CAPE COD
COMMISSION

2016 REGIONAL TRANSPORTATION PLAN

Technical Appendix B: Existing Conditions

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Technical Appendix B: Existing Conditions

VEHICLE INFRASTRUCTURE

ROADS

Travel by vehicle in Barnstable County is the primary method of transportation and can often be a unique and picturesque for visitors and residents. The style of the roads and the buildings that line them are internationally recognized as Cape Cod. In certain parts of the county the historical district or town by-laws dictate the style of the road and the buildings along that road to preserve the culture of the town or city. The residents on Cape Cod have a long standing connection to the preservation of infrastructure character and natural open space. It is well known that the largest attractions in Barnstable County are the beaches; however it is the style of roadway that enhances the experience of traveling to destinations while living or visiting the region.

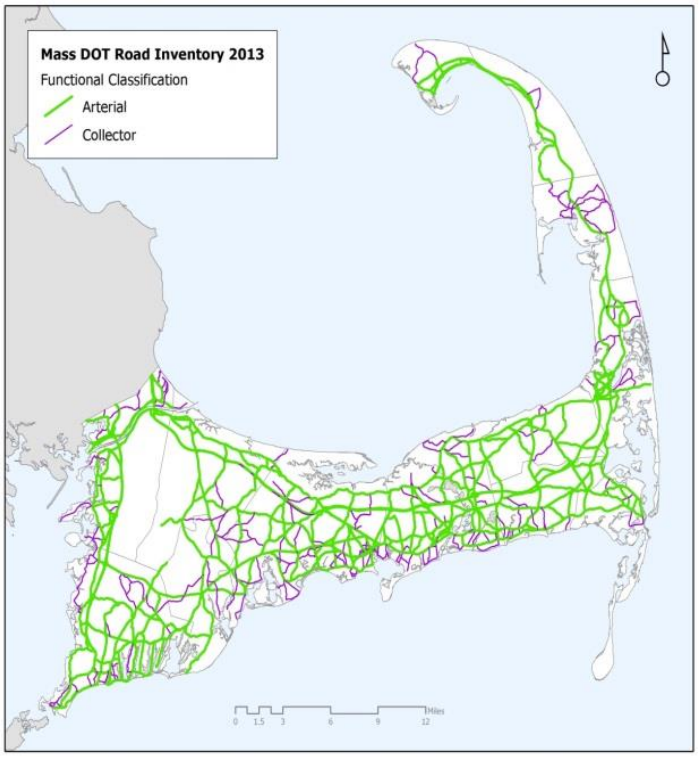

FIGURE 1: ROADWAY CLASSIFICATION

Roadway Functional Classification

Cape Cod's three major routes, Route 6, Route 28, and Route 6A, comprise only less than 6% of Cape Cod's roads by mileage. The majority (80%) of Cape Cod roads are designated as Functional Class "0/null," or local roads. 6% of roads are classified as minor or major "Collector" roadways. This means that just over two-tenths of Cape Cod's roadways are used as primary routes, while the remaining nearly eight-tenths are used to access residential and other private areas. There are no interstate highways on Cape Cod. Cape Cod's roadway functional classes are presented in the following figure.

Limited Access Roads

Limited-access highways south/east of the Cape Cod Canal bridges are portions of either Route 6 or Route 28 and are shown in the figure above. The only limited-access portions of Route 28 are located in Bourne and Falmouth. Most of Route 28 (MacArthur Boulevard) in Bourne is partial-access control with sporadic opportunities to change direction in U-turn lanes. The majority of Cape Cod's roads do not have access control. The lack of availability of limited access routes, especially on the Outer Cape area can create congestion.

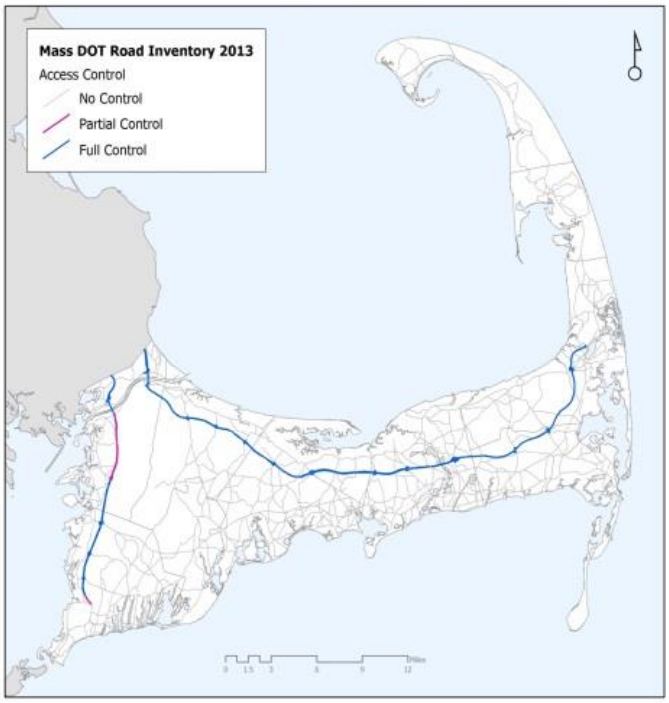

FIGURE 2: LIMITED ACCESS ROADS

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. The majority of roads that are not recognized as highways have posted speed limits below 50 mph. Exceptions include portions of Route 28 in Falmouth, Mashpee and Barnstable and Route 151 in Falmouth and Mashpee.

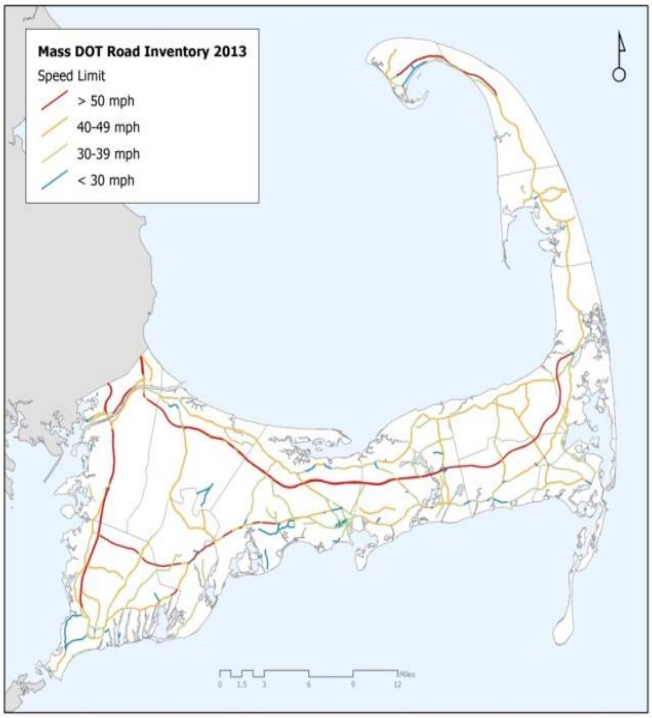

FIGURE 3: SPEED LIMITS

FIGURE 5: SPEED LIMITS

Intersections

There are thousands of roadway intersections across Cape Cod. Of these intersections, 129 are signalized and 25 are circular. Circular intersections refer to rotaries and roundabouts. Rotaries tend to be larger in diameter, and their interior travel speed is often faster than a modern roundabout. Roundabouts are identified by smaller diameters and approaches that enter at a greater angle than rotaries – encouraging slower speeds. Barnstable has five circular intersections, the most of any Cape Cod town.

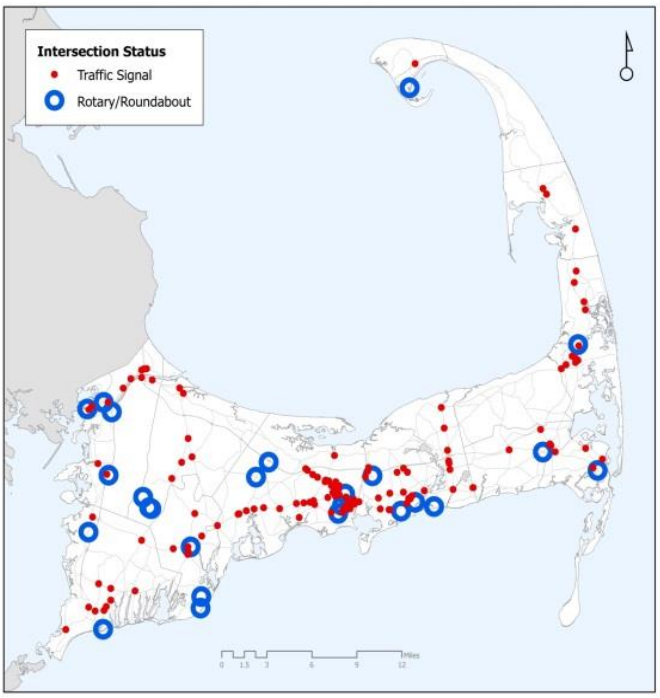

FIGURE 6: INTERSECTIONS

Average Annual Daily Traffic

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. High volumes of traffic are found on the roads leading to and within the Hyannis area (an area that receives/sends goods to/from many businesses, institutions such as Cape Cod Hospital and multimodal facilities such as the ferry ports). In comparison, downtown Falmouth also experiences high levels of congestion.

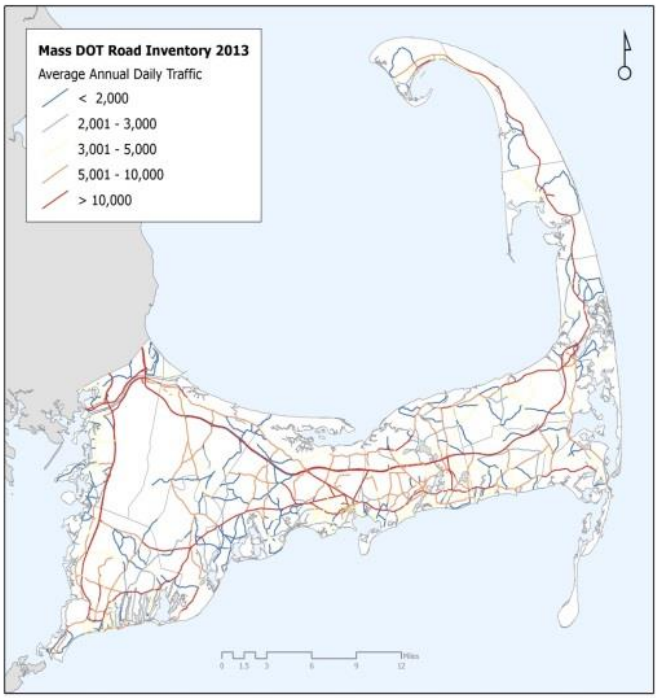

FIGURE 7: AVERAGE ANNUAL DAILY TRAFFIC

U.S. Route 6

U.S. Route 6 runs from Provincetown, Massachusetts all the way to Bishop, California, and is the longest continuous route in the United States. On Cape Cod, Route 6 is the major transportation corridor, particularly for those traveling long distances. From where it enters Barnstable County in Buzzards Bay until its end in Provincetown, it provides a primarily limited-access high-speed means of traveling along the spine of the Cape for commercial traffic. The Route 6 corridor in the Outer Cape does not have limited access. This portion of Route 6 also contains segments of the Claire Saltonstall Bikeway, or State Bicycle Route 1. 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 or in Wellfleet or in Dennis.

FIGURE 8: ROUTE 6 FROM BUZZARDS BAY TO SAGAMORE BRIDGE

Buzzards Bay to Sagamore Bridge

From where it enters the county in Buzzards Bay to where it crosses the Cape Cod Canal at the Sagamore Bridge Route 6 is a two- to four-lane road with curb cuts on both sides. The Sagamore Rotary, located north of the Sagamore Bridge, was eliminated by 2006. This grade separated intersection provides for a direct connection between Route 3 and the Sagamore Bridge.

FIGURE 9: ROUTE 6 FROM SAGAMORE BRIDGE TO EXIT 9

Sagamore Bridge to Exit 9, Dennis

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

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.

FIGURE 10: ROUTE 6 FROM EXIT 9 TO ORLEANS ROTARY

Orleans Rotary to Provincetown

Route 6 in the Outer Cape area is generally a consolidation of existing roadways 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 – several sections of which have been realigned.

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 limits crossovers on sections of Route 6 in Provincetown.

FIGURE 11: ROUTE 6 FROM ORLEANS ROTARY TO PROVINCETOWN

State Route 28

State Route 28 begins at the New Hampshire border and joins Route 6 as it enters Barnstable County at Cohasset Narrows on the border of Bourne/Wareham. Route 28 runs for almost sixty-five miles after crossing the Cape Cod Canal and passing through villages adjacent to Buzzards Bay/Nantucket Sound/the Atlantic Ocean from Bourne to Orleans Center. Route 28 is a regional roadway but it does not provide direct inter-regional travel options in most cases. 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.

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. Some sections, such as in Hyannis and Falmouth, can experience congestion year-round.

Buzzards Bay to Bourne Rotary

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

Bourne Rotary to Palmer Avenue, Falmouth

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

FIGURE 12: ROUTE 28 FROM BOURNE ROTARY TO PALMER AVENUE

Palmer Avenue, Falmouth to Orleans Rotary

From Palmer Avenue in Falmouth, Route 28 is predominately two lanes to the intersection of Old Stage Road in Barnstable. Route 28 then transitions to four Lanes from Old Stage Road to Phinneys Lane in Barnstable and then predominately is two lanes from Phinneys Lane to the Orleans/Eastham Rotary. Portions of this route are more developed than others. The most developed and subject to congestion area is Hyannis. Congestion in this area is experienced year-round.

FIGURE 13: ROUTE 28 IN YARMOUTH

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 serves much of the Old Kings Highway Historic District and is designated as a state Scenic Byway.

FIGURE 14: ROUTE 6A CORRIDOR

Route 6A is a narrow and windy two lane road with little or no shoulder. One exception to this is the four-lane cross section in Orleans (which is not included in the Old Kings Highway Historic District). Because of the narrow shoulders, passing zones are limited and biking can be difficult. There are not any rest areas located on this corridor. Traffic congestion along the corridor is generally heavy during the summer however; the level of traffic varies greatly along the corridor.

Much of the Route 6A corridor is congested during summer peak hours. Recommendations from the Route 6A Corridor Management Plan (Cape Cod Commission, 2010) include the reduction of speed limits to 35 MPH and accommodation of alternate mode users such as pedestrians, bicyclists and public transportation users.

BRIDGES

Cape Cod Canal Bridges

The largest bottlenecks on Cape Cod occur at the canal bridges during the summer season. Cape Cod's bridges serve many important functions, one of which is to permit travel over waterways by automobile and along waterways by boat or barge, between Buzzards Bay and Cape Cod Bay. The Bourne Bridge and Sagamore Bridge permit vehicular travel over the Cape Cod Canal. If not for the canal bridges, vehicles would have to use a ferry to reach Cape Cod. Summer time delays at the canal bridges can sometimes be measured in hours.

FIGURE 15: CONGESTION AT THE BOURNE BRIDGE

The Bourne Bridge and Sagamore Bridge are both under the jurisdiction of the Army Corp of Engineers (ACOE). One or the other of the two highway bridges may have restrictions on lanes

and heavy vehicles during several weeks of the year to accommodate painting and structural maintenance activities. While avoiding the heavy summer traffic season, these lane closures have been observed to result in traffic backups of several hours.

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

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

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

Bridge condition information, provided by MassDOT is presented in Appendix P: Statewide Tables.

INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems (ITS) is an emerging aspect of infrastructure that has surfaced on Cape Cod. Along Route 6, permeant message boards display travel time to exits on the roadway. This information calculated using Bluetooth technology to calculate drive times. This information has been effective at reducing distraction and driver confusion by presenting valuable information to automobile drivers outside of content received by cellphones or GPS devices. The project began in 2012 with signage installed on Route 3 approaching Cape Cod and plans to be statewide in 2015.

FIGURE 16: TRAVEL TIME ITS

A second source of Intelligent Transportation Systems on Cape Cod is the use of remote counting stations. Currently there are seven stations maintained by MassDOT including Sagamore Bridge, Bourne Bridge, Route 6 East of Exit 5 in Barnstable, Route 3 at the Bourne/Plymouth Town Line, Route 28 East of Higgins Crowell Road in Yarmouth, and Route 28 West of Old Post Road in

Barnstable. A counter at Route 28 East of Main Street Cotuit in Barnstable was maintained by MassDOT but recently was discontinued. In addition to the MassDOT devices, the Cape Cod Commission Maintains three permeant counters at Route 137 at Route 39 in Harwich, Route124 at Queen Anne Road in Harwich, and Route 28 at Lumbert Mill Road in Barnstable. Each of these counting stations count vehicles using detectors installed in the pavement. Similar technologies use cameras to count cars, but this is not practiced on Cape Cod. This information is useful to planners in reflecting traffic patterns throughout the year and could redefine seasonal factors used in design, improve signal optimization or affect the priority of regional projects.

Other technologies that are emerging or integrated include assisted diving cars or signal priority for emergency vehicles. As new technologies their acceptance into infrastructure is changing the way people travel. Intelligent transportation systems in development or in practice nationally that have not been integrated on Cape Cod include infrastructure to support driverless cars, pavement that is responsive to weather changes, and signal priority for transit.

BUS INFRASTRUCTURE

INTERMODAL FACILITIES

Hyannis Transportation Center

FIGURE 17: HYANNIS TRANSPORTATION CENTER

The Hyannis Transportation Center was built in 2002 as a hub for Cape Cod's transportation needs. 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. Electronic 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.

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.

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

FIGURE 18: MACMILLAN PIER

MacMillan Pier and Bus Depot

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.

Falmouth Bus Depot

The Falmouth Bus Depot is located on Depot Avenue in Falmouth. The building itself used to be a railway station. After rail service to Woods Hole was suspended, the building was converted into a bus terminal. The facility is open 7 days a week, excepting holidays, from 5am to 5pm. Limited parking is available. The Falmouth Bus Depot serves as a destination for local transit and interregional bus service, and provides connections to various ferry terminals. Peter Pan service from Boston to Woods Hole stops at the Falmouth Bus Depot. Additionally, the RTA's Hyannis-Falmouth SeaLine service and the seasonal WHOOSH Trolley will make stops at the Bus Depot. These transit services provide connections to the ferry terminals at Woods Hole and Falmouth Marina. Beyond the available transit services, the Shining Sea Bike Path 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.

Woods Hole Steamship Authority Piers

The Steamship Authority piers in Woods Hole are also used as a bus terminal.

FIGURE 19: WOODS HOLE STEAMSHIP AUTHORITY PIERS

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, and food services. 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.

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. Tickets can be purchased inside Tedeschi and a portion of their parking lot is available for commuters.

FIGURE 20: SAGAMORE PARK-AND-RIDE LOT

Sagamore Park-and-Ride Lot

The Sagamore Park-and-Ride Lot is owned by MassDOT located by Interchange 1a in Bourne, near Routes 3 and 6. In early 2009, the lot was been expanded to a total of 396. 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.

Barnstable Park-and-Ride Lot

FIGURE 21: BARNSTABLE PARK-AND-RIDE LOT

The Barnstable Park-and-Ride Lot is a MassDOT owned facility located off Exit 6 of Route 6 in Barnstable. The lot was expanded to 365 parking spaces in August 2001. As part of the expansion, two new shelters were installed and currently appear to be in good condition. This lot has a ramp directly onto Route 6 westbound, making it convenient for motorists and buses. The Exit 6 facility is adjacent to amenities such as restrooms, food service, a convenience store, ATMs, fuel, and a seating area. The Barnstable Mobil Mart located inside is open 24 hours and sells tickets for interregional bus service. The Barnstable Park-

and-Ride Lot is used as a stop for the Plymouth and Brockton route from Hyannis to Boston and for the Peter Pan route from Hyannis to Providence. The CCRTA's Barnstable Villager service provides local bus service to the Route 132 entrance to the Park-and-Ride lot, with connections to Barnstable Village, Route 132, and Hyannis.

Harwich Park-and-Ride Lot

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

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.

Park-and-Ride Lot Usage

Data collected at Park-and-Ride locations are organized in the Figure 22 to show the capacity, average occupancy, and maximum occupancy for each of the lots from 1995-2013. The dark shaded bar graphs represent the capacity of each lot. The capacity has historically changed at the Barnstable and Sagamore Locations due to construction. The Barnstable location has grown from 225 spaces to 365 spaces from 1995-2013. The Sagamore Lot was reduced in 2005 due to the reconstruction of bridge access and then expanded in 2009 to accommodate 378 vehicles.

The average occupancy for each lot is shown by the lighter color on the bars. These data were collected in various samples during the summer months and shows inconsistent trends when comparing the data. The average occupancy does show that the Harwich lot averages fewer than 50 percent capacity for each year despite the removal of commuter bus service.

The maximum occupancy is shown by the red line located on or above the bar. A line located on the bar indicates that observations did not find a lot exceeding the capacity. A line located above the bar indicates that the lot did on occasion exceed capacity. Exceeding capacity would result in illegally parked cars. It can be noted that the Barnstable lot exceeded capacity 2011 and 2013, 2012 was observed at maximum capacity but not exceeding. The Sagamore Lot has not been observed to exceed capacity in the last ten years.

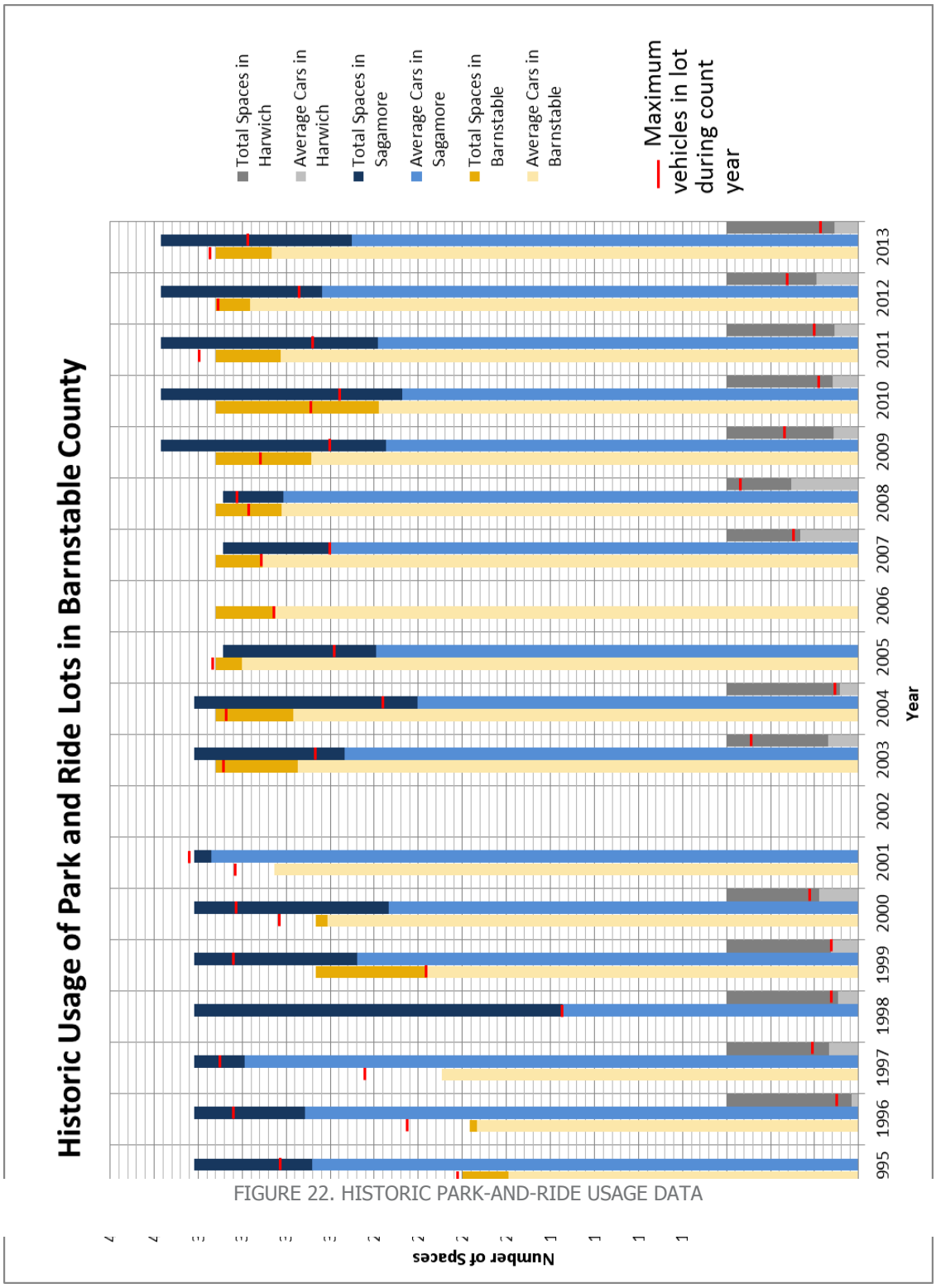

FIGURE 22. HISTORIC PARK-AND-RIDE USAGE DATA

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.

FIGURE 23: PLYMOUTH AND BROCKTON BUS

Plymouth and Brockton Street Railway Company

The Plymouth and Brockton Street Railway (P&B) was established in 1888, as a local service provider for the area. According to P&B, electric trolley cars carried passengers to and from work, and on weekend "joy rides." Following World War I, street railway tracks were abandoned and replaced by motor coaches throughout the South Shore. Plymouth and Brockton's final electric trolley run was made on June 28, 1928 between Jabez Corner and Kingston. The company was purchased by the Anzuoni family in 1948, who continue to operate and manage the Plymouth and Brockton Street Railway to this day. P&B serves 25 cities and towns from Boston to Cape Cod and is partially subsidized by the Massachusetts Bay Transportation Authority (MBTA), MassPort, and the Cape Cod Regional Transit Authority (CCRTA).

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 as shown on Table 1.

TABLE 1. PLYMOUTH AND BROCKTON OUTER CAPE BUS STOPS

STOP NAME	LOCATIONS
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

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). Buses terminate in Boston at Park Plaza, Logan Airport, and most frequently South Station. Total operations are reduced during the fall and winter to reflect the lower demand for travel.

TABLE 2. PLYMOUTH AND BROCKTON COMMUTER BUS STOPS

STOP NAME	LOCATIONS
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

Peter Pan and Bonanza Bus Lines

FIGURE 24: PETER PAN BUS

Bonanza Bus Lines was founded in 1955. 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. Additionally, Peter Pan has partnered with Greyhound to provide ticketing services, more connections and increased service. Currently, the Peter Pan Bus Lines network includes a 1,560-mile route system serving New England and beyond.

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. Service may be reduced in the winter to reflect reduced demand.

TABLE 3. PETER PAN WOODS HOLE TO BOSTON

STOP NAME	LOCATIONS
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. Service may be reduced in the winter in order to accommodate demand. Connections can be made at a number of stops along each route.

TABLE 4. PETER PAN HYANNIS TO PROVIDENCE

STOP NAME	LOCATIONS
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

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 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. Some Paratransit and Demand Response services are not operated directly by the CCRTA, but are contracted.

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. All CCRTA fixed route buses have bicycle racks, designed to carry two bicycles. In addition, all fixed route buses are wheelchair accessible and equipped with low floors, ramps or lifts. Service animals are the only animals allowed to board the buses.

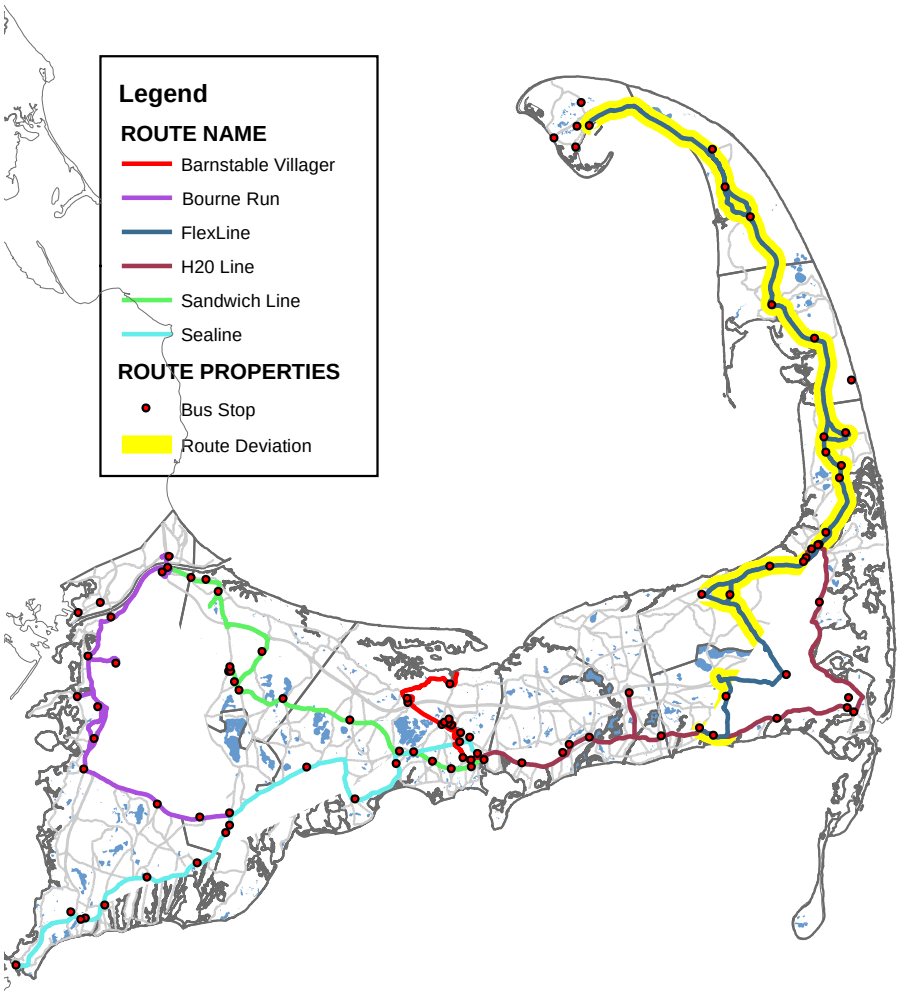

FIGURE 25: CAPE COD REGIONAL TRANSIT AUTHORITY SYSTEM MAP

Source: Cape Cod Regional Transit Authority

Hyannis-Falmouth Service: "SeaLine"

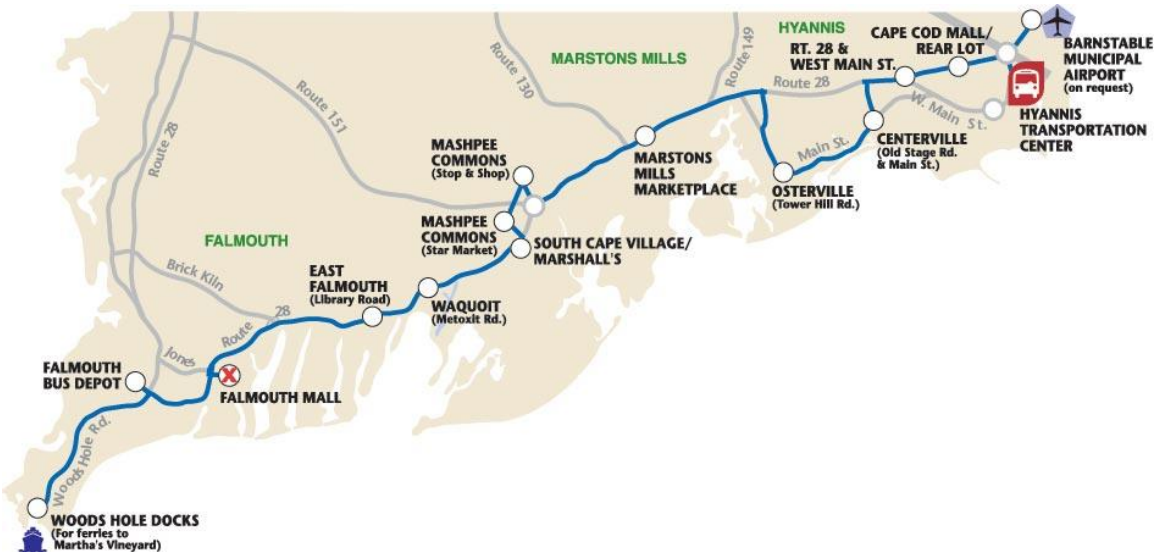

FIGURE 26: CCRTA SEALINE MAP

Source: Cape Cod Regional Transit Authority

The Hyannis-Falmouth service known as the SeaLine runs from the Hyannis Transportation Center to the Falmouth Mall on Route 28. Passengers can board the bus at any of the 10 designated stops, or flag the driver anywhere along the route to stop. The SeaLine operates round trips beginning at 5:30am and ending at 8:58pm. Some of the round trips feature stops that other do not and the number of trips are increased in the summer. Buses are schedule to run every 60 minutes, with a complete one-way trip taking one hour. During the summer months service operates 7 days per week. Outside of the summer months service operates Monday through Friday and reduced on Saturdays. Service may be reduced during the winter in order to reflect lower demand. The first two trips, made before 8:00am, skip the Centerville and Osterville stops, continuing straight down Route 28, and ending at the Steamship Authority Docks in Woods Hole. The SeaLine will also stop at the Barnstable Municipal Airport uponr equest. The SeaLine connects to the WHOOSH Trolley in Woods Hole and to most other lines at the Hyannis Transportation Center.

Hyannis-Orleans Service: "H2O"

FIGURE 27: CCRTA H2O MAP

Source: Cape Cod Regional Transit Authority

The Hyannis-Orleans service, also known as the H2O Line, runs from the Hyannis Transportation Center to the Stop and Shop on Routes 28/6A in Orleans. Passengers can board the bus at any of the 17 designated stops, or flag the driver anywhere along the route to stop. The H2O operates round trips beginning at 5:45am and ending at 8:50pm. Buses are scheduled to run about every hour, with the complete one-way trip taking 1 hour and 50. During the summer months the H2O operates seven days per week including holidays. Outside of the summer months the H2O operates Monday through Friday and reduced on Saturday. Service may be 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. Passengers riding the H2O can transfer to the Flex at four locations indicated by a red X on the map above in Harwichport and Orleans, and to most other lines at the Hyannis Transportation Center.

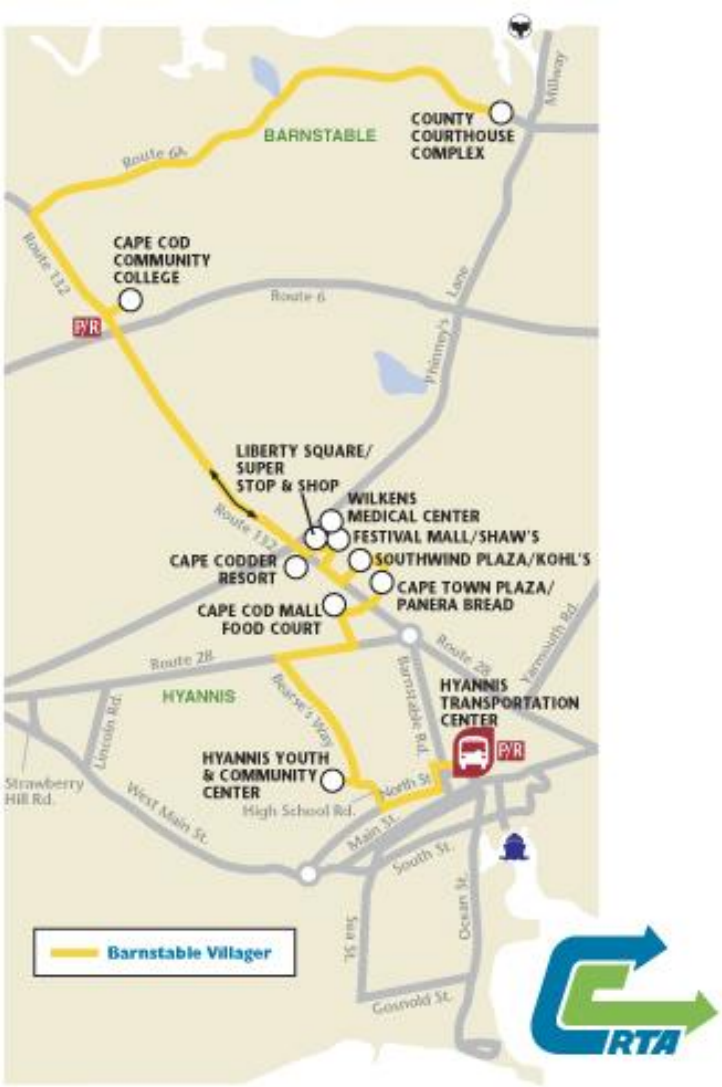

FIGURE 28: CCRTA BARNSTABLE VILLAGER MAP

Source: Cape Cod RTA

Barnstable Villager

The Barnstable Villager service runs from the Hyannis Transportation Center to the Barnstable County Complex on Route 6A and Barnstable Harbor. Passengers can board the bus at any of the designated stops, or flag the driver anywhere along the route to stop. The Barnstable Villager makes round trips, beginning at 7:30am and ending at 6:15pm. Buses are scheduled to run every hour, with the complete one-way trip scheduled to take 45 minutes. During the Summer Months the Villager operates seven days per week. Outside of the summer months service is offered Monday through Friday and reduced on Saturday. Service may be reduced during the winter in order to accommodate lower demand. The Barnstable Villager will stop at the Barnstable Municipal Airport upon request. Passengers riding the Villager can transfer to most other lines at the Hyannis Transportation Center.

Flexible Route Bus Service: "the Flex"

FIGURE 29: CCRTA FLEX MAP

Source: Cape Cod RTA

The Flex stretches from Harwichport to Provincetown. Along this route, the Flex picks up passengers at any of the designated stops. Of the designated stops, some are “Main Stops.” This means that the Flex bus always makes a stop, usually within five minutes of schedule. The remaining 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. In addition to the “Main Stops” and “In-Between Stops” passengers may flag the bus down along the main route, with the exception of portions along Route 6.

The bus can also “flex” off its route up to ¾ of a mile to pick up passengers who cannot reach a regular stop. Users must call the RTA at least two hours in advance in order to schedule a Flex bus pick up or drop off. The fare for a one-way “off-route trip” is $4. TTY service is available for the deaf or hearing impaired.

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.

Buses are scheduled to run every 30 minutes, with a one-way trip taking 2 hours and 15 minutes. Service is available Monday through Friday and reduced on Saturdays. Service may be reduced during the winter in order to reflect lower demand. Transfers are available to the Hyannis-Orleans Breeze and Plymouth and Brockton service.

Bourne Route

FIGURE 31: CCRTA BOURNE RUN MAP

Source: Cape Cod RTA

The Bourne Run operates from the Mashpee Commons to the Walmart in Wareham. Passengers can board the bus at any of the designated stops, or flag the driver anywhere along the route to stop. Buses are scheduled to run about every hour and a half, with the complete one-way trip taking 1 hour and 15 minutes. The Bourne Run operates Monday through Friday and reduced on Saturday. Service may be reduced during the winter in order to reflect lower demand. Passengers riding the Bourne Run can transfer to the Sealine at the location indicated by a red X on the map above in Mashpee, and to intercity buses in Buzzards Bay.

Sandwich Line

FIGURE 32: CCRTA SANDWICH LINE MAP

Source: Cape Cod RTA

The Sandwich Line operates from the Hyannis Transportation Center to Park and Ride Lot in Sagamore. Passengers can board the bus at any of the designated stops, or flag the driver anywhere along the route to stop. Buses are scheduled to run about every hour and a half, with the complete one-way trip taking 1 hour and 15 minutes. The Sandwich Line operates Monday through Friday and reduced on Saturday. Service may be reduced during the winter in order to reflect lower demand. Passengers riding the Bourne Run can transfer to the Sealine at the

location indicated by a red X on the map above in Barnstable, and to other CCRTA routes and intercity buses in Buzzards Bay.

Seasonal Services

Hyannis Shuttle

FIGURE 33: CCRTA HYANNIS SHUTTLE

The Hyannis Shuttle is the summer service from the Hyannis Transportation Center to several beaches in the Hyannis area. Passengers can board the bus at any of the designated stops, or flag the driver anywhere along the route to stop. The Hyannis Shuttle makes round trips, beginning at 11:00am and ending at 9:00pm. Buses operate 7 days per week including holidays starting late June and continuing through Labor Day. Passengers riding the Hyannis Shuttle can transfer to most other lines at the Hyannis Transportation Center.

Provincetown/Truro Shuttle

FIGURE 34: CCRTA PROVINCETOWN/TRURO SHUTTLE

The Shuttle serves Downtown Provincetown, Provincetown Airport, Race Point Beach, Herring Cove Beach, and North Truro. The Shuttle operates on a reduced schedule from 7:am to 12:30am Monday through Saturday and from 7:00am to 8:00pm on Sunday from Memorial Day to mid-June. During the summer, shuttles run every 30 minutes, between 7:00am and 12:30am seven days per week, including holidays. Passengers riding the Shuttle may board at designated stops or flag the bus down at any location along its route. Passengers also are able to transfer to the Flex bus for free at Dutra's Market in North Truro.

The WHOOSH Trolley

FIGURE 35: CCRTA WOOSH 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 designated stops, or flag the driver anywhere along the route to stop. During the summer, the WHOOSH Trolley operates between 9:30am and 7:30pm Sunday through Thursday and 9:30am till 10:00pm on Friday and Saturday, including holidays. Transfers are available to the Sealine at the Falmouth Mall.

Demand Response Bus Service

Demand response bus service 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, as requested.

Dial-A-Ride Transportation (DART)

The DART service is a demand response service that 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. If multiple passengers are being picked up or dropped off in the same location their trips will be grouped. For this reason, users must be flexible with their pick up and drop off times. If passengers do not show for a requested trip they are considered a "No-Show" and are subject to restrictions when scheduling their next trip. Repeat "No-Shows" could result in the loss of riding privileges.

The standard fare to ride the DART is $3.00. This rate is reduced for seniors and individuals with disabilities, and monthly passes are available. Many passengers use the DART to get to work or school, shopping trips, doctor's appointments, and even trips to medical centers in Boston.

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 specifically for individuals with disabilities. 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 on the day prior to the desired service.

ADA Paratransit 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.

Fully Funded and Councils on Aging

The CCRTA also helps transport passengers through contracting or funding bus service for other agencies. The buses are not operated by CCRTA staff, but were obtained through contract.

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 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 and every hour from 7:55am to 5:30pm. 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, disabled, students, and children. Monthly passes are also available.

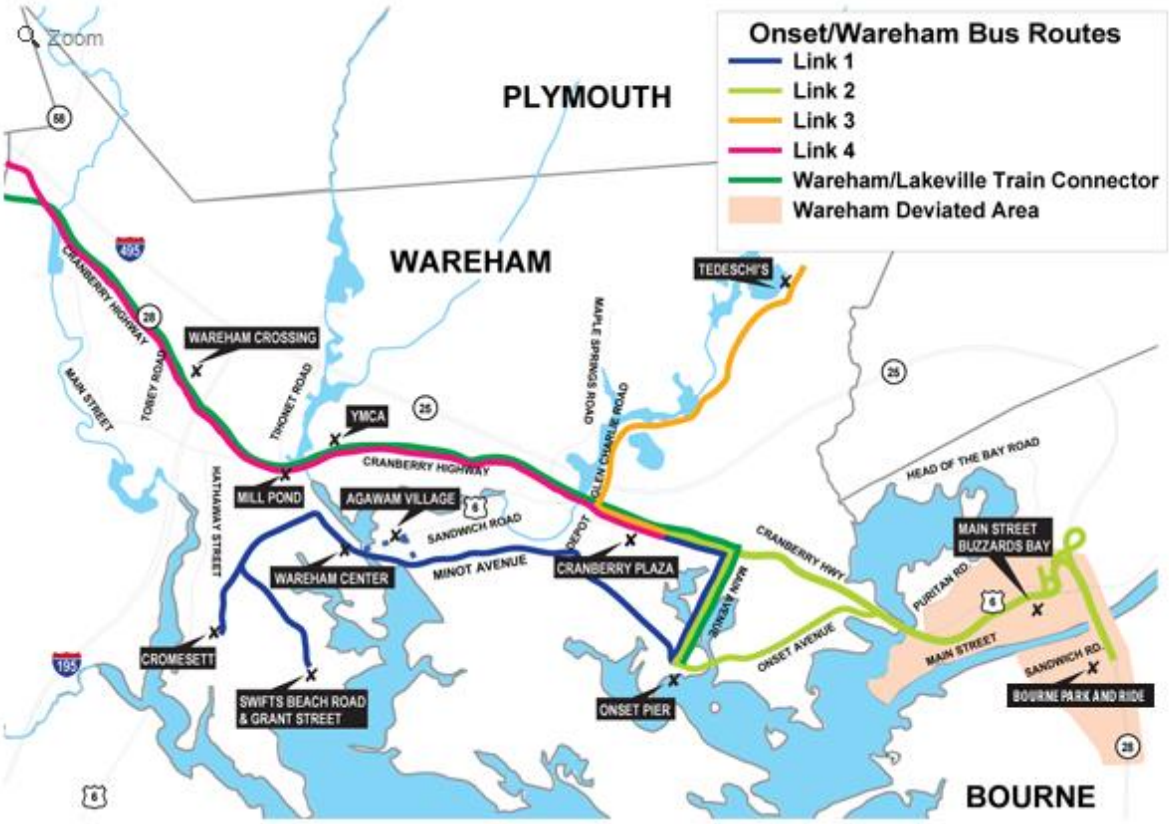

FIGURE 36: GATRA SERVICE IN BOURNE/WAREHAM/ONSET

Source: Greater Attleboro Taunton Regional Transit Authority

RAIL INFRASTRUCTURE

RAILS

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 visitor.

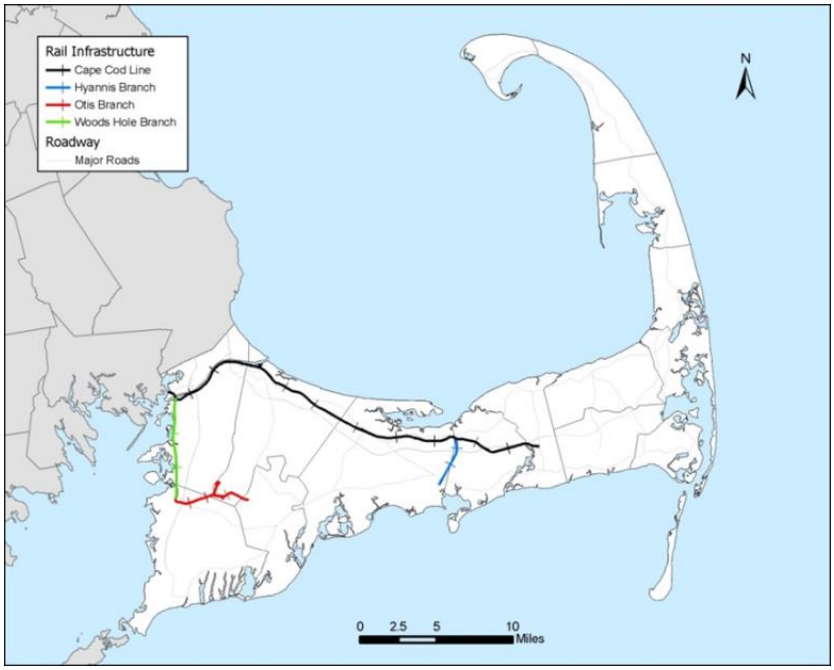

FIGURE 37: CAPE COD RAIL INFRASTRUCTURE

Rail infrastructure extended the entire length of Cape Cod, from Bourne to Provincetown, in the first half of the 1900s. Service was also available along the west coast, extending from Bourne to Woods Hole in Falmouth, and to Chatham. Today the expanse and usage of rail is reduced. Active rail still exists starting in Bourne and ending in three locations, Joint Base Cape Cod, Hyannis, and Yarmouth.

The portion of track that formally connected Dennis to Provincetown was dismantled. From Route 134 in Dennis to LeCount Hollow Road in Welfleet the former tracks were turned into the Cape Cod Rail Trail bicycle facility. From LeCount Hollow Road north the rail track right of way had various conversions including sale to private owners. An extension of the Rail Trail is planned to connect into Barnstable, using rail right-of-way from Route 134 in Dennis to an area to the east of Higgins Crowell Road in Yarmouth. Rail track in Falmouth, from Old County south to Woods Hole have also been converted to a bike path called the Shining Sea Bikeway in 1976.

The rail tracks that have remained in place have varied levels of usage. Figure 37 shows the location of existing rails and Table 5 details the mileage and percent of total. This data was obtained from the MassDOT roadway inventory file.

TABLE 5. CAPE COD RAIL MILEAGE BY CATEGORY

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

Cape Cod Line

The Cape Cod Line begins in Buzzards Bay, Bourne after it crosses over the Cohasset Narrows Bridge. The tracks pass the former train station in Buzzards Bay. This building is currently used by the Canal Area Chamber of Commerce, is a stop on the CapeFLYER summer service and the parking lot has varied users including inter-city bus passengers. There are currently two rail platforms at this location. Cape Flyer passengers use the short raised platform, and the longer ground level platform is considered obsolete because it is not handicap accessible.

FIGURE 38: CAPE COD CANAL RAIL BRIDGE

Immediately after passing the Buzzards Bay train station the train must cross the Cape Cod Canal over the Cape Cod Canal Railroad Bridge. The Cape Cod Canal Railroad Bridge was first built in 1910 during the construction of the Cape

FIGURE 39: FORMER RAIL STATION IN BUZZARDS BAY

Cod Canal. When the canal was reconstructed in 1933, a new railroad bridge was built over the widened waterway. Since the railroad grade could not be easily raised, the Army Corps of Engineers constructed a vertical lift railroad bridge. The new bridge was completed in December of 1935 and was the longest bridge of its kind at the time. Recently, the Cape Cod Railroad Bridge underwent a major rehabilitation effort, in large part through $25 million in Federal funds. Normally the bridge remains in the "up" position, 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 but can be managed to accommodate scheduled train service such as the Cape Flyer. The bridge is 806 feet long, 297 feet high and has a high water clearance of 136 feet. Rail improvement is scheduled for 2015 to decrease waiting time for crossing the bridge.

FIGURE 40: RAIL TRACKS WEST OF THE SAGAMORE BRIDGE

After Crossing the Cape Cod Canal the track splits between the Cape Cod Branch and Woods Hole Branch. The Cape Cod Branch follows the Cape Cod Canal and then runs alongside Route 6A through Sandwich and Barnstable. Out of service side tracks and former stations can be seen in West Barnstable and Sandwich. Plans to build a new platform for CapeFLYER passengers on the south side of the canal after the split were been presented in 2014. The Cape Cod Line continues to the Yarmouth "wye" (triangular junction) at Willow Street in Yarmouth. Here, the Hyannis Branch turns south, while the Cape Cod Line continues to the 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. Mass Coastal Railroad operates its "Energy Train" from this facility, usually one or two trips a day exporting solid waste to a waste-to-energy facility in Rochester, Mass. In total, the segment contains 3.38 miles of track, the grade separated crossing of Route 6, and 23 total roadway crossings.

FIGURE 41: RAIL CROSSING AT WILLOW STREET IN YARMOUTH

The last segment of the Cape Cod line is not in service. This segment starts at the Yarmouth Waste Management Facility east of Station Avenue and crosses the Bass River via a bridge. The Cape Cod Line used to continue all the way to Provincetown, with the Chatham Branch starting west of Route 124 in Harwich. However, the tracks were dismantled and a portion of the right-of-way was converted into the Cape Cod Rail Trail, which serves bicycle users and recreational purposes. Currently, however, the Cape Cod Line extends as far as Route 134 in Dennis. This final segment of track is out of service, abandoned, and not usable by train. Vegetation has encroached upon the rail tracks, crossing signals have been left in disrepair, and road crossings have been paved over. Plans for the westerly extension of the Rail Trail on a portion of this rail track through Yarmouth to Station Avenue have been designed are currently programed for construction in 2015.

FIGURE 42: RAIL TRACKS EAST OF GREAT WESTERN ROAD IN YARMOUTH

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

Hyannis Branch

The Hyannis Branch begins at the Yarmouth "wye" (triangular junction) 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 Cape Cod Central Railroad. A restaurant and a retail store now occupy part of the site. The terminus of the Hyannis Branch is a station for the Cape Cod Central. 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

FIGURE 43: RAIL PLATFORM AT THE HYANNIS TRANSPORTATION CENTER

connection were dismantled however, and the right of way converted into Old Colony Road. This segment has also been rated for 30 MPH travel. In total, the Hyannis Branch contains 4.39 miles of track, 2 grade separated crossings under Route 6, and 6 total roadway crossings. Currently the Hyannis Branch only serves passengers.

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. The track from Otis Junction to Joint Base Cape Cod is currently are owned by Mass Coastal Railroad but currently not in use by train. An out of service side track runs from Old Main Road to the Otis Junction. This portion of the Woods Hole Branch has been rated for 30 MPH travel. In total, the segment contains 8.43 miles of track, 2 bridges over waterways, 5 grade separated roadway crossings, and 17 total road crossings.

FIGURE 44: 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. Vegetation encroached upon the rail tracks and crossing signals have been left in disrepair, and road crossings have been paved. This section has been 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 Bike path.

FIGURE 45: RAIL TRACKS AT THE OTIS JUNCTION

Otis Branch

From the Otis Junction, the Otis Branch runs east into Joint Base Cape Cod. Inside the base, the track splits into several terminals, with one track running as far east as Mashpee. The track from Otis Junction to Joint Base Cape Cod is

currently used by Mass Coastal Railroad to export solid waste; this service is due to expire later this year. In total, the segment contains 10.51 miles of track, 3 grade separated roadway crossings, and 15 total roadway crossings.

ROAD CROSSINGS

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.

TABLE 6. RAILROAD CROSSING BY TYPE

		TOTAL	GRADE SEPARATED	GATED	SIGNALIZED	SIGNED	OTHER\ NONE
	Cape Cod Total	102	22	4	26	19	31
By Rail Line	Cape Cod Line	62	10	3	20	11	18
	Hyannis Branch	6	2	1	-	1	2
	Otis Branch	15	3	-	-	2	10
	Woods Hole Branch	19	7	-	6	5	1
By Owner	Federally Owned	13	4	-	5	3	1
	Army Corps of Engineers	15	3	-	2	-	10
	MassDOT	73	15	4	27	13	14
By Town	Barnstable	18	1	3	8	4	2
	Bourne	27	11	-	6	5	5
	Dennis	3	-	-	-	-	3
	Falmouth	6	4	-	1	-	1
	Mashpee	33	2	1	11	3	16
	Sandwich	15	4	-	1	6	4
	Yarmouth	7.8	14.5%				

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

AVIATION INFRASTRUCTURE

For Cape Cod travelers, air transportation provides an important link from Cape Cod to Boston, New York, and the islands of Martha's Vineyard and Nantucket. Six airfields and airports serve Cape Cod as a base for air transportation (see Table 7).

TABLE 7: AIRPORTS AND AIRFIELDS OF CAPE COD

NAME	FAA IDENTIFIER	FACILITY TYPE
Barnstable Municipal Airport	HYA	Scheduled Air Carrier Service
Provincetown Municipal Airport	PVC	Scheduled Air Carrier Service
Chatham Municipal Airport	CQX	General Aviation
Falmouth Airpark	5B6	General Aviation
Cape Cod Airfield	2B1	General Aviation
Cape Cod Coast Guard Air Station	FMH	Military

The commercial service airports, Barnstable Municipal Airport and Provincetown Municipal Airport, supply data on total enplanements to the Federal Aviation Administration (FAA). In 2013, Barnstable Municipal Airport reported 87,648 enplanements and Provincetown Municipal Airport reported 11,288 enplanements.[1]

[1] 2013 Air Carrier Activity Information System data

Barnstable Municipal Airport

FIGURE 46. BARNSTABLE MUNICIPAL AIRPORT TERMINAL

The largest airport on Cape Cod is Barnstable Municipal Airport, Boardman-Polando Field located in Hyannis. It is one of 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. 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. 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. 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.

FIGURE 47. BARNSTABLE MUNICIPAL AIRPORT

Recent improvements to the airport include a new 35,000 sq. ft. passenger terminal, a new 85 ft. air traffic control tower, and a new vehicle access road—all opened at the end of 2011—extensive parking facilities, new aircraft ramps and taxiways, a rescue and maintenance building and an aircraft fuel farm.

Barnstable Municipal Airport the airport is home to Cape Air, Nantucket Airlines, Island Airlines, and Rectrix Aviation along with other charter, corporate and general aviation aircraft operators. JetBlue operates daily service to JFK-New York in season.[2]

A 2014 state study found that the airport has a direct economic impact of $119.2 million a year on the Cape Cod community. The analysis, by the Aeronautics Division of the Massachusetts Department of Transportation, calculated the value of jobs, payroll and business generated by the airport and its tenants, along with visitor spending.

[2] http://www.town.barnstable.ma.us/airport/aboutairport/aboutairport.asp

The study found there is a measurable multiplier of an additional $88.7 million a year produced by the recirculation of money spent locally by airport businesses and the people employed there. Overall, the study determined that Barnstable Municipal Airport generates 2,135 jobs, an $85.3 million payroll and $208 million a year in direct and indirect benefits.[3]

Provincetown Municipal Airport

The Provincetown Municipal Airport also has scheduled air carrier service. The Airport provides passenger service to Logan Airport in Boston. The airport is located at the end of Race Point Road and is one of two airports in the country that is located in National Park territory. Cape Air and Jet Blue Airways operate passenger services.

FIGURE 48. PROVINCETOWN MUNICIPAL AIRPORT

Cape Cod Coast Guard Air Station

U.S. Coast Guard Air Station Cape Cod (ASCC), with its four MH-60T Jayhawk helicopters and three HC-144A Ocean Sentry fixed-wing aircraft, is the only Coast Guard Aviation facility in the northeast. As such, ASCC is responsible for the waters from New Jersey to the Canadian border. Centrally located at Joint Base Cape Cod, ASCC maintains the ability to launch a helicopter and/or fixed-wing aircraft within 30 minutes of a call, 365 days-a-year, 24 hours-a-day, and in nearly all weather conditions.[4]

Other General Aviation Airports

Several other airports are open to the public and offer general aviation service. Chatham Municipal Airport, located on George Ryder Road, offers a variety of tours around Monomoy Island and the Outer Cape. One asphalt runway provides service for the 31 aircraft based on the field.

Another general aviation airport is the Falmouth Airpark, located near Route 28 and Fresh Pond Road. The airpark has a single asphalt runway, which serves 53 aircrafts. A nearby "Fly-In Community," with aircraft access from the homes to the runway, offers shares of the Falmouth Airpark with residence.

Lastly, the Cape Cod Airfield on Route 149 and Race Lane in Marstons Mills provides tours. and glider rides from three turf runways. The length of the runways, the height of the nearby trees and the absence of a fence restrict the type of airplanes that can use the airfield. It opened as the Cape Cod Airport on July 4, 1929 with an air circus, stunt flights, parachute jumps, and other

[3] http://www.town.barnstable.ma.us/airport/aboutairport/aboutairport.asp
[4] http://www.uscg.mil/d1/airstacapecod/

spectacles. Currently, the airfield is operated by Cape Cod Flying Service and serves as a base for 14 aircrafts.

AIR SERVICE ACCESSIBILITY AND MOBILITY

Barnstable Municipal Airport is accessible by various means. According to the Cape Cod Transit Task Force Report, the vast majority airport users arrive by automobile. Rental car service is provided by over a dozen rental car agencies, with taxi service available as well. Moreover, the Villager Line of the Cape Cod Regional Transit Authority provides local bus service to the airport upon request, carrying passengers to the Hyannis Transportation Center and Barnstable Park-and-Ride lot. Paratransit service to the airport can also be arranged.

The roadways surrounding the Barnstable Municipal Airport have always provided a challenge in providing safe and convenient access for passengers. While the airport is near many regional roadways (ie. Route 132 and Route 28), getting from the regional roadways to the airport is not always straightforward. While recent signage improvements and resources online, see Figure 49, have assisted motorists, long-term improvements are needed. Such access improvements, particularly at the Airport Rotary, have been included in preliminary designs that were part of the Hyannis Access Study[5]. As funding decisions are made, it is critical to the regional air service that these improvements be seen as a priority for the region.

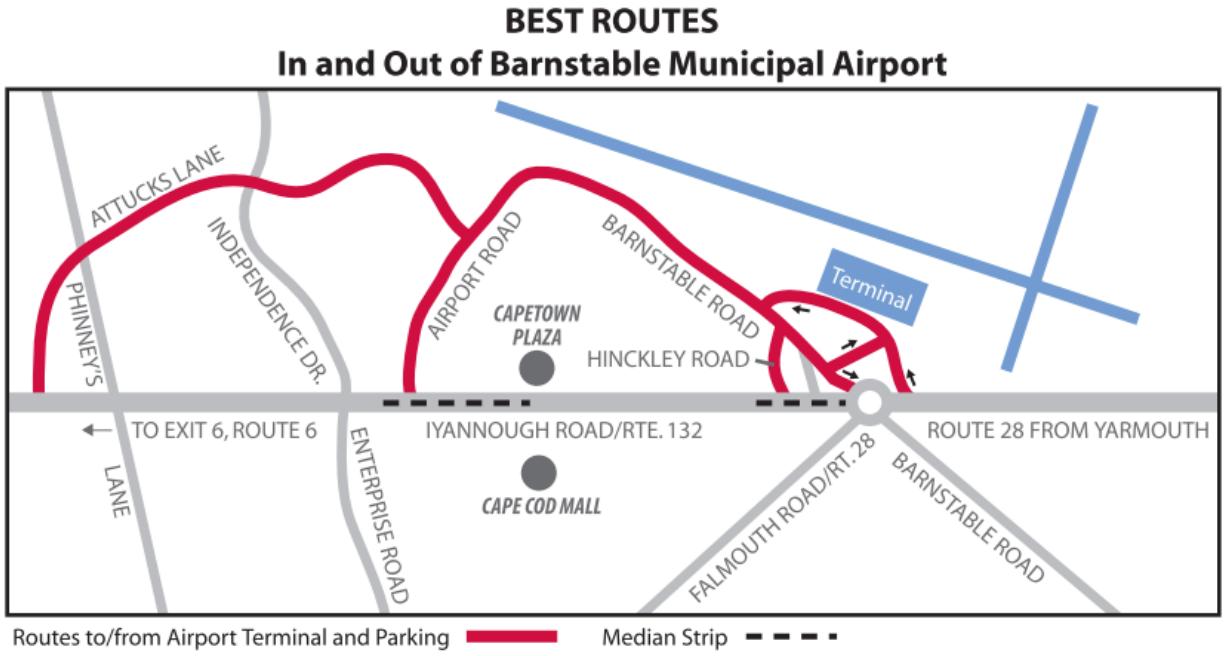

FIGURE 49. BARNSTABLE MUNICIPAL AIRPORT ACCESS

5 http://www.capecodcommission.org/resources/transportation/hyannisaccess/HASI_2013_final_report06282013.pdf

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.

Interregional bus service also links travelers on Cape Cod to air service in Boston. Plymouth and Brockton Street Railway Company runs 16 buses each weekday from the Hyannis Transportation Center to the terminals at Logan International Airport and 15 per day on weekends and holidays. This route includes stops at the Barnstable and Sagamore Park-and-Ride lots. By providing direct service to Logan International Airport, Plymouth and Brockton provides travelers with increased access to domestic and international air services. Peter Pan Bus Lines currently offer six daily buses from Bourne to T.F. Green Airport in Providence, RI.

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

MARTIME INFRASTRUCTURE

Cape Cod has approximately 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.

CAPE COD CHANNELS

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.Finally, in 1907, August Belmont purchased the charter to build the canal. Work began in June of 1909, and was completed in 1914 at 100 feet wide and 25 feet deep. The new toll seaway opened with great celebration, however small dimensions and low toll revenues dogged operations in the upcoming years.

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. The Cape Cod Canal was sold to the federal government for $11.5 million in 1921. Responsibility for the Cape Cod Canal was passed to the Army Corps of Engineers, who subsequently set out to improve it. The Corps began construction on an expanded canal in 1935 and completed the work by 1940. The existing canal is the result of this work.

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

state of the art Marine Traffic Control System, Marine Traffic Patrol by Corps vessels, and maintenance and improvement of the Canal channel and mooring basins.

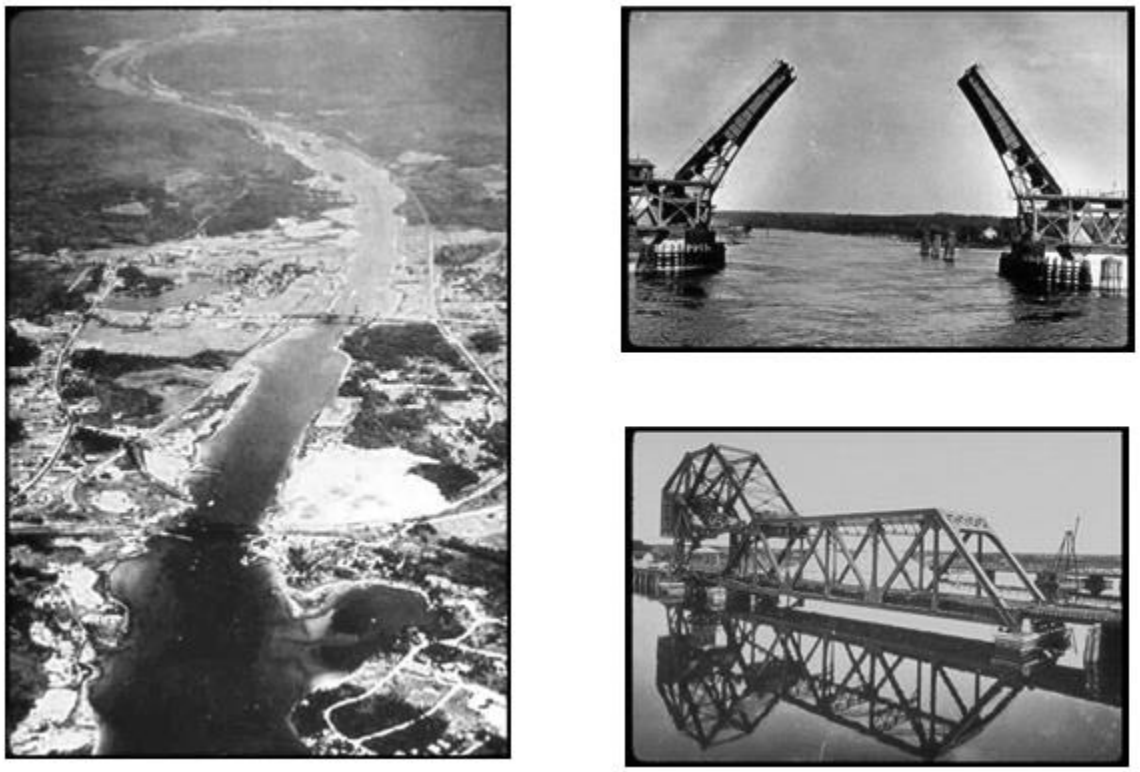

FIGURE 50. HISTORIC CAPE COD CANAL PICTURES

Source: U.S. Army Corps of Engineers

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

Woods Hole Channel

Woods Hole Channel connects ports and ferry terminals in Woods Hole Harbor to seaports in Buzzards Bay and Vineyard Sound and is the most heavily traveled Cape Cod waterway. 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 (see following figure). 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.

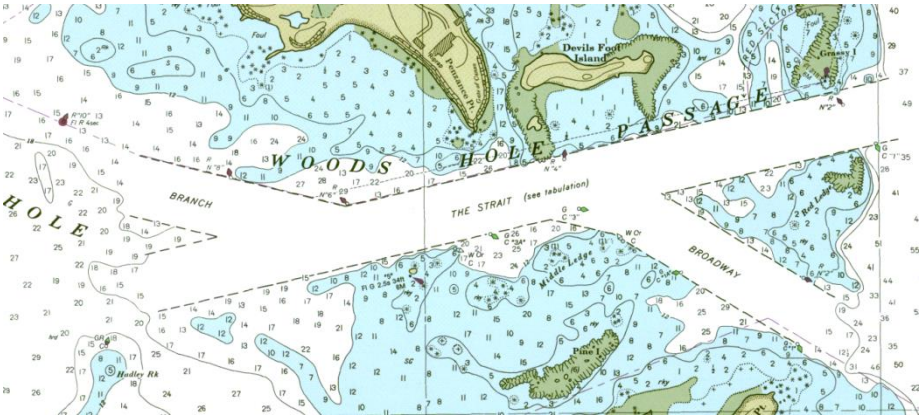

FIGURE 51. WOODS HOLE CHANNEL

Nantucket Sound Channels

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 (see following table). 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 (see following figure).

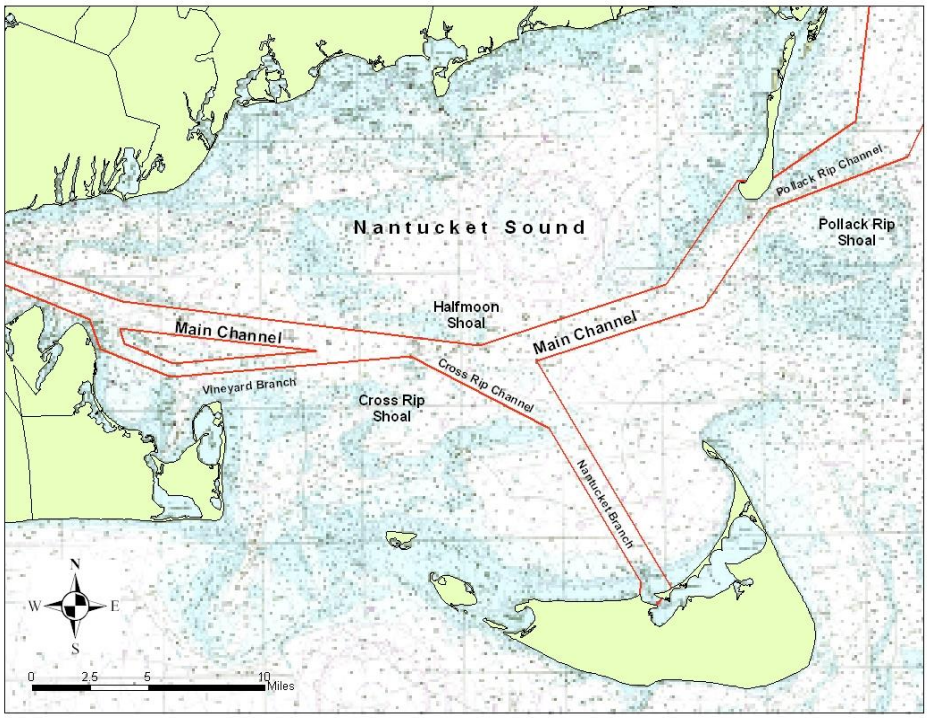

FIGURE 52. NANTUCKET SOUND CHANNELS

WATER TRANSPORTATION INFRASTRUCTURE

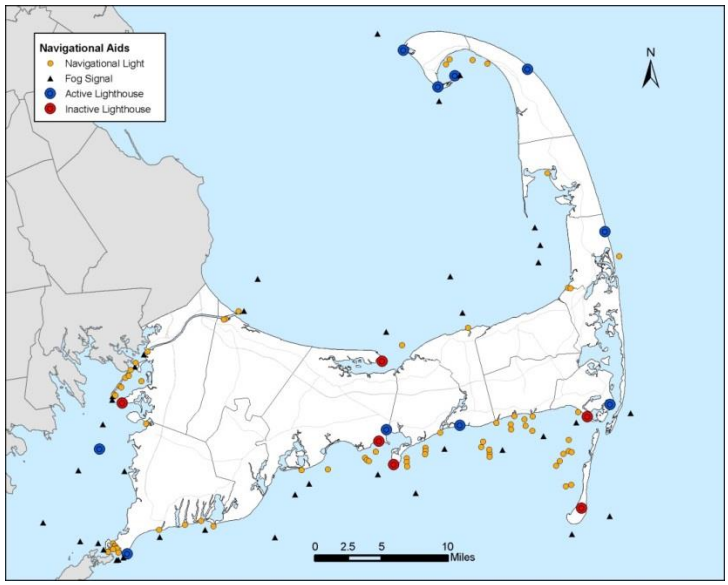

FIGURE 53. NAVIGATIONAL AIDS

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, as listed in the table below. 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. Cape Cod has 43 fog signals and 72 navigational lights in total.

TABLE 8: LIGHTHOUSES

LIGHTHOUSE NAME	TOWN
Nobska Light	Falmouth
Cleveland Ledge Light	In Buzzards Bay
Lewis Bay Light	Barnstable
West Dennis Light	Dennis
Chatham Lighthouse	Chatham
Nauset Light	Eastham
Highland Light	Truro
Race Point Light	Provincetown
Wood End Light	Provincetown

TABLE 9: NAVIGATIONAL LIGHTS AND FOG SIGNALS

	NAVIGATIONAL LIGHTS	FOG SIGNALS
Atlantic Ocean	1	4
Buzzards Bay	13	13
Cape Cod Bay	12	11
Nantucket Sound	46	15
Total	72	43

HARBORS

Charts of various ports shown in the following figures were produced by the National Oceanic and Atmospheric Administration's *Coast and Geodetic Survey*.

Woods Hole Harbor

Woods Hole Harbor is located in Falmouth. It is split into two harbors by Juniper Point: Great Harbor and Little Harbor (see following figures). Little Harbor is located in the 550,000 square feet of water between Juniper and Nobska Points. 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. 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.

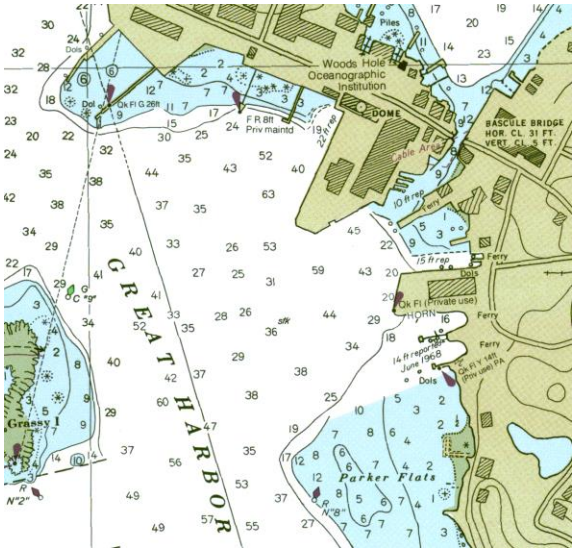

FIGURE 55: GREAT HARBOR IN FALMOUTH

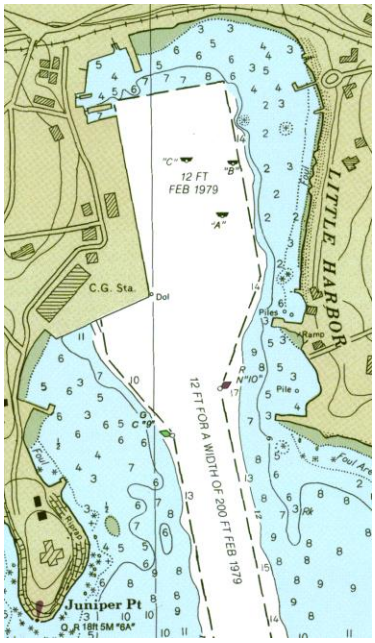

FIGURE 54: LITTLE HARBOR IN FALMOUTH

Hyannis Harbor

Hyannis Harbor in Barnstable consists of an outer harbor, a middle harbor (known as Lewis Bay), and an inner harbor (see following figure). 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.

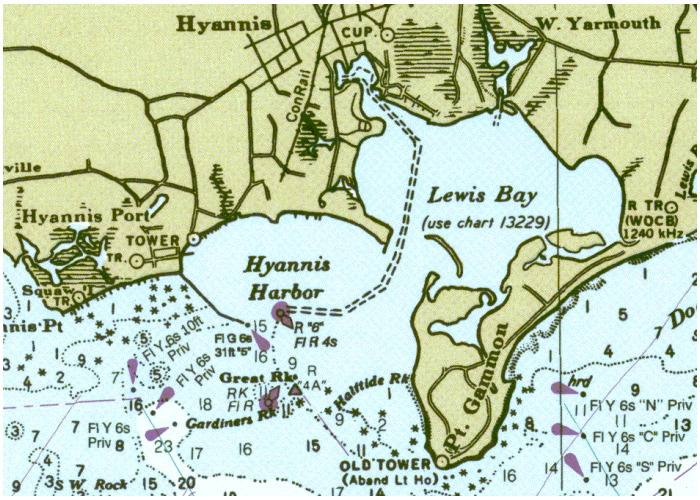

FIGURE 56: HYANNIS HARBOR

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 (see following figure). Local and state officials have discussed and rejected the expansion of the harbor to include a freight pier. According to a MassDOT report ("Identification of Massachusetts Freight Issues and Priorities," 1999), the narrow streets in Provincetown's historic district and the traffic congestion during peak hours make such a proposal unfeasible.

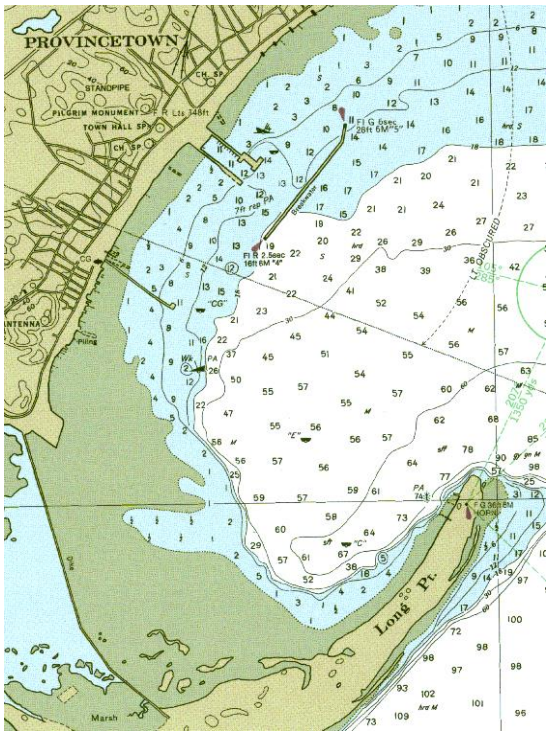

FIGURE 58: PROVINCETOWN HARBOR

Falmouth Harbor

Falmouth Harbor is located three miles east of Woods Hole, on the waterway between Falmouth Heights Road and Scranton Avenue. 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.

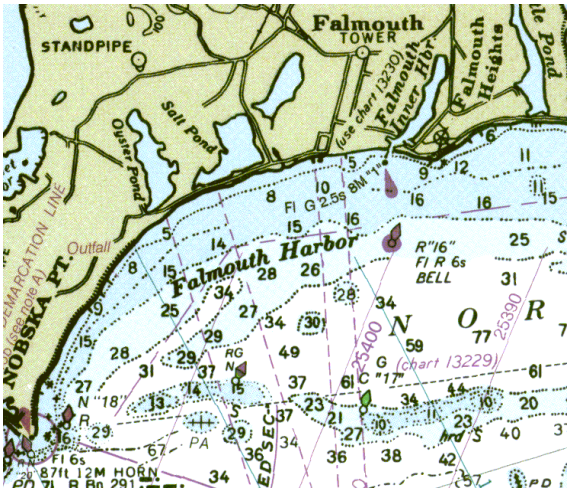

FIGURE 60: FALMOUTH HARBOR

Saquatucket Harbor (Harwichport)

Saquatucket Harbor in Harwich serves the Lower Cape (see following figure). 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. A private passenger ferry operates from this harbor to provide seasonal service to Nantucket.

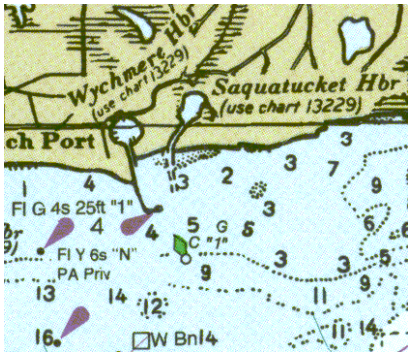

FIGURE 61: SAQUATUCKET HARBOR

Wellfleet Harbor

Wellfleet Harbor is located at the mouth of Duck Creek, just south of Wellfleet Center (see figure above). 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 o f 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.

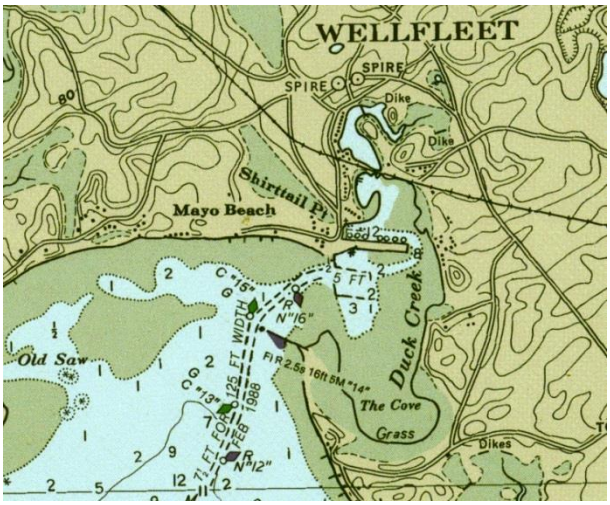

FIGURE 62: WELLFLEET HARBOR

Stage Harbor (Chatham)

Stage Harbor, located in Chatham, is one of the major seaports in the Lower Cape (see following figure). 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 63: STAGE HARBOR

Barnstable Harbor

Barnstable Harbor lies between Sandy Neck and the mainland of Cape Cod (see figure above). 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.

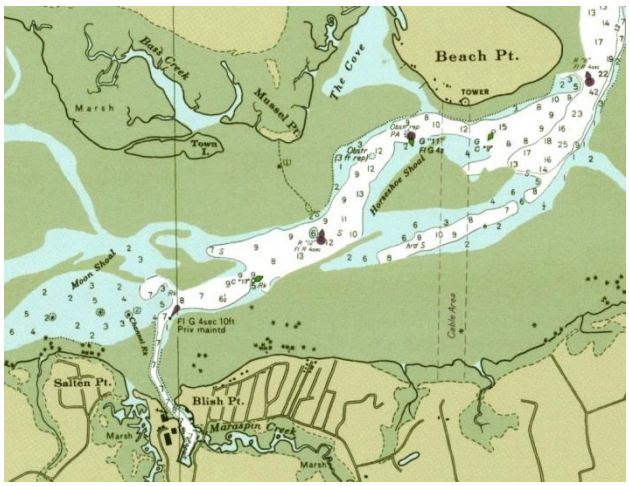

FIGURE 64: BARNSTABLE HARBOR

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. The marina primarily serves recreational and fishing vessels. 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 (see following figure).

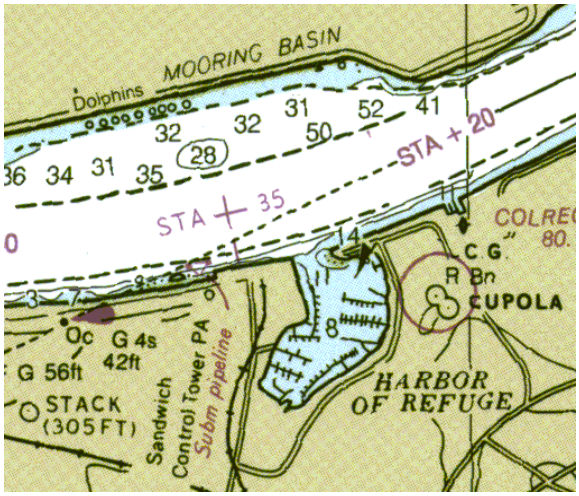

FIGURE 65: SANDWICH MARINA

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 (see figure above). 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.

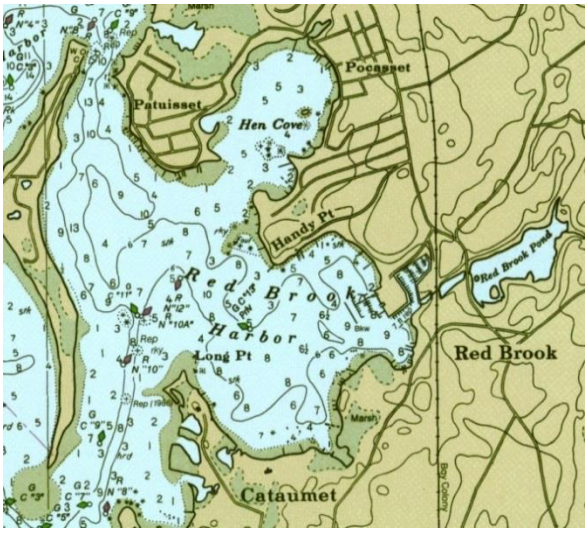

FIGURE 66: RED BROOK HARBOR IN BOURNE

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 (see following figure). 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.

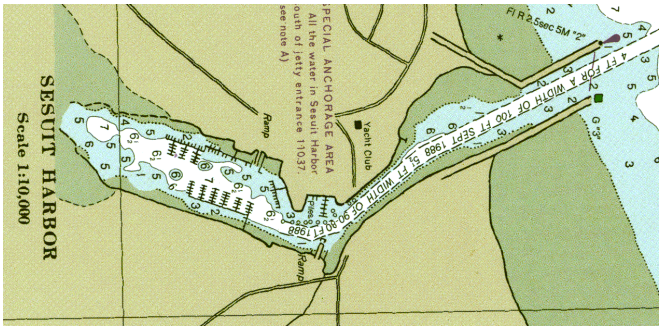

FIGURE 67: SESUIT HARBOR IN DENNIS

The nine ferry routes provide connection from Falmouth (Falmouth Harbor and Woods Hole), Hyannis (Hyannis Harbor), Provincetown (Fishermans Wharf), and Harwich Port (Squatucket Harbor) to Martha's Vineyard, Nantucket, Boston, and Plymouth.

BICYCLE AND AS A PEDESTRIAN INFRASTRUCTURE

There are numerous destinations and pathways for bicyclists and pedestrians to use on Cape Cod. Bicycle and pedestrian 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. Bicycle routes are roadways with wide shoulders that have been designated for bicycle use.

Pedestrians utilize shared use paths and sidewalks. Facilities of this type support village centers and local businesses, and encourage travelers to walk instead of driving. According to the Rails to Trails Conservancy, bicycle and pedestrian facilities can increase property values and make areas more attractive to new residents, businesses, and tourists.

The bicycle and pedestrian infrastructure of Cape Cod along with discussion of challenges those road users face in presented in Appendix F.

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CAPE COD COMMISSION

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