Cape Cod

RTP
2007

2007 Regional Transportation Plan

April 2007

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

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

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

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

Cape Cod Metropolitan Planning Organization

Endorsement of the Cape Cod 2007 Regional Transportation Plan

Re-Determination of Air Quality Conformity

Whereas the 1990 Clean Air Act Amendments (CAAA) require Metropolitan Planning Organizations within ozone non-attainment areas to perform air quality conformity determinations prior to the approval of transportation plans and transportation improvement programs, and at such other times as required by regulation, the Committee of Signatories representing the Metropolitan Planning Organization (MPO) for the Cape Cod Region, in accordance with 23 CFR Part 450 Sections 322 and 324 of the October 28, 1993 Final Rules for Statewide and Metropolitan Planning, hereby endorses the 2007 Regional Transportation Plan (RTP).

Specifically, the MPO for Cape Cod has completed its review in accordance with Section 176(c) (4) of the Clean Air Act as amended in 1990 [42 U.S.C. 7251 (a)], and hereby certifies that implementation of the Cape Cod 2007 Regional Transportation Plan (RTP) satisfies the conformity criteria specified in both 40 CFR Parts 51 and 93 (August 15, 1997) and 310 CMR 60.03 (December 30, 1994). This conformity determination is based on the air quality documentation contained in this RTP and TIP, together with the supplemental document "Air Quality Conformity Determination for the Cape Cod Metropolitan Planning Organization." The RTP continues to include all regionally significant, non-exempt projects as contained in the previously endorsed plan, while the TIP reflects these same projects. Based on the results of the new conformity analyses, both the Cape Cod 2007 Regional Transportation Plan and the Cape Cod Transportation Improvement Program 2007-2010 continue to be consistent with the air quality goals of, and in conformity with, the Massachusetts State Implementation Plan.

SIGNATORY CERTIFICATION: ***DATE:*** 3/30/07

for
Bernard Cohen, Secretary,
Executive Office of Transportation

for
Luisa Paiewonsky, Commissioner,
Massachusetts Highway Department

W. Bradford Crowell, Chairman
Cape Cod Commission

Brian Currie, Chairman,
Cape Cod Regional Transit Authority

William Doherty
Barnstable County Commissioners

Paul Niedzwiecki ~~Janet Joakim, Chairman~~ Asst. Town Mgr.
Barnstable Town Council

Wayne Taylor, Selectman, Mashpee
Bourne, Falmouth, Mashpee, Sandwich

Jane Otis, Selectman, Dennis,
Brewster, Chatham, Dennis, Harwich, Yarmouth

John Hinckley, Jr., Selectman, Orleans
Eastham, Orleans, Provincetown, Truro, Wellfleet

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www.gocapecod.org/rtp

Cape Cod

RTP 2007

2007 Regional Transportation Plan

Chapter 1

Goals and Objectives

April 2007

Prepared by CAPE COD COMMISSION Transportation Staff
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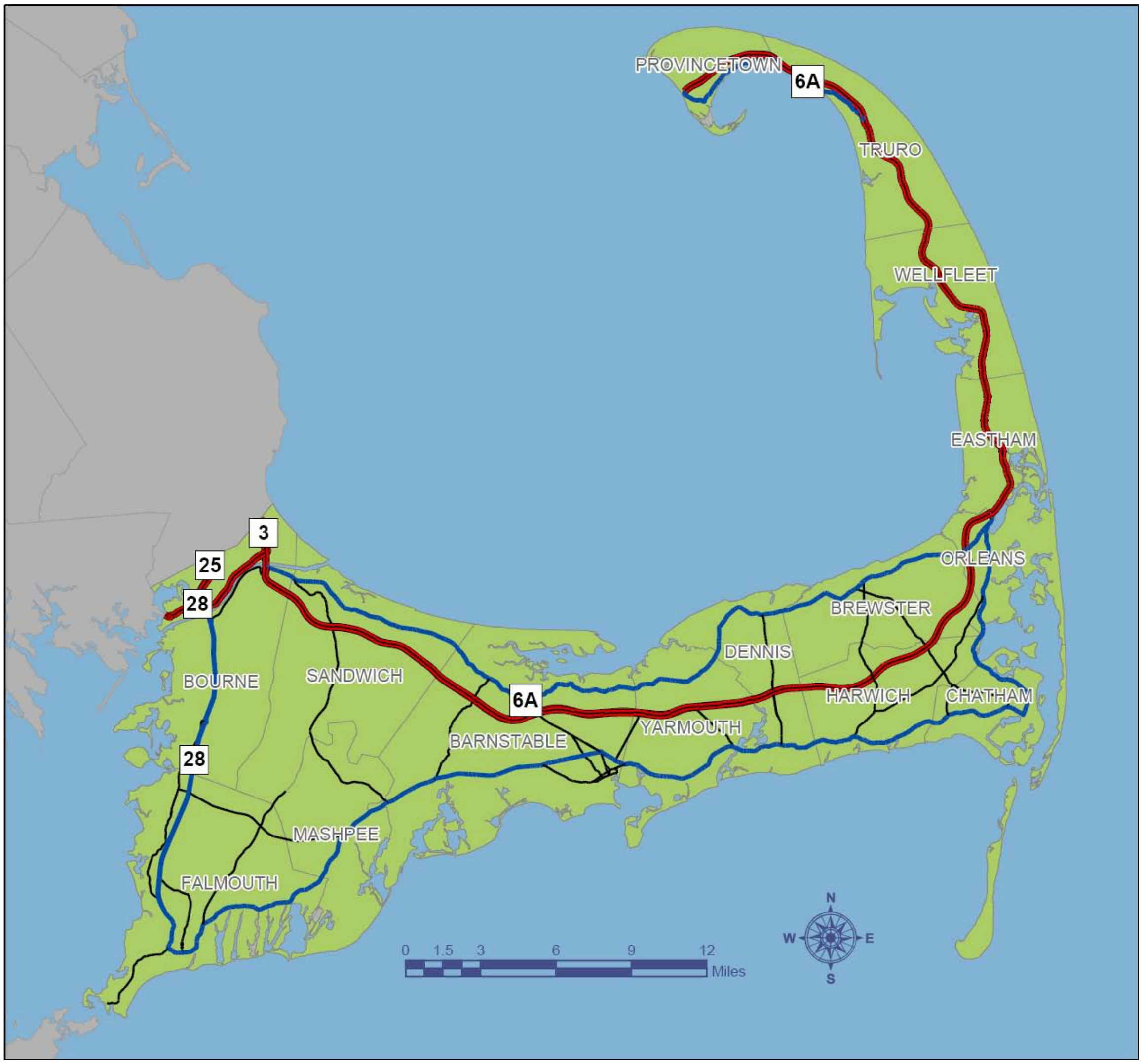
1. Introduction

This 2007 Cape Cod Regional Transportation Plan (RTP) is a fiscally constrained set of transportation projects, programs, "smart" solutions, and transportation studies for the 24 years between 2007 and 2030. 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 2003 plan are also discussed in this chapter.

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)
- Listings of alternatives including evaluation based on RTP conformity criteria
- A set of recommended projects, programs, "smart" solutions, and transportation studies



1.1 - 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. In November of 2005 the MPO expanded to nine members. The official position/agency of each membership is as follows:

- Secretary/Massachusetts Executive Office of Transportation
- Commissioner/Massachusetts Highway Department
- 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

*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.

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:

<u>Regulatory Agencies</u>
Cape Cod Metropolitan Planning Organization
Cape Cod Joint Transportation Committee
Cape Cod Commission
Massachusetts Executive Office of Transportation
Massachusetts Highway Department
Massachusetts Department of Recreation and Conservation
Cape Cod Towns
Federal Highway Administration
Federal Transit Administration
U.S. Army Corps of Engineers
Barnstable County Government

<u>Coordinating Agencies</u>
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

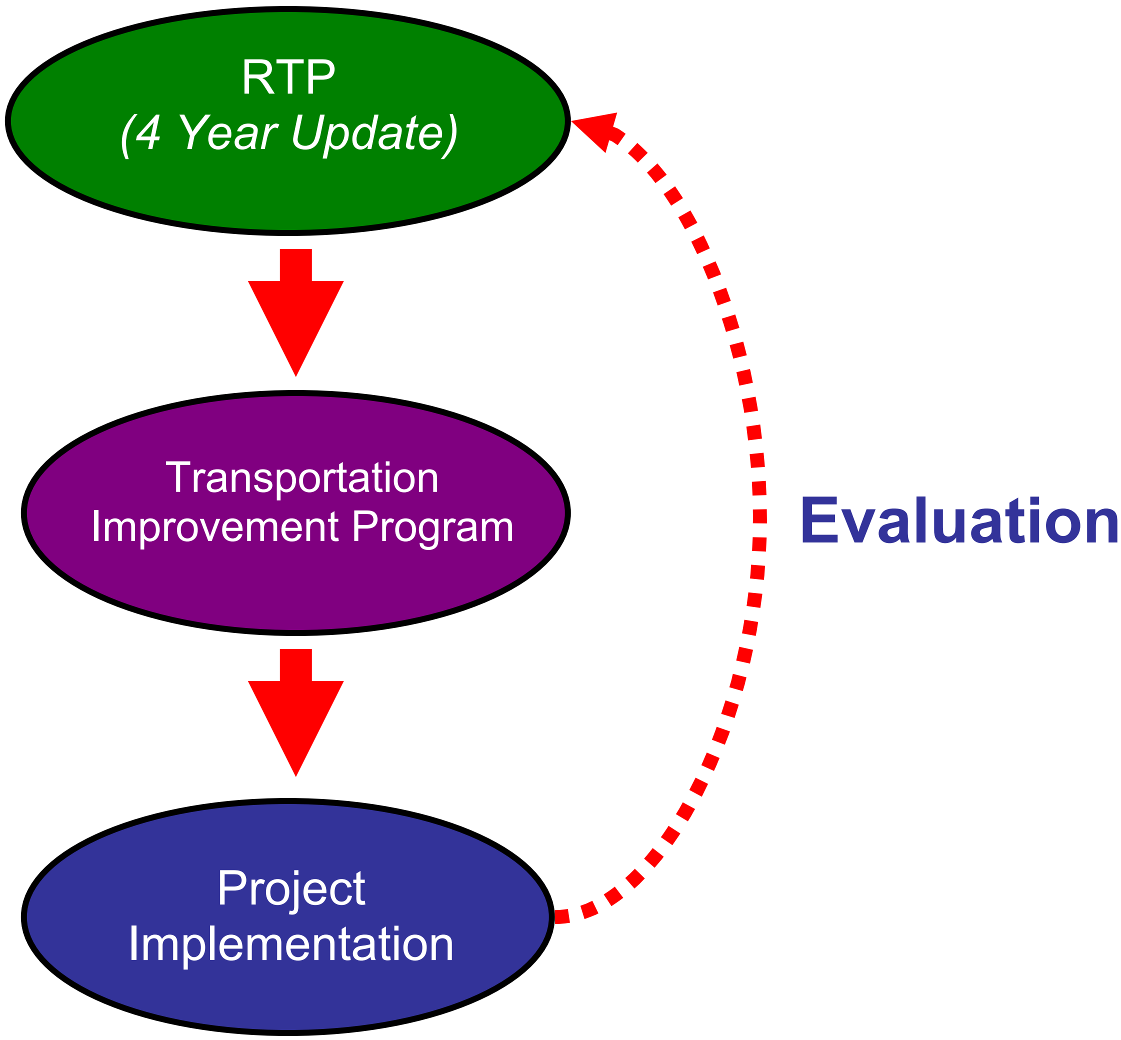


Figure 1-1 - Transportation Planning Process Flowchart

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.

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 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.

<u>Cape Cod Metropolitan Planning Organization</u> (9)

- Friday, March 30, 2007 – 1:00 PM (Barnstable Superior Courthouse)
- Tuesday, February 27, 2007 – 1:00 PM (Hyannis Transportation Center)
- Friday, January 19, 2007 – 1:00 PM (Barnstable Superior Courthouse)
- Friday, November 17, 2006 – 1:00 PM (Hyannis Transportation Center)
- Friday, June 27, 2006 – 12:00 PM (Hyannis Transportation Center)
- Friday, March 31, 2006 – 1:00 PM (Hyannis Transportation Center)
- Friday, February 17, 2006 – 1:00 PM (Barnstable - First District Courthouse)
- Friday, January 20, 2006 - 1:30 PM (Barnstable - First District Courthouse)
- Friday, December 2, 2005 – 9:00 AM (Hyannis Transportation Center)

<u>Cape Cod Joint Transportation Committee</u> (8)

- Friday, March 2, 2007 – 8:30 AM (Barnstable Superior Courthouse)
- Friday, January 5, 2007 – 8:30 AM (Barnstable Superior Courthouse)
- Friday, December 1, 2006 – 8:30 AM (Barnstable Superior Courthouse)
- Friday, June 2, 2006 – 8:30 AM (Barnstable Superior Courthouse)
- Friday, April 7, 2006 – 8:30 AM (Barnstable Superior Courthouse)
- Friday, May 5, 2006 – 8:30 AM (Barnstable Superior Courthouse)
- Friday, February 3, 2006 – 8:30 AM (Barnstable Superior Courthouse)
- Friday, January 6, 2006 - 8:30 AM (Barnstable Superior Courthouse)

<u>RTP Workshop: Focus on:</u> (4)

- <u>Roadways:</u> Wednesday, June 21, 2006 – 3:00 PM (Barnstable Superior Courthouse)
- <u>Air, Ferry, and Rail:</u> Tuesday, June 27, 2006 – 3:00 PM (Hyannis Transportation Center)
- <u>Bicycle and Pedestrian:</u> Tuesday, July 11, 2006 – 3:00 PM (Hyannis Transportation Center)
- <u>Transit:</u> Thursday, July 20, 2006 – 3:00 PM (Hyannis Transportation Center)

<u>Regional Transportation Plan Public Meeting</u> (3)
Friday, March 2, 2007 – 10:00 AM Barnstable Superior Courthouse
Wednesday, December 14, 2005 – 7:00 PM (Yarmouth Police Facility)
Monday, December 12, 2005 – 2:00 PM (Hyannis Transportation Center)

<u>Cape Cod Regional Transit Authority</u> (2)
Wednesday, March 21, 2007 – 9:00 AM (Hyannis Transportation Center)
Wednesday, January 18, 2006 – 9:00 AM (Hyannis Transportation Center)

<u>Cape Cod Commission Planning Committee</u> (2)
Monday, March 5, 2007 – 9:00 AM (Cape Cod Commission Office)
Monday, January 23, 2006 – 9:00 AM (Cape Cod Commission Office)

<u>Regional Transportation Plan / Transportation Improvement Program Meeting</u> (2)
Tuesday, August 1, 2006 – 2:00 PM (Cape Cod Nat'l Seashore – Salt Pond Visitor Center, Eastham)
Wednesday, March 1, 2006 – 7:00 PM (Harwich Community Center)

<u>Cape Cod Commission</u> (1)
Thursday, March 8, 2007 – 3:00 PM (First District Courthouse)

<u>Transportation Consultant Dr. Christopher Lovelock</u> (1)
Friday, March 10, 2006 – 12:00 PM (Orleans)

<u>Eastham Selectmen's Meeting</u> (1)
Monday, March 6, 2006 – 6:00 PM (Eastham Town Hall)

<u>Cape Cod Commission Executive Committee</u> (1)
Monday, March 6, 2006 – 10:00 AM (Cape Cod Commission Office)

<u>Lower/Outer Cape Employers' Conference</u> (1)
Tuesday, February 28, 2006 – 9:00 AM (Cape Cod National Seashore Visitor Center)

<u>Wellfleet Planning Board Members</u> (1)
Tuesday, January 31, 2006 – 10 AM (Cape Cod Commission Office)

<u>Cape Cod Chamber of Commerce</u> (1)
Friday, January 13, 2006 – 8:30 AM (Hyannis)

<u>Buzzards Bay Village Association</u> (1)
Tuesday, January 10, 2006 – 4:00 PM (Bourne Community Center)

1.2.2 Surveys and Comment Forms

Every five years, the Cape Cod Commission (CCC) prepares a Regional Policy Plan 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 Plan 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).

To further facilitate public comment, a two-page RTP questionnaire was distributed at public meetings. The questionnaire was also published in the Cape Cod Commission *Reporter* newsletter, and on the Cape Cod Commission Transportation Information Center at www.gocapecod.org/rtp. The form 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).

Over 50 comment forms were submitted via mail 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. Some selected responses include:

<u>Regional Congestion Areas:</u>

- Route 132
- Airport Rotary
- Route 28
    - @ Yarmouth Road (Barnstable)
    - Falmouth
    - Yarmouth
- Bourne Bridge
- Sagamore Bridge
- Mashpee Rotary
- Bourne Rotary

<u>Local Congestion Areas:</u>

- Jones Road (Falmouth)
    - Gifford Street intersection
    - Route 28 intersections (both)
- Route 28
    - Downtown Falmouth
    - MacArthur Boulevard (Bourne)
    - Hyannis
- Route 151
- Mashpee Rotary
- Bass River Bridge

<u>Safety Areas</u>

- Route 6
    - Exit 5
    - Exit 7
    - Exit 9 to Eastham Rotary
- Route 28
    - Downtown Falmouth
    - MacArthur Boulevard
- Jones Road (Falmouth)
- Mashpee Rotary
- Route 130 (Mashpee/Sandwich townline)

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 nearly 130 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 Goals of the 2007 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:

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

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 with federal, state and local transportation goals.

1.3.1 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 2007 Regional Transportation Plan sets the 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 actions and concepts specify ways in which this goal can be implemented:

- 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 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
- ***Incorporate intelligent transportation systems***, such as variable message signs, 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, Wood's Hole port facilities, park-and-ride lots, and Cape Cod Canal Bridges.

1.3.2 Congestion Relief

Congestion presents users with longer travel times, increased safety concerns, and greater frustration. It also makes it harder for alternative transportation modes, such as buses, bicycles, and pedestrians. Additionally, congestion affects non-users, such as businesses who rely on transportation access for their employees and customers. Congestion also produces more air pollution, negatively impacts the natural environment, 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 2007 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 actions and concepts specify ways in which this goal can be implemented:

- ***Identify high traffic congestion locations*** throughout Cape Cod and consider solutions to address that congestion
- Consider strategies that ***encourage alternative transportation modes***, so that people have options other than automobiles
- Consider strategies to ***address the behavioral causes*** of traffic congestion 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.
- 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.

1.3.3 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 2007 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 so that people and goods can get from where they are to where they are meant to go.

The following actions and concepts specify ways in which this goal can be implemented:

- ***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*** with a broad range of transportation options, such as roadways, transit, and bicycle
- ***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.

1.3.4 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 2007 Regional Transportation Plan sets 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 actions and concepts specify ways in which this goal can be implemented:

- 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.
- Create and implement asset management tools for ***monitoring*** and maintaining the existing transportation system.
- 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.
- 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.

1.3.5 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. In order to maintain and enhance the current state of the environment for future generations, the 2007 Regional Transportation Plan sets environmental protection as a goal.

Goal #5:
Create a transportation system that maintains, protects, and enhances the natural environment of Cape Cod.

The following actions and concepts specify ways in which this goal can be implemented:

- ***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.
- Comply with ***state and federal environmental regulations.***

- Encourage the use of ***alternative transportation*** modes that reduce air pollution, fuel consumption, and other environmental impacts.
- Pursue strategies that will get automobiles and trucks moving at ***speeds that will minimize air pollution***.
- Replace public buses and vehicles with ***fuel-efficient, hybrid, or bio-diesel*** vehicles that will reduce fossil fuel consumption.
- 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***

1.3.6 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 2007 Regional Transportation Plan sets 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 actions and concepts specify ways in which this goal can be implemented:

- 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.
- 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 MassHighway 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 MassHighway District Office Director.

1.3.7 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.

Goals #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 actions and concepts specify ways in which this goal can be implemented:

- 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.

1.3.8 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.

> **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 actions and concepts specify ways in which this goal can be implemented:

- 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 and the "Massachusetts Long-Range Transportation Plan"
- 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

1.4 Changes since the 2003 Plan

This section includes discussions of new or expanded transportation planning goals and a status listing of projects since the 2003 RTP.

1.4.1 Relation of 2003 Goals to the Current Goals

This current RTP now recognizes eight specific planning goals compared to only five in the 2003 Plan. There is some overlap with the previous RTP goals as well as expansion or clarification of new priorities (e.g., Safety & Security). A comparison of the 2003 RTP goals to the 2007 goals is shown in the following table.

1.4 - Goals Compared: 2003 vs. 2007 RTP

	Safety and Security	Reduced Congestion	Accessible, Multimodal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders
2003 RTP Goals	**2007 RTP Goals**							
Maintain the System				✓				
Develop Alternatives to the Automobile		✓	✓					
Integrate Land Use and Transportation Planning						✓		
Maintain the Cape's Natural Environment					✓			
Advance Environmental Justice							✓	

1.4.2 Transportation Projects Since the 2003 Plan

Following the creation of the 2003 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.

Table 1-1 - TIP Projects Constructed, Implemented, Advertised, or Underway

Town	Location
Barnstable	Route 6 resurfacing and drainage improvements
Barnstable	Bearses Way from Route 28 to Pitchers Way: roadway improvements
Barnstable	Route 132 Boulevard
Bourne	Sagamore Rotary area improvements: MHD Depot construction; temporary Park & Ride lot
Bourne	Sagamore Rotary area improvements: Fire Station
Bourne	Sagamore Rotary area improvements: grade separation ("Flyover")
Chatham	Cape Cod Rail Trail spur from Harwich townline, by Chatham airport to downtown Chatham
Dennis	Swan River Road improvements
Dennis, Harwich	Route 28 pavement overlay
Eastham, Wellfleet	Route 6: traffic safety improvements
Falmouth	Meadow Neck Road bridge over the Moonakis River
Falmouth	Shining Sea Bikeway phase IIB: Skating Lane to Carlson Lane
Falmouth	Woods Hole Bridge,: Water Street over Eel Pond
Falmouth	Palmer Avenue Bridge improvements
Orleans	Main Street, Rock Harbor Road, and Old Colony Road improvements
Orleans	Skaket Corners, Route 6A @ West Road/Eldredge Park Way
Orleans	Route 28 @ Finlay Road intersection improvements
Sandwich	Town Hall Sq: Water Street and Main Street intersection
Yarmouth	Willow Street reconstruction from Route 6 to relocated Higgins Crowell Road

1.5 Comparing Goals with Other Plans

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

1.5.1 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 2007 RTP is presented in the following table.

Table 1-2 - Goals Compared: Federal vs. 2007 RTP

SAFETEA-LU	2007 RTP Goals: Safety and Security	Reduced Congestion	Accessible, Multi-modal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders
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		✓		✓				

1.5.2 Consistency with Commonwealth Transportation Planning Goals

The RTP is formulated in cooperation with statewide planning efforts. The latest Massachusetts transportation plan (draft) is called The Commonwealth of "Massachusetts Long-Range Transportation Plan" A comparison of state planning goals with those of the 2007 RTP is presented in the following table.

Table 1-3 - Goals Compared: Massachusetts Transportation Plan vs. 2007 RTP

Commonwealth of "Massachusetts Long-Range Transportation Plan"	2007 RTP Goals							
	Safety and Security	Reduced Congestion	Accessible, Multimodal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders
Objective, coordinated, transparent, and inclusive decision-making process								✓
Preserve and Improve the system by allocating sufficient resources in the most effective manner				✓				
Foster a sustainable society					✓	✓		
Build and operate in an efficient and cost-effective manner			✓	✓				
Provide increased mobility for people and goods and address the growth in traffic congestion		✓	✓				✓	
Be safe both for users and non-users	✓							
Be secure, with all modes and users protected from external threats	✓							
Be designed, built, and operated so it serves all of its users and is accessible and convenient for patrons of diverse physical ability and economic status			✓				✓	

1.5.3 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 transportation goals with those of the 2007 RTP is presented in the following table.

Table 1-4 - Goals Compared: Regional Policy Plan vs. 2007 RTP

Transportation Goals from the Cape Cod Regional Policy Plan	2007 RTP Goals: Safety and Security	Reduced Congestion	Accessible, Multimodal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders
To maintain an acceptable level of safety on all roads on Cape Cod for all users	✓						✓	
To reduce and/or offset the expected increase in motor vehicle trips on public roadways and to reduce dependency on automobiles		✓	✓					
To maintain travel times and level of service on regional roads and intersections and to ensure that all road and intersection construction or modification is consistent with community character, historic, or scenic resources				✓	✓	✓		

1.5.4 Comparison to the Transportation Planning Goals of other Metropolitan Planning Organizations

During development of the RTP, consideration is also given transportation planning goals of other Massachusetts Metropolitan Planning Organizations (MPOs). A comparison of other MPO planning goals with those of the 2007 Cape Cod RTP is presented in the following table.

Table 1-5 - Goals Compared: Other MPOs vs. 2007 Cape Cod RTP

	Safety and Security	Reduced Congestion	Accessible, Multi-modal Connections	System Maintenance	Environmental Protection	Community Orientation	Equitability	Cooperation among Stakeholders
Goals from the RTPs of other Massachusetts MPOs	**2007 Cape Cod RTP Goals**							
Improve, maintain, and preserve the existing transportation system and infrastructure				✓				
Increase integration and connectivity between various transportation modes			✓					
Reduce congestion on existing facilities		✓						
Provide equal accessibility to people with disabilities							✓	
Provide equitable service to all residents							✓	
Provide safe and secure transportation facilities	✓							
Encourage development in areas most suitable as is consistent with regional and local land use policies						✓		
Enhance and foster the economic vitality of the region, and support the region's comprehensive economic development strategy						✓		
Preserve and promote environmental quality					✓			
Minimize the use of energy resources				✓	✓			
Ensure that the plan meets environmental justice requirements							✓	

Cape Cod

RTP 2007

2007 Regional Transportation Plan
Chapter 2
The Transportation System

April 2007

Prepared by C*APE* C*OD* C*OMMISSION* *Transportation Staff*
on behalf of the

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

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

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

Chapter 2 Overview

Existing and Future Conditions

In this chapter we set the stage for dealing with transportation issues. The Cape Cod transportation system is a complex set of networks and services that work in combination to move people and goods to their respective destinations. Given its complexity, the system is examined from a variety of perspectives, breaking down Cape Cod transportation by mode and by region. The following sections describe the regional, modal, and geographical perspectives used in looking at the Cape transportation system.

2.1 Regional Issues

Before delving into the various components of the Cape Cod transportation system, it is helpful to take an overview of issues relevant to the entire region. Some concerns transcend region or mode, such as demographic changes, economic trends, or housing issues. This section will address issues relating to Cape Cod as a region.

2.1.1 Demographics

Since 1920, Cape Cod has been among the leading counties in Massachusetts for population growth[1]. Between 1990 and 2000, Barnstable County added about 35,600 residents, an increase of 19.1%[2]. Another 6,453 new residents have been added since 2000 according to estimates by the U.S. Census Bureau (**Figure 2.1-1** and **Table 2.1-1**). Compared to the other 13 counties in Massachusetts, Cape Cod ranks fifth for growth between 2000 and 2004[3]. Regional transportation infrastructure and services must be prepared to handle the additional trips generated by these new residents.

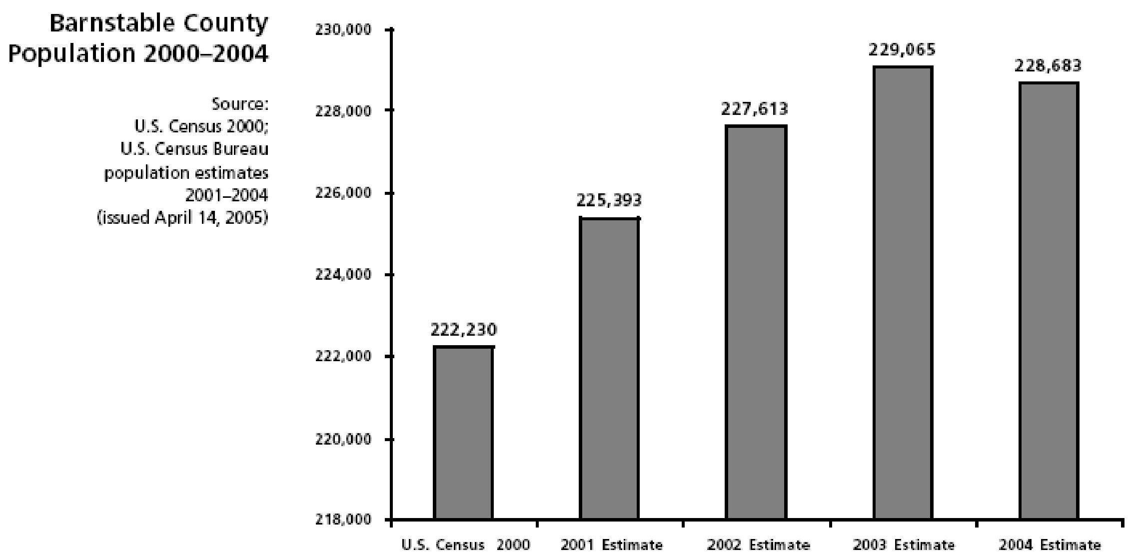


Figure 2.1-1: Barnstable County Population Growth 2000-2004[4]

Town/County	Population		2000-04 Change	
	U.S. Census 2000	2004 Estimate	#	%
Barnstable	47,821	48,535	714	1.5%
Bourne	18,721	19,516	795	4.2%
Brewster	10,094	10,368	274	2.7%
Chatham	6,625	6,860	235	3.5%
Dennis	15,973	16,123	150	0.9%
Eastham	5,453	5,622	169	3.1%
Falmouth	32,660	33,806	1,146	3.5%
Harwich	12,386	12,809	423	3.4%
Mashpee	12,946	14,301	1,355	10.5%
Orleans	6,341	6,474	133	2.1%
Provincetown	3,431	3,450	19	0.6%
Sandwich	20,136	20,826	690	3.4%
Truro	2,087	2,180	93	4.5%
Wellfleet	2,749	2,841	92	3.3%
Yarmouth	24,807	24,972	165	0.7%
Barnstable County	222,230	228,683	6,453	2.9%
Massachusetts	6,349,097	6,416,505	67,408	1.1%

Source: U.S. Census 2000; U.S. Census Bureau 2004 Population Estimates issued June 30, 2005

Table 2.1-1: A Comparison of Massachusetts Towns' 2000-2004 Population Change[5]

There was a lot of variation in population growth rates among towns within Cape Cod. Mashpee led the county in growth with an increase of 1,355 residents, or 10.5%. Truro (4.5%), Bourne (4.2%), Falmouth (3.5%), and Chatham (3.5%) also ranked among the top five fastest growing towns on Cape Cod. Provincetown (0.6%), Yarmouth (0.7%), and Dennis (0.9%), grew at the lowest rates of any Cape Cod towns between 2000 and 2004, and at a lower rate than the Commonwealth as a whole. The population increases across Barnstable County would seem to indicate that new residents do not seem to prefer any one region of Cape to another. Transportation infrastructure in areas where land is available for residential development must be prepared to handle these local increases. 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 2.1-2: Number of Households and Household Size for Cape Cod and Towns[6]

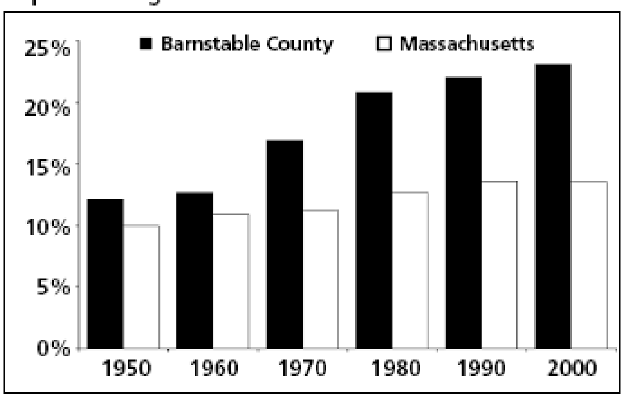
	Total Households 2000	% Change from 1990	Avg. Household Size 2000	Change from 1990
United States	105,480,101	14.7%	2.59	-0.04
Massachusetts	2,443,580	8.7%	2.51	-0.07
Cape Cod	94,822	22.2%	2.28	-0.07
Barnstable	19,626	18.2%	2.38	-0.02
Bourne	7,439	26.1%	2.39	-0.21
Brewster	4,124	21.9%	2.34	-0.08
Chatham	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

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%. In the past 10 years, 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 2.1-1**). Nationwide, Barnstable County ranked 126th out of 3,141 counties in terms of percent of population over the age of 65[7]. The total number of residents on Cape Cod over 65 is

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, 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 2.1-3**). It is clear that while Barnstable may have a large elderly population, being the most populous town, the Mid- and Lower Cape have the largest percentages of elderly residents. 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 2.1-2: Percent of Barnstable County and Massachusetts population Age 65+[8]

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 2.1-3: State Ranking by Town: Percent of Cape Residents age 65+[9]

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 2.1-4: Residents Aged 12-21 on Cape Cod, by Town[10]

	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%**	**-**

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.

2.1.2 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 2.1-5: Median Household Income in Barnstable County[11]

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).

Average Monthly Employment in Barnstable County, 1980–2002

Source: Massachusetts Division of Employment and Training

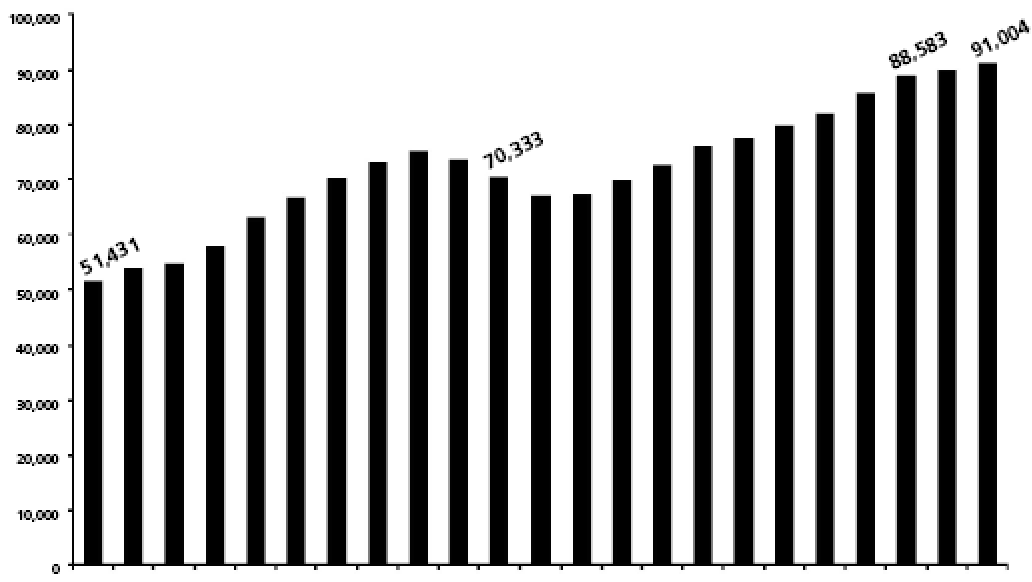


Figure 2.1-3: Employment in Barnstable County - Average Month, 1980-2002[12]

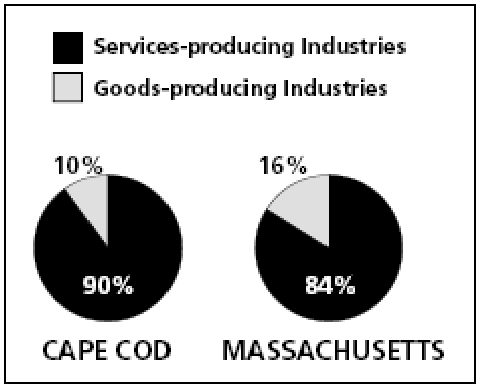
Table 2.1-6: Residents Living and Working within Cape Cod and Towns, 2000[13]

	# 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%**

Employment on Cape Cod has also increased. This makes sense given the increase in year-round population on Cape Cod. Between 1980 and 2000, employment on Cape Cod increased from 51,431 to 88,583, an increase of 72.2% (**Figure 2.1-3**). 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 (**Table 2.1-6**).

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.



Source: Massachusetts Division of Employment and Training, 2002

Figure 2.1-4: Goods vs. Service Producing Industries in Cape Cod and Mass.[14]

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 2.1-7: Barnstable County Employment by Major Industry Sector, 2002[15]

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.

2.1.3 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. An additional 30% is publicly-owned land, of which much is open space. Less than 3 percent is used for employment[16].

2.1.3.1 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.

Table 2.1-8: Housing Change in Massachusetts Counties, 1950-2004[17]

Housing Change in Massachusetts Counties, 1950–2004
Source: U.S. Census 1950–2000; U.S. Census Bureau estimate issued July 21, 2005

COUNTY	1950	1960	1970	1980	1990	2000	1950–2000 CHANGE #	1950–2000 CHANGE %	2004 ESTIMATE	2000–2004 CHANGE #	2000–2004 CHANGE %
BARNSTABLE	**30,306**	**54,703**	**65,676**	**99,946**	**135,192**	**147,083**	**116,777**	**385%**	**152,583**	**5,500**	**3.7%**
BERKSHIRE	41,710	48,690	51,321	59,245	64,324	66,301	24,591	59%	67,146	845	1.3%
BRISTOL	116,666	133,675	148,106	176,657	201,235	216,918	100,252	86%	221,687	4,769	2.2%
DUKES	3,987	5,340	5,510	8,819	11,604	14,836	10,849	272%	15,670	834	5.6%
ESSEX	164,567	190,231	216,201	244,335	271,977	287,144	122,577	74%	292,125	4,981	1.7%
FRANKLIN	17,470	19,186	21,576	26,832	30,394	31,939	14,469	83%	32,534	595	1.9%
HAMPDEN	107,793	138,904	151,498	167,229	180,025	185,876	78,083	72%	187,432	1,556	0.8%
HAMPSHIRE	23,490	30,308	35,951	46,641	53,068	58,644	35,154	150%	60,002	1,358	2.3%
MIDDLESEX	296,983	366,946	431,048	492,966	543,796	576,681	279,698	94%	583,879	7,198	1.2%
NANTUCKET	2,503	2,817	3,063	4,784	7,021	9,210	6,707	268%	10,042	832	9.0%
NORFOLK	112,258	149,789	181,211	212,827	236,816	255,154	142,896	127%	259,617	4,463	1.7%
PLYMOUTH	73,933	95,684	110,662	151,299	168,555	181,524	107,591	146%	187,574	6,050	3.3%
SUFFOLK	249,289	268,600	264,471	276,731	289,276	292,520	43,231	17%	293,383	863	0.3%
WORCESTER	159,230	186,125	204,106	239,835	279,428	298,159	138,929	87%	308,387	10,228	3.4%
MASSACHUSETTS	**1,400,185**	**1,690,998**	**1,890,400**	**2,208,146**	**2,472,711**	**2,621,989**	**1,221,804**	**87%**	**2,672,061**	**50,072**	**1.9%**

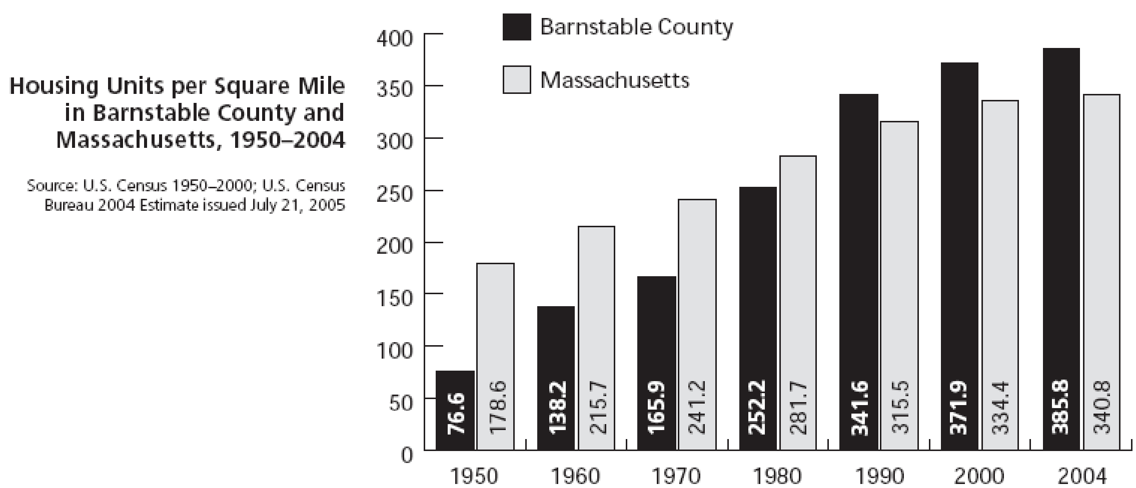


Figure 2.1-5: Housing Units per Square Mile in Barnstable County and Massachusetts, 1950-2004[18]

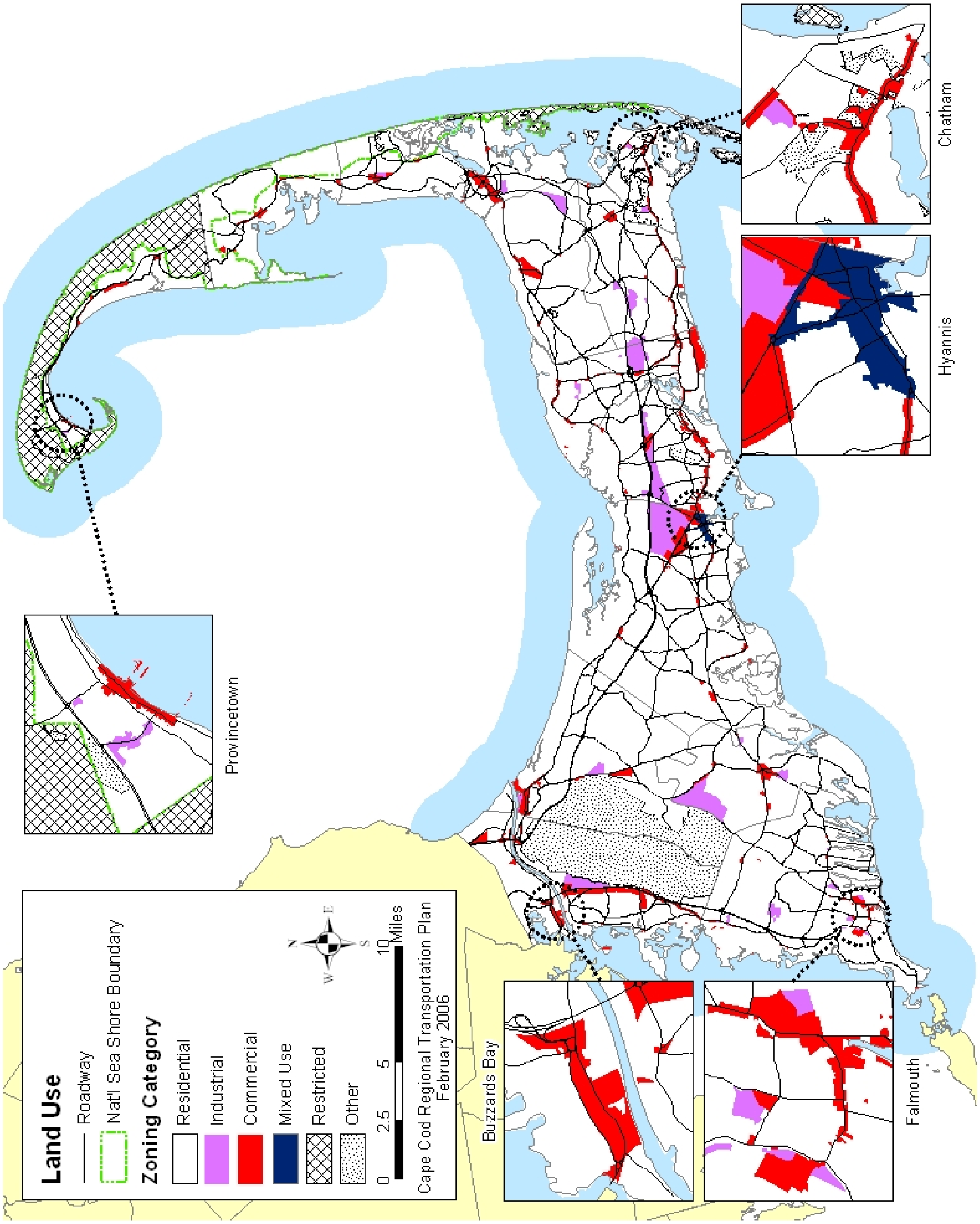


Figure 2.1-6: Cape Cod Zoning and Land Use Patterns[19]

2.1.3.2 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.

2.1.3.3 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.

2.1.3.4 Open Space

Figure 2.1-7: 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.

2.1.4 Safety and Security

Ensuring the safety and security of Cape Cod’s transportation system is the first goal of the Regional Transportation Plan. People must be able to freely travel; knowing that infrastructure is designed properly and that transportation services are provided in a safe and professional manner. Goods must also be able to be transported across Cape Cod without the threat of damage or loss of value. Moreover, the transportation network and its components must be protected from natural disasters and external threats. As such, safety and security are system wide concerns. *Chapter 3: Safety and Security* specifically details the current measures being taken to ensure the safety and security of Cape Cod’s transportation system as well as possible improvements to be made.

2.1.5 Congestion

Reducing congestion is also a goal of the Regional Transportation Plan. Congestion causes longer travel times, increased safety concerns, and frustration on the part of the user. It impedes the effectiveness of alternative modes of transportation and produces air pollution and other negative environmental effects. All of these concerns affect Cape Cod as a region. The state of Cape Cod traffic congestion is detailed in *Chapter 4: Congestion Management*, as well as some strategies to address congestion problems.

2.1.6 Accessibility, Mobility and Connectivity

Accessibility, mobility, and connectivity are important measures of the Cape Cod transportation system. Transportation that is accessible is easy to reach and easy to use. This means that facilities are within walking distance of residences and businesses, or in places that are convenient to other modes of transportation. All users are accommodated, with consideration given to environmental justice populations, the elderly and the disabled. Mobility refers to where users can go using transportation services. A system with high mobility connects users to many destinations, with regular and frequent service. Connectivity refers to the manner in which various modes of transportation interact. A user in a highly connective transportation system can use multiple modes to reach their destination quickly and directly and can transfer between modes easily.

A goal of the Regional Transportation Plan is to "Connect village centers, economic and employment centers, and points of interest using multiple coordinated modes of transportation in a direct and efficient manner so that people and goods can get from where they are to where they are meant to go." In each section of this chapter, issues of accessibility and mobility are explored for each mode, as well as connections with other transportation modes.

2.1.7 Environmental Justice

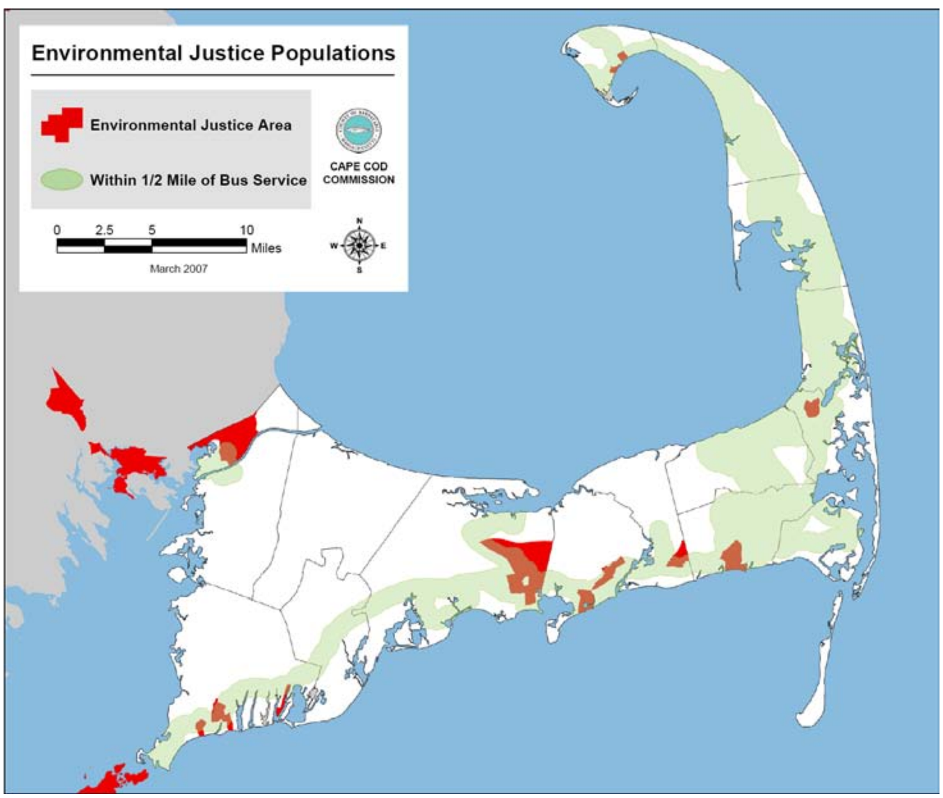


Figure 2.1-8: Map of Environmental Justice Populations on Cape Cod

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.

2.1.8 Regional Issues Conclusion

Cape Cod has experienced growth in population, households, employment and development. Transportation safety, security, congestion, accessibility, and mobility are all affected by these changes. The remaining sections of this chapter will address the various modes of transportation available on Cape Cod as well as sub-regional and local issues. These sections 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 will then be used in the remaining chapters to evaluate projects and programs, and to make informed planning decisions for the future of transportation on Cape Cod.

[1] Cape Trends, "Population", http://www.capecodcommission.org/data/capetrends.htm.
[2] Metro Data Center of the Metropolitan Area Planning Council. "Barnstable County: Profiles of General Demographics Characteristics, Census 2000." Boston, MA: 2001. http://www.capecodcommission.org/data/othersources.htm.
[3] Cape Trends, "Population Estimates – 2004", http://www.capecodcommission.org/data/capetrends.htm
[4] Cape Trends, "Population Estimates – 2004", http://www.capecodcommission.org/data/capetrends.htm
[5] U.S. Census 2000; U.S. Census Bureau 2004 Population Estimates issued June 30, 2005. Available at http://www.capecodcommission.org/data/CapeTownPopulation2000-04.pdf.
[6] Metro Data Center of the Metropolitan Area Planning Council. "Profiles of General Demographics Characteristics, Census 2000" for US, Massachusetts, Barnstable County, and Cape Cod Towns. Boston, MA: 2001. http://www.capecodcommission.org/data/othersources.htm.
[7] Cape Trends, "Age (Part 2)", http://www.capecodcommission.org/data/capetrends.htm
[8] Cape Trends, "Age (Part 2)", http://www.capecodcommission.org/data/capetrends.htm
[9] Cape Trends, "Age (Part 2)", http://www.capecodcommission.org/data/capetrends.htm
[10] U.S. Census Bureau, U.S. Census 2000.
[11] Cape Trends, "Income", http://www.capecodcommission.org/data/capetrends.htm
[12] Cape Trends, "Jobs (Part 2)", http://www.capecodcommission.org/data/capetrends.htm
[13] U.S. Census Bureau, 2000 U.S. Census Journey to Work.
[14] Cape Trends, "Jobs (Part 1)", http://www.capecodcommission.org/data/capetrends.htm
[15] Cape Trends, "Jobs (Part 2)", http://www.capecodcommission.org/data/capetrends.htm

[16] Cape Cod Commission Geographic Information Systems (GIS) Staff, 2006
[17] Cape Trends, "Housing (Part 1)", http://www.capecodcommission.org/data/capetrends.htm
[18] Cape Trends, "Housing (Part 2)", http://www.capecodcommission.org/data/capetrends.htm
[19] Cape Cod Commission Geographic Information Systems (GIS) Staff, 2006

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 2.2-1 - The Average Cape Cod Road

There are 2,589.73 miles of road on Cape Cod. The “Average Cape Cod Road” is a two-lane road surrounded by woods or houses. 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. The most popular road/street name is “Main” Street, at 1.63% of all Cape Cod roads by mileage. Other popular names include “Shore” (0.5%), “Long

Pond" (0.4%), or "Depot" (0.2%). The top 50 most popular street names comprise 12.5% of Cape Cod's roads by mileage[1]. This means that street names on Cape Cod are diverse.

2.2.2 Road Infrastructure

Major roads including Route 6, Route 28, Route 6A and others comprise only 20.6% of Cape Cod's roads by mileage. The majority (70.3%) of Cape Cod roads are designated as Functional Class "0," or local roads. A mere 9.1% are classified as "Collector" roadways. This means that only three-tenths of Cape Cod's roadways are used as primary routes of travel, while the remaining seven-tenths are used to access residential and other private areas.

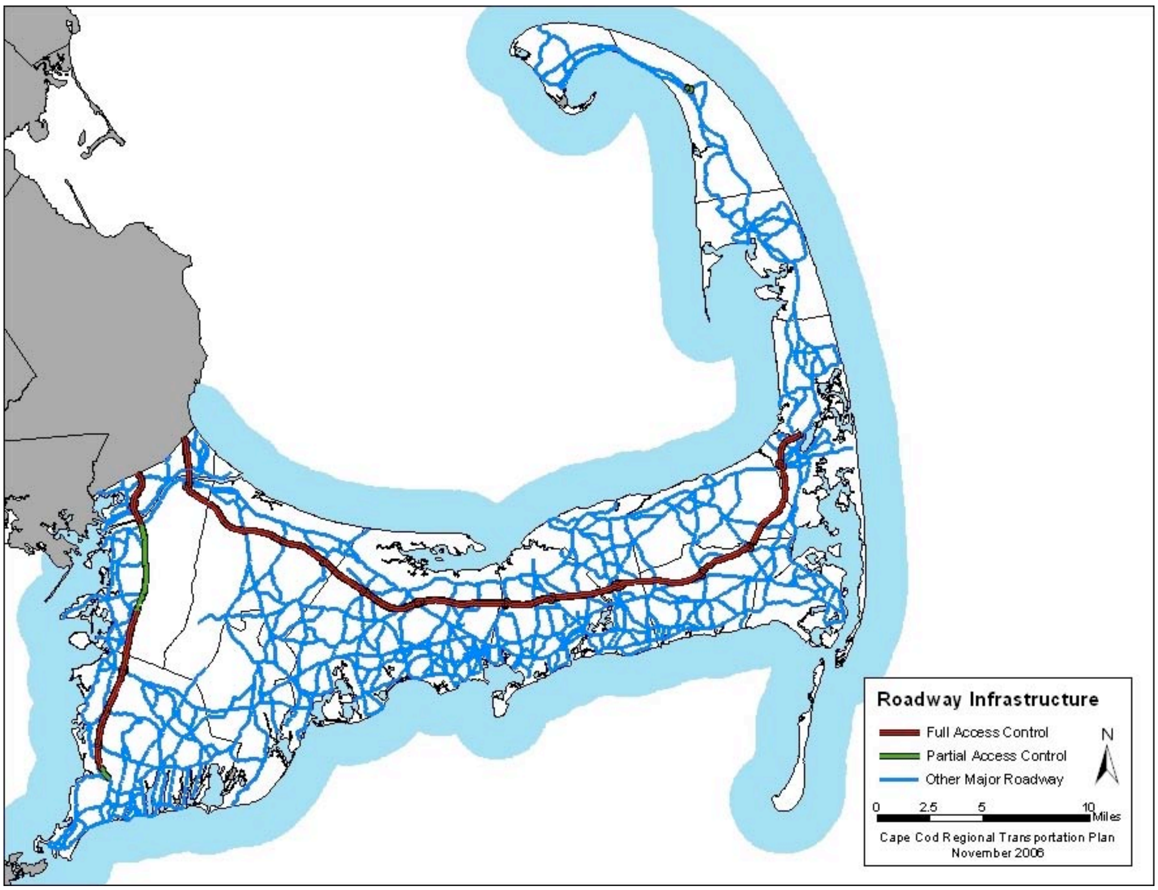


Figure 2.2-2 - Roadway Infrastructure

Source: Massachusetts Roadway Inventory File

Larger towns in the Mid- and Upper-Cape have the most road mileage (450.04 miles in Barnstable; 348.32 miles in Falmouth). Towns in the Outer-Cape have the least mileage

(28.95 miles in Provincetown; 59.61 miles in Truro); this is partly due to the large amount of protected land inside the Cape Cod National Seashore.

Table 2.2-1 - Road Mileage by Functional Class

	Interstate	Arterial	Collector	Local	Total
Barnstable	0.00	93.90	49.82	306.32	450.04
Bourne	0.00	52.02	19.05	118.32	189.39
Brewster	0.00	32.09	6.95	129.17	168.21
Chatham	0.00	16.11	4.20	93.24	113.55
Dennis	0.00	36.90	17.38	158.33	212.61
Eastham	0.00	18.17	7.63	77.66	103.46
Falmouth	0.00	80.79	27.96	239.57	348.32
Harwich	0.00	44.91	10.65	96.11	151.67
Mashpee	0.00	23.71	9.96	97.24	130.91
Orleans	0.00	21.83	5.59	68.07	95.49
Provincetown	0.00	3.93	13.25	11.77	28.95
Sandwich	0.00	43.08	13.46	159.78	216.32
Truro	0.00	9.90	12.41	37.30	59.61
Wellfleet	0.00	7.30	19.70	43.88	70.88
Yarmouth	0.00	49.51	17.30	183.52	250.33
Totals	**0.00**	**534.15**	**235.31**	**1820.28**	**2,589.74**

Source: Massachusetts Roadway Inventory File

Looking at who owns Cape Cod's roadways, 65.1% of Cape Cod's roadways by mileage are owned by local towns. MassHighway also owns a significant 201.97 miles of roadway (7.8%), consisting 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 MassHighway. These 31.28 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 MassHighway, with only 2.58 miles. The majority of federally owned roadway is located in Bourne and Falmouth, partly 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.

Table 2.2-2 - Road Mileage by Jurisdiction

	Mass Highway	City/ Town	County & Other State	Federal	Un-accepted	Total
Barnstable	30.57	351.76	0.45		67.25	**450.03**
Bourne	31.28	95.98		23.19	38.95	**189.40**
Brewster	10.77	56.48	10.77		90.19	**168.21**
Chatham	7.35	62.77			43.42	**113.54**
Dennis	10.03	144.96			57.63	**212.62**
Eastham	6.30	50.95		4.49	41.72	**103.46**
Falmouth	24.81	216.92			106.59	**348.32**
Harwich	12.73	126.70			12.24	**151.67**
Mashpee	3.78	115.78	0.11	2.74	8.50	**130.91**
Orleans	10.20	50.85	0.85		33.60	**95.50**
Provincetown	2.58	19.88		5.87	0.62	**28.95**
Sandwich	18.41	147.91	1.24	25.87	22.89	**216.32**
Truro	10.35	38.00		0.54	10.73	**59.62**
Wellfleet	7.98	54.66	1.47	4.20	2.57	**70.88**
Yarmouth	14.83	152.33			83.18	**250.34**
Totals	**201.97**	**1,685.93**	**14.89**	**66.90**	**620.08**	**2,589.77**

Source: Massachusetts Roadway Inventory File

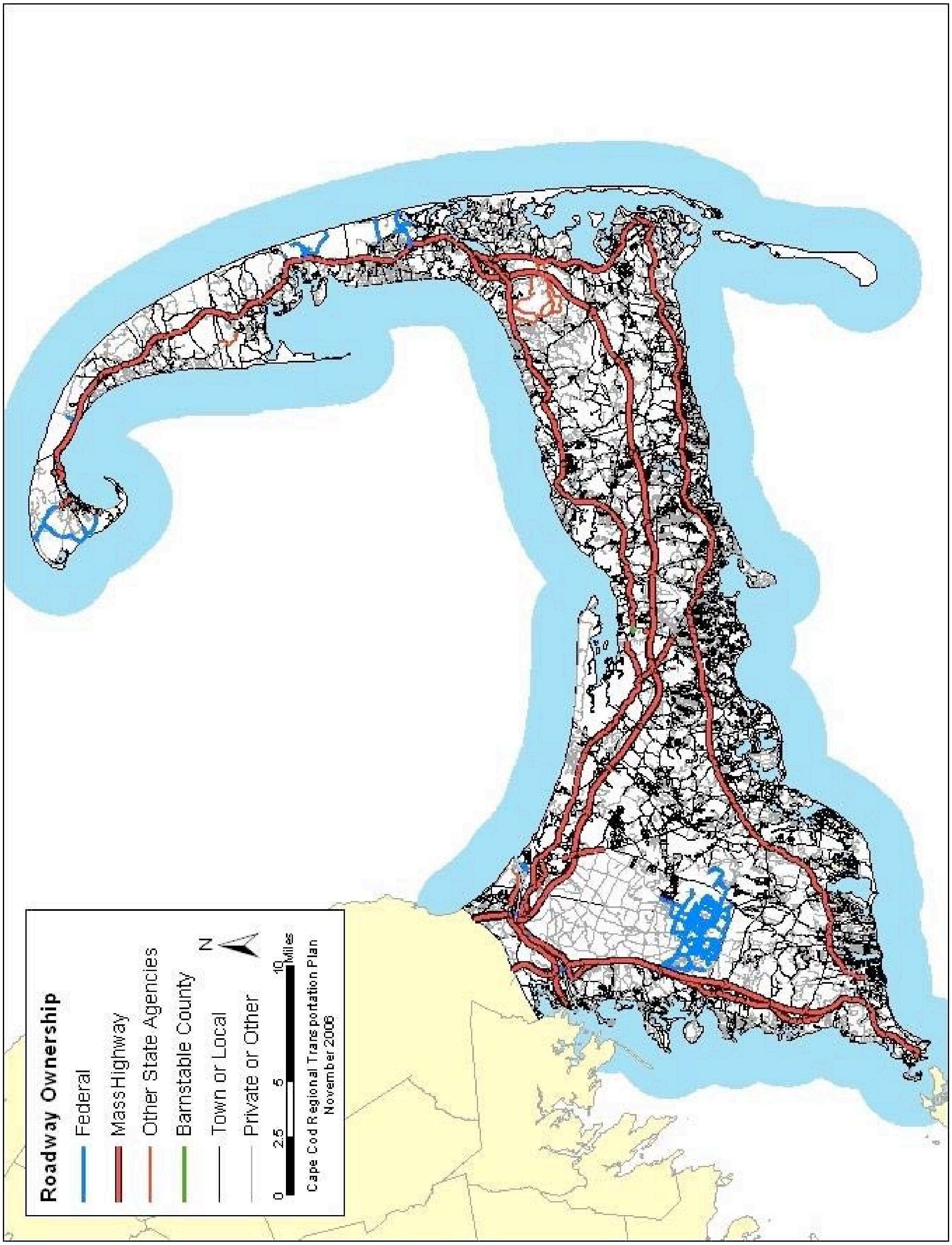


Figure 2.2-3 - Ownership of Cape Cod's Roadways

There are thousands of roadway intersections across Cape Cod. Of these intersections, 112 are signalized and 23 are circular. Barnstable has 33 traffic signals, which is the most of any town on Cape Cod. Bourne has 4 circular intersections (Belmont Circle, Bourne Rotary, Buzzard's Bay Rotary, and the Otis Rotary), 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 2.2-3 - Intersection Type

	Signalized Intersections	Pedestrian Crossing Signals (mid-block)	Circular Intersections
Bourne	9	0	4
Sandwich	9	0	3
Falmouth	11	0	2
Mashpee	6	0	3
Barnstable	33	0	3
Yarmouth	16	1	3
Dennis	9	0	1
Harwich	2	2	1
Chatham	2	1	1
Brewster	0	0	0
Orleans	6	0	0
Eastham	4	0	1
Wellfleet	3	0	0
Truro	0	0	0
Provincetown	2	0	1
Cape Cod	**112**	**4**	**23**

Source: Massachusetts Roadway Inventory File

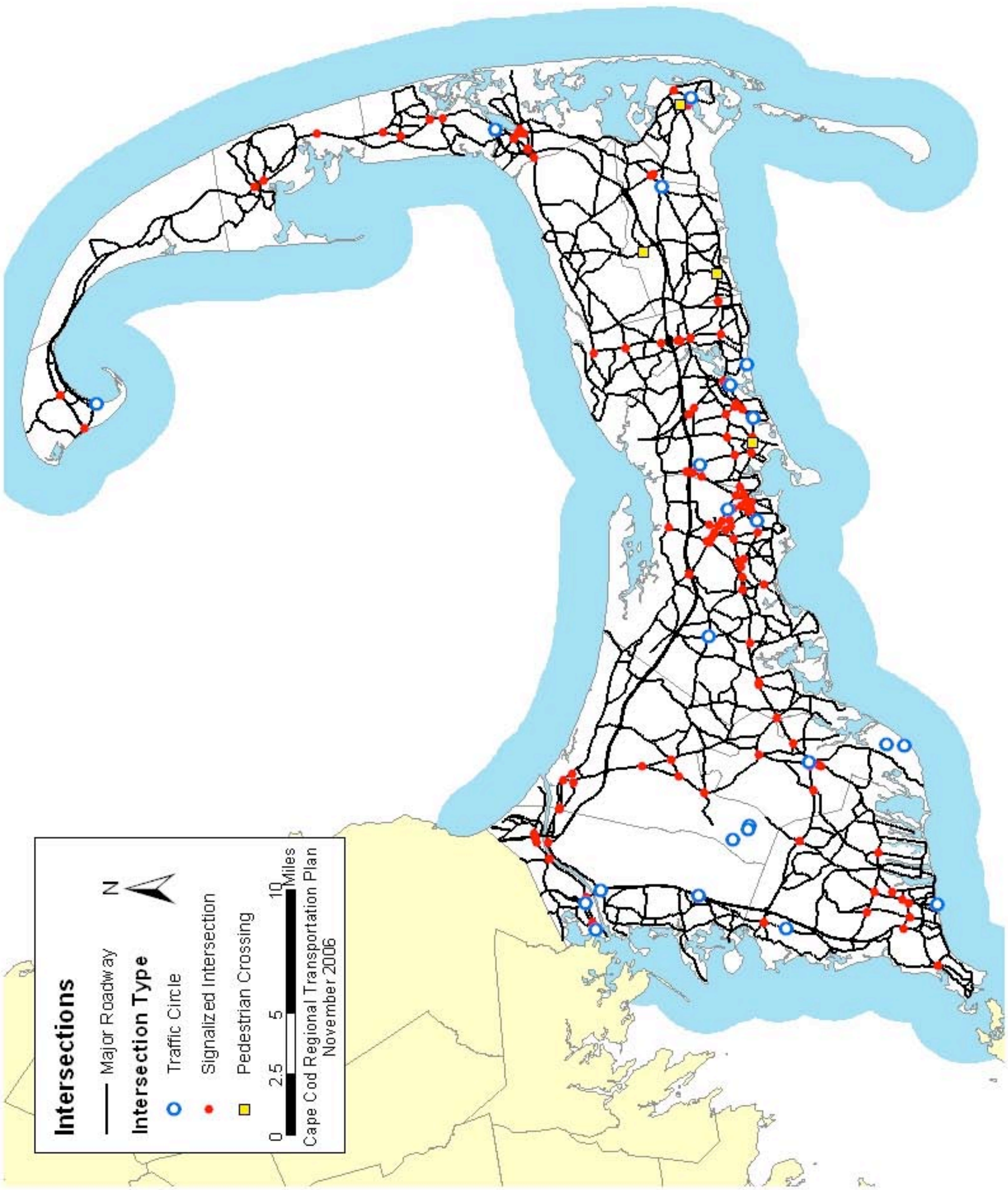


Figure 2.2-4 - Roadway Intersections – Traffic Control

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.

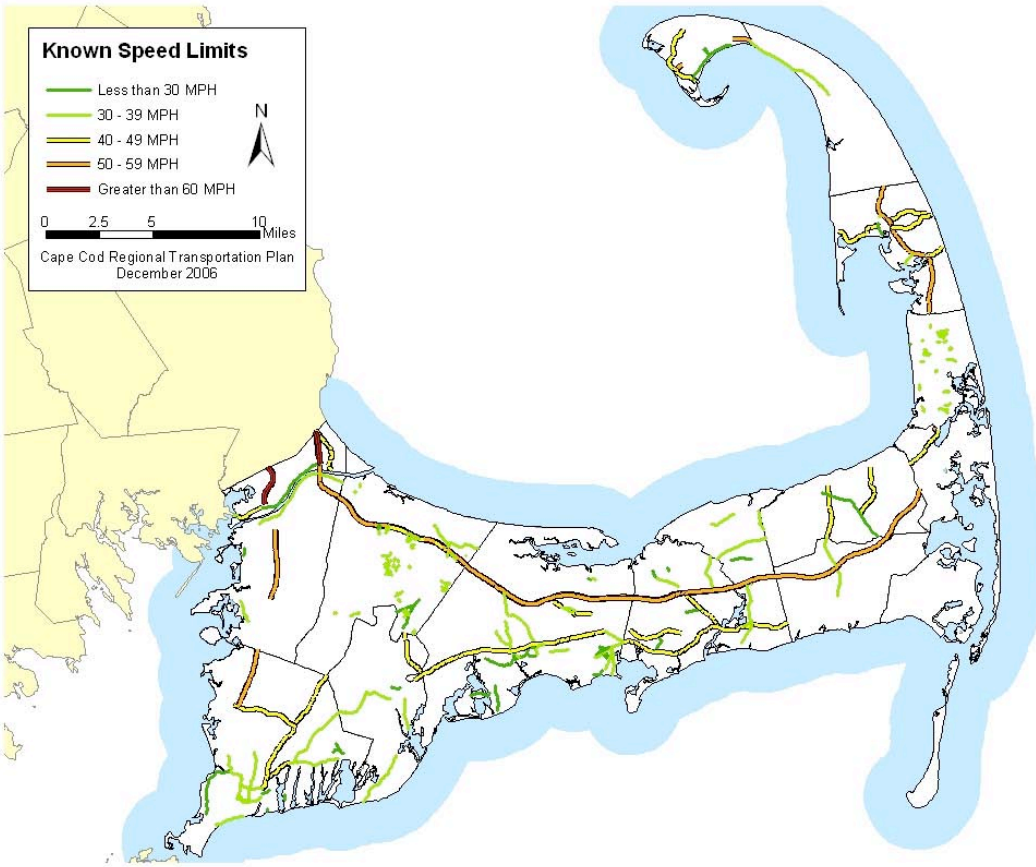


Figure 2.2-5 - Speed Limits on Cape Cod Roadways

Source: Massachusetts Roadway Inventory File

2.2.4 Roadway Volumes

Traffic levels on Cape Cod have been generally increasing, with short periods of occasional decline. During the most recent one-year comparison (2005 Cape Cod Traffic counting Report) summer traffic declined over 3.5% from 2004 to 2005. Looking at a longer term, summer traffic has increased annually at a rate of nearly one percent (see following table).

Table 2.2-4 - Cape Cod Summer Traffic Growth: 1995-2005

Region	Number of Comparisons	Total Growth	Average Annual Growth Rate	95% Confidence Interval
All Roads	**284**	**9.60%**	**0.92%**	**±0.22%**
Upper Cape	83	10.37%	0.99%	±0.36%
Mid-Cape	72	12.74%	1.20%	±0.41%
Lower Cape	76	4.86%	0.47%	±0.43%
Outer Cape	53	5.55%	0.54%	±0.74%
Rt. 6 (All)	45	8.07%	0.77%	±0.38%
Rt. 28 (All)	31	8.20%	0.79%	±0.66%

"Upper" = Bourne, Sandwich, Falmouth, Mashpee	"Lower" = Harwich, Chatham, Brewster, Orleans
"Mid" = Barnstable, Yarmouth, Dennis	"Outer" = Eastham, Wellfleet, Truro, Provincetown

Source: 2005 Cape Cod Traffic Counting Report

At most traffic counting locations, year-round average daily traffic is estimated using MassHighway Adjustment Factors in combination with summer traffic counts. These adjustment factors are calculated based on continuous traffic counts from:
Bourne Bridge, Sagamore Bridge, Route 3 at the Bourne/Plymouth town line, Route 6 east of Exit 5, Route 28 east of Putnam Avenue in Cotuit, and Route 28 east of Higgins Crowell Road in Yarmouth. The Cape Cod MPO has supported 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.

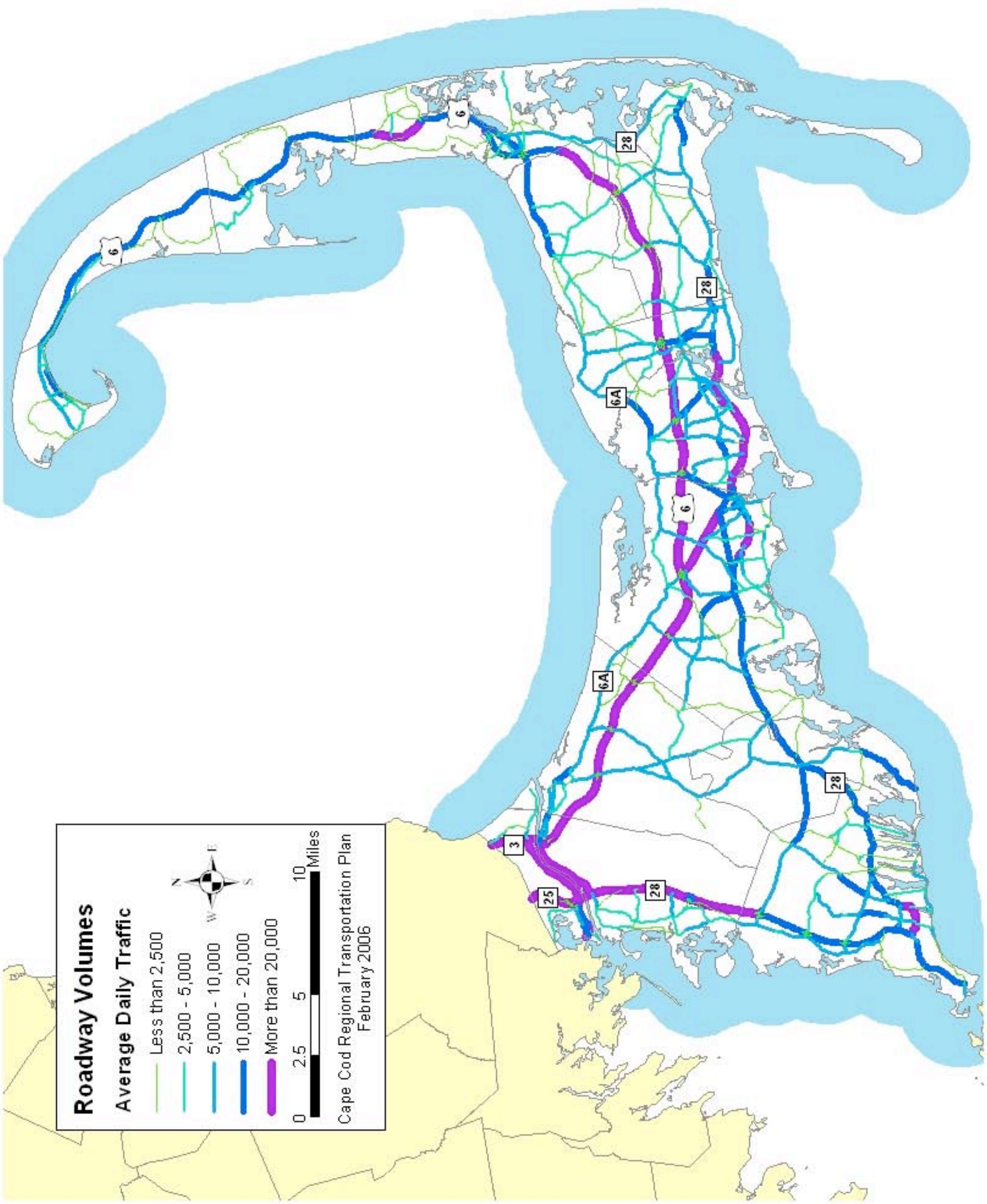


Figure 2.2-6 –Year-Round Average Daily Roadway Volumes

Source: MassHighway Road Inventory 2005

The following figure shows the annual average summer traffic growth for the ten-year period from 1995 to 2005. Results are reported for the Cape's sub-regions. The Mid-Cape area experienced the highest growth and the Lower Cape experienced the lowest growth rate.

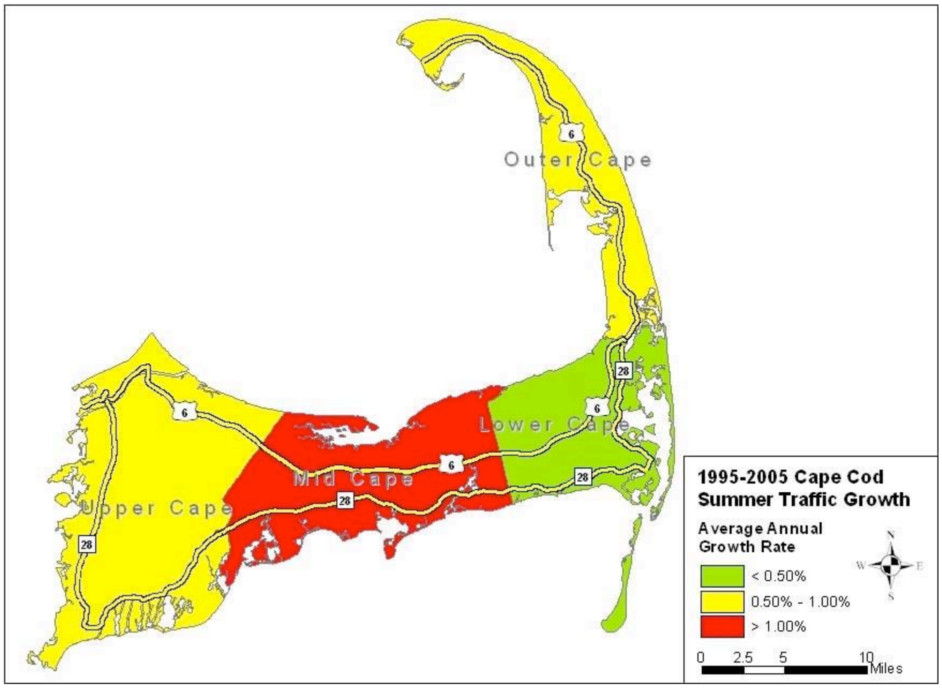


Figure 2.2-7 - 1995-2005 Cape Cod Summer Traffic Growth

Source: 2005 Cape Cod Traffic Counting Report

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 2.2-5 - 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. High signal density, extensive queuing, or progression/timing are the typical.
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[2]

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:

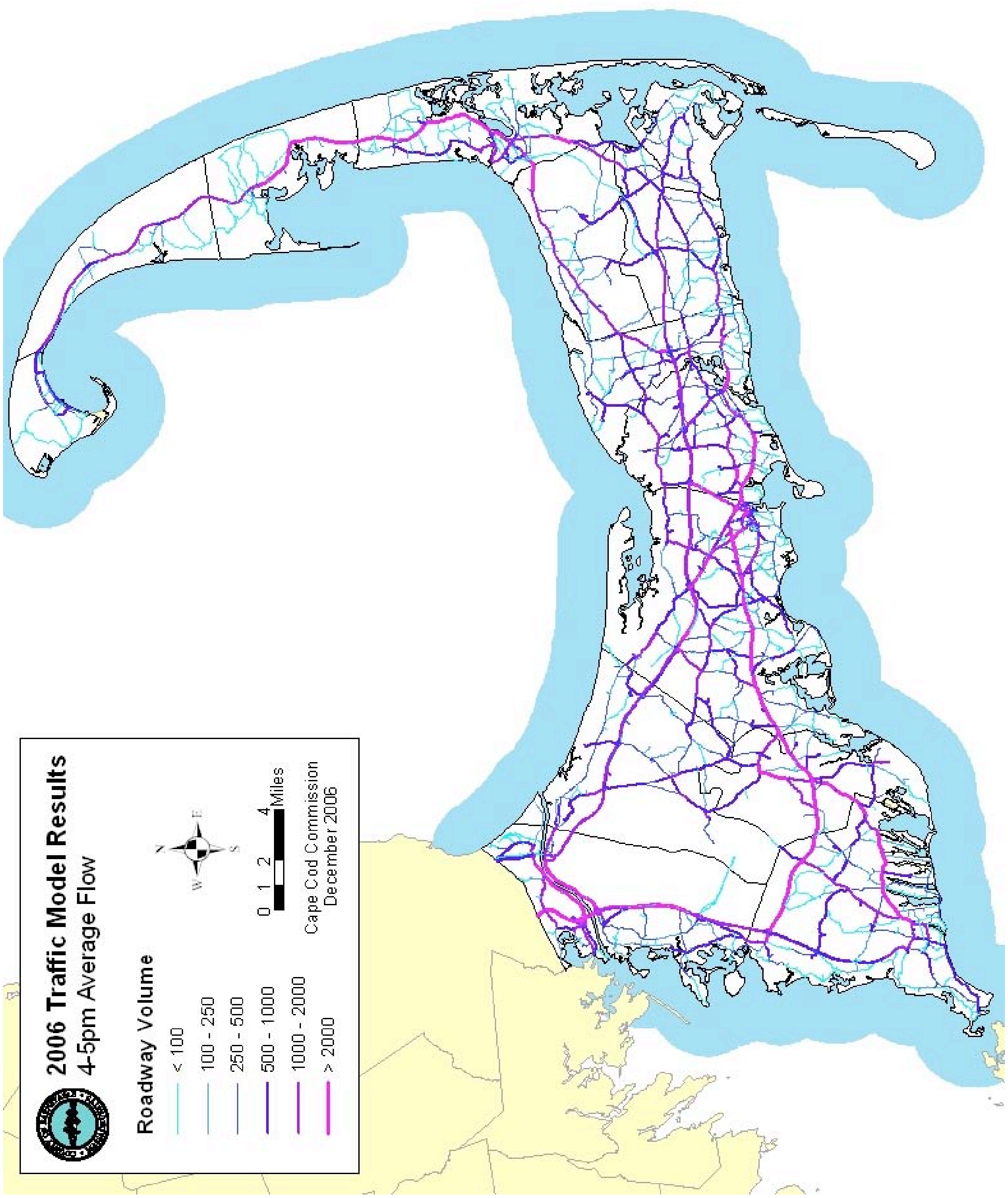


Figure 2.2-8 - Estimated 2006 Traffic Flows

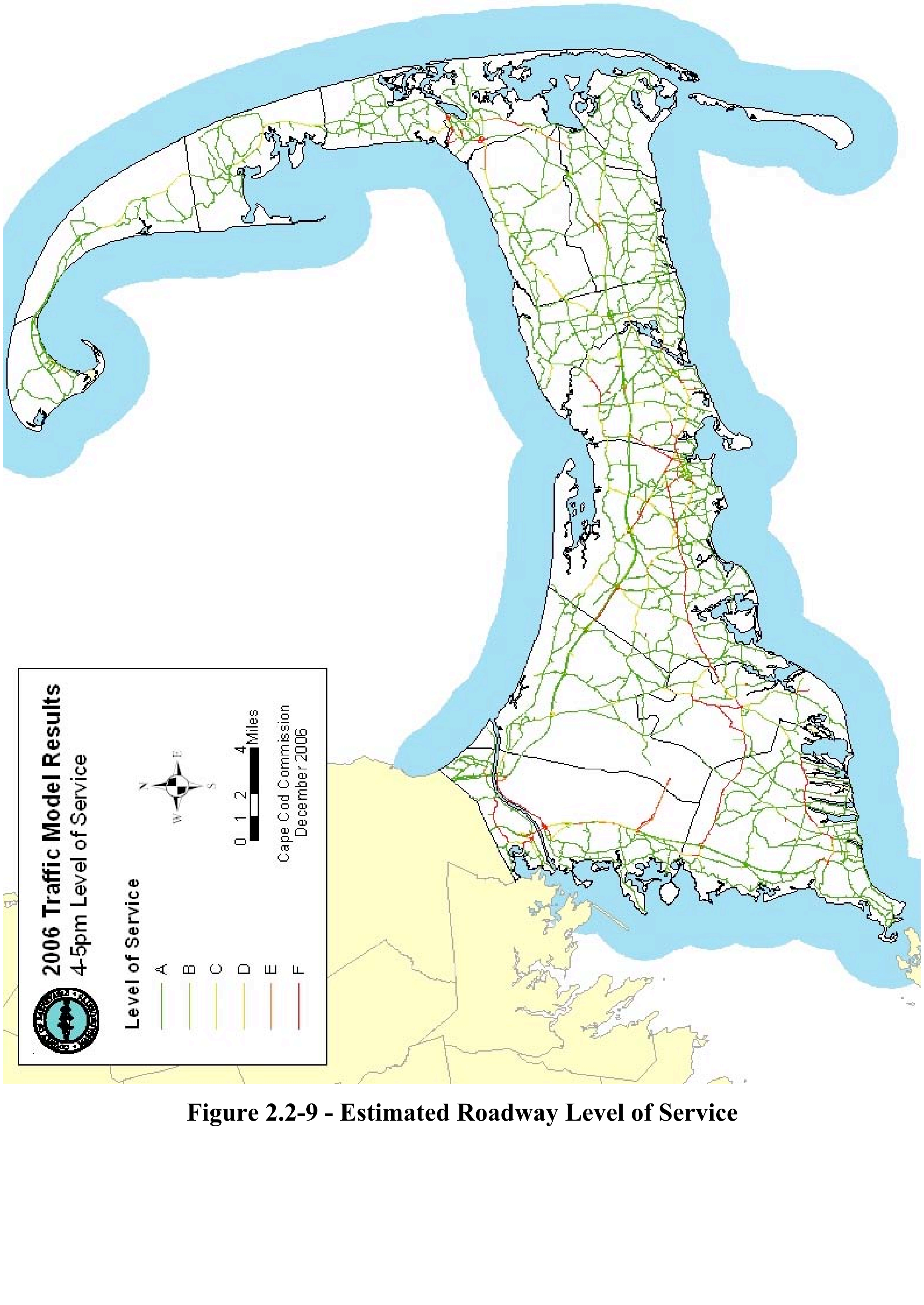


Figure 2.2-9 - Estimated Roadway Level of Service

2.2.6 Auto Ownership

Based on census reports, over 131,000 vehicles are owned by Cape Cod households. 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. This is higher than both the 34.9% of Boston households that do not own a car[3], and the 12.7% of Massachusetts' households who do not own a car[4]. The dependence of Cape Cod households on automobiles is due to the low density of housing, jobs, and retail.

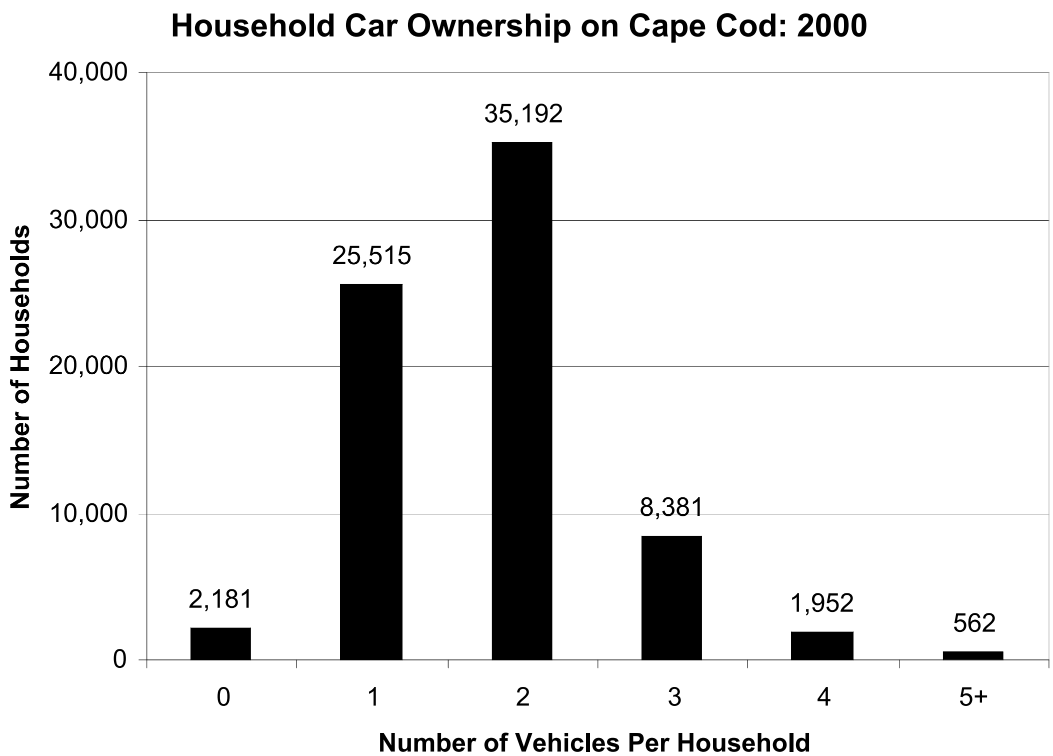


Figure 2.2-10 - Household Car Ownership on Cape Cod: 2000

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.

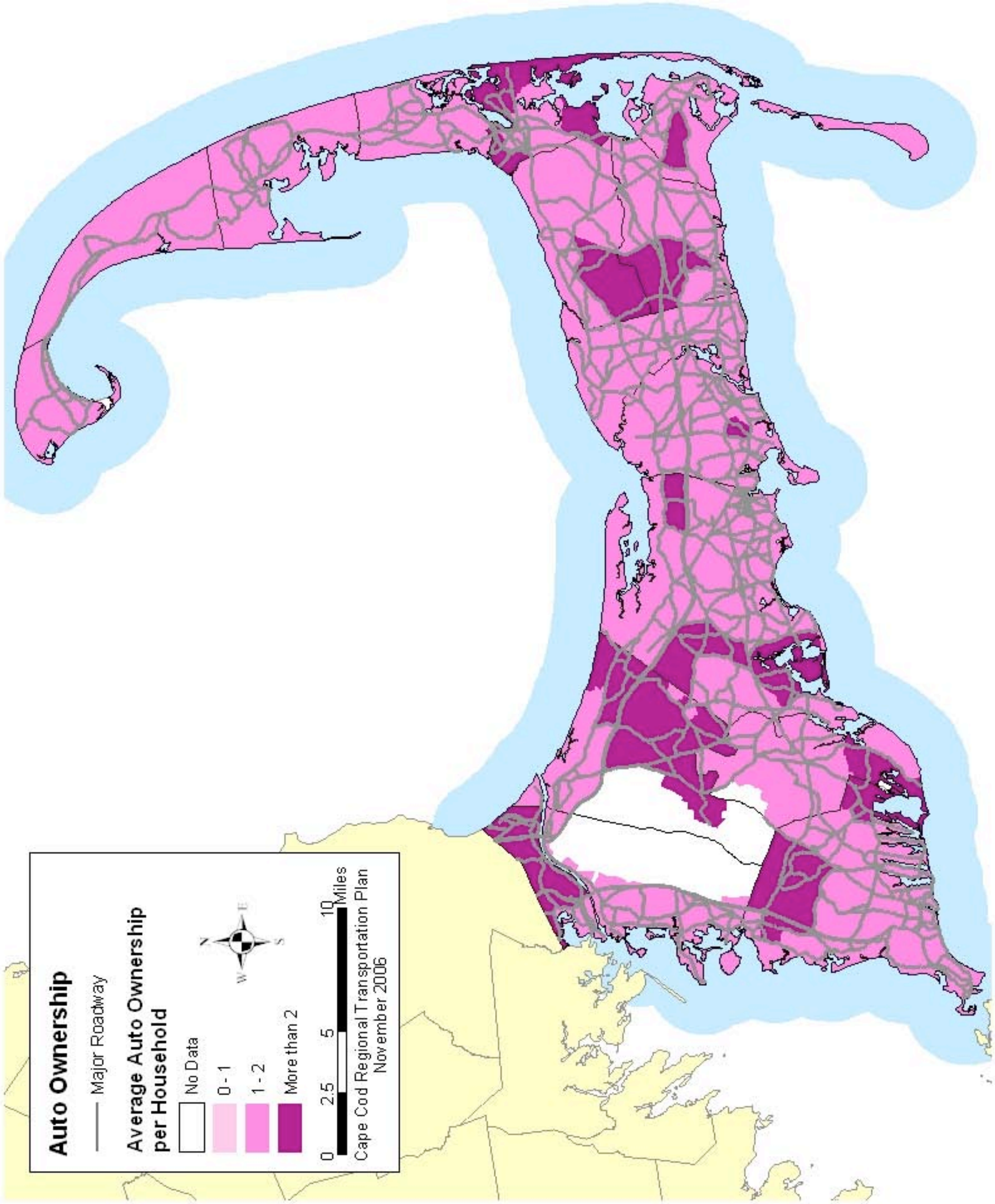


Figure 2.2-11 - Auto Ownership on Cape Cod

Source: US Census 2000

2.2.7 Commuter Traffic

On average 20% of trips made daily by individuals are work-related[5]. 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.

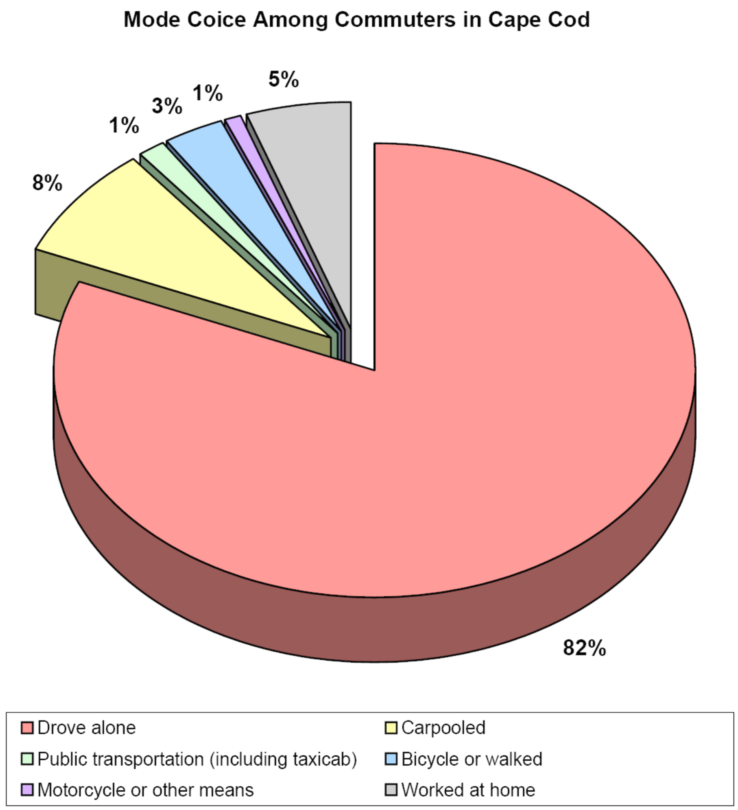


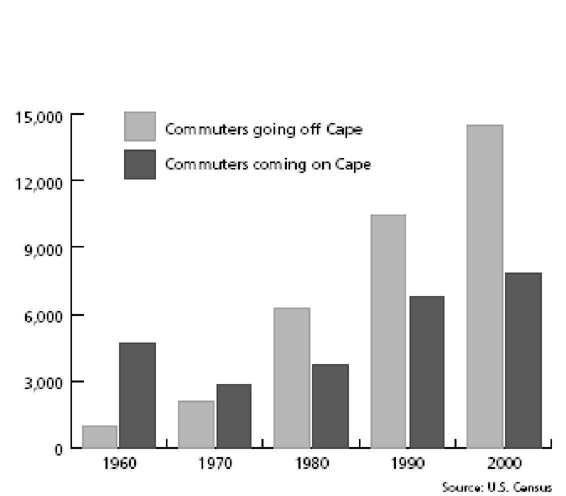
Figure 2.2-12 - Commuter Mode Choice among Cape Cod Residents

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[6]. Thus, despite the significant trips generated by long distance commuters, almost half of journey-to-work trips made by Cape Cod residents are local.

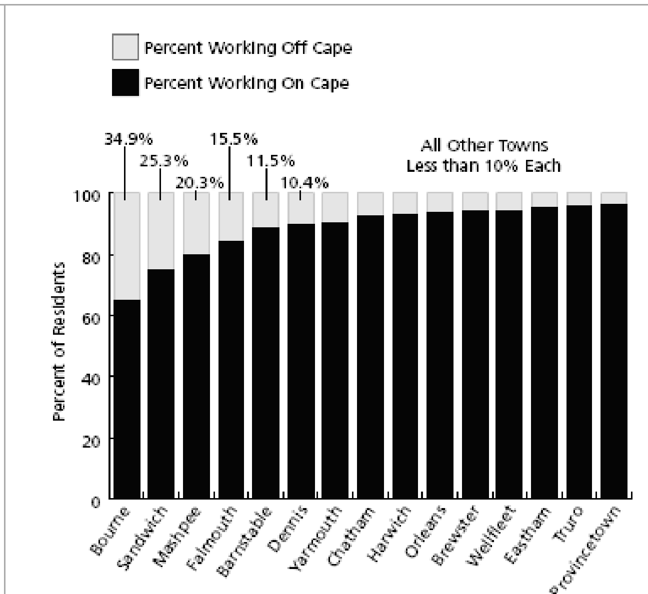
Several roads serve as major commuter corridors. Route 6 serves long distance commuters. Traffic at the entrance and exit ramps of the Mid Cape Highway can become congested at peak hours as commuting traffic attempts to transfer from Route 6 to the local road network, or vice versa. Exit 6 to Route 132 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[7]. The majority of those trips are from commuters going off Cape (see figure below).



Commuting Trends for Barnstable County, 1960-2000[8]



Commuting Behaviors for Barnstable County Towns, 2000 Census[9]

Figure 2.2-13 - Commuting Trends and Patterns

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 2.2-6 - 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 2.2-7 - 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, shown in red, are 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.

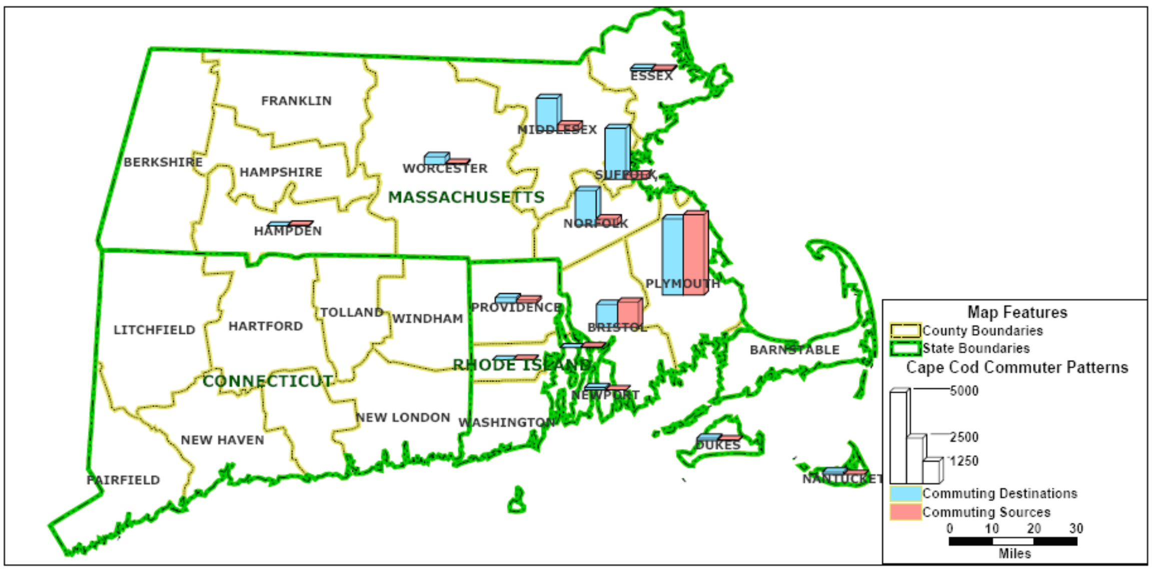
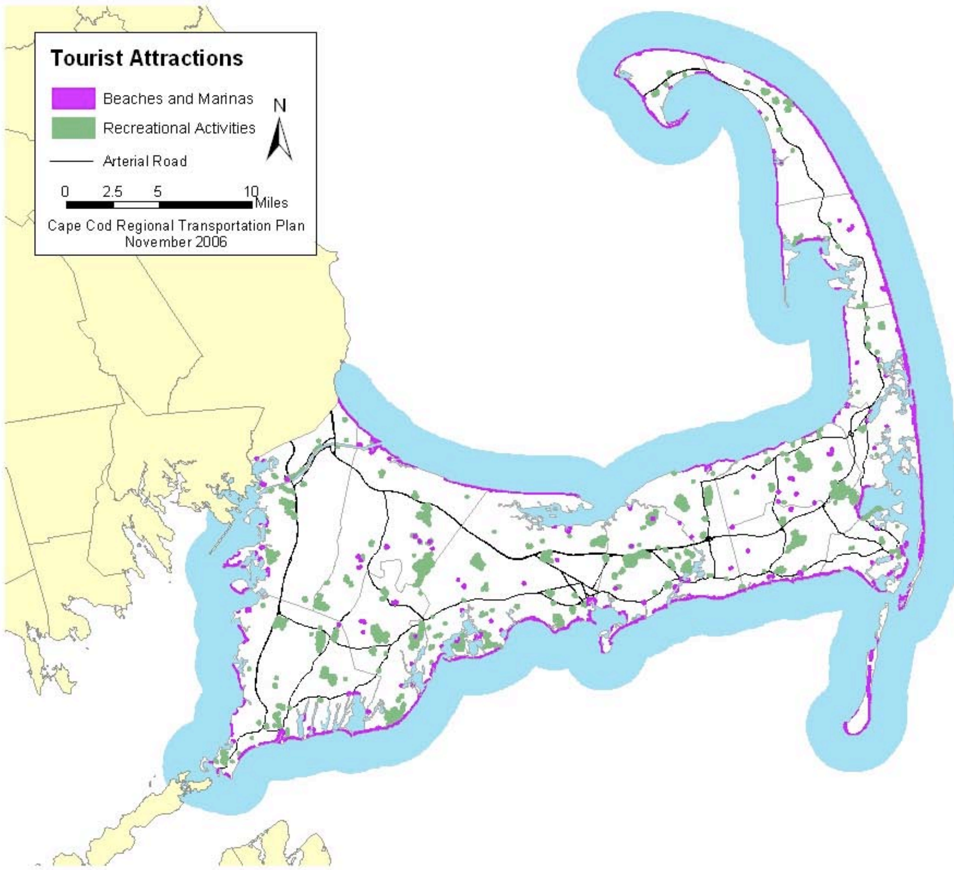


Figure 2.2-14 - Commuting Patterns (Destinations of Cape Cod Residents)

2.2.8 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.



Note: Map features have been enlarged with a 0.1 mile buffer to provide better visibility

Figure 2.2-15 - Visitor Attractions on Cape Cod

Route 6 License Plate Survey

In April and August of 1999, the Cape Cod Commission conducted a license plate survey of vehicles traveling on Route 6. The survey recorded the license plates optically with high speed cameras at a location in Sandwich and one in Wellfleet. The information was analyzed through optical recognition software and the license plate numbers were

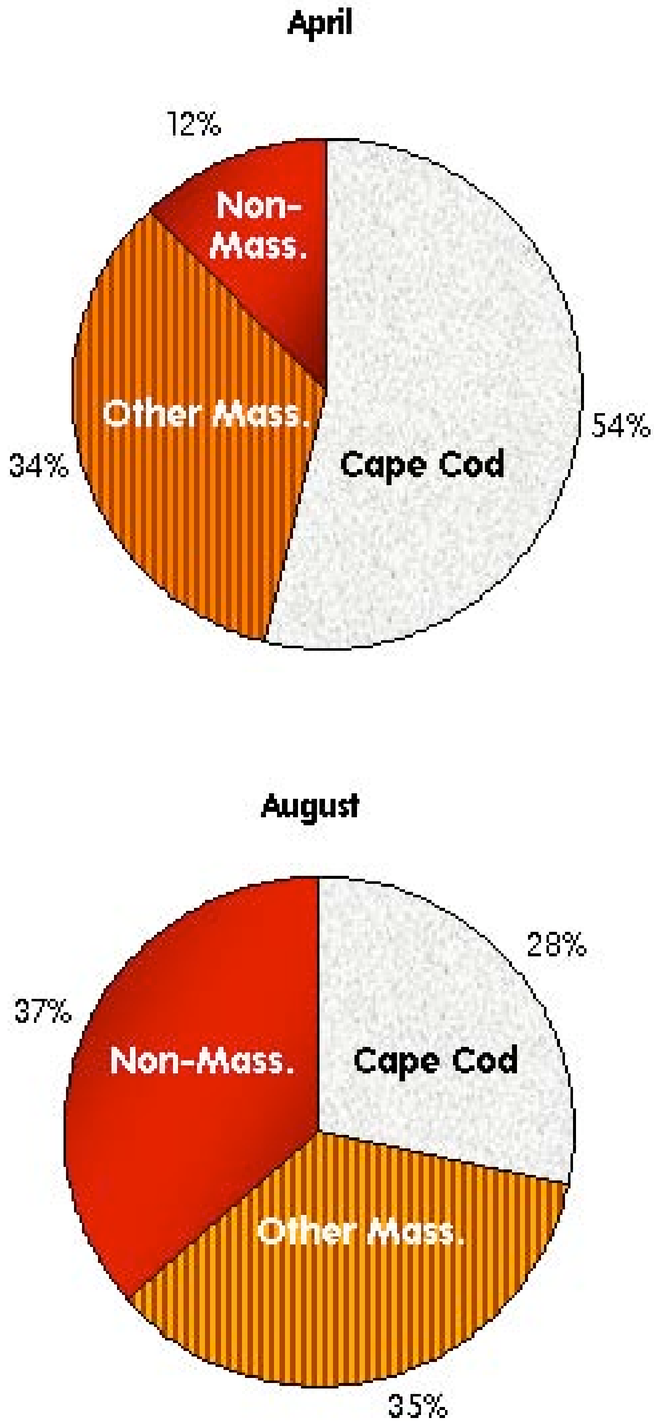


Figure 2.2-16 – 1999 Route 6 Traffic Sources (Based on Vehicle Registrations)

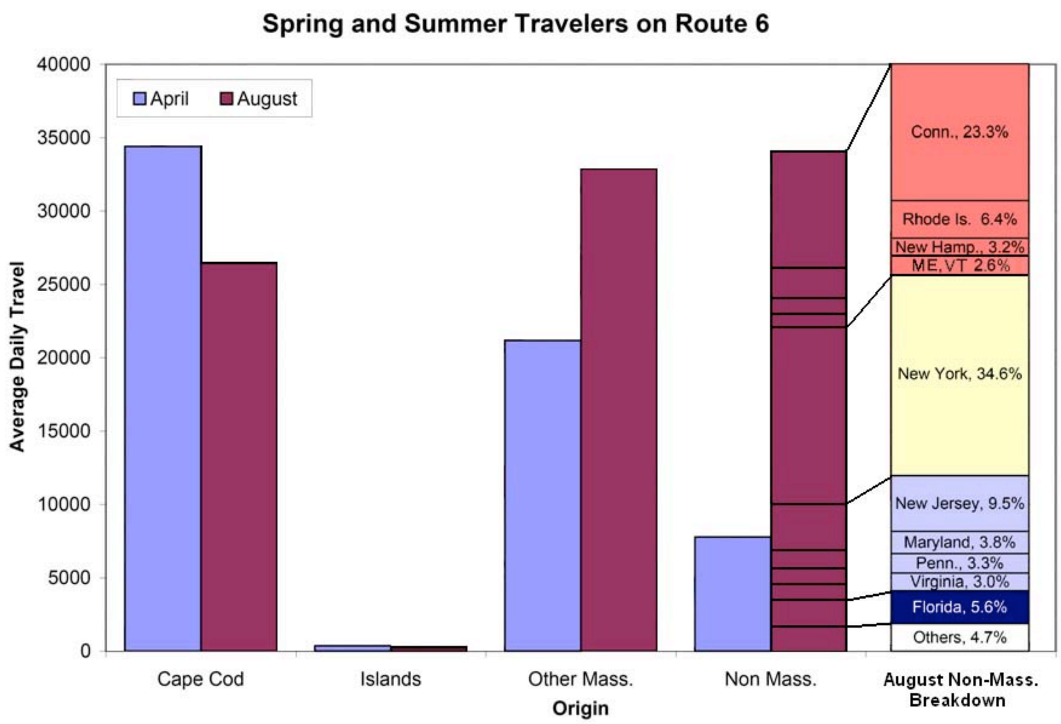


Figure 2.2-17 - Spring and Summer Travelers on Route 6

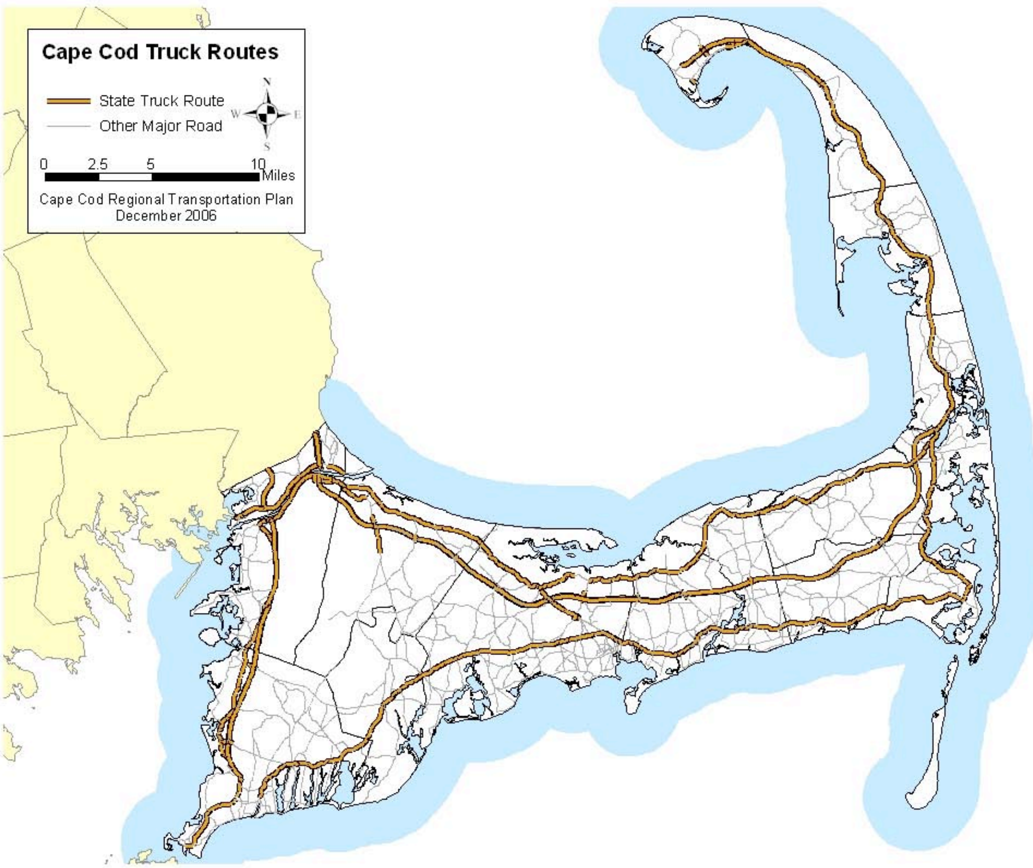
Source: 1999 License Plate Study

compiled. Out of state plates were compiled by state, province, or country and Massachusetts plates were compiled by the city or town in which they were registered.

The most significant finding was that fewer vehicles registered in Cape Cod towns use Route 6 during the summer survey than the spring survey. This would indicate that Cape Cod year round residents are making fewer trips in the summer, shifting some travel to late evenings, or finding alternate routes to Route 6.

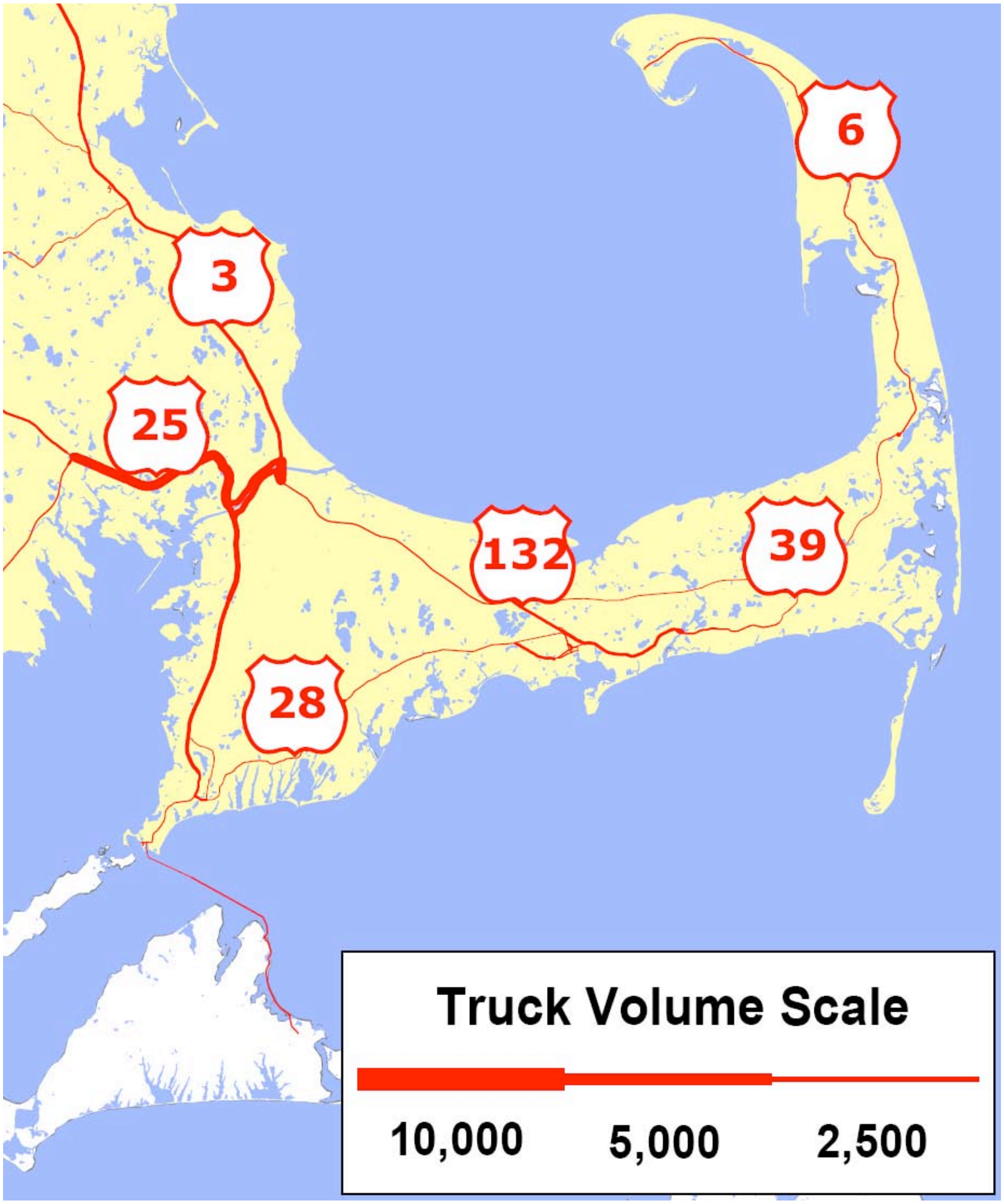
2.2.9 Freight Traffic

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.



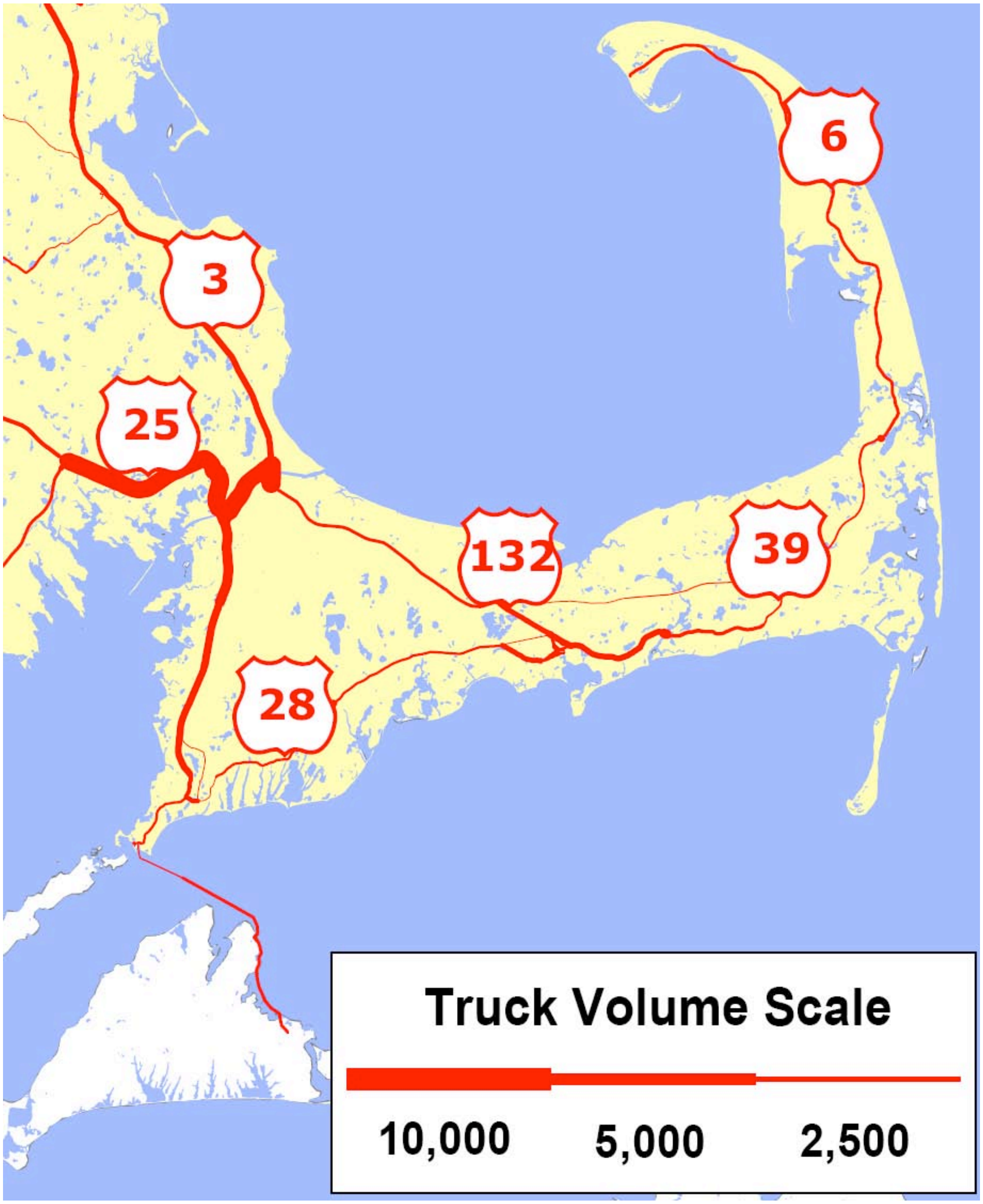
Source: Massachusetts Roadway Inventory File

Figure 2.2-18 - Designated Truck Routes under State Authority



Source: FHWA

Figure 2.2-19 - Estimated Average Annual Daily Truck Traffic: 1998



Source: FHWA

Figure 2.2-20 - Estimated Average Annual Daily Truck Traffic: 2020

2.2.10 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 Section 2.9. 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, and 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 2.2-8 - Bridge Conditions of Cape Cod, by Town

	Total Bridges	Functional Bridges	Functionally Obsolete Bridges	Structurally Deficient Bridges
Bourne	12	6	6	0
Sandwich	9	3	6	0
Falmouth	25	18	5	2
Mashpee	0	0	0	0
Barnstable	16	8	8	0
Yarmouth	9	4	5	0
Dennis	12	5	4	3
Harwich	8	5	3	0
Chatham	1	0	0	1
Brewster	1	1	0	0
Orleans	4	4	0	0
Eastham	1	1	0	0
Wellfleet	3	2	0	1
Truro	2	0	0	0
Provincetown	0	0	0	0
Cape Cod	**103**	**59**	**37**	**7**

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 103 bridges on Cape Cod, only 6 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.

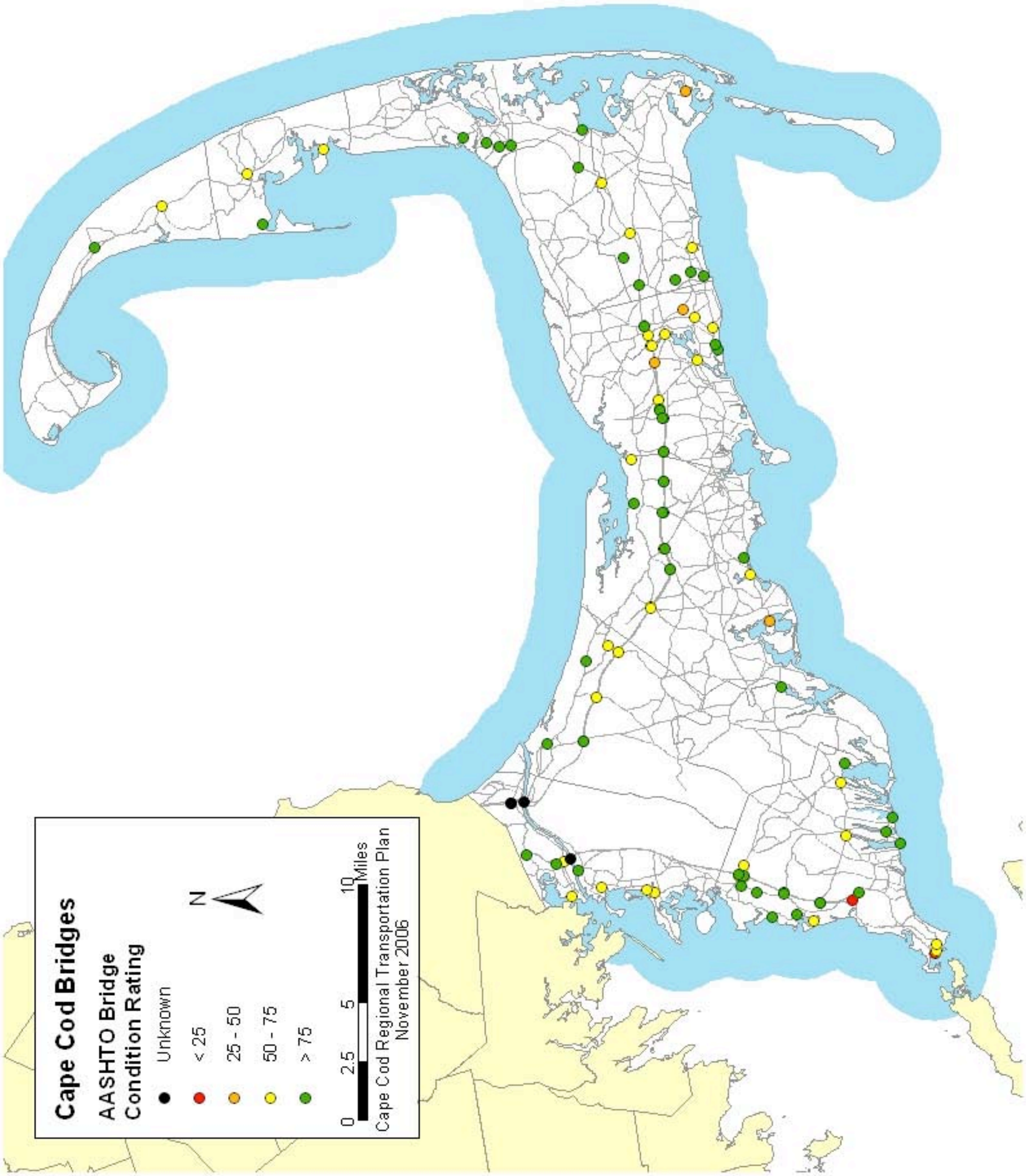


Figure 2.2-21 - The Bridges of Barnstable County

Figure 2.2-22 - 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 37 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.

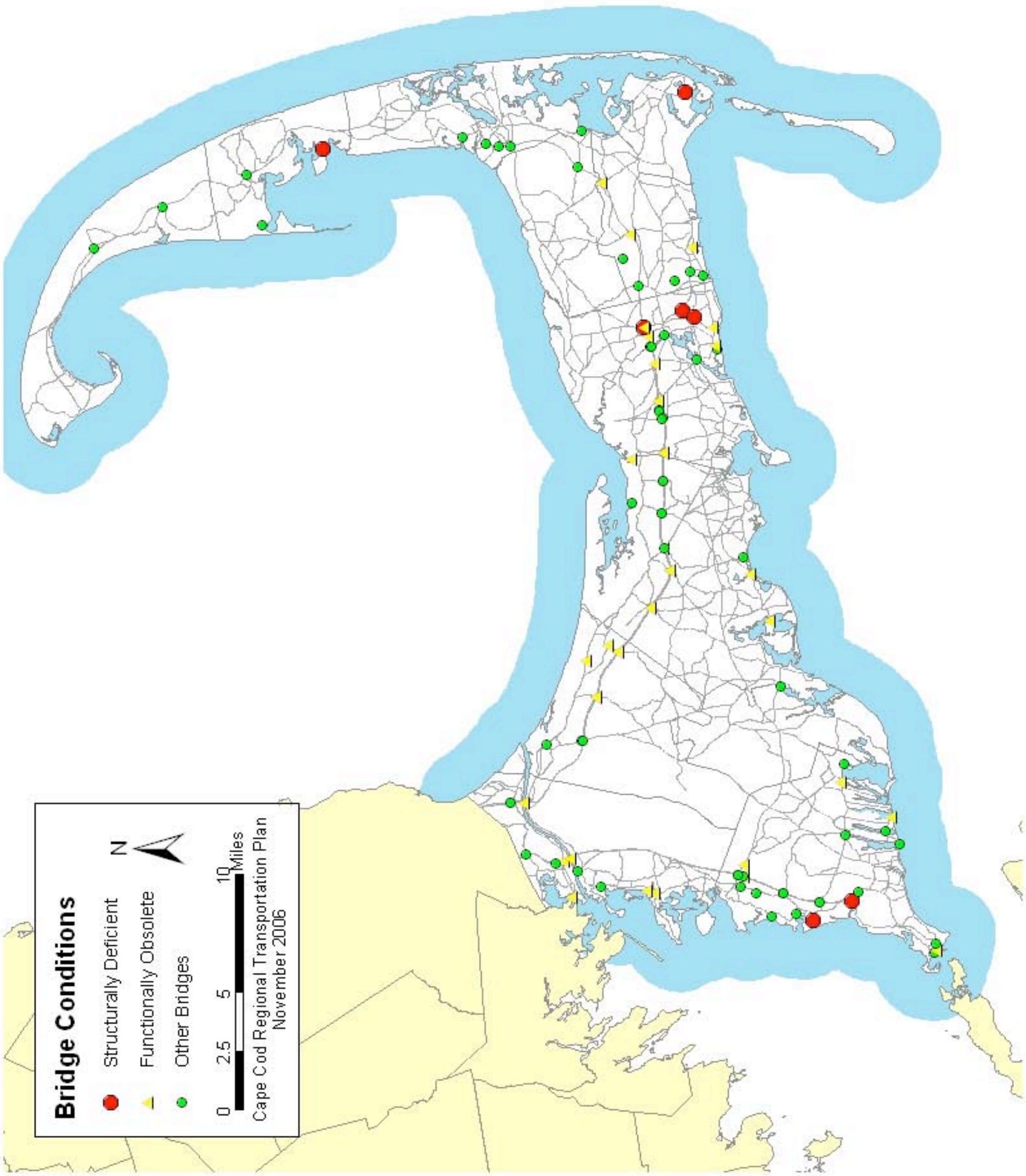


Figure 2.2-23 - Structurally Deficient and Functionally Obsolete Bridges on Cape Cod

2.2.11 U.S. Route 6

U.S. Route 6 runs from Bishop, CA to Provincetown, MA, 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 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 east of the Sagamore Bridge, was eliminated by 2006. This change provides for a direct connection between Route 3 and the Sagamore Bridge and, according to MHD, will help relive 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.

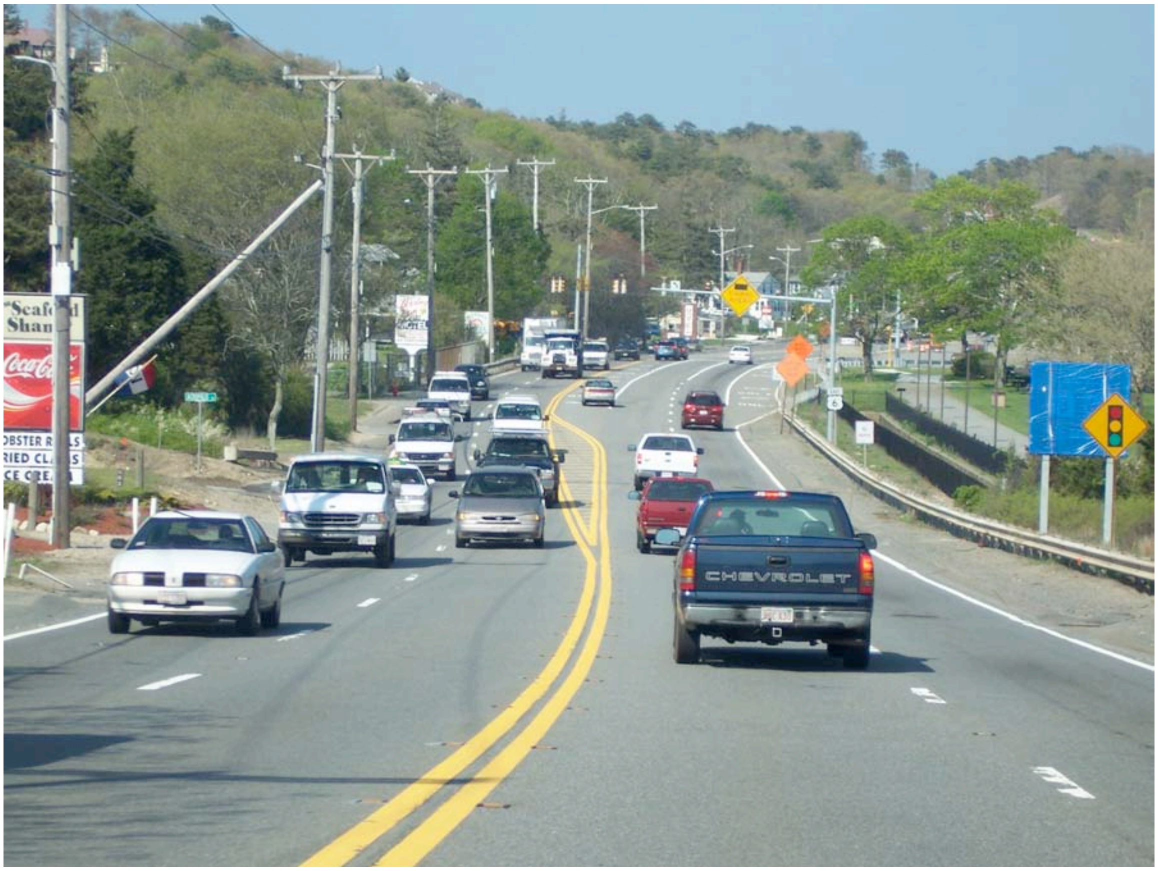


Figure 2.2-24 - Scenic Highway (Route 6), west of Bournedale Road

<u>Sagamore Bridge to Exit 9, Dennis</u>

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 2.2-25 - Route 6 at Exit 4 in Sandwich

Figure 2.2-26 - 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. This section is actually built on what was designed to be one direction of a divided highway.

Figure 2.2-27 - 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 2.2-28 - Route 6 North of Governor Prence Road, Eastham (Outer Cape)

Table 2.2-9 - 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. Route 6 overall has a crash rate of 0.73 crashes per million vehicle miles traveled (for a town-by-town listing of crash rates please see Chapter 3). The overall fatality rate for Route 6 is 0.46 fatal crashes per 100 million vehicle miles traveled. Crashes along the portion of Route 6 from Dennis to Orleans in the past led to the creation of the raised median and stanchions. Safety on Route 6 is discussed in further detail in Chapter 3 of the RTP.

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.

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 2.2-10 - Traffic Volumes & Mileage: Route 6

Town	Summer ADT	Annual ADT	Miles	Avg. Daily Vehicle Miles Traveled (VMT)
Bourne	70,029	53,922	7.02	378,532
Sandwich	63,392	48,812	15.2	741,942
Barnstable	69,394	53,433	8.28	442,425
Yarmouth	65,300	50,281	4.56	229,281
Dennis	49,398	38,037	2.04	77,594
Harwich	30,068	23,152	5.63	130,346
Brewster	27,400	21,098	2.92	61,606
Orleans	23,660	18,219	3.6	65,587
Eastham	31,594	24,327	6.12	148,881
Wellfleet	22,932	17,658	8.56	151,152
Truro	17,266	13,295	9.93	132,019
Provincetown	15,551	11,974	3.8	45,501
Total			**77.66**	**2,604,869**

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

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. 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.

2.2.12 State Route 28

State Route 28 begins at the Eastham Rotary, runs for almost sixty-five miles through villages adjacent to the Atlantic Ocean/Nantucket Sound/Buzzards Bay from Orleans

Center to Bourne before crossing the Cape Cod Canal and continuing north to the New Hampshire border. 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 39, Great Western Road, Buck Island Road, Route 151, Upper and Lower County Roads, 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 from the Bourne Rotary to Saconesset Hills in Falmouth.

Figure 2.2-29 - 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 two lanes from Phinneys Lane to the Orleans/Eastham Rotary.

Figure 2.2-30 - Route 28 North of Jones Road/David Straits, Falmouth (Upper Cape)

Figure 2.2-31 - Route 28, east of Route 149 in Barnstable (Mid-Cape)

Figure 2.2-32 - Route 28 in South Yarmouth (Mid-Cape)

Figure 2.2-33 - Route 28 east of Routes 124 and 39 (Lower Cape)

Figure 2.2-34 - 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 overall has a crash rate of 3.02 crashes per million vehicle miles traveled (for a town-by-town listing of crash rates please see Chapter 3). The overall fatality rate for Route 28 is 0.99 fatal crashes per 100 million vehicle miles traveled.

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 how to provide for modes other than the automobile.

Table 2.2-11 - Traffic Volumes & Mileage: Route 28

Town	Summer ADT	Annual ADT	Miles	Avg. Daily Vehicle Miles Traveled (VMT)
Bourne	46,488	35,796	8.7	311,425
Falmouth	22,774	17,536	14.6	256,026
Mashpee	22,595	17,399	3.7	64,374
Barnstable	27,835	21,433	10.4	222,903
Yarmouth	24,839	19,126	5.2	99,455
Dennis	14,792	11,390	3.4	38,726
Harwich	13,598	10,471	6.4	67,011
Chatham	11,089	8,539	7.3	62,331
Orleans	12,879	9,917	4.9	48,593
Total			**64.6**	**1,170,845**

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

2.2.13 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. For this reason, 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 2.2-35 - Route 6A west of Willow Street (Mid-Cape)

Safety

Route 6A overall has a crash rate of 2.86 crashes per million vehicle miles traveled (for a town-by-town listing of crash rates please see Chapter 3). The overall fatality rate for Route 6A is 0.55 fatal crashes per 100 million vehicle miles traveled.

Another 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 (see Appendix) is to develop rural road design guidelines that will provide "footprint roadway" options to preserve the character of scenic roadways such as Route 6A.

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 conducted for the Commission in 1995. One recommendation from this study was the reduction of speed limits to 35 MPH. Recently an access management study was done that resulted in recommendations for improving access to Route 6A and other similar Cape Cod roadways.

Table 2.2-12- Traffic Volumes & Mileage: Route 6A

Town	Summer ADT	Annual ADT	Miles	Avg. Daily Vehicle Miles Traveled (VMT)
Bourne	15,083	11,614	0.6	6,968
Sandwich	13,473	10,374	7.5	77,805
Barnstable	9,826	7,566	8.4	63,554
Yarmouth	13,264	10,213	3.7	37,788
Dennis	10,337	7,960	4.3	34,226
Brewster	16,565	12,755	7.8	99,489
Orleans	25,678	19,772	1.7	33,612
Total			**34**	**353,443**

Source: Cape Cod Commission 2004-2005 Traffic Volumes
Note: Annual ADT Estimates Based on MassHighway 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.

2.2.14 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.

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[1] MA Roadway Inventory File
[2] Highway Capacity Manual, Transportation Research Board Number 212, January 1990.
[3] Census Bureau, 2000 Census, Boston, MA Selected Housing Characteristics: 2000, Census.gov
[4] Census Bureau, 2000 Census, MA Selected Housing Characteristics: 2000, Census.gov
[5] "Nationwide Personal Transportation Survey User's Guide to the Public Use Tapes", Research Triangle Institute. 1991.
[6] U.S. Census Bureau, 2000 U.S. Census Journey to Work.
[7] See *Chapter 2: Existing and Future Conditions*, Section 2.1.3: Economics.
[8] Cape Trends, "Commuting Trends", http://www.capecodcommission.org/data/capetrends.htm
[9] Cape Trends, "Commuting (Part 1)", http://www.capecodcommission.org/data/capetrends.htm

2.3 Bus Transportation

Figure 2.3-1: Bus Routes and Connections on Cape Cod[1]

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[2]. 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 2.3-2**). 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.

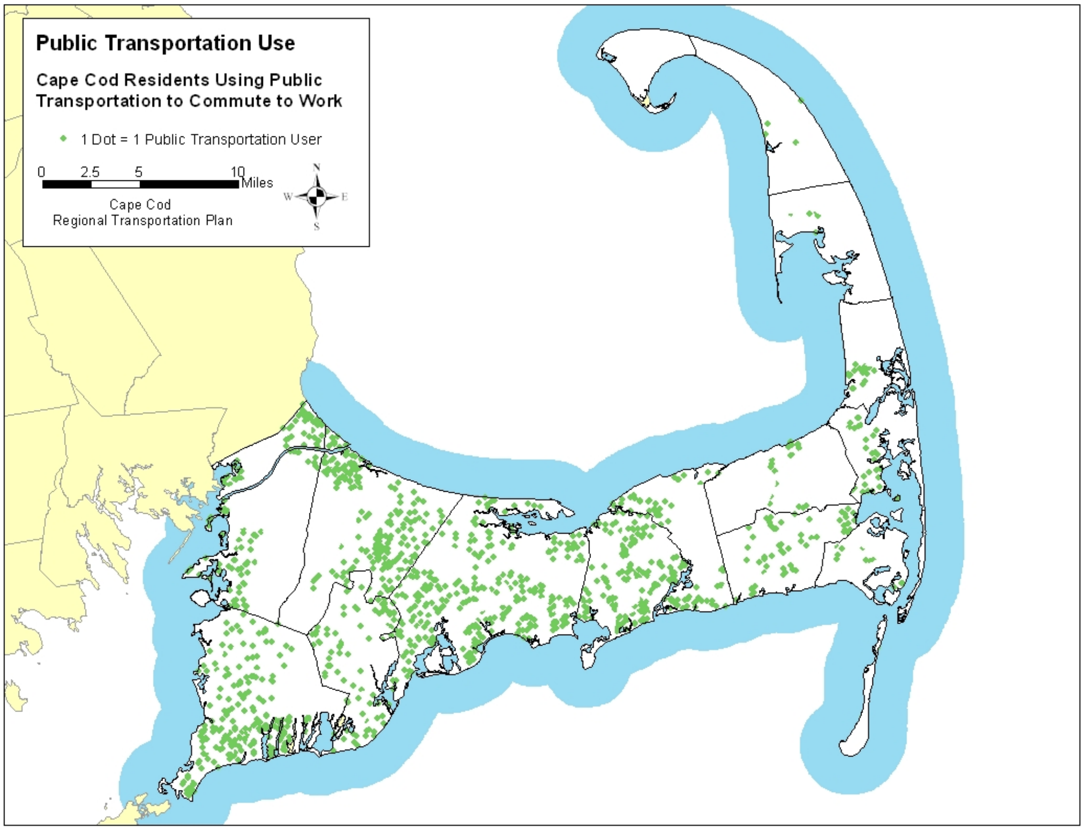

Figure 2.3-2: Public Transportation Use on Cape Cod[3]

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 2.3-3: Hyannis Transportation Center, North Side

Figure 2.3-4: Hyannis Transportation Center, West Side

Figure 2.3-5: Bus Terminal at the Hyannis Transportation Center

Figure 2.3-6: 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 2.3-7: 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 Breeze 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 2.3-8: 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. MassHighway 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 1 in Bourne, near Routes 3 and 6. Due to construction, the lot has been temporarily relocated to Meeting House Road. The temporary lot has 361 parking spaces. When the Sagamore Interchange project is complete, the Park-and-Ride Lot will be located behind the McDonald's and Mobil Station. The new lot is expected to be of similar size to the original lot. 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.

The temporary lot has experienced higher levels of usage than the original lot. Based on five observations taken in 2003 and 2004 by the Cape Cod Commission, the average demand of the original lot was 73%, or 275 vehicles. The peak parking demand at the original lot was observed in July 2003 with 309 parked vehicles (82%). The average demand of the temporary lot was 76% in 2005, or 274 vehicles, based on four observations. Even though demand has remained the same, the temporary lot has a higher percentage of use because it is smaller.

Figure 2.3-9: Aerial View of the Original Sagamore Park-and-Ride Lot, 2002

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 Barnstable Villager Breeze provides local bus service to the Park-and-Ride lot, with connections to Barnstable Village, Route 132, and Hyannis.

Figure 2.3-10: Bus Shelters at Barnstable Park-and-Ride Lot

Figure 2.3-11: Parking Available at Barnstable Park-and-Ride Lot

The lot experiences heavy usage, often near or over-capacity. For the 5 observations taken by the Commission staff in 2005, the average observed demand was 96% of capacity. The peak parking demand was observed in August, with 363 parked vehicles

(99% of capacity). Including observations as far back as 2001, the average observed demand is 89% 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 used as a stop for Plymouth and Brockton service between Hyannis and Provincetown.

Due to its location, size and amount of service, the Harwich Park-and-Ride Lot has limited usage. For the 13 observations taken by the Cape Cod Commission staff in 2004, the average observed demand was 14% of capacity. The peak parking demand was observed in August, with 19 parked vehicles (25% of capacity). Including observations as far back as 2001, the average observed demand is 20% of capacity. However, the number of vehicles parking at the Harwich Park-and-Ride Lot may increase 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 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. The electric trolley cars carried passengers to and from work, and on weekend "joy rides[4]." 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[5]. 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).

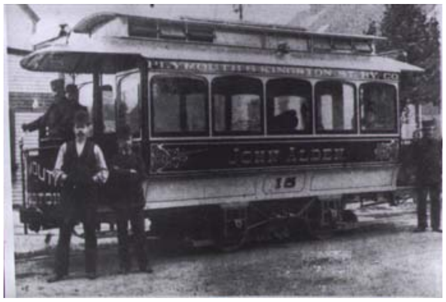

Figure 2.3-12: Plymouth and Kingston Street Railway Car[6]

Figure 2.3-13: Plymouth and Brockton Street Railway Car[7]

Figure 2.3-14: An Older Bus Model from Plymouth and Brockton[8]

Figure 2.3-15: An Older Bus Model from Plymouth and Brockton[9]

Figure 2.3-16: Plymouth and Brockton Bus at the Hyannis Transportation Center

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 2.3-1: 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 accommodate the lower demand for travel.

Table 2.3-2: 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

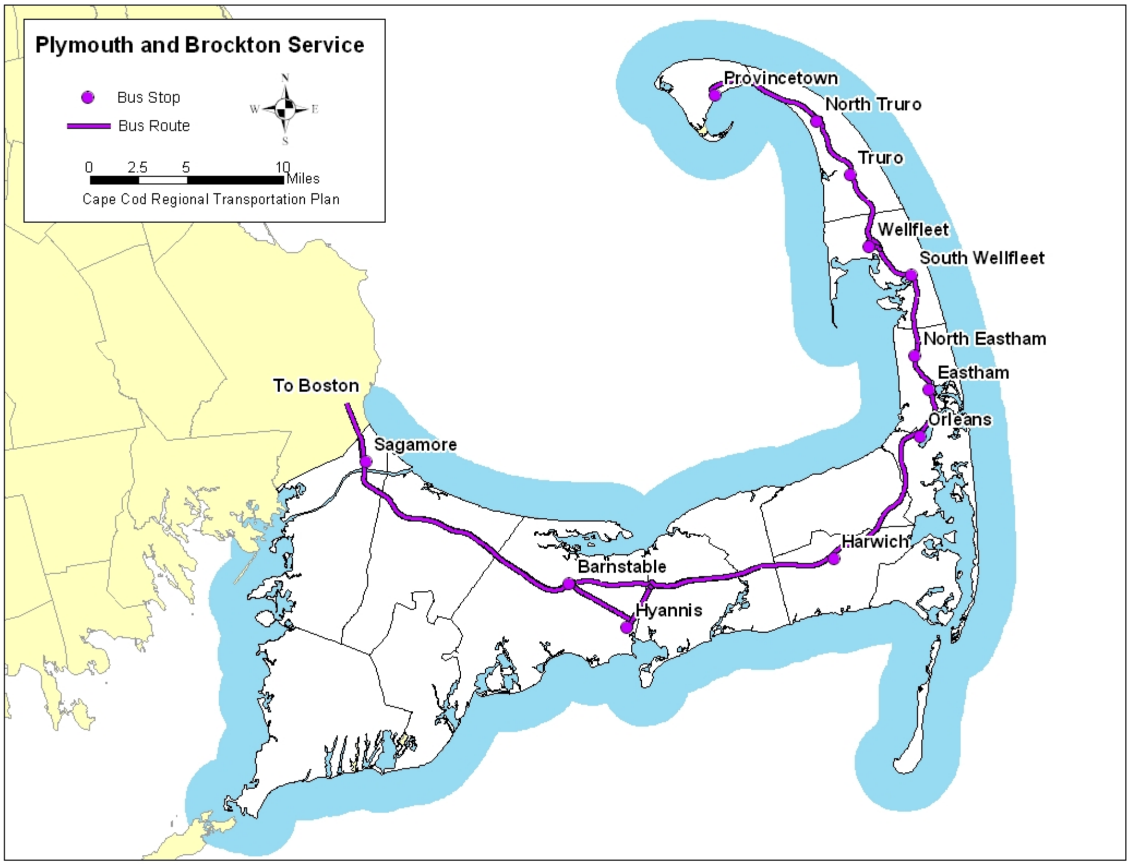

Figure 2.3-17: Plymouth and Brockton Bus Routes

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 2.3-18: 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 2.3-3: 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 2.3-4: 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.

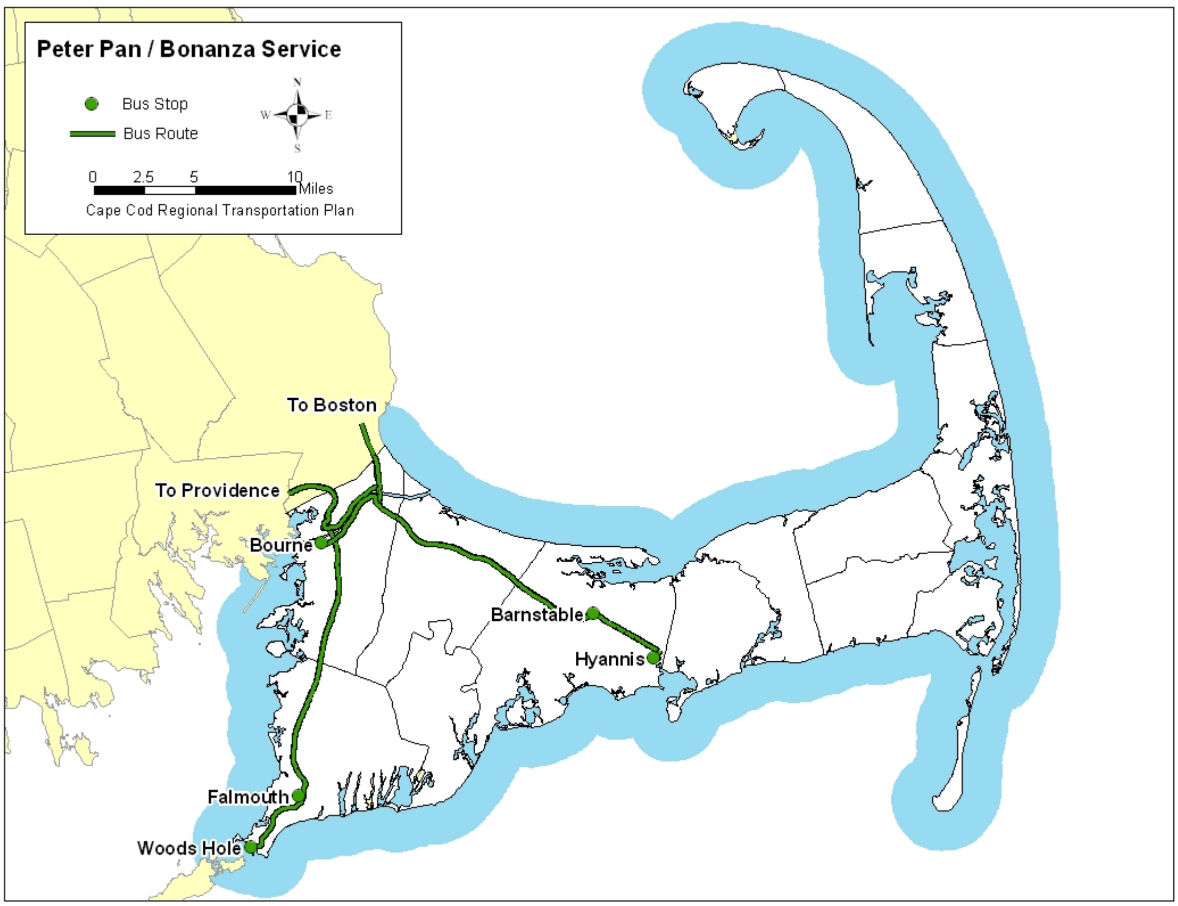

Figure 2.3-19: Peter Pan / Bonanza Bus Routes

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. The CCRTA service area is 395 square miles, covering the Barnstable urbanized zone and all of Barnstable County[10]. 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 87 buses and vans, with an average age of 5.7 years. Using this fleet, the CCRTA recorded 605,650 unlinked trips* in 2004. This is a decrease from the 653,149 unlinked trips in 2003. These passengers were carried 4,374,691 miles across Cape Cod in 2003. The CCRTA fleet is run at 100% capacity for fixed-route service, and roughly 90% for demand response service[12].

Table 2.3-5: Cape Cod Local Bus Service Consumption and Supply, 2004[11]

Service Consumption		
Annual Passenger Miles	4,374,691	
Annual Unlinked Trips	605,650	
Average Weekday Unlinked Trips	2,100	
Average Saturday Unlinked Trips	910	
Average Sunday Unlinked Trips	680	
Service Supplied		
Annual Vehicle Revenue Miles	3,107,144	Q
Annual Vehicle Revenue Hours	182,775	Q
Vehicles Operated in Maximum Service	81	
Vehicles Available for Maximum Service	87	
Base Period Requirement	20	

Note – Q = Questionable Data

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). Since 1998, fare revenues have declined as a percentage of total operating funds, from 45% to 10%. By contrast, 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. Decreased ridership has also led to a decrease in the total dollar amount collected in fares as well (**Figure 2.3-20**). Overall, this means that the CCRTA has become more 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 2.3-6: Funding for Operations by the CCRTA, 2004[13]

Total Operating Funds			Total Operating Expenses		
Fare Revenues	$810,452	10.1%	Salary/Wages/Benefits	$875,307	10.9%
Local Funds	$940,829	11.7%	Materials and Supplies	$0	0%
State Funds	$4,976,291	61.7%	Purchased Transportation	$7,186,288	89.1%
Federal Funds	$1,260,913	15.6%	Other Expenses	$0	0%
Other Funds	$73,109	0.9%			
Total	**$8,061,594**		**Total**	**$8,061,595**	

Table 2.3-7: Funding for Capital Improvements by the CCRTA, 2004[14]

Total Capital Funds			Total Capital Expenses		
Local Funds	$0	0%	Purchase of Vehicles	$694,823	100%
State Funds	$694,823	100%	Systems and Guideways	$0	0%
Federal Funds	$0	0%	Facilities and Stations	$0	0%
Other Funds	$0	0%	Other	$0	0%
Total	**$694,823**		**Total**	**$694,823**	

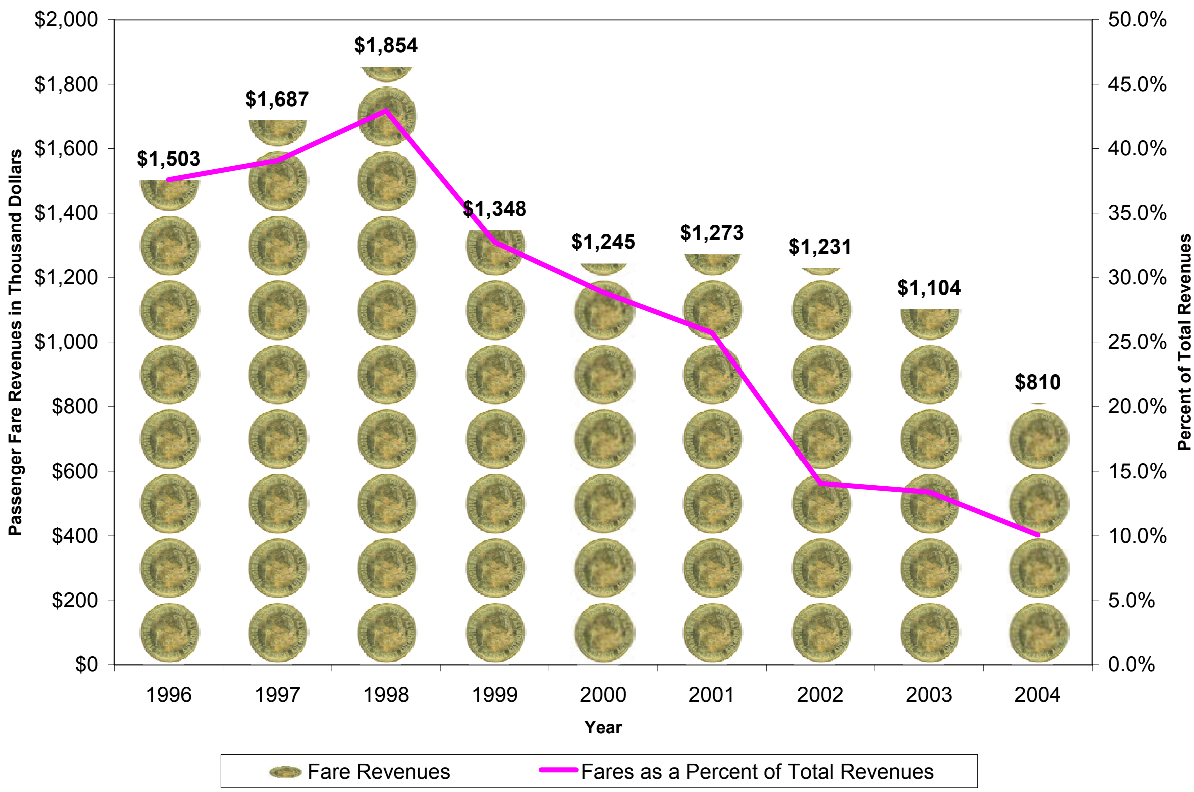

Figure 2.3-20: CCRTA Fare Revenues and Fares as a Percent of Total Revenues[15]

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 2004, the CCRTA received $694,823 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 $2.59 for every mile the CCRTA travels and $44.11 for every hour that the CCRTA operates. Despite the fact that the CCRTA has been losing service efficiency over the past few years, it is comparable with the Greater Attleboro-Taunton Regional Transit Authority (GATRA), an agency with a neighboring service area (See the following Table and Figure). It costs $13.31 to transport the average CCRTA passenger. Moreover, the cost of transporting the average passenger has been rising for the past four years. This increase can be attributed to a drop off in ridership and the high cost of demand response services (**Figure 2.3-22**). The cost for the CCRTA to transport a passenger by bus is more comparable to GATRA and the Massachusetts Bay Transit Authority (MBTA). The overall CCRTA service is also less effective than GATRA or the MBTA. However, the CCRTA bus service is comparable in its effectiveness to GATRA and the MBTA (See Table below).

Table 2.3-8: Performance Measures for Cape Cod Regional Transit Authority and Other Massachusetts Regional Transit Authorities, 2004[16]

	CCRTA				
	Bus	Demand Reponses	Overall	GATRA	MBTA
Service Efficiency					
Operating Expense per Vehicle Revenue Mile	$2.10	$2.75	$2.59	$2.57	$12.57
Operating Expense per Vehicle Revenue Hour	$34.04	$47.49	$44.11	$46.50	$204.71
Cost Effectiveness					
Operating Expense per Passenger Mile	$0.65	$3.33	$1.84	$0.56	$0.57
Operating Expense per Unlinked Passenger Trip	$5.35	$20.72	$13.31	$7.96	$2.73
Service Effectiveness					
Unlinked Passenger Trips per Vehicle Revenue Mile	0.39	0.13	0.19	0.32	4.6
Unlinked Passenger Trips per Vehicle Revenue Hour	6.36	2.29	3.31	5.82	74.85

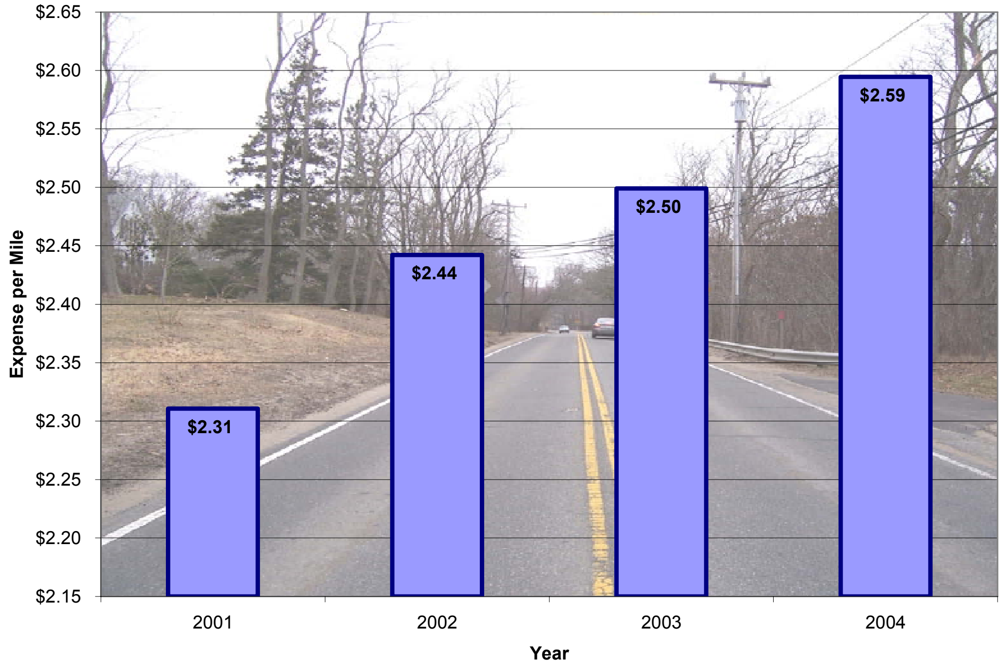

Figure 2.3-21: Operating Expense per Vehicle Revenue Mile[17]

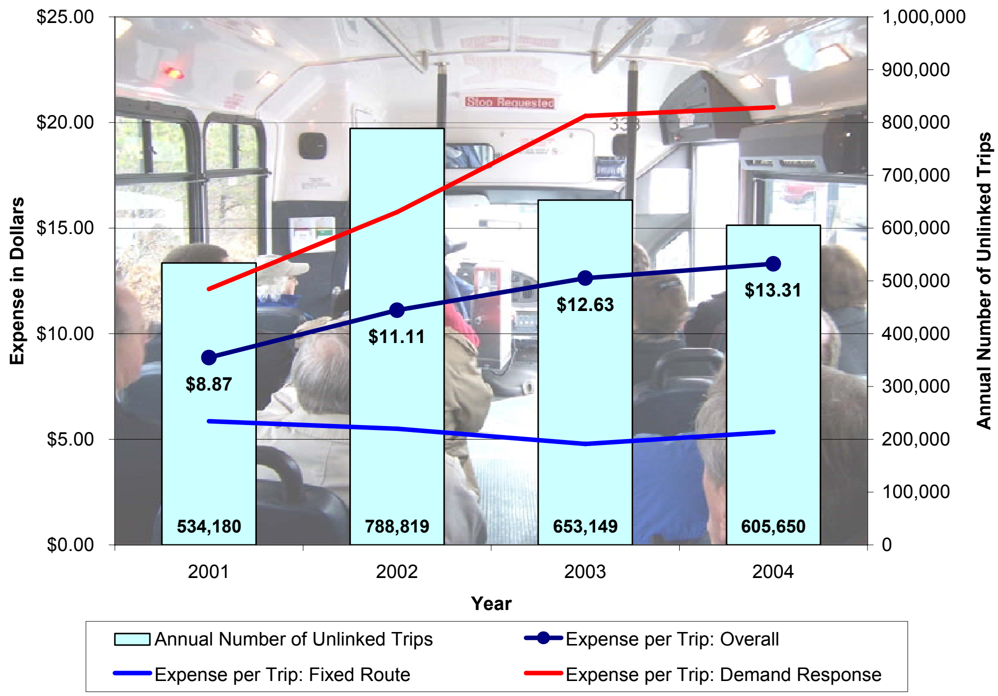

Figure 2.3-22: Operating Expense per Unlinked Passenger Trip[18]

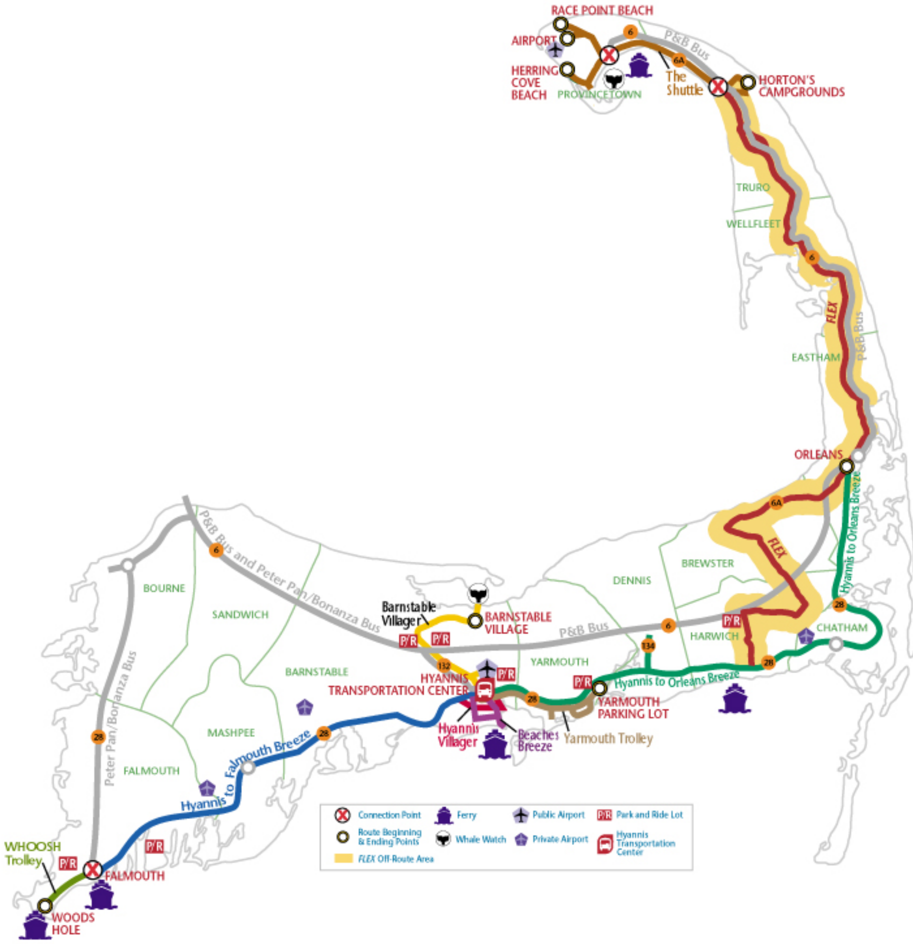

Figure 2.3-23: Cape Cod Regional Transit Authority System Map[19]

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 Breeze. The CCRTA offers eight fixed route services.

2.3.6.1 Hyannis-Falmouth Breeze

Figure 2.3-24: Hyannis-Falmouth Breeze Route Map[20]

Table 2.3-9: Hyannis-Falmouth Breeze Ridership, July 2002 – December 2006[21]

	2006	2005	2004	2003	2002
January	3,689	2,947	3,158	3,314	
February	3,146	2,826	2,927	3,031	
March	4,519	3,887	4,245	3,839	
April	3,512	3,324	3,339	3,541	
May	5,174	3,715	4,333	3,798	
June	3,855	3,155	3,667	3,728	
July	4,025	3,088	3,450	3,635	3,656
August	4,916	3,535	3,247	3,480	3,530
September	5,717	4,170	4,888	5,299	4,758
October	5,483	4,049	4,390	4,657	4,903
November	5,195	4,167	3,855	3,438	3,736
December	4,261	3,839	3,889	3,548	3,518
Total	**53,447**	**42,702**	**45,388**	**45,308**	-
Avg. Riders / Day*	213.8	170.8	181.6	181.2	-

* - Assuming 250 Days of Operation (No Weekends, No Federal Holidays)

Figure 2.3-25: Hyannis-Falmouth Breeze Bus Parked near Jones Road and Route 28

The Hyannis-Falmouth Breeze, also known as the Blue Line or Sea Line, 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 Hyannis-Falmouth Breeze 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 Hyannis-Falmouth Breeze will also stop at the Barnstable Municipal Airport upon request. The Hyannis-Falmouth Breeze 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 Breeze

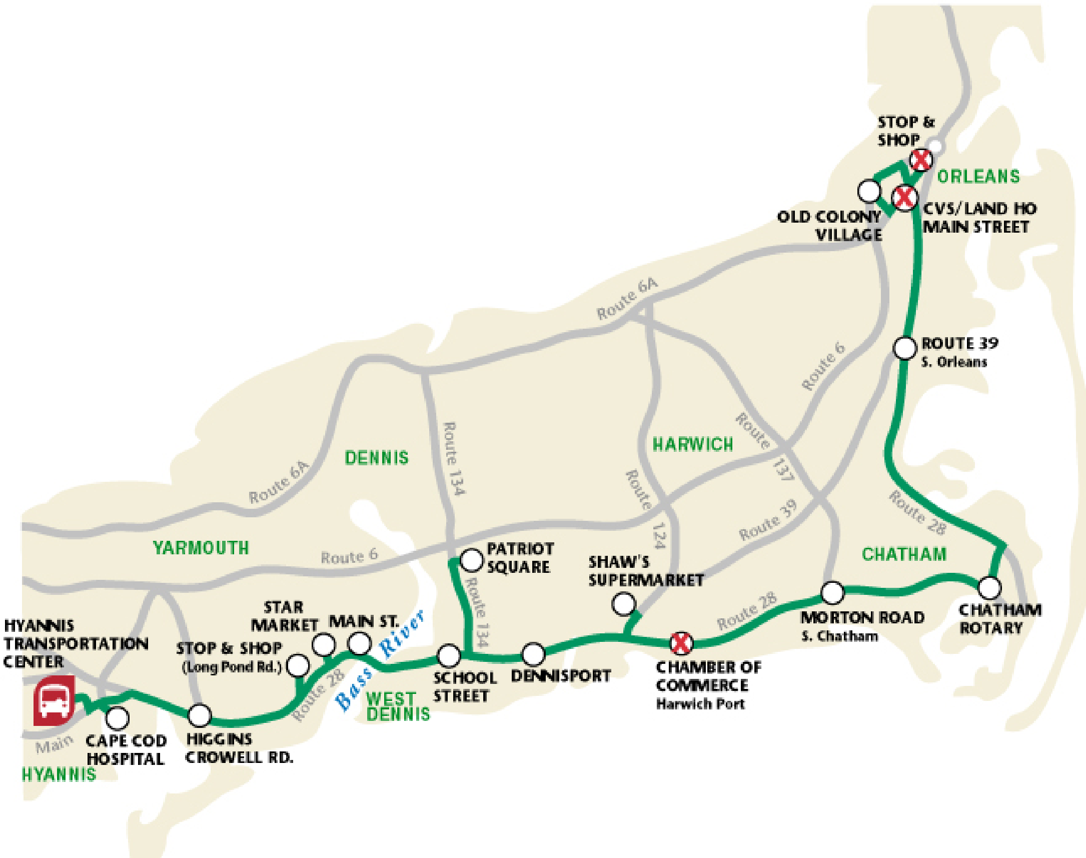

Figure 2.3-26: Hyannis-Orleans Breeze Route Map[22]

Table 2.3-10: Hyannis-Orleans Breeze Ridership, July 2002 – December 2006[23]

	2006	2005	2004	2003	2002
January	2,438	1,966	2,203	2,037	
February	2,440	2,241	2,511	1,581	
March	3,269	3,089	3,066	2,258	
April	3,193	2,858	2,494	2,413	
May	4,470	3,266	3,514	2,901	
June	5,771	5,022	3,805	3,518	
July	6,008	3,178	2,414	2,904	3,334
August	7,063	3,134	2,491	2,791	3,146
September	6,570	4,448	3,501	3,559	3,924
October	6,023	3,560	2,836	3,620	3,415
November	5,055	2,998	2,448	2,789	2,195
December	4,657	2,527	2,363	2,805	2,026
Total	**56,957**	**38,287**	**33,646**	**33,176**	**-**
Avg. Riders / Day*	227.8	153.1	134.6	132.7	-

* - Assuming 250 Days of Operation (No Weekends, No Federal Holidays)

The Hyannis-Orleans Breeze, also known as the Green Line or 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 operates 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 Breeze

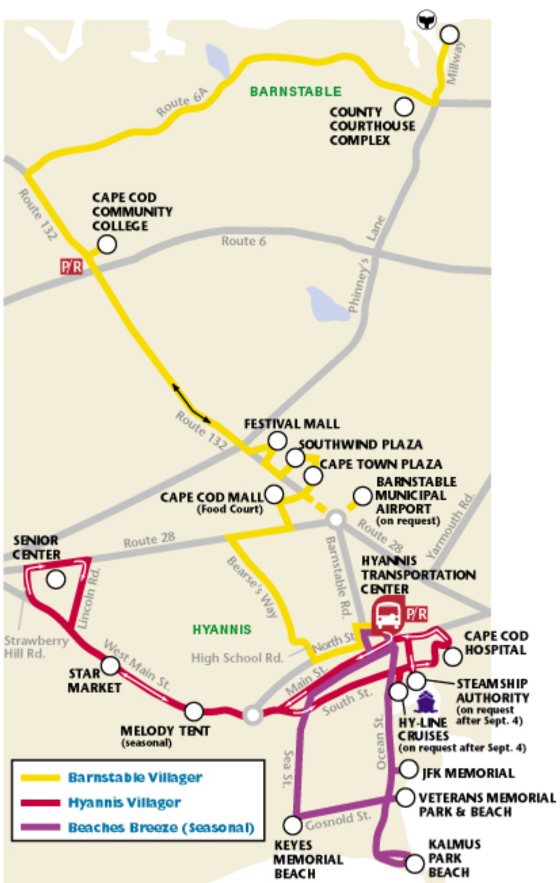

Figure 2.3-28: Route Map for Barnstable Villager Breeze, Hyannis Villager Breeze, and Hyannis Beaches Breeze[24]

Figure 2.3-27: Barnstable Villager Bus Parked in the Barnstable County Complex Figure

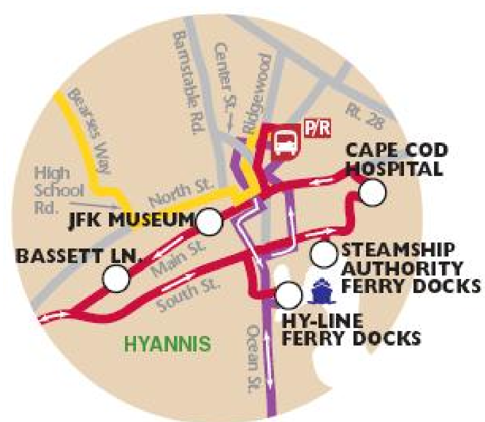

Figure 2.3-29: Detail of CCRTA Services in Downtown Hyannis[25]

Table 2.3-11: Combined Villager Breeze Ridership, July 2002 – December 2006[26]

	2006	2005	2004	2003	2002
January	2,542	2,825	2,574	2,073	
February	2,469	3,898	3,320	2,019	
March	3,321	3,580	3,694	2,091	
April	2,715	2,148	3,220	2,528	
May	3,221	1,973	3,047	2,313	
June	3,169	2,090	3,265	2,722	
July	5,663	3,903	6,050	8,720	6,526
August	6,426	4,664	7,231	9,194	6,288
September	4,434	3,395	4,874	4,229	3,370
October	3,806	3,537	3,878	3,627	2,948
November	3,642	3,198	3,552	2,736	2,261
December	3,396	2,925	3,475	3,036	1,790
Total	**44,804**	**38,136**	**48,180**	**45,288**	**-**
Avg. Riders / Day*	179.2	152.5	192.7	181.2	-

* - Assuming 250 Days of Operation (No Weekends, No Federal Holidays)

The Barnstable Villager Breeze, also known as the Yellow Line, 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 Breeze will stop at the Barnstable Municipal Airport upon request. Passengers riding the Hyannis-Orleans Breeze can transfer to most other lines at the Hyannis Transportation Center. Free transfers are available to the Hyannis Villager Breeze[27].

2.3.6.4 Hyannis Villager Breeze

The Hyannis Villager Breeze, also known as the Red Line, runs from the Hyannis Transportation Center to the Hyannis Senior Center on Route 28. Passengers can board the bus at any of the 6 designated stops, or flag the driver anywhere along the route to stop. During the summer, the Hyannis Villager Breeze makes 28 round trips, beginning at 7:00am and ending at 8:00pm. Buses are scheduled to run every hour, with the complete round trip scheduled to take 1 hour, 7 days per week. Service is reduced during the winter in order to reflect lower demand. Due to the one-way streets in Hyannis, the routes and stops vary by direction. The bus stops at Main Street locations and the West End Rotary on the way to the Senior Center. On the return trip, the bus stops at the Steamship Authority Ferry Docks and Cape Cod Hospital. Both trips will stop at the Melody Tent on West Main Street when in season. After Labor Day, stops at the Hy-Line Ferry or Steamship Authority Docks must be requested. Passengers riding the

Hyannis Villager Breeze can transfer to most other lines at the Hyannis Transportation Center. Free transfers are available to the Barnstable Villager Breeze[28].

2.3.6.5 Hyannis Beaches Breeze

The Hyannis Beaches Breeze 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 Beaches Breeze 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 Beaches Breeze can transfer to most other lines at the Hyannis Transportation Center.

Table 2.3-12: Hyannis Beaches Breeze Ridership, July 2002 – September 2005[29]

	2005	2004	2003	2002
June	0	103	43	-
July	667	778	786	1,066
August	837	679	931	715
September	153	70	27	14
Total	**1,657**	**1,630**	**1,787**	**-**

2.3.6.6 Yarmouth Shuttle

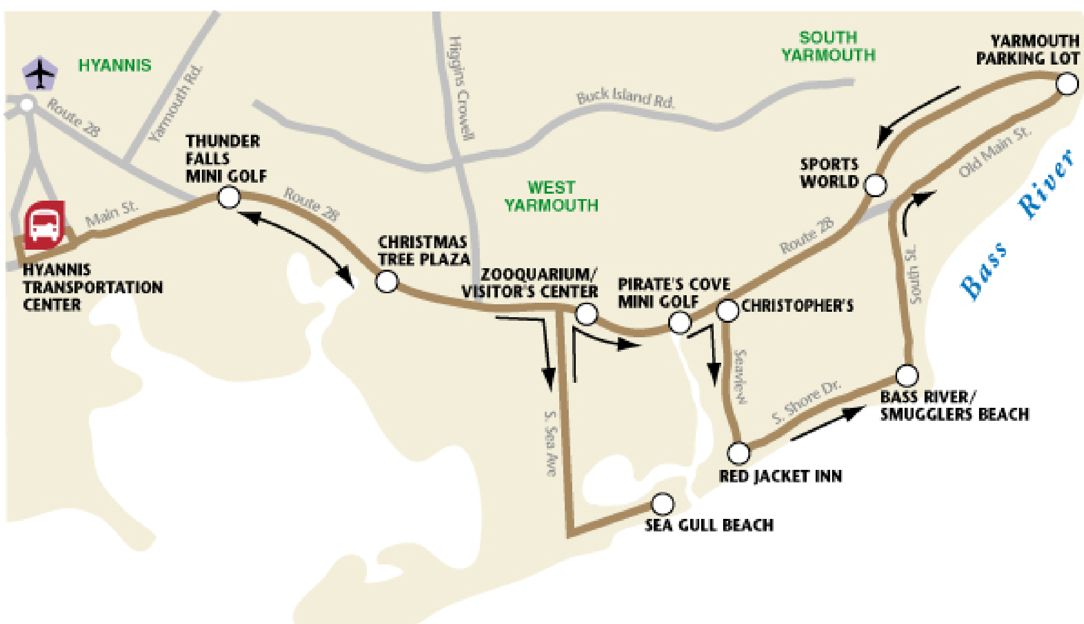

Figure 2.3-30: Yarmouth Shuttle Route Map[30]

Table 2.3-13: Yarmouth Shuttle Ridership, July 2002 – September 2005[31]

	2005	2004	2003	2002
May	122	0	0	-
June	3,822	327	166	-
July	1,444	2,250	2,936	4,083
August	1,589	3,081	3,220	4,535
September	240	536	68	186
Total	**7,217**	**6,194**	**6,390**	**-**

The Yarmouth Shuttle is a summer service that runs from the Hyannis Transportation Center to beaches and attractions in Yarmouth. Passengers can board the bus at any of the 11 designated stops, or flag the driver anywhere along the route to stop. During the summer, the Hyannis Villager Breeze makes 28 round trips, beginning at 7:00am and ending at 9:00pm. Buses are scheduled to run every hour, with the complete round trip taking 1 hour. Service operates seven days a week, including holidays, through Labor Day. Passengers riding the Yarmouth Shuttle can transfer to the Hyannis-Orleans Breeze anywhere along Route 28, and to most other lines at the Hyannis Transportation Center.

2.3.6.7 The 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 2.3-14: Provincetown Shuttle Ridership, July 2002 – September 2005[32]

	2005	2004	2003	2002
May	841	772	629	-
June	8,016	8,478	7,501	-
July	31,958	27,643	32,467	44,723
August	38,700	28,385	37,979	47,777
September	9,481	9,363	5,679	9,431
October	1,374	1,873	1,780	3,768
Total	**90,370**	**76,514**	**86, 035**	**-**

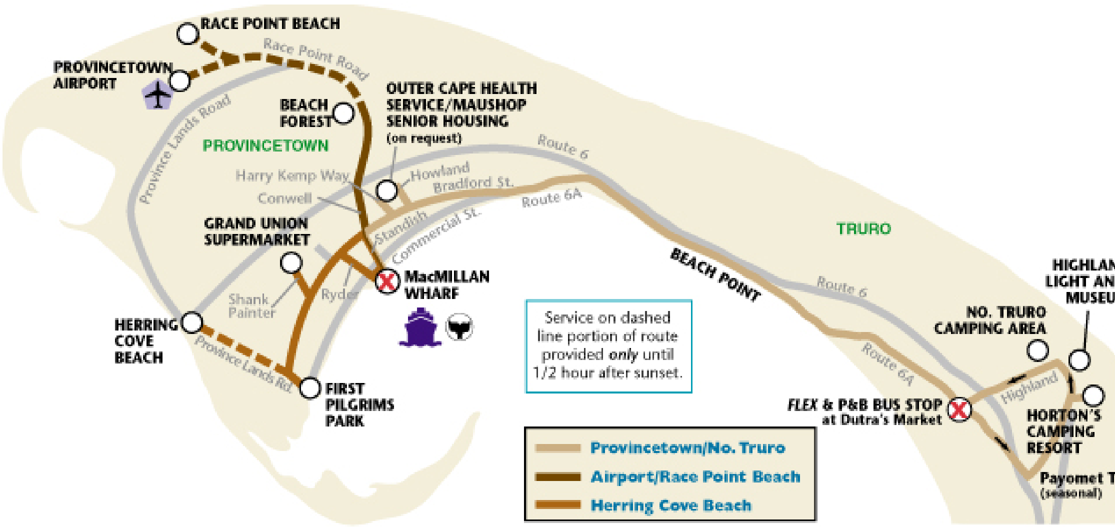

Figure 2.3-31: The Shuttle Route Map[33]

2.3.6.8 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 2.3-15: WHOOSH Trolley Ridership, July 2002 – September 2005[34]

	2005	2004	2003	2002
May	122	265	373	-
June	3,822	2,691	2,375	-
July	10,075	8,469	9,361	9,569
August	11,618	10,600	9,179	8,672
September	1,347	1,770	137	364
Total	**26,984**	**23,795**	**21,425**	**-**

Figure 2.3-32: The WHOOSH Trolley Route Map[35]

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[36].

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[37].

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

Figure 2.3-33: Flex Route Map[38]

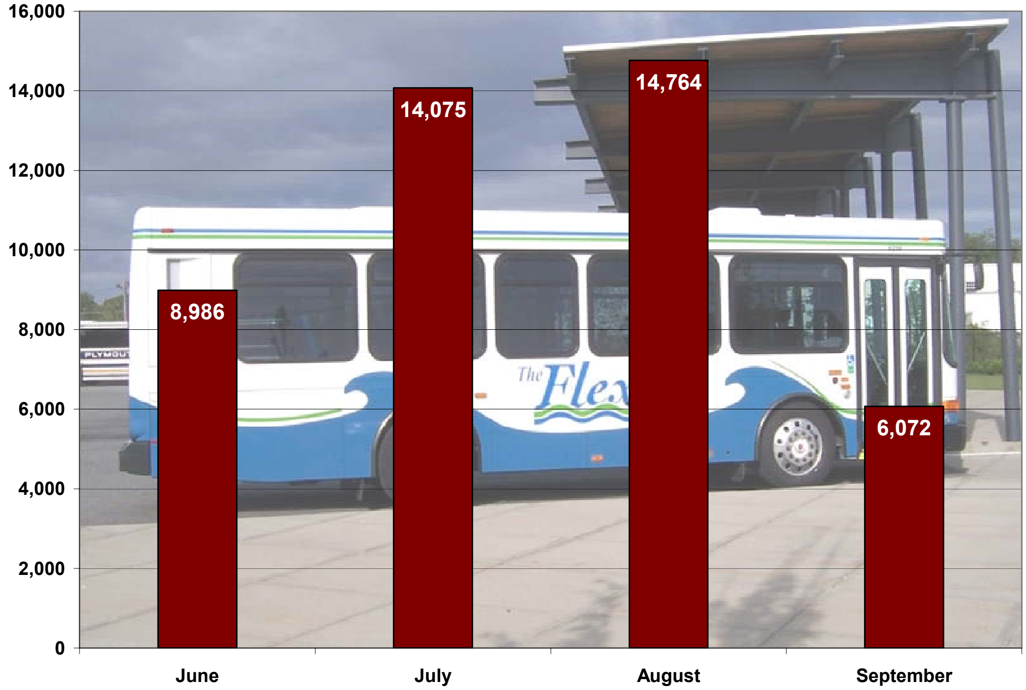

Figure 2.3-34: Flex Bus Ridership, July – September 2006[39]

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[40]" 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 2.3-35: 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. GATRA's service area is 72 square miles and includes Attleboro, Middleborough, Plymouth, Taunton, and Wareham[41]. 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.

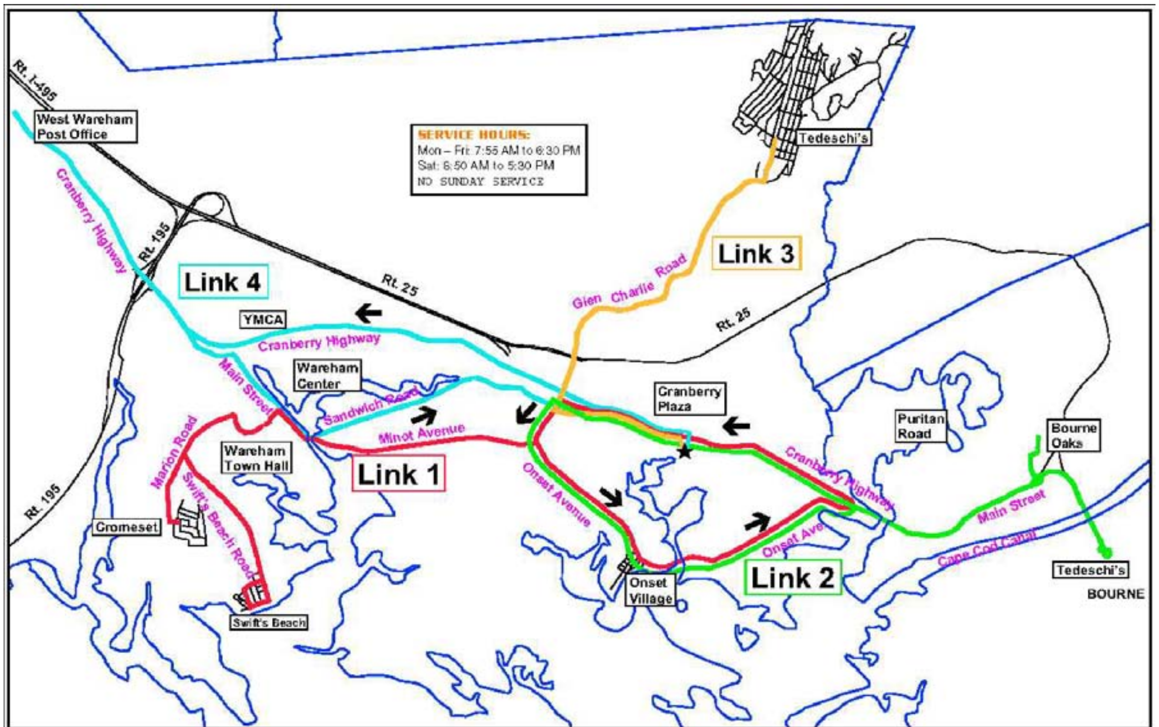

Figure 2.3-36: GATRA Onset Wareham Link Service[42]

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. 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 2.3-37**). 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 2.3-16: Land and Persons near Transit Routes, breakout by Town and by Region[43]

	Population *(2000 Census)*			**Area** *(mi^2)*		
	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%**

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.

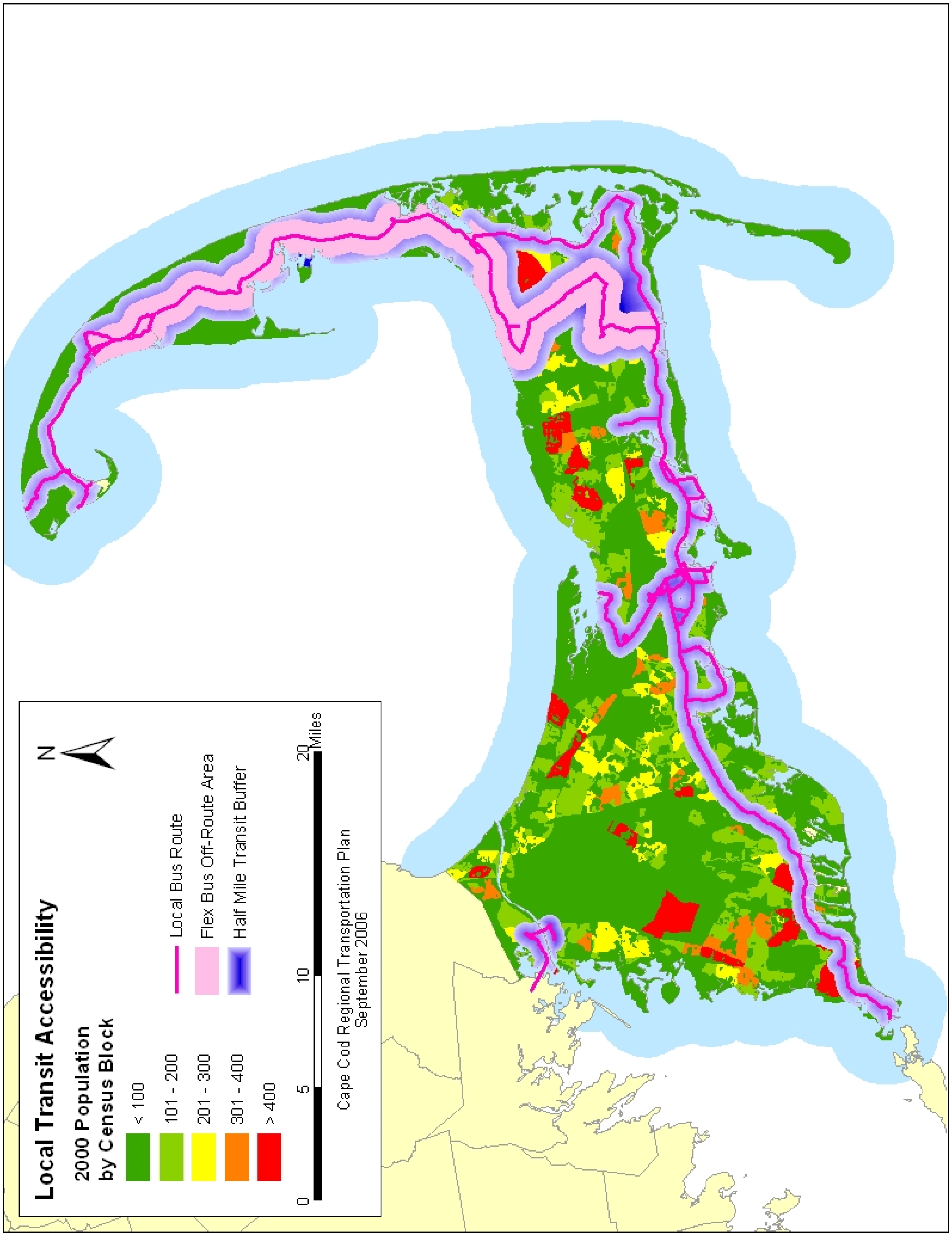

Figure 2.3-37: Land and Persons near Transit Routes[44]

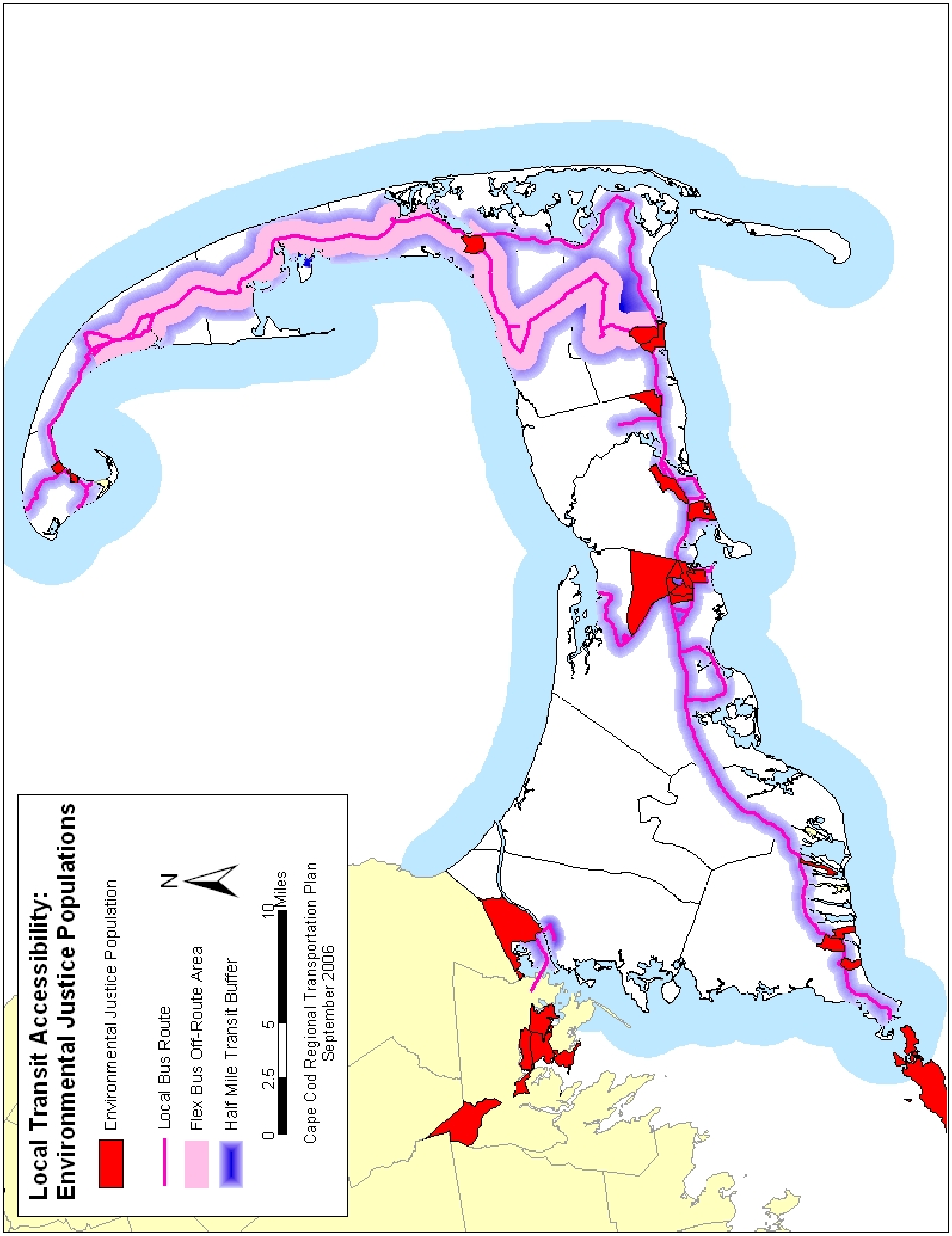

Figure 2.3-38: Environmental Justice Populations near Transit Routes[45]

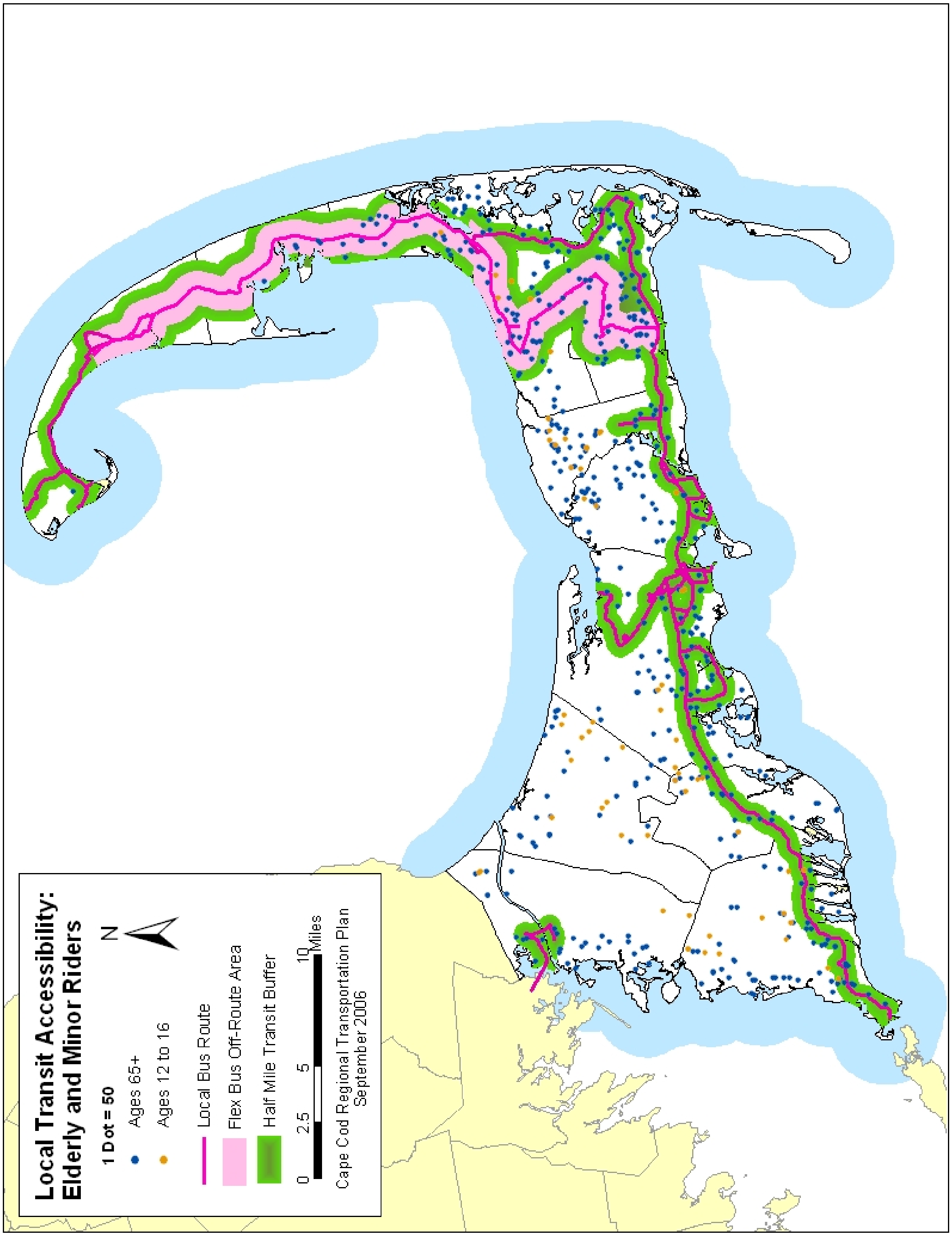

Figure 2.3-39: Elderly and Minor Populations near Transit Routes[46]

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 2.3-39**). 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. Because 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[47]. 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.

2.3.11 Bus Transportation Mobility and Connectivity

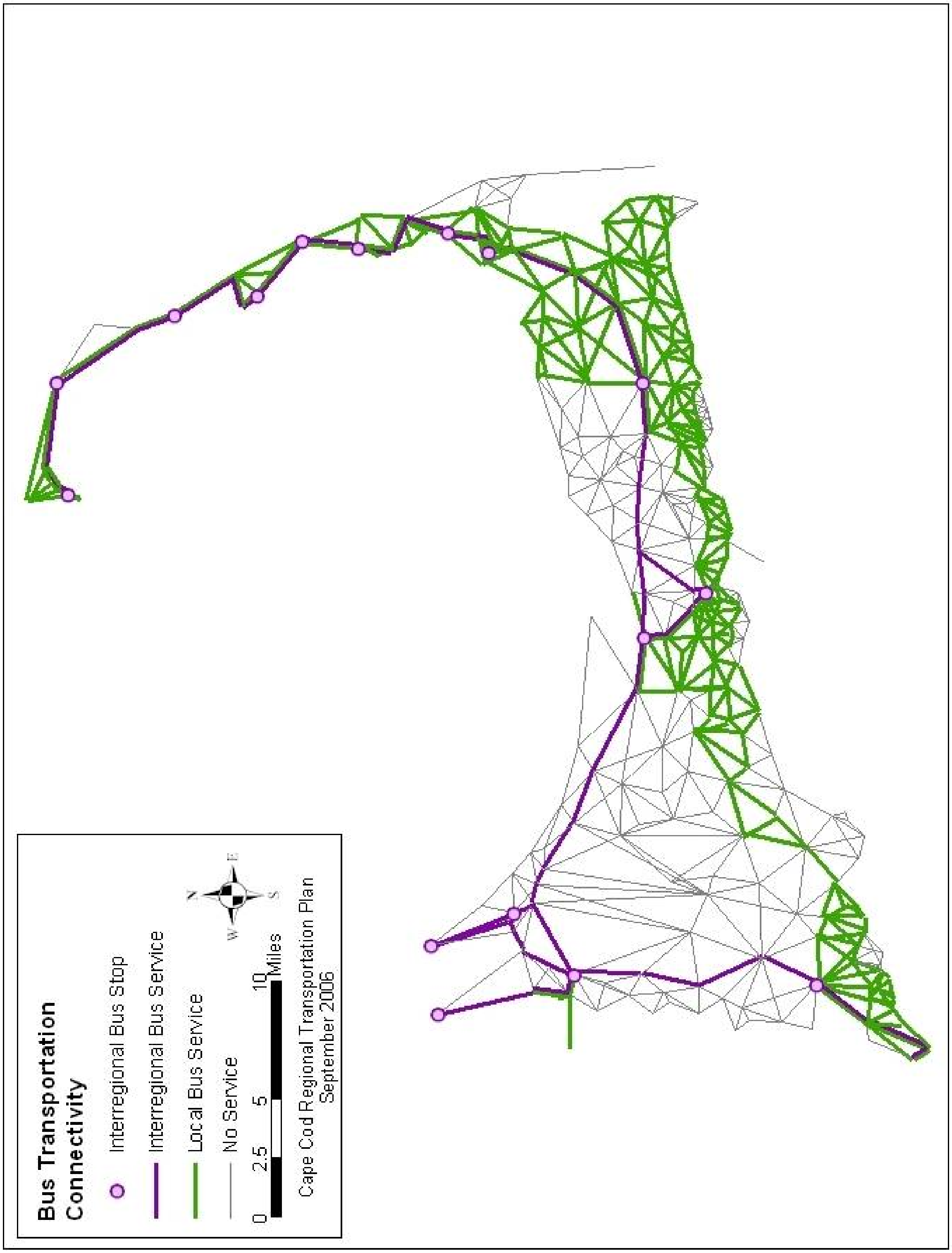

Figure 2.3-40: Cape Cod Transportation Analysis Zones Connected by Bus Transportation

Bus transportation mobility refers to the destinations made available by transit and the frequency of service. A system with high mobility will connect to many different areas, with buses running on a regular and frequent basis. Transit can be completely accessible, but users will not ride if it does not take them where and when they want. There are many different ways in which the concerns of mobility are addressed on Cape Cod.

The Cape Cod Transportation Demand Model divides Cape Cod into 267 Transportation Analysis Zones (TAZ) based on census data, economic activity, travel patterns and other factors. The Cape Cod transportation network can be conceptualized as a series of links that connect neighboring TAZs. Each link represents a potential transportation connection, and is not necessarily associated with the existence of a roadway or other transportation facility. In this way, areas of Cape Cod that are connected by bus transportation can be identified, as well as areas that lack connections (**Figure 2.3-40**). It is of note, however that as the lines represent conceptual connectivity, they may appear to over simplify or over complicate the actual connectivity between points, as some points at great distance may actually be more connective than points within close proximity.

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.

2.3.12 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, 20.7% of surveyed 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.

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2.4 Bicycle and Pedestrian Transportation

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. Moreover, bicycle and pedestrian facilities can increase property values and make areas more attractive to new residents, businesses, and tourists[1].

2.4.1 Bicycle Paths

Table 2.4-1: Bike Path and Route Mileage by Town and Region

	Length in Miles	
Town / Region	**Bike Paths**	**Bike Routes**
All Cape	83.8	333.0
Upper Cape	22.2	166.1
Mid Cape	16.6	66.6
Lower Cape	25.4	50.7
Outer Cape	19.6	49.6
Bourne	11.5	26.1
Sandwich	2.5	22.5
Falmouth	4.8	92.6
Mashpee	3.4	25.0
Barnstable	4.8	41.2
Yarmouth	4.5	11.6
Dennis	7.3	13.8
Harwich	8.7	20.2
Chatham	2.3	7.3
Brewster	12.5	12.1
Orleans	1.9	11.1
Eastham	7.2	10.0
Wellfleet	2.8	16.4
Truro	1.9	17.6
Provincetown	7.7	5.6

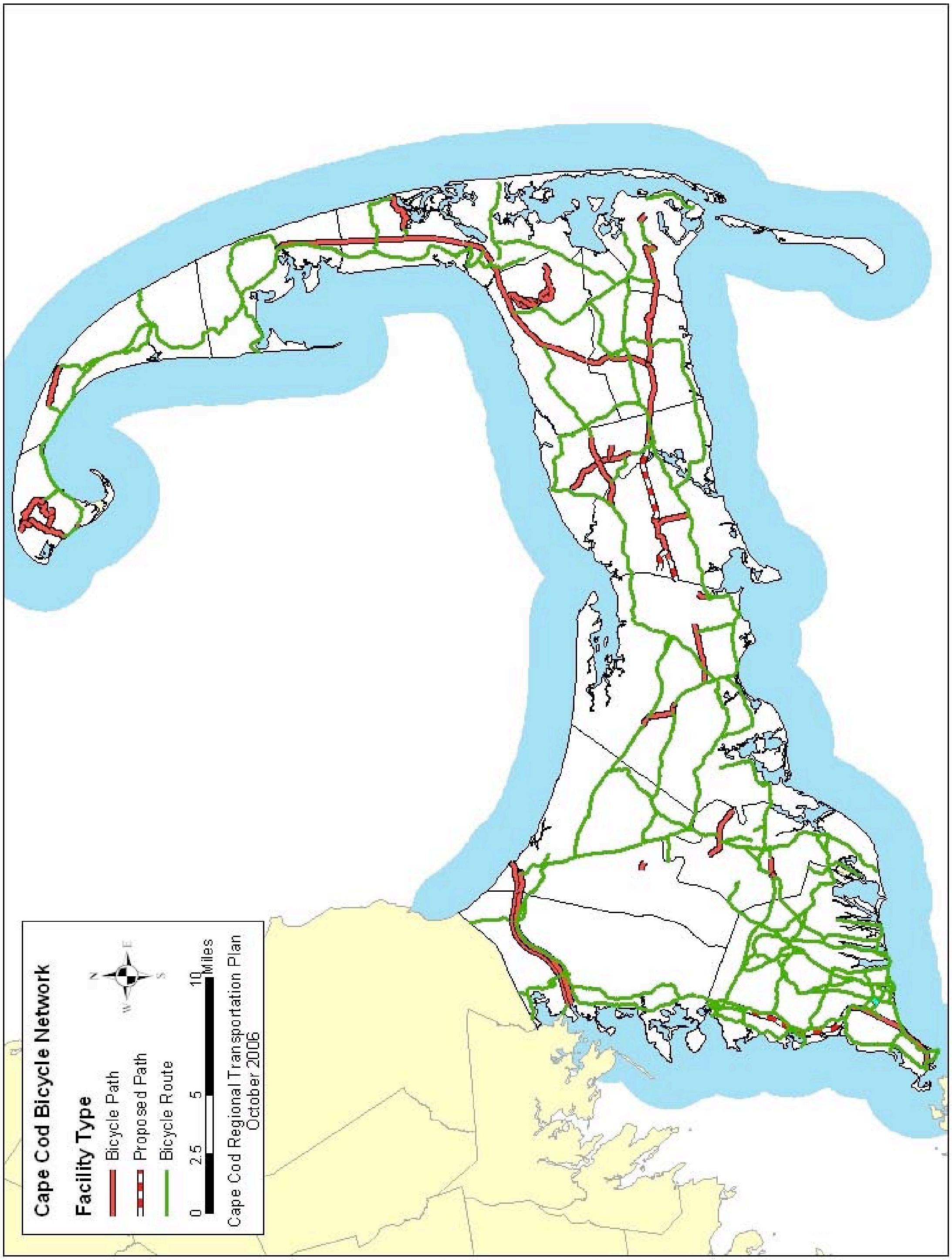

Figure 2.4-1: Bicycle Paths and Routes on Cape Cod

A bicycle path is a paved right of way, separate from roadways. 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[2]. There are many bicycle paths throughout Cape Cod. Some serve recreational needs, while others serve transportation needs.

2.4.1.1 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 (**Figure 2.4-6**). 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 is still under renovation and slated for completion in June 2007[3]. 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. The feasibility study is planned for completion in February 2007. A further extension to the Hyannis Transportation Center is also under consideration.

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[4]. 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 2.4-2: Cape Cod Rail Trail Crossing at Main Street, Harwichport

Figure 2.4-3: Cape Cod Rail Trail at Brackett Road, Eastham

Figure 2.4-4: Harwich-Chatham Rail Trail Extension at the Harwich-Chatham Town Line

Figure 2.4-5: End of the Harwich-Chatham Rail Trail Extension At Crowell Rd., Chatham

Figure 2.4-6: Bicycle Roundabout on the Cape Cod Rail Trail, Harwich

2.4.1.2 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 2.4-7: Southern-Side of the Canal Bicycle Path, East of Sagamore Bridge

Figure 2.4-8: Mainland-Side of the Canal Bicycle Path, East of Railroad Bridge

Figure 2.4-9: Shining Sea Bicycle Path at Ter Huen Drive, Falmouth

Figure 2.4-10: Shining Sea Bicycle Path at Palmer Ave., Falmouth

2.4.1.3 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.

2.4.1.4 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 2.4-11: Provincelands Trail at the Race Point Visitors Center, Facing West

2.4.1.5 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 Street, 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 2.4-12: Setucket Road Path East of North Dennis Road, Looking East

Figure 2.4-13: Setucket Road Path East of North Dennis Road, Looking West

2.4.1.6 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 6 roadway crossings.

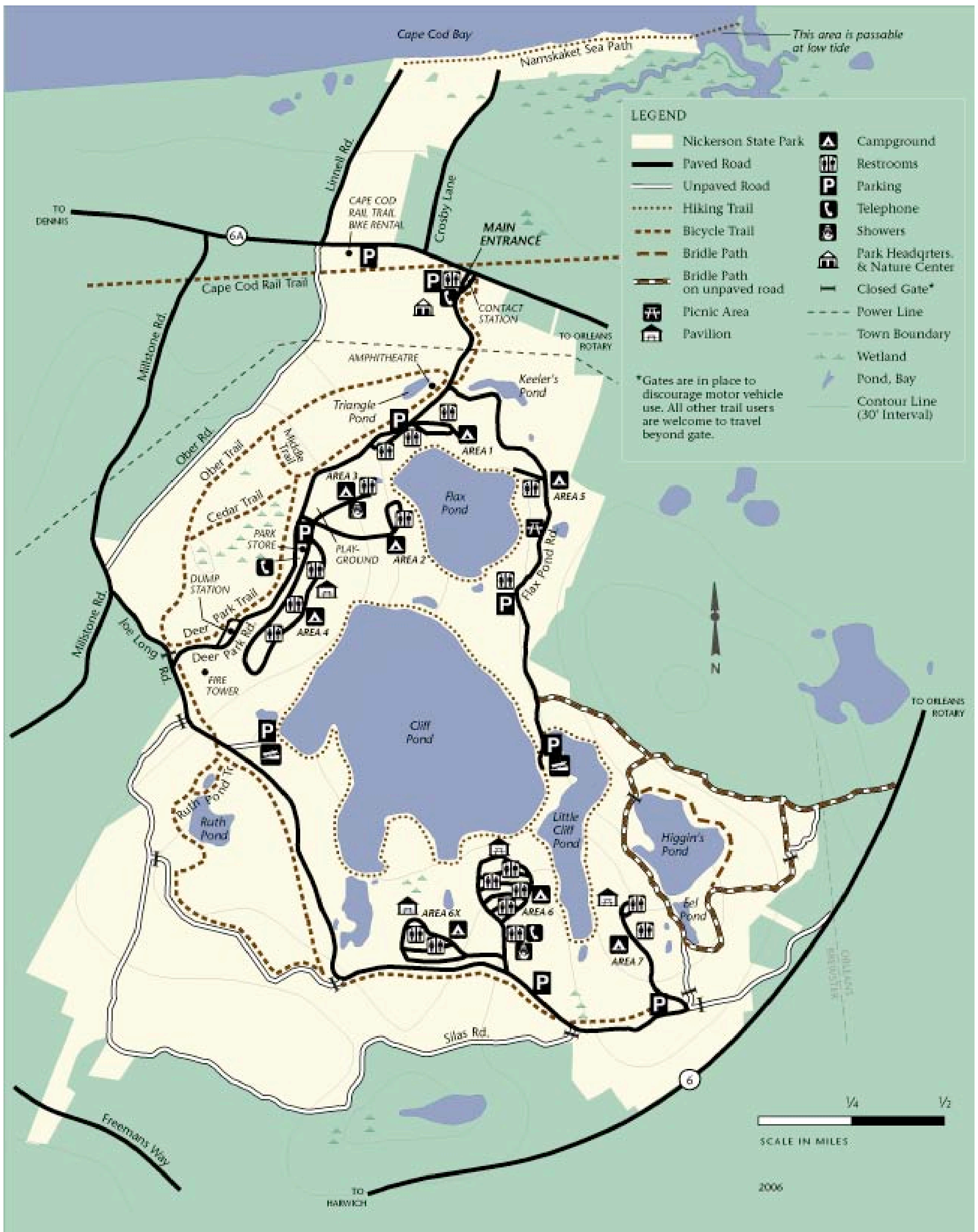

Figure 2.4-14: Map of Nickerson State Park Trails[5]

2.4.1.7 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 6 roadway crossings.

Figure 2.4-15: Nauset Trail from the Salt Pond Visitor's Center Looking East

Figure 2.4-16: Nauset Trail from Coastguard Beach Parking Lot in Eastham

2.4.1.8 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 2.4-17: Head of the Meadow Trail at Head of the Meadow Road, Truro

2.4.1.9 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[6]. 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.

2.4.1.10 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 2.4-18: Looking North on Route 130 Bicycle Path at Lovell's Lane, Mashpee

Figure 2.4-19: Looking South on Route 130 Bicycle Path at Lovell's Lane, Mashpee

2.4.1.11 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 3 roadway crossings.

Figure 2.4-20: Old Townhouse Road Path East of West Yarmouth Rd., Yarmouth

Figure 2.4-21: Old Townhouse Road Path West of West Yarmouth Rd., Yarmouth

Figure 2.4-22: Old Townhouse Road Path at the Bayberry Golf Course in Yarmouth

Figure 2.4-23: Old Stage Road Path at the Service Road in Barnstable

2.4.1.12 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 6 roadway crossings.

2.4.1.13 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 2.4-24: Forest Road Path, Looking North

Figure 2.4-25: Forest Road Path, Looking South

2.4.1.14 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 2.4-2: 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

2.4.1.15 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 3 roadway crossings.

2.4.1.16 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 2 roadway crossings.

2.4.1.17 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.

2.4.2 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.

2.4.2.1 Claire Saltonstall Bikeway

Figure 2.4-26: 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. The bikeway was mapped and established in 1978[7] by the Massachusetts General Court as a memorial to Claire Saltonstall, who died in a bicycle-motor vehicle accident[8]. The Claire Saltonstall Bikeway, indicated by a green oval (**Figure 2.4-26**), 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[9]. 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.

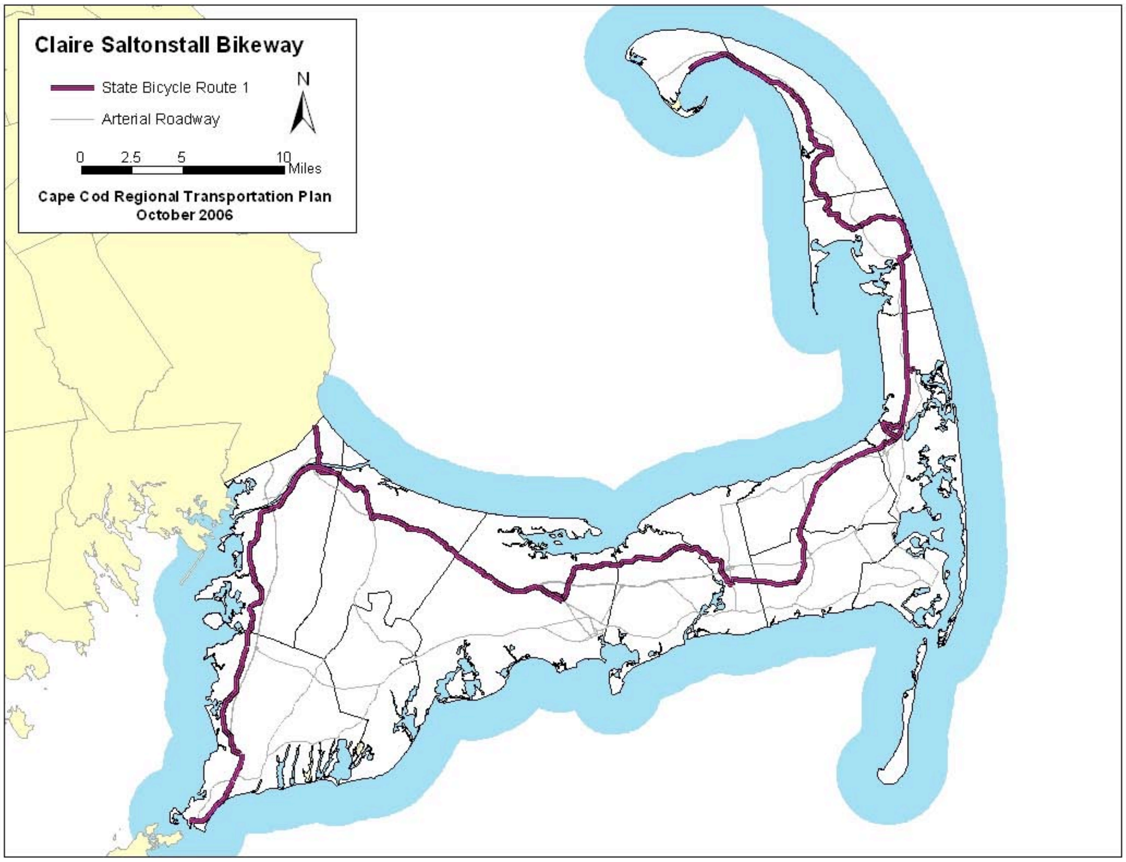

Figure 2.4-27: Claire Saltonstall Bikeway

2.4.2.2 State Bicycle Routes

The Commonwealth of Massachusetts has also identified other bicycle routes throughout Cape Cod[10]. Some examples are Buck Island Road in Yarmouth, Great Western Road in Dennis and Harwich, or Great Neck Road in Mashpee (**Figure 2.4-1**). The Cape Cod Commission and Americorps performed a survey of many of these roads in June 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.

2.4.2.3 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 2.4-28: Route 28 North of the Davis Straits Intersection, a Designated Bicycle Route in Falmouth

2.4.2.4 Low Volume Roads

Bicyclists and pedestrians can utilize low volume roads with minimal automobile conflicts. Cape Cod has 445.3 miles of major roads with summer average daily volumes (ADT) of 5,000 vehicles per day or less, and 85.3 miles of major roads with 1,000 vehicles per day or less. For reference, an ADT of 5,000 is equivalent to about 1 vehicle every 7 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 1,450 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.

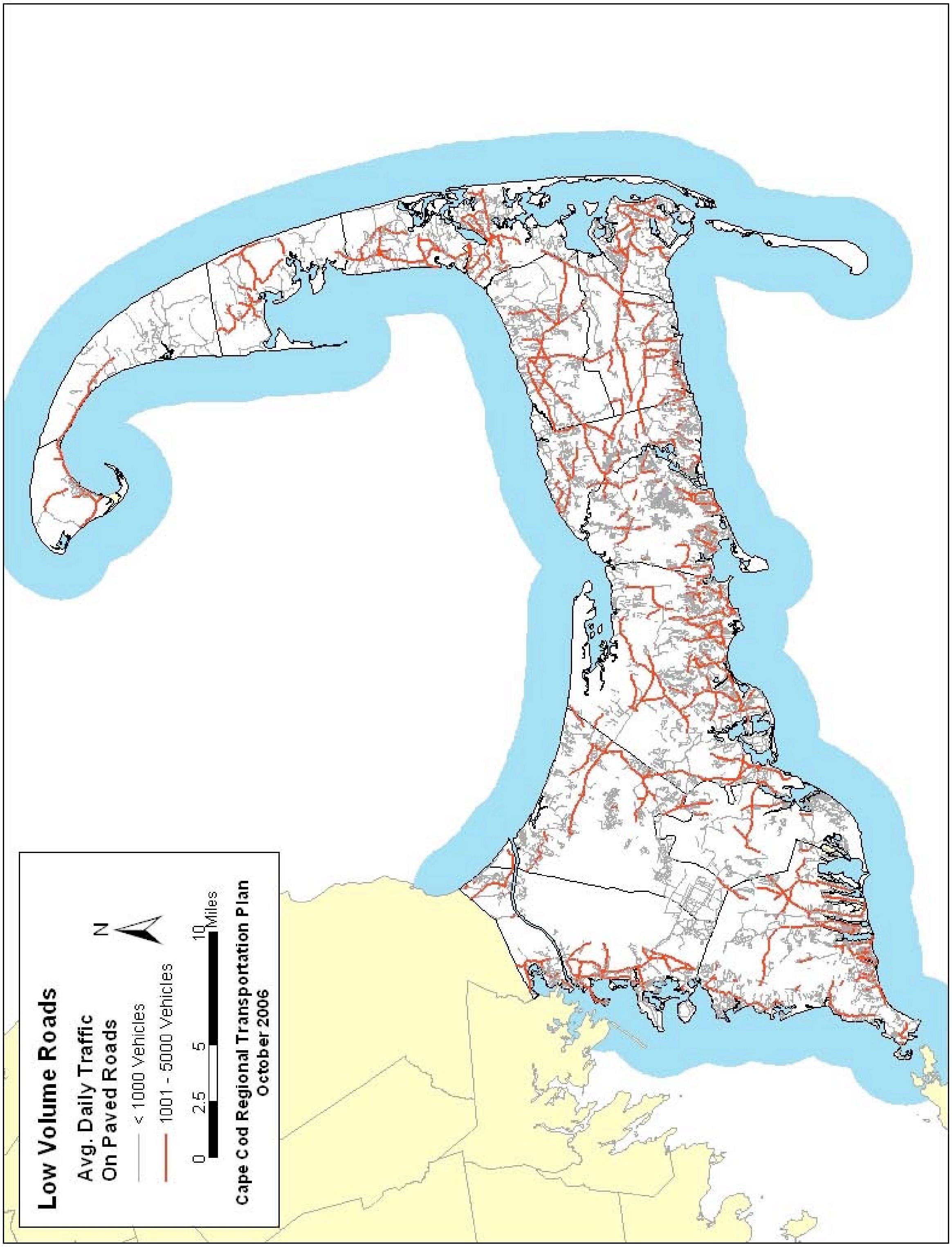

Figure 2.4-29: Low Volume Roads

2.4.3 Sidewalk Network

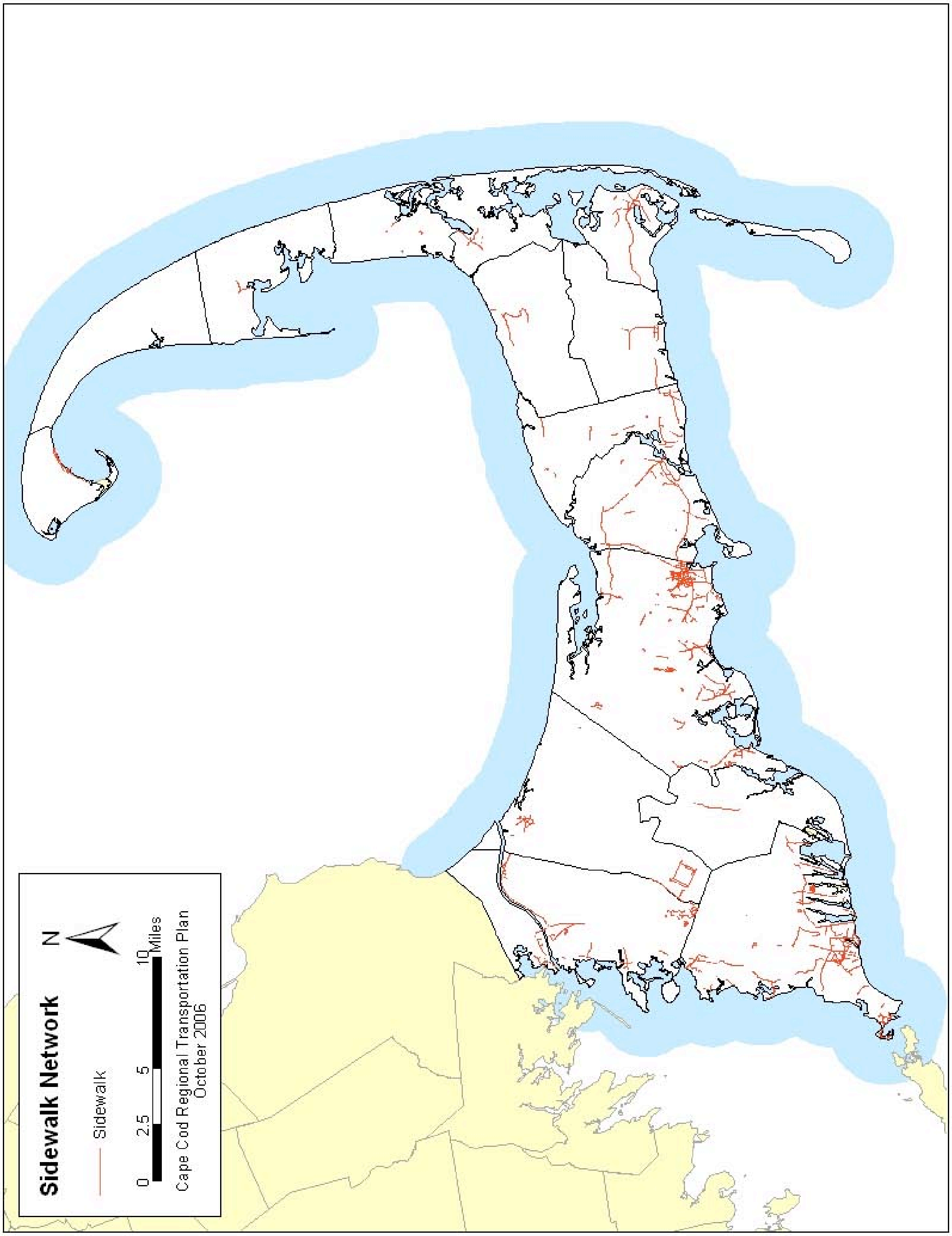

Figure 2.4-30: Sidewalk Network

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[11]. In Massachusetts, bicyclists may ride on sidewalks outside business districts unless otherwise prohibited by local ordinances[12].

According to the 2005 Massachusetts Statewide Roadway Inventory File, there are 225.8 miles of sidewalk located on Cape Cod[13]. In addition, 26.5 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, 8.5% 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.

2.4.4 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. All of the amenities address the "destination barriers[14]" 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.

2.4.5 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 (**Figure 2.4-31** and **Figure 2.4-32**). 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 2.4-31: West Yarmouth Road crossing of the Old Townhouse Road Trail

Figure 2.4-32: Meetinghouse Road crossing of the Harwich-Chatham Extension of the Cape Cod Rail Trail

Mobility is also a very important issue to consider when discussing bicycle paths and routes. The Cape Cod Transportation Demand Model divides Cape Cod into 267 Transportation Analysis Zones (TAZ) based on census data, economic activity, travel patterns and other factors. The Cape Cod transportation network can be conceptualized as a series of links that connect neighboring TAZs. Each link represents a potential transportation connection, and is not necessarily associated with the existence of a bikeway or other transportation facility. In this way, areas of Cape Cod that are connected by bicycle transportation can be identified, as well as areas that lack connections (**Figure 2.4-33**).

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[15]. For this reason, bicycle transportation can help to connect users to other modes of transportation.

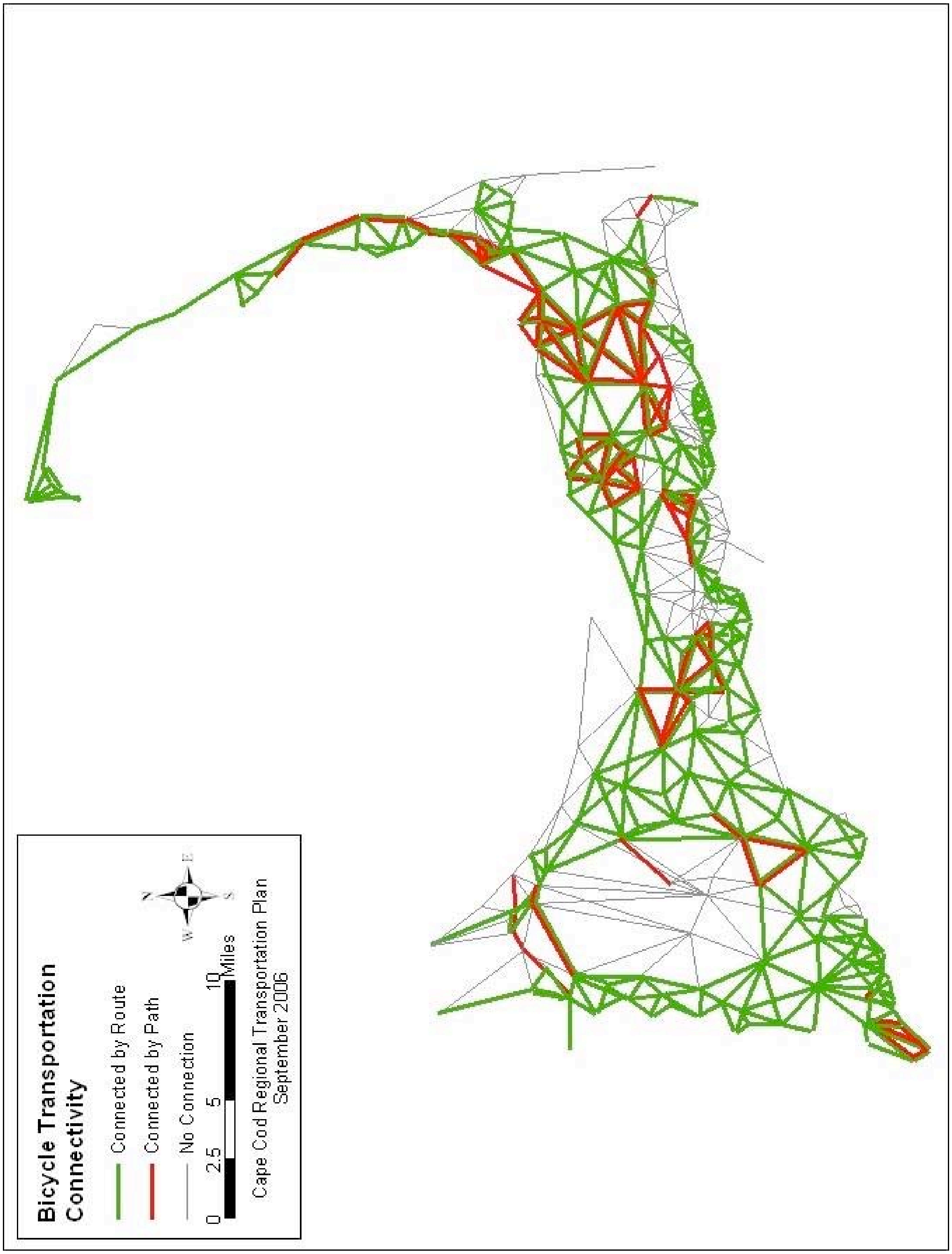

Figure 2.4-33: Cape Cod TAZs Connected by Bicycle Transportation

2.4.6 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.

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2.5 Rail Transportation

Rail Transportation on Cape Cod has a history of over 150 years. Currently, there are 58.85 miles of track on Cape Cod, with different segments owned by the Massachusetts Executive Office of Transportation, federal agencies, and the Town of Falmouth.

2.5.1 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.

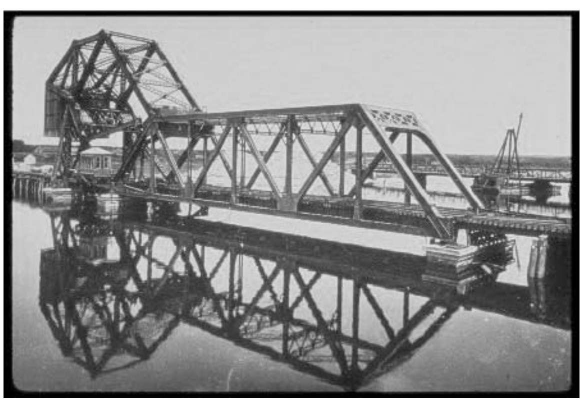

Figure 2.5-1: The Original Railroad Bridge over the Cape Cod Canal, 1914-1935[1]

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[2]. The station houses were razed or vandalized[3]. 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

Massachusetts Department of Conservation and Recreation. Tracks from Palmer Avenue in Falmouth to the ferry terminal in Woods Hole were converted into the Shining Sea Bikepath in 1976[4]. Further segments are slated for conversion to bikepaths including a segment from Dennis to Station Avenue in Yarmouth, and the remainder of tracks south of the Otis Junction in Falmouth. Today, The Massachusetts Executive Office of Transportation (EOT) owns the majority of rail tracks on Cape Cod, with other sections of track owned by the federal government, the Army Corps of Engineers, and the Town of Falmouth.

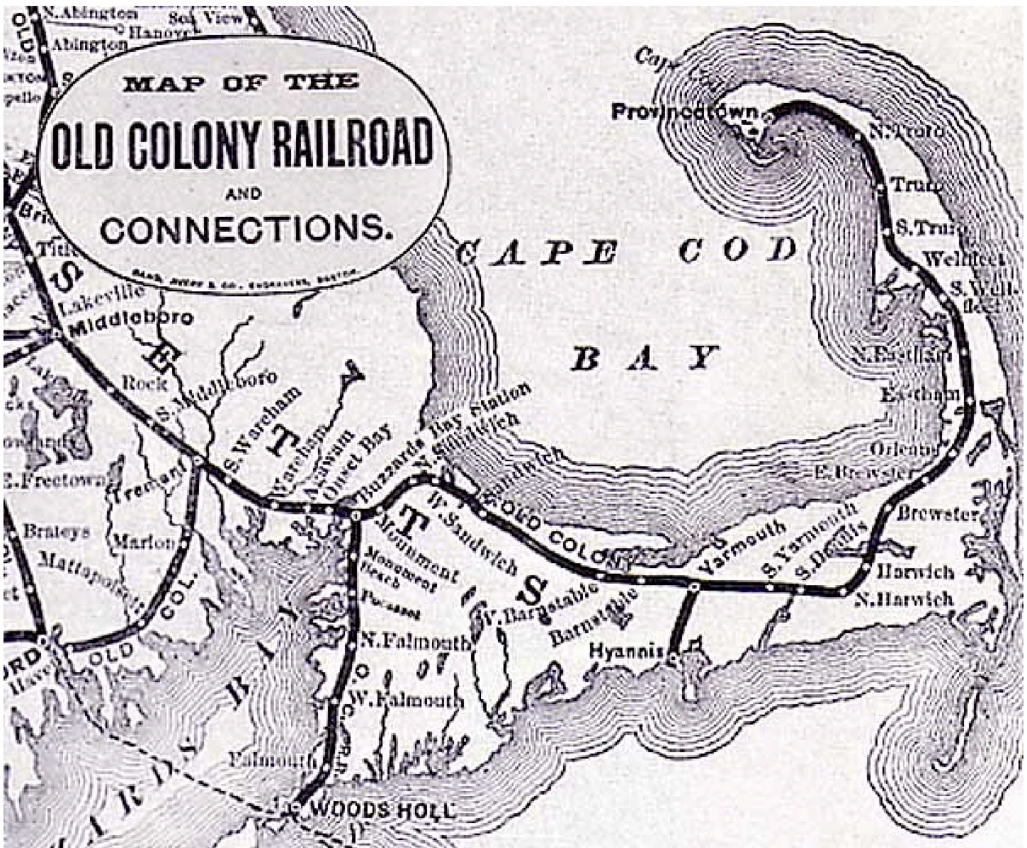

Figure 2.5-2: Map Showing Cape Cod Railroads, Circa 1880[5]

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. “Cape Codder” service was discontinued in 1996[6]. According to a report by the Cape Cod Transit Task Force[7], 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.

2.5.2 Rail Infrastructure

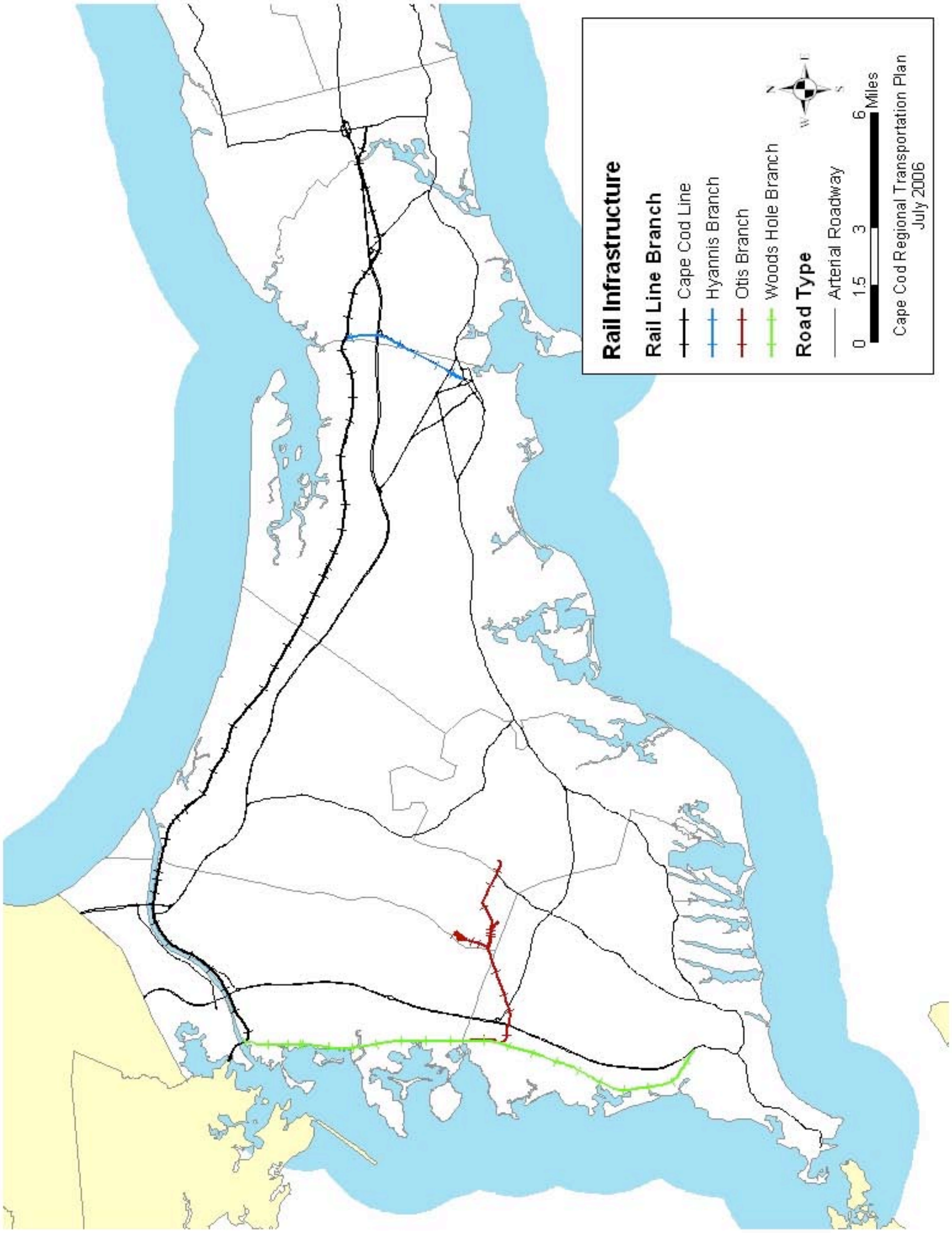

Figure 2.5-3: Cape Cod Rail Line and Branches

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 2.5-1: Rail Tracks on Cape Cod

		Total Mi.	Percent of Total
	Cape Cod Total	58.85	
By Rail Line	Cape Cod Line	31.09	52.83%
	Hyannis Branch	4.39	7.46%
	Otis Branch	10.51	17.86%
	Woods Hole Branch	12.85	21.84%
By Owner	Locally Owned	5.82	10.00%
	Federally Owned	9.80	16.65%
	Army Corps of Engineers	0.18	0.31%
	Exec. Office of Transportation	43.05	73.14%
By Town	Barnstable	11.18	19.00%
	Bourne	14.25	24.21%
	Dennis	1.18	2.01%
	Falmouth	9.88	16.79%
	Mashpee	0.42	0.71%
	Sandwich	14.11	23.98%
	Yarmouth	7.83	13.31%
By Service	Bay Colony Railroad	41.45	70.43%
	Cape Cod Central Railroad	24.29	41.27%
	Not in Service	12.95	22.01%

2.5.2.1 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 2.5-4** and **Figure 2.5-5**). This segment is owned by the Executive Office of Transportation (EOT) and leased to the Bay Colony Railroad Corporation, which is also referred to as the Bay Colony Lines Railroad (BCLR). According to a study done for the Cape Cod Transit Task Force, these tracks are rated for 30 MPH travel[8]. The Bourne Chamber of Commerce currently occupies the former Buzzards Bay Station building south of Main

Street (**Figure 2.5-6**). 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.

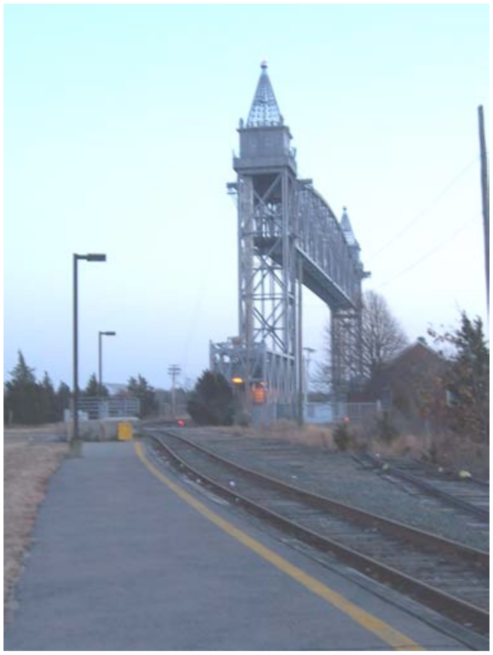

Figure 2.5-4: Rail Tracks Leading South to the Cape Cod Canal Bridge

Figure 2.5-5: Rail Tracks Leading North to the Cohasset Narrows

Figure 2.5-6: 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 2.5-11**). The EOT owns this segment of the Cape Cod Line, from the Cape Cod Canal to Yarmouthport, and leases it to BCLR, who in turn allows usage by the Cape Cod Central Railroad (CCCRR). 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 2.5-7: Rail Tracks West of the Sagamore Bridge

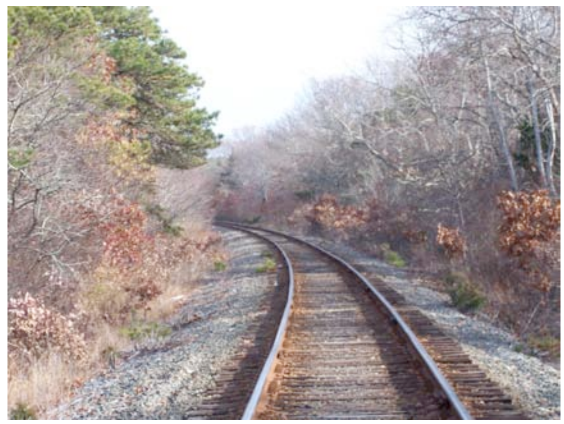

Figure 2.5-8: Rail Tracks East of Mary Dunn Rd. in Barnstable

Figure 2.5-9: Rail Tracks and Switch West of Willow Street in Yarmouth

Figure 2.5-10: 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, The EOT owns this entire segment and leases it to BCLR. In total, the segment contains 3.38 miles of track, the grade separated crossing of Route 6, and 23 total roadway crossings.

Figure 2.5-11: An Out of Service Track Runs Several Hundred Feet on Either Side of Willow Street in Yarmouth

Figure 2.5-12: Rail Tracks East of Willow Street in Yarmouth

Figure 2.5-13: Rail Tracks in Yarmouth, Facing West.
The shiny metal surface of the rail tracks indicates their continued use.

Figure 2.5-14: 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 Falmouth 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 2.5-16**). The EOT owns the right-of-way and is negotiating a lease with the towns of Yarmouth and Dennis. The towns are currently studying the feasibility of using the right-of-way to extend the Cape Cod Rail Trail. In total, the segment contains 3.5 miles of track and 3 roadway crossings.

Figure 2.5-15: Rail Tracks East of Station Avenue in Yarmouth

Figure 2.5-16: Rail Tracks East of Great Western Road, Yarmouth.
The rail tracks have been paved over, while vegetation and a boulder block the way.

Figure 2.5-17: Bass River Rail Bridge, Facing West

Figure 2.5-18: 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 Bay Colony Railroad and Cape Cod Central Railroad.

2.5.2.2 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 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. EOT owns the Hyannis Branch and leases it to BCLR, who in turn allows usage by the CCCRR. This segment has also been rated for 30 MPH travel[9]. In total, the Hyannis Branch contains 4.39 miles of track, 2 grade separated crossings under Route 6, and 6 total roadway crossings.

Figure 2.5-19: Rail Tracks West of Willow Street, Facing North

Figure 2.5-20: The Hyannis Rail Yard, With CCCRR Cars Parked on the Side Tracks

Figure 2.5-21: The Terminus of the Hyannis Branch at the CCCRR Station

2.5.2.3 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 2.5-22**). An out of service side track, runs from Old Main Road to the Otis Junction (**Figure 2.5-23**). EOT owns this entire segment and leases it to BCLR. Moreover, this portion of the Woods Hole Branch has been rated for 30 MPH travel[10]. 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 2.5-22: 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 2.5-23: 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 2.5-24**, **Figure 2.5-25** and **Figure 2.5-26**). EOT 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 2.5-24: A Bush Grows in the Middle of the Woods Hole Line

Figure 2.5-25: A Crossing Signal at Old Dock Road Overgrown With Vegetation

Figure 2.5-26: The Woods Hole Line has Been Paved Over at Old Dock Road

Figure 2.5-27: Otis Branch Rail Tracks, East of Route 28A

2.5.2.4 Otis Branch

From the Otis Junction, the Otis Branch runs east into the Otis Air Force Base (**Figure 2.5-27**). 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 BCLR. In total, the segment contains 10.51 miles of track, 3 grade separated roadway crossings, and 15 total roadway crossings.

2.5.2.5 Cape Cod Canal Railroad Bridge

In order to enter Cape Cod, trains must cross the Cape Cod Railroad Bridge (**Figure 2.5-28**). In 1910, the Buzzards Bay Railroad Bridge was completed over the first Cape Cod Canal, which was under construction at the time (**Figure 2.5-1**). 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[11]. Normally the bridge remains in the "up" position (**Figure 2.5-30**), 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 2.5-29**). The bridge is 806 feet long, 297 feet high and has a high water clearance of 136 feet.

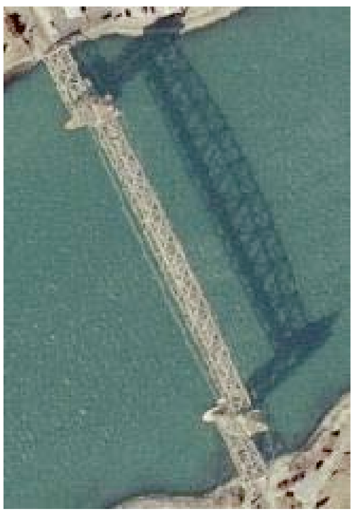

Figure 2.5-28: Aerial View of the Cape Cod Railroad Bridge

Figure 2.5-29: Buzzards Bay Tower Housing Rail Control Mechanisms

Figure 2.5-30: Cape Cod Railroad Bridge from Bridge Park, in the "Up" Position

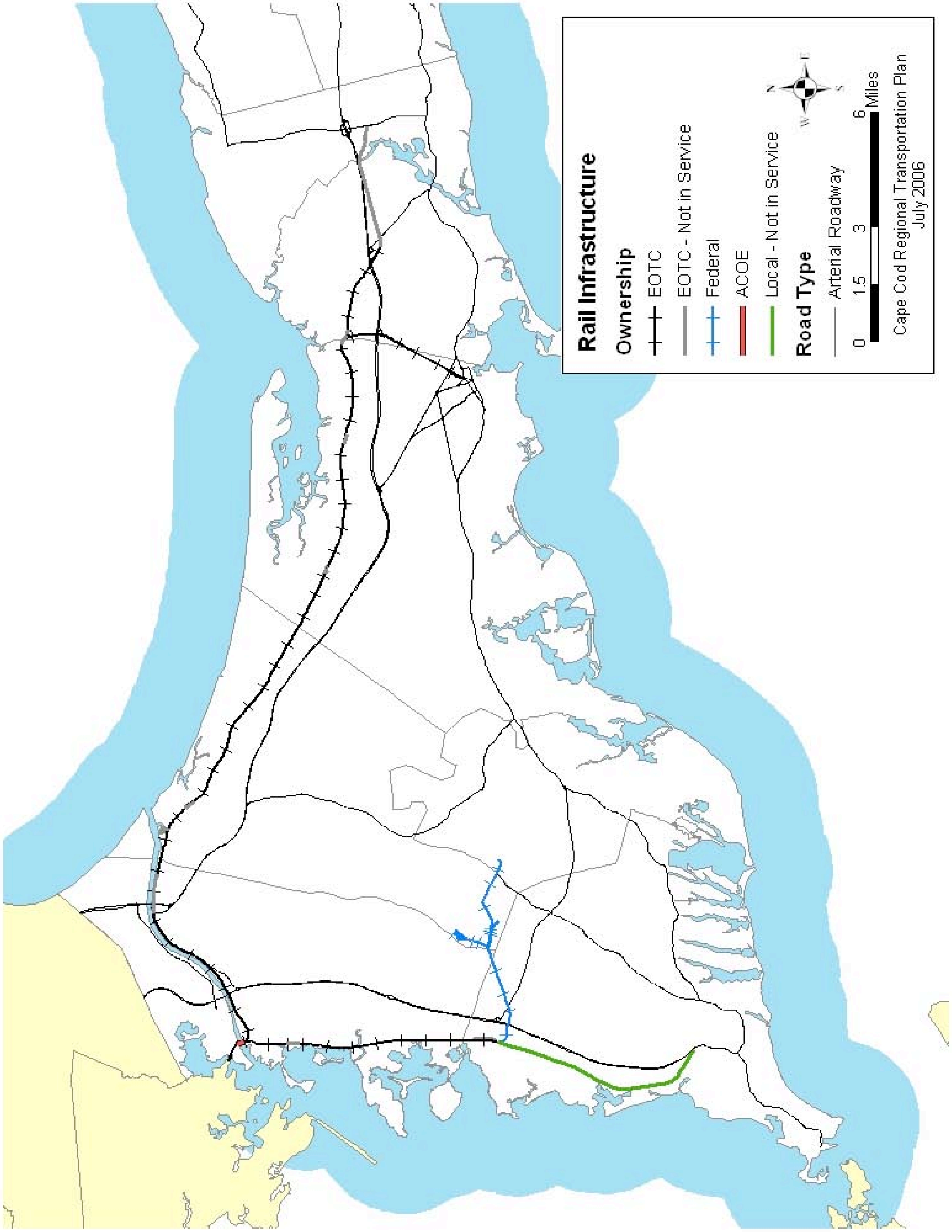

Figure 2.5-31: Rail Infrastructure and Ownership on Cape Cod

2.5.3 Signals and Crossings

Table 2.5-2: Rail Infrastructure throughout Cape Cod

	Railroad Crossings at Cape Cod Roads					
	Total	**Grade Separated**	**Gated**	**Signalized**	**Signed**	**Other\None**
Cape Cod Total	101	22	4	34	16	25
Cape Cod Line	51	8	3	21	7	12
Hyannis Branch	6	2	1	-	1	2
Otis Branch	15	3	-	2	-	10
Woods Hole Branch	29	9	-	11	8	1
Locally Owned	13	4	-	5	3	1
Federally Owned	15	3	-	2	-	10
Exec. Office of Transportation	73	15	4	27	13	14
Barnstable	15	1	3	8	2	1
Bourne	25	8	-	6	5	6
Dennis	2	-	-	-	-	2
Falmouth	18	8	-	6	3	1
Sandwich	27	1	1	11	3	11
Yarmouth	14	4	-	1	5	4
Bay Colony Railroad	80	16	3	29	13	19
Cape Cod Central Railroad	46	8	4	19	5	10
Not in Service	16	4	-	5	3	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.

2.5.4 Freight Service

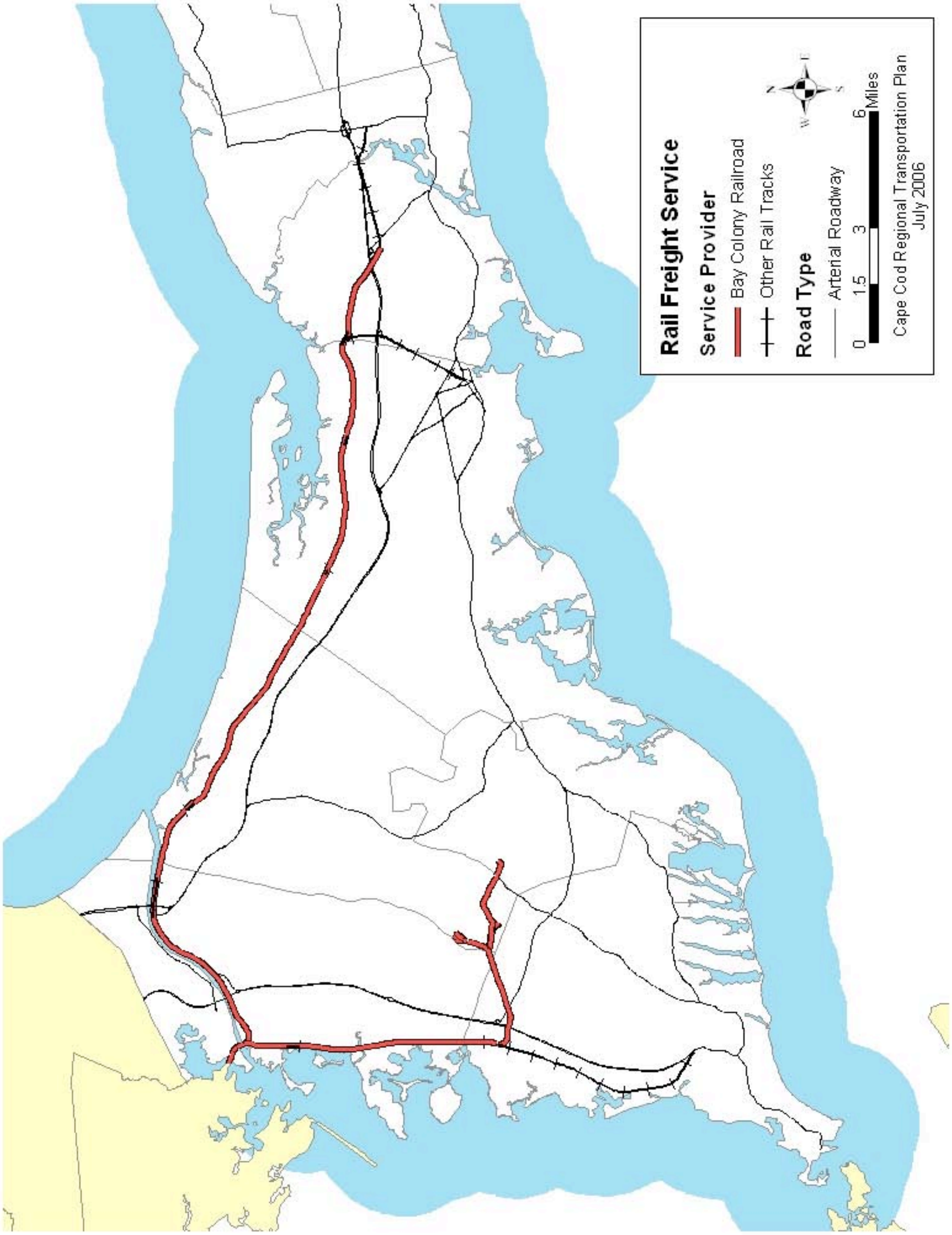

Figure 2.5-32: Bay Colony Railroad Cape Cod Service

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[12]. The Commonwealth of Massachusetts, through the Executive Office of Transportation (EOT) still owns most railroad tracks on Cape Cod today, with Bay Colony Railroad Corporation (BCLR) still operating under contract to provide freight service.

Currently, the primary use of Cape Cod's rails is for freight transportation by Bay Colony Railroad Corporation. Bay Colony Railroad is a short line freight railroad serving Cape Cod and southeastern Massachusetts. BCLR was charted on March 31, 1977 with the intent of operating freight service from Middleboro to Cape Cod. While BCLR's primary source of revenue is freight transportation, it also performs railcar repair work, bids out track construction projects, and provides facilities to the CCCRR. The BCLR is also responsible for dispatching all trains and for maintaining the tracks it leases in compliance with certain Federal Railroad Administration guidelines[13].

Table 2.5-3: Engines in the Bay Colony Railroad Corporation Fleet[14]

Engine #:	Engine Model / Engine Type	Horsepower	Date Built	Date Acquired	Status
1058	ALCO S-4 diesel	1,000	1950	1982	In Storage
1061	ALCO S-4 diesel	1,000	1950	1983	In Storage
1701	EMD GP-7 diesel Redesignated GP-8 567B, 16 cylinder	1,500	-	1987	Active
1702	EMD GP-9R diesel 567C, 16 cylinder	1,750	-	1996	Active
1703	EMD GP-9 diesel 567C, 16 cylinder	1,750	1957	1999	Active
1751	EMD GP-9 diesel 567C, 16 cylinder	1,750	1955	1987	Active
1771	EMD GP-9 diesel 567C, 16 cylinder	1,750	-	2006	Active
2243	EMD CF-7 diesel 567BC, 16 V-cylinder	1,500	1977	1996	Active
2501	ALCO C-245 diesel	2500	1966	1999	Active

BCLR's major service is the "trash train," which carries garbage to the SEMASS waste-to-energy plant in Rochester, MA from transfer stations in Cape Cod[15]. The plant was opened in 1989 after four years of construction. For its work in designing, developing and marketing the SEMASS plant, Modern Railroads awarded Bay Colony Railroad its second Golden Freight Car Award. Cape Cod has two waste transfer stations accessed by Bay Colony Railroad: The Yarmouth/South Dennis station between Route 6 and Station Avenue in Yarmouth, and the Falmouth Station within the Otis Air Force Base. Two trains connect together to form one "trash train," which is then taken over the Cape Cod Canal Rail Bridge to the SEMASS waste-to-energy plant.

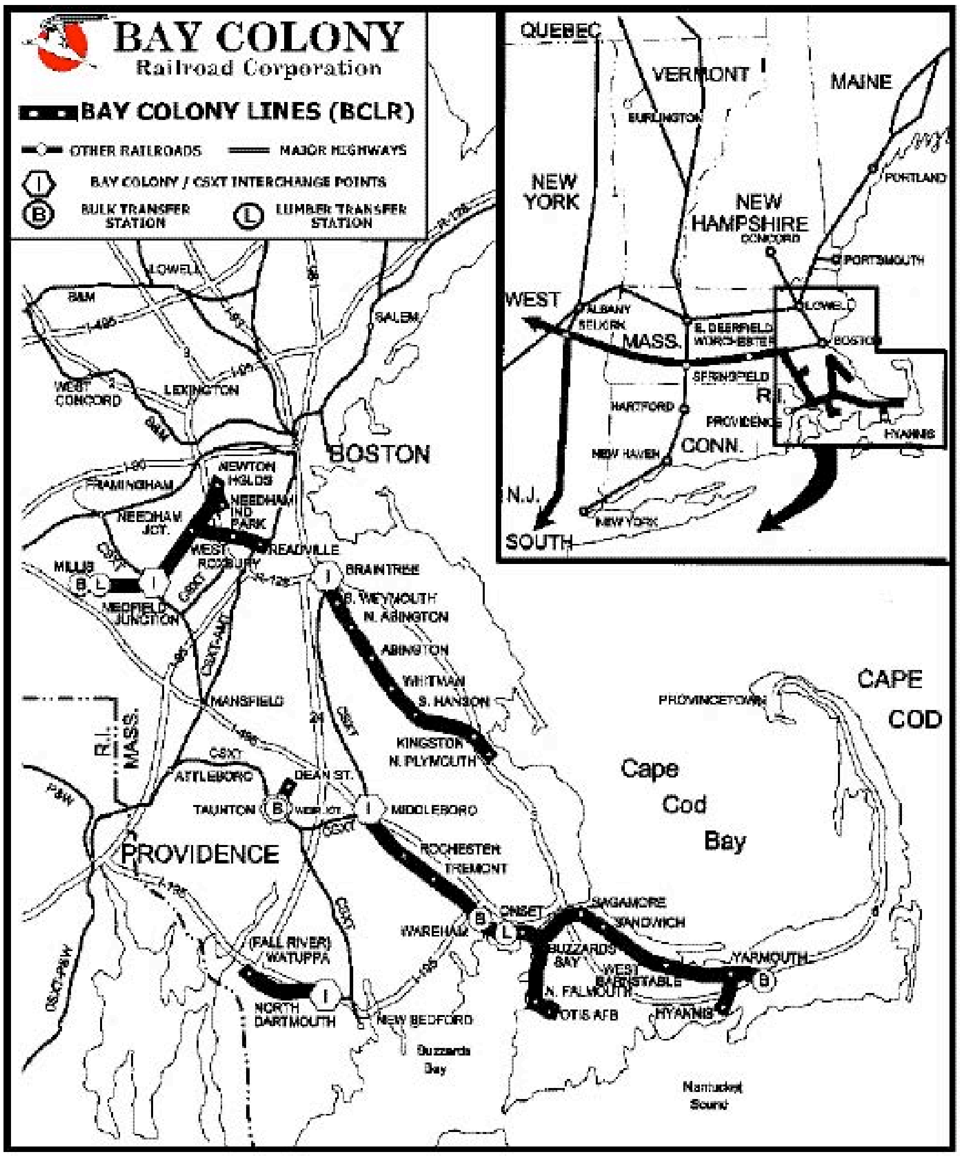

Figure 2.5-33: Bay Colony Railroad Corporation System Map

2.5.5 Passenger Service

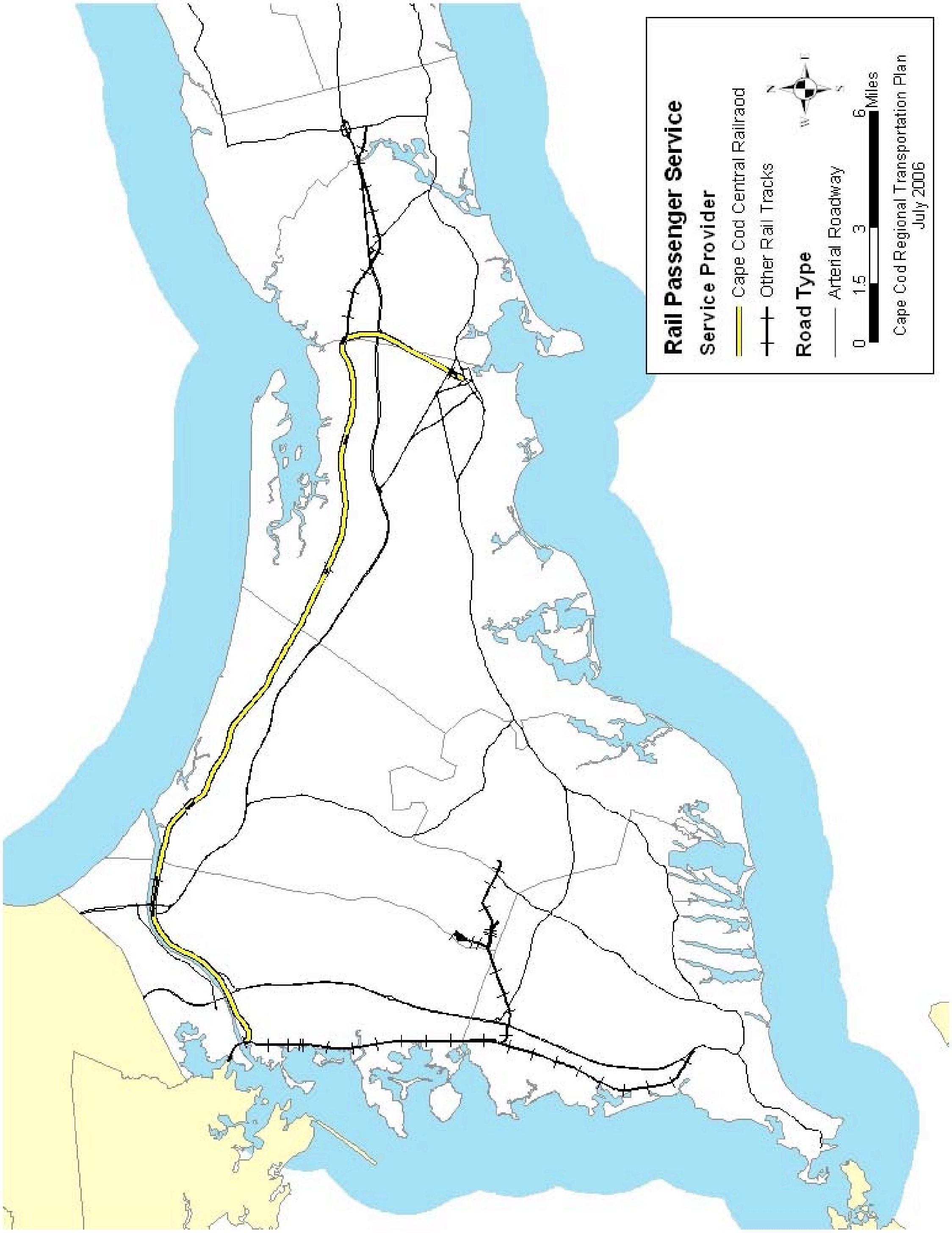

Figure 2.5-34: Cape Cod Central Railroad Service

The prospects for returning year-round passenger rail service to Cape Cod are unclear. The Massachusetts Bay Transit Authority (MBTA) is the only Commonwealth agency that can provide operating subsidies for rail service. Therefore, EOT cannot provide operating subsidies for transportation services without specific legislative approval and funding. According to the Transit Task Force Report, proposals for passenger rail service should be self-supporting and include a fee to EOT for the right to operate trains over the Commonwealth owned tracks. Moreover, proposals would need to address the issues of coordination with freight service, equipment costs, station capacity and design, schedules, coordination with state and local agencies, and the costs of repairing and maintaining the tracks themselves. Several studies have been performed and are underway to determine the feasibility of returning passenger service to Cape Cod.

Proposals to improve summer passenger rail include:

- Restore summer passenger rail service to Middleboro Commuter Rail Station. This is the current termination point of the MBTA Commuter rail service from South Station in Boston. This summer service would operate weekends during the summer season Friday, Saturday, and Sunday to provide a connection to Hyannis Transportation Center.
- Implement a connection rail service to Providence, RI. This service would connect with the high-speed Acela train along the New England corridor and allow summer visitors to come to the Cape by train.
- Reinstitute the *Cape Codder*. This service would originate in Washington DC and travel to Cape Cod.

Tourist/Dinner Trains

Cape Cod Central Railroad (CCCRR) formed in 1999 to provide recreational train service to Cape Cod. Under an arrangement with Bay Colony Railroad Company, CCCRR is permitted to use railroad tracks on 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 2.5-21**). The CCCRR owns three engines (**Table 2.5-4**). Engines 1501 and 1502 were built by General Motors' Electro-Motive Division (EMD) in 1952 and serve as CCCRR's primary motive power (**Figure 2.5-35**). Engine 1201, nicknamed "Lulubell," was built in 1951 by American Locomotive Company (ALCo) and serves CCCRR as a backup engine (**Figure 2.5-36**). These three engines move the various excursion trains offered by CCCRR.

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 (**Table 2.5-5**). 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 2.5-4: Engines in the Cape Cod Central Railroad Fleet[16]

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

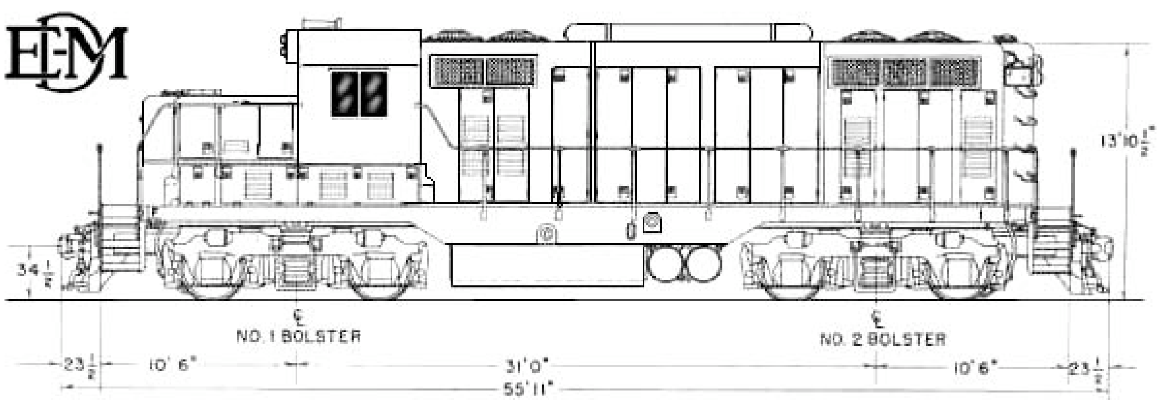

Figure 2.5-35: Diagram for Engines 1501 and 1502[17]

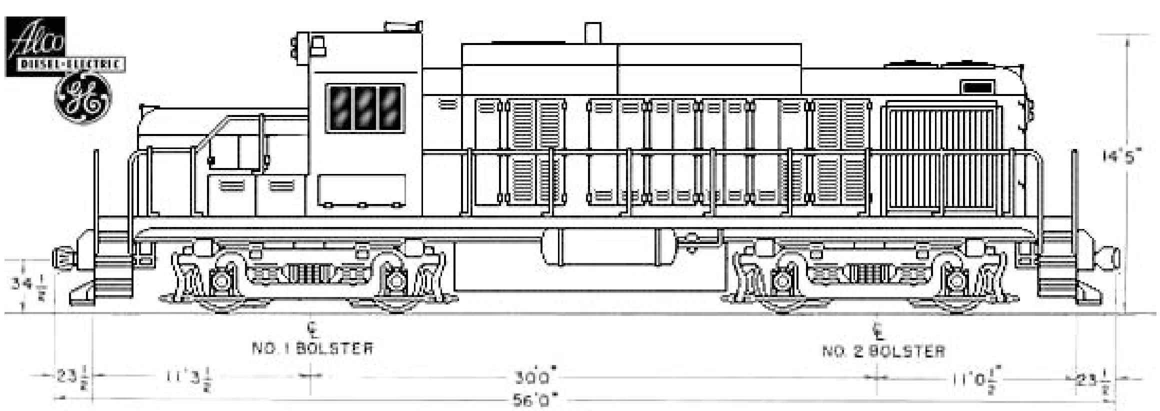

Figure 2.5-36: Diagram for Engine 1201[18]

Table 2.5-5: Rail Cars in the Cape Cod Central Railroad Fleet[19]

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

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. The operator projects 65,000 passengers in 2001[20].

2.5.6 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.

Elements of the Cape Cod Transportation Demand Model can be used to examine the mobility and connectivity of rail transportation. The Cape Cod Transportation Demand Model divides Cape Cod into 267 Transportation Analysis Zones (TAZ) based on census data, economic activity, travel patterns and other factors. The Cape Cod transportation network can be conceptualized as a series of links that connect neighboring TAZs. Each link represents a potential transportation connection, and is not necessarily associated with the existence of a railway or other transportation facility. In this way, areas of Cape Cod that are connected by rail transportation can be identified, as well as areas that lack connections (**Figure 2.5-37**).

Based on the TAZ analysis 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.

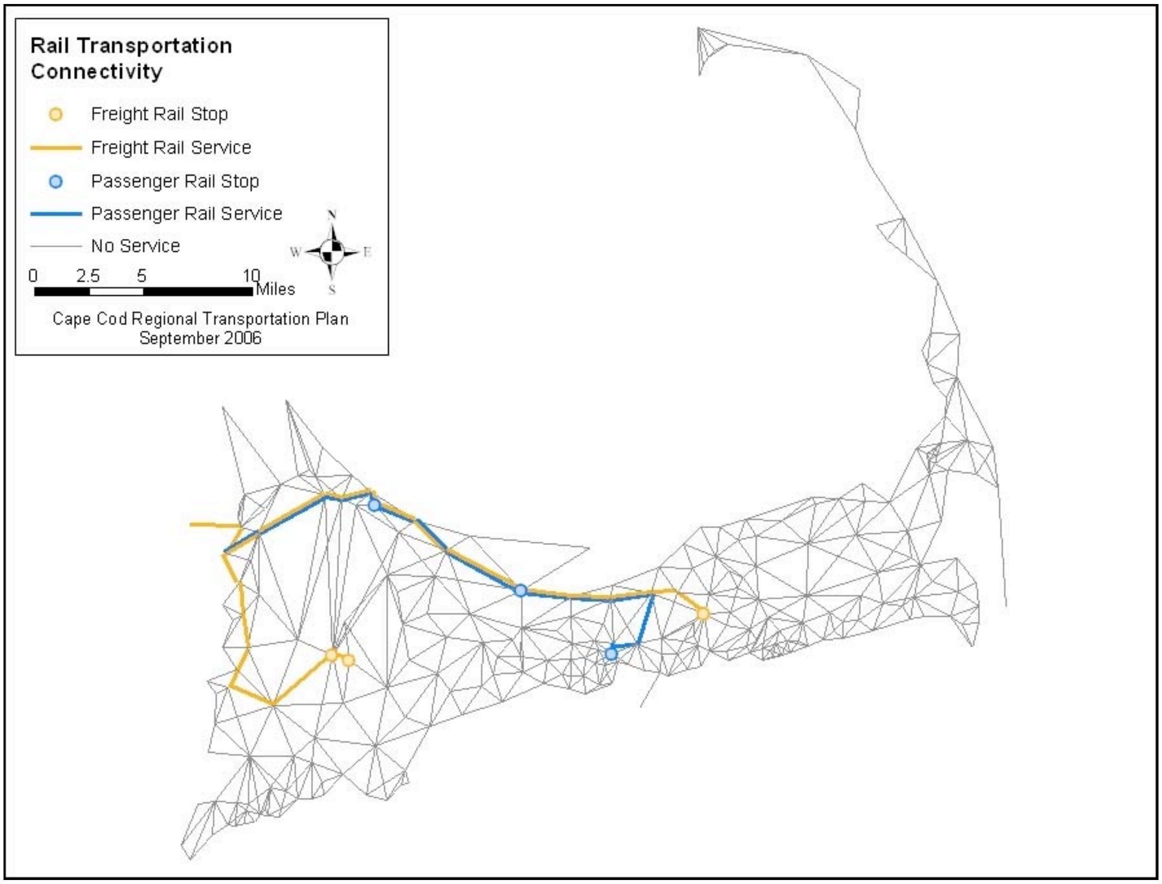

Figure 2.5-37: Cape Cod TAZs Connected by Rail Transportation

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.

2.5.7 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. EOT owns the majority of rail tracks on Cape Cod, but some tracks are owned by the Town of Falmouth and federal agencies. Currently though, only the BCLR freight service and the CCCRR scenic train service operate on Cape Cod. A study is underway by the state to evaluate rail service options to Buzzards Bay. 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.

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[1] "Cape Cod Canal, Photographs, Army Corps of Engineers." www.nae.usace.army.mil/recreati/ccc/photo_album/photo_index.htm.
[2] "Cape Cod Central Railroad - Railroad History." www.capetrain.com/history.
[3] "Cape Cod Rail Trail." http://www.mass.gov/dcr/parks/southeast/ccrt.htm.
[4] "Falmouth Bike Trail." http://members.aol.com/falbike/bike/bike/history.htm.
[5] "Cape Cod Central Railroad - Railroad History." www.capetrain.com/history.
[6] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page 3-13
[7] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page 3-14
[8] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page A-6
[9] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page A-6
[10] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page A-6
[11] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page 3-13
[12] "Cape Cod Central Railroad - Railroad History." www.capetrain.com/history.
[13] "About Bay Colony." http://www.baycolonyrr.com/about%20bay%20colony.htm.
[14] "Rolling Stock." www.baycolonyrr.com/locomotives.htm. Train Information from Wikipedia. http://en.wikipedia.org/wiki/Main_Page.
[15] "The Trash Train." http://www.baycolonyrr.com/the_trash_train.htm.
[16] "Cape Cod Central Railroad – Equipment Roster." http://www.capetrain.com/roster/. Train Information from Wikipedia. http://en.wikipedia.org/wiki/Main_Page.
[17] "Cape Cod Central Railroad – Equipment Roster." http://www.capetrain.com/roster/.
[18] "Cape Cod Central Railroad – Equipment Roster." http://www.capetrain.com/roster/.
[19] "Cape Cod Central Railroad – Equipment Roster." http://www.capetrain.com/roster/.
[20] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page 3-14

2.6 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.

2.6.1 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[1], the agency that maintains many of them. These and other seaports are discussed in this section.

2.6.1.1 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 2.6-2** and **Figure 2.6-3**). 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.

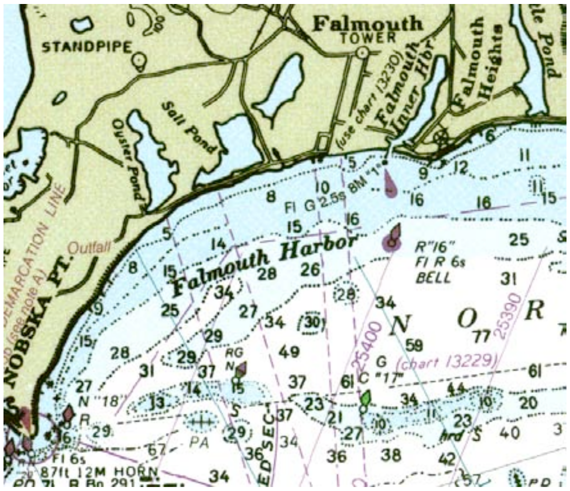


Figure 2.6-1: Falmouth Harbor[2]

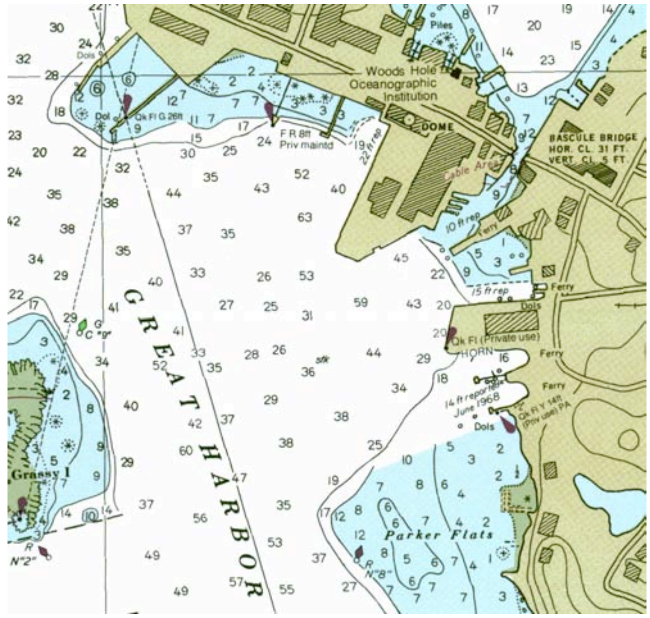


Figure 2.6-2: A Section of Great Harbor, Woods Hole in Falmouth[3]

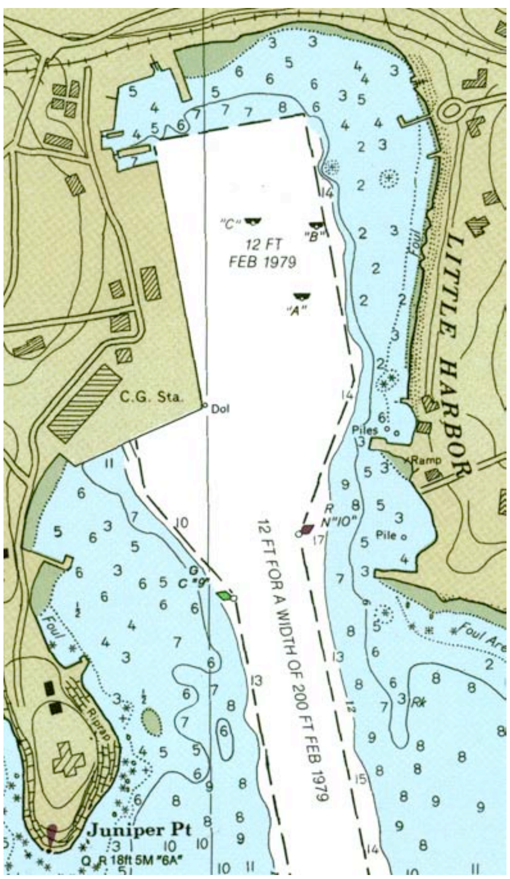


Figure 2.6-3: Little Harbor, Woods Hole in Falmouth[4]

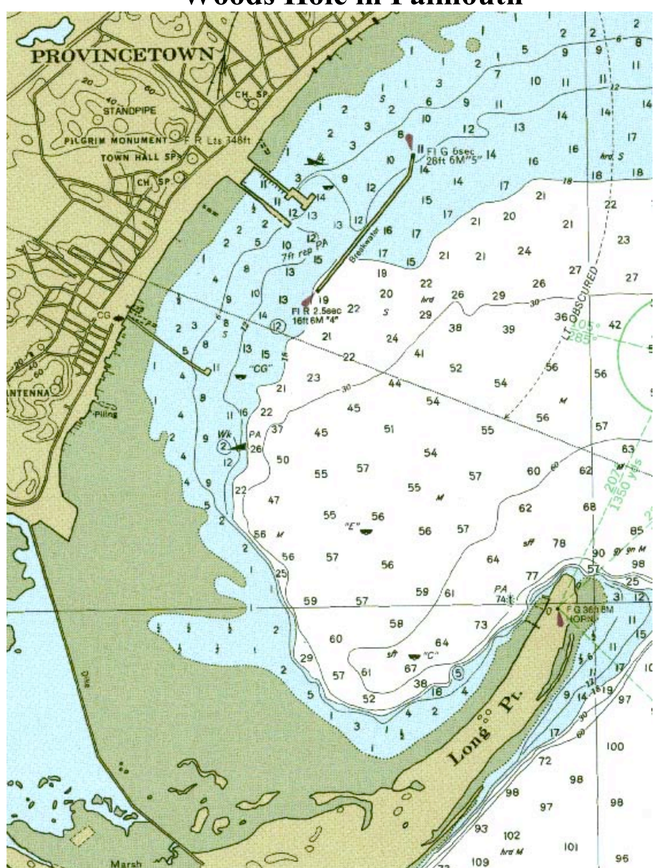


Figure 2.6-4: Provincetown Harbor[5]

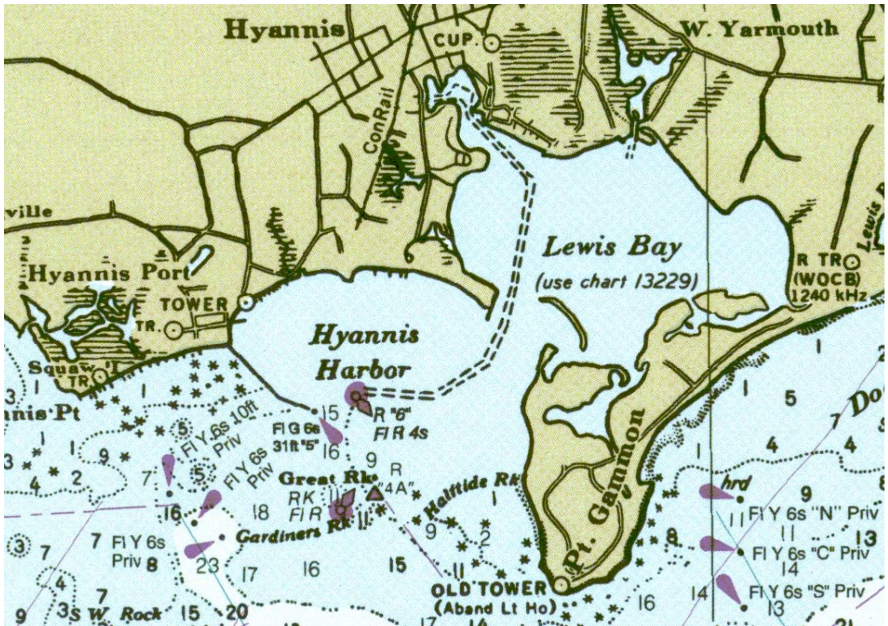


Figure 2.6-5: Hyannis Harbor[6]

2.6.1.2 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 2.6-5**). 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.

2.6.1.3 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 2.6-4**). Local and state officials have discussed and rejected the expansion of the harbor to include a freight pier. The narrow streets in

Provincetown's historic district and the traffic congestion during peak hours make such a proposal unfeasible[7].

2.6.1.4 Falmouth Harbor

Falmouth Harbor is located three miles east of Woods Hole, on the waterway between Falmouth Heights Road and Scranton Avenue (**Figure 2.6-1**). 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.

2.6.1.5 Saquatucket Harbor (Harwichport)

Saquatucket Harbor in Harwich serves the Lower Cape (**Figure 2.6-6**). 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.

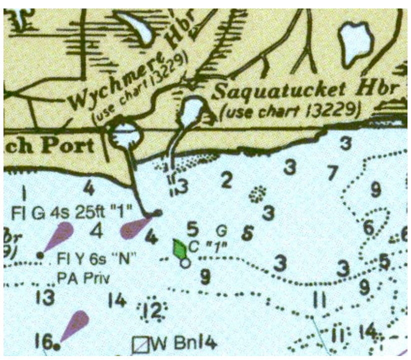


Figure 2.6-6: Saquatucket Harbor[8]

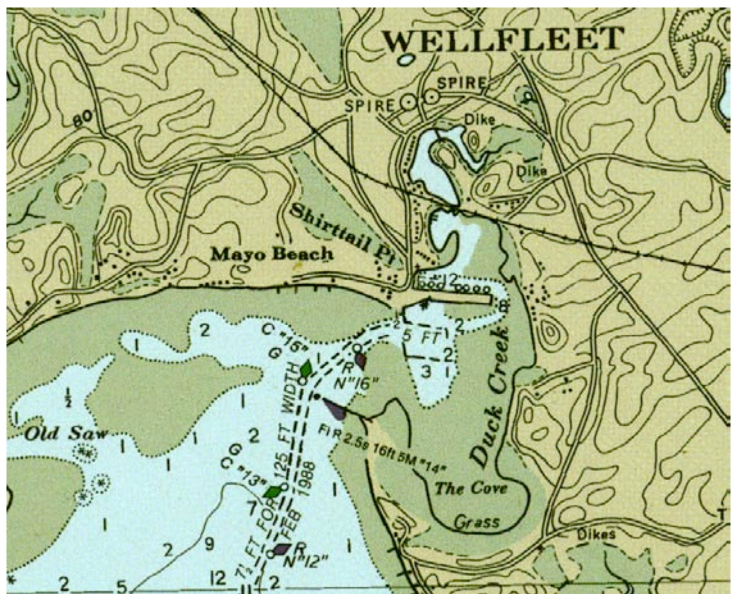


Figure 2.6-7: Wellfleet Harbor[9]

2.6.1.6 Wellfleet Harbor

Wellfleet Harbor is located at the mouth of Duck Creek, just south of Wellfleet Center (**Figure 2.6-7**). 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.

2.6.1.7 Stage Harbor (Chatham)

Stage Harbor, located in Chatham, is one of the major seaports in the Lower Cape (**Figure 2.6-8**). 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 2.6-8: Stage Harbor[10]

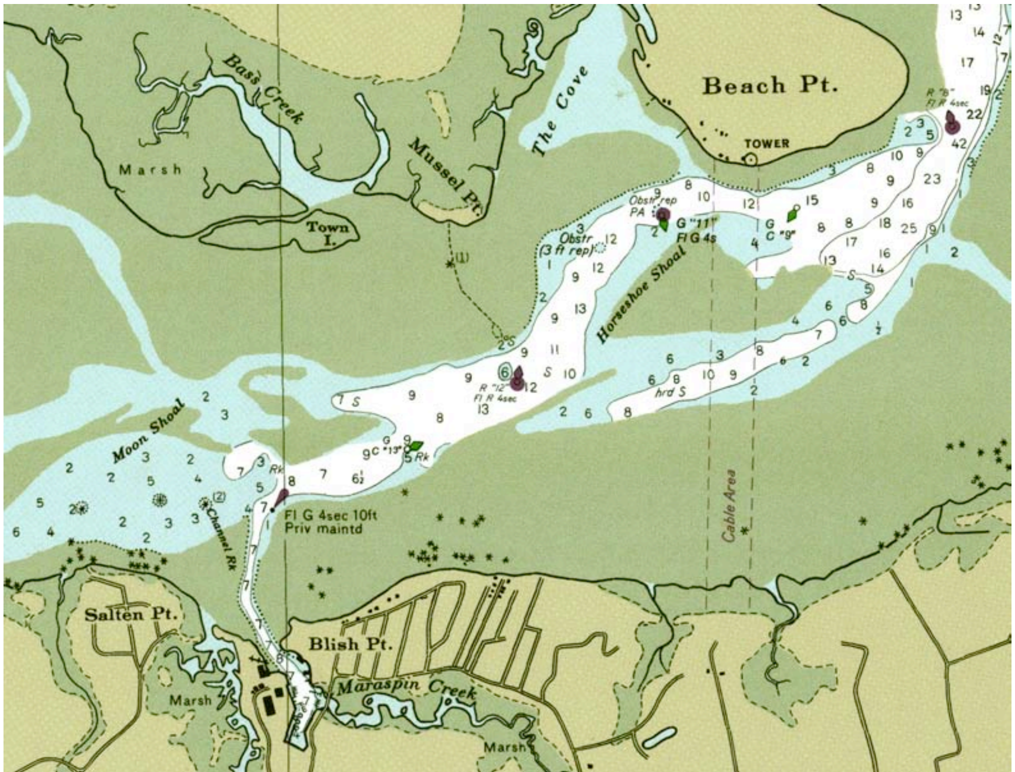


Figure 2.6-9: Barnstable Harbor and Marina[11]

2.6.1.8 Barnstable Harbor

Barnstable Harbor lies between Sandy Neck and the mainland of Cape Cod (**Figure 2.6-9**). 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.

2.6.1.9 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 2.6-11**). 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.

2.6.1.10 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 2.6-10**). 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.

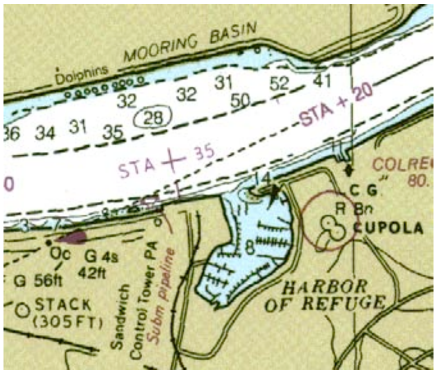


Figure 2.6-11: Sandwich Marina[13]

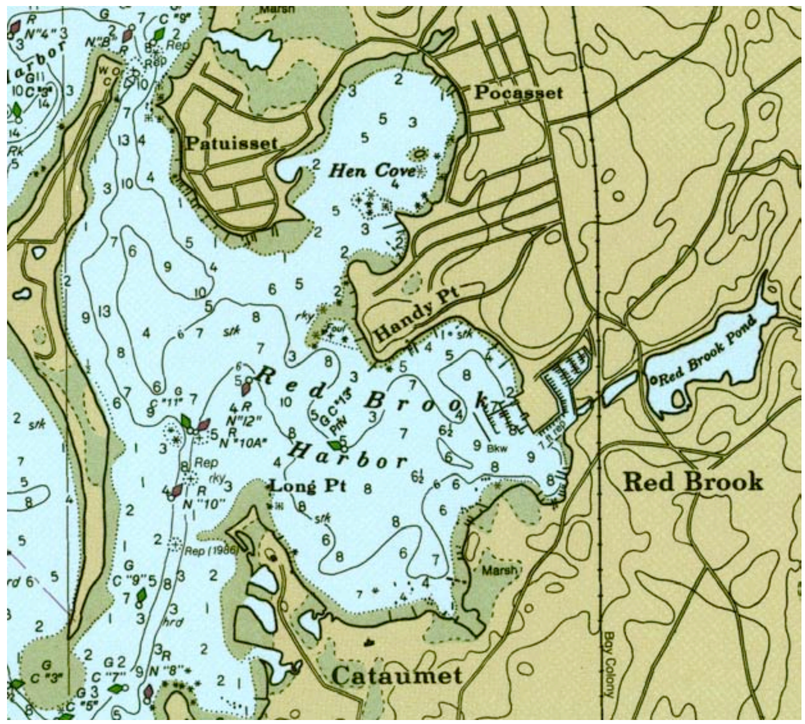


Figure 2.6-10: Red Brook Harbor, Bourne[12]

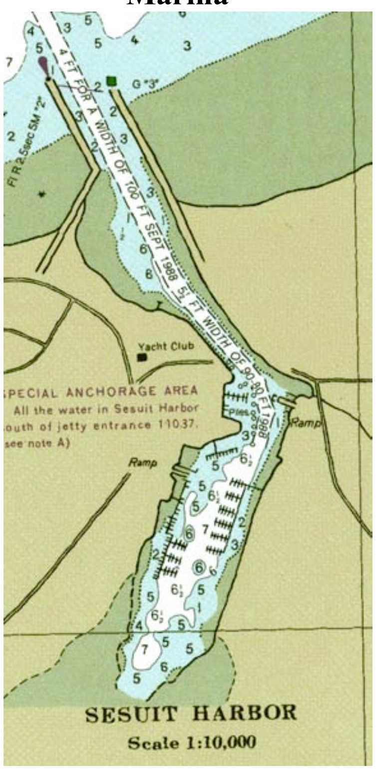


Figure 2.6-12: Sesuit Harbor, Dennis[14]

2.6.1.11 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 2.6-12**). 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.

2.6.2 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 acquire the title until March 30, 1928.

Figure 2.6-14: First Cape Cod Canal, 1914-1935[16]

Figure 2.6-13: The original Bourne Bridge completed in 1911[15]

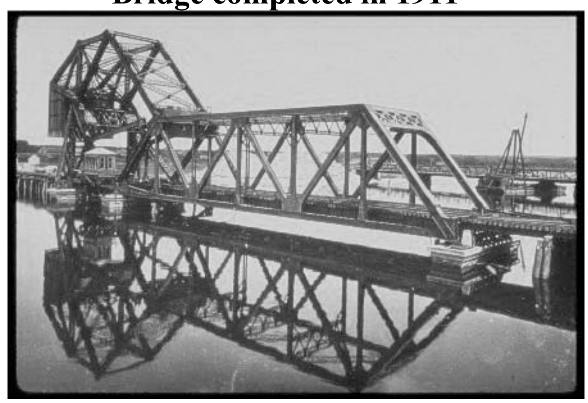


Figure 2.6-15: The original railroad bridge over the Cape Cod Canal, 1914-1935[17]

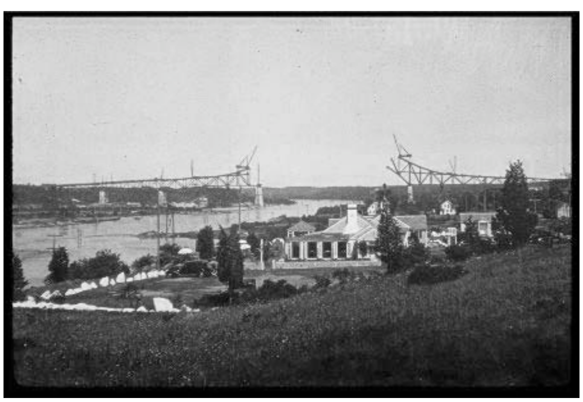


Figure 2.6-16: Construction of the Bourne Bridge[18]

Figure 2.6-17: Construction of the Bourne Bridge[19]

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. Built simultaneously with Work Progress Administration funds, the existing bridges have larger spans 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. Marine traffic is monitored and regulated at all hours. Over two thousand ships passed through the canal in 2003. Moreover, Corps patrol ships 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.

Figure 2.6-18: A small boat travels through the Cape Cod Canal

Figure 2.6-19: Cape Cod Canal and Railroad Bridge in the distance, facing west

2.6.3 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.

2.6.3.1 Woods Hole Channel

The Woods Hole Channel is the most heavily traveled Cape Cod waterway (**Table 2.6-1**). 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 2.6-20**). 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.

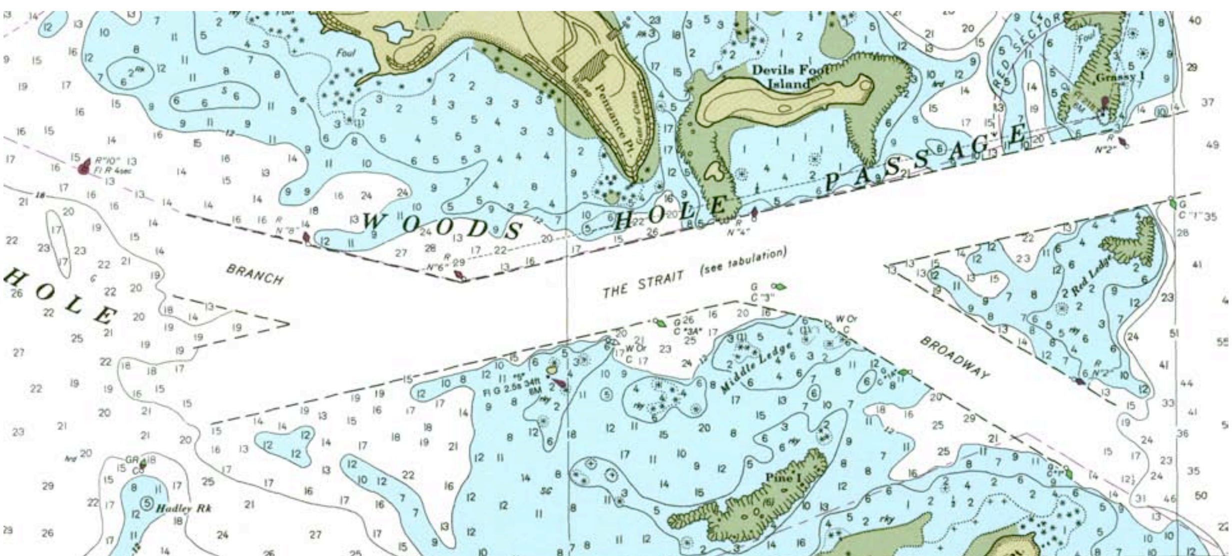


Figure 2.6-20: Woods Hole Channel[20]

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 (**Table 2.6-2**).

2.6.3.2 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 2.6-1**). 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 2.6-21**).

Table 2.6-1: 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 2.6-2: Trips of Vessels for Cape Cod Ports and Channels, 2003[21]

Facility	Total Up/Inbound	Total Down/Outbound	Total
Cape Cod Canal	1,124	1,025	2,149
Cross Rip Shoals	288	291	579
Falmouth Harbor	3,311	3,311	6,622
Hyannis Harbor	9,039	9,037	18,076
Woods Hole Channel	16,702	16,700	33,402
Total	**30,464**	**30,364**	**60,728**

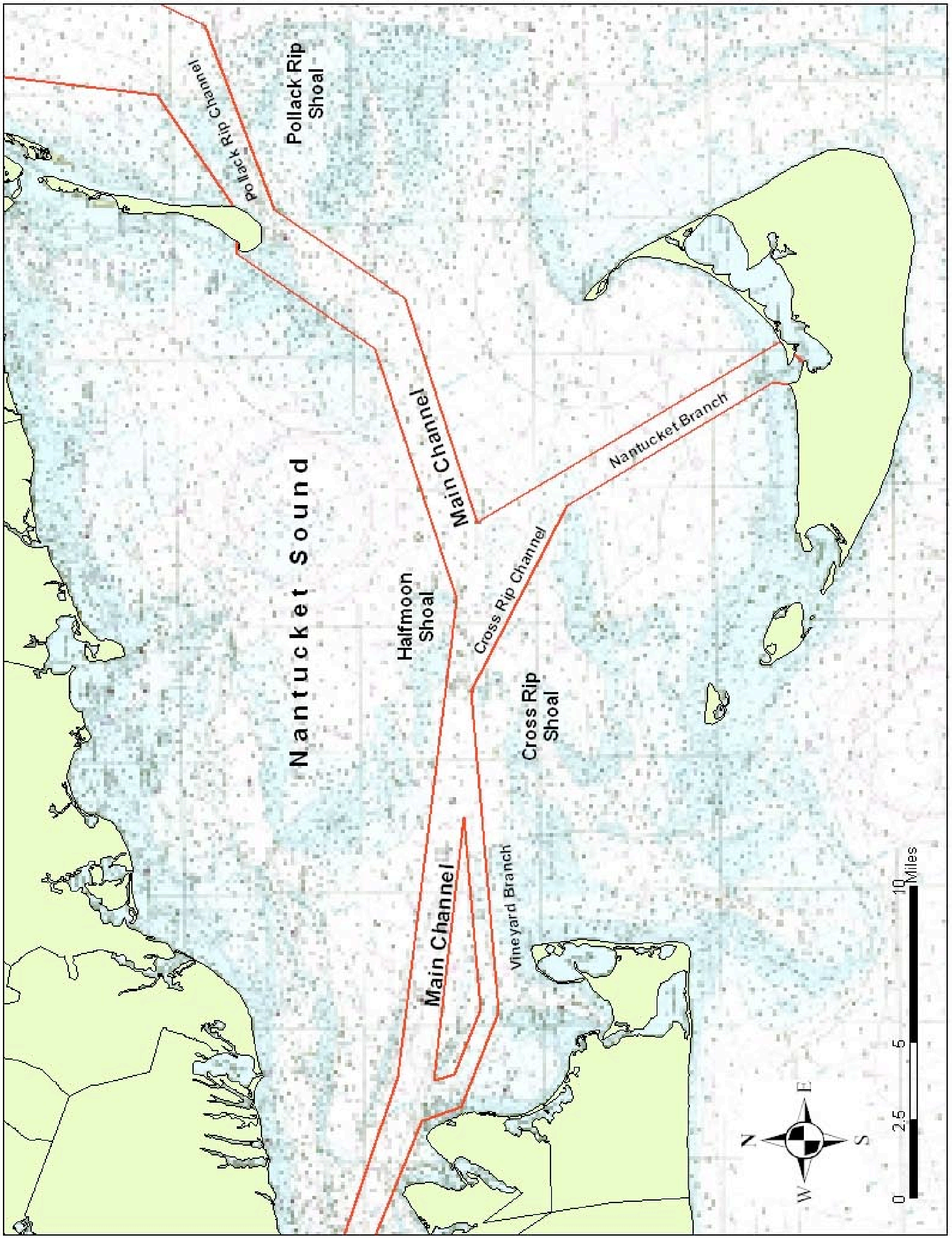


Figure 2.6-21: Nantucket Sound Channels

2.6.4 Water Transportation Infrastructure

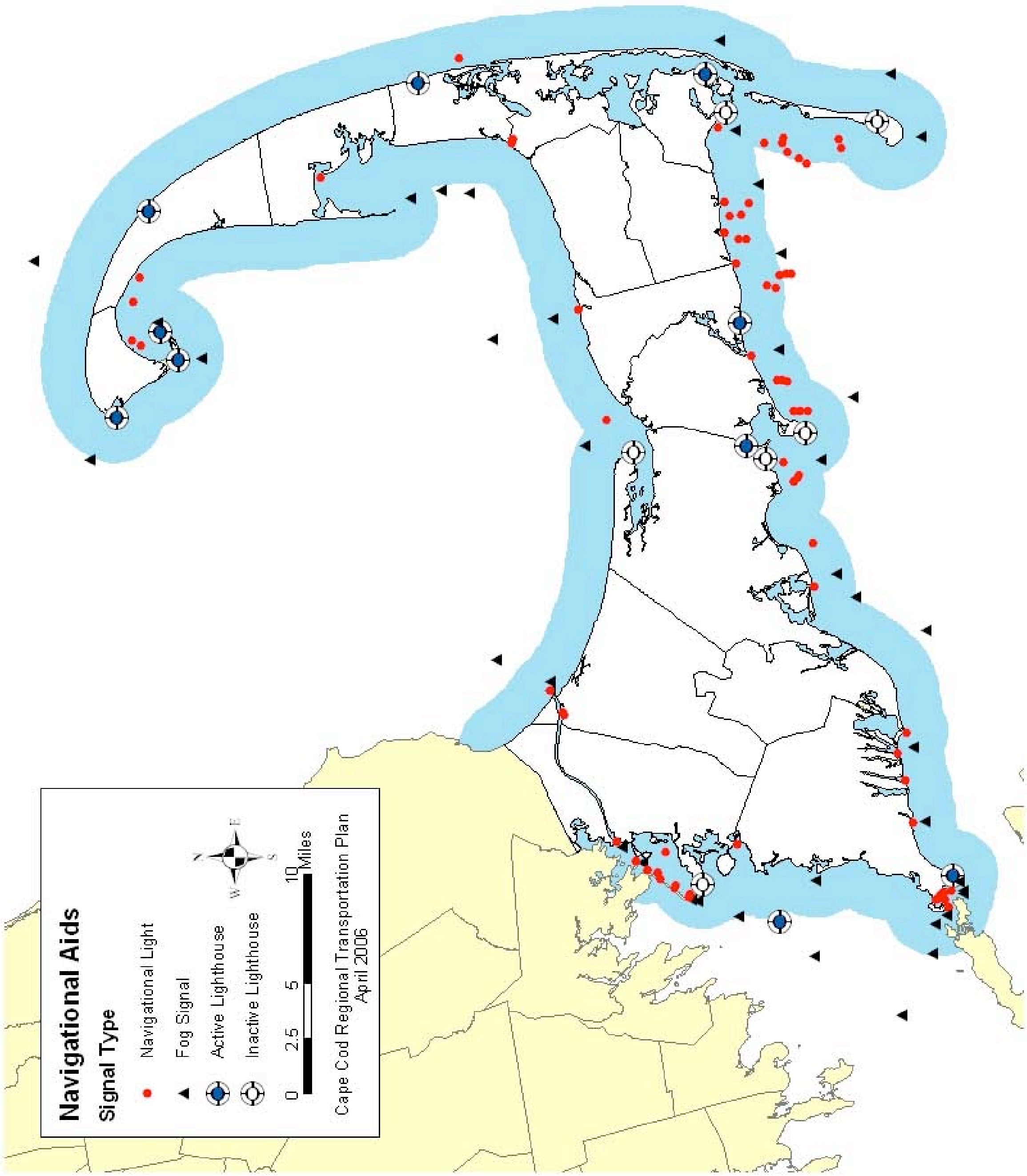


Figure 2.6-22: Navigational Aids within Three Miles of Cape Cod

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 2.6-3**). 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 2.6-4**). Cape Cod has 43 fog signals and 72 navigational lights in total.

Table 2.6-3: Active Cape Cod Lighthouses[22]

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 2.6-4: 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

2.6.5 Water Freight Service

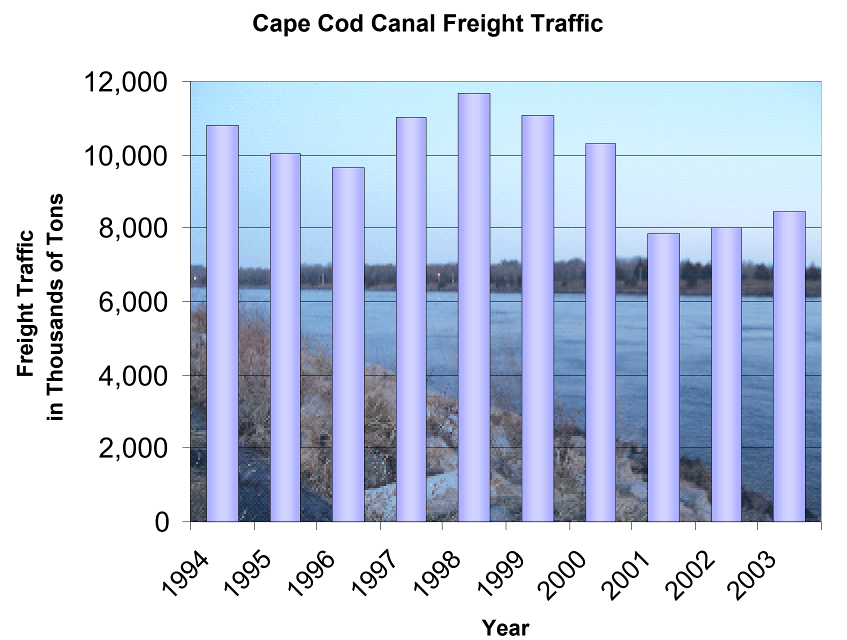
Goods are transported by water via ferries, barges, and tankers. The busiest Cape Cod water facility in terms of freight transportation is the Cape Cod Canal. Although more vessels may pass through the Woods Hole Channel per year, more tons of freight pass through the Cape Cod Canal (**Table 2.6-5**). 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 2.6-6**). 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[23]. Understandably, the Cape Cod Canal is listed as one of the major waterways of New England by the Army Corps of Engineers[24].

Falmouth Harbor is the only Cape Cod Harbor for which freight traffic is reported[25]. 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[26], 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 2.6-5: Freight Traffic through Cape Cod Ports and Channels Rounded to the Nearest Thousand Tons, 2003[27]

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

Table 2.6-6: Comparative Statement of Traffic through Cape Cod Ports and Channels in Thousand Tons, 1994-2003[28]



Year	Freight Traffic in 1,000's tons
2003	8,464
2002	7,991
2001	7,844
2000	10,317
1999	11,067
1998	11,654
1997	11,033
1996	9,666
1995	10,051
1994	10,799

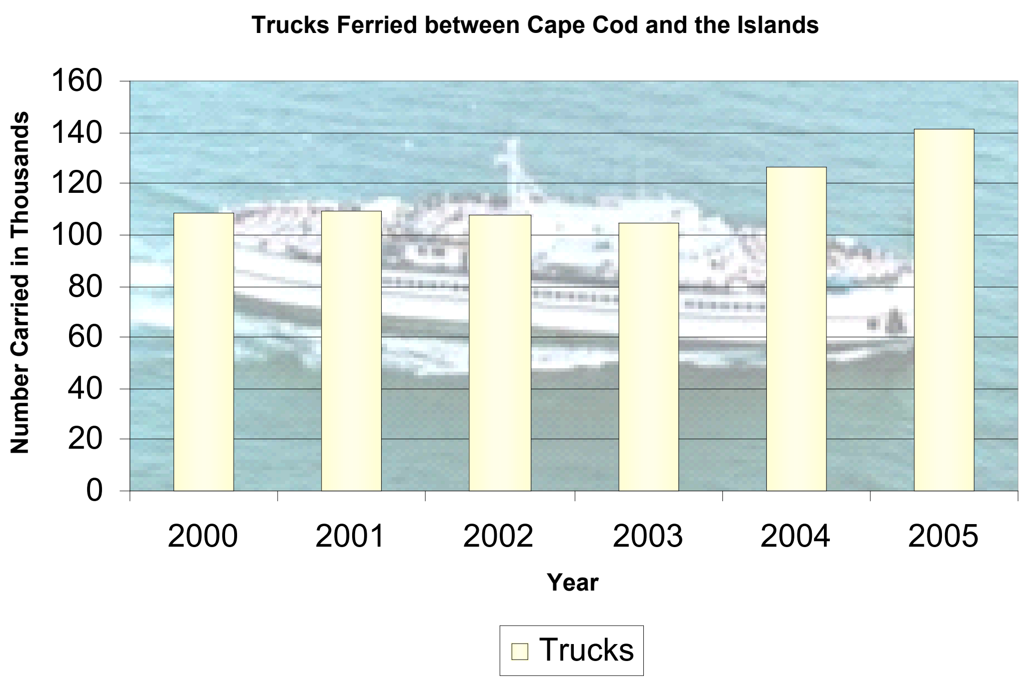


Figure 2.6-23: Combined Vehicular Traffic between Cape Cod and the Islands, 2000-05[29]

Table 2.6-7: Trucks Carried[30]

	Woods Hole to Martha's Vineyard and Return	Hyannis to Nantucket and Return	Combined
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

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. Last year 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.

2.6.6 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. People are unlikely to take the ferry because it is inconvenient, not going where they want, or because they prefer to drive[31].

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[32]. 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[33]. 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[34]. Advertising ferry services in this manner will be more successful.

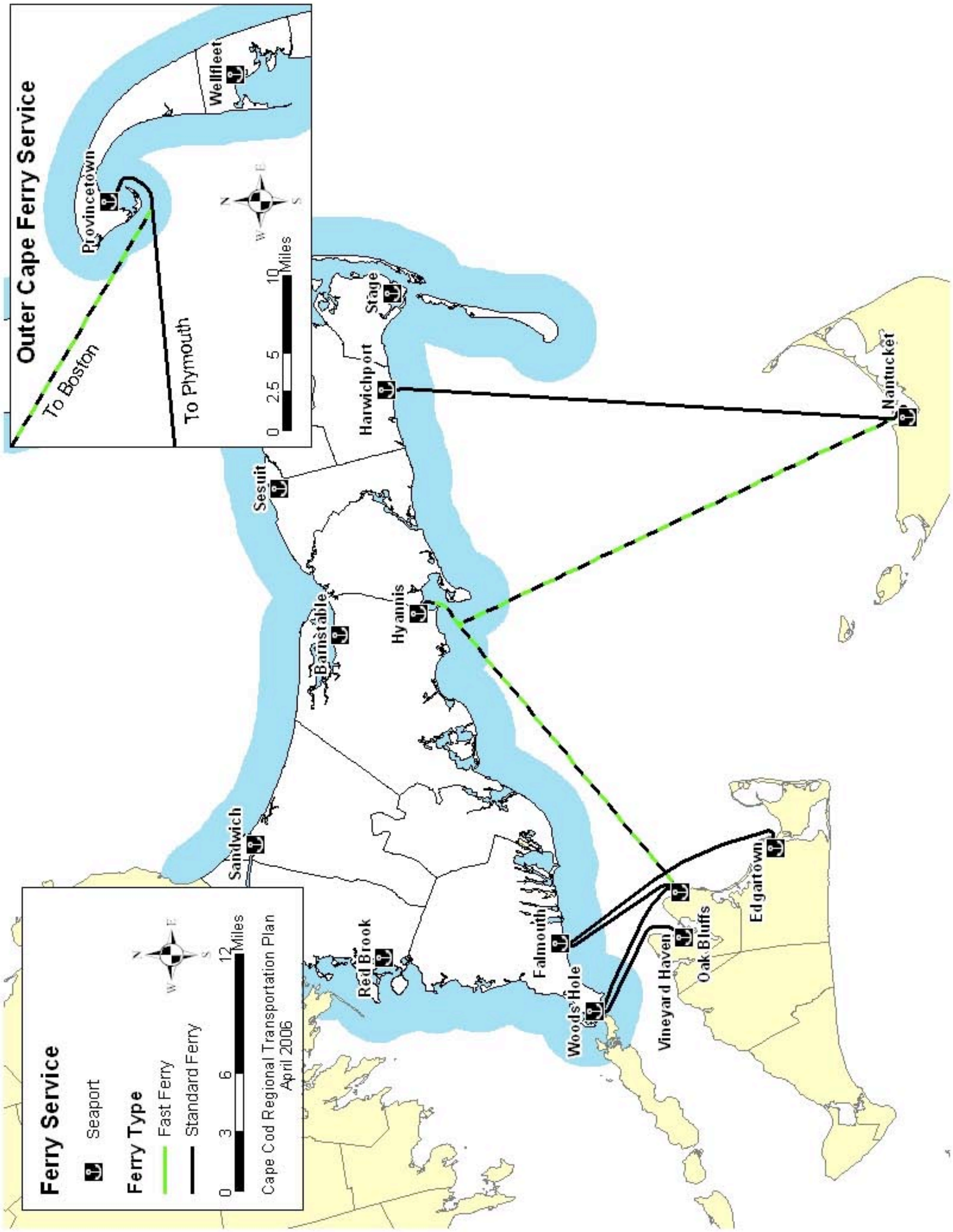


Figure 2.6-24: Cape Cod Ferry Service

2.6.6.1 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 2.6-8: Steamship Authority Fleet[35]

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

The Steamship Authority operates a fleet of nine vessels, including a high-speed passenger-only ferry (**Table 2.6-8**). 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.

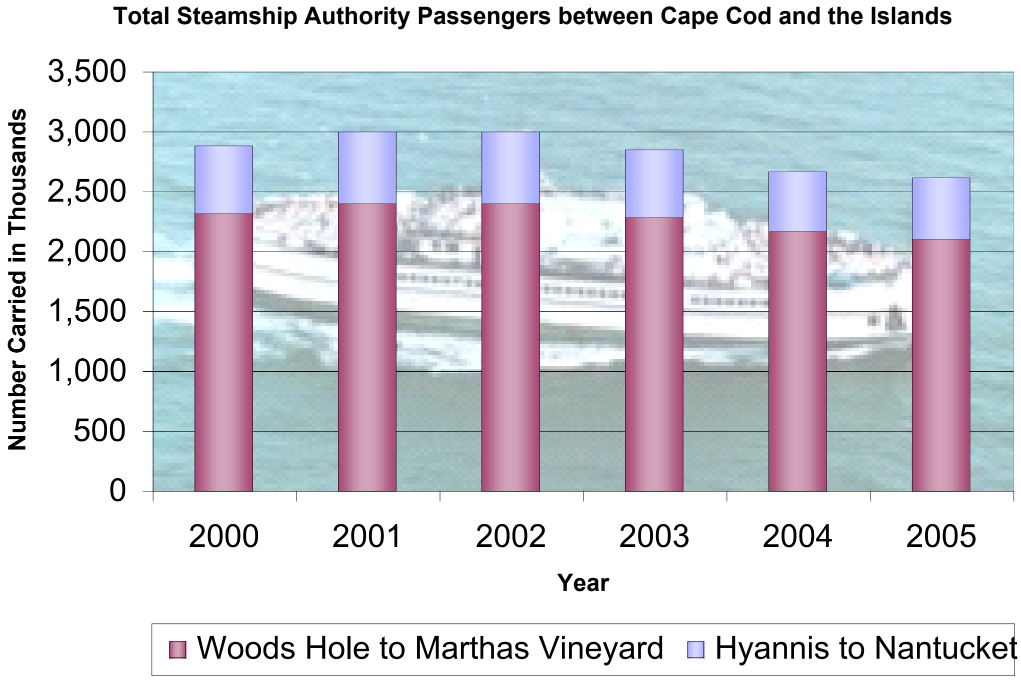


Figure 2.6-25: Steamship Authority Passengers, 2000-2005[36]

Table 2.6-9: Passengers Carried by the Steamship Authority[37]

	Woods Hole to Martha's Vineyard and Return	Hyannis to Nantucket and Return	Combined
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

Table 2.6-10: Automobiles Carried by the Steamship Authority[38]

	Woods Hole to Martha's Vineyard and Return	Hyannis to Nantucket and Return	Combined
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

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 whom are unionized.

2.6.6.2 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 2.6-11**). 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.

2.6.6.3 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 2.6-11: 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 unserved 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[39]. Addressing these gaps in service may be a way to reduce automobile congestion and encourage alternative transportation.

2.6.7 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[40]. 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.

2.6.7.1 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[41]. 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.

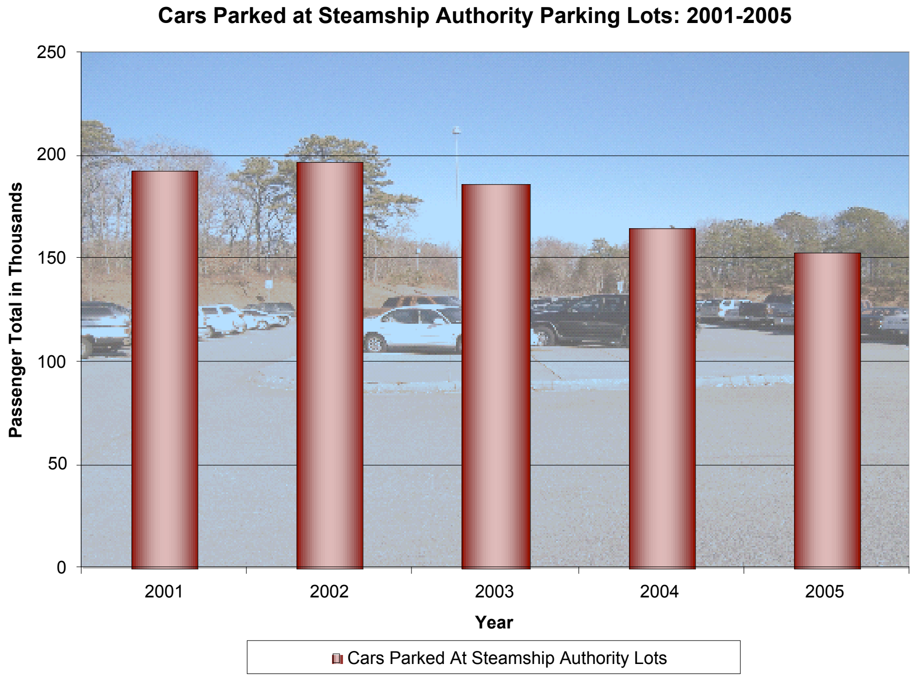


Figure 2.6-26: Ferry Parking Demand[42]

2.6.7.2 Local Bus Accessibility

Four of the five Cape Cod ferry ports are accessible via local bus. The Breeze Blue Line of the Cape Cod Regional Transit Authority (RTA) makes its final stop at the Woods Hole docks several times daily. The blue line connects ferry passengers in Woods Hole to downtown Falmouth and Hyannis. The Breeze Red Line of the RTA stops at both the Steamship Authority and Hy-Line terminals. From there, ferry passengers can connect to the Hyannis Transportation Center, downtown Hyannis, and the local Senior Center. In Provincetown, the North Truro Shuttle and the Beach/Airport Shuttle make regular stops at MacMillan Wharf, with connections to the Outer Cape Flex Route. Lastly, the Breeze Green Line 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 Blue Line passes within several blocks, there is no direct access. Variable route bus service, the B-Bus, can be arranged in advance to any ferry port.

2.6.7.3 Local Bus Coordination

Despite the local bus connections, there is little coordination (**Table 2.6-12**). 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. Of the 39 relevant bus stop times (within one hour before ferry departure time), less than one-third are 15 to 30 minutes before a ferry departure. The other 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.

Table 2.6-12: Coordination between Summer Weekday Local Bus and Ferry Departure Schedules

Woods Hole - Vineyard Haven (**Bold** = Oak Bluffs)		Hyannis - Nantucket (**Bold** = Oak Bluffs)		Provincetown - Boston (**Bold** = Plymouth)		Harwichport - to Nantucket	
Blue Line	Ferry	Red Line*	Ferry	P-Town Shuttle**	Ferry	Green Line*	Ferry
6:55a	7:00a		6:30a	*9:00a*		*6:25a*	
7:55a	8:15a		**7:00a**	9:05a		7:45a	8:00a
	9:30a		7:30a	*10:00a*	10:00a	9:20a	
9:40a	10:45a		9:00a	10:05a		*10:45a*	11:20a
10:55a	**12:00p**		9:10a	*11:00a*	11:00a	*3:50p*	
12:55p	1:15p		9:15a	*2:00p*		4:40p	5:30a
1:55p	**2:30p**		**9:15a**	2:05p			
	3:45p		**9:30a**	2:35p			
3:55p		9:45a		*3:00p*	3:00p		
4:55p	**5:00p**	10:45a		3:05p			
	6:15p	11:45a	12:00p	3:35p			
6:55p	**7:30p**		**12:15p**	*4:00p*	4:00p		
	8:30p	12:45p	1:00p	4:05p	**4:30**		
	9:45p		1:30p	*6:00p*			
	10:30p	1:45p		6:35p			
		2:45p	2:45p	*7:00p*			
			3:15p	7:05p	7:30p		
		3:45p	**5:25p**				
			6:00p				
			6:10p				
			6:30p	Regular		Regular	
			7:45p	North Truro Shuttle		Hyannis to Orleans	
			8:00p	*Italics*		*Italics*	
			8:45p	*Airport Shuttle*		*Orleans to Hyannis*	

Ferry times are departure times
* - Actual Stop time may vary by up to 5 minutes
** - Shuttle runs every hour until 12:15p, then every _ hour. Only the relevant times have been shown.

2.6.7.4 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.

2.6.7.5 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.

2.6.7.6 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.

2.6.7.7 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.

2.6.8 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.

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2.7 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.

2.7.1 Cape Cod Airports

Six airfields and airports serve Cape Cod as a base for air transportation (**Table 2.7-1**). 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 2.7-1: Airports and Airfields of Cape Cod[1]

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	-

2.7.1.1 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. 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 2.7-2**). A total of 72 aircraft are based out of Barnstable Municipal Airport, including one jet. The airport employs 27 full-time employees, leases space to 43 tenant businesses and 1,143 personnel[2]. The airport is currently undergoing construction as its terminal is expanded and several other facilities are relocated.

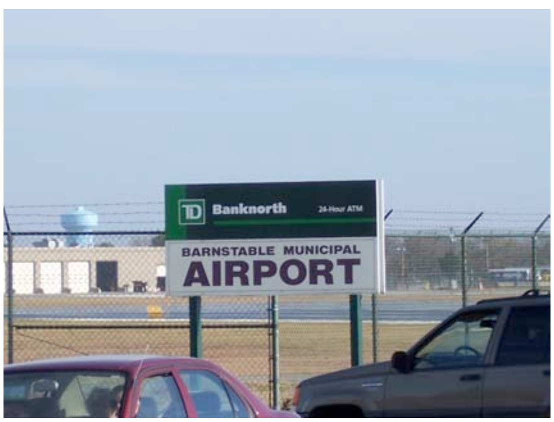

Figure 2.7-1: Runway 6/24 of Barnstable Municipal Airport from Route 28

Figure 2.7-2: Cape Cod Airfield

2.7.1.2 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 one multi-engine plane 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.

2.7.1.3 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 (**Figure 2.7-3** and **Figure 2.7-4**). One asphalt runway provides service for the 39 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 43 aircraft. A nearby "Fly-In Community," with aircraft access from the homes to the runway, offers shares of the Falmouth Airpark with residence[4]. 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[5]. Currently, the airfield is operated by Cape Cod Flying Service and serves as a base for 12 aircraft.

Figure 2.7-3: Chatham Municipal Airport

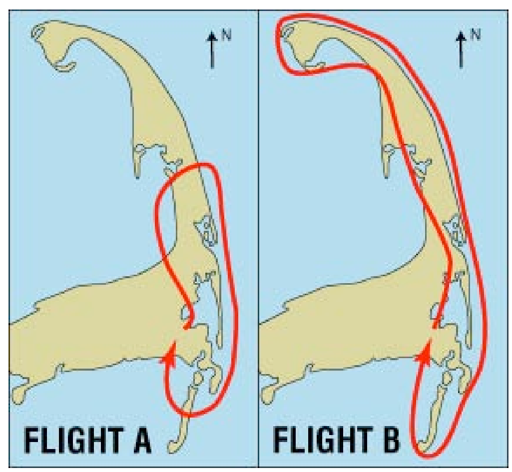

Figure 2.7-4: Recreational Flight Paths from Chatham Municipal Airport[3]

2.7.1.4 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 2.7-2: Cape Cod Runway Information[6]

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: -	-	-

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

2.7.2 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. As the Commonwealth's third largest and busiest airport, Barnstable Municipal Airport serves its passengers with an average wait time of less than 15 minutes[7]. Despite this, only 16% of Cape Cod residents use the airports on Cape Cod for their air service needs (**Figure 2.7-6**). 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[8]. 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[9].”

Table 2.7-3: Annual Enplanements by Airport and Service Type: 2000-2004[10]

Year	Small and Commuter Planes	Air Taxi (Charter Service)	Total
Barnstable Municipal Airport			
2004	87,547	79,975	167,522
2003	85,965	72,395	158,360
2002	100,593	80,214	180,807
2001	109,426	87,680	197,106
2000	115,188	90,718	205,906
Provincetown Municipal Airport			
2004	11,419	5	11,424
2003	11,795	6	11,801
2002	10,354	179	10,533
2001	12,982	4	12,986
2000	15,651	43	15,694

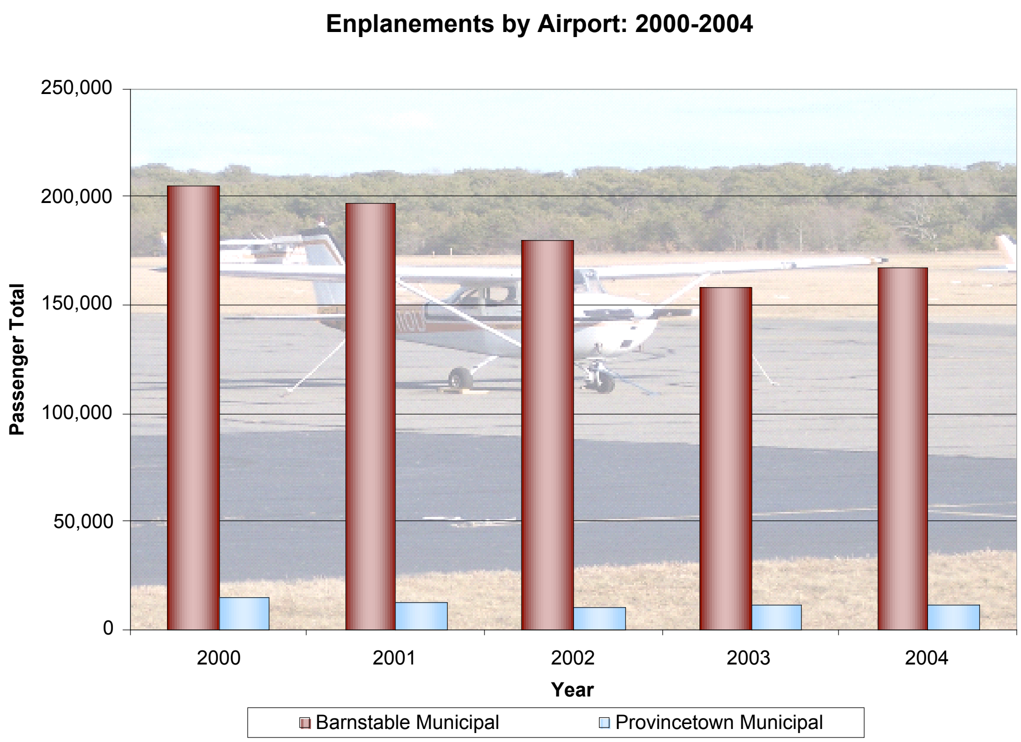

Figure 2.7-5: Annual Enplanements by Airport: 2000-2004[11]

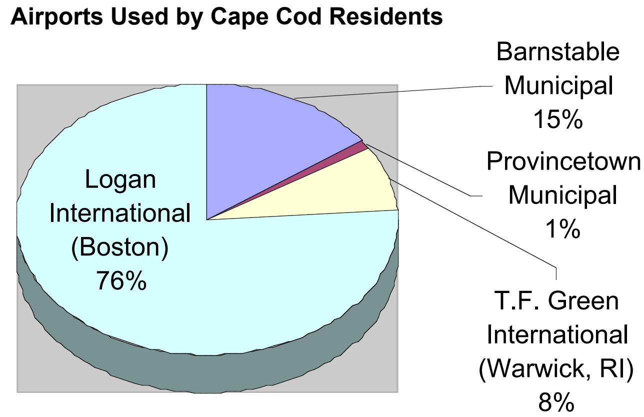

Figure 2.7-6: Airports Used by Cape Cod Residents[12]

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 49 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, "the Nantucket Shuttle[13]," offers flights almost every half-hour, as well as charter and air freight service. Together, Cape Air and Nantucket Airlines provide a total operation of 39 daily flights during winter weekdays and 63 daily flights during summer weekdays (**Table 2.7-4** and **Table 2.7-5**).

Another air service provider is Island Airlines, "Nantucket's Community Airline[14]." 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. Overall, Island Airlines provides a total operation of 37 daily flights during weekdays (**Table 2.7-4** and **Table 2.7-5**).

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. Overall, U.S. Airways offers a total operation of 10 daily flights during winter weekdays and 26 daily flights during summer weekdays (**Table 2.7-4** and **Table 2.7-5**).

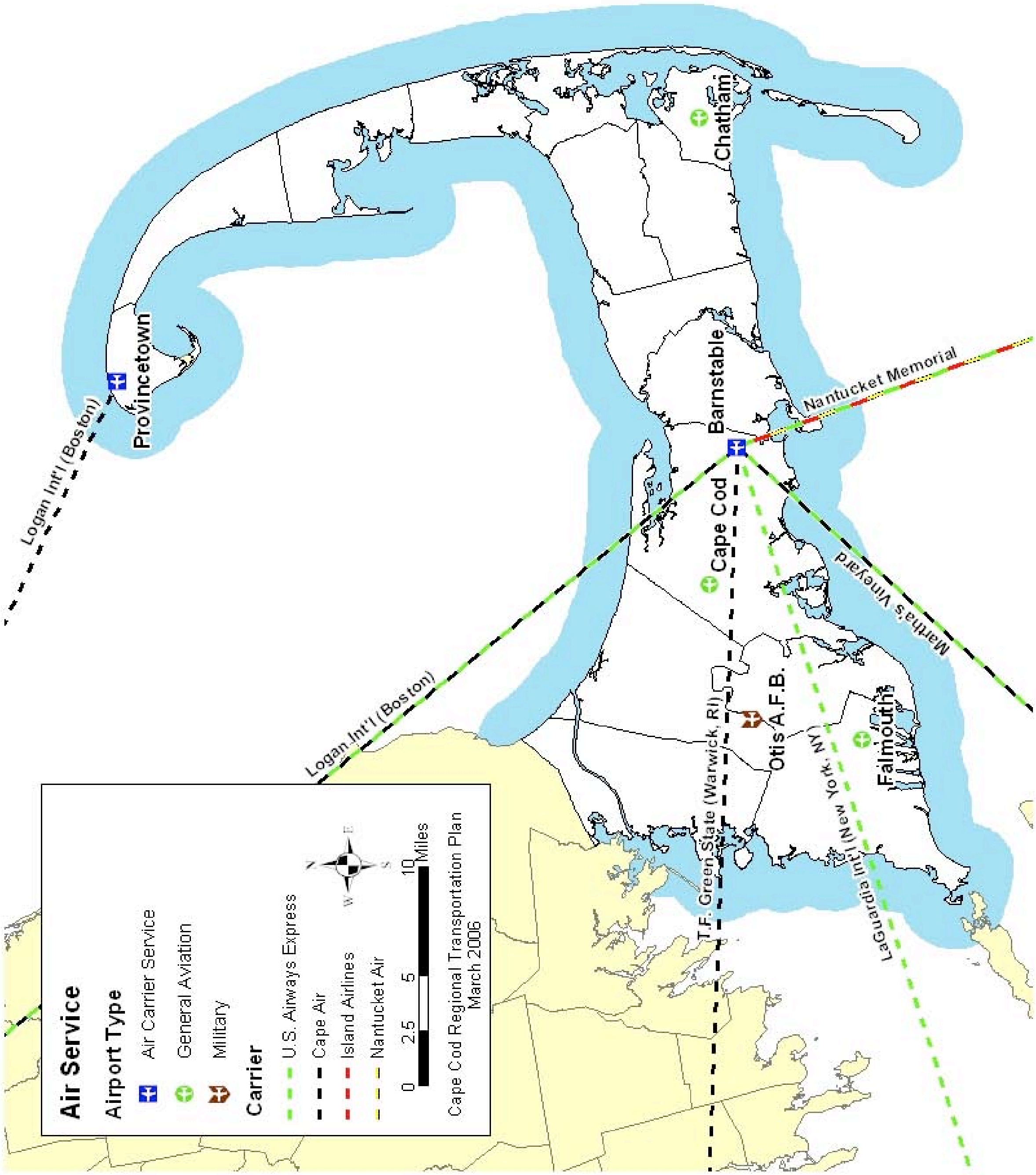

Figure 2.7-7: Air Service on Cape Cod

Table 2.7-4: Winter Weekday Service

	Departing to							Arriving From						
	Boston (from HYA)	Boston (from PVC)	Martha's Vineyard	Nantucket	Providence	New York City	**Total**	Boston (to HYA)	Boston (to PVC)	Martha's Vineyard	Nantucket	Providence	New York City	**Total**
Cape Air	1	3	-	-	-	-	**4**	2	2	2	-	-	-	**6**
Island Airlines	-	-	-	19	-	-	**19**	-	-	-	18	-	-	**18**
Nantucket Airlines	-	-	-	14	-	-	**14**	-	-	-	15	-	-	**15**
U.S. Airways Express	-	-	-	3	-	2	**5**	-	-	-	3	-	2	**5**
Total	**2**	**3**	**-**	**36**	**-**	**2**	**42**	**2**	**2**	**2**	**36**	**-**	**2**	**44**

Table 2.7-5: Summer Weekday Service

	Departing to							Arriving From						
	Boston (from HYA)	Boston (from PVC)	Martha's Vineyard	Nantucket	Providence	New York City	**Total**	Boston (to HYA)	Boston (to PVC)	Martha's Vineyard	Nantucket	Providence	New York City	**Total**
Cape Air	4	6*	5	-	2	-	**17**	4	6*	4	-	2	-	**16**
Island Airlines	-	-	-	19	-	-	**19**	-	-	-	18	-	-	**18**
Nantucket Airlines	-	-	-	16	-	-	**16**	-	-	-	15	-	-	**15**
U.S. Airways Express	2	-	1	3	-	7	**13**	2	-	1	3	-	7	**13**
Total	**6**	**6**	**6**	**38**	**2**	**7**	**65**	**6**	**6**	**5**	**36**	**2**	**7**	**62**

* - Not All Weekdays, HYA - Barnstable Municipal Airport, PVC - Provincetown Municipal Airport)

2.7.3 Air Service Accessibility and Mobility

Barnstable Municipal Airport is accessible by various means. According to a Cape Cod Transit Task Force Report, 69% of airport users arrive by automobile[15]. Limited parking is available. Rental car service is provided by Avis, Budget, Enterprise Rent-a-Car, and Hertz, with taxi service available as well. Moreover, the Breeze Yellow Line of the Cape

Cod Regional Transit Agency provides local bus service to the airport upon request, carrying passengers to the Hyannis Transportation Center and Barnstable Park-and-Ride lot. B-Bus paratransit service to the airport can also be arranged. However, less than 1% arrive by bus[16].

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.

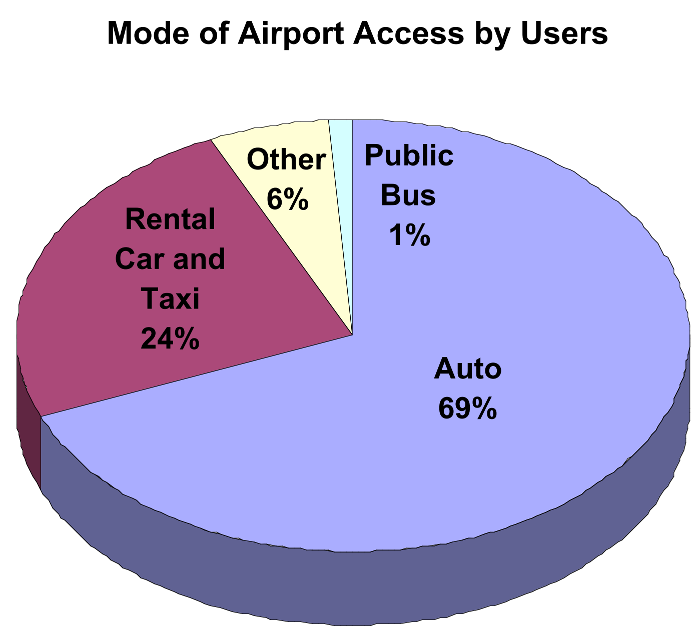

Figure 2.7-8: Mode of Barnstable Municipal Airport Access by Users[17]

Interregional bus service also links travelers on Cape Cod to air service in Boston. Plymouth and Brockton Street Railway Company runs 24 buses daily, and 17 on weekends, between the Hyannis Transportation Center and the terminals at Logan International Airport. 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. There is currently no direct service to T.F. Green Airport in Rhode Island.

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.

2.7.4 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.

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[17] Cape Cod Transit Task Force. "Five-Year Public Transportation Plan." June 2002. Page 3-20.

2.8 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, those 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.

2.8.1 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.

2.8.2 Canal Bridge Conditions

Currently, the Canal Bridges are cared for by the Army Corps of Engineers. The Army Corps of Engineers must now work 8 months of the year, repairing bridge elements, in order to maintain them in usable condition.

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 in a following section of this chapter.

Figure 2.8-1 - Bourne Bridge

Figure 2.8-2 - Sagamore Bridge

Figure 2.8-3 - Roadway over Sagamore Bridge

Figure 2.8-4 - Sagamore Bridge Structure

2.8.3 Highway Bridge Capacity

According to MassHighway'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.

2.8.4 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 2005, the average daily traffic (ADT) of both directions of travel on both highway bridges was over 96,000, with a summer ADT of over 128,000. Of the two bridges, the Sagamore Bridge is more heavily traveled, by about 10,000 vehicles. 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, 2005 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 today's off-peak volumes.

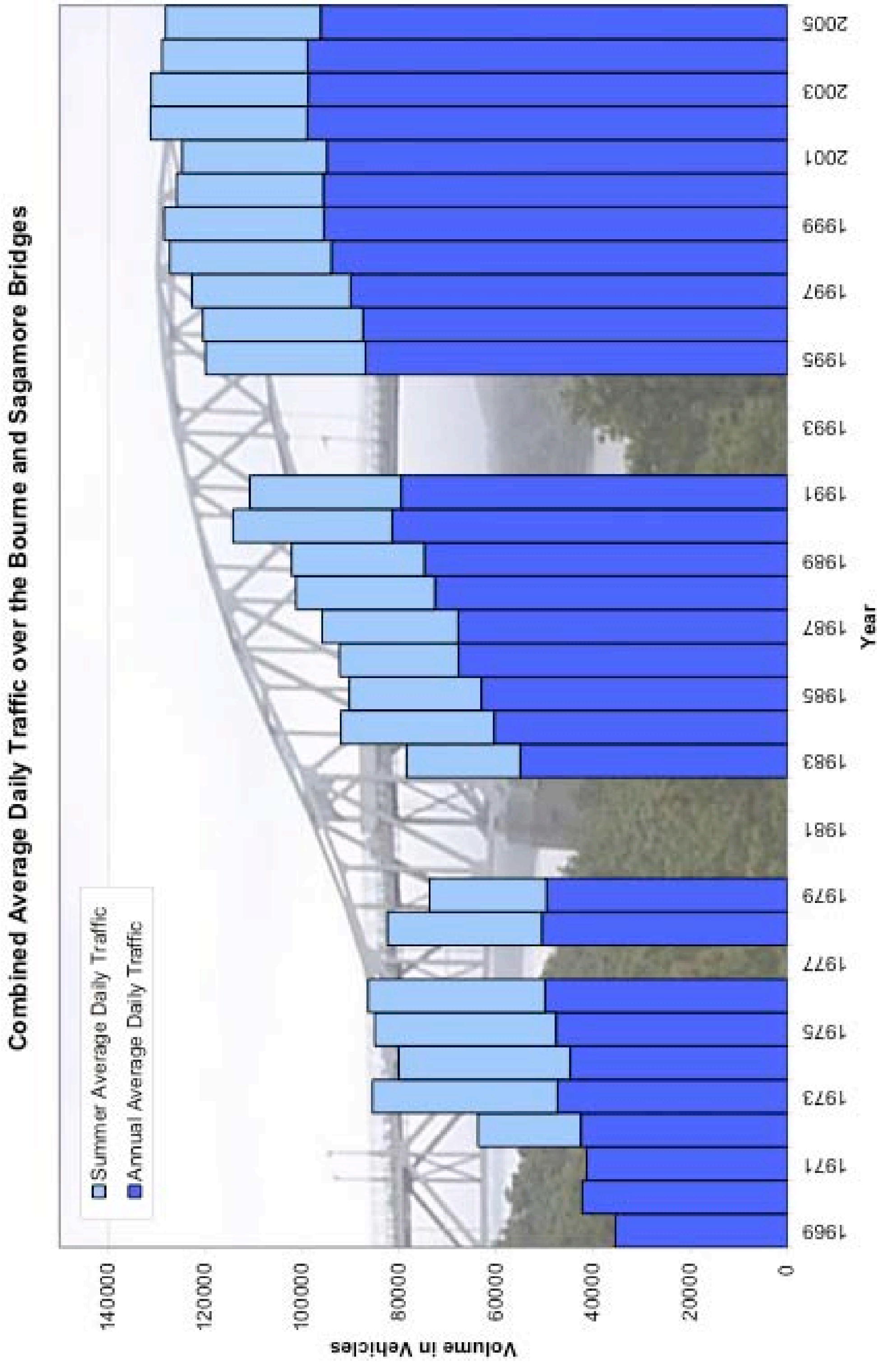


Figure 2.8-5 - Combined Average Daily Traffic over Bourne and Sagamore Bridges

(Source: MassHighway)

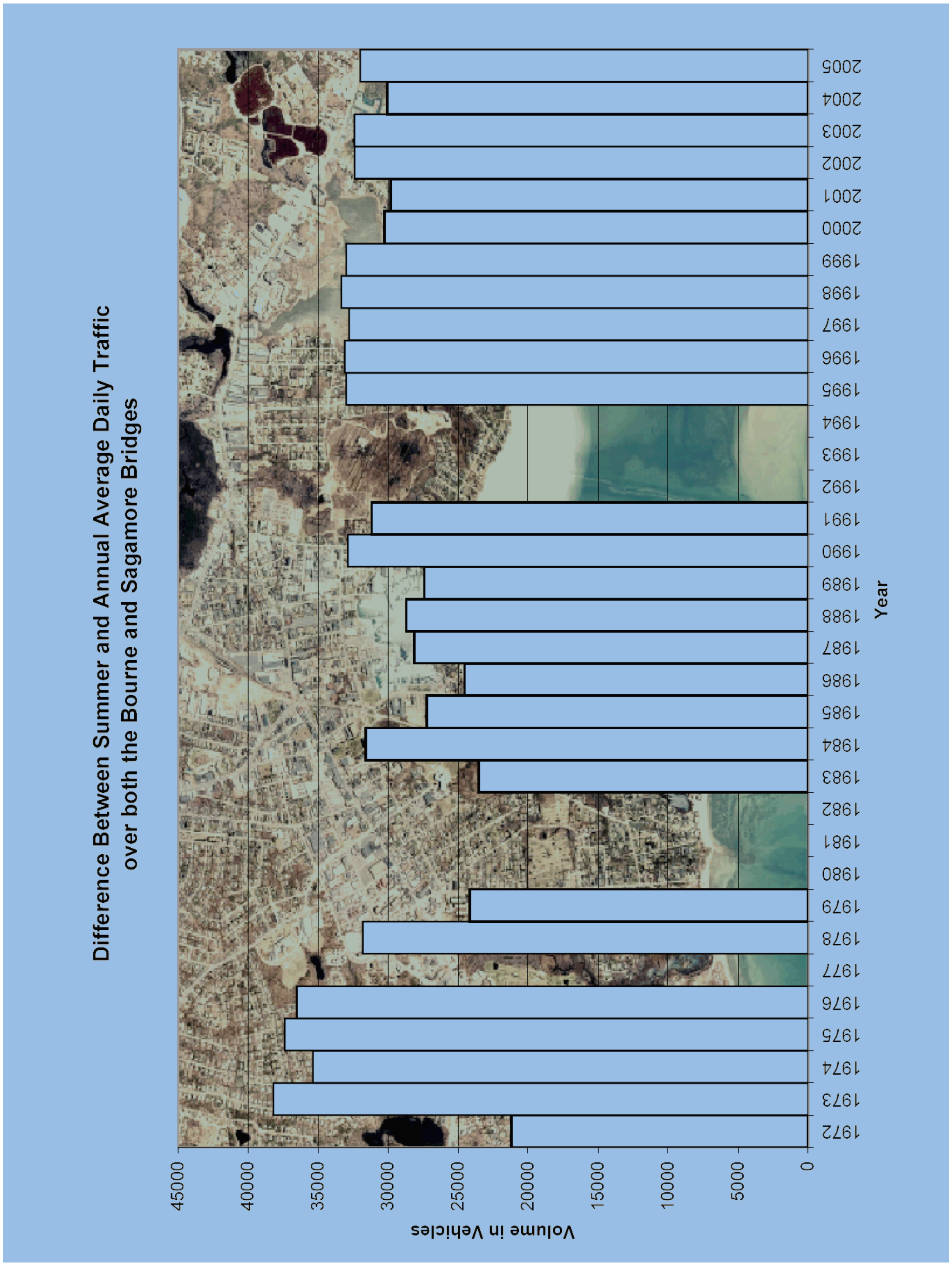


Figure 2.8-6 - Difference Between Summer and Annual Average Daily Traffic over Both the Bourne and Sagamore Bridges

(Source: MassHighway)

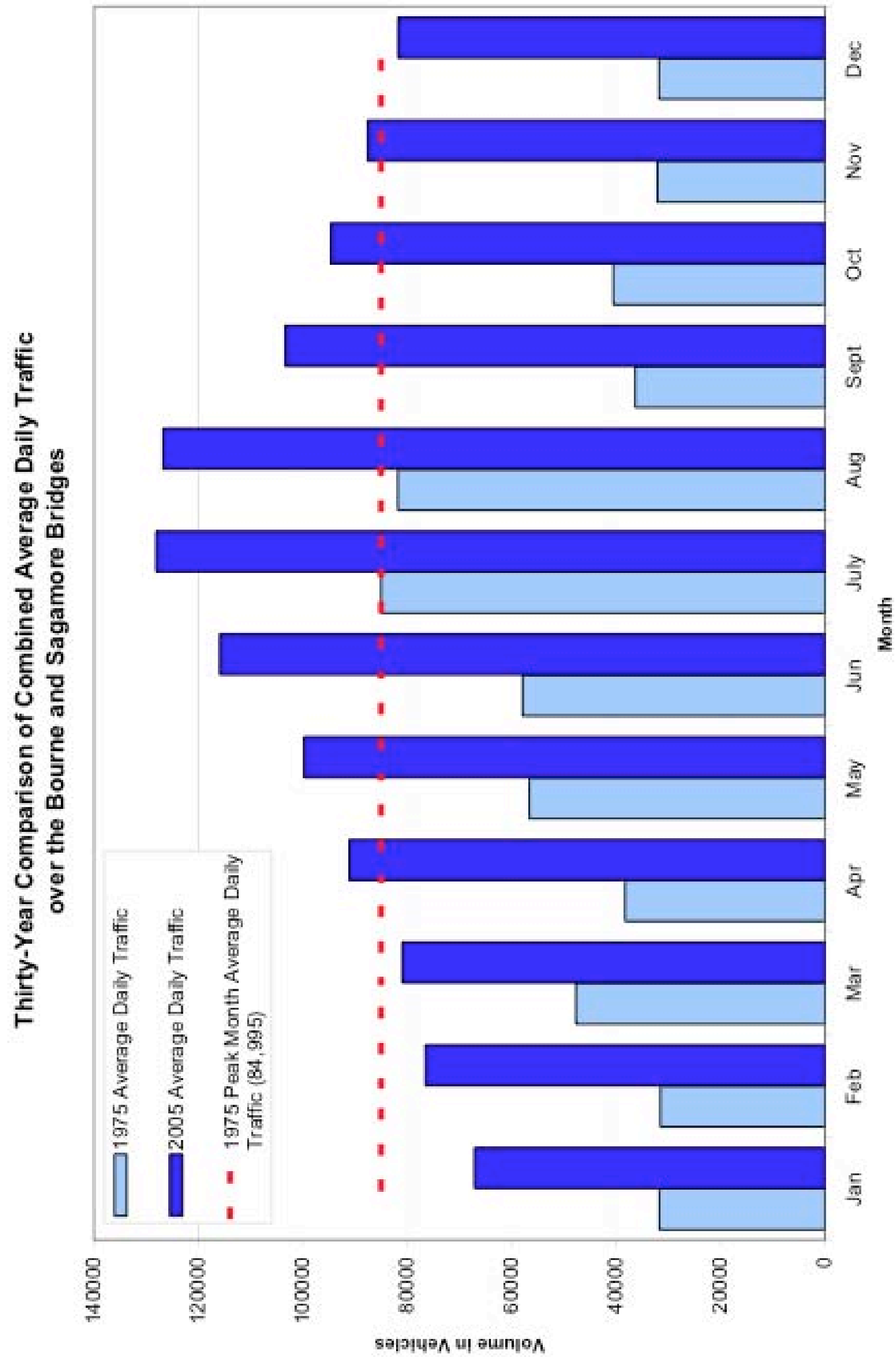
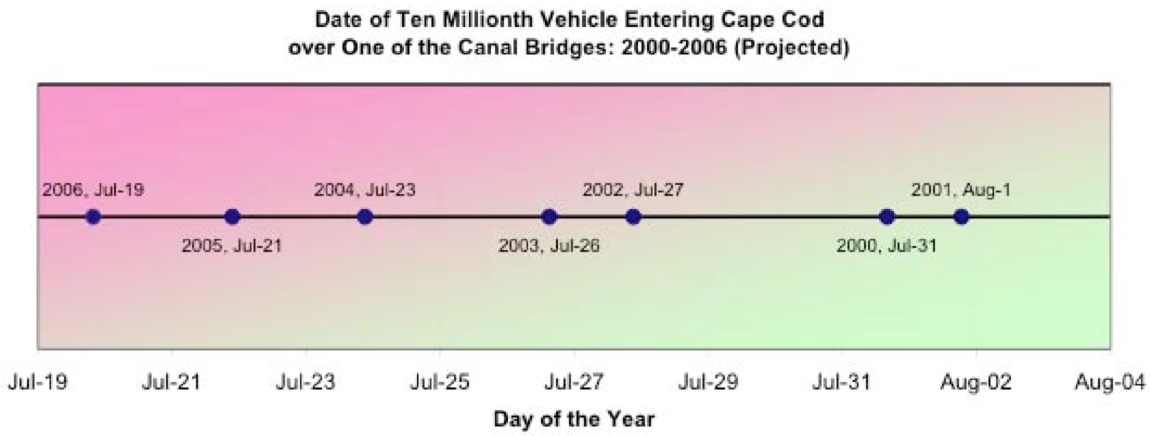


Figure 2.8-7 - Thirty-Year Comparison of Combined Average Daily Traffic over the Bourne and Sagamore Bridges

Table 2.8-1 - Cape Cod Canal Bridges Traffic Volumes 1969-2004 (MassHighway)

	#707 Bourne Bridge		#708 Sagamore Bridge		Combined (both bridges)	
	Yr.Round	Summer	Yr.Round	Summer	Yr.Round	Summer
2005	43,873	58,858	52,282	69,279	96,155	128,137
2004	44,684	59,615	53,922	69,274	98,606	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	
1970	20,250		22,000		42,250	
1969	16,000		19,400		35,400	



Based on the traffic counts collected at the permanent counting stations, the date and time that the ten million vehicle enters Cape Cod each year can be determined (see figure above). Since daily data is only available from 2004, the dates for 2005 and 2006 have been estimated. In recent years, the Ten Millionth Vehicle (TMV) Day has occurred from mid-July to early August. As annual traffic grows, TMV Day has also been getting earlier and earlier in the year.

2.8.5 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 Corps 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 MassHighway 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 were 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 2.8-2 - 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. 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 would be more likely to adjust travel mode, choice of bridge crossing and approach routes, or timing.

• *Scheduling Maintenance Activities for Off-Peak Periods:* minimizes disruptions to traffic during heavy travel periods. The 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.

• *Traveler Information Systems:* provide travelers with information in advance regarding the timing of lane closures and alternative ways to get to/from Cape Cod (bus, ferry, air, etc.). 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 Corps' website to provide travelers with the latest information on lane closures.

• *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.

In addition to the programs and projects recommended by the Metropolitan Planning Organization in this Plan, the Cape Cod Joint Transportation Committee (CCJTC) supports planning for improved crossing of the Cape Cod Canal. By the end of the Plan period (2030) the Cape Cod Canal highway bridges will have been in use for over ninety-five years. While carefully maintained bridges may last for many centuries, several issues factor in the decisions that will need to be made:

- Functional obsolescence: the ability of the bridges to safely and efficiently move vehicular traffic may be compromised by travel speeds, vehicle weights and widths, and quantity of flow.

- Improvements to existing structures: by relocating the existing sidewalk on each bridge, travel lanes could be widened to improve traffic flow and safety. This would require that the sidewalks (and utilities located under them) be cantilevered on the side of the bridges. A structural engineering study would be required to assess feasibility.

- Options for increased capacity: to accommodate increased vehicular demand, a new facility would be required (bridge or tunnel). Bicycle access should be maintained or improved.

- Consistency with other projects: the recent improvements in the Sagamore area provide a direct connection from Route 3 to the Sagamore Bridge. In the event of replacement of the Sagamore Bridge, one technique is to construct a new bridge adjacent to the existing bridge. This would require a major relocation of the Sagamore interchange including its ramps and highway alignment.

2.8.6 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 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. 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 is 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, the maximum number of vehicles that could be diverted is 56,000 on an average summer day.

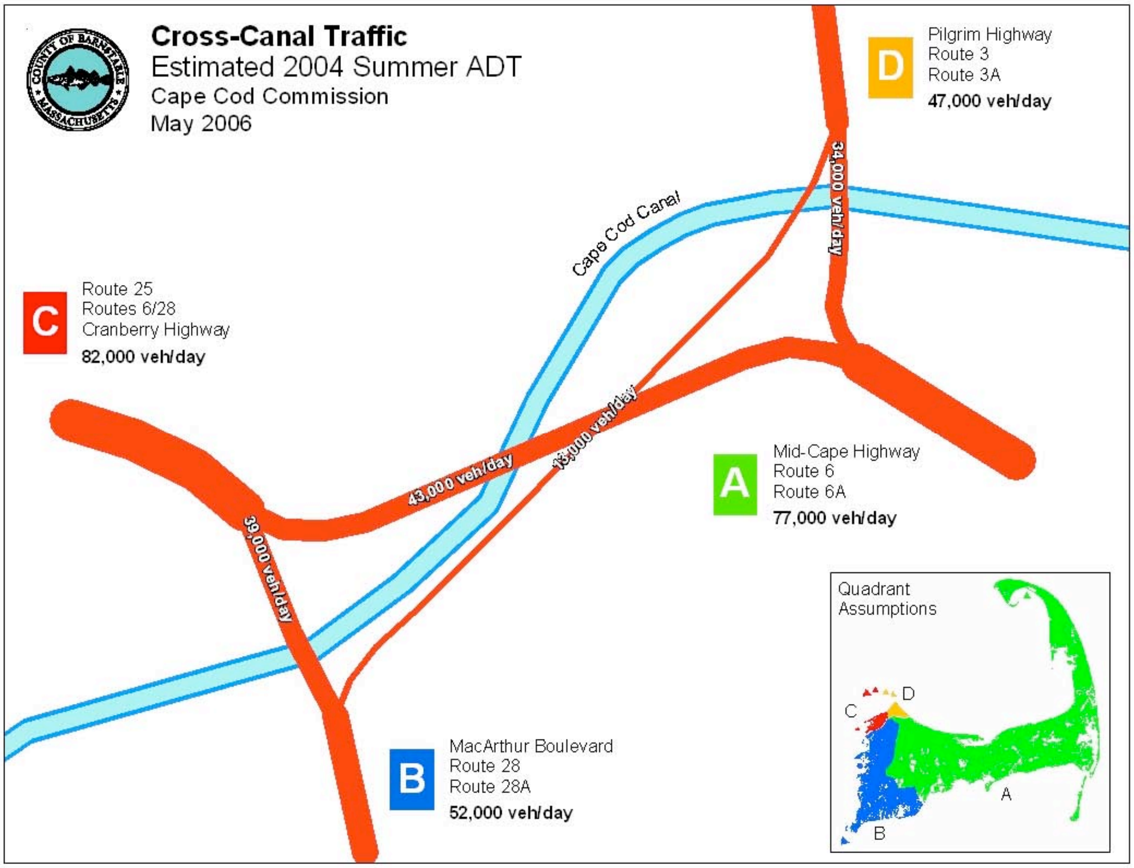


Figure 2.8-8 - Cross-Canal Traffic, Estimated 2004 Summer ADT

2.8.7 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. Aerial views of the newly completed Sagamore Interchange are not available and a diagram has been included following the figure below.

Figure 2.8-9 - Sagamore Crossing

(note: Sagamore Rotary has been eliminated – see following figure)

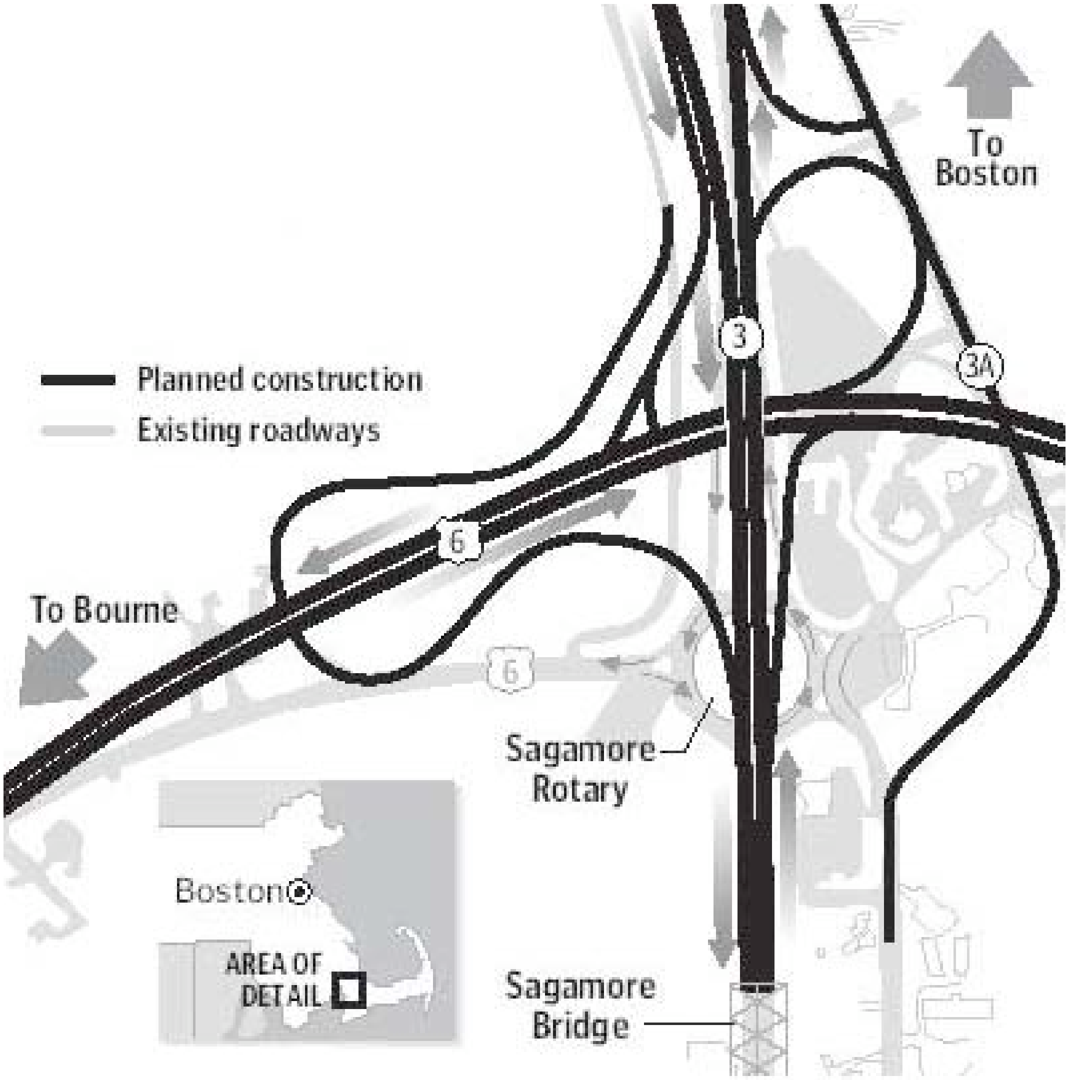


Figure 2.8-10 - Sagamore Interchange Diagram

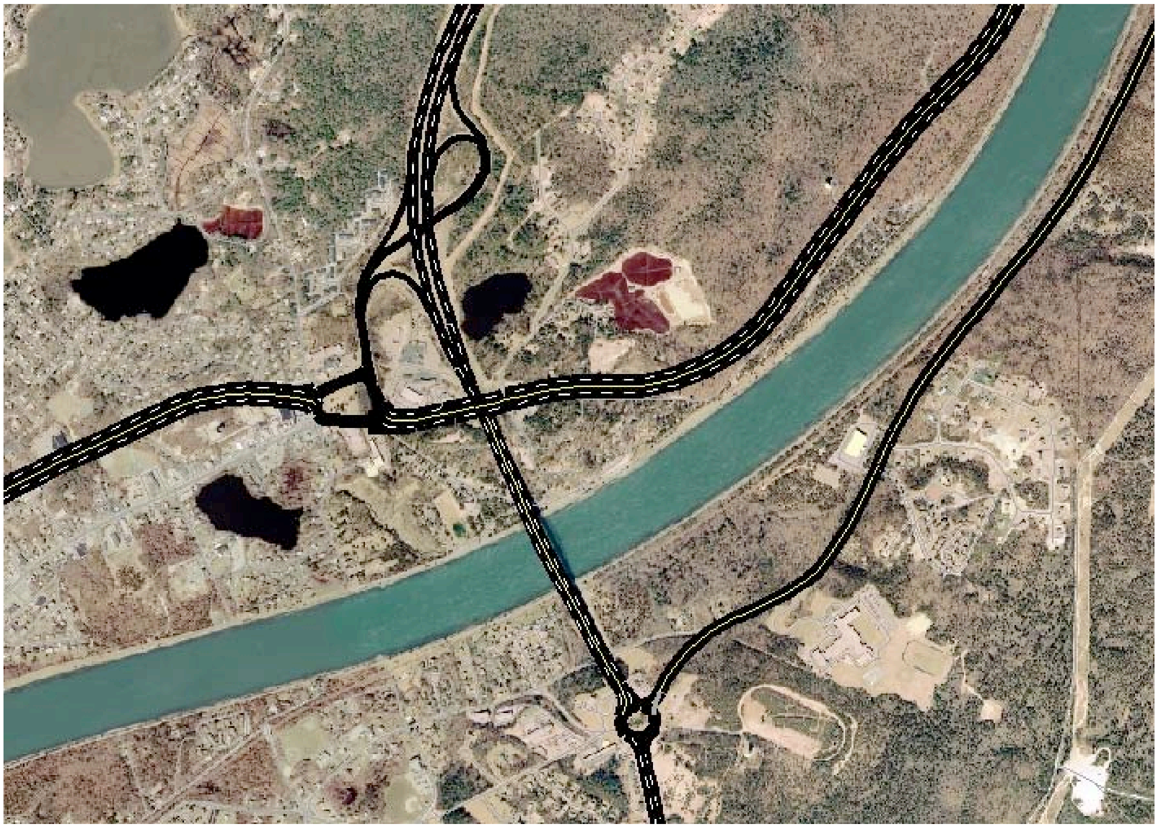


Figure 2.8-11 - Bourne Crossing

2.8.7.1 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. 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. 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 2.8-12 - Scenic Highway (U.S. Route 6), Facing East

Figure 2.8-13 - Scenic Highway, Facing East

Figure 2.8-14 - Scenic Highway at the Bournedale Road Intersection

2.8.7.2 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 2.8-15 - Sandwich Road facing East

2.8.7.3 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 2.8-16 - The Belmont Circle, facing East towards the Scenic Highway

Figure 2.8-17 - Signs directing motorists through the Belmont Circle

Figure 2.8-18 – Until 2006, a New York Central Tugboat adjacent to the Belmont Circle

2.8.7.4 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 2.8-19 - The Former Sagamore Rotary and Congestion

Figure 2.8-20 - Route 3 Congestion at the Former Sagamore Rotary, from Scenic Highway

Figure 2.8-21 - The Sagamore Interchange overpass, during construction

2.8.7.5 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 2.8-22 - The Mid-Cape Connector (Interchange 1) north of the Outlet Store entrance

2.8.7.6 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.

2.8.8 Rail Bridge Usage

The rail bridge is used by Bay Colony Light Rail Company. The bridge is lowered for the daily trash train. The trash train transports solid waste from transfer stations in Yarmouth and the Massachusetts Military Reservation to the incinerator/generator at the SEMASS facility in Rochester, Massachusetts. Rail issues are discussed in detail in sub-chapter 2.5 of this Plan.

2.8.9 Conclusion

The Cape Cod Canal 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. 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.

Changes to the Canal's road system must be carefully considered in order to balance traffic impacts and focus improvements where they are most needed.

2.9 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.

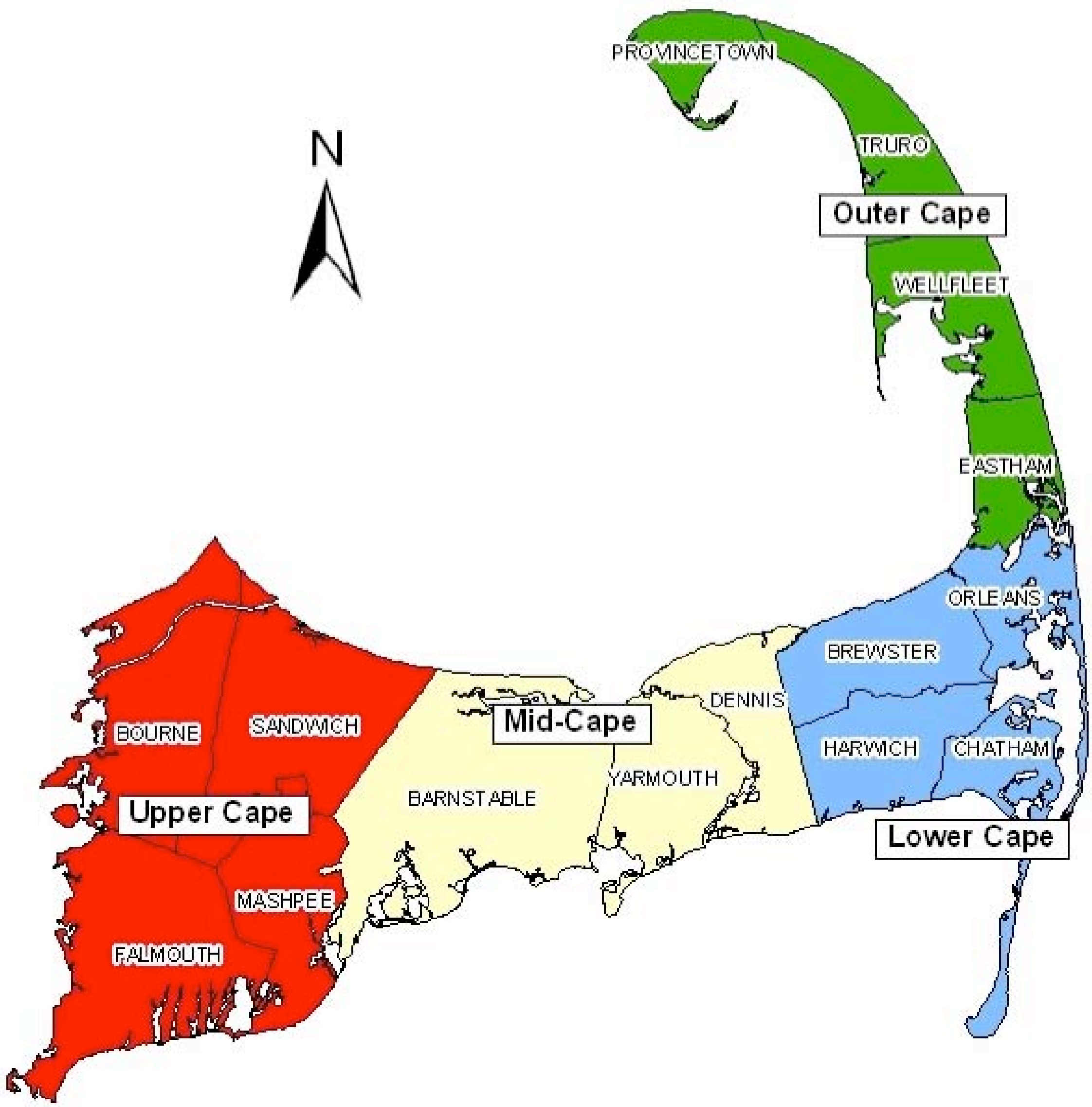


Figure 2.9-1 - Cape Cod Sub-Regions

2.9.1 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 84,463 residents or 38% of the Cape's population. For Cape residents, they also contain 32% of the jobs in the county. The Upper Cape area includes regional and local services, such as the transportation connections, shopping centers, and the 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).

2.9.1.1 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.

<u>Roadway Network</u>

The Cape Cod Canal bisects the Town of Bourne 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. However, both Route 6A and Route 6 function more as intra-regional travel collectors from Falmouth and Mashpee as no direct connections are made to these towns by these corridors. 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.

<u>Transit Service</u>

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 *Breeze*; 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. In recent years, the Greater Attleboro Regional Transit

Authority (GATRA) has operated 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 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. The 2003 schedule includes 22 round trips per summer weekday. 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 reaches 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 downtown Falmouth to Woods Hole.

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 railroad bridge is currently undergoing maintenance. The Cape Cod Central Railroad operates excursion train service between Hyannis and Sandwich (typically four round trips during the tourist season).

2.9.1.2 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 principal study, the Canal Area Study, currently in draft form, 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 (2.8).

2.9.2 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 88,601 residents or 40% of the Cape's population. They also contain 45% of the jobs in the county.

2.9.2.1 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 the 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 and Yarmouth, both to 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 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 a two-lane roadway with occasional turning lanes. 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. Improvements on Willow Street are also underway.

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 Blue Line (Sealine Breeze) from Falmouth to the Hyannis Transportation Center. Along Route 28 from Hyannis to Orleans, the Cape Cod RTA operates the Green Line, a year-round bus service. The Cape Cod RTA also operates a paratransit service called the B-Bus. The B-Bus 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. Since the 2003 edition of this Plan, service has undergone new management.

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 was experiencing delays. A cloverleaf interchange was recently completed by MassHighway. This 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.

2.9.2.2 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.
- It is recommended that the construction of new travel lanes on Route 132 be accompanied by a median from Route 6 to Bearses Way, access management and controlled land use, as well as bicycle and pedestrian accommodation.
- 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.

2.9.3 Lower Cape

The Lower Cape includes the towns of Harwich, Chatham, Brewster, and Orleans and lie 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 35,446 residents (16% of the Cape) and 5,699 jobs (7% of the county total).

2.9.3.1 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, the Cape Cod National Seashore sites, and the commercial center of Orleans.

<u>Roadway Network</u>

Routes 6, 6A, and 28 all traverse the region from the Yarmouth 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 6/124 interchange in Harwich.

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 (Green Line) along Route 28 from Hyannis to Orleans. Introduced in 2006, the *Flex* service provided fixed-schedule service with deviations of up to _ 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 (connecting downtown Chatham to the Rail Trail near Harwich center) has also been completed recently as were bicycle bridges across Route 6 in Harwich and Orleans for the Cape Cod Rail Trail.

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.

2.9.3.2 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 worsening, and persisting for longer portions of the year.

The Lower Mid-Cape region is also where Route 6 becomes a limited access highway with one lane in each direction. 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.

2.9.4 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 13,720 year round residents (6 % of the Cape). They also posses nearly 7% of the jobs in the county.

2.9.4.1 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.

<u>Roadway Network</u>

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” 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 recently completed 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 the 2003 summer season there were 6 round trips per day scheduled between Provincetown and Boston with an additional excursion trip on Fridays, Saturdays, and Sundays. 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. The additional service will also benefit from the current reconstruction project at McMillan Wharf in Provincetown.

2.9.4.2 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. However, in other parts of the country where roadway widening has been possible, mobility was not enhanced for the long term. In general, the 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.

2.9.5 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

RTP 2007

2007 Regional Transportation Plan
Chapter 3
Safety

April 2007

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

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

:

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

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

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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 2007 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.

3.1 Safety Problem Areas

During the public process for this plan a comment form was distributed. One of the questions asked was "*Please list the top three areas within your town that you feel have the worst local safety problems*." The responses were reviewed and the following is a list of the top two locations in each town indicated as safety problems:

Table 3-1 - RTP Safety Problem Areas (from public comment form)

Town	Top Two (per town)	Safety Problem Areas
Barnstable	Airport Rotary	Rte 132/Shoot Flying Hill Rd
Bourne	Canal Area	MacArthur Blvd - Lefts
Brewster	Rte 6A/Millstone	Rte 6A/Underpass
Dennis	Rte 28/School St	Rte 28 - Dennis/Harwich TL
Eastham	Rte 6/Brackett Rd	Rte 6/Governor Prence Rd
Falmouth	Rte 28 - Downtown	Teaticket Post Office
Harwich	Rts 124 & 137 @ Rt 6 ramps	Rte 39/Rte 137
Mashpee	Mashpee Rotary/Rte 151	Rte 28 Mashpee Commons- Fal.
Orleans	Rte 28/Rte 6A	Rte 28/Rte 39
Sandwich	Rte 6/Exit 2	Cotuit Rd
Truro	Rte 6A	Rte 6
Yarmouth	Rte 6A/Union St	Rte 6/Exit 7

In December of 2005, MassHighway produced the "Top 1,000 High Crash Locations Report: 1999-2001." The following table includes a summary of the eleven Cape Cod locations that appeared in the report:

Table 3-2 – Cape Cod Locations from Massachusetts "Top 1,000 Crash Locations Report: 1999-2001"

RANK	MAP I.D. #	CITY/TOWN	MHD DISTRICT	ROUTE1	STREET	ROUTE2	INTERSECTING STREET	TOTAL CRASHES	PROPERTY DAMAGE CRASHES	INJURY CRASHES	FATAL CRASHES	WEIGHTED AVERAGE
49	1	BOURNE	5	6	CRANBERRY HIGHWAY	6	SAGAMORE ROTARY	297	233	64	0	553
203	2	BOURNE	5	28	BOURNE BRIDGE	25	ROUTE 25	145	119	26	0	249
207	3	DENNIS	5	134	ROUTE 134	6	MID CAPE HIGHWAY	99	62	37	0	247
212	4	BOURNE	5	28	SOUTH BOURNE ROTARY	28	MACARTHUR BOULEVARD NORTHBOUND	137	110	27	0	245
260	5	BARNSTABLE	5	28	FALMOUTH ROAD	28	AIRPORT ROTARY	94	63	31	0	218
438	6	BOURNE	5	28	MACARTHUR BOULEVARD NORTHBOUND	28	OTIS AIR FORCE BASE ROTARY	89	71	18	0	161
449	7	BARNSTABLE	5		IYANOUGH ROAD	6	MID CAPE HIGHWAY	69	47	22	0	157
467	8	MASHPEE	5	28	MASHPEE CIRCLE	28	FALMOUTH ROAD	75	55	20	0	155
485	9	BOURNE	5	6	CRANBERRY HIGHWAY	6	NORTH BOURNE ROTARY	66	45	21	0	150
874	10	YARMOUTH	5	6	MID CAPE HIGHWAY		WILLOW STREET	43	27	16	0	107
983	11	MASHPEE	5		GREAT NECK ROAD NORTH	130	FORESTDALE ROAD	32	15	17	0	100

Notes
- "Weighted Average" is a calculation assigning *1* to each Property Damage Crash, *5* to each Injury Crash, and *10* to each Fatality Crash.
- The old Sagamore Rotary is ranked 49th, the Bourne Bridge is ranked 203rd, and Route 134/Route 6 interchange is ranked 207th.

The eleven locations are shown on the map on the following page. Among the top Cape Cod Region accident locations, the old Sagamore Rotary is an active MHD project, nearing completion. The RTP includes a discussion of maintenance, operations, and replacement issues of both the Bourne Bridge and Sagamore Bridge. The Route 134/Route 6 interchange has been improved since 2001. Improvements at Yarmouth's Mid Cape Highway/Willow Street interchange (ranked 874th) are currently underway. Signalization has recently been installed at Mashpee's Great Neck Road/Route 130 intersection (ranked 983rd).

The remaining Cape Cod Region accident locations, based on MassHighway's "Top 1,000 High Crash Locations Report: 1999-2001", are recommended for study based on safety concerns.

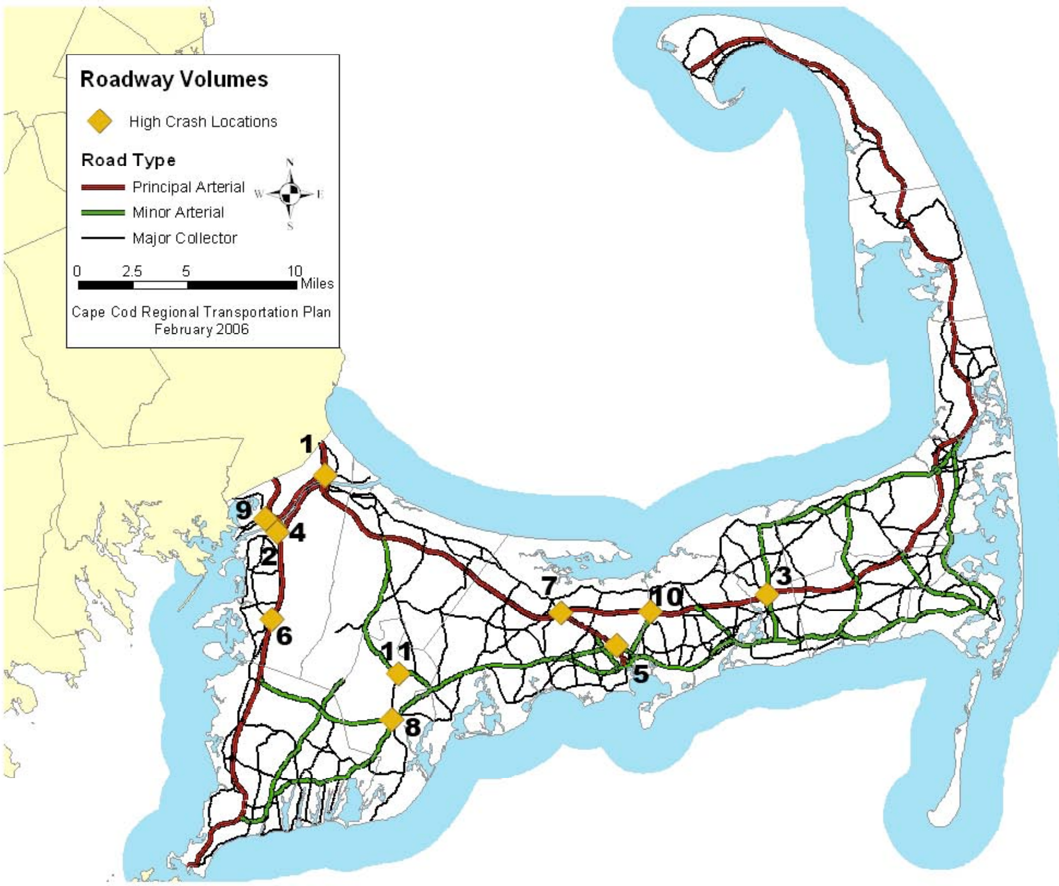


Figure 3-1 - Cape Cod's "Massachusetts' Top 1000 High Crash Locations Report: 1999-2001"

Source: MassHighway 1999-2001 Accident Records. See listing of locations on previous table.

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 were 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.

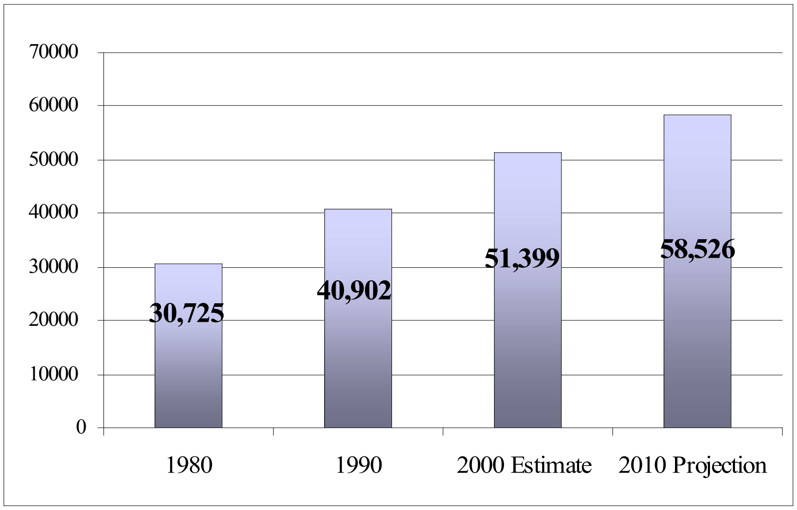
Another dimension defining the unique character of Cape Cod drivers is their seasonal nature. The Cape is inundated with visitors, many of whom are not familiar with Cape Cod roads. Drivers that are used to city streets or parkways are also subjected to the scenic rural roads that compose a significant 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.

Table 3-3 - 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 3,854 miles of roadways in Barnstable County (note: mileage of divided highways is approximately doubled). 140 miles are considered Principal Arterials, 117 miles are considered Minor Arterials, 375 miles are considered Major Collectors, and there are 198 miles of Minor Collectors. The remaining 3,024 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 1999-2001. Changes in reporting after this period have not yet been standardized to the point that comparisons among towns can be made.

Table 3-4 - Crash Rates (based on years 1999-2001): Route 6

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	326	0.3	2.58	0.26
Sandwich	58	0.7	0.24	0.27
Barnstable	84	0.0	0.61	0.00
Yarmouth	47	0.0	0.65	0.00
Dennis	49	0.0	2.09	0.00
Harwich	24	0.0	0.50	0.00
Brewster	8	0.0	0.38	0.00
Orleans	16	0.3	0.81	1.72
Eastham	122	1.3	2.05	2.23
Wellfleet	43	0.7	0.69	1.06
Truro	27	0.7	0.42	1.05
Provincetown	9	0.0	0.48	0.00
Total	**814**	**4.0**	**0.90**	**0.44**

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

Table 3-5 - Crash Rates (based on years 1999-2001): Route 28

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	197	0.3	1.73	0.29
Falmouth	147	0.7	1.70	0.77
Mashpee	111	0.0	4.51	0.00
Barnstable	194	1.7	2.54	2.17
Yarmouth	248	0.3	4.41	0.59
Dennis	70	0.3	3.65	1.75
Harwich	71	0.0	3.84	0.00
Chatham	109	0.0	2.60	0.00
Orleans	34	0.3	2.01	1.95
Total	**1180**	**3.7**	**2.60**	**0.81**

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

Table 3-6 - Crash Rates (based on years 1999-2001): Route 6A

Town	All Crashes (Avg. Annual)	Fatal Crashes (Avg. Annual)	Crashes per million VMT	Fatal Crashes per 100 million VMT
Bourne	18	0.0	6.52	0.00
Sandwich	37	0.3	1.49	1.33
Barnstable	14	0.0	0.59	0.00
Yarmouth	55	0.0	3.16	0.00
Dennis	41	0.0	2.36	0.00
Brewster	93	0.0	2.96	0.00
Orleans	71	0.3	9.05	4.27
Total	**329**	**0.7**	**2.64**	**0.53**

Registry of Motor Vehicles' Crash Records supplied by MassHighway
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.

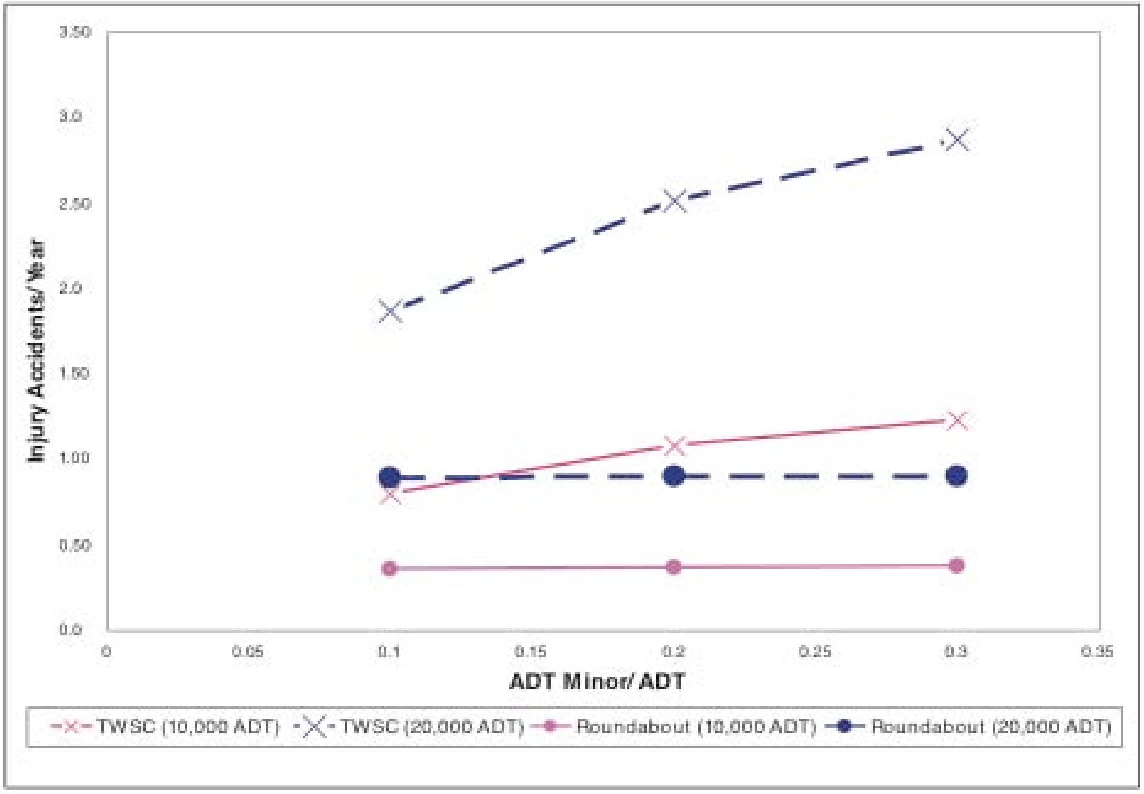


Figure 3-2 - Comparison of Predicted Roundabout Injury Crashes with Rural 2-Way Stop -Controlled Intersections.

(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.

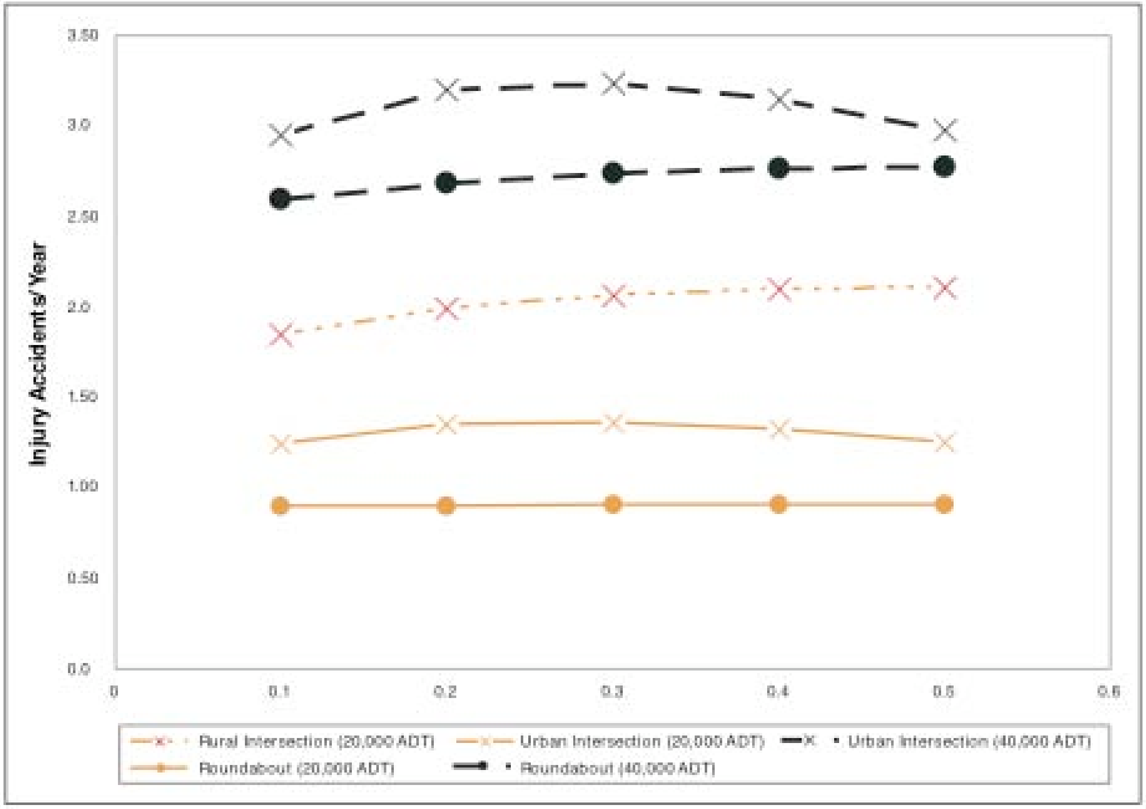


Figure 3-3 - Comparison of Predicted Injury Crashes for Single-Lane and Double-Lane Roundabouts with Rural or Urban Signalized Intersections.

(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

Massachusetts EOT, the Governor's Highway Safety Bureau, and many other agencies are participating in developing a "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.

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 draft safety plan has identified "higher risk transportation system users" and potential strategies to improve their safety.

Pedestrian Safety

The safety plan promotes a vision that:

> "Increasing numbers of people throughout Massachusetts, residents and visitors alike, will be able to walk safely and conveniently to their destinations. Pedestrians, bicyclists, and drivers will be aware of each other's needs, and will act appropriately for the situation in which they are walking, riding, or driving. Walking will increase, while accidents involving pedestrians will decrease."

To support this vision, the safety plan includes a goal to "raise the awareness of pedestrian safety to motorists, the general public, visitors, and state legislators ultimately leading to a decrease in the number of crashes involving pedestrians."

Strategies suggested in the draft safety plan include:

- Publicize Pedestrian Safety resources
- Provide input to the Safety Chapter of the updated *Massachusetts Pedestrian Transportation Plan*
- Provide expert advice to communities that are trying to mitigate pedestrian risk

Young Driver Safety

The safety plan includes a goal to "reduce the number of crashes involving young drivers and encourage greater compliance with the Massachusetts Junior Operator Law." Strategies suggested in the draft safety plan include:

- Evaluating before and after Junior Operator Law data for crashes involving teen drivers;
- Educating parents of Junior Operator Law responsibilities; and
- Conducting literature /program review to determine best practices in prevention and driver behavior modification methods.

The safety plan will also include discussions on bicycle safety and older driver safety.

Infrastructure Safety

In the development of the draft safety plan, a need to better prioritize improvement projects was identified. An overall goal emerged to: "Encourage greater compliance with the *Manual on Uniform Traffic Control Devices* (MUTCD) and the Massachusetts Highway Department's *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:

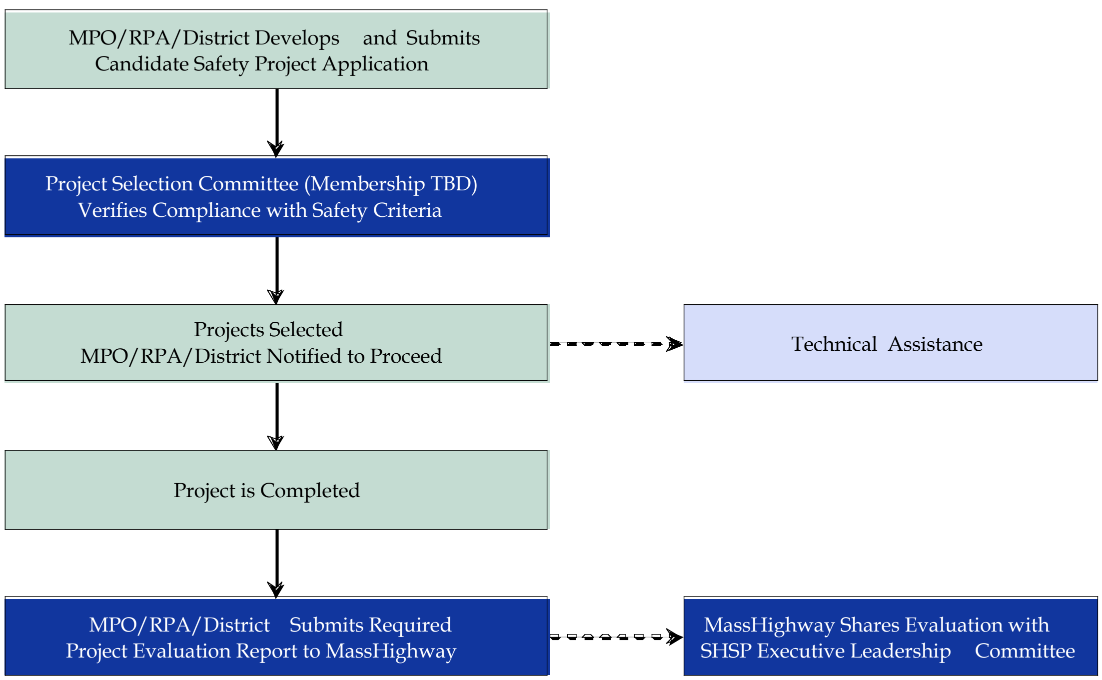


Figure 3-4 - Infrastructure Safety Project Selection Process

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:

- 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.

3.3.5 Community Character/Safety Issues

The following recommendations are intended to preserve community character while addressing safety issues:

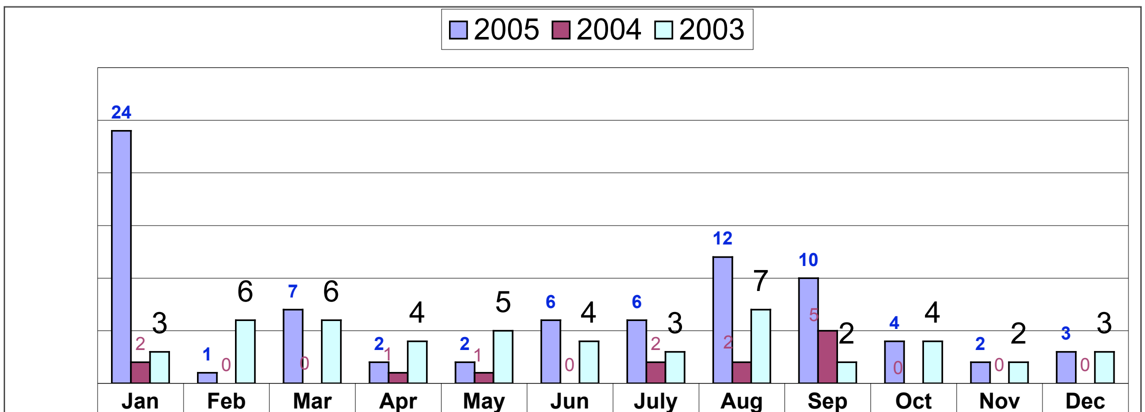
- Use alternative guardrail treatments, such as steel Corten or steel backed timber - all on wood posts, where guardrail is necessary.
- Consider roundabouts as an alternative to signalized intersections
- Continue policies that disallow business logo signs on state highways in Barnstable County.
- Preserve 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 Multimodal Transportation Safety

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

3.4.1 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 2003-2005 as shown in the following figure.



	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
2005	24	1	7	2	2	6	6	12	10	4	2	3
2004	2	0	0	1	1	0	2	2	5	0	0	0
2003	3	6	6	4	5	4	3	7	2	4	2	3

Figure 3-5 - Cape Cod Regional Transit Authority Reported Accidents

The accidents listed in the figure above represent several categories including collisions of several types, boarding and alighting, on-board accidents, and glass. For example, of the 24 accidents reported in January 2005, the breakdown is as follows:

Intersection Collisions	3
Non-Intersection Collisions	5
Front End Collisions	8
Glass	8
January 2005 Total	**24**

3.4.2 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 1999-2001. With 41 reported crashes over the three-year period, Yarmouth had the greatest number of bicyclist-vehicle crashes (Dennis was second with 21 crashes). Staff have 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 3-7 - Bicyclist-Vehicle Crash History (1999-2001)

Town	All Crashes (3-year total)	Fatal Crashes (3-year total)
Bourne	12	0
Sandwich	4	0
Falmouth	9	0
Mashpee	6	0
Barnstable	7	0
Yarmouth	41	0
Dennis	21	1
Harwich	9	0
Chatham	10	0
Brewster	5	0
Orleans	9	0
Eastham	10	0
Wellfleet	5	0
Truro	0	0
Provincetown	17	0
Total	**165**	**1**

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.

3.4.3 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 (33) of crashes reported from 1999 to 2001. 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 3-8 – Pedestrian-Vehicle Crash History (1999-2001)

Town	All Crashes (3-year total)	Fatal Crashes (3-year total)
Bourne	19	1
Sandwich	3	1
Falmouth	13	1
Mashpee	6	0
Barnstable	16	3
Yarmouth	33	1
Dennis	22	1
Harwich	11	0
Chatham	11	0
Brewster	2	0
Orleans	9	1
Eastham	3	1
Wellfleet	2	0
Truro	1	0
Provincetown	12	0
Total	**163**	**10**

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.

3.4.4 Air Travel Safety

The Federal Aviation Administration has assembled a database of safety incidents at Cape Cod airports. During the years 1996-2005, 24 incidents occurred. Of these, there were eight fatalities and 43 injuries classified as "Minor/None." For a more thorough listing please see the appendix. These data are summarized in the following table:

Table 3-9 - Air Travel Safety Incidents

Year	Fatal	Serious	Minor/None
1996	1	0	6
1997	2	0	8
1998	1	0	1
1999	0	0	9
2000	0	0	8
2001	2	0	3
2002	0	0	3
2003	2	0	0
2004	0	0	2
2005	0	0	3

(Source: Federal Aviation Administration)

3.4.5 Summary of 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

3.5 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 Massachusetts Highway Department; 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.

MassHighway 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 MassHighway Traffic Operations Center in South Boston. The Massachusetts Highway Department 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 MassHighway website.

3.6 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

RTP
2007

2007 Regional Transportation Plan

Chapter 4

Security

April 2007

Prepared by C*APE* C*OD* C*OMMISSION* *Transportation Staff*
on behalf of the

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

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

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

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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 2007 Regional Transportation Plan sets the goal of providing security to people and goods.

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 MassHighway.

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.

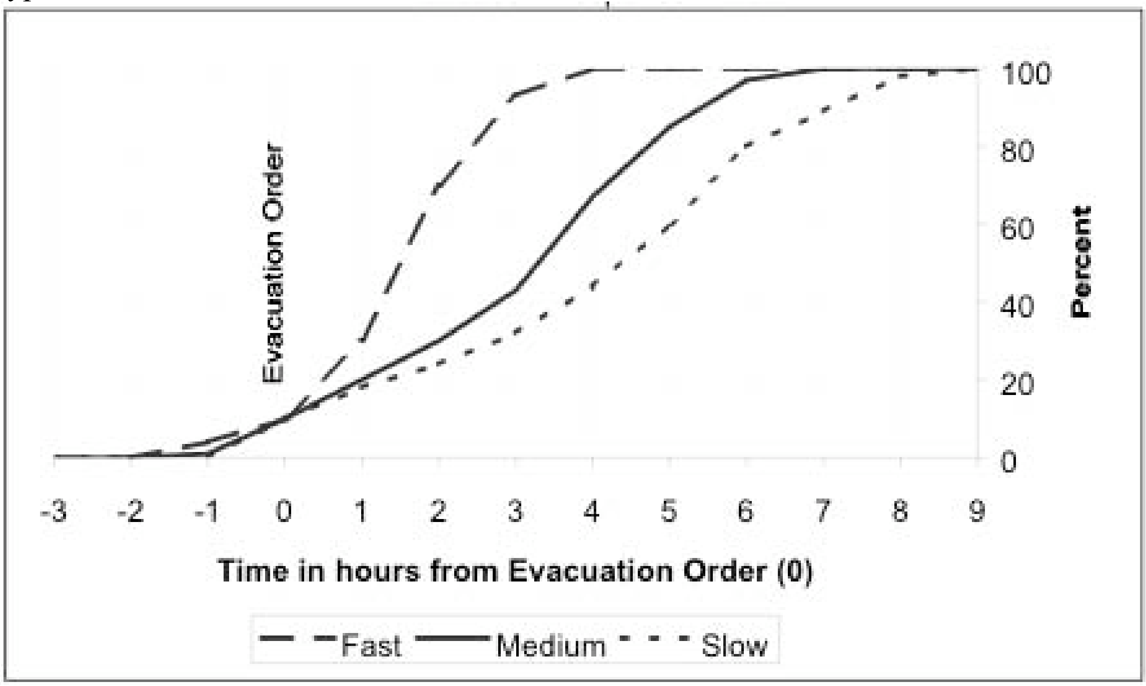

Figure 4-1 - Evacuation Behavior Response Curves

(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 draft "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
MassHighway 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>

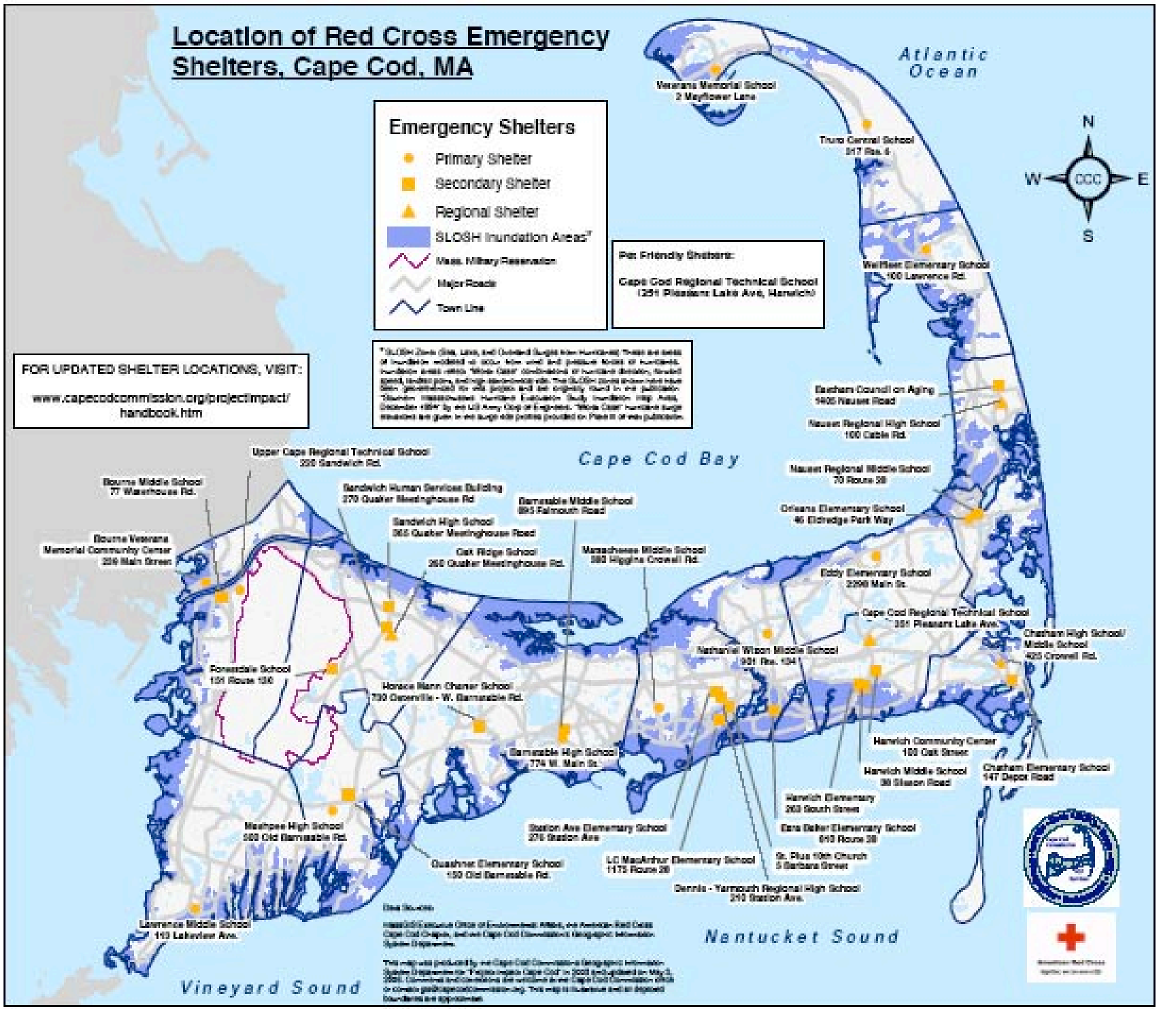

Figure 4-2 - Location of Emergency Shelters

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:

Management and Accountability

1. Written security program and emergency management plans are established.
2. The security and emergency management plans are updated to reflect anti-terrorist measures and any 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.
4. The security and emergency management plans are signed, endorsed and approved by top management.
5. The security and emergency management programs are assigned to a senior level manager.
6. Security responsibilities are defined and delegated from management through to the front line employees.
7. All operations and maintenance supervisors, forepersons, and managers are held accountable for security and emergency management issues under their control.

Security Problem Identification

8. A threat and vulnerability assessment resolution process is established and used.
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).

Employee Selection

10. Background investigations are conducted on all new front-line operations and maintenance employees.
11. Criteria for background investigations are established.

Training

12. Security orientation or awareness materials are provided to all front-line employees.
13. Ongoing training programs on safety, security and emergency procedures by work area are provided.
14. Public awareness materials are developed and distributed on a system wide basis.

Audits and Drills

15. Periodic audits of security and emergency management policies and procedures are conducted.
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.

Document Control

17. Access to documents of security critical systems and facilities are controlled.
18. Access to security sensitive documents is controlled.

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.

MassHighway's Traffic Operations Center (MTOC) is located in South Boston. The MTOC'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 MassHighway district office, which assigns the necessary personnel and equipment, required to abate the incident.

4.5 Summary of Transportation Security Recommendations

Recommendations for transportation security may include:

- Incorporating intelligent transportation systems, such as variable message signs, 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, Wood's Hole 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

RTP
2007

2007 Regional Transportation Plan
Chapter 5
Congestion Management

April 2007

Prepared by CAPE COD COMMISSION Transportation Staff
on behalf of the

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

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

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

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5. 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).

5.1. 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.

5.2. 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 MassHighway, 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.

5.3. 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 5-1 - 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.

5.4. 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

5.5. Develop Strategies to Address Identified Problems

The following subsections include descriptions of the process to be used to produce CMP strategies.

5.5.1. 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.

5.5.2. 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 EOT 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.

5.5.3. 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.

5.6. Develop Annual Congestion Management Program Report

The CMP report will be an annual report that documents the region's mobility concerns. The report will contain 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.

5.7. Summary of the 2005 Traffic Counting Program

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 2005 Traffic Counting Report* published in November 2005.

The information presented in the following tables and figures includes calculated traffic growth rates for sub-regions and major roads in Barnstable County.

Table 5-2 - Cape Cod Summer Traffic Growth: 1995-2005

Region	# of Comparisons	Total Growth	Average Annual Growth Rate	95% Confidence Interval
All Roads	284	9.60%	0.92%	±0.22%
Upper Cape	83	10.37%	0.99%	±0.36%
Mid-Cape	72	12.74%	1.20%	±0.41%
Lower Cape	76	4.86%	0.47%	±0.43%
Outer Cape	53	5.55%	0.54%	±0.74%
Rt. 6 (All)	45	8.07%	0.77%	±0.38%
Rt. 28 (All)	31	8.20%	0.79%	±0.66%

"Upper" = Bourne, Sandwich, Falmouth, Mashpee	"Lower" = Harwich, Chatham, Brewster, Orleans
"Mid" = Barnstable, Yarmouth, Dennis	"Outer" = Eastham, Wellfleet, Truro, Provincetown

Table 5-3 - Cape Cod Summer Traffic Growth on Various Types of Roads: 1995-2005

Traffic Volume	# of Comparisons	Total Growth	Avg. Annual Summer Growth Rate	95% Confidence Interval
Roads > 20,000	59	9.67%	0.92%	±0.33%
Roads > 12,000	93	9.37%	0.89%	±0.29%
Roads < 12,000	191	10.75%	1.02%	±0.48%
Roads < 2,500	51	25.81%	2.32%	±1.40%

Table 5-4 - Cape Cod Summer Traffic Growth: 2004-2005

	# of Comparisons	Total Growth	Average Annual Growth Rate	95% Confidence Interval
All Roads	33	-3.56%	-3.56%	3.37%

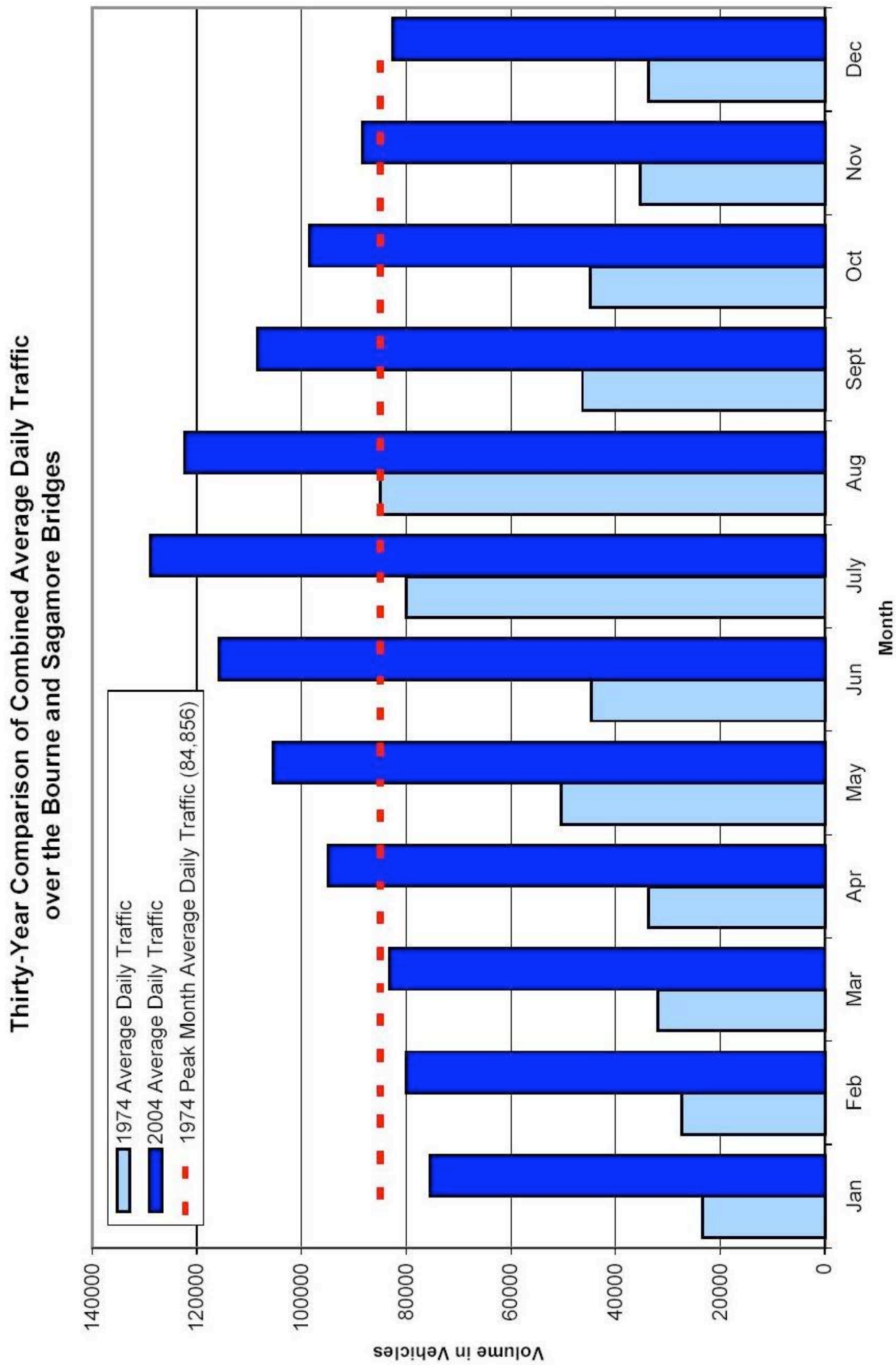

Figure 5-1 - 30 Year Traffic Growth: Canal Bridges

5.8. 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.

5.8.1. 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 provided shows the recent average annual daily bridge crossings and the summer average since 2004.

5.8.2. Gas Prices

Gas prices have increased significantly and affect the use of the automobile and transit. The following Massachusetts retail price/gallon data (as of 9/10/2006) is from www.gasbuddy.com.

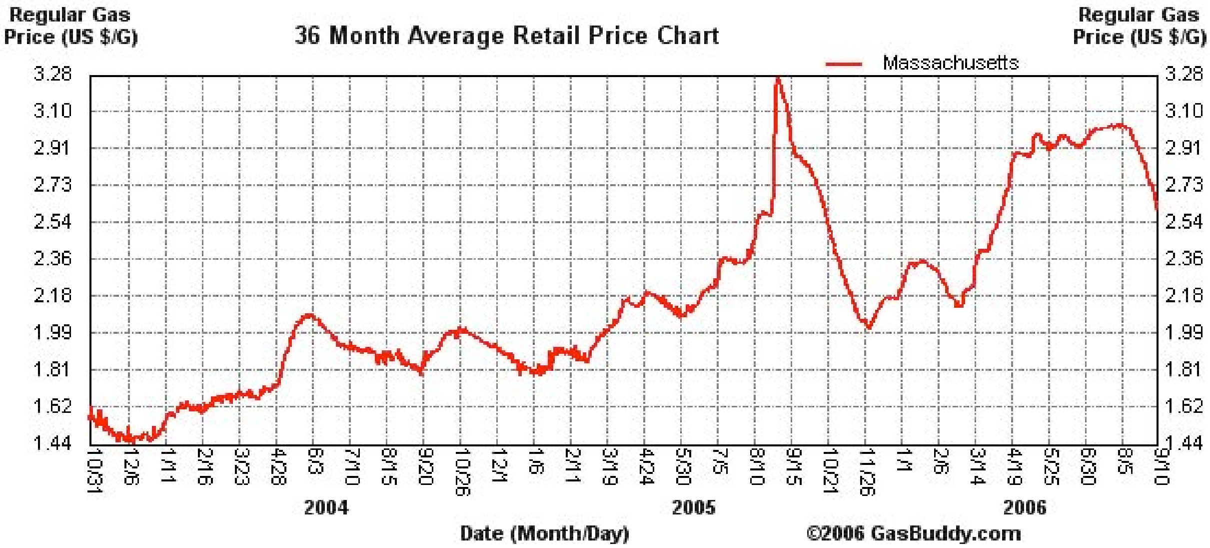

Figure 5-2 - Historic Gas Prices

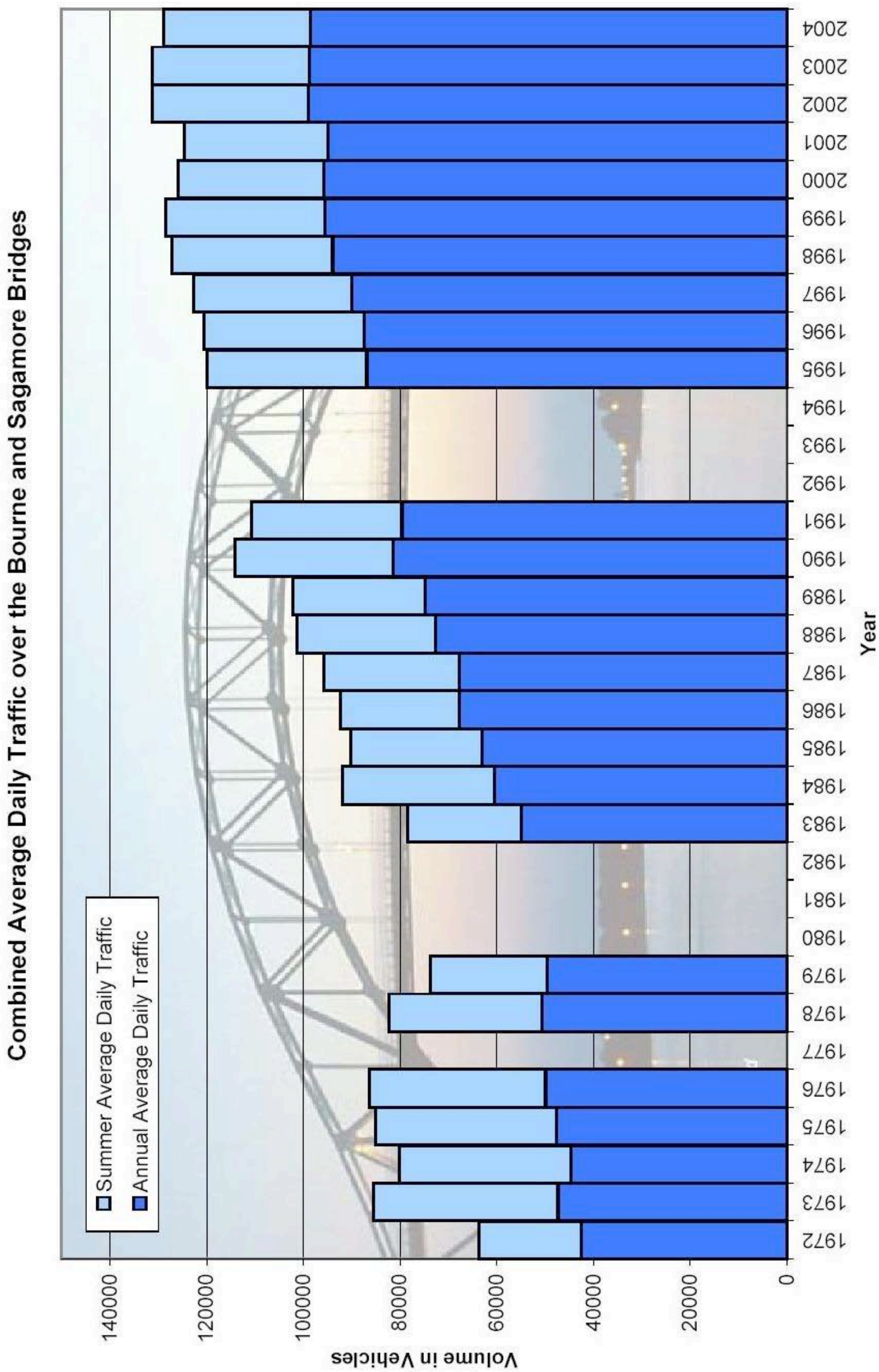

Figure 5-3 - Annual Average Daily Traffic: Canal Bridges

5.8.3. 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 following data on the CCRTA transit ridership does not include FY2006 when ridership overall, exclusive of new services, increased by 22%. 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.

System-wide Ridership

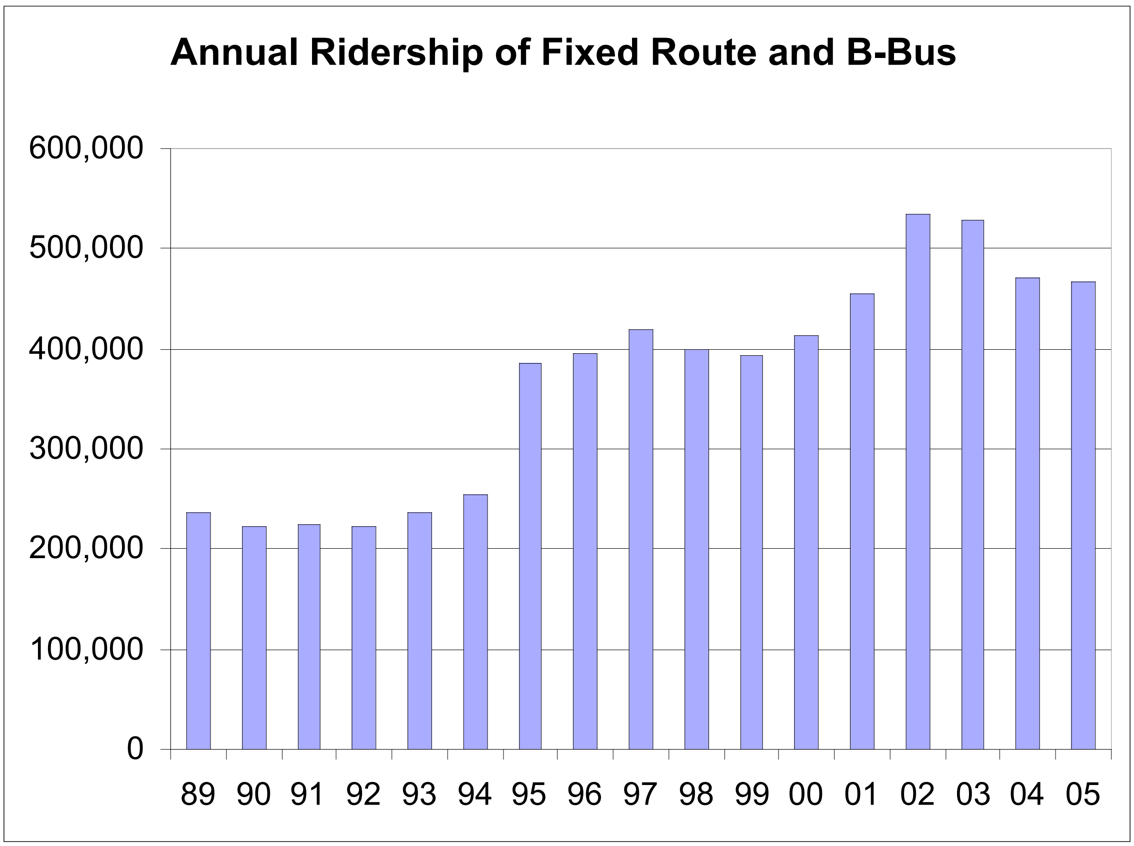

Figure 5-4 - Cape Cod RTA Ridership

Source: Cape Cod Regional Transit Authority

FY 2005 ridership dropped 5.3% from 2004, estimated summer highway traffic volumes also decreased 3.7% between 2004 and 2005. The Cape Cod Regional Transit Authority (CCRTA) has implemented a major new service in May 2006 on the Outer Cape that is expected to increase their annual ridership significantly. Total CCRTA ridership projected for FY2006 is 520,532, including the new service, which is a 25% increase over the 2005 ridership.

5.8.4. Summer Ridership by Service

In addition to the annual ridership tracked by the Cape Cod Center for Sustainability, the CCRTA also tracks summer ridership by service which indicates trends for different areas of the Cape. These trends are affected by the levels of service provided and this is, unfortunately, not clearly documented.

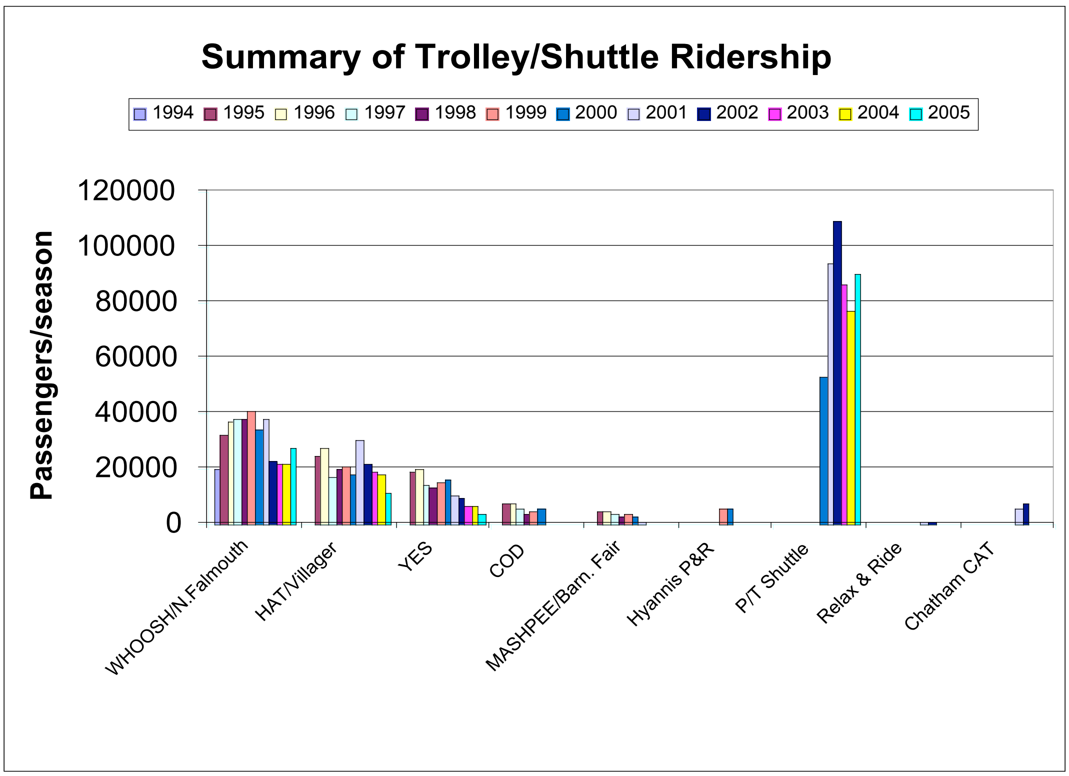

Figure 5-5 - Summer Trolley and Shuttle Ridership

Table 5-5 - 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

RTP 2007

2007 Regional Transportation Plan
Chapter 6
Alternatives Analysis

April 2007

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

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

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

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

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6 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. This chapter includes information on the many potential solutions, analysis methods used, and descriptions of alternatives. The results of these analyses are used in the prioritization listing in the following chapter.

6.1 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.

6.1.1 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 2030. 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.

6.1.2 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.

6.1.3 "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 Breeze Schedules with each other
- Coordinate Breeze and Ferry Schedule with each other
- Develop, Sign, and Publish a Cape-wide Bicycle Route System

Smart Solutions are fully listed at the end of this chapter.

6.1.4 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.

6.2 Population and Employment Growth

The Massachusetts Executive Office of Transportation (EOT) has consulted with Cape Cod Commission staff on the potential growth. EOT's projections pivot around trends established in the existing regional demographic projections done by EOT in collaboration with the RPA's in 2003. However, some long-standing, society-wide trends are expected to abate or end during the last five years of the forecast period. The following section describes some of the assumptions and methodologies used to develop these forecasts.

<u>Population</u>
Extrapolate to 2030 the annual percentage change between 2000 and 2025 in the 2003 EOT/RPA projections. (*Rationale*: In most regions, the rate of population change has been consistent for several decades. The post-2000 time period and new information are too limited to alter the basic trends).

<u>Employment</u>
Begin with the annual percentage change between 2000 and 2025 in the 2003 EOT/RPA projections, reduce it by 50%, and extrapolate to 2030. (*Rationale*: Retirement of the baby-boom generation will sharply curtail the rate of growth in labor supply, especially in later years of the projection period. Succeeding cohorts of young workers are likely to be much smaller in number).

<u>Group Quarters Population</u>
Multiply the 2000 share of total population that resided in group quarters by the 2030 population projection. (*Rationale*: There is little basis for change from the 2003 EOT/RPA projections, though a rapidly aging population could increase this share.

<u>Population in Households</u>
Subtract the 2030 group quarters population from the 2030 total population.

<u>Households</u>
Assume that the average household size is unchanged from 2025. Divide the 2030 population in households by the 2030 average household size. (*Rationale:* Many population watchers believe that the long decline in household size is nearing an end. Changes in the composition of households are slowing dramatically. The increasing expense of shelter may reverse the proclivity of young and low-income adults to form their own households).

EOT 2030 MUNICIPAL PROJECTION METHODS

EOT's projections pivot around trends established in the existing municipal demographic projections done by the RPA's in collaboration with EOT in 2003. Essentially, the municipal trend in regional share captured between 2000 and 2025 is extended an additional five years.

<u>Population</u>

For each municipality, calculate its share of the region's population in 2000 and 2025 based upon the 2003 EOT/RPA population projections. Annualize that change in population share by dividing by the number of years (25). Multiply the annual change in population share by five years (to extend the projection by five years). Finally, multiply the 2030 regional population projection by the five-year change in population share for each municipality.

<u>Employment</u>

For each municipality, calculate its share of the region's employment in 2000 and 2025 based upon the 2003 EOT/RPA employment projections. Annualize that net change in share by dividing by the number of years (25). Multiply the annual change in employment share by five years (to extend the projection by five years). Finally, multiply the 2030 projection of regional employment by the five-year change in employment share for each municipality.

<u>Households</u>

For each municipality, calculate its share of the region's households in 2000 and 2025 based upon the 2003 EOT/RPA household projections. Annualize that net change in share by dividing by the number of years (25). Multiply the 2030 region household projection by the net annual change in each municipality's household share times 5 years (to reflect the 2025 to 2030 time period). Finally, multiply the 2030 projection of regional employment by the five-year change in household share for each municipality.

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 6-1 - Estimated Population and Employment

	2000	2007	2010	2020	2030	Numeric Change	Percent Change
Cape Cod							
Employment	98,203	101,000	102,500	111,100	116,000	17,797	18.1
Population	222,230	232,800	237,000	266,000	293,200	70,970	31.9
Households	94,822	101,200	103,700	118,700	132,100	37,278	39.3
Massachusetts							
Employment	3,381,144	3,477,400	3,486,800	3,635,000	3,743,500	362,356	10.7
Population	6,349,097	6,549,600	6,722,400	7,052,300	7,274,400	925,303	14.6
Households	2,443,580	2,569,300	2,648,400	2,825,800	2,951,600	508,020	20.8

Source: Massachusetts EOT

The following three tables include breakdowns for population, employment, and households for each of the Cape's fifteen towns.

Table 6-2 - Population Forecasts by Town

POPULATION					
Town	**2000**	**2007**	**2010**	**2020**	**2030**
Barnstable	47,821	50,179	51,115	57,583	63,660
Bourne	18,721	19,855	20,309	23,446	26,420
Brewster	10,094	11,740	12,394	16,909	21,320
Chatham	6,625	7,064	7,216	8,269	9,280
Dennis	15,973	16,124	16,185	16,600	16,900
Eastham	5,453	5,541	5,575	5,816	6,010
Falmouth	32,660	34,058	34,613	38,448	42,020
Harwich	12,386	13,067	13,337	15,205	16,970
Mashpee	12,946	13,334	13,488	14,552	15,520
Orleans	6,341	6,641	6,782	7,756	8,660
Provincetown	3,431	3,680	3,780	4,464	5,120
Sandwich	20,136	21,085	21,459	24,038	26,460
Truro	2,087	2,210	2,260	2,603	2,930
Wellfleet	2,749	3,037	3,151	3,936	4,700
Yarmouth	24,807	25,185	25,336	26,374	27,230
Grand Total	**222,230**	**232,800**	**237,000**	**266,000**	**293,200**

Source: Massachusetts EOT

Table 6-3 - Employment Forecasts by Town

EMPLOYMENT					
Town	**2000**	**2007**	**2010**	**2020**	**2030**
Barnstable	30,512	31,381	31,847	34,519	36,040
Bourne	7,831	8,054	8,174	8,859	9,250
Brewster	2,694	2,770	2,812	3,048	3,180
Chatham	3,296	3,390	3,440	3,729	3,890
Dennis	5,179	5,327	5,406	5,860	6,120
Eastham	1,176	1,209	1,227	1,330	1,390
Falmouth	15,985	16,441	16,685	18,085	18,880
Harwich	3,625	3,728	3,783	4,101	4,280
Mashpee	3,664	3,768	3,824	4,145	4,330
Orleans	4,862	5,000	5,074	5,500	5,740
Provincetown	2,615	2,690	2,730	2,959	3,100
Sandwich	5,333	5,485	5,567	6,034	6,300
Truro	571	588	596	646	670
Wellfleet	1,127	1,159	1,176	1,275	1,330
Yarmouth	9,733	10,010	10,159	11,011	11,500
Grand Total	**98,203**	**101,000**	**102,500**	**111,100**	**116,000**

Source: Massachusetts EOT

Table 6-4 - Household Forecasts by Town

HOUSEHOLDS					
Town	**2000**	**2007**	**2010**	**2020**	**2030**
Barnstable	19,626	21,000	21,592	24,768	27,680
Bourne	7,439	8,050	8,286	9,769	11,130
Brewster	4,124	4,890	5,197	7,240	9,230
Chatham	3,160	3,410	3,503	4,099	4,640
Dennis	7,504	7,700	7,803	8,173	8,410
Eastham	2,396	2,480	2,514	2,678	2,800
Falmouth	13,859	14,720	15,074	17,099	18,890
Harwich	5,471	5,890	6,046	7,039	7,940
Mashpee	5,256	5,520	5,620	6,192	6,670
Orleans	3,087	3,330	3,418	3,992	4,510
Provincetown	1,837	2,010	2,077	2,505	2,900
Sandwich	7,335	7,830	8,019	9,173	10,200
Truro	907	980	1,009	1,187	1,350
Wellfleet	1,301	1,460	1,529	1,951	2,350
Yarmouth	11,520	11,930	12,075	12,836	13,400
Grand Total	**94,822**	**101,200**	**103,700**	**118,700**	**132,100**

6.3 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

The MassHighway Project Design and Development Guide (See Appendix 2-A-2) 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

MassHighway'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
    - Public support
- Land Use and Economic Development
    - Business
    - Sustainable development
    - Consistency with local and regional plans

- 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

The Cape Cod 2003 Regional Transportation Plan 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:
<u>Travel Miles</u>:
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.

<u>Travel Hours</u>:
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.

<u>Safety</u>:
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.

<u>Air Quality</u>:
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.

<u>Goal Benefit</u>:
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.

6.4 Transportation Alternatives

The following pages contain a listing of alternatives considered in for the 2007 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.

6.4.1 Transportation Programs

Transportation Programs are intended to allow funding over the life of the plan (to 2030) 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 Year

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	12,000		276,000
3001	Program 2	Capewide	Intersection	Intersection Improvements	Highway	1,250		28,750
3002	Program 3	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	750		17,250
3003	Program 4	Capewide	Roundabouts	Improve traffic flow and safety at selected locations by conversion of existing signalized intersections, non-conforming rotaries, and upgrades at unsignalized intersections to modern roundabouts	Safety	1,000		23,000
3004	Program 5	Capewide	Transit Marketing & Education	Implement education programs and marketing activities to support public transit	Transit	10	30	260
3005	Program 6	Capewide	Sidewalks & safe routes to schools	Installation of sidewalks and provide other improvements and programs to promote safe routes to schools	Bicycle/ Pedestrian	50		1,150
3006	Program 7	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	Park & Ride	50		1,150
3007	Program 8	Capewide	Traffic Calming	Promote the installation of Traffic Calming features at appropriate locations	Safety	50		1,150
3008	Program 9	Capewide	Regional Bike Network	Regional links of bicycle trails and inter-town paths	Bicycle/ Pedestrian	75	3,125	4,850
3009	Program 10	Capewide	Cape-wide ITS	Design and implement real-time transportation monitoring and notification technologies at facilities throughout Cape Cod	ITS/ Management	500		11,500
3010	Program 11	Capewide	Left-Turn Signal Phasing	Install left-turn phases at signalized intersections with left-turn lanes	Highway	100		2,300
3011	Program 12	Capewide	Access Management	Eligible for all state and local numbered routes. Curb cut consolidation, medians, other access improvements	ITS/ Management	100		2,300
3012	Program 13	Capewide	Cape-wide Flex Service	Expand Flex bus service throughout Cape Cod	Transit	750		17,250
3013	Program 14	Capewide	Intelligent Transportation Systems	Coordinate, plan and implement ITS programs for highway and transit to and on Cape Cod.	ITS/ Management	300		6,900
3014	Program 15	Harwich to Truro	Flex Parking	Construct or designate parking areas for The Flex transit service	Park & Ride	15		345
3015	Program 16	Capewide	Additional CCRTA Service	Public transit shuttles connecting villages along Route 6A from Sandwich to Orleans, Provincetown-Orleans Shuttle, etc.	Transit	1,500		34,500
3016	Program 17	Capewide	Bus Shelter	Design and provide bus shelters and amenities designed to be compatible with the Cape Cod character at three levels; bus stop, transfer shelter, and "mini modal" center.	Transit	250		5,750
3017	Program 18	Capewide	Telephone Pole Relocation	Relocate telephone poles away from sidewalks (and roadways) to improve walkability and roadway safety	Safety	15		345
3018	Program 19	Capewide	Railway Infrastructure Preservation	Maintain rail infrastructure	Rail	50		1,150
3019	Program 20	Capewide	Red Light Running Cameras	Support legislation to allow installation of red-light running cameras at high-crash signalized intersections	Safety	15		345
3020	Program	Capewide	Bridge	Bridge Replacement/Reconstruction	Bridge	2,400		55,200
3021	Program	Capewide	Transit Operating	Transit Operating Assistance	Transit	6,665		153,295
3022	Program	Capewide	Bicycle/Pedestrian Projects	Bicycle and/or pedestrian facilities and programs	Bicycle/ Pedestrian	300		6,900

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr($K)	Start Cost ($K)	Total Cost ($K)
3023	Program	Capewide	Transit Capital	Transit Capital Needs	Transit	1,800		41,400
3024	Program	Capewide	TDM/TSM	Travel Demand Management/Transportation Systems Management projects	ITS/ Management	500		11,500
3025	Program	Capewide	New Ferry Service	Passenger ferries connecting Cape Cod harbors	Ferry	250		5,750
3026	Program	Capewide	Trans. Management Association	Provide assistance to employers and institution for the development and coordination of alternative transportation options for employees and patrons.	ITS/ Management	10		230
3027	Program	Sandwich, Barnstable, Yarmouth, Dennis, Brewster, Orleans	Route 6A/Scenic Byways	Corridor Management Plan update and implement recommended improvements	Highway	50	125	1,275
3028	Program	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	Park & Ride	20		460
3029	Program	Capewide	Bike Lane Construction	Install wider shoulders to be used for bike lanes where feasible & appropriate	Bicycle/ Pedestrian	10		230
3030	Program	Capewide	Bikepath Accessibility Improvements	Install tactile features and Braille signage at locations along shared-use facilities such as the Cape Cod Rail Trail	Bicycle/ Pedestrian	5		115
3031	Program	Capewide	Bicycle Amenities	Install bicycle amenities (racks, lockers etc.) at strategic locations (bus stops, major employment centers, etc.).	Bicycle/ Pedestrian	5		115
3032	Program	Capewide	Audible Pedestrian Signals	Install audible "walk/don't' walk" countdown annunciators at signalized intersections to serve vision-impaired pedestrians where appropriate.	Bicycle/ Pedestrian	5		115
3033	Program	Capewide	Vegetation Management	Implement a comprehensive program to trim/remove vegetation from encroaching areas	Safety	10		230
3034	Program	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	10		230
3035	Program	Capewide	Toll Collection	Consider toll collection at strategic locations to provide funding for transportation needs	ITS/ Management	-47,000	5,000	-1,076,000
3036	Program	Capewide	Street Lighting	Install street lighting in woody areas where appropriate	Safety	10		230
3037	Program	Capewide	Bus Schedule Signage	Provide bus schedule signage at bus stops	Transit	5		115
3038	Program	Capewide	Bus Stops	Install bus stop signage and separate stopping lanes at strategic locations along transit lines	Transit	5		115
3039	Program	Capewide	Bus Shelters	Install bus shelters at strategic locations along transit lines	Transit	10		230
3040	Program	Capewide	Low-Floor Loading Buses	Purchase/acquire low-floor loading buses for Cape Cod services	Transit	10		230

6.4.2 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.
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Town	Geographic area.
Title	Short listing.
Description	Longer description
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Start Cost	One time cost (e.g., construction cost or capital purchase)
Total Cost	Calculation of Start Cost + Ann. Cost x 23 Year

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr($K)	Start Cost ($K)	Total Cost ($K)
3300	Project 1	Bourne	Scenic Highway Median Barrier	Construct median barrier along Route 6 Scenic Highway from Herring Pond Road to Belmont Circle in Bourne	Safety		15,000	15,000
3301	Project 2	Sandwich, Barnstable	Interchange Improvements Rte 6	Mid-Cape Hwy - Implement improvements to Route 6 Interchanges	Highway		38,200	38,200
3302	Project 3	Capewide	Cape Cod Rail Trail Extensions	Extend Cape Cod Rail Trail to Provincetown in the north, Hyannis (or Bourne) in the west via new bike path, including direct connection to Hyannis Transportation Center	Bicycle/ Pedestrian		4,000	4,000
3303	Project 4	Barnstable	Route 132 Access Management	Construct traffic channelization, land acquisition, combine/eliminate driveways to improve traffic flow and safety from Airport Rotary to Phinneys Lane	Safety		5,000	5,000
3304	Project 5	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
3305	Project 6	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		7,000	7,000
3306	Project 7	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
3307	Project 8	Cape Cod to Rhode Island (T.F. Green Airport)	T.F. Green Bus Service	Introduce public transit bus service between Cape Cod and T.F.Green Airport in Rhode Island	Transit	1,200	6,000	33,600
3308	Project 9	Barnstable	Airport Rotary Modification	Reconfigure Airport Rotary to improve traffic flow and safety. May include realignment of approaches and reduction of diameter to conform to modern roudanbout design	Safety		900	900
3309	Project 10	Barnstable	Barnstable Airport Access Roads	Extend Attucks Lane to Barnstable Municipal Airport and Route 28, Signalize Nightingale Ln/Route 28 intersection	Highway		5,000	5,000
3310	Project 11	Capewide	Canal Area Intelligent Transportation System	Implement transportation monitoring system to improve congestion & safety while providing real-time information Capewide & beyond	ITS/ Management		3,000	3,000
3311	Project 12	Barnstable	Yarmouth Road Additional Travel Lanes	Construct 2 additional travel lanes w/landscaped median on Yarmouth Road to connect from Yarmouth town line to Hyannis Transportation Center/Route 28	Highway		10,000	10,000
3312	Project 13	Bourne	Sandwich Road Parkway	Develop Sandwich Road into a 4 lane parkway with a landscaped median.	Highway		35,000	35,000
3313	Project 14	Barnstable	Rte 132 Boulevard Landscaping	Install landscaping within the median divider and along the corridor	Enhancements		1,500	1,500
3314	Project 15	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
3315	Project 16	Bourne	Otis Rotary Area Improvements	Construct interim safety improvements & consider grade-separated interchange on Route 28/Connery Avenue/Route 28A to replace the Otis Rotary	Safety		5,000	5,000
3316	Project 17	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
3317	Project 18	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
3318	Project 19	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
3319	Project 20	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

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr($K)	Start Cost ($K)	Total Cost ($K)
3320	Project 21	Capewide--Bourne (Buzzards Bay?)	Buzzards Bay Transportation Center	Construct intermodal transportation center in Buzzards Bay	Transit		2,000	2,000
3321 S	Project 22	Capewide--Orleans	Orleans Local Transportation Center	Construct a Local Transportation Center in Orleans in the vicinity of the Eastham Rotary	Transit		1,000	1,000
3322	Project	Bourne	Rte 28 MacArthur Boulevard Improvements*	Bourne - *Recommend MIS - - Construction of 2 new northbound lanes on Rte 28, reverse existing northbound, existing southbound becomes frontage road	Highway		20,000	20,000
3323	Project	Barnstable	Rte 132 Boulevard	Barnstable - Construction of 2 new lanes from Rte 6 to Bearses Way (incl. landscaped median divider)	Highway		12,000	12,000
3324	Project	Dennis to Hyannis (Dennis, Yarmouth, Barnstable)	Rte 28 Bike Accommodation: Hyannis-Dennis	Construction, marking, and signage of Bicycle facility along Route 28 from Hyannis - Dennis	Bicycle/ Pedestrian		5,000	5,000
3325	Project	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
3326	Project	Capewide	Cape-wide Highway Advisory Radio	Provide travel information cape-wide via AM radio	ITS/ Management		250	250
3327	Project	Provincetown	Provincetown Local Intermodal Center	Develop an intermodal center in the vicinity of MacMillan Wharf to facilitate transfers and coordination between local bus, intercity coach, ferries, and other public transportation	Transit		1,000	1,000
3328	Project	Capewide--Bourne (Buzzards Bay?)	Upper Cape Local Intermodal Center	Develop an intermodal center(s) in the Upper Cape to facilitate transfers and coordination between local bus, intercity coach, ferries, and other public transportation	Transit		1,500	1,500
3329	Project	Capewide	Human Services Dispatch Center	Develop a central dispatch center for human services to coordinate and optimize resources.	ITS/ Management		1,500	1,500
3330	Project	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
3331	Project	Bourne	Scenic Highway/Rte 25 Connector Ramp	Develop a direct connection from Scenic Highway to Rte. 25 to divert traffic from the Bourne rotary.	Highway		10,000	10,000
3332	Project	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		2,000	2,000
3333	Project	Yarmouth, Dennis, Harwich, Chatham	Route 28 Improvements	Implement improvements in Yarmouth, Dennis, Harwich, and Chatham per the *Rte 28 Safety and Traffic Flow Study*	Safety		3,000	3,000
3334	Project	Wellfleet	Lt Island Rd Br Replacement	Replace Lieutenant Island Road/Loagy Bay Bridge (Wellfleet)	Bridge		1,000	1,000

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr($K)	Start Cost ($K)	Total Cost ($K)
3335	Project	Bourne	Relocate Canal Bridge Sidewalks	Relocate canal bridge sidewalks to outside (cantilever) of structure	Bicycle/ Pedestrian		10,000	10,000
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
3337	Project	Falmouth	Cross-Falmouth Bikepath	Bike path connection from E. Falmouth to Gifford St. to Shining Sea Bike Path	Bicycle/ Pedestrian		3,000	3,000
3338	Project	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
3339	Project	Barnstable	Bearses Way Extension	Construct extension of Bearses Way from Route 132 to Attucks Lane in Barnstable	Highway		2,000	2,000
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	ITS/ Management		3,000	3,000
3341	Project	Falmouth	Chappaquoit Br Rehabilitation	Rehabilitate Chappaquoit Road/West Falmouth Harbor Bridge (Falmouth)	Bridge		2,500	2,500
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
3344	Project	Falmouth	Falmouth Bus Depot Upgrade	Improve facilities at Falmouth bus depot and expand service	Transit	100	1,000	3,300
3345	Project	Barnstable	Villager Bus Service (Red Line) Split	Divide CCRTA Villager service (Red Line) into two separate, coordinated lines	Transit	5		115
3346	Project	Dennis	Rte 134 Bridge Rehabilitation	Rehabilitate Route 134/Route 6 Bridge (Dennis)	Bridge		1,000	1,000
3347	Project	Capewide	Bike Racks on Woods Hole & Orleans Buses	Install bike racks on Woods Hole & Orleans buses	Transit	1	5	28
3348	Project	Barnstable	Hyannis-Route 6 Bus Service	Improve transit bus service between Route 6 to Hyannis & Cape Cod Mall area	Transit	10		230
3349	Project	Dennis	Rte 28 Main St Bridge Rehabilitation	Rehabilitate Route 28 Main Street/Swan Pond River Bridge (Dennis)	Bridge		500	500
3350	Project	Bourne	Bourne Bridge - Falmouth or Sandwich Bus Service	Introduce public transit bus service between the Bourne Bridge area and Sandwich or Falmouth	Transit	500		11,500
3351	Project	Capewide	Cape Cod Commuter Rail	Introduce commuter rail services to Buzzards Bay with connections to Providence (& T.F. Green Airport, RI) and Boston	Rail	2,000	3,000	49,000
3352	Project	Dennis	Upper County Rd Bridge Rehabilitation	Rehabilitate Upper County Road/Swan Pond River Bridge (Dennis)	Bridge		2,000	2,000
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 or Wareham SRPEDD?	Cohasset Narrows Bridge Improvements & Traffic Management	Repair bridge abutments, prepare and implement traffic management plans as part of repairs to the Cohasset Narrows Bridge in Bourne [***review schedule]	Highway		300	300

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr($K)	Start Cost ($K)	Total Cost ($K)
3356	Project	Chatham	Bridge St Bridge Replacement	Replace Bridge Street/Mitchell River Bridge (Chatham)	Bridge		10,000	10,000
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 Signalization	Install traffic signal at Route 6A/Union Street intersection in Yarmouth	Highway		1,000	1,000
3359	Project	Eastham	Route 6/Gov. Prence Road Signalization	Install traffic signal at Route 6/Governor Prence Road intersection in Eastham	Safety		1,000	1,000
3360	Project	Eastham	Route 6/Brackett Road Improvements	Improve signal timing, add left-turn lane on Brackett; sidewalks & bike lanes on Bracket Road at Route 6 (Eastham)	Highway		3,000	3,000
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
3362	Project	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
3363	Project	Yarmouth	West Yarmouth Roundabout	Construct modern roundabout at intersection of 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
3367	Project	Barnstable Boston	Hyannis-Boston Ferry Service	Ferry service: Hyannis to Boston	Ferry		15,000	15,000
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
3369	Project	Truro	Truro Route 6 Sidewalk	Install sidewalk along Route 6 from Truro Elementary School to Truro Safety Facility	Bicycle/ Pedestrian		200	200
3370 S	Project	Capewide	Coast Guard Beach Shuttle Replacement - Phase 2	Replace existing vehicles	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 Natl 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
3376 S	Project	Capewide	Bicycle accommodations - 2 Vans, trailers, and development of waiting/loading area	Procure vans and trailers and construct pick-up and drop-off areas to serve the Cape Cod Rail Trail demands.	Bicycle/ Pedestrian		200	200
3377 S	Project	Capewide	Construct Satellite Maintenance Facility	This facility will provide routine maintenance and storage for the Outer Cape transit vehicles.	Transit		1,300	1,300

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr($K)	Start Cost ($K)	Total Cost ($K)
3378 S	Project	Capewide	Expand Flex Route System - Buses	Acquire additional buses to accommodate service expansion.	Transit		1,000	1,000
3379 S	Project	Capewide	Upgrade Radio System for Flex Service/ITS	Improve communications systems and provide capacity to accommodate ITS components.	ITS/ Management		150	150
3380 S	Project	Capewide	Information Kiosks - Phase II	Procure, install, and enable public transportation information kiosks	ITS/ Management		200	200
3381 S	Project	Capewide	Parking Improvement Implementation - Phase 1	Develop inland parking for the National Seashore	Park & Ride		150	150
3382 S	Project	Capewide	Expand Flex Route - Support Elements	Provide bus stop shelters and passenger amenities.	Transit		400	400
3383 S	Project	Capewide	Information Kiosks III	Procure, install, and enable public transportation information kiosks	ITS/ Management		200	200
3384 S	Project	Capewide	Variable Message Signs - Phase 2	Permit, and install variable message signs for the Outer Cape.	ITS/ Management		500	500
3385 S	Project	Capewide	Beach Shuttle Expansion	Acquire additional buses to accommodate inland National Seashore parking needs.	Transit		400	400
3386 S	Project	Capewide	Expand Flex Route System - Buses II	Acquire additional buses to accommodate service expansion.	Transit		1,500	1,500
3387 S	Project	Capewide	Replace Provincetown/Truro Shuttle Buses	Replace 5 existing vehicles	Transit		1,500	1,500
3388 S	Project	Provincetown	Provincetown Bicycle Path Ext - Phase I	Develop an extension from Race Point to Rte 6.	Bicycle/ Pedestrian		1,000	1,000
3389 S	Project	Provincetown	Provincetown Bicycle Path Ext - Phase II	Develop ped/bicycle facility using a portion of the Rte. 6 ROW	Bicycle/ Pedestrian		1,000	1,000
3390 S	Project	Provincetown	Provincetown Intermodal Gateway Project - Construction	Construct the Gateway	Enhancements		8,000	8,000
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

6.4.3 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 Year

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)
3700	Smart Solution 1	Capewide	Speed Management	Implement education, signage and enforcement to lower traffic speeds on roadways with speed-related safety problems	Safety			0
3701	Smart Solution	New Bedford	Promote Ferry Service from New Bedford		Ferry			0
3702	Smart Solution	Capewide	Right-of-Way Preservation	Maintain rights-of-way for future transportation uses and to avoid future traffic generation	ITS/ Management			0
3703	Smart Solution	Capewide	Vanpooling & Carpooling Incentives	Provide incentives to increase vanpooling and carpooling	ITS/ Management			0
3704	Smart Solution	Capewide	Employer TDM Plans	Create incentives for employers to prepare and implement Travel Demand Management (TDM) plans (>25 Employees)	ITS/ Management			0
3705	Smart Solution	Capewide	Redesignate 195 & 495	Redesignate Route 25 Extension as Route 195 or Route 495 or Route 195/495	ITS/ Management			0
3706	Smart Solution	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
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
3708	Smart Solution	Capewide	Bicycling & Motorist Traffic Law Enforcement	Enforce traffic laws on bicyclists and motorists	Safety			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
3710	Smart Solution	Capewide	Cell Phone Driving Ban	Consider supporting a ban on the use of mobile phones while driving	Safety			0
3711	Smart Solution	Capewide	CCRTA/Steamship Authority Coordination	Coordinate schedules among the CCRTA Sealine (Blue Line) and Steamship Authority Ferries	Transit			0
3712	Smart Solution	Capewide	Hotel Shuttles	Provide shuttle service to hotel users	Transit			0
3713	Smart Solution	Capewide	Bus Users Incentives: Shopping Discounts	Provide shopping discounts to bus users	Transit			0
3714	Smart Solution	Capewide	Free Breeze Bus Service	Provide free (and/or reduced fare) service on CCRTA public transit where feasible	Transit			0
3715	Smart Solution	Capewide	Transit Education & Marketing on Local TV	Implement education programs and marketing activities on community-access television to support public transit	Transit			0
3716	Smart Solution	Capewide	Vanpooling at Steamship Authority Lots	Permit use of Steamship Authority parking facilities for vanpooling	Park & Ride			0
3717	Smart Solution	Capewide	WiFi Hotspots	Install wireless internet services at strategic locations throughout Cape Cod	ITS/ Management			0
3718	Smart Solution	Capewide	Zoning/Planning Support for Sidewalks	Improve zoning regulations & planning efforts to invest in sidewalks	Bicycle/ Pedestrian			0

6.4.4 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#	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 Year

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)
3800	Study 1	Capewide	Cape Cod & Islands Rural Roads	Develop concept plans for demonstration projects compatible with Cape Cod character considering the latest MassHighway design guidelines	Highway		300	300
3801	Study 2	Eastham, Wellfleet	Access Management for Route 6	Identify restrictions of left- turn movements at intersections and driveways along Route 6, construct left-turn lanes at key locations (Eastham-Wellfleet)	Safety		300	300
3802	Study 3	Barnstable	Hyannis Access Improvements	Improve access to downtown Hyannis per ongoing Hyannis Access Study	Highway		15,000	15,000
3803	Study 4	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
3804	Study 5	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
3805	Study 6	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
3806	Study 7	Orleans	Rt 28/Rt 39 Intersection Improvements	Identify safety improvements at Route 28/Route 39/Quanset Road intersection in Orleans	Safety		100	100
3807	Study 8	Bourne, Army Corps	Cape Cod Canal Bridges Replacement/Expansion/Addition	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
3808 S	Study 9	Capewide	Flex Phase II Evaluation Study	Evaluate improvements and expansion of the Flex transit service.	Transit		30	30
3809	Study 10	Capewide	Freight Study	Conduct a study of freight (quantities, origins, destinations, etc.)	ITS/ Management		250	250
3810	Study	Bourne	Belmont Circle Improvements	Identify improved geometry for connections between Route 6 approaches (Scenic Highway, Bypass, Main Street) and Route 25 ramps in Bourne	Highway		200	200
3811	Study	Capewide	Disaster/Emergencies/Security Plan	Develop plans to address disasters, emergencies, and security issues	Security		500	500
3812	Study	Mashpee	Mashpee Commons Bus Services	Examine public transit bus services including "FLEX" in the Mashpee Commons area; and Mashpee-Boston express service	Transit		100	100
3813	Study	Capewide	Railways for Transporting Emergency Supplies	Develop contingency plan to use railways for transporting supplies during emergencies	Security		75	75
3814	Study	Wellfleet	Lieutenant Island Road/Route 6 Intersection Improvements	Examine reconstruction of Lieutenant Island Road approach to Route 6 to create separation of left-turn and right turn lanes and/or signalization (Wellfleet)	Highway		40	40
3815	Study	Bourne	Study re-use of Buzzards Bay Bypass	Study options for re-use of Route 6 Bypass in Buzzards Bay	Highway		75	75
3816	Study	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
3817 S	Study	Chatham	Flex Expansion Planning	Develop improvements to the Flex service and expansion of coverage to Chatham.	Transit		30	30
3818 S	Study	Capewide	ITS Implementation Study	Develop an implementation plan for highway and transit ITS elements.	ITS/ Management		250	250
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

RTP#	Type Rank	TOWN	Title	Description	Category	Ann. Cost /yr($K)	Start Cost ($K)	Total Cost ($K)
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**
3821 S	**Study**	Capewide	Development of the Renewable Fuels Partnership Strategic Implementation Plan	Identify potential markets, create an educational program, explore public/private partnerships, and infrastructure needs	Enhancements		**150**	**150**
3822 S	**Study**	Capewide	Smart Card Study	Investigate current technologies, compatibilities with local planning, define potential partners, and make recommendations.	ITS/ Management		**75**	**75**
3823 S	**Study**	Capewide	Smart Card Demonstration Program	Implement a Smart Card program on the Outer Cape	ITS/ Management		**250**	**250**
3824 S	**Study**	Eastham, Wellfleet, Truro, Provincetown	Bicycle Transportation Needs Study	Develop a bicycle plan for the Outer Cape.	Bicycle/ Pedestrian		**50**	**50**
3825 S	**Study**	Capewide	CACO Parking study and data collection	Explore National Seashore parking needs and develop alternative inland beach parking sites.	Park & Ride		**80**	**80**
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**
3829 S	**Study**	Capewide	Develop Origin/Destination Transit Mode Split Model	Create a transit model for Cape Cod	Transit		**250**	**250**
3830 S	**Study**	Capewide	Evaluation of Partner Program II	Continue the evaluation of the public/private carrier coordination program.	ITS/ Management		**15**	**15**
3831 S	**Study**	Provincetown	Provincetown Intermodal Gateway Project - Alternatives/Design	Perform alternatives analysis, public review process and final design of the Provincetown Gateway	Enhancements		**750**	**750**
3832 S	**Study**	Capewide	Renewable Fuels Partnership Strategic Implementation Plan	Identify potential renewable fuel options, technologies, markets, and infrastructure neesds to make use of biofuels both viable and sustainable	Enhancements		**200**	**200**

6.5 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

RTP 2007

2007 Regional Transportation Plan
Chapter 7
Financial Plan

April 2007

Prepared by C*APE* C*OD* C*OMMISSION* *Transportation Staff, on behalf of the*

CAPE COD METROPOLITAN PLANNING ORGANIZATION:

:

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

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

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7 Financial Information / Introduction

The Regional Transportation Plan (RTP) is data collection and analysis, discussion and outreach, on the existing system issues and problem areas in the Cape Cod Transportation System. This lends insight into possible solutions for improved mobility of both residents and visitors to, from, and within the Cape Cod region. However, planning for improvements is meaningless without funding for the solutions.

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. Therefore this transportation planning effort includes a look at the financial outlook, and at what solutions will be recommended for implementation within the available funds. To be financially constrained the RTP recommendations for implementation may include only the projects within the funds that are reasonably expected to be available. Other proposed projects, programs, and/or studies may be included for information purposes only.

7.1 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 the current legislation entitled the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU), signed into law on August 10, 2005, by President George Bush. SAFETEA-LU authorizes specific dollar amounts for each program. Each year Congress provides an annual appropriation which funds the programs specified in SAFETEA-LU.

The 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	cubic foot

*To be determined; 1997 amount is 48.54 cents per thousand cubic feet for Compressed natural gas.

STATE TAX AMOUNTS

gasoline .... 21.0 cents/gallon
gasahol ....
diesel fuel ....
liquefied petroleum gas 19.1%

For this RTP financial plan, the federal funding provided by SAFETEA-LU 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 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 designed 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.

7.2 Federal Transportation Funds: Categories and Eligible Activities

Basically, all transportation modes are eligible for this federal funding with the exception of airport related projects that have a separate federal bill for funding. The following table provides examples of the 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 Unified Planning Work Program (UPWP), the Regional Transportation Plan (RTP), and the Transportation Improvement Program (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) 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) 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 in accordance with section. 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.
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. Operating assistance is limited to three (3) years.
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 transit facilities within, adjacent, or providing access to public lands, national parks, national forests, refuge roads, and Indian reservations. Includes Alternative Transportation in Parks and Public Lands (ATPPL)—a new program in SAFETEA-LU for alternative transportation. 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).
Recreational Trails Program (RTP) Trails	Develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses.

Federal Highway Administration Programs (continued)	
Fund and Primary Purpose	**Eligible Activities**
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 (PL) Section 5303 To carry out the metropolitan transportation planning process under 49 U.S.C. 5303	23 U.S.C. 134 metropolitan transportation planning process
Statewide Planning & Research (SPR) To carry out the provisions of 49 U.S.C. sections 5304, 5306, 5315, and 5322.	23 U.S.C. 135 statewide transportation planning process.
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.

Federal Transit Administration Programs (continued) Fund and Primary Purpose	Eligible Activities
Alternative Transportation in Parks and Public Lands (ATPPL) 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.	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. Federal land management agencies and State, tribal and local governments acting with the consent of a Federal land management agency are eligible to apply.
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.
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.

7.3 Summary of Previous Expenditures

Time Frame	Federal Highway Administration (includes state matching amount)	.Federal Transit Administration (includes state amount)
1993-1996	$ 19,800,585	$ 28,598,220
1997-2000	$ 28,218,353	$ 16,818,216
2001-2004	$ 24,516,794	$ 28,280,117
Total Amount	**$ 72,535,732**	**$ 73,696,553**
Average Annual	**$ 6,044,644**	**$ 6,141,379**

7.4 Estimated Available Funds

A summary of the estimated available federal funding including state matching and operating funds for the next 24 years—2007 to 2030—for recommendations in this Cape Cod Regional Transportation Plan (RTP) is below by associated source and time frame.

Time Frame	Federal Highway Administration (includes state matching amount)	Federal Transit Administration (includes state amount)
2007-2010	$ 92,204,289 [1]	$ 41,237,603 [2]
2011-2015	$ 114,761,000	$ 61,738,840
2016-2020	$ 167,660,000	$ 70,978,920
2021-2025	$ 193,222,000	$ 81,612,738
2026-2030	$ 222,856,000	$ 93,852,036
2007-2030 Totals	**$ 722,999,000**	**$ 349,420,137**

[1] **2007-2010 FHWA "Highway" Funding by basic type** (from the August 2006 TIP)

Federal Highway Administration (FHWA) & state targeted amount	$ 25,622,305
Federal Aid Bridge amount	$ 4,500,000
Other Federal Aid projects (earmarks and discretionary)	$ 37,581,984
Major Infrastructure Amount (Bourne / Sagamore project)	$ 24,500,000
Total FHWA/state amount programmed in TIP	**$ 92,204,289**

[2] **2007-2010 FTA "Transit" Funding by basic type (**from the August 2006 TIP)

Federal Transit Administration (FTA) 5307 capital funds	$19,044,215
5311-5312 Operating Assistance/CCRTA services (local $ not included)	$ 7,038,834
Mobility Assistance Program	$ 2,758,725
Alternative Transportation in Parks & Public Lands (ATPPL)	$ 1,305,000
Total FTA/state amount programmed in TIP	**$30,146,774**

Specific programmed items in years 2007-2010 of the Regional Transportation Plan and the current Transportation Improvement Program (TIP) follow under "HIGHWAY", for the Federal Highway Administration (FHWA) source funds, and under "TRANSIT", for the Federal Transit Administration (FTA) source funds.

7.5 Projects Recommended 2007-2030

	Recommended Projects	ESTIMATED COST	AIR QUALITY STATUS	Air Quality Analysis Completion Year
A. Programs				(ongoing)
1	Roadways: Rehabilitation, Reconstruction	$130,000,000	EXEMPT	NO
2	Geometrics: Intersection, Land Conservation, Roundabouts, Traffic Calming, Signals, Access Management, Enhancements, Reconfigurations	$70,000,000	EXEMPT	NO
3	Safety: Roundabouts, Traffic Calming, Relocation of telephone poles, Red Light running cameras	$40,000,000	EXEMPT	NO
4	Bicycle / Pedestrian	$30,000,000	EXEMPT	NO
5	Intelligent Transportation Systems (ITS): Real Time Traffic Information, Canal Area Real Time Traffic Information	$30,000,000	EXEMPT	NO
6	Rail Infrastructure Preservation	$10,000,000	EXEMPT	NO
7	Bridges - ongoing	$30,999,000	EXEMPT	NO
8	Capewide Transit Marketing and Education	**$1,000,000**	EXEMPT	NO
9	Transit Capital - ongoing, Bus Purchases, Rail, Park & Ride Lots, Bus Shelters, ITS	**$223,260,000**	EXEMPT	NO
10	Transit Operating - bus ongoing, year-round rail service	**$125,000,000**	EXEMPT	NO
A. TOTAL		***$690,259,000***		
	Average Annual Amount	$28,760,792		

Recommended Projects

B. Projects

		ESTIMATED COST	AIR QUALITY (AQ) STATUS	AQ Analysis Completion Year
1	Bourne, Scenic Highway Median Barrier	$15,000,000	EXEMPT	2010
2	Sandwich to Orleans, Rte 6 Interchange Improvements (Exits 2-12)	$68,241,000	EXEMPT	2010
3	Cape Cod Rail Trail Extensions (Den-Yarm-Barns. To Hyannis Transportation Center)	$4,000,000	EXEMPT	2010
5	Bourne, Bourne Rotary Improvements (short-term)	$1,000,000	EXEMPT	2010
7	Year-Round Daily Passenger Rail Service (Hyannis, Buzzards Bay, Middleborough (to Boston), Providence, RI (to TF Green, to NY)	$26,000,000	EXEMPT	2010
11	Bourne, Canal Area ITS for Real Time Information	$3,000,000	EXEMPT	2010
14	Barnstable, Route 132 Boulevard Landscaping	$1,500,000	EXEMPT	2010
22	Orleans Transportation Center	$1,000,000	EXEMPT	2010
4	Barnstable , Route 132 Access management, Phinneys Lane to Airport Rotary	$5,000,000	EXEMPT	2020
5L	Bourne, Bourne Rotary Improvements (long-term)	$60,000,000	NON-EXEMPT	2020
6	Bourne Route 6 WB Reconfigure Exit 1 on-ramp	$7,000,000	EXEMPT	2020
8	TF Green Bus	$33,600,000	EXEMPT	2020
9	Barnstable Airport Rotary Modification	$900,000	EXEMPT	2020
10	Barnstable Airport Access Roads-- extend Attucks Lane	$15,000,000	NON-EXEMPT	2020
12	Barnstable Yarmouth Road add lanes	$10,000,000	NON-EXEMPT	2030
13	Bourne Sandwich Road Parkway-- 4 lanes and median	$35,000,000	NON-EXEMPT	2030
15	Capewide Traffic Counting Equipment Installation for Continuous Monitoring	$1,000,000	EXEMPT	2030
16	Bourne, Otis Rotary Area Improvements	$5,000,000	EXEMPT	2030
17	Orleans, Route 6A and Route 28 Intersection Improvements	$1,000,000	EXEMPT	2030
18	Barnstable, Independence Park Bikepath	$7,000,000	EXEMPT	2030
19	Barnstable, Route 6A and 132 roundabout	$1,000,000	EXEMPT	2030
20	Capewide, Transportation Management Center	$6,500,000	EXEMPT	2030
21	Buzzards Bay Transportation Center	$2,000,000	EXEMPT	2030
B. TOTAL		***$309,741,000***		
	Average Annual Amount	$12,905,875		
A + B TOTAL		**$1,000,000,000**		
	Average Annual Amount	$41,666,667		

7.5.1 Projects Programmed 2007-2010

2007-2010 FHWA "HIGHWAY" Funding Projects (based on the August 2006 TIP

State ID	MUNICIPALITY	DESCRIPTION	FUND	RTP	TOTAL COST	Year expected to be advertised
604914	BARNSTABLE	Route 132 Boulevard--Landscaping phase (Enhancements?)	STP-U	Target project	$1,500,000	2009
601441	BARNSTABLE	Route 132, widen with median boulevard from just east of Route 6 to Bearse's Way; Advance Construct 2005+, 2008 third AC year	STP-U	Target project	$3,600,000	2008
604096	BARNSTABLE	Route 28 Intersection Improvements at 3 locations--Rte 149, So. County Rd, Lumbert Mill Rd.	possible CMAQ	Target project	$1,900,000	2008
112 Earmark	BARNSTABLE	Cape Cod Hyannis Memorial Statue Gateway/ Walkway, Massachusetts	112 STP (100% Federal Funds)	Other Federal Aid Projects	$100,000	2007
117 Earmark	BARNSTABLE	Cape Cod Hyannis Gateway, Massachusetts	117 STP (100% Federal Funds)	Other Federal Aid Projects	$378,944	2007
SSA	Barnstable / Nantucket	Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (SSA) M/V Eagle Mid-Life Refurbishment	FBD	Other Federal Aid Projects	$5,900,000	2008
SSA	Barnstable / Nantucket	Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (SSA) HYANNIS Terminal Slip Modifications	FBD	Other Federal Aid Projects	$4,500,000	2008
603894	BOURNE	Route 6 Scenic Highway Median installation and safety improvements at Edge Hill Road AC Project 07-08 Total $5.5 mil	STP	Target project	$5,500,000	2007
603847	BOURNE	Real Time Traffic Information System -- Design Build of year-round 24/7 Web based traffic information system based on cameras, sensors, 511	CMAQ	Target project	$1,375,542	2010
603847	BOURNE	Sagamore Rotary Area Improvements	STP - FLEX	Major Infrastructure Projects	$22,500,000	2007
603847	BOURNE	Sagamore Rotary Area Improvements	STP - FLEX	Major Infrastructure Projects	$2,000,000	2008
247	CAPEWIDE	Rural Roads Initiative, Cape & Islands	HPP#247	Other Federal Aid Projects	$218,000	2007
601467	CHATHAM	Streetscape Improvements Main St	STP	Target project	$1,306,920	2009

HIGHWAY: 2007-2010 Federal Highway Administration and state (continued)

State ID	MUNICIPALITY	DESCRIPTION	FUND	RTP	TOTAL COST	Year expected to be advertised
604742	DENNIS	Great Western Rd & South Gage's Way Intersection Improvements	STP	Target project	$650,000	2010
600395	DENNIS	Route 134, from Route 28 to Upper County Rd	STP	Target project	$2,000,000	2010
113 Earmark	DENNIS	Bass River Gateway Project (Howland Property)	113 STP	Other Federal Aid Projects	$1,400,000	2007
603892	DENNIS	BRIDGE Upper County Rd Footprint replacement, BR#D-07-001	BRIDGE - ON	BRIDGE	$2,000,000	2010
604488	DENNIS, YARMOUTH, BARNSTABLE	Cape Cod Rail Trail Extension [Design Amount in 2007]	SAFETEA-LU EARMARK TI#173	Other Federal Aid Projects	$595,975	2007
604488	DENNIS, YARMOUTH & BARNSTABLE	Cape Cod Rail Trail Extension [CMAQ and Earmark construction]	CMAQ	Target project	$1,375,542	2009
604488	DENNIS, YARMOUTH, BARNSTABLE	Cape Cod Rail Trail Extension [Design Amount in 2008; Total earmark $2,598,780 in federal earmark amount]	SAFETEA-LU EARMARK TI#173	Other Federal Aid Projects	$2,652,500	2010
PLH	Department of Conservation and Recreation	Cape Cod Seashore Eastham Dennis Bike Trail Repair	Public Lands Highway	Other Federal Aid Projects	$1,190,400	2007
603609	FALMOUTH	Route 28 Reconstruction at Reine's Corner	STP	Target project	$500,000	2007
603520	FALMOUTH	Shining Sea Bikeway Extension [CMAQ and Earmark]	CMAQ	Target project	$1,375,542	2007
603520	FALMOUTH	Shining Sea Bikeway Extension [Total earmark $2,765,632 in federal earmark amount]	SAFETEA-LU EARMARK HPP#1326	Other Federal Aid Projects	$2,065,040	2007
603520	FALMOUTH	Shining Sea Bikeway Extension [Total earmark $2,765,632 in federal earmark amount]	SAFETEA-LU EARMARK HPP#1326	Other Federal Aid Projects	$696,000	2008
603520	FALMOUTH	Shining Sea Bikeway Extension [Total earmark $2,765,632 in federal earmark amount]	SAFETEA-LU EARMARK HPP#1326	Other Federal Aid Projects	$696,000	2009
SSA	FALMOUTH	Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (SSA) Woods Hole Terminal reconstruction / improvements to the terminal, 2 ferry slips, new longer transfer bridges, ticket office building.	FBD	Other Federal Aid Projects	$10,000,000	2010

HIGHWAY: 2007-2010 Federal Highway Administration and state (continued)

State ID	MUNICIPALITY	DESCRIPTION	FUND	RTP	TOTAL COST	Year expected to be advertised
603494	FALMOUTH	BRIDGE, Chappaquoit BR#F-3-9	BRIDGE - OFF	BRIDGE	$2,500,000	2008
604882	HARWICH	Route 124 at Queen Anne Road Intersection Improvements	STP	Target project	$600,000	2010
604744	SANDWICH	Route 6 Ramps at Route 130, Intersection improvements	STP	Target project	$650,000	2010
PIF PNF	TRURO	Route 6 safety improvements for bike ped	CMAQ	possible CMAQ	$2,000,000	2010
SSA	Vineyard / Nantucket	Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (SSA) M/V Nantucket Mid-Life Refurbishment	FBD	Other Federal Aid Projects	$6,600,000	2007
602327	YARMOUTH	Higgins Crowell Road from Rte. 28 to Mid-Tech Drive	STP	Target project	$2,580,000	2009
602923	YARMOUTH	Packets Landing Improvements	HPP#404	Other Federal Aid Projects	$589,125	2007

TRANSIT: 2007-2010 Federal Transit Administration and state funds / Cape Cod Regional Transit Authority Projects

Year	Fund	Project Description	Total Cost	Federal	State
2007	5311	Operating Assistance	$956,922	$46,018	$910,904
2007	5307	Operating Assistance	$971,786	$134,530	$837,256
2007	5307	Preventative Maintenance	$2,544,262	$1,578,775	$965,487
2007	5307	ADA Paratransit	$1,379,268	$467,695	$911,573
2007	5307	Transit Enhancements	$53,916	$44,930	$8,986
2007	5307	Hyannis Transportation Center ($474,750 in local funds)	$750,000	$275,250	$474,750
2007	5307	Transit buses, supervisor vehicle, transit shop equipment, benches, signs, bike racks, ITS equipment/installation	$1,151,691	$921,353	$230,338
2007	MAP31	Minibuses (10)	$570,000	$0	$570,000
2007	MAP31	Lift Van (3)	$110,000	$0	$110,000
2007	MAP31	Mobile radios/base sta. MDTs	$10,000	$0	$10,000
2007	ATPPL	National Seashore CG Beach shuttle replacement - phase 1	$400,000	$400,000	$0
2007	ATPPL	National Seashore Evaluate & Procure transit software system	$250,000	$250,000	$0
2007	ATPPL	National Seashore Flex satellite maint needs / alternative study	$200,000	$200,000	$0
2007	ATPPL	National Seashore Flex evaluation study	$30,000	$30,000	$0
2007	ATPPL	transportation partner coordination program	$175,000	$175,000	$0
2007	ATPPL	National Seashore ITS implementation study	$250,000	$250,000	$0
2008	5312	CCRTA Wi-MAX Project Field Operational Test	$625,000	$500,000	$125,000
2008	5311	Operating Non-Urb Area	$956,922	$46,018	$910,904
2008	5307	Operating Subsidy	$538,120	$0	$538,120
2008	5307	Preventative Maintenance	$2,260,155	$1,578,775	$681,380
2008	5307	ADA Paratransit	$799,115	$467,695	$331,420
2008	5307	Transit Enhancements	$85,530	$44,930	$40,600
2008	5307	Transit buses, minibuses, vans; ITS Equipment; bus stops/signs	$1,423,770	$1,250,000	$173,770
2008	MAP32	Minibuses (10)	$588,610	$0	$588,610
2008	MAP32	Lift Van (2)	$81,280	$0	$81,280
2008	MAP32	Mobile radios/base sta. MDTs	$10,612	$0	$10,612

TRANSIT: 2007-2010 Federal Transit Administration and state funds / Cape Cod Regional Transit Authority Projects (continued)

Year	Fund	Project Description	Total Cost	Federal	State
2009	5311	Operating Assistance	$956,922	$46,018	$910,904
2009	5307	Operating Assistance	$538,120	$0	$538,120
2009	5307	Preventative Maintenance	$2,322,710	$1,578,775	$743,935
2009	5307	ADA Paratransit	$809,058	$467,695	$341,362
2009	5307	Transit Enhancements	$85,530	$44,930	$40,600
2009	5307	Bundled Transit Projects	$1,148,520	$974,750	$173,770
2009	MAP32	Minibuses (10)	$600,382	$0	$600,382
2009	MAP32	Lift Van (2)	$82,906	$0	$82,906
2009	MAP32	Mobile radios/base sta. MDTs	$10,824	$0	$10,824
2010	5311	Operating Assistance	$956,922	$46,018	$910,904
2010	5307	Operating Assistance	$538,120	$0	$538,120
2010	5307	Preventative Maintenance	$2,387,083	$1,578,775	$808,308
2010	5307	ADA Paratransit	$809,058	$467,695	$341,362
2010	5307	Transit Enhancements	$85,530	$44,930	$40,600
2010	5307	Bundled Transit Projects	$1,148,520	$974,750	$173,770
2010	MAP32	Minibuses (10)	$600,382	$0	$600,382
2010	MAP32	Lift Van (2)	$82,906	$0	$82,906
2010	MAP32	Mobile radios/base sta. MDTs	$10,824	$0	$10,824

7.5.2 Recommended Projects for 2011-2030

The list of recommended projects for 2011-2030 includes the same projects that are listed on pages 8 and 9 that are to be implemented after 2010. Programs are "ongoing" and are accomplished throughout the entire plan life. The two lists below include both the programs and the specific projects for 2011-2030.

Programs 2011-2030

- Roadways: Rehabilitation, Reconstruction
- Geometrics: Intersection, Land Conservation, Roundabouts, Traffic Calming, Signals, Access Management, Enhancements, Reconfigurations
- Safety: Roundabouts, Traffic Calming, Relocation of telephone poles, Red Light running cameras
- Bicycle / Pedestrian
- Intelligent Transportation Systems (ITS): Real Time Traffic Information, Canal Area Real Time Traffic Information
- Rail Infrastructure Preservation
- Bridges - ongoing
- Capewide Transit Marketing and Education
- Transit Capital - ongoing, Bus Purchases, Rail, Park and Ride Lots, Bus Shelters, ITS
- Transit Operating - bus ongoing, year-round rail service

Projects 2011-2030:

- Barnstable, Route 132 Access management, Phinneys Lane to Airport Rotary
- Bourne, Bourne Rotary Improvements (long-term)
- Bourne, Route 6 WB Reconfigure Exit 1 on-ramp
- Barnstable, Hyannis to T.F. Green Airport in Warwick, Rhode Island Bus
- Barnstable, Airport Rotary Modification
- Barnstable, Airport Access Roads-- extend Attucks Lane
- Barnstable, Yarmouth Road add lanes
- Bourne, Sandwich Road Parkway-- 4 lanes and median
- Capewide, Traffic Counting Equipment Installation for Continuous Monitoring
- Bourne, Otis Rotary Area Improvements
- Orleans, Route 6A and Route 28 Intersection Improvements
- Barnstable, Independence Park Bikepath
- Barnstable, Route 6 and 132 roundabout
- Capewide, Transportation Management Center
- Bourne, Buzzards Bay Transportation Center

7.6 Conclusion

The recommended projects and programs to move forward in this Regional Transportation Plan (RTP) are contained within the financial resources estimated to be available for the region over the same time frame. Therefore, the RTP is financially constrained.

The RTP recommended programs and projects now have implementation funds allocated. The programs are ongoing items that are primarily geared to maintenance and operations of the existing system. These items, for example, include the existing capital purchases, operations, and maintenance of the Cape Cod Regional Transit Authority services. There are also included "bundled" amounts for smaller intersection projects that are not specifically listed, but are important safety and/or congestion improvements for the current transportation system.

The RTP is currently updated every four years, therefore, the shorter range recommended projects, listed below, are the projects that are in the design process or are about to begin to move forward with design/implementation now.

Recommended Projects for 2007-2010

- Bourne, Scenic Highway Median Barrier
- Sandwich to Orleans, Rte 6 Interchange Improvements (Exits 2-12)
- Cape Cod Rail Trail Extensions (Dennis-Yarmouth-Barnstable To Hyannis Transportation Center)
- Bourne, Bourne Rotary Improvements (short-term)
- Year-Round Daily Passenger Rail Service (Hyannis, Buzzards Bay, Middleborough (connect to Boston), Providence, Rhode Island (connect to TF Green Airport; to New York)
- Bourne, Canal Area Intelligent Transportation Systems (ITS) for Real Time Traffic Information
- Barnstable, Route 132 Boulevard Landscaping
- Orleans Transportation Center

These recommended projects will also be listed in the short range budget for implementation—the Cape Cod Transportation Improvement Program (TIP). The TIP aligns the projects within the next four specific years for advertising and/or implementation. The TIP is now required under federal legislation to be updated every four years, but 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.