenic byway;
- Reduce travel lane width to 10 feet (remaining width for shoulder use by non-motorized travel); and
- Explore educational and enforcement programs.

IMPLEMENTATION RECOMMENDATION:
Connect sidewalks throughout the Scenic Byway (on both sides of the road in village centers)

Substantial areas along Route 6A have no pedestrian paths. Without accommodations for walking (for pleasure/recreation or for a short trip), travelers are forced to choose cars. Sidewalks serve a basic need for many of the shorter trips along the byway. When pedestrians are not present, sidewalks are also useful for beginning cyclists and low speed biking. MassDOT has indicated that 4-foot wide sidewalks are acceptable (narrowing intermittently to 3-feet at restrictions such as utility poles).

IMPLEMENTATION RECOMMENDATION:
Provide public transit service

Providing continuous, frequent, and coordinated public transit service can support other non-automobile uses (bikes are accommodated on racks of all Cape Cod Regional Transit Authority buses) throughout the corridor. Public transit uses relieve the stress of automobile demand and its associated congestion and safety problems. One of the most viable options for improving public transit and access along the corridor would be to provide summer shuttle service. A Route 6A summer shuttle bus could serve as an alternative to automobile travel for visitors and residents during the peak seasons when car traffic is heaviest on the roadway.

IMPLEMENTATION RECOMMENDATION:
Roundabout

The intersection of Route 6A/Route 132 is a concern for drivers due to the wide expanse of pavement, high speed approaches, and complicated traffic channelization. In addition, non-motorized travel such as by bicycle is highly risky since some turning maneuvers require multiple points of exposure to potential side-on collisions. The current Cape Cod Regional Transportation Plan (RTP) has identified construction of a roundabout at this location as the 19th highest priority project on Cape Cod. According to the RTP, such a project would "improve traffic flow and safety of the Route 6A/Route 132 intersection through channelization of traffic movements (roundabout)."

The following figure illustrates a roundabout concept for the intersection of Route 6A/Route 132. Modern roundabouts have been shown to improve traffic safety and traffic flow as well as provide other community benefits. The geometry of a properly designed roundabout encourages low-speed entry, circulation, and exit that is consistent for each approaching roadway. In certain circumstances roundabouts can have significantly improved operations compared to signalized intersections and many unsignalized intersections. The main advantage of roundabouts is that they provide continuous traffic flow, as there is no "all-red" phase where all traffic must stop. A roundabout's continuous traffic flow generally results in less noise than the stop-idle-accelerate traffic movements of a signalized intersection.

A correctly designed roundabout encourages consistent lower speeds of all users—a safer option—versus the wide range of operating speeds at a signalized or unsignalized intersection (containing a mixture of stopped vehicles and high-speed through traffic). Additionally, the geometry of a modern roundabout is well-suited for creating a "gateway" to welcome visitors to a special area.

Due to the proximity of residences to the Route 6A/Route 132 intersection, it is important to use a low noise-emitting surface for the truck apron (the rumble strip inside the circulating roadway). A stamped-asphalt installation (as used at the Route 39/Queen Anne's Road roundabout in Harwich) is recommended.

FIGURE 3 - INTERSECTION OF ROUTE 6A, ROUTE 132, AND OAK STREET IN BARNSTABLE
(Photo taken from Route 132, facing north. Source: CCC)

FIGURE 4 - ROUNDABOUT CONCEPT: RT 6A, RT 132, OAK ST IN BARNSTABLE

IMPLEMENTATION RECOMMENDATION:

Shared-use pavement markings

Traffic lanes on roads such as Route 6A are often too narrow for sharing side-by-side by bicyclists and passing automobiles or trucks. Bicyclists riding too close to the roadway edge run the risks of being run off the road, being "clipped" by overtaking motorists who misjudge passing clearance, or encountering drainage structures, poor pavement, debris, and other hazards.

Riding farther to the left may help avoid these problems (and is legally permitted where needed for safety) but can run counter to motorist expectations and be hazardous. A pavement marking that indicates the legal and appropriate bicyclist line of travel, and cues motorists to pass with sufficient clearance, is recommended for certain locations on route 6A.

Guidance for proper installation indicates that a shared-lane marking should not be placed on roadways that have a speed limit above 35 miles per hour. Markings should be placed immediately after an intersection and spaced at intervals not greater than 250 feet thereafter. If used on a street without on-street parking (like most of Route 6A), the centers of the markings should be at least 4 feet from the face of the curb, or from the edge of pavement where there is no curb. The centers of the markings should be 11 feet from the edge where there is parking.

An example of a "sharrow" pavement marking on a narrow road is shown in the following photo:

FIGURE 5 - "SHARROW" PAVEMENT MARKING
(Source: National Committee on Uniform Traffic Control Devices 2007)

For Route 6A, the most effective use of the sharrow markings would be on road segments that are not served by alternate routes suitable for regional bike travel. Four segments of Route 6A do not have suitable alternate routes for bicycle use. These are identified by a western and an eastern roadway intersection as shown in the Table 4 (next page).

TABLE 5 - ROUTE 6A ENHANCED BICYCLE ACCOMMODATION SEGMENTS

Town	Western Transition	Eastern Transition	Length (miles)
Sandwich	Chipman Road	Spring Hill Road	0.5
Sandwich	Jacobs Meadow Road	Old County Road	0.4
Barnstable	Parker Road	Keveney Lane	5.0
Brewster	Stony Brook Rd (E)	Tubman Road	0.1

The longest segment is approximately five miles long from Parker Road to Keveney Lane in Barnstable.

IMPLEMENTATION RECOMMENDATION:
Collect vehicle classification data

The Cape Cod Commission traffic counting program should collect vehicle classification data at all Route 6A automated traffic count locations. (Twelve locations are scheduled for the 2010 traffic counts.) This will help determine the number of large trucks using Route 6A, which not only poses potential safety concerns but also could impact the condition of the roadway.

7.5 ADDITIONAL REGIONAL EFFORTS

This section provides summaries of regional efforts that are likely to benefit the Cape's transportation system.

7.5.1 *OPENCAPE*

The OpenCape initiative will provide a fiber-optic backbone for Cape Cod. This will provide capacity to support intelligent transportation systems in two ways: direct connections and 700 MHZ radio systems. This $40 million project is underway and is expected to be complete by 1/31/2013.

The Cape Cod ITS implementation planning has been oriented toward utilization of this system. There are 12 strands available to the Commonwealth for their use and it is expected these will be incorporated into the Cape's eventual ITS design.

7.5.2 LOCAL TRANSPORTATION CENTER STUDY

Sites for local transportation centers were recommended in short- and long-term public transportation plans. FTA funding to develop locations on the Lower and Outer Cape were provided and a site selection was done for Orleans and two concepts were explored in Provincetown. Currently, the town of Orleans is not interested in hosting a transportation center and funding for the Provincetown center has not been identified.

7.5.3 TRANSPORTATION PARTNER STUDY

The Transportation Partner Study included the development of inexpensive wireless automatic vehicle location technology and has been included on public and private transportation. The system will include local transit, intercity bus, and ferries. The real-time vehicle locations will be used to allow “smart transfers” when congestion makes schedules difficult to maintain (see link below):

http://www.geolabvirtualmaps.com/CapeCodRegionalTransitAuthority_Legacy.aspx

7.5.4 RENEWABLE FUEL PARTNERSHIP

This initiative provided forums for biodiesel and ethanol education. Barnstable County made biodiesel available through their procurement process that many towns take advantage of. The next step for this group is development of a Renewable Fuels Strategic Implementation Plan which is currently unfunded.

7.5.5 CULTURAL COAST FERRY PLAN

Planning for a “Cultural Coast” ferry system was initiated by the Massachusetts Chambers of Commerce and Congressman Delahunt. The planning looked at a service network primarily to serve National Parks from the Boston Harbor Islands to the Cape Cod National Seashore with a hub located in Quincy at the Squantum Pier. Final recommendations for this system have not been made.

7.5.6 COORDINATED HUMAN SERVICE TRANSPORTATION PLAN

The Coordinated Human Service Transportation Plan development included a significant out reach to transportation providers within the Barnstable Urbanized Area (UZA) defined by the 2000 U.S. Census. The plan developed the following goals and objectives:

1. Plan Goals and Objectives
   1.1. Service Improvements
      1.1.1. Goal 1 – provide service to address barriers and unmet needs for; journey to work, weekends and available span of service.
      Objectives
         - Provide weekend and evening service
         - Improve journey to work options
            - Improve service opportunities for day care access
            - Improve outreach to employers
      1.1.2. Goal 2 – Encourage service opportunities in underserved areas.
      Objectives
         - Provide opportunities for:
            - Fixed route service in the Bourne/Falmouth area
            - Service between Barnstable and Sandwich especially to support elder day care programs
            - Service to the Cape Cod Career Centers

- Increased use of taxi services

1.1.3. Goal 3 – Improve accessible services
Objectives

- Provide additional accessible vehicles in:
  - Wareham
  - Carver
  - Marion
  - Rochester
  - Bourne
  - Plymouth
  - Sandwich
  - Other underserved areas
- Improve demand response scheduling
- Encourage medical escort services
- Expand the number of handicap accessible taxis

1.2. Service Coordination

1.2.1. Goal 4 - Reduce duplication of services.
Objectives

- Form a coordination body
- Development of a regional reservation and dispatch process
- Consolidation of trips for different funding agencies, where possible
  - Encourage inter agency cooperation where cost and ride sharing is possible.

1.2.2. Goal 5 – Improve service planning
Objectives

- Update the Cape Cod 5-Year Public Transportation Plan
- Support more inter regional RTA planning for services
- Develop more outreach programs to schools, employers, and human service organizations to determine barriers to transportation, unmet needs and opportunities.

7.5.7 OUTER CAPE MAINTENANCE FACILITY STUDY

The primary goal of this study is to assess the suitability of a satellite vehicle maintenance facility on the Outer Cape as a means of addressing some of the operational challenges and maintenance needs of Cape Cod National Seashore and its partners. The central finding of the study is that while such a satellite facility would indeed reduce deadheading time for transit vehicles serving the Outer Cape, and potentially yield other maintenance efficiencies, these savings would be greatly outweighed by the substantial upfront capital costs need for construction of the facility. Moreover, certain changes that have taken place since the project was originally proposed, such as reductions in the frequency of transit service on the Outer Cape, have reduced the prospects for cost-effectiveness.

The study report has presented an overview of three alternative approaches that would yield at least some of the advantages of a satellite facility at much lower cost: a simple overnight storage space for transit vehicles, a scaled-down satellite maintenance facility, and a mobile maintenance unit. Each of these approaches has its own set of tradeoffs and partnership considerations. Based on the information collected in the study and stakeholder feedback received, the mobile maintenance unit appears to warrant further examination as means of addressing many of the Outer Cape's maintenance needs in a cost-effective way. Key implementation issues such as forging an effective partnership for sharing the mobile resource and its costs, developing an acceptable service agreement, and addressing the potential impacts on existing in-house maintenance and staffing, are beyond the scope of the study but would need to be addressed by project partners before proceeding. Finally, it is also important to consider the virtues of a "no action" alternative. Current vehicle maintenance arrangements on the Outer Cape involve certain inefficiencies such as towing vehicles long distances for service, yet may represent the most cost-effective approach for a region with relatively low population density and modest maintenance needs.

A recommended next step would be to form a task force (perhaps under the auspices of the Outer Cape Inter-Municipal Coordination Committee) that would evaluate the viability of a shared mobile maintenance unit by gauging interest and studying institutional and financial options. The primary issues that the task force would need to examine are:

- Partners' preferences for in-house vs. contracted maintenance
- Inventory of partners' maintenance activities for which a mobile unit would be preferred over current practices and associated costs
- Operational changes from use of the mobile unit
- Ability to have a mobile unit dedicated to the Outer Cape, given projected maintenance needs
- Staffing and labor issues and (for Towns) any limitations due to the Pacheco Law
- Legal mechanisms (e.g. MOU) to govern cost-sharing among partners and the use of the mobile unit.

7.5.8 MONOMOY ACCESS STUDY

This study developed alternative transportation options to improve access between the Monomoy Wildlife Refuge and Chatham area, with potential connections to other Federal Lands. Alternatives included: satellite parking with a shuttle, relocation of the Monomoy Visitor Center, roadway improvements, and bicycling improvements. Currently the Refuge manager is exploring shuttle bus options.

7.5.9 PARKING AND TRANSIT STUDY

This study developed parking projections for Outer Cape beaches and projected erosion for a 20 year horizon. The study also developed information on beach capacity and constraints due to other issues such as area at high tide, lifeguards, and bathhouse septic capacity.

The study developed alternative parking sites and shuttles to meet expected parking needs and to centrally locate this parking rather than rebuild it in a fragile shoreline environment. A number of options were identified for contingencies in the event of a major loss in beach parking. The most likely catastrophic loss would be in the area near Nauset High School which was identified as a primary alternative for consideration.

7.5.10 ITS IMPLEMENTATION PLAN

ROADMAP STEP 1: COMPLETE SYSTEM EXPLORATION AND ASSESS FEASIBILITY

The first step of the roadmap comprises two elements that together produce an optimal concept for the system (or systems) to be formally designed and implemented. Stakeholders should be involved again as appropriate as problem definition and feasibility assessment proceed.

Complete System Exploration

The goal of this element is to achieve a confirmation that the conditions in need of ITS solutions have been correctly defined so that the solutions are on target. It will have the National Seashore, its planning partners, and stakeholders systematically arrive at a common definition of the condition to be remedied, define the evaluation criteria for assessment and comparison of alternative solution ideas, expand the array of system concepts, and align those concepts with real-world ITS solutions.

Assess Project Feasibility

The revised system concepts are assessed against the evaluation criteria to see if they are technically, economically, and operationally viable.

ROADMAP STEP 2: REVISE THE CONCEPTS OF OPERATIONS AND REQUIREMENTS

With the completion of this first reality check against market packages and actual ITS systems, the National Seashore and its collaborators will be in a position to re-cast their description of the systems of interest. Any revision to the functional requirements for the new systems should also be worked through.

The Roadmap shows these revisions to be successive. While the ConOps drives the requirements, ITS planning is a heavily iterative exercise, and so these two steps will essentially happen in tandem.

ROADMAP STEP 3: OBTAIN A DETAILED ENGINEERING PLAN

In this step, the National Seashore will secure the services of an engineering consultant. The consultant will offer expert advice on technical matters and perform the necessary field work and measurements to translate the system's requirements into detailed technical specifications and a preliminary design.

ROADMAP STEP 4: CONSIDER DEPLOYMENT STRATEGIES

Some systems can be implemented all at once. Others for reasons of feasibility and/or external conditions are rolled out in stepwise fashion. A very important factor in this choice should be the National Seashore's level of experience with ITS deployment to date, and its comfort level with taking on the management and operations of new systems.

ROADMAP STEP 5: CHOOSE A PROCUREMENT MODEL AND PROCURE

The procurement process includes four dimensions: work distribution, method of award, contract form, and contract type. Once these key procurement decisions have been made then appropriate terms and conditions can be identified.

ITS system procurement decisions should be driven as much by how, and by whom, the project will be executed as by the intended system's purpose and functional and technical specifics. Any ITS project has a much greater chance of coming in on time and on budget if it performs thorough planning in advance of the project's administrative and technical management.

This aspect of project planning involves:

- assignment of project management responsibility and authority to individuals experienced in ITS deployment, and
- development of a detailed project plan and a systems engineering management plan.

The sponsoring agency has to factor into its planning how experienced it is with ITS deployment, and whether it has the appropriate personnel (that is, both experienced and sufficiently available) needed to manage the project so that it is executed on time and within budget. When necessary, the project management function can be procured; in that event the contractor develops the project and systems engineering plans as early deliverables. The sponsoring agency must still dedicate resources to assure active oversight of the project at all times.

The project plan documents how the project will be managed and controlled from a programmatic standpoint. It identifies the detailed work plans for both administrative and technical tasks. For each project task, the PP documents what is to be done, by whom, with what funds, when, how (processes to be used), and dependencies. The systems engineering management plan defines how the engineering portion of the project will be executed and controlled. It describes how the efforts of system designers, test engineers, and other engineering and technical disciplines will be integrated, monitored, and controlled during the complete life cycle.

ROADMAP STEP 6: EXECUTE AND OVERSEE PROJECT

Even when the administrative and technical planning and management of an ITS project are procured, the sponsoring agency has a significant role to play throughout project implementation. Each step in the systems engineering process has a gate at its termination that formally precludes going on to the next step until a series of documentation review and acceptance procedures are executed with the participation of agency personnel with assigned authority and responsibilities. At the completion of the project, after it has been installed and tested, the agency is responsible for the final acceptance testing. The system should not be accepted unless it passes this test. Additionally, the agency must validate the system once it is operating to confirm that the system has been built, is functioning as intended, and is having the desired impact in relation to the stakeholder needs it was originally conceptualized to address. In that way the benefits of the system are documented relative to its costs.

7.6 TRANSPORTATION ALTERNATIVES

The following pages contain a listing of alternatives considered for the 2012 RTP. It is expected that alternatives meeting MPO approval would undergo further analysis per the procedures outlined in the previous section. For this document, transportation alternatives were identified through an extensive public participation process and in consultation with local, state, and federal transportation officials. Commission transportation staff compiled a ranking of alternatives for each of the following four categories of alternatives:

- Transportation Programs;
- Transportation Projects;
- Smart Solutions; and
- Transportation Studies.

7.6.1 TRANSPORTATION PROGRAMS

Transportation Programs are intended to allow funding over the life of the plan (to 2035) for projects that are program-compatible but may not yet be specified. For example, the most important program, Roadway Maintenance, is expected to have numerous individual projects associated with it but these cannot be specifically identified at this time. The following table presents a priority listing of Transportation Programs. Priorities were developed through public input and consultation with Cape Cod Commission, Cape Cod Joint Transportation Committee members, and refinements requested by the Cape Cod Metropolitan Planning Organization. Some of the following headings are used in the table:

RTP#	Index number used for reference. Numbers followed by an "S" are funded through a program sponsored by the Cape Cod National Seashore.
Type Rank	For "Type," each alternative is listed as one of the following: Program, Project, Smart Solution, or Study. Ranking based on importance (#1 being most important). Unranked alternatives are also supported. Non-supported projects have been eliminated from the listing.
Town	Geographic area.
Title	Short listing.
Description	Longer description
Category	Some alternatives may also benefit other categories (e.g., many "Highway" alternatives also have benefits to "Safety" alternatives. "Highway" may also have congestion and mobility benefits as well).
Ann. Cost	estimated recurring operating cost or average funding allocation (may vary from year to year)
Start Cost	One time cost (e.g., construction cost or capital purchase)
Total Cost	Calculation of Start Cost + Ann. Cost x 23 Years

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3000	Program 1	Capewide	Roadway Rehabilitation & Reconstruction	Roadway resurfacing, rehabilitation, and reconstruction	Highway	360,000		8,280,000
3020	Program 2	Capewide	Bridge	Bridge Replacement/Reconstruction	Bridge	9,000		207,000
3001	Program 3	Capewide	Intersection Improvements	Intersection Improvements, including roundabouts, to address safety and congestion relief. Includes left-turn lanes & phases at signalized intersections	Highway	800		18,400
3009	Program 3	Capewide	Cape-wide Intelligent Transportation Systems (ITS)	Design and implement real-time transportation monitoring and notification technologies at facilities throughout Cape Cod. Includes highway and transit users traveling to and within Barnstable County.	ITS/ Management	2,500		57,500
3022	Program 5	Capewide	Bicycle/Pedestrian Projects	Bicycle and/or pedestrian facilities and programs. Includes development of a regional bike network, bike lane construction, bicycling accessibility improvements and amenities, pedestrian accessibility improvements and sidewalk network expansion.	Bicycle/ Pedestrian	2,000	3,125	49,125
3021	Program 6	Capewide	Transit Operating	Transit Operating Assistance	Transit	3,050		70,150
3023	Program 7	Capewide	Transit Capital	Transit Capital Needs	Transit	2,150		49,450
3018	Program 8	Capewide	Railway Infrastructure	Maintain & provide rail infrastructure	Rail	2,000		46,000
3015	Program 9	Capewide	Additional CCRTA Service	Public transit shuttles connecting villages along Route 6A from Sandwich to Orleans, Provincetown-Orleans Shuttle, etc.	Transit	750		17,250
3024	Program 10	Capewide	Travel Demand Management/Transportation Systems Management (TDM/TSM)	Travel Demand Management/Transportation Systems Management projects (TDM/TSM). Includes support of Transportation Management Associations (TMAs). Provide assistance to employers and institutions for the development and coordination of alternative transportation options for employees and patrons.	ITS/ Management	50		1,150
3320	Program 10	Capewide	Local Transportation Centers	Construct intermodal transportation centers in Buzzards Bay, Orleans, etc.	Transit	166		3,818
3034	Program 12	Capewide	Underground Utilities/Pole Relocation	Remove above ground utilities adjacent to roadways and install them underground or away from roadsides to improve safety where appropriate	Safety	3,000		69,000
3007	Program 14	Capewide	Traffic Calming	Promote the installation of Traffic Calming features at appropriate locations	Safety	100		2,300
4020	Program 16	Capewide	MBTA-Compatible Electronic Fare Systems on Transit and Inter-City Buses	Electronic fare system (EFS) on all CCRTA vehicles, interoperable with Massachusetts Bay Transit Authority.	Transit	200		4,600
3014	Program 17	Harwich to Truro	Flex Parking	Construct or designate parking areas for The Flex transit service	Multi-Modal	75		1,725
3028	Program 17	Capewide	Park-and-Ride Lot Management	Monitor parking usage of parking facilities at Barnstable (Exit 6), Sagamore, Harwich (Exit 10); identify & acquire new facilities, expansions as necessary	Multi-Modal	10		230
4021	Program 17	Capewide	Construction of Enhanced Bus Shelters	Build intelligent, accessible, and energy efficient Cape Cod style bus shelters that provide real-time customer information and amenities.	Transit	36		900
3011	Program 20	Capewide	Access Management	Eligible for all state and local numbered routes. Curb cut consolidation, medians, other access improvements	ITS/ Management	300		6,900

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3035	Program 21	Capewide	Congestion Management	Consider peak period pricing at strategic locations to provide funding for transportation needs	ITS/ Management	-47,000	5,000	-1,076,000
3012	Program 22	Capewide	Cape-wide Flex Service	Expand Flex bus service throughout Cape Cod	Transit	100		2,300
3027	Program 23	Sandwich, Barnstable, Yarmouth, Dennis, Brewster, Orleans	Route 6A/Scenic Byways	Corridor Management Plan update and implement recommended improvements. Includes connection of sidewalks (on both sides in villages), "Sharrow" pavement markings for bike accommodation. For report, see www.gocapecod.org/6Away	Highway	10	125	355
3002	Program	Capewide	Land Conservation	Strategic purchase of land to reduce sprawl and inefficient allocation of transportation resources. Also used to acquire land for improvement of intersections and protection of operations at new interchanges	ITS/ Management	1,000		23,000
3004	Program	Capewide	Transit Marketing & Education	Implement education programs and marketing activities to support public transit	Transit	50		1,150
3005	Program	Capewide	Safe Routes to Schools	Installation of sidewalks and provide other improvements and programs to promote safe routes to schools	Bicycle/ Pedestrian	30		690
3019	Program	Capewide	Red Light Running Cameras	Support legislation to allow installation of red-light running cameras at high-crash signalized intersections	Safety	200		4,600
3025	Program	Capewide	New Ferry Service	Passenger ferries connecting Cape Cod harbors	Ferry	250		5,750
3033	Program	Capewide	Vegetation Management	Implement a comprehensive program to trim/remove vegetation from encroaching areas	Safety	450		10,350
3036	Program	Capewide	Street Lighting	Install street lighting in woody areas where appropriate	Safety	10,000		230,000
3037	Program	Capewide	Bus Service Amenities	Provide bus schedule signage & related amenities	Transit	150		3,450
3040	Program	Capewide	Low-Floor Loading Buses	Purchase/acquire low-floor loading buses for Cape Cod services	Transit	1,125		25,875
4008	Program	Capewide	Signal Preemption	Install and maintain signal preemption hardware at traffic signals to improve public safety vehicle access	Safety	225		5,175
4076	Program	Capewide	Mashpee Wampanoag Roadway & Transit Projects	Implement roadway& transit improvements to improve accessibility & mobility to and within tribal lands in Mashpee	Multi-Modal	200		4,600

7.6.2 TRANSPORTATION PROJECTS

Transportation Projects are alternatives specific to location and effect. The following table presents a priority listing of Transportation Programs. Priorities were developed through public input and consultation with Cape Cod Commission, Cape Cod Joint Transportation Committee members, and refinements requested by the Cape Cod Metropolitan Planning Organization. Some of the following headings are used in the table:

RTP#	Index number used for reference. Numbers followed by an "S" are funded through a program sponsored by the Cape Cod National Seashore.
Type Rank	For "Type," each alternative is listed as one of the following: Program, Project, Smart Solution, or Study. Ranking based on importance (#1 being most important). Unranked alternatives are also supported. Non-supported projects have been eliminated from the listing.
Town	Geographic area.
Title	Short listing.
Description	Longer description
Category	Some alternatives may also benefit other categories (e.g., many "Highway" alternatives also have benefits to "Safety" alternatives. "Highway" may also have congestion and mobility benefits as well).
Ann. Cost	estimated recurring operating cost or average funding allocation (may vary from year to year)
Start Cost	One time cost (e.g., construction cost or capital purchase)
Total Cost	Calculation of Start Cost + Ann. Cost x 23 Years

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3802	Project 1	Barnstable	Hyannis Access Improvements	Improve access to downtown Hyannis per Hyannis Access Study. Construct 2 additional travel lanes w/landscaped median on Yarmouth Road to connect from existing 4-lanes in Yarmouth to Route 28 in Hyannis. Includes multi-use path and sidewalk.	Highway		50,000	50,000
3305	Project 2	Bourne	Rte 6 Reconfigure Interchange One	Improve westbound on-ramp near Sagamore Bridge during peak times for off-cape traffic flow: Route 6, Exit 1: Reconfigure WB on-ramp	Highway		11,500	11,500
3302	Project 3	Capewide	Cape Cod Rail Trail Extensions	Extend Cape Cod Rail Trail from Bourne to Provincetown via new bike path, including direct connection to Hyannis Transportation Center	Bicycle/ Pedestrian		74,000	74,000
4085	Project 4	Bourne	Route 25 Access Ramp Widening/Belmont Circle Modification	Widen Route 25 Ramps to 2 lanes in each direction. Modify Belmont Circle to 2-way travel. Construct pedestrian underpass at Route 25 Ramps. Per 2007 "Buzzards Bay Village Comprehensive Transportation Plan."	Highway		5110	5,110
4011	Project 5	Sandwich Barnstable Yarmouth	Route 6 Hydroplaning	Route 6 stormwater improvements to remove runoff from traveled way, including construction of shoulders as needed	Safety		10,000	10,000
3306	Project 6	Capewide	Year-Round Daily Rail Service	Implement year-round daily rail service from Hyannis to Buzzards Bay, Middleborough (connect to Boston), Providence, RI, (connect to T.F. Green Airport and N.Y. City)	Rail	1,000	3,000	26,000
3319	Project 6	Capewide	Transportation Management Center	Design & construct Operations Center to monitor traffic operations, issue real-time reports to traveling public, control variable message signs and coordinated traffic signals	ITS/ Management		6,450	6,450
3332	Project 8	Orleans, Eastham, Wellfleet, Truro, Provincetown	Rte 6 Improvements Orleans to Provincetown	Implement improvements in the corridor between Orleans and Provincetown per the *Rte 6 Safety and Traffic Flow Study*	Highway		5,000	5,000
3315	Project 9	Bourne	Otis Rotary Area Improvements	Construct safety improvements on Route 28/Connery Avenue/Route 28A at the Otis Rotary	Safety		5,000	5,000
3314	Project 10	Capewide	Permanent Traffic Counting Stations	Install permanent traffic counting stations at strategic locations Cape-wide, including remote-accessible detection at signalized intersections	ITS/ Management	5	175	290
4081	Project 10	Truro	Bus Stop Livability Enhancements	Livability enhancements / Improvements for bus stop area	Enhancements			1,000

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3300	Project 12	Bourne	Scenic Highway Median Barrier	Complete construction of median barrier along Route 6 Scenic Highway from Edge Hill Road to Belmont Circle in Bourne	Safety		12,000	12,000
3338	Project 12	Barnstable	Osterville-Cotuit Bike Connection	Construct off-road connection south of Route 28 for bicycle-pedestrian access between Osterville and Cotuit	Bicycle/ Pedestrian		2,000	2,000
3362	Project 12	Mashpee	Mashpee Rotary Ring Roads	Construct connector roads outside of the Mashpee Rotary: from Great Neck Road South to Route 28 East Leg; from Great Neck Road North to Route 151	Highway		20,000	20,000
4023	Project 12	Provincetown	Shank Painter Rd Corridor Improvements	Corridor improvements including new sidewalks, curb cut consolidation, landscaping, bicycle lanes, etc.	Bicycle/ Pedestrian		2000	2,000
3312	Project 16	Bourne	Sandwich Road Parkway	Develop Sandwich Road into a 4 lane parkway with a landscaped median.	Highway		35,000	35,000
3359	Project 16	Eastham	Route 6/Gov. Prence Road Intersection Improvements	Install improvements at Route 6/Governor Prence Road intersection in Eastham	Safety		1,000	1,000
4086	Project 18	Bourne	Memorial Circle Reconfiguration (Routes 6/28, Main Street Buzzards Bay)	Convert Memorial Circle to 4-way Intersection; includes slip lane connection for eastbound Routes 6/28 to Main Street. Per 2007 "Buzzards Bay Village Comprehensive Transportation Plan."	Highway		1802	1,802
3304	Project 19	Bourne	Bourne Rotary Improvements	Reconfigure Bourne rotary to allow direct connection between Bourne Bridge to Route 28 (MacArthur Blvd). Interim improvements to improve flows at rotary entrances and exits by widening and pavement markings/signage.	Highway		50,000	50,000
3317	Project 19	Barnstable	Independence Park Bikepath	Connect western extension of Cape Cod Rail Trail through Independence Park (Barnstable) to Service Rd at Exit 6	Bicycle/ Pedestrian		7,000	7,000
3322	Project 19	Bourne	Rte 28 MacArthur Boulevard Improvements	Bourne - Construction of 2 new northbound lanes on Rte 28, reverse existing northbound, existing southbound becomes frontage road	Highway		20,000	20,000
3325	Project 19	Capewide	Variable Message Signs	Remote operated variable message signs installed along all major routes - Rte 6, Rte 28 in Bourne & Falmouth, Rte 25 Extension, Rte 3	ITS/ Management	10	1,000	1,230
3367	Project 19	Barnstable Boston	Barnstable-Boston Ferry Service	Ferry service: Barnstable to Boston	Ferry		15,000	15,000
3337	Project 24	Falmouth	Cross-Falmouth Bikepath	Bike path connection from E. Falmouth to Gifford St. to Shining Sea Bike Path	Bicycle/ Pedestrian		3,000	3,000

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3356	Project 24	Chatham	Bridge St Bridge Replacement	Replace Bridge Street/Mitchell River Bridge (Chatham)	Bridge		12,000	12,000
3390 s	Project 26	Provincetown	Provincetown Intermodal Gateway Project - Construction	Construct the Gateway	Enhancements		8,000	8,000
3389 s	Project 27	Provincetown	Provincetown Bicycle Path Ext	Develop ped/bicycle facility using a portion of the Rte. 6 ROW	Bicycle/ Pedestrian		1,000	1,000
3301	Project 28	Sandwich	Interchange Improvements Rte 6	Mid-Cape Hwy - Implement improvements to Route 6 Interchanges	Highway		38,200	38,200
3324	Project 29	Yarmouth Dennis Harwich Chatham	Rte 28 Multimodal Improvements: Hyannis-Dennis	Construction, marking, and signage of Bicycle facility along Route 28 from Hyannis - Dennis using existing pavement with minor widening. Connect/construct Route 28 sidewalks from Yarmouth to Chatham in Dennis & Harwich. Implement improvements per the Rte 28 Safety and Traffic Flow Study; Includes turning lanes, signal optimization. See report: www.gocapecod.org/outreach	Multi-Modal		10,000	10,000
3331	Project 29	Bourne	Scenic Highway/Rte 25 Connector Ramp	Develop a direct connection from Scenic Highway to Rte. 25 to divert traffic from the Belmont Circle.	Highway		10,000	10,000
3330	Project 31	Sandwich, Bourne	Bus-Only Lanes for Rte 3 & Rte 6	Provide bus-only lanes between both Exits "2" and the Sagamore Bridge for both Rte. 3 and Rte. 6. This is expected to be achieved by widening and strengthening the shoulder section	Transit		5,000	5,000
4087	Project 32	Bourne	Reconfigure Route 6/28 Bypass (Buzzards Bay)	Reduce road width to 1 travel lane in each direction; provide local access to cross-streets; construct multi-use path from Memorial Circle to Belmont Circle. Per 2007 "Buzzards Bay Village Comprehensive Transportation Plan."	Highway		4455	4,455
3303	Project 33	Barnstable	Route 132 Access Management	Construct traffic channelization, land acquisition, combine/eliminate driveways to improve traffic flow and safety from CC Mall to Phinneys Lane	Safety		5,000	5,000
3308	Project 34	Barnstable	Airport Rotary Traffic Improvements	Reconfigure Airport Rotary to improve traffic flow and safety. May include realignment of approaches and reduction of diameter to conform to modern roundabout design	Safety		900	900
3310	Project 35	Capewide	Canal Area Intelligent Transportation System	Expand transportation monitoring system to improve congestion & safety while providing real-time information Capewide & beyond	ITS/ Management		3,000	3,000

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3316	Project 36	Orleans	Rt 6A/Rt 28 Intersection Improvements	Per recommendations of 2006 Safety Study, install traffic signal or roundabout at intersection of Route 6A/Route 28/Canal Street in Orleans	Highway		1,000	1,000
3318	Project 37	Barnstable	Barnstable Roundabout	Improve traffic flow and safety of the Route 6A/Route132 intersection through channelization of traffic movements (roundabout)	Safety		1,000	1,000
3006	Project	Bourne, Sandwich	Cape Cod Canal Park-and-Ride Lot(s) Improvements	Construct new and/or expand existing Park-and-Ride facilities on both sides of the Cape Cod Canal near highway bridges	Multi-Modal		1,150	1,150
3326	Project	Capewide	Cape-wide Highway Advisory Radio	Provide travel information cape-wide via AM radio	ITS/ Management		250	250
3336	Project	Bourne	Bourne Central Bikepath	Relocate rail line to the east of MacArthur Blvd (Bourne,) convert existing rail to bikepath	Bicycle/ Pedestrian		10,000	10,000
3340	Project	Barnstable	Truck Staging at Route 6 Interchange	Construct truck transfer staging area near a Route 6 (e.g., Exit 6 or Exit 7) interchange for transfer of freight from large trucks to smaller trucks for destinations in the Hyannis Area. Consider rail freight transfer.	ITS/ Management		3,000	3,000
3342	Project	Capewide	Emergency Routes & Shelters Signage	Install signage indicating emergency routes and shelter locations	Security		150	150
3343	Project	Barnstable	Villager Bus (Red Line) Phinneys Lane	Reroute CCRTA Villager service (Red Line) to include direct service to or from Barnstable Village directly to Route 132 via Phinneys Lane	Transit	40		920
3345	Project	Barnstable	Villager Bus Service (Red Line) Split	Add CCRTA Villager service into two separate, coordinated lines	Transit	5		115
3349	Project	Dennis	Rte 28 Main St Bridge Rehabilitation	Rehabilitate Route 28 Main Street/Swan Pond River Bridge (Dennis)	Bridge		6,000	6,000
3350	Project	Bourne	Bourne Rotary - Falmouth /Sandwich Bus Services	Introduce public transit bus service between the Bourne Bridge area and Sandwich/ Falmouth (CMAQ funding)	Transit	276		6,351
3352	Project	Dennis	Upper County Rd Bridge Rehabilitation	Rehabilitate Upper County Road/Swan Pond River Bridge (Dennis)	Bridge		3,000	3,000
3353	Project	Wellfleet	Marconi Beach Road/Route 6 Intersection Signage	Add correct signage indicating "disappearing lane" at Marconi Beach Road/Route 6 intersection in Wellfleet	Highway		5	5
3354	Project	Wellfleet	Cemetery Road & Old Wharf Road/Route 6 Improvements	Reconstruct intersections to consolidate Cemetery & Old Wharf Rd at Route 6 in Wellfleet	Highway		500	500
3355	Project	Bourne	Cohasset Narrows Bridge Improvements & Traffic Management. Includes multi-use path	Repair bridge abutments, prepare and implement traffic management plans as part of repairs to the Cohasset Narrows Bridge in Bourne [***review schedule]	Bridge		300	300
3357	Project	Falmouth	Dillingham Av/Davis Straights Signalization	Install traffic signal at Dillingham Avenue/Davis Straights intersection in Falmouth	Highway		1,000	1,000
3358	Project	Yarmouth	Route 6A/Union Street Intersection Improvements	Route 6A/Union Street intersection improvements in Yarmouth	Highway		1,000	1,000

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3361	Project	Mashpee Barnstable	Left-Turn Lanes - Route 28	Construct turning lanes on Rte 28 from Route 130 to Orchard Road in Mashpee (esp. at Bowdoin Road)	Highway		500	500
3363	Project	Yarmouth	West Yarmouth Rt 28 Intersection Improvements	Construct intersection improvements at Route 28 & East Main Street in West Yarmouth	Safety		1,000	1,000
3364	Project	Capewide	HOV Lanes	Construct High-Occupancy Lanes at key segments of freeways such as Route 6, 3, 25, and 28.	Highway		10,000	10,000
3365	Project	Eastham	Align Roadways: Aspinet /Nauset	Align Aspinet Rd with Nauset Rd at Route 6(Eastham)	Safety		1,000	1,000
3366	Project	Falmouth	Left Turn Phase - Gifford/Jones	Add left-turn phase Gifford St/Jones Rd (Falmouth)	Highway		50	50
3368	Project	Falmouth and Hyannis to New Bedford	2 New Ferry Services	Provide new ferry services: New Bedford-Woods hole, New Bedford-Hyannis	Ferry	2,000	100,000	146,000
3370 s	Project	Capewide	Coast Guard Beach Shuttle Replacement - Phase 2	Replace existing vehicles - National Park Service	Transit		500	500
3371 s	Project	Capewide	Outer Cape ITS Operations Control Center	Design and build an initial control center to accommodate ITS deployment for the Outer Cape	ITS/ Management		250	250
3372 s	Project	Capewide	Information Kiosks	Procure, install, and enable public transportation information kiosks	ITS/ Management		200	200
3373 s	Project	Capewide	Variable Message Signs - Phase 1	Permit, and install variable message signs for the Outer Cape.	ITS/ Management		500	500
3374 s	Project	Capewide	Surveillance Cameras	Permit, and install surveillance cameras for the Outer Cape to observe traffic conditions and monitor Nat'l Seashore parking facilities.	ITS/ Management		50	50
3375 s	Project	Capewide	Highway Advisory Radio System	Permit and install a highway advisory system for the lower/outer Cape area.	ITS/ Management		200	200
3379 s	Project	Capewide	Upgrade Radio System for CCRTA Service	Improve communications systems and provide capacity to accommodate ITS components /Narrowband Radio.	ITS/ Management		150	150
3381 s	Project	Capewide	Parking Improvement Implementation - Phase 1	Develop inland parking for the National Seashore	Park & Ride		150	150
3384 s	Project	Capewide	Variable Message Signs - Phase 2	Permit, and install variable message signs for the Outer Cape.	ITS/ Management		500	500

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3385 s	Project	Capewide	Beach Shuttle Expansion	Acquire additional buses to accommodate inland National Seashore parking needs - National Park Service.	Transit		400	400
3388 s	Project	Provincetown	Provincetown Bicycle Path Ext - Phase I	Develop an extension from Race Point to McMillan Pier.	Bicycle/ Pedestrian		1,000	1,000
3391 s	Project	Capewide	Renewable Fuels Pilot Stations	Develop pilot stations for renewable fuels such as biodiesel and ethanol. Proposal includes one station in the Mid-Cape area and one in the Outer Cape area	Enhancements		999	999
4000	Project	Barnstable	CCRTA Bike Rental	Provide bike rental service at Hyannis Transportation Center	Bicycle/ Pedestrian			0
4001	Project	Eastham Orleans	Eastham Rotary Bike/Ped Accommodation	Add bike/ped accommodation to connect Orleans to Rock Harbor Rd & Rt 6 in Eastham via periphery of rotary	Bicycle/ Pedestrian			0
4003	Project	Sandwich	Bike Information Kiosk	Construct informational kiosk by Canal bikeway near Sandwich Marina	Bicycle/ Pedestrian			0
4006	Project	Eastham	Route 6 Complete Street	Route 6 in Eastham: add bike accommodation, improve sidewalks, bus turnouts & stops to create "Complete Street"	Highway			5,000
4010	Project	Bourne	Rail Connection at "Y"	Construct direct connection from Canal-side rail to Falmouth rail (eliminating need to lower Canal rail bridge)	Rail			0
4012	Project	Barnstable	West Main St Transit	Provide transit service along West Main Street from SeaLine connection at Rt 28 to downtown Hyannis	Transit			0
4013	Project	Falmouth	Falmouth Transit Improvements	Add service/stops to Surf Drive, Maravista Ave, Brick Kiln Rd, Jones Rd.	Transit			0
4015	Project	Capewide	Mobility Management Call Center	One-stop traveler call center to coordinate all travel modes and to manage eligibility and special requirements for human services.	Transit			0
4017	Project	Capewide	Expansion of Next-Gen Mobile Data Terminals to Paratransit	State-of-the-art displays, global positioning systems (GPS), automatic vehicle location (AVL) systems, in-vehicle navigation systems, digital driver manifests and mobile data collection.	Transit			0
4018	Project	Capewide	Next Bus Stop Announcements and Automatic Passenger Counting	Add technology to Mobile Data Terminals (MDTs) to provide next bus stop announcements/displays onboard. Includes automatic passenger counters.	Transit			0
4019	Project	Capewide	Web 2.0 Integrated Intermodal Traveler Information over the Web	Internet-based intermodal trip planning, displays at malls and terminals to provide real-time mapping of transit vehicles, estimated time of arrival (ETA). Includes real-time displays for major destinations and terminals, ETA displays at bus shelters, and smartphone applications	Transit			0
4024	Project	Brewster	Rt 124/Tubman Safety Improvements	Context-sensitive improvements to improve intersection safety	Highway			0
4027	Project	Barnstable	Rt 6A W. Barnstable Sidewalk	Construct sidewalk along Route 6A in W. Barnstable	Bicycle/ Pedestrian			0

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
4028	Project	Barnstable	Route 28/Bearses Way Access Improvements	Intersection improvements including accommodation of bike/ped & public transportation amenities	Highway		2500	2,500
4029	Project	Barnstable	Rt 28/Yarmouth Rd Intersection Improvements	Construction of turning lanes and signal upgrades per Hyannis Access Study	Highway		2000	2,000
4030	Project	Bourne	Main Street (Buzzards Bay) Streetscaping Phase 3	Continue streetscaping improvements along Route 6/28 Main Street in Buzzards Bay	Enhancements			0
4032	Project	Bourne Sandwich	Rt 6 Resurfacing	Resurfacing and related work on Rt 6 from Sagamore Bridge to Sandwich/Barnstable TL	Highway		8000	8,000
4033	Project	Brewster	Rt 6A Resurfacing	Coldplaning/resurfacing of Rt 6A from Dennis T.L to Orleans T.L. in Brewster	Highway		6500	6,500
4034	Project	Dennis Harwich Brewster Orleans Eastham Wellfleet Truro Provincetown	Route 6 Stormwater Improvements	Route 6 stormwater improvements to remove runoff from traveled way, including construction of shoulders as needed from Dennis to Provincetown	Safety			0
4035	Project	Chatham	Rt 28/Crowell Rd/Depot Rd/Queen Anne Rd Intersection Improvements	Intersection improvements at Rt 28/Crowell Rd/Depot Rd/Queen Anne Rd in Chatham	Highway			0
4036	Project	Chatham	Rt 28 Corridor improvements	Access management improvements along Rt 28 from George Ryder Rd to Barnhill Rd	Highway			0
4037	Project	Falmouth	Rt 28/Old Meetinghouse Rd Intersection Improvements	Intersection improvements at Rt 28/Old Meetinghouse Rd in Falmouth	Highway		0	0
4038	Project	Falmouth	Rt 28/Jones Rd/Worcester Ct Intersection Improvements	Intersection improvements at Rt 28/Jones Rd/Worcester Ct in Falmouth	Highway		1500	1,500
4039	Project	Harwich	Rt 124 (Harwich) Reconstruction	Reconstruction of Rt 124 from Headwaters Dr to Brewster T.L. in Harwich	Highway		4000	4,000
4040	Project	Harwich	Rt 39 (Harwich) Reconstruction	Reconstruction of Rt 39 from Oak St to Brewster T.L. in Harwich	Highway			0
4041	Project	Orleans	Rt 6A/Main St Intersection Improvements	Intersection improvements at Rt 6A/Main St in Orleans	Highway			0
4042	Project	Orleans	Rt 28/Main St Intersection Improvements	Intersection improvements at Rt 28/Main St in Orleans	Highway			0
4044	Project	Sandwich	Rt 6A over Scorton River Bridge	Replace bridge: Rt 6A over Scorton River in Sandwich	Bridge		3000	3,000
4045	Project	Yarmouth	Old Townhouse Rd/Forest Rd Intersection Improvements	Intersection improvements at Old Townhouse Rd/Forest Rd in Yarmouth	Highway			0
4046	Project	Barnstable Bourne	Upper/Mid Cape Real Time Traffic Information System	Real Time Traffic Information System -- Design Build of year-round 24/7 Web based traffic information system based on cameras, sensors, with 511 to reduce road rage, congestion, and improve mobility and incident management through improved information	ITS/ Management		3000	3,000

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
4047	Project	Barnstable Yarmouth	Hyannis Access Bicycle/Pedestrian Improvements	Regional bicycle/pedestrian access in the Route 28/Yarmouth Road and Willow Street area between Hyannis Transportation Center and planned extension of the existing Cape Cod Rail Trail in Dennis-Yarmouth; Design build grade crossings of Willow Street and Railroad	Bicycle/ Pedestrian		13000	13,000
4048	Project	Brewster	Rt 124(Brewster) Reconstruction	Full depth reclamation Harwich Road / Rte 124	Highway		1500	1,500
4049	Project	Brewster	Rt 137(Brewster) Reconstruction	Full depth reclamation Long Pond Road / Rte 137	Highway		1900	1,900
4050	Project	Brewster	Stony Brook Rd, Rt 6A, Satucket Rd (Brewster) Reconstruction	Full depth reclamation Stony Brook Road, Rte 6A - Satucket Rd	Highway		600	600
4051	Project	Capewide	Rail Upgrade (Bourne +)	Buzzards Bay to Middleborough capital improvements for rail upgrade	Rail		6000	6,000
4052	Project	Capewide	Intercity Seasonal Connector-demonstration	Intercity Seasonal Rail Connector-demonstration	Transit		4000	4,000
4053	Project	Dennis	Rt 134/Airline Rd Roundabout	Route 134 at Airline Road, Intersection Improvements (roundabout)	Highway		600	600
4054	Project	Dennis	Old Wharf Rd (Dennis) reconstruction	Old Wharf Road, reconstruction, sidewalks, and drainage improvements	Highway		450	450
4056	Project	Dennis Harwich Brewster Orleans	Rt 6 Reconstruction	Route 6 National Highway System NHS, section with failing pavement	Highway		15000	15,000
4060	Project	Orleans	Rock Harbor Rd (Orleans) Reconstruction	Rock Harbor Road drainage improvements and roadway reconstruction	Highway		600	600
4061	Project	Orleans	Main Street (Orleans) Improvements	Main Street Sidewalk extension and reconstruction of Meeting House Road intersection	Bicycle/ Pedestrian		300	300
4062	Project	Provincetown	Commercial St (Provincetown) Reconstruction	Commercial Street Reconstruction	Highway		3500	3,500
4063	Project	Sandwich	Rt 130 Exit 2 Rt 6 Intersection Improvements phase 2	Route 130 Exit 2 Phase 2, WB exit ramp and Service Road intersection improvements	Safety		3000	3,000
4064	Project	Sandwich	Quaker Meetinghouse Rd Sidewalk	Quaker Meetinghouse Road Pedestrian Accessibility 3 miles of sidewalk	Bicycle/ Pedestrian		800	800
4065	Project	Sandwich	Quaker Meetinghouse Rd Resurfacing	Sandwich, Quaker Meetinghouse Road - 2 miles long, mill and pave	Highway		925	925
4066	Project	Capewide	MV Eagle Refurbishment	Woods Hole, Martha's Vineyard, and Nantucket Steamship Authority (SSA) MV Eagle Mid-Life Refurbishment	Ferry		5900	5,900
4067	Project	Capewide	Ferry Sewage Pump-out Systems	Vessel Sewage Pump-out Systems -- Installation of 3 land-side pump-out systems and vessel modifications in Woods Hole, Vineyard Haven, and Nantucket	Ferry		2700	2,700
4068	Project	Capewide	Passenger Loading Ramps	Passenger loading ramp modifications in Woods Hole, Vineyard Haven, Oak Bluffs, and Nantucket	Ferry		1600	1,600
4069	Project	Wellfleet	Chequessett Bridge	Chequessett Bridge Rehabilitation	Bridge		12000	12,000
4074	Project	Yarmouth	South Shore Dr (Yarmouth) Sidewalks	Yarmouth, Sidewalk improvements: South Shore Drive sidewalk- from Sea View Ave. to South Middle Beach	Bicycle/ Pedestrian		650	650
4075	Project	Yarmouth	Winslow Gray Rd (Yarmouth) Sidewalks	Yarmouth, Sidewalk improvements: Winslow Gray Rd. sidewalk 0.75 miles long from Buck Island Rd. to Long Pond Dr.	Bicycle/ Pedestrian		400	400

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
4078	Project	Eastham	Governor Prence Road reconstruction and improvements	Reconstruction to improve sub-surface, pavement, and multimodal accommodation	Safety			0
4079	Project	Dennis	Rt 6A (Dennis) Sidewalks	Route 6A sidewalks Yarmouth TL to Sesuit Neck Road	Bicycle/ Pedestrian		2,000	2,000
4080	Project	Dennis	Rt 134 (Dennis) Bike/Ped Accommodation	Route 134 state section sidewalks / pedestrian bicycle accommodation, existing gap	Bicycle/ Pedestrian		300	300
4082	Project	Harwich	Bike Path Connector	Bike Path Connection from Old Colony Rail Trail to Rt 28 & Beaches (Harwich)	Bicycle/ Pedestrian		500	500
4083	Project	Sandwich	Canal Connector Bike Path	Bike Path Connection from Cape Cod Canal to Sandwich Center	Bicycle/ Pedestrian		500	500

7.6.3 SMART SOLUTIONS CONSIDERED

"Smart Solutions" are alternatives that do not require major investments in capital or operations. These are called "Smart" Solutions because they do require thoughtful promotion and coordination of transportation services that for the most part already exist. The following table presents a priority listing of Smart Solutions. Priorities were developed through public input and consultation with Cape Cod Commission, Cape Cod Joint Transportation Committee members, and refinements requested by the Cape Cod Metropolitan Planning Organization. Some of the following headings are used in the table:

RTP#	**I**ndex number used for reference. Numbers followed by an "S" are funded through a program sponsored by the Cape Cod National Seashore.
Type Rank	For "Type," each alternative is listed as one of the following: Program, Project, Smart Solution, or Study. Ranking based on importance (#1 being most important). Unranked alternatives are also supported. Non-supported projects have been eliminated from the listing.
Town	Geographic area.
Title	Short listing.
Description	Longer description
Category	Some alternatives may also benefit other categories (e.g., many "Highway" alternatives also have benefits to "Safety" alternatives. "Highway" may also have congestion and mobility benefits as well).
Ann. Cost	estimated recurring operating cost or average funding allocation (may vary from year to year)
Start Cost	One time cost (e.g., construction cost or capital purchase)
Total Cost	Calculation of Start Cost + Ann. Cost x 23 Years

Note that for Smart Solutions, costs have not been estimated for the draft RTP.

RTP#	Type	Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3718	Smart Solution	1	Capewide	Zoning/Planning Support for Sidewalks	Improve zoning regulations & planning efforts to invest in sidewalks	Bicycle/ Pedestrian			0
3706	Smart Solution	2	Capewide	Remote Continuous Traffic Counting	Encourage installation of equipment at signalized intersections and other locations to conduct traffic counts throughout Cape Cod throughout the year using remotely-accessible detection equipment	ITS/ Management			0
3711	Smart Solution	3	Capewide	CCRTA/Steamship Authority Coordination	Coordinate schedules among the CCRTA SeaLine (Blue Line) and Steamship Authority Ferries	Transit			0
4014	Smart Solution	4	Bourne Wareham	CCRTA-GATRA Coordination	Coordinate schedules and service between GATRA and CCRTA	Transit			0
3708	Smart Solution	5	Capewide	Bicycling & Motorist Traffic Law Enforcement	Enforce traffic laws on bicyclists and motorists	Safety			0
4009	Smart Solution	6	Boston	Logan Intercity Bus Information	Provide real-time bus location information, schedules, fares etc. for service from Logan to Cape Cod	ITS/ Management			0
3705	Smart Solution	7	Capewide	Redesignate 195 & 495	Redesignate Route 25 Extension as Route 195 or Route 495 or Route 195/495	ITS/ Management			0
3704	Smart Solution	8	Capewide	Employer TDM Plans	Create incentives for employers to prepare and implement Travel Demand Management (TDM) plans (>25 Employees)	ITS/ Management			0
4005	Smart Solution	9	Falmouth	New Bedford-Martha's Vineyard Freight	To reduce traffic on Woods Hole Rd, operate barges between New Bedford and Martha's Vineyard to carry fuel trucks and garbage trucks.	Ferry			0
3700	Smart Solution	10	Capewide	Speed Management	Implement education, signage and enforcement to lower traffic speeds on roadways with speed-related safety problems	Safety			0
3715	Smart Solution	11	Capewide	Transit Education & Marketing on Local TV	Implement education programs and marketing activities on community-access television to support public transit	Transit			0
3702	Smart Solution	12	Capewide	Right-of-Way Preservation	Maintain rights-of-way for future transportation uses and to avoid future traffic generation	ITS/ Management			0
3713	Smart Solution	13	Capewide	Bus Users Incentives: Shopping Discounts	Provide shopping discounts to bus users	Transit			0
3717	Smart Solution	13	Capewide	Wi-Fi Hotspots	Install wireless internet services at strategic locations throughout Cape Cod	ITS/ Management			0
3701	Smart Solution		New Bedford	Promote Ferry Service from New Bedford		Ferry			0

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3703	Smart Solution	Capewide	Vanpooling & Carpooling Incentives	Provide incentives to increase vanpooling and carpooling	ITS/ Management			0
3707	Smart Solution	Capewide	Carpooling "Stands/Stops"	Install signage and implement education & marketing program for the use of carpooling stands/stops" to promote higher occupancy vehicle use	ITS/ Management			0
3709	Smart Solution	Capewide	Rail Line Buffer Zone	Implement zoning protections to reduce future development for a distance of 100' along rail lines	Rail			0
3716	Smart Solution	Capewide	Vanpooling at Steamship Authority Lots	Permit use of Steamship Authority parking facilities for vanpooling	Multi-Modal			0

7.6.4 TRANSPORTATION STUDIES CONSIDERED

Transportation Studies are alternatives that have not been fully realized. From the public participation process, there have been many occasions on which a clear course of action is not revealed. In these cases, there may be many conflicting (and potentially infeasible) “solutions” proposed. Perhaps the only consensus is that there is in fact a problem worthy of further review. Therefore, this final category forms the basis for future planning efforts. These Transportation Studies provide the vehicle for generating Programs, Projects, and Smart Solutions.

The following table presents a priority listing of Transportation Studies. Priorities were developed through public input and consultation with Cape Cod Commission, Cape Cod Joint Transportation Committee members, and refinements requested by the Cape Cod Metropolitan Planning Organization. Some of the following headings are used in the table:

RTP#	**I**ndex number used for reference. Numbers followed by an “S” are funded through a program sponsored by the Cape Cod National Seashore.
Type Rank	For “Type,” each alternative is listed as one of the following: Program, Project, Smart Solution, or Study. Ranking based on importance (#1 being most important). Unranked alternatives are also supported. Non-supported projects have been eliminated from the listing.
Town	Geographic area.
Title	Short listing.
Description	Longer description
Category	Some alternatives may also benefit other categories (e.g., many “Highway” alternatives also have benefits to “Safety” alternatives. “Highway” may also have congestion and mobility benefits as well).
Ann. Cost	estimated recurring operating cost or average funding allocation (may vary from year to year)
Start Cost	One time cost (e.g., construction cost or capital purchase)
Total Cost	Calculation of Start Cost + Ann. Cost x 23 Years

Note that costs for Studies are generally considered as one-time expenditures despite some studies which may be performed over two or more years.

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
3807	Study 1	Bourne, Army Corps	Cape Cod Canal Bridges Replacement/Expansion/Addition. Includes evaluation of Belmont Circle and Buzzards Bay Bypass and other roads.	Evaluation of future needs for highway crossings of Cape Cod Canal. Includes consideration of replacement or expansion of existing bridges; additional crossings	Highway		1,000	1,000
3803	Study 2	Falmouth, Mashpee, Barnstable, Yarmouth, Dennis, Harwich, Chatham	Southside Bike Route	Identify network (on- and off-road) for bike route from Woods Hole to Chatham	Bicycle/ Pedestrian		500	500
3809	Study 3	Capewide	Freight Study	Conduct a study of freight (quantities, origins, destinations, etc.)	ITS/ Management		250	250
3804	Study 4	Barnstable	Exit 6 Park-and-Ride Lot Expansion	Examine options at Exit 6 Park-and-Ride Lot such as parking structure or surface lot expansion to expand parking supply	Park & Ride		250	250
3811	Study 5	Capewide	Disaster/Emergencies/Security Plan	Develop plans to address disasters, emergencies, and security issues	Security		500	500
3816	Study 6	Barnstable, Mashpee, Falmouth	Hyannis-Falmouth Transportation Study	Identify needed roadway, public transit, and other modes' needed improvements for future travel demands between Hyannis and Falmouth	Highway		500	500
3832 s	Study 7	Capewide	Renewable Fuels Partnership Strategic Implementation Plan	Identify potential renewable fuel options, technologies, markets, and infrastructure needs to make use of biofuels both viable and sustainable	Enhancements		200	200
3829 s	Study 8	Capewide	Develop Origin/Destination Transit Mode Split Model	Create a transit model for Cape Cod	Transit		250	250
4026	Study 9	Sandwich Mashpee	Rt 130 Road Diet	Narrow travel lane width to reduce speeds and accommodate bicycles/ pedestrians	Safety			0
4007	Study 10	Eastham Orleans	Eastham Rotary Bypass	Relocate Rock Harbor Road access from Rotary to new Bridge Rd/Rt 6 signalized intersection. Convert rotary to roundabout	Highway			0
3805	Study 12	Bourne	Sagamore Bridge Speed Management	Identify measures to encourage safe speeds on Route 3 and Route 6 approaches to the Sagamore Bridge	Safety		350	350
4025	Study 12	Wellfleet	Rt 6 at Wellfleet/Eastham TL	Congestion mitigation where two NB lanes merge to one	Highway			0
4077	Study 14	Capewide	Mashpee Wampanoag Roadway & Transit Study	Identify roadway& transit improvements to improve accessibility & mobility to and within tribal lands in Mashpee	Multi-Modal			0
3822 s	Study 15	Capewide	Smart Card Study	Investigate current technologies, compatibilities with local planning, define potential partners, and make recommendations.	ITS/ Management		75	75
4004	Study 15	Bourne Falmouth	Falmouth-Wareham Bike Connection	Connect Falmouth bike paths to Bourne/Wareham town line at William Dalton Bridge including connection to Cod Canal bike paths	Bicycle/ Pedestrian			0

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr ($K)	Start Cost ($K)	Total Cost ($K)
4084	Study 16	Barnstable	Rt 28 Corridor Study	Identify multimodal corridor improvements from Mashpee T.L. to Yarmouth T.L. along Route 28	Multi-Modal		750	750
3806	Study	Orleans	Rt 28/Rt 39 Intersection Improvements	Identify safety improvements at Route 28/Route 39/Quanset Road intersection in Orleans	Safety		100	100
3808 s	Study	Capewide	Flex Phase II Evaluation Study	Evaluate improvements and expansion of the Flex transit service.	Transit		30	30
3813	Study	Capewide	Railways for Transporting Emergency Supplies	Develop contingency plan to use railways for transporting supplies during emergencies	Security		75	75
3819 s	Study	Capewide	Evaluation of Existing Transit Info Software/Procurement	Evaluate customer information software to be used for a web-based system to support CCRTA operations	ITS/ Management		250	250
3820 s	Study	Capewide	Evaluation and refinement of Partner Program	Develop recommendations based on the public/private transportation provider coordination efforts.	ITS/ Management		100	100
3826 s	Study	Capewide	ITS Evaluation and Phase II Recommendation study	Evaluate ITS deployment and make recommendations.	ITS/ Management		150	150
3827 s	Study	Capewide	Evaluation of Customer Information Systems	Evaluate Customer Information Systems and make recommendations.	ITS/ Management		25	25
3828 s	Study	Capewide	Update 5-Year and Long Range Cape Cod Public Transportation Plans	Update the 2002 5-Year Plan and the 2003 Long Range Public Transportation Plan.	ITS/ Management		175	175
3830 s	Study	Capewide	Evaluation of Partner Program II	Continue the evaluation of the public/private carrier coordination program.	ITS/ Management		15	15

7.7 CONCLUSION

More than 200 Transportation Programs, Projects, Smart Solutions, and Studies were identified through a comprehensive public participation process. Many of these alternatives where refined, combined, and eliminated in the process of developing an MPO-supported priority ranking. Final MPO recommendations are based on fiscal constraint.

Funding issues are critical to the implementation of any of the above transportation alternatives. The following chapter includes a financial plan and listing of recommended alternatives constrained within estimated available funds.

CAPE COD
COMMISSION

2012 REGIONAL TRANSPORTATION PLAN

Chapter 8: Recommendations and Financial Plan

Endorsed
August 22, 2011

Revised May 20,2013

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8. Recommendations and Financial Plan

8.1 INTRODUCTION

The Regional Transportation Plan (RTP) contains data collection and analysis, discussion about and outreach for the existing Cape Cod transportation system, related issues, and potential solutions. The overarching objective of the RTP is for improved mobility of both residents and visitors to, from, and within the Cape Cod region, and connections beyond the region. While smaller improvements are not specifically identified, the RTP goals assist is directing design and implementation.

Many sources and outreach efforts over the last several years, along with ongoing data collection, analysis, and communications have resulted in a list of recommendations for improvement to Cape Cod's regional transportation system.

However, planning for improvements is meaningless without considering how potential solutions can be financed. The implementation of the proposed projects and programs recommended from this RTP effort—whether large or small, transit, or roadway related—will need financing to proceed.

Under Title 23, federal transportation law, currently an extension of the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU), a regional transportation plan may only recommend implementation of programs and projects where funding "can reasonably be expected to be available" per 23 CFR 450.322(b)(11). In other words, just as in a local budget, the plan is not approved unless the fiscal analysis shows that there is expected to be enough funding to implement the recommendations. Other proposed projects, programs, and/or studies may be included for informational purposes only.

Therefore, this chapter presents the RTP recommendations within the financial resources expected to be available for the region.

8.2 BACKGROUND / SOURCE OF THE FINANCIAL RESOURCES

The primary source of funding for implementation of the RTP projects and programs is from the federal Highway Trust Fund (HTF). Distribution of Highway Trust Fund revenues are appropriated by Congress for surface transportation purposes through the United States Department of Transportation (USDOT) Federal Highway Administration (FHWA) and the USDOT Federal Transit Administration (FTA) from federal legislation, with the most recent six-year act entitled the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU). SAFETEA-LU was signed into law on August 10, 2005, by President George Bush, and has now expired. Continuing resolutions and extensions of SAFETEA-LU have provided funds that will continue through the end September 2011. Efforts are underway in Congress on a draft new bill.

The federal legislation provides authorization; it sets policy, programs, and amounts. It typically authorizes specific dollar amounts for each program. Each year Congress provides an annual appropriation which funds the programs authorized, however, the Congressional amount that is appropriated, or budgeted, is generally less than the amount authorized.

Obligation of the federal dollars occurs for Federal Highway and state funded projects as each project is advertised for construction. For a transit project, the obligation of the federal dollars is as the funds are approved through the online Transportation Electronic Award and Management (TEAM) system.

The federal Highway Trust Fund (HTF) receipts are collected primarily based on user taxes on fuel. Examples of the current tax per gallon by fuel type are as follows:

FEDERAL HIGHWAY TRUST FUND TAX AMOUNTS

FUEL TYPE	CENTS PER UNIT	UNIT
Gasoline	18.4	gallon
Gasahol	18.4	gallon
Diesel fuel	24.4	gallon
Liquefied petroleum gas	18.3	gallon
Liquefied natural gas	24.3	gallon
Compressed natural gas	48.54	1,000 cubic ft

STATE GAS TAX AMOUNT

Gasoline ....21.0 cents/gallon

For this RTP financial plan, the federal funding provided by SAFETEA-LU extensions through, and in cooperation with, the Commonwealth of Massachusetts is what forms the basis for the estimated available funds for the federal aid eligible components of the transportation system. State funds provide a matching project implementation amount. For a highway construction project the state amount is typically 20% of the construction cost, and the federal highway amount is 80%. Exceptions include the Highway Safety Improvement Program (HSIP) funds, which are 90% federal and 10% state funds. For a transit project the state amount may average at a higher percentage due to the state funding a large percent of operating cost.

Local funds play a large part in the process through project design. Most of the project designs on Cape Cod are funded by the local town where the project is located. This may be the practice even for certain state facilities, because local towns are interested in moving a project forward. Transit services also have a local share in funding, with a portion of service operating costs assessed to the towns through the Cape Cod Regional Transit Authority.

8.3 FEDERAL TRANSPORTATION FUNDS: CATEGORIES AND ELIGIBLE ACTIVITIES

The Regional Transportation Plan process considers all transportation modes. However, the financial estimates are only for the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) eligible facilities. At this time, there is a separate federal source for airport related projects, through the Federal Aviation Administration (FAA). The following table provides examples of the FHWA and FTA federal funding categories and general uses.

Federal Highway Administration Programs	
Fund and Primary Purpose	**Eligible Activities**
Metropolitan Planning (PL) To carry out the metropolitan transportation planning process	Multimodal transportation planning. Primary documents required are the UPWP, RTP, and the TIP.
Statewide Planning and Research (SPR) Highway and transit planning Statewide transportation planning	Metropolitan transportation planning and Statewide transportation planning process and public transportation management systems; 25% of SPR to be used for Research, Development, and Training
National Highway System (NHS) NHS is the system of significant rural and urban roads serving major population centers, international border crossings, intermodal transportation facilities, and major travel destinations. NHS funds are for Improvements to rural and urban roads that are part of the NHS or that are NHS Intermodal connectors	NHS corridor improvements that are highway, transit, or system demand management (such as carpool programs). Includes funding for environmental restoration and pollution abatement to minimize the impact of transportation projects. NHS related transportation planning.
Surface Transportation Program (STP) Construction, reconstruction, rehabilitation, and operational improvements for highways, bridges, and other modes 10% set aside for Transportation Enhancements	Capital costs of construction for highway, bicycle/pedestrian accommodation, and/or transit projects (with transfer to FTA for transit) Surface transportation planning programs
Transportation Enhancements To provide for linked but non-typical highway related items—12 specific activities are included in the federal definition	Examples of the 12 specific activities include landscaping, bicycle/pedestrian components, stormwater mitigation projects.
Highway Bridge Replacement / Rehabilitation Replace and rehabilitate deficient highway bridges and to seismically retrofit bridges located on any public road.	Funds provided for Off-System bridges may not be transferred to other 23 U.S.C. programs without a needs determination.
Construction of Ferry Boats & Ferry Terminal Facilities—Ferry Boat Discretionary Ferry projects	Construction of ferry boats and ferry terminal facilities. Priority ferry systems that provide critical access to areas that are not well-served by other modes of surface transportation; carry the greatest number of passengers and vehicles; or carry the most passengers in passenger only service.

Federal Highway Administration Programs (continued) Fund and Primary Purpose	Eligible Activities
Highway Safety Improvement Program (HSIP) Safety projects	Funds projects that are designed to produce a reduction in traffic fatalities and serious injuries on public roads. Rail-highway crossing improvements
Congestion Mitigation and Air Quality Improvement Program (CMAQ) Air quality benefits	Projects in nonattainment and maintenance areas that reduce transportation related emissions. Any transit capital projects and operating expenses for new services. Operating assistance is limited to new or expanded transportation services, and limited to three (3) years.
Recreational Trails Program (RTP) Trails	Develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses.
Federal Lands Highways Program (FLHP) Coordinated program of public roads and transit facilities serving Federal and Indian lands. Funding is broken into 4 discrete sources: Indian Reservation Roads (IRR); Public Lands Highway - Discretionary & Forest Highways; Parkways & Park Roads; Refuge Roads	May be used for facilities within, adjacent, or providing access to public lands, national parks, national forests, refuge roads, and Indian reservations. SAFETEA-LU added Alternative Transportation in Parks and Public Lands (ATPPL). May be administered by FHWA or may be transferred to FTA for transit projects eligible for FLH funds under 23 U.S.C. 204(h).
Transportation, Community, and System Preservation Program (TCSP) Provides funding for a comprehensive program to facilitate the planning, development, and implementation of strategies to integrate transportation, community, and system preservation plans or practices.	Improve the efficiency of the transportation system Reduce the impacts of transportation on the environment. Reduce the need for costly future investments in public infrastructure Provide efficient access to jobs and services Examine community development patterns and identify strategies to encourage private sector development
Safe Routes To Schools Provides funding to encourage and make safer walking and bicycling routes to schools.	Funds are for planning, design, and construction of projects that will substantially improve the ability of students to walk and bicycle to school.

Federal Transit Administration Programs Fund and Primary Purpose	Eligible Activities
Metropolitan Planning Program Section 5303 To carry out the metropolitan transportation planning process under 49 U.S.C. 5303	Metropolitan transportation planning process (23 U.S.C. 134)
Urbanized Area Formula Grants Section 5307 Transit capital and planning assistance to urbanized areas	In a Transportation Management Area, the MPO may elect to transfer portions of its FTA Section 5307 funds that cannot be used for operating assistance to FHWA for highway projects subject to the requirements of 49 U.S.C. 5307(b)(2).
Section 5309 Earmark or discretionary funds for bus/rail	Priority for capital bus needs unmet by formula funds, fleet expansion, clean fuels. Eligible New Starts construction program funds for new or extensions to light rail, rapid rail (heavy rail), commuter rail, monorail, busway, and automated fixed guideway system (such as a "people mover").
Special Needs of Elderly Individuals and Individuals With Disabilities Program (49 U.S.C. 5310) Section 5310 Intended primarily for private non-profit organizations, public bodies approved by the State to coordinate services for the elderly and individuals with disabilities	Capital funding to assist in providing transit services for the elderly and/or disabled population The Mobility Assistance Program (MAP) administered by the state provides assistance with capital needs for services related to elderly and/or disabled individuals.
Non Urbanized Area Formula Program Section 5311 Eligible subrecipients include State and local public agencies, Indian Tribes, private non-profit organizations, and private operators of public transportation services.	For the purpose of supporting public transportation in areas with a population of less than 50,000. May be used for capital, operating, state and/or project administration.
Transit in the Parks Program **Section 5320?** A new program in SAFETEA-LU for alternative transportation serving Federal and Indian lands. Capital and planning projects are selected from applications based on criteria as in the solicitation notice. Eligible subrecipients include the National Park Service and Tribal Governments. Local governments acting with the consent of a Federal land management agency are also eligible to apply.	Projects must conserve natural, historical, and cultural resources, reduce congestion and pollution, and improve visitor mobility and accessibility. No more than 25 percent may be allocated for any one project. May be used for transit facilities within, adjacent, or providing access to public lands, national parks, national forests, refuge roads, and Indian reservations. .
Job Access and Reverse Commute Program (49 U.S.C. 5316) The Job Access and Reverse Commute (JARC) program The federal requirement is that projects selected for funding be included in a locally developed coordinated public transit/human service transportation plan for Sections 5310, 5316 (JARC) and 5317 (New Freedom).	The Job Access and Reverse Commute (JARC) program provides formula funding to States and Designated Recipients to support the development and maintenance of job access projects designed to transport welfare recipients and eligible low-income individuals to and from jobs and activities related to their employment, and for reverse commute projects designed to transport residents of UZAs and other than urbanized to suburban employment opportunities.

Federal Transit Administration Programs (continued)	
Fund and Primary Purpose	**Eligible Activities**
New Freedom Program (49 U.S.C. 5317) To provide new transportation services beyond requirements of the Americans with Disabilities Act of 1990 (ADA). The federal requirement is that projects selected for funding be included in a locally developed coordinated public transit/human service transportation plan for Sections 5310, 5316 (JARC) and 5317 (New Freedom).	Funding is available for transportation services provided by public, non-profit, or private-for-profit operators that are both new and go beyond ADA. The Federal share is 80 percent of capital expenses and 50 percent of operating expenses. Funds provided under other Federal programs (other than those of the DOT) may be used for local/state match for funds provided under Section 5317, and revenue from service contracts may be used as local match.

These tables are provided as an overview to inform the reader of the potential for the use of the FHWA and FTA funds for transportation improvements. However, it is not a comprehensive list of all the funding categories or descriptions. For more information, please see the United States Department of Transportation (U.S. DOT), and the FHWA and FTA websites:

U.S. DOT: http://www.dot.gov/

FHWA: http://www.fhwa.dot.gov/

FTA: http://www.fta.dot.gov/

8.4 SUMMARY OF PREVIOUS EXPENDITURES

The summary of previous expenditures is based on projects that were implemented through the local short-range planning document, the Transportation Improvement Program (TIP). From the RTP effort, further project specific analysis and feasibility review leads to project design development, and subsequently to inclusion on the TIP for implementation. Typically, the four-year TIP is updated annually in Massachusetts.

The TIP includes projects that are proposed to be ready for implementation within the TIP four-year time frame. For a "highway" funded project, this generally means that a project on the TIP is under design, or has a design completed and approved by MassDOT. For a transit project in the TIP, the Cape Cod Regional Transit Authority (CCRTA) is a direct grant recipient from FTA, and is generally the project proponent. The CCRTA Board approves an annual budget based on available resources from FTA, state, and local sources, and the transit projects move forward with TIP and FTA approval.

This section is to provide an overview of the previous federal aid resources invested in the Cape Cod transportation system through the MPO processes. This does not include additional local resources that may be used in the area, such as the local state aid for roadways or "Chapter 90" funds.

8.4.1 FEDERAL HIGHWAY ADMINISTRATION PREVIOUS EXPENDITURES

(Includes state matching amount)

The summary of previous expenditures on the highway side includes a variety of projects and funding categories, and is provided for basic information here. Recently funded specific transportation projects within these amounts include: Route 132 section to four lanes in Barnstable, Sagamore area improvements in Bourne, the Shining Sea Bikeway extension in Falmouth, and the Harwich intersection of Route 124 at Queen Anne Road

Time Frame	Amount
1993-1998	$ 34,856,217
1999-2004	$ 75,522,184
2005-2010	$ 55,464,533
Total Amount	**$ 165,842,934**
Average Annual Amount	$ 9,213,416

8.4.2 FEDERAL LANDS HIGHWAY PROGRAM ADMINISTRATION

Cape Cod has benefited historically from funding programs under the Federal Lands Highway Program (FLHP). The FLHP funds have been used for roadway and transit facilities related by the National Park Service for access to the Cape Cod National Seashore, and for planning and studies in the area. The average amount of FLHP funds to the CCNS since the previous RTP is about $2.3 million annually. With the official federal recognition of the Mashpee Wampanoag Tribe, FLHP funds are also available for improvements related to the designated Indian Reservation Roads in the vicinity.

However, these funds have not been included as revenues that are known for fiscal constraint in this RTP due to the fact that there is not an estimate for future funding amounts.

8.4.3 FEDERAL TRANSIT ADMINISTRATION PREVIOUS EXPENDITURES

(Includes state amount)

The summary of previous expenditures on the transit side includes a variety of projects and funding categories, and is also provided for basic information here. Recently funded specific transportation projects within these amounts include: replacement vehicles for the CCRTA services, new fare boxes, bus stops, and a portion of the maintenance and operating expenses.

Time Frame	Amount
1993-1998	$ 36,303,710
1999-2004	$ 45,089,333
2005-2010	$ 68,270,818
Total Amount	**$149,672,861**
Average Annual Amount	$ 8,804,286

8.5 ESTIMATED AVAILABLE FUNDS

Previous sections have outlined that the primary source for transportation planning and implementation funds are from federal sources, along with the sub-categories of funding purpose and general use. In section 8.3, specific Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) funding categories that may be used on Cape Cod and the general uses are described.

This section provides the estimated funding expected to be available for the next 24 years—2012 to 2035—for the Cape Cod Region.

8.5.1 FEDERAL HIGHWAY ADMINISTRATION SOURCE FUNDS

In April 2011, the Cape Cod Region received estimated available funding on the highway side from the Massachusetts Department of Transportation (MassDOT). A summary is included in the table below of the estimated available funds for the Cape Cod region from Federal Highway Administration (FHWA) including the state matching funds.

TABLE 1 – FFY 2012-2035 ESTIMATED REGIONAL TRANSPORTATION PLAN HIGHWAY FUNDING

	2012-2015	2016-2020	2021-2025	2026-2030	2031-2035	TOTAL
Total Highway Revenue Available for Cape Cod RTP Programming	**$117,572,000**	**$141,653,000**	**$194,018,000**	**$236,559,000**	**$274,237,000**	**$964,039,000**
Major Infrastructure Projects	$ 7,462,000	$10,029,000	$15,152,000	$18,514,000	$21,462,000	$72,619,000
Federal Aid Bridge Projects	$12,642,000	$13,928,000	$20,841,000	$25,423,000	$29,472,000	$102,305,000
National Highway System (NHS) Projects	$15,361,000	$16,462,000	$24,710,000	$30,159,000	$34,962,000	Ŕ121,654,000
Statewide Maintenance	$49,488,000	$50,482,000	$61,433,000	$72,298,000	$83,813,000	$317,512,000
Regional Discretionary Funding	$32,619,000	$50,752,000	$71,883,000	$90,167,000	$104,528,000	$349,949,000

The Cape Cod Regional Transportation Plan (RTP) estimates for federal and state highway funding are based on the existing short-term TIP estimates for 2012-2014. Year 2015 is level-funded with 2014, and from 2016 through 2035 an annual inflation rate of 3% is calculated. The statewide items and other programs, such as the bridge program, are estimated using the current TIP/STIP shares and the same 3% annual inflation rate. Additional state financial plan factors have been considered, such as in 2022, where the numbers increase to higher levels reflecting the repayment of the Grant Anticipation Notes (GANS) for the Accelerated Bridge Program.

8.5.2 FEDERAL TRANSIT ADMINISTRATION SOURCE FUNDS

In August 2011, the Cape Cod Region received estimated available funding for transit in tables from the Massachusetts Department of Transportation (MassDOT).

This Federal Transit Administration (FTA) and state matching funding are allocated through the Cape Cod Regional Transportation Plan (RTP) recommendations according to regional priorities and the funding time frame. The Cape Cod Regional Transit Authority (CCRTA), whose Chairman also serves as MPO Member, is a direct recipient of Federal Transit Administration funds. The CCRTA Administrator and its Board work to maintain and operate services through use of these funds in their annual budgeting and the TIP.

In section 8.3, the various transit funding categories through the Federal Transit Administration (FTA) are described. A summary of the estimated available funds for the Cape Cod region from Federal Transit Administration (FTA) are in Table 2; these amounts include estimated state contract funds.

TABLE 2 – ESTIMATED REGIONAL TRANSPORTATION PLAN TRANSIT FUNDING

Massachusetts Transit Program Funding Forecasts
2012-2036
As of August 18, 2011

v 2.3

RTA: CCRTA
Recipient Name: Cape Cod RTA
MPO: Cape Cod MPO

Federal Formula Program		Note	FFY 2012-2016	FFY 2017-2021	FFY 2022-2026	FFY 2027-2031	FFY 2032-2036	Total
§ 5307	Urbanized Area Formula		$ 26,551,897	$ 30,780,926	$ 35,683,529	$ 41,366,990	$ 47,955,679	$ 182,339,020
§ 5309	Capital Fixed Guideway Program	A	$ -	$ -	$ -	$ -	$ -	$ -

Commonwealth Programs for RTA		Note	FFY 2012-2016	FFY 2017-2021	FFY 2022-2026	FFY 2027-2031	FFY 2032-2036	Total
SCA	State Contract Operating Assistance		$ 17,289,736	$ 20,038,000	$ 23,220,000	$ 26,909,000	$ 31,186,000	$ 118,642,736
RTACAP	RTA Capital Assistance Program		$ 1,698,573	$ 2,212,350	$ 2,433,585	$ 2,676,943	$ 2,944,637	$ 11,966,088
ITCCAP	RTA Intermodal Assistance Program	D	$ -	$ -	$ -	$ -	$ -	$ -

Statewide Programs for all eligible participants		Note	FFY 2012-2016	FFY 2017-2021	FFY 2022-2026	FFY 2027-2031	FFY 2032-2036	Total
§ 5310	Elderly/Persons with Disabilities	B	$ 14,542,206	$ 16,837,000	$ 19,481,000	$ 22,543,000	$ 26,097,000	$ 99,500,206
§ 5311	Rural Area/Non Urbanized	B	$ 13,917,629	$ 16,124,000	$ 18,676,000	$ 21,634,000	$ 25,063,000	$ 95,414,629
§ 5311(f)	Intercity bus		$ 2,783,522	$ 3,218,000	$ 3,718,000	$ 4,297,000	$ 4,969,000	$ 18,985,522
MAP	Mobility Assistance Program	C	$ 18,721,340	$ 21,703,164	$ 25,159,916	$ 29,167,238	$ 33,812,823	$ 128,564,481
RBFAP	Regional Bus Fleet Acquisition Program	E	$ 6,500,000	$ 8,250,000	$ 9,075,000	$ 9,982,500	$ 10,980,750	$ 44,788,250
RTAP	Rural Transportation Assistance		$ 542,519	$ 620,000	$ 701,000	$ 800,000	$ 915,000	$ 3,578,519
MassDOT	MassDOT Admin		$ 5,558,272	$ 6,417,000	$ 7,389,000	$ 8,512,000	$ 9,821,000	$ 37,697,272

JARC & New Freedom Programs		Note	FFY 2012-2016	FFY 2017-2021	FFY 2022-2026	FFY 2027-2031	FFY 2032-2036	Total
§ 5316	Jobs Access Reverse Commute	C	$ 15,402,464	$ 17,805,000	$ 20,537,000	$ 23,711,000	$ 27,391,000	$ 104,846,464
	MassDOT Admin		$ 1,179,833	$ 1,358,000	$ 1,561,000	$ 1,796,000	$ 2,071,000	$ 7,965,833
	Boston		$ 8,400,344	$ 9,734,000	$ 11,270,000	$ 13,048,000	$ 15,109,000	$ 57,561,344
	Small Urban		$ 1,568,566	$ 1,811,000	$ 2,086,000	$ 2,406,000	$ 2,777,000	$ 10,648,566
	Rural		$ 649,566	$ 745,000	$ 848,000	$ 970,000	$ 1,110,000	$ 4,322,566
	Central Mass		$ 1,218,213	$ 1,406,000	$ 1,615,000	$ 1,858,000	$ 2,141,000	$ 8,238,213
	Cape Cod		$ 510,298	$ 585,000	$ 661,000	$ 755,000	$ 861,000	$ 3,372,298
	Pioneer Valley		$ 1,875,643	$ 2,166,000	$ 2,496,000	$ 2,878,000	$ 3,322,000	$ 12,737,643
§ 5317	New Freedom	C	$ 11,851,934	$ 13,690,000	$ 15,780,000	$ 18,202,000	$ 21,013,000	$ 80,536,934
	MassDOT Admin		$ 921,992	$ 1,065,000	$ 1,221,000	$ 1,401,000	$ 1,610,000	$ 6,218,992
	Boston		$ 6,595,232	$ 7,641,000	$ 8,848,000	$ 10,245,000	$ 11,870,000	$ 45,199,232
	Small Urban		$ 1,132,658	$ 1,306,000	$ 1,503,000	$ 1,731,000	$ 1,991,000	$ 7,663,658
	Rural		$ 570,042	$ 650,000	$ 740,000	$ 843,000	$ 965,000	$ 3,768,042
	Central Mass		$ 874,160	$ 1,003,000	$ 1,151,000	$ 1,321,000	$ 1,518,000	$ 5,867,160
	Cape Cod		$ 514,742	$ 590,000	$ 666,000	$ 760,000	$ 866,000	$ 3,396,742
	Pioneer Valley		$ 1,243,108	$ 1,435,000	$ 1,651,000	$ 1,901,000	$ 2,193,000	$ 8,423,108

All programs subject to the appropriation of the sponsoring entity.
Federal Program and State Contract Assistance escalations based on 2.00% annual inflation (per Federal Reserve guidance)
State Capital programs are actual programmed through 2016; 10% increase every fifth year thereafter.

A WRTA is only RTA with 5309 funds included
B Competitive program with funding allocated based on actual application and award.
C Competitive program with funding allocated based on actual application and award. Amount displayed reflects upper annual potential award.
D ITCCAP program sunsets by 2014 and merges into RTACAP program

8.6 RECOMMENDATIONS WITHIN AVAILABLE RESOURCES

The Regional Transportation Plan (RTP) programs and projects were derived from the analysis, outreach, and evaluation process, and resulted in the RTP alternatives list. With receipt of the estimated financial resources for the RTP, staff began the process of aligning the expected available revenues, as shown in Table 1, to the RTP highest priorities. The result of this process, proposed Major Infrastructure and Regional Discretionary category funds allocations, are shown in Table 3 on the following page. Each RTP project has an cost estimate for implementation in the current (FY 2012) year . Of course, resources are only expected to be available over the life of the RTP on an annual basis. Therefore, costs for each project in the Year of Expenditure have been increased by four percent per year. The Year of Expenditure is assumed to be the middle-year in each 5-year time band in the following table.

TABLE 3 – ALLOCATION OF AVAILABLE HIGHWAY FUNDING

Project / Program	2012 Total Estimated Cost	Year of Expenditure (YOE) Estimated Cost	Regional Discretionary Source Amount	Major Infrastructure Source Amount	Total YOE Estimated Cost	Years of Funding Source
Barnstable: Hyannis Access Improvements Phase I *#3802*	$ 6,378,549	$7,462,000	$ 0	$7,462,000	$7,462,000	2012-2015
TIP Projects		$32,619,000	$32,619,000		$32,619,000	2012-2015
Subtotal Funding	**$6,378,549**	**$40,081,000**	**$32,619,000**	**$7,462,000**	**$40,081,000**	**2012-2015**
Barnstable: Hyannis Access Improvements Phase II *#3802*	$43,621,451	$55,195,052	$45,166,052	$10,029,000	$55,195,052	2016-2020
TIP Projects		$5,585,948	$5,585,948		$5,585,948	2016-2020
Subtotal Funding	**$43,621,451**	**$60,781,000**	**$50,752,000**	**$10,029,000**	**$60,781,000**	**2016-2020**
Bourne: Route 6 Reconfigure Interchange One *#3305*	$11,500,000	$18,411,871	$8,259,871	$10,152,000	$18,411,871	2021-2025
Capewide: Cape Cod Rail Trail Extensions *#3302* Phase I	$22,422,816	$35,899,651	$30,899,651	$5,000,000	$35,899,651	2021-2025
TIP Projects		$32,723,478	$32,723,478		$32,723,478	2021-2025
Subtotal Funding	**$33,922,816**	**$87,035,000**	**$71,833,000**	**$15,152,000**	**$87,035,000**	**2021-2025**
Capewide: Cape Cod Rail Trail Extensions Phase II *#3302*	$6,265,854	$12,205,261	$12,205,261	$0	$12,205,261	2026-2030
Bourne: Route 25 Access Ramp Widening/Belmont Circle Modification *#4085*	$5,110,000	$9,953,772	$0	$9,953,772	$9,953,772	2026-2030
Sandwich Barnstable Yarmouth : Route 6 Hydroplaning *#4011*	$10,000,000	$19,479,005	$10,918,777	$8,560,228	$19,479,005	2026-2030
Capewide: Transportation Management Center *#3319*	$6,450,000	$12,563,958	$12,563,958	$0	$12,563,958	2026-2030
Orleans, Eastham, Wellfleet, Truro, Provincetown: Route 6 Improvements *#3332*	$5,000,000	$9,739,502	$9,739,502	$0	$9,739,502	2026-2030
Bourne: Otis Rotary Area Improvements *#3315*	$5,000,000	$9,739,502	$9,739,502	$0	$9,739,502	2026-2030
TIP Projects		$35,000,000	$35,000,000		$35,000,000	2026-2030
Subtotal Funding	**$37,825,854**	**$108,681,000**	**$90,167,000**	**$18,514,000**	**$108,681,000**	**2026-2030**
Capewide: Year-Round Daily Rail Service *#3306*	$16,000,000	$37,918,701	$30,456,701	$7,462,000	$37,918,701	2031-2035
Mashpee: Mashpee Rotary Ring Roads *#3362*	$20,000,000	$47,398,376	$33,398,376	$14,000,000	$47,398,376	2031-2035
TIP Projects		$40,672,923	$40,672,923		$40,672,923	2031-2035
Subtotal Funding	**$36,000,000**	**$125,990,000**	**$104,528,000**	**$21,462,000**	**$125,990,000**	**2031-2035**

The Cape Cod Region has worked cooperatively with partners and stakeholders in an ongoing effort to assess, maintain, and improve the region's transportation system. Within the previous expenditures, there are many different types of projects that have been supported through the process. These include contributions to: property acquisition adjacent to Route 6 in Provincetown, movement and landscaping of Nauset Light in Eastham, Route 132 Boulevard in Barnstable, Sagamore area improvements in Bourne, along with CCRTA transit services.

Balancing the expenditures to the region's needs is increasingly difficult within the available federal, state, and local resources. The condition of the roadway system is always a top concern for the region, and that includes an ongoing look at safety issues. It is also an ongoing process with the stakeholders and partners as individual projects and/or programs move forward. Annual expenditures for a particular category can vary from 10% - 100% in a given year. One example is the extensions of the bikeways on Cape Cod that are increasingly used for all trip types, and also provide a healthful benefit for the rider and the climate while reducing roadway congestion. This type of project is considered "Mobility" and can, in an individual year, use much of that year's funding. The Shining Sea Bikeway extension was programmed at $4.8 million in the TIP, and was recently completed in Falmouth. Other projects combine multiple modes to improve vehicular, bicycle, and pedestrian operations, and therefore are difficult to categorize as purely "roadway" improvements. Therefore, the task of projecting future funds by type within the limited resources is difficult, and is included for planning purposes here.

TABLE 4 – ESTIMATED REGIONAL DISCRETIONARY EXPENDITURES
(In Million Dollars)

	Anticipated 2012-2015 Costs (Based on the TIP)		**2016 - 2020**	**2021 - 2025**	**2026 - 2030**	**2031 - 2035**	**Total 2016-2035**	**Percentages 2016-2035**
Roadway Reconstruction/ Resurfacing	$ 10.3		$ 1.8	$ 10.8	$ 11.6	$ 13.4	$ 37.6	33%
Safety	$ 7.1		$ 1.4	$ 8.2	$ 8.8	$ 10.1	$ 28.5	25%
Mobility	$ 15.2		$ 2.4	$ 13.7	$ 14.7	$ 17.1	$ 47.9	42%
Total	$ 32.6		$ 5.6	$ 32.7	$ 35	$ 40.6	$ 114	100%

The following table provides a list of bridge projects within the Cape Cod region with estimated costs of over $10 million that are currently scheduled for advertisement.

TABLE 5 – PROJECTS FUNDED BY THE ACCELERATED BRIDGE PROGRAM/GANS

City/Town	Project	Estimated Cost	2012 – 2015	2016 – 2020	2021 – 2025	2026 – 2030
Chatham	Bridge Street bridge over the Mitchell River	$14,400,000	$14,400,000			
TOTAL ACCELERATED BRIDGE PROGRAM/ GANS		$14,400,000	$14,400,000			

Design financing and oversight is typically performed by the project proponent, who may also be the facility owner. Many of the Cape Cod Towns have contributed design funds for projects to be implemented or constructed through the MPO process funds. All projects seeking Federal Highway Administration (FHWA)/state funds are required to have the project designs reviewed by the MassDOT Highway Division. A public hearing is held at the 25% design stage. Many project proponents have early local public input meetings during the project development process in addition to the official 25% design stage public hearing.

Projects that are recommended in this Regional Transportation Plan for Cape Cod will move forward in the short range budget for implementation—the Cape Cod Transportation Improvement Program (TIP), as the project designs are developed. The TIP aligns the projects within the next four specific years for advertising and/or implementation. The TIP is required under federal legislation to be updated at least every four years. In the Commonwealth of Massachusetts the TIP is typically updated each year by the Cape Cod Metropolitan Planning Organization (MPO), in cooperation with state and federal partners. The MPO meetings are all public and input is welcome.

8.7 CONCLUSION

The recommended priorities to move forward in this Regional Transportation Plan (RTP) are contained within the financial resources estimated to be available for the region over the RTP time frame. Therefore, the RTP is financially constrained.

The Cape Cod region continues to collect transportation system condition, usage, and safety data and analyze it as part of the ongoing planning process. Development and implementation of the RTP guides future transportation improvements. However, it should be noted that although this plan extends to 2035, the RTP is currently updated every four years. Therefore, the shorter-range recommended projects are beginning the design process now in order to move forward toward implementation.

CAPE COD COMMISSION

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CAPE COD
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Cape Cod 2012
Regional Transportation Plan
2012-2035

AIR QUALITY CONFORMITY

July 18, 2011

Air Quality Conformity

INTRODUCTION

The 1990 Clean Air Act Amendments (CAAA) require Metropolitan Planning Organizations within ozone nonattainment areas to perform air quality conformity determinations prior to the approval of Regional Transportation Plans (RTPs) and Transportation Improvement Programs (TIPs). Conformity is a way to ensure that federal funding and approval goes to those transportation activities that are consistent with air quality goals. This section presents information and analyses for the air quality conformity determination for the 2012 Regional Transportation Plan of the Cape Cod MPO, as required by Federal Regulations 40 CFR Parts 51 and 93, and the Massachusetts Conformity Regulations (310 CMR 60.03). This information and analyses include: regulatory framework, conformity requirements, planning assumptions, emissions budgets, and conformity consultation procedures.

BACKGROUND

The Commonwealth of Massachusetts is classified as serious nonattainment for ozone, and is divided into two nonattainment areas. The Eastern Massachusetts ozone nonattainment area includes Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Suffolk, and Worcester counties. Berkshire, Franklin, Hampden, and Hampshire counties comprise the Western Massachusetts ozone nonattainment area. With these classifications, the 1990 Clean Air Act Amendments (CAAA) required the Commonwealth to reduce its emissions of volatile organic compounds (VOCs) and nitrogen oxides (NOx), the two major precursors to ozone formation to achieve attainment of the ozone standard.

In April 2002, the cities of Lowell, Waltham, Worcester and Springfield were re-designated to attainment for carbon monoxide with EPA-approved limited maintenance plans. In April 1996, the communities of Boston, Cambridge, Chelsea, Everett, Malden, Medford, Quincy, Revere, and Somerville were classified as attainment for carbon monoxide (CO). Air quality conformity analysis must still be completed in these communities, as they have a carbon monoxide maintenance plan approved into the state implementation plan (SIP). The year 2010 carbon monoxide motor vehicle emission budget established for the Boston CO attainment area with a maintenance plan is 228.33 tons of carbon monoxide per winter day.

A prior conformity determination for all RTPs occurred in 2007, when the Federal Highway Administration (FHWA) – in consultation with the Environmental Protection Agency (EPA New England) and the Massachusetts Department of Environmental Protection (DEP) – confirmed that all 13 of the RTPs for the year 2007 in Massachusetts were in conformity with the Massachusetts State Implementation Plan (SIP). A summary of major conformity milestones in recent years is as follows:

Between 2003 and 2006, several new conformity determinations were made that were triggered by various events, including: The 2003 regional transportation plans, a change in designation from the one-hour ozone standard to an eight-hour ozone standard, and various changes to regional TIPs that involved reprogramming transportation projects across analysis years.

In 2007, air quality analyses were conducted on behalf of all the 2007 Regional Transportation Plans (RTPs), the purposes of which were to evaluate the RTPs' air quality impacts on the SIP. Conformity determinations were performed to ensure that all regionally significant projects were included in the RTPs. The Massachusetts Department of Transportation found the emission levels from the 2007 Regional Transportation Plans to be in conformance with the SIP.

On April 2, 2008, EPA found that the 2008 and 2009 motor vehicle emissions budgets (MVEBs) in the January 31, 2008 Massachusetts 8-hour ozone State Implementation Plan revision were adequate for transportation conformity purposes. The submittal included 2008 and 2009 MVEBs for the Boston-Lawrence-Worcester (Eastern Massachusetts) and Springfield (Western Massachusetts) 8-hour ozone nonattainment areas. Massachusetts submitted these budgets as part of the 8-hour ozone attainment demonstration and reasonable further progress plan for both nonattainment areas, and as a result of EPA's adequacy finding, these budgets were required to be used for conformity determinations. EPA later determined (in 2010) that only the most recent MVEBs - 2009 - be used for future conformity determinations.

In 2010, air quality analyses were conducted on behalf of all the 2011-2014 Regional Transportation Improvement Programs (TIPs), the purposes of which were to evaluate the TIPs' air quality impacts on the SIP. Conformity determinations were performed to ensure that all regionally significant projects were included in the TIPs. The Massachusetts Department of Transportation found the emission levels from the 2011-2014 TIPs to be in conformance with the SIP. On November 15, 2010, EPA confirmed that both the Eastern and Western Massachusetts Non-Attainment areas collectively demonstrated transportation conformity, with concurrence from Massachusetts DEP on 11/23/10. On December 22, 2010, FHWA and FTA determined that the TIPs were in conformity with the Clean Air Act and the EPA conformity regulations (40 CFR Part 51).

CONFORMITY REGULATIONS

The CAAA revised the requirements for designated MPOs to perform conformity determinations by ozone non-attainment area for their RTPs and TIPs. Section 176 of the CAAA defines conformity to a State Implementation Plan to mean conformity to the plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of the standards. The Cape Cod MPO must certify that all activities outlined in the 2012 Cape Cod Regional Transportation Plan:

- will not cause or contribute to any new violation of any standard in any area
- will not increase the frequency or severity of any existing violation of any standard in any area
- will not delay the timely attainment of any standard or any required interim emission reductions or other milestones in any area

The federal conformity regulations from EPA set forth requirements for determining conformity of Transportation Plans, Transportation Improvement Programs, and individual projects. The requirements of the conformity analysis are summarized below and will be explained in detail in this conformity determination:

- Conformity Criteria
- Horizon Years
- Latest planning assumptions
- Latest emission model used
- Timely implementation of transportation control measures (TCMs)
- Conformity in accordance with the consultation procedures and SIP revisions
- Public Participation Procedures
- Financially Constrained Document
- Procedures for Determining Regional Transportation Emissions
- The Conformity Test
- Consistent with emission budgets set forth in SIP
- Contribute to reductions in CO nonattainment areas

In addition, the regulations set specific requirements for different time periods depending on the timeframe of the Commonwealth's SIP submittals to EPA. These periods are defined as follows:

Control Strategy Period: Once a control strategy SIP has been submitted to EPA, EPA has to make a positive adequacy determination of the mobile source emission budget before such budget can be used for conformity purposes. The conformity test in this period is consistency with the mobile source emission budget.

Maintenance Period is the period of time beginning when the Commonwealth submits and EPA approves a request for redesignation to an attainment area, and lasting for 20 years. The conformity test in this period is consistency with the mobile source emission budget.

HORIZON YEAR REQUIREMENTS

Horizon years for regional and state model analyses have been established following 40 CFR 93.106(a) of the Federal Conformity Regulations. The years for which the regional and state transportation models were run for ozone precursor emission estimates are shown below:

- 2010: Milestone Year – This year is now being used by the statewide travel demand model as the new base year for calculation of emission reductions of VOCs and NOx.

- 2016: Milestone Year and Analysis Year: This year is used to show conformity with the existing emission budgets for ozone precursors in Western Massachusetts.

- 2020: Analysis Year
- 2025: Analysis Year
- 2035: Horizon Year – last forecast year of the regional transportation plan

LATEST PLANNING ASSUMPTIONS

Section 93.110 of the Federal Conformity Regulations outlines the requirements for the most recent planning assumptions that must be in place at the time of the conformity determination. Assumptions must be derived from the estimates of current and future population, households, employment, travel, and congestion most recently developed by the MPO. For the 2012 Cape Cod Regional Transportation Plan and other regional plans, the MassDOT developed a series of forecasts – in cooperation with all the MPOs – that represent the most recent planning assumptions for all of Massachusetts.

TRANSIT OPERATING POLICY ASSUMPTIONS

For the Cape Cod MPO, the operating policies and assumed transit ridership have not changed since the conformity determination prepared for the 2007 Transportation Plan.

LATEST EMISSIONS MODEL

Emission factors used for calculating emission changes were determined using MOBILE 6, the model used by DEP in determining motor vehicle emission budgets. Emission factors for motor vehicles are specific to each model year, pollutant type, temperature, and travel speed. MOBILE 6 requires a wide range of input parameters including inspection and maintenance program information and other data such as anti-tampering rates, hot/cold start mix, emission failure rates, vehicle fleet mix, fleet age distribution, etc. The input variables used in this conformity determination were received from DEP and approved by EPA.

TIMELY IMPLEMENTATION OF TRANSPORTATION CONTROL MEASURES

Transportation Control Measures (TCMs) have been required in the SIP in revisions submitted to EPA in 1979 and 1982. All SIP TCMs have been accomplished through construction or through implementation of ongoing programs. All of the projects have been included in the Region's Transportation Plan (present of past) as recommended projects or projects requiring further study. A list of those projects include:

DEP submitted to EPA its strategy of programs to show Reasonable Further Progress of a 15% reduction of VOCs in 1996 and the further 9% reduction of NOx toward attainment of the National Ambient Air Quality Standards (NAAQS) for ozone in 1999. Within that strategy there are no specific TCM projects. The strategy does call for traffic flow improvements to reduce congestion and, therefore, improve air quality. Other transportation-related projects that have been included in the SIP control strategy are listed below:

- Enhanced Inspection and Maintenance Program
- California Low Emission Vehicle Program
- Reformulated Gasoline for On- and Off-Road Vehicles
- Stage II Vapor Recovery at Gasoline Refueling Stations
- Tier I Federal Vehicle Standards

CONSULTATION PROCEDURES

The final conformity regulations require that the MPO make a conformity determination according to consultation procedures set out in the federal and state regulations, and the MPO must also follow public involvement procedures established under federal metropolitan transportation planning regulations. The consultation requirements of both the state and federal regulations require that the Cape Cod MPO (and all other MPOs), MassDOT, Mass. DEP, US EPA - Region 1 and FHWA – Massachusetts Division, consult on the following issues:

- Selection of regional emissions analysis models including model development and assessment of project design factors for modeling
- Selection of inputs to the most recent EPA-approved emissions factor model
- Selection of CO hotspot modeling procedures, as necessary
- Identification of regionally significant projects to be included in the regional emissions analysis
- Identification of projects which have changed in design and scope
- Identification of exempt projects
- Identification of exempt projects that should be treated as non-exempt because of adverse air quality impacts
- Identification of the latest planning assumptions and determination of consistency with SIP assumptions

These issues have all been addressed through consultation among the agencies listed above.

PUBLIC PARTICIPATION PROCEDURES

Title 23 CFR Section 450.322 and 310 CMR 60.03(6)(h) require that the development of the Regional Transportation Plan, TIP, and related certification documents provide an adequate opportunity for public review and comment. Section 450.316(b) also establishes the outline for MPO public participation programs.

Provide a brief description of your region's public participation program, and include how and when this plan will be noticed in newspaper(s), by website, other locations available, etc.

The Draft RTP will be made available as per the 2007 Public Participation Plan. The Draft RTP will be presented at local public meetings during the public comment period with broad notice to the community through mail and posting. The Draft RTP will also be posted online at the Cape Cod Commission transportation / MPO web site: www.gocapecod.org/rtp.

Meetings expected to have the Draft RTP for discussion include, tentatively:

Date	Meeting	Location
July 18, 2011	MPO Meeting	Barnstable
August 3, 2011	Public Meeting	Barnstable
August 12, 2011	CCJTC Meeting	Barnstable
August 22, 2011	MPO Meeting	Barnstable

All meetings are tentative, pending the release of the Draft RTP by the MPO on July 18, 2011.

FINANCIAL CONSISTENCY

Title 23 CFR Section 450.322 and 40 CFR 93.108 require the 2012 Cape Cod Regional Transportation Plan to "be financially constrained by year and include a financial plan that demonstrates which projects can be implemented using current revenue sources and which projects are to be implemented using proposed revenue sources."

The 2012 Plan is financially constrained to projections of federal and state resources reasonably expected to be available during the appropriate time frame. Projections of federal resources are based upon the estimated apportionment of the most recent federal authorizations, as allocated to the region by the state or as allocated among the various MPOs according to federal formulae or MPO agreement. Projections of state resources are based upon the allocations contained in the current Transportation Bond Bill and historic trends. Therefore, the 2012 Plan substantially complies with the federal requirements relating to financial planning.

MODEL SPECIFIC INFORMATION

40 CFR Part 93.111 of the federal regulations outlines requirements to be used in the network-based transportation demand models. These requirements include modeling methods and functional relationships to be used in accordance with acceptable professional practice and reasonable for purposes of emission estimation. MassDOT, on

behalf of the Cape Cod MPO, has used the methods described in the conformity regulations in the analysis of this 2012 Regional Transportation Plan.

HIGHWAY PERFORMANCE MONITORING SYSTEM ADJUSTMENTS

As stated in EPA guidance, all areas of serious ozone and carbon monoxide nonattainment must use FHWA's Performance Monitoring System (HPMS) to track daily vehicle-miles of travel (VMT) prior to attainment to ensure that the state is in line with commitments made in reaching attainment of the ambient air quality standards by the required attainment dates. MassDOT provided HPMS information to DEP. DEP used this information in setting mobile-source budgets for VOC, NOx, and CO in all SIP revisions prior to 1997. DEP has since revised its VOC and NOx budgets using transportation-demand model runs. However, the models must still be compared to HPMS data since HPMS remains the accepted tracking procedure as outlined in the regulations.

The conformity regulations require that all model-based VMT be compared with the HPMS VMT to ensure that the region is in line with VMT and emission projections made by DEP. An adjustment factor that compares the 2010 HPMS VMT to the 2010 transportation model VMT has been developed. This adjustment factor is then applied to all modeled VOC and NOx emissions for the years 2016 through 2035 to ensure consistency with EPA-accepted procedures.

2010 HPMS 6,869,000 VMT = Adjustment factor = 1.541 for Cape Cod

2010 Modeled 4,456,118 VMT for VOC and NOx

HPMS adjustment factors, calculated on a regional basis, are applied to the model output of future scenarios, and they change as base-year models are updated or improved, or as HPMS data is revised or updated. The latest factors for Eastern Massachusetts are as follows:

REGION	2010 HPMS VMT (miles)	Travel Demand Model VMT (miles)	HPMS/Model Conversion Factor
Cape Cod	6,869,000	4,456,118	1.541
Central Massachusetts	14,564,000	11,924,422	1.221
Martha's Vineyard	266,000	224,944	1.183

	2010 HPMS	Travel Demand	HPMS/Model
Merrimack Valley	9,353,000	9,143,834	1.023
Boston	60,751,000	71,225,035	0.853
Montachusett	5,015,000	4,392,193	1.142
Nantucket	153,000	71,899	2.128
Northern Middlesex	6,523,000	6,735,326	0.968
Old Colony	6,883,000	6,549,927	1.051
Southeastern Massachusetts	14,710,000	13,745,040	1.070
Eastern MA	125,087,000	128,468,738	0.974
State Total	148,937,000	142,159,733	1.048

CHANGES IN PROJECT DESIGN SINCE THE LAST CONFORMITY DETERMINATION ANALYSIS

The Commonwealth requires that any change in project design from the previous conformity determination for the region is identified. Changes that have occurred since the last conformity determination in 2010 are as follows:

- The modeled base year has changed from 2007 to 2010.
- A new analysis year has been included in the conformity determination. An air quality analysis has been completed for 2016. This complies with EPA's Transportation Conformity Rule Restructuring Amendments (40 CFR Part 93.118, expected to become effective August 2011) which states that "if the attainment date has not yet been established, the first analysis year must be no more than five years beyond the year in which the conformity determination is being made." (2011 base to 2016 analysis year).
- Emission factors have been developed for 2010, 2016, 2020, 2025, and 2035 using Mobile 6.2 with inputs approved by Mass DEP and US EPA.
- New HPMS adjustment factors have been developed for the new 2010 base year.

PROCEDURES FOR DETERMINING REGIONAL TRANSPORTATION EMISSIONS

The federal conformity regulations set specific requirements for determining transportation emissions, which are estimated from a combination of emission rates, HPMS volume data, and travel demand model projections. Travel demand models use estimates of population, households, and employment to project future travel volumes and patterns. Chapter X of the Plan presents these estimates as part of the existing and future regional transportation system.

Only “regionally significant” projects are required to be included in the travel demand modeling efforts. The final federal conformity regulations define regionally significant as follows:

Regionally significant: a transportation project (other than an exempt project) that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sport complexes, etc., or transportation terminals as well as most terminals themselves) and would be included in the modeling of a metropolitan area's transportation network, including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel.

In addition, specific classes of projects have been exempted from regional modeling emissions analysis. The categories of exempt projects include:

- Intersection channelization projects
- Intersection signalization projects at individual intersections
- Interchange reconfiguration projects
- Changes in vertical and horizontal alignment
- Truck size and weight inspection stations
- Bus terminals and transfer points

Previous conformity amendments now allow traffic signal synchronization projects to be exempt from conformity determinations prior to their funding, approval or implementation. However, once they are implemented, they must be included in conformity determinations for future plans and TIPs

The milestone and analysis year transportation model networks are composed of projects proposed in this RTP. Projects in these networks consist of all in-place regionally significant projects that can reasonably be expected to be completed by a given analysis/horizon year with consideration of available funding commitments. This project group would include, but not be limited to, regionally significant projects where at least one of the following steps has occurred within the past three years:

- Comes from the first year of a previously conforming TIP,
- Completed the NEPA process, or
- Currently under construction or are undergoing right-of-way acquisition

A complete listing of future regionally significant projects for the entire Eastern Massachusetts Ozone Non-Attainment Area is provided below:

REGIONALLY SIGNIFICANT PROJECTS INCLUDED IN THE REGIONAL TRANSPORTATION MODELS FOR THE EASTERN MASSACHUSETTS OZONE NON-ATTAINMENT AREA

Analysis Year	Community	Project Description – Boston Region
2016	Bedford, Burlington	Middlesex Turnpike Improvements Phases 1and 2
2016	Bellingham	Pulaski Boulevard
2016	Boston	Fairmount Line Improvements, including new stations
2016	Boston	East Boston Haul Road/Chelsea Truck Route (new grade separated roadway)
2016	Concord, Lincoln	Route 2/Crosby's Corner (grade separation)
2016	Danvers	Route 128/Route 35 and Route 62
2016	Hudson	Route 85 (capacity improvements from Marlborough TL to Rte 62)
2016	Marshfield	Route 139 Widening (to 4 lanes between School St. and Furnace St.)
2016	Quincy	Quincy Center Concourse, Phase 2 (new roadway: Parking Way to Hancock St.)
2016	Randolph to Wellesley	Route 128 Additional Lanes
2016	Somerville	Assembly Square Orange Line Station
2016	Somerville	Assembly Square Roadways (new and reconfigured)
2016	Weymouth, Hingham, Rockland	South Weymouth Naval Air Station Access Improvements
2016	Region-wide	1000 Additional Park and Ride Spaces
Analysis Year	**Community**	**Description of Recommended Plan Projects– Boston Region**
2016	Beverly	Beverly Station Commuter Rail Parking Garage
2016	Boston	Conley Haul Road
2016	Salem	Salem Station Commuter Rail Parking Garage Expansion
2016	Somerville, Cambridge, Medford	Green Line Extension to Medford Hillside/Union Square
2016	Weymouth	Route 18 Capacity Improvements
2020	Bedford, Burlington, Billerica	Middlesex Turnpike Improvements Phase 3 – widening Plank St. to Manning Rd.
2020	Boston	Sullivan Square/Rutherford Avenue Improvements
2020	Hanover	Route 53 Final Phase (widening to 4 lanes between Rte 3 and Rte 123)
2020	Salem	Bridge Street (widening to 4 lanes between Flint and Washington St.)
2020	Somerville, Medford	Green Line Extension to Mystic Valley Parkway (Route 16)
2025	Canton	I-95 (NB)/Dedham Street Ramp/Dedham Street Corridor (new ramp with widening on Dedham St. from I-95 to University Ave.)
2025	Canton	I-95/I-93 Interchange (new direct connect ramps)
2025	Newton, Needham	Needham Street/Highland Avenue (includes widening Charles River Bridge)
2025	Woburn	Montvale Avenue (widening between Central St. to east of Washington St.)

2025	Woburn	New Boston Street Bridge (reestablish connection over MBTA Lowell line)
Analysis Year	**Community**	**Description of Recommended Plan Projects– Boston Region (continued)**
2035	Braintree	Braintree Split - I-93/Route 3 Interchange
2035	Framingham	Route 126/135 Grade Separation
2035	Reading, Woburn, Stoneham	I-93/I-95 Interchange (new direct connect ramps)
2035	Revere, Malden, Saugus	Route 1 (widening from 4 to 6 lanes between Copeland Circle and Rt. 99)
2035	Wilmington	Tri-Town Interchange (new “Lowell Junction” interchange on I-93 between Route 125 and Dascomb Rd.)
Analysis Year	**Community**	**Project Description – Cape Cod Region**
2020	Barnstable	Yarmouth Road / Rte. 28 (widening to 4 lanes median & bike / ped) with Hyannis Access Improvements
2025	Bourne	Rte. 6 Exit 1 WB on-ramp changes and interchange improvements
2035	Bourne	Route 25 Access Ramp widening / Belmont Circle two-way travel
2035	Capewide	Daily Passenger Rail Service: between Hyannis – Middleborough for connections to Boston and Providence, RI
2035	Mashpee	Mashpee Rotary Ring Roads (connectors, Great Neck Rd., Rtes. 28 and 151.)
Analysis Year	**Community**	**Project Description - Central Massachusetts Region**
2016	Northborough	Rte 20 Church to South, signal coordination in corridor
2016	Shrewsbury/Worcester	Rte 9 Bridge over Lake Quinsigamond: widening, additional lane each direction
2016	Auburn	Rte 12/20 to Auburn TL capacity improvements and raised median
2016	Worcester	Lincoln/Highland/Pleasant Streets intersection corridor improvements, minor widening, select signal coordination
2016	Worcester	Route 20 Widening to a consistent 4 lanes
2020	Charlton, Oxford	Route 20 Widening to a consistent 4 lanes
2025	Westborough, Hopkinton	I-90/I-495 and I-495/Rt 9 Interchange Improvements (CD or frontage roads)
2035	Worcester	Route 122/122A Madison St/Chandler St. Kelley Square to Pleasant St: various improvements and signal coordination
2035	Worcester	I-290 Hope Ave. (to full interchange and roundabout at Webster and Hope)
2035	Millbury, Sutton	Route 146 Improvements: Route 122A to Central Turnpike
Analysis Year	**Community**	**Project Description – Martha’s Vineyard Region**
n/a	n/a	none
Analysis Year	**Community**	**Project Description – Merrimack Valley Region**
2016	Amesbury	Route 110 from I-495 to I-95 (widen from 2 lanes to 4)
2020	Newburyport, Amesbury	I-95 over Merrimack River (Whittier Bridge widening from 6 to 8 lanes)
2020	Methuen	Route 110/113 (Methuen Rotary – new interchange ramps at I-93)
2025	Lawrence, North Andover	Route 114 (widening from I-495 to Waverly Road)
2035	Andover	Tri-Town Interchange (new “Lowell Junction” interchange on I-93 between Route 125 and Dascomb Rd.) and I-93 widening to 4 lanes in each direction from new interchange/current “lane drop” area to I-495.
Analysis Year	**Community**	**Project Description – Montachusett Region**

2016	Fitchburg/Westminster	New Wachusett Commuter Rail Station
2016	Ayer to South Acton	Fitchburg Line Commuter Rail Improvements (double track)
2020	Leominster	Route 13 Hawes St. to Prospect St. (some widening, new signals, etc)
2025	Athol	New Interchange on Route 2 at South Athol Road
Analysis Year	**Community**	**Project Description – Nantucket Region**
n/a	n/a	none
Analysis Year	**Community**	**Project Description – Northern Middlesex Region**
2016	Westford	Route 110 Minot's Corner to Nixon widen to 4 lanes
2020	Billerica	Middlesex Turnpike Improvements Phase 3 – widening Plank St. to Manning Rd.
2035	Tewksbury	Tri-Town Interchange (new "Lowell Junction" interchange on I-93 between Route 125 and Dascomb Rd.) and I-93 widening to 4 lanes in each direction from new interchange/current "lane drop" area to I-495.
2035	Westford	I-495 at Boston Road (Exit 32) widening of on and off ramps
2035	Lowell, Tewksbury, Chelmsford, and Westford	I-495 Additional travel lane each direction between Exits 32 and 35 and between Exits 37 and 40
2035	Lowell	Wood Street, Rourke Bridge: new bridge, widening and corridor improvements
Analysis Year	**Community**	**Project Description – Old Colony Region**
2016	Abington	Route 18 - Widening to 4 Lanes from Route 139 to Highland Rd.
2020	Brockton	Route 123 - Widen from Route 24 to Angus Beaton Drive
2020	Bridgewater n/a	Route 24 - Add Northbound Slip Ramp from Route 104 WB to Route 24 NB Northbound
2020	Plymouth	Route 3 - Add Northbound on-Ramp at Long Pond Road (Exit 5)
2020	Plymouth	Long Pond Road Bridge widening (Exit 5)
2025	Brockton	Main Street, Warren Avenue, Spring Street, West Elm Street, Belmont Street - Reestablish Two-Way Circulation
2025	West Bridgewater	Route 106 - Widening from 2 to 4 Lanes between Route 24 and Route 28
2035	Plymouth	Route 3 – Add NB Off-ramp to Plimouth Plantation Hwy (Exit 4)
2035	Plymouth	Route 25 - Add New Interchange Before Exit 1 and connect to Bourne Road
2035	West Bridgewater	Route 28, Route 106, Central Square Signal and intersection coordination
Analysis Year	**Community**	**Project Description – Southeastern Massachusetts Region**
2016	Fall River, Somerset	New Brightman Street Bridge - capacity improvements to 4 lane divided facility
2016	Fall River	Route 79/Davol Street (interchange improvements and new traffic circulation)
2016	Freetown	Route 24 - New Interchange (Exit 8 ½)
2016	Mansfield	Route 140 / I-495 New Southbound On-Ramp
Analysis Year	**Community**	**Project Description – Southeastern Massachusetts Region (continued)**
2020	Dartmouth	Route 6 (Faunce Corner Rd) / I-195 Interchange - Bridge Widening to 5 Lanes
2035	Taunton	Route 24 / 140 - Interchange Reconstruction

AIR QUALITY CONFORMITY ANALYSIS

The emissions from the following MPOs have been combined to show conformity with the SIP for the Eastern Massachusetts Ozone Nonattainment Area:

- Cape Cod MPO
- Central Massachusetts MPO
- Merrimack Valley MPO
- Boston MPO
- Montachusett Region MPO
- Northern Middlesex MPO
- Old Colony MPO
- Southeastern Region MPO
- Martha's Vineyard Commission*
- Nantucket Planning and Economic Development Commission*

* These regions do not contain any official urbanized areas, but are considered to be MPOs for planning purposes.

Using the latest planning assumptions, the Massachusetts Department of Transportation, Office of Transportation Planning, in coordination with MPO staff, estimated the emissions for VOC and NOx for all MPOs in Eastern Massachusetts through a combination of the statewide and Boston Region travel demand models. The VOC mobile source emission budget for 2009 and beyond for the Eastern Massachusetts Nonattainment Area has been set at 63.50 tons per summer day and the 2009 (and beyond) mobile source budget for NOx is 174.96 tons per summer day. As shown in Tables 1 and 2, the results of the air quality analysis demonstrate that the VOC and NOx emissions from all Action scenarios are less than the VOC and NOx emissions budgets for the Eastern Massachusetts Nonattainment Area:

TABLE 1: VOC EMISSIONS ESTIMATES FOR THE EASTERN MASSACHUSETTS OZONE NONATTAINMENT AREA (ALL EMISSIONS IN TONS PER SUMMER DAY)

Year	Cape Cod Action Emissions	Eastern MA Action Emissions	Budget	Difference (Action - Budget)
2010	n/a	64.974	n/a	n/a
2016	1.9519	36.232	63.50	-27.268
2020	1.7496	32.386	63.50	-31.114
2025	1.6404	30.988	63.50	-32.512
2035	1.6981	31.063	63.50	-32.437

TABLE 2: NOX EMISSIONS ESTIMATES FOR THE EASTERN MASSACHUSETTS OZONE NONATTAINMENT AREA (ALL EMISSIONS IN TONS PER SUMMER DAY)

Year	Cape Cod Action Emissions	Eastern MA Action Emissions	Budget	Difference (Action - Budget)
2010	n/a	178.925	n/a	n/a
2016	3.3645	66.219	174.96	-108.741
2020	2.2223	45.188	174.96	-129.772
2025	1.6799	36.521	174.96	-138.439
2035	1.4689	29.038	174.96	-145.922

The Cape Cod MPO has conducted an air quality analysis of the 2012 Cape Cod Regional Transportation Plan and its latest conformity determination. The purpose of the analysis is to evaluate the air quality impacts of the Plan on the SIP. The analysis evaluates the change in ozone precursor emissions (VOCs, and NOx) due to the implementation of the 2012 Cape Cod Regional Transportation Plan. The modeling procedures and assumptions used in this air quality analysis follow guidance from EPA and the Commonwealth and are consistent with all present and past procedures used by the Massachusetts DEP to develop and amend the SIP.

MassDOT has found the emission levels from all MPOs in Eastern Massachusetts – including from the 2012 Cape Cod Regional Transportation Plan – to be in conformance with the SIP according to conformity criteria. Specifically, the following conditions are met:

- The VOC emissions for the Action (build) scenarios are less than the 2009 VOC motor vehicle emission budget for analysis years 2016 through 2035.

- The NOx emissions for the Action (build) scenario are less than the 2009 NOx motor vehicle emission budget for analysis years 2016 through 2035.

In accordance with Section 176(c)(4) of the Clean Air Act as amended in 1990, the MPO for the Cape Cod Region has completed its review and hereby certifies that the 2012 Cape Cod Regional Transportation Plan and its latest conformity determination satisfies the conformity criteria where applicable, and therefore conditionally conforms with 40 CFR Parts 51 and 93, and 310 CMR 60.03, and is consistent with the air quality goals in the Massachusetts State Implementation Plan.

CAPE COD COMMISSION

2012 REGIONAL TRANSPORTATION PLAN

Appendix: Summary of Changes to Public Draft and Comments Received

Endorsed
August 22, 2011

COUNTY OF BARNSTABLE • MASSACHUSETTS •

Table of Contents

General

- Document referred to as “2012” RTP
- Reformatting (typeface, footers, etc. to conform to CCC style guide)

Chapter 1 – Goals & Objectives

Section 1.1 Transportation Planning Process

Add discussion of role of Unified Planning Work Program (UPWP) in the transportation planning process.

Section 1.2.1 Meetings

Insert date of Public Meeting (August 16, 2011)

Section 1.3 Livability

Include text emphasizing US DOT support for Livability. Add indicators of MPO-endorsed Livability projects to the list in Table 3 (Section 1.5.1)

Section 1.4 Goals of the 2012 Plan – Section 1.4.1 Safety and Security

Included text at end of section to strengthen connection to Massachusetts' *Strategic Highway Safety Plan*

Section 1.4.5 Environmental Protection

Included language describing GreenDOT policy

Section 1.5.1 Transportation Projects since the 2007 Plan

- Corrected text to match total costs in Table 3
- Add indicators of MPO-endorsed Livability projects to the list in Table 3.

Chapter 2 – Existing Conditions

Section 2.1 - Land Use & Environment

Modify section 2.1.7 Greenhouse Gas (GHG) impacts (due to unavailable data)

Section 2.2 - Roadways

- Section 2.2.6 Pavement Management – modify text to identify pavement condition improvement given investment limited by financial constraint
- Section 2.2.12 U.S. Route 6 – Replace "MHD" with MassDOT
- Table 4 – formatting of parentheses

Section 2.7 – Cape Cod Canal Area

Emphasize fact that current year-round traffic levels exceed that of peak summer conditions of a couple of decades ago.

Chapter 3 - Safety

Section 3.3.3 – Coordination with Massachusetts' Strategic Highway Safety Plan (SHSP)

- Included SHSP list of "Emphasis Areas" to strengthen connection between RTP & SHSP.
- Reference in Figure 5 to MassDOT Highway Division

Section 3.3.4 Policies & Strategies

Identified with asterisk items that support SHSP Emphasis Areas.

Section 3.4 Roadway Safety Audits (RSAs)

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

Chapter 4 – Security

Section 4.2 – Public Transportation Security

Included Cape Cod RTA implementation of items on list of "Top 20 Security Program Action Items for Transit Agencies."

Chapter 5 – Bike & Pedestrian Issues

Introduction: Sentence fragment corrected regarding "Cape Cod Bikeways"

Section 5.4.2 – Improvements to Existing Facilities

Added text summarizing public process for project selection

Chapter 7 – Analysis of Alternatives

Updates to Tables 2, 3, and 4 listing state totals of population, employment, and housing forecasts & supporting discussion

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Chapter 8 – Recommendations and Financial Plan

- Completed & corrected financial information in Tables 1-5, including percentage totals of categories.
- Corrected table headings from “2011” to “2012,” inserted rows to create 5-year time bands

Section 8.5.1 Federal Highway Administration Source Funds

Notes regarding inflation (3% per year for revenues)

Section 8.6 Recommendations Within Available resources

Notes regarding inflation (4% per year for costs of projects)

Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Jeffrey B. Mullan, Secretary & CEO

massDOT
Massachusetts Department of Transportation

August 15, 2011

Mr. Glenn Cannon
Technical Services Director
Cape Cod Commission
3225 Main Street P.O. Box 226
Barnstable, MA 02630

Dear Mr. Cannon:

The Office of Transportation Planning has reviewed the draft 2012 Regional Transportation Plan (RTP) released by the Cape Cod Commission on July 18, 2011. I would like to take this opportunity to comment on the draft document released for public review. Please find our comments below:

- Please ensure that the page numbers run consecutively throughout the document, and are not chapter-specific.
- On page 5, the Unified Planning Work Program (UPWP) should also be included as part of the transportation planning process, as it is the work the MPO staff performs on behalf of the MPO to generate and support the project development and prioritization process.
- In Chapter 1, under 1.4.5, Environmental Protection, the RTP should also reference GreenDOT as a recent effort on behalf of the state to protect and preserve our environment.
- In Chapter 1, under 1.5.1, Transportation Projects Since the 2007 Plan, the estimated total cost listed in the language is "nearly 67 million dollars." However, the ensuing table states that the estimated total cost is $86,752,105. Please verify which number is correct and change accordingly.
- In Chapter 2, under 2.2.12, U.S. Route 6, MHD is referenced. Please replace that reference with MassDOT.
- In Chapter 2, under 2.2.4 – 2.2.5, there are some formatting issues concerning the parentheses referencing Tables 4 and 5. Please ensure consistent formatting throughout the document.
- In Chapter 2, under 2.7.9, the major point of this chapter should be emphasized, which is that traffic has increased year-round, and not just seasonally.
- In Chapter 3, in Figure 1, the Draft Infrastructure Safety Project Selection Process chart should refer to MassDOT Highway Division, not MassHighway.

Ten Park Plaza, Suite 3170, Boston, MA 02116
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- In Chapter 4, under 4.2, there are 20 security program action items for transit agencies listed. Please describe to what extent the region and the CCRTA has complied with or implemented these action items.
- In Chapter 5, under the introduction in the second paragraph, the second sentence is a fragment. Please complete the sentence about the "Cape Cod Bikeways."
- In Chapter 5, under 5.4.2, there are sixteen projects proposing improvements listed. Please explain how these projects were chosen and prioritized. Similarly, for other instances of proposed projects, please explain why they were chosen and prioritized.
- In Chapter 8, under 8.4.2, in Table B, please ensure that the project costs reflect Year of Expenditure increases.
- In Chapter 8, under 8.4.2, in Tables A and B, please remove the lines describing "Average Annual Amount." This is misleading the region as to how much funding the region is actually apportioned.
- In Chapter 8, under 8.6.1, in Table 1, please separate the bridge, NHS, and statewide maintenance funding in each five year band to better reflect the amount of funding apportioned to the region in each category.
- In Chapter 8, under 8.6.1, in Table 2, please ensure that the project costs reflect Year of Expenditure increases.
    - In the same table, in the five-year bands of 2011-15 and 2016-20, the amount of major infrastructure available is incorrect. In 2011-15, $7,462,000 is available, and in 2016-20, $10,029,000 is available.
    - In the same table, the funding for 2011-15 and 2016-20 should not be combined. Please separate the funding for these five-year bands into separate line items.

Please feel free to contact me at (617) 973-7844 or Calli Cenizal at (617) 973-8079 if you have any questions.

Sincerely,

David J. Mohler
Executive Director
Office of Transportation Planning

FHWA Comments on Cape Cod MPO RTP

8-9-2011

Previously discussed:

At the end of the Livability chapter (1.3)

I recommend that this section make reference to the fact that the US DOT considers the principle of Livability to be essential to the success of regional transportation planning. I also recommended that the chapter refer to some livability initiatives / projects that the MPO has endorsed, which support federal and state initiatives to include livability in the transportation network.

1.4 Goals of the Plan

I thought the section was well written but also asked you to look at safety goals (section 1.41) and identify goals that are consistent with the state's SHSP. There should be a definite link between the state's Emphasis Areas in the SHSP and the regional safety goals. They do not need to be identical; the region may have pressing safety needs that do not appear in the state's top safety concerns, and so are not readily related to all of the Emphasis Areas, but there should be some consistency. This section should make the link between the two documents, so the reader can appreciate the consistency that Mass DOT and CCMPO share regarding safety needs. I did read the chart that showed the RTP's consistency with the DOT's You Move Massachusetts' Plan.

3.3.3 Coordination with Massachusetts SHSP

I was glad to see this section included, explaining to the reader what the SHSP is. It should also tell the reader where there are commonalities between the SHSP and the region's safety needs, captured in the RTP. This link is important and should be made. I recommend looking through chapter 3.3.4. There are numerous recommended safety improvement methods mentioned. A quick look at the SHSP should help identify which of these bulleted recommendations address Emphasis Areas found in the SHSP. I recommend that an asterisk be used prior to the recommendation and that a footnote be added that defines tose recommendations with an asterisk address Emphasis Areas found in the SHSP.3.4 Roadway Safety Audits

This section includes some great information and lets the reader know that, not only does the MPO consider safety to be of prime importance, but the MPO has endorsed efforts to improve some of the most pressing safety deficiencies in the region. I think this section can be enhanced by adding some text that explains that the RSA was borne directly from the HSIP Program, formally created by SAFETEA-LU and that these efforts align with using data to identify the most serious safety deficiencies responsible for fatal accidents and serious injuries. Again, taking an opportunity to make the link between federal law and state/local efforts to improve safety.

2.2.6 Pavement Management

The Pavement Management section was well thought out and well written. Existing pavement conditions were identified and an improved set of pavement conditions were defined. Looks like about $20 million worth of improvements are identified. A discussion of how affordable this is, should be included. Maybe this is considered in the CCC as affordable, but the discussion of whether or not this is something that the TIP could afford over the next several years should be presented. This is a cost that should also be identified in the O+M chapter and factored into the overall costs and compared to the revenues reasonable expected to be available.

Chapter 8 – Recommendations and Financial Plan

Section 8.4.1, Programs Recommended 2011-2035 should not include the year 2011. This RTP should be considering projects, programs and costs to implement them, as well as revenues expected to be available, between the years 2012 and 2035. The 2011 year should be removed from all financial considerations and discussions.

Projects shown in the Recommendations table (B) in Section 8.4.2 should be shown in 5-year time bands; 2012-2015, 2016-2020, etc… Notably, there are no projects listed that fall within timeframes before 2020. It should be noted that all projects that are to have a federal action taken on them must be specifically named in the 5-year bands of the financial plan and financially represented using Year Of Expenditure dollars. This is to be done using 4% per year, compounded annually, beyond the current year. Please make a notation that explains to the reader that the costs are inflated to account for the time value of money (Year Of Expenditure). The same practice should be applied to revenues; inflate at 3%, not 4%, and use a footnote or another effective way to call the reader's attention to the fact that inflation was applied to the future value of revenue.

It is noted that, as shown, the RTP shows $117,660,349 in projects to be undertaken in the 2035 timeframe. It is not clear if this means between the timeframe of 2030-2035, however, this amount far exceeds the Cape Cod MPO's TIP funding for this timeframe. FHWA has the following questions:

- Have these projects been modeled in the Air Quality model for this timeframe?
- Has financial constraint been observed, by expecting that these projects will be completed within this timeframe?
- How does the MPO plan to fund these projects, within this timeframe?

This discussion will require follow-up.

In the table of Recommended projects (Table B), please remove air quality references. The same projects, and all others that require federal action, or are over $10 Million, should be shown in a similar table, devoted to Air Quality status and modeling year.

Financial Constraint

A similar table should be provided that shows all Operations and Maintenance costs, including pavement management costs. These costs, along with all costs expected to be incurred as a result of constructing individual projects, and other asset management costs for the region, should all be summed and compared to the revenue for the same 5-year time bands. There must be financial constraint within each time band, as well as throughout the entire horizon covered by this plan.

Section 8.6.1,

Table 1, should also not show the funding for 2011. This data is not relevant to the future planning discussed in the RTP.

Table 2 shows projects broken into time bands. These time bands do not align with the revenue time bands in Table 3. For consistency, use 5-year time bands for both tables, and do show all projects individually that exceed $10 Million, or that will require federal action. An example of a federal action is a project requiring FHWA to approve any environmental document, including and above an Individual Categorical Exclusion (CE). Programmatic CEs are approved by Mass DOT.

BFDC
Bourne Financial
Development Corporation

508 457-5305 www.bfdconline.org
P.O. Box 289, Buzzards Bay, MA 02532-0289

Statement for Transportation Planning Public Comment Period

In summary, the mission of the BFDC is to improve the quality of life for Bourne residents. In that context, BFDC Directors are concerned about the public safety hazards, congestion, travel delays and other disruptions caused by the Bourne rotary and its associated access roads.

The BFDC Directors welcome the opportunity for public comment on the region's transportation planning documents: the Regional Transportation Plan for 2011-2035, the Transportation Improvement Program for 2012-2015 and the Unified Planning Work Program for 2012.

Bourne's transportation planning priorities are:

* Completion of Bourne's Downtown Main Street streetscape
* Reconfiguration of Bourne's Downtown road network including Route 25 access ramp/Belmont Circle, Memorial Circle, and the by-pass
* Removal and/or redesign of the Bourne rotary and its approaches and the connections between approaches

In that context, we have the following comments:

Unified Planning Work Program: We are extremely disappointed in noting the absence of any planning efforts concerning the removal/redesign of the Bourne Rotary and its approaches and connections. Congestion around the rotary is not just a tourist problem. People commuting to work from off-Cape or from the Cape to off-Cape sites, people traveling to medical appointments or to the grocery store, drug store and dry cleaners, families taking children to school or after-school programs – all use the bridges every day, all year. And these drivers encounter travel delays, safety concerns, increased pollution, and other hazards in transiting to and from the Bourne Bridge. Removing the rotary will be a multi-year project – we advocate for planning to begin immediately.

Transportation Improvement Program: We are concerned, especially in the context of the statement above, that under "Projects on Need of Funding" there is no mention of planning for changes to the Bourne Rotary, or changing the Route 25 access ramp/Belmont Circle and other Buzzards Bay road reconfigurations which were endorsed by the Bourne Board of Selectmen and presented to the JCT and MPO with enthusiastic responses. Changing the Route 25 access ramp/Belmont Circle would be a quick and relatively inexpensive fix for the congestion frequently encountered on Scenic Highway (Route 6) approaching the Bourne Bridge and the ramp to routes 25 and I-495.

Transportation Improvement Program: We believe that the $7+ million planned for a 2012 resurfacing project for Route 28 (MacArthur Boulevard) in 2012 could be better used for other state highway projects within the Town. The main concern is timing – the Town is working to improve the commercial component of Route 28 which will include altering access to businesses, improving public safety, and other infrastructure alterations. In the context of these changes, resurfacing Route 28 at this time would only have to be repeated, a duplication of expense.

Adopted by vote of the BFDC Board of Directors: August 10, 2011

RECEIVED
AUG 17 2011
Cape Cod Commission

Cape Cod Metropolitan Planning Organization
Priscilla Leclerc, Senior Transportation Planner
c/o Cape Cod Commission

via e-mail

August 17, 2011

Dear Priscilla:

On behalf of the Town of Bourne, I am submitting a copy of a statement voted unanimously by the Bourne Board of Selectmen at its meeting last evening, Tuesday, August 16, 2011. The statement is intended as public comment during the MPO's public comment period on the three draft planning documents: the Cape Cod Regional Transportation Plan, the Cape Cod Transportation Improvement Program for Federal Fiscal Years 2012-2015, and the Unified Planning Work Program for Federal Fiscal Year 2012.

The Selectmen's statement is followed here by a copy of a letter that has been sent to the Massachusetts DOT from the Bourne Planning Board. This is for the information of the MPO members.

Please see that the Selectmen's statement is included in the public comments that will be reviewed by the MPO before it votes to endorse tbe drafts of the RTP, TIP, and UPWP.

Thank you for your assistance.

Sallie K. Riggs

Sallie Riggs

Cc: Tom Guerino, Town Administrator
Coreen Moore, Town Planner
Glenn Cannon, Cape Cod Commission

MOTION: I move that the Board of Selectmen, on behalf of the Town of Bourne, strongly advise the Cape Cod Metropolitan Planning Organization (MPO) to re-prioritize the Unified Planning Work Program to include thorough planning efforts for the reconfiguration or removal of the Bourne Rotary; and further that the MPO support and move forward the Buzzards Bay road configuration project as previously endorsed by the Bourne Selectmen and reviewed by the Joint Transportation Committee and MPO. Additionally, the Selectmen urge that the MPO allocate funds funding for the proposed fixed route regional transit program for both the Towns of Bourne and Sandwich.

We encourage the MPO to reassess the excessive expenditure of seven million dollars for the resurfacing of MacArthur Boulevard and reallocate funding for more substantive projects that will better enhance the quality of life and ease transportation difficulties for all residents of and visitors to Cape Cod.

unanimously approved 8/16/11

[signature], Chair

Don Pickard, Chairman

TOWN OF BOURNE
Planning Board
Bourne Town Hall
24 Perry Avenue
Buzzards Bay, MA 02532
Phone: (508) 759-0615 Fax: (508) 759-0611

August 12, 2011

Ms Pamela Hazner, MassDOT Project Manager
District 5
1000 County Street
Taunton, MA 02780

Re: Route 28 & Route 6 Resurfacing & related Work

Dear Ms. Hazner:

The Bourne Planning Board is submitting this letter in response to a letter dated June 7, 2011 referencing the MassDOT resurfacing projects in the Town of Bourne specifically Route 28 (General MacArthur Boulevard) from the Bourne Bridge to the Bourne/Falmouth Town line and the Route 6 (Mid-Cape Highway).

It is our understanding that the project will basically be a repaving project and not include any infrastructure changes. We appreciate MassDOT efforts to improve the surfacing of the roadway however we feel that there are other significant issues that should be addressed before $7,000,000 ± is spent on resurfacing.

As you know MacArthur Boulevard is a significant local, regional and state roadway. The Town of Bourne has identified MacArthur Boulevard as high priority action item in our Local Comprehensive Plan. Our first concern is that of safety, the other concern is for the local businesses along the boulevard. The Town is currently in the process of requesting an increase in the development of regional impact threshold from the Cape Cod Commission for projects along MacArthur Boulevard. However, we understand that if improvements are not made to the roadway we are limited to the amount of growth that will be able to occur. We believe this is a perfect opportunity to discuss potential improvements along the boulevard not only to improve safety but to enhance the local economy.

We would like to request a meeting to discuss this further. We would also like you to consider delaying the resurfacing project until we are able to discuss potential short term and long term changes along MacArthur Blvd. We would suggest that the following items be part of the discussion:

1. Improvements to the existing turnarounds including reconfiguration, relocation and/or elimination. Especially the turnarounds at the landfill, Waterhouse Road, Clay Pond Road and Barlow's Landing Road.
2. Consolidation of curbcuts in the area of 606 – 630 MacArthur Boulevard by formally creating an access road and or the addition of guardrails or berm to prevent direct access onto MacArthur Boulevard.
3. The addition of a third lane as a breakdown/deceleration lane from rotary to rotary
4. Signage for local businesses
5. Vista pruning of the median to increase visibility of those businesses on the southbound lane.
6. Improvements to the Bourne Rotary that would address backups on MacArthur Blvd north to Bourne Bridge and Sandwich Road, and a total reconfiguration of the rotary including a bypass road.

We would also like to offer the following recommendations for the Route 6 Mid Cape Highway improvements

1. Extend off ramps
2. Improve drainage at the bottom of the bridge
3. Vista pruning to enhance visibility for surrounding businesses

Thank you for your attention in this matter, we look forward to hearing from you.

Sincerely,

Christopher Farrell, Chairman Bourne Planning Board

Cc: Coreen V. Moore, Bourne Town Planner
Bourne Board of Selectmen
Thomas Guerino, Bourne Town Administrator
Ricki Tellier, Bourne DPW Superintendent
Michael Blanton, Bourne rep to the CCC
Bourne's Transportation Advisory Committee
Sallie Riggs, Bourne Financial Development Corporation

Lev Malakhoff

From: John Powers <johns.powers@comcast.net>
Sent: Monday, July 18, 2011 9:46 PM
To: Transportation Information
Subject: 'RTP' Comment

What will people do when 28A or 6B are filled with motor-vehicles (MV)? Your missing the issue completely.

What Cape Cod needs are 'bike lanes', designated only for bicyclists.
Easy by allowing 1 meter (4 feet) of the road upon major roads, almost like a shoulder but with painted signs. It makes roadways easier for plows during the winter, too.

I work upon Route 6A and biking is easy. I had AARP change seniors way of telling cyclists with a horn and plow through. Does little for myself being Deaf to a horn. I live with mirrors.

"Conclusion; safety is the highest priority goal of the RTP. The Cape's transportation system should ensure travelers will arrive at their destinations unharmed and undamaged." Sounds good but far from that today. Street sweeping the roads or cutting back overgrowth of branches would help immensely. That and to 'complete the streets', sidewalks upon a metropolitan (Hyannis, Barnstable). A joke now, for a traveler at the Raddison Hotel Hyannis to walk to the Hyannis Airport safely.

John S. Powers
95 Great Western Road
So. Yarmouth, MA 02664

Lev Malakhoff

From: Frey, Bob (DOT) <bob.frey@state.ma.us>
Sent: Tuesday, July 19, 2011 4:31 PM
To: Lev Malakhoff
Cc: Cenizal, Callida (DOT)
Subject: RE: RTP demographic projections documentation
Attachments: Final Regional Totals.xls

Lev,

The discussion is generally fine, but under the heading, "Statewide and regional totals adjusted to latest available 2010 estimates," you should add one sentence about final adjustments subsequently being made after the 2010 census results were released.

In that vein, although the regional numbers are correct on Page 9 Table 1, all STATE totals are WRONG (I think they represent an earlier iteration).
Tables 2, 3, and 4 are correct, but refer to the attached spreadsheet for correcting all the statewide numbers in Table 1.

Thanks,
Bob

Bob Frey | Director of Transportation Analysis | Massachusetts Department of Transportation - Office of Transportation Planning
10 Park Plaza Room 4150 Boston MA 02116 | 617-973-7449 |HYPERLINK "mailto:bob.frey@state.ma.us"| www.mass.gov/massdot
How Can We Help You Today? For news and updates: www.mass.gov/blog/transportation or twitter at www.twitter.com/massdot.

From: Lev Malakhoff [mailto:lmalakhoff@capecodcommission.org]
Sent: Tuesday, July 19, 2011 3:43 PM
To: Frey, Bob (DOT)
Subject: RE: RTP demographic projections documentation
Hi Bob,

To minimize unnecessary changes, could you take a look at our existing discussion and "bless" it? The fewer changes, the less stress we'll all have at our August meeting:

http://www.gocapecod.org/rtp/RTP2011docs/07_alternatives-06132011.pdf
Discussion begins on page 8.

Thanks,

-Lev

Lev Malakhoff
Cape Cod Commission
3225 Main Street • Barnstable MA 02630
Tel: (508) 362-3828 • Fax: (508) 362-3136
www.capecodcommission.org • www.gocapecod.org

From: Frey, Bob (DOT) [mailto:bob.frey@state.ma.us]
Sent: Tuesday, July 19, 2011 12:10 PM
To: ckus@berkshireplanning.org; akoirala@berkshireplanning.org; Lev Malakhoff; Clay Schofield; Priscilla Leclerc;

sujatha@cmrpc.org; mblunt@cmrpc.org; transpor@frcog.org; mrhodes@frcog.org; Harris, Brad (MRPC); gsnow@mrpc.org; mmauro@mvcommission.org; Komornick, Tony (MVPC); mkbeninati@mvpc.org; sbradbury@nmcog.org; Wo! ods, Beverly (NMCOG); mburns@nantucket-ma.gov; Kilmer, Charlie (OCPC); wmcnulty@ocpcrpa.org; gmroux@pvpc.org; RJammal@pvpc.org; jhadfield@srpedd.org; pmission@srpedd.org; arecchia@srpedd.org; Anne McGahan (amcgahan@ctps.org)
Cc: Guenard, Mark (DOT); Cenizal, Callida (DOT); Wadsworth, Trey (DOT); Lehmann, Andrew (DOT); Palmer, William (DOT); Pearson, Karen (DOT)
Subject: FW: RTP demographic projections documentation

Hello All,

Some of you have asked about any available description of methods used for developing the socio-economic projections - so a brief description can be included in your RTP. Three files are attached - two files are! from an email that went out to all RPAs on 1/28/10. A subsequent brief update document, the third attachment, was written in November 2010.

We have not summarized any of this further beyond what is in these documents, plus any emails that have been part of ongoing correspondence.
The only thing to add would be that the final population and households figures, as you know, were adjusted based on the 2010 US Census results, down to the municipal level.

My advice would be to just cut and paste a few topic sentences from key paragraphs in these docume! nts, if you're looking to put together a short documentation section in your RTP. It doesn't have to be long - just an updated listing of sources at least. Use your previous RTPs as a guide....

Let me know if you have any questions.

NOTE TO WESTERN MASS RPAs: AQ text and numbers will be finalized and sent to you later this week...

Thanks,
Bob

Bob Frey | Director of Transportation Analysis | Massachusetts Department of Transportation - Office of Transportation Planning
10 Park Plaza Room 4150 Boston MA 02116 | 617-973-7449 |HYPERLINK "mailto:bob.frey@state.ma.us"| www.mass.gov/massdot
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MASSACHUSETTS POPULATION, EMPLOYMENT AND HOUSEHOLDS: 1980 - 2035

POPULATION

						AQ		AQ		AQ		
MPO Region	**Census 1980**	**Census 1990**	**Census 2000**		**Census 2010**	**2017**	**2020**	**2025**	**2030**	**2035**	**% growth 1980-2010**	**% growth 2010-2035**
Berkshire	144,223	139,352	134,953		131,219	131,700	131,900	132,300	132,600	133,000	-9%	1%
Boston	2,862,252	2,922,934	3,066,394	3,208,000	3,161,712	3,268,200	3,294,000	3,353,500	3,413,000	3,475,000	10%	10%
Cape Cod	147,895	186,605	222,230		215,888	230,000	236,000	245,010	256,000	266,000	46%	23%
Central Mass	434,305	482,436	518,480		556,698	576,000	586,000	600,000	620,000	640,000	28%	15%
Franklin	64,317	70,092	71,535		71,372	73,600	74,300	74,900	76,200	77,000	11%	8%
Martha's Vineyard	8,935	11,639	14,987		16,535	17,300	18,000	18,700	19,500	20,000	85%	21%
Merrimack Valley	257,252	288,280	318,556		333,748	343,000	348,000	357,000	366,000	375,000	30%	12%
Montachusett	200,767	223,865	228,005		236,475	240,000	243,000	247,000	251,000	255,000	18%	8%
Nantucket	5,087	6,012	9,520		10,172	11,503	12,086	13,090	14,012	15,005	100%	48%
Northern Middlesex	231,781	263,659	281,225		286,901	293,000	297,000	304,000	312,000	320,000	24%	12%
Old Colony	275,406	296,864	321,515		333,468	348,000	353,000	361,000	369,000	377,000	21%	13%
Pioneer Valley	576,873	602,878	608,479		621,570	637,000	641,000	647,000	653,000	658,000	8%	6%
Southeastern Mass	516,371	563,130	597,294		616,670	640,000	653,000	675,000	698,000	721,000	19%	17%
Subtotal	5,725,464	6,057,746	6,393,173		6,592,428	6,809,303	6,887,286	7,028,500	7,180,312	7,332,005	15%	11%
(less dual members)	39,789	41,321	44,076		44,799	46,403	46,486	47,600	48,712	49,905	13%	11%
Statewide Totals	5,685,675	6,016,425	6,349,097		6,547,629	6,762,900	6,840,800	6,980,900	7,131,600	7,282,100	15%	11%
Growth from 2010						3.29%	4.48%	6.62%	8.92%	11.22%		

EMPLOYMENT

						AQ		AQ		AQ		
MPO Region	**1980 ES-202**	**1990 ES-202**	**2000 ES-202**	**2009 ES-202**	**DET est. 2010**	**2017**	**2020**	**2025**	**2030**	**2035**	**% growth 1980-2000**	**% growth 2010-2035**
Berkshire	56,899	61,022	61,481	60,526	60,900	61,000	61,100	61,400	61,700	62,000	8%	2%
Boston	1,499,903	1,699,058	1,875,839	1,783,706	1,793,400	1,882,720	1,921,000	1,926,500	1,932,000	1,937,000	25%	8%
Cape Cod	51,387	70,251	88,594	88,409	88,900	94,000	98,000	100,000	102,000	104,000	72%	17%
Central Mass	183,573	201,507	230,600	222,771	224,000	233,000	241,000	245,000	248,000	250,000	26%	12%
Franklin	20,094	24,187	27,754	25,650	25,800	26,000	26,500	27,000	27,600	28,200	38%	9%
Martha's Vineyard	3,590	5,084	7,167	7,662	7,700	8,000	8,600	8,800	8,900	9,000	100%	17%
Merrimack Valley	103,008	117,138	137,694	128,013	128,700	138,000	141,000	144,000	147,000	150,000	34%	17%
Montachusett	72,512	74,788	81,712	78,107	78,500	80,000	81,000	82,000	83,000	84,000	13%	7%
Nantucket	2,408	3,693	5,698	5,696	5,731	5,990	6,444	6,691	7,038	7,270	137%	27%
Northern Middlesex	75,473	98,196	123,616	111,357	112,000	123,000	126,000	128,000	131,000	133,000	64%	19%
Old Colony	82,920	109,539	123,881	123,709	124,400	131,000	135,000	138,000	141,000	142,000	49%	14%
Pioneer Valley	232,641	248,048	259,999	249,857	251,200	258,000	263,000	265,000	266,000	267,000	12%	6%
Southeastern Mass	189,071	209,085	239,268	228,135	229,400	238,000	243,000	250,000	260,000	265,000	27%	16%
Subtotal	2,573,479	2,921,596	3,263,303	3,113,598	3,130,631	3,278,710	3,351,644	3,382,391	3,415,238	3,438,470	27%	10%
(less dual members)	9,436	17,024	17,703	18,454	19,031	19,810	20,144	19,991	19,838	19,670	88%	3%
Statewide Totals	2,564,043	2,904,572	3,245,600	3,095,144	3,111,600	3,258,900	3,331,500	3,362,400	3,395,400	3,418,800	27%	10%
Growth from 2010						4.73%	7.07%	8.06%	9.12%	9.87%		

HOUSEHOLDS

						AQ		AQ		AQ		
MPO Region	**Census 1980**	**Census 1990**	**Census 2000**		**Census 2010**	**2017**	**2020**	**2025**	**2030**	**2035**	**% growth 1980-2010**	**% growth 2010-2035**
Berkshire	52,400	54,315	56,006		56,091	56,350	56,450	56,650	56,850	57,050	7%	2%
Boston	1,035,191	1,111,708	1,197,397	1,294,280	1,243,189	1,339,896	1,359,446	1,398,359	1,437,272	1,464,349	20%	18%
Cape Cod	58,556	77,586	94,822		95,755	103,000	106,000	112,000	117,000	122,000	64%	27%
Central Mass	154,017	177,733	196,274		210,870	223,110	229,160	236,690	244,810	253,360	37%	20%
Franklin	24,228	27,640	29,466		30,462	31,400	31,710	32,090	32,700	33,160	26%	9%
Martha's Vineyard	3,872	5,003	6,421		7,368	7,750	8,100	8,500	8,900	9,200	90%	25%
Merrimack Valley	92,524	104,156	117,270		123,577	128,400	130,700	135,100	139,400	143,300	34%	16%
Montachusett	69,688	80,725	85,262		89,816	91,700	93,600	96,000	98,300	100,300	29%	12%
Nantucket	2,155	2,597	3,699		4,229	4,794	5,022	5,412	5,781	6,165	96%	46%
Northern Middlesex	74,983	90,119	99,342		104,022	107,000	108,800	112,100	115,500	118,900	39%	14%
Old Colony	90,883	101,026	112,855		119,437	125,600	127,900	131,800	135,200	138,700	31%	16%
Pioneer Valley	202,280	219,958	231,279		238,629	250,100	252,700	257,300	260,700	263,800	18%	11%
Southeastern Mass	184,633	208,604	229,491		240,223	252,400	259,600	269,400	279,800	290,200	30%	21%
Subtotal	2,045,410	2,261,170	2,459,584		2,563,668	2,721,500	2,769,188	2,851,401	2,932,213	3,000,484	25%	17%
(less dual members)	12,693	14,060	16,004		16,593	17,500	18,088	18,801	19,513	19,984	31%	20%
Statewide Totals	2,032,717	2,247,110	2,443,580		2,547,075	2,704,000	2,751,100	2,832,600	2,912,700	2,980,500	25%	17%
Growth from 2010						6.16%	8.01%	11.21%	14.35%	17.02%		

CAPE COD COMMISSION

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