CAPE COD
COMMISSION

2016 REGIONAL TRANSPORTATION PLAN

Technical Appendix F: Bicycle & Pedestrian

Draft
June 15, 2015

COUNTY OF BARNSTABLE
MASSACHUSETTS

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Technical Appendix F: Bicycle & Pedestrian

Bicyclists and pedestrians while having a minimal impact on the environment are our most vulnerable users and the most in need of providing a safe transportation network. This appendix presents a discussion of crashes, road safety audits, pedestrian safety and planning studies, planning tools, and planning efforts related to bicycles and pedestrians on Cape Cod.

CAPE COD BICYCLISTS AND PEDESTRIANS

To varying degrees, all travelers at some point in their journey are pedestrians. This occurs in the short walking trip from a parked car to a destination (or from a parked bicycle or after disembarking from a bus).

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.

The U.S. Census Bureau provides information on means of transportation through the "American Community Survey" – the latest tabulation being available for 2006-2010. As presented in the Table 1, Provincetown had the largest number of people who commuted by bicycle (240) of any of the fifteen towns as well as the largest percentage (12.8%). Barnstable had the largest numbers of people walking to work (620) and Provincetown had the highest percentage (22.7%).

TABLE 1 – JOURNEY TO WORK BY TOWN - MEANS OF TRANSPORTATION

TOWN	BIKE TO WORK	WALK TO WORK	ALL WORKERS	PERCENTAGE BIKING	PERCENTAGE WALKING
Barnstable	80	620	22,535	0.4%	2.8%
Bourne	10	315	9,285	0.1%	3.4%
Brewster	75	160	4,630	1.6%	3.5%
Chatham	25	95	2,784	0.9%	3.4%
Dennis	0	155	6,105	0.0%	2.5%
Eastham	20	145	2,100	1.0%	6.9%
Falmouth	120	230	14,615	0.8%	1.6%
Harwich	0	75	5,270	0.0%	1.4%
Mashpee	0	85	6,905	0.0%	1.2%
Orleans	15	100	2,345	0.6%	4.3%
Provincetown	240	425	1,875	12.8%	22.7%
Sandwich	0	145	10,275	0.0%	1.4%
Truro	0	30	899	0.0%	3.3%
Wellfleet	0	135	1,603	0.0%	8.4%
Yarmouth	50	225	10,590	0.5%	2.1%
Barnstable County Totals	635	2,940	101,816	0.6%	2.9%

Source: U.S. Census Bureau, American Community Survey 2006-2010 Five-year estimates. (Workers 16 years and over).

VEHICULAR CRASH RECORDS

The following sections include discussions of vehicular crash records that include bicyclists or pedestrians.

BICYCLIST CRASH HISTORY

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. Bicyclist and Pedestrian crashes are shown in the figure on the following page.

Table 2 includes a town-by-town breakdown of bicycle-vehicle crashes for the years 2010-2012. With 61 reported crashes over the three-year period, Barnstable had the greatest number of bicyclist-vehicle crashes (Falmouth was second with 43 crashes). Staff has observed numerous cyclists along Route 28 (where many of the identifiable crashes occurred) during the summer season. Comments at public meetings indicate that many summer workers in use bicycling to commute to work – many of these workers originate from outside of the United States and may be less familiar with our customary safe bicycling practices such as riding in the direction of traffic while wearing a helmet.

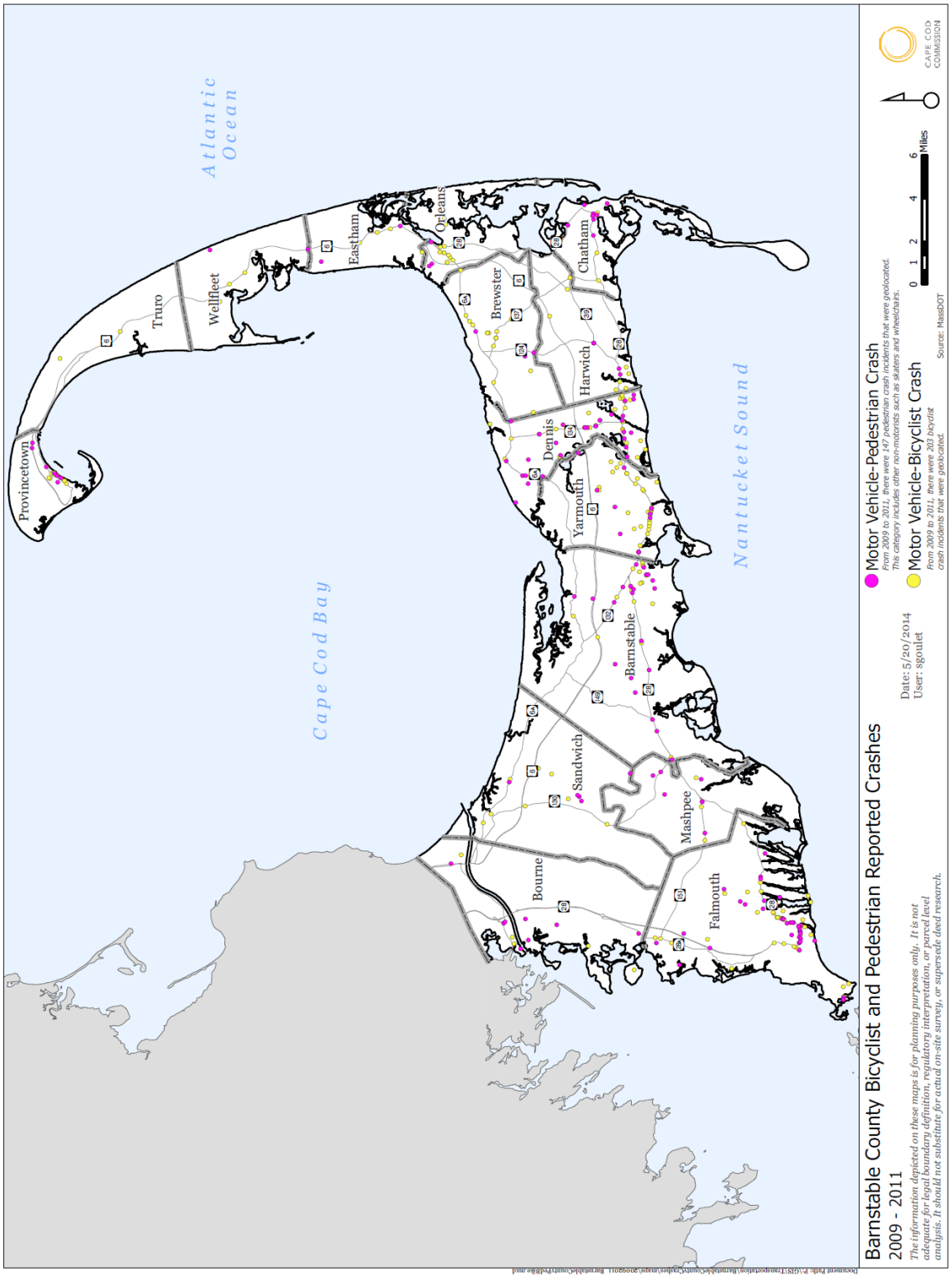

FIGURE 1 – BICYCLIST AND PEDESTRIAN VEHICULAR CRASHES

TABLE 2 - BICYCLIST-VEHICLE CRASH HISTORY (2010-2012)

TOWN	ALL CRASHES (3-YEAR TOTAL)	FATAL CRASHES (3-YEAR TOTAL)
Bourne	7	0
Sandwich	8	0
Falmouth	43	0
Mashpee	4	0
Barnstable	61	1
Yarmouth	35	0
Dennis	35	0
Harwich	8	0
Chatham	4	0
Brewster	17	0
Orleans	13	0
Eastham	12	0
Wellfleet	5	0
Truro	3	0
Provincetown	9	0
Total	**265**	**1**

(Source: MassDOT)

PEDESTRIAN – VEHICULAR CRASHES

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. Table 3 showns the number of vehicle-pedestrian crashes for each town. Falmouth had the highest number (52) of crashes reported from 2010 to 2012. 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., safe pedestrian crossings at intersections) resulting in the high crash history.

TABLE 3 – PEDESTRIAN-VEHICLE CRASH HISTORY (2010-2012)

TOWN	ALL CRASHES (3-YEAR TOTAL)	FATAL CRASHES (3-YEAR TOTAL)
Bourne	13	1
Sandwich	15	1
Falmouth	52	2
Mashpee	16	0
Barnstable	45	3
Yarmouth	17	1
Dennis	33	2
Harwich	2	0
Chatham	5	0
Brewster	1	0
Orleans	5	0
Eastham	3	0
Wellfleet	7	0
Truro	0	0
Provincetown	19	1
Total	**233**	**11**

(Source: MassDOT)

ROADWAY SAFETY AUDITS – BICYCLE/PEDESTRIAN RECOMMENDATIONS

Since 2007 there have been eighteen Road Safety Audits (RSAs) completed for locations throughout Cape Cod. The Audit process is overseen by MassDOT and brings together community officials and others in an intensive review of high-crash locations' operational and geometric deficiencies. Each audit includes a review of traffic and crash information, an onsite field review. The following sections provide an overview of the bicycle and pedestrian safety recommendations from the audits.

BARNSTABLE ROAD SAFETY AUDITS

There have been six completed audits within the town of Barnstable since 2007:

Iyannough Road (Route 132) at Cape Cod Community College/Cape Cod Conservatory Intersection

Completed in 2014, the audit includes recommendations to improve bicyclist and pedestrian safety:

- Provide advance warning signage notifying motorists along Route 132 of the upcoming crosswalk.
- Install an accessible ramp on the western side of the Route 132 crosswalk.
- During intersection improvements, include accommodations for bicyclists such as widened shoulders or bike lanes on Route 132.
- Consider creating an accessible and well-lit unpaved path from Route 132 to Community College Parking Lot #2 to shorten walking distances between the college and the Park and Ride Lot; if warranted consider installation of a crosswalk on Route 132 on the northern leg of the Route 6A westbound ramps intersection to provide access to the path.

Route 28 at Osterville-West Barnstable Road

Completed in 2012, the audit includes recommendations to improve bicyclist and pedestrian safety:

- Upgrade bicycle and pedestrian accommodations with future maintenance and/or reconstruction efforts.
- Consider adding an island with the left turn lanes for a break in bicycle/pedestrian crossing of Route 28.

Iyannough Road (Route 28) at Yarmouth Road

Completed in 2012, the audit includes recommendations to improve bicyclist and pedestrian safety:

- Consider the feasibility/appropriateness of providing bicycle accommodations at the intersection (i.e., shared lanes and/or within a 4-foot shoulder, bicycle detection at signals, signage, and pavement markings) in accordance with the 2006 Project Development and Design Guide.

- As part of the design process and long-term planning efforts, include a Route 28 bicycle/pedestrian crossing to connect the future extension of the Cape Cod Rail Trail through the intersection.
- Evaluate the feasibility and safety benefits of providing pedestrian accommodations at the Route 28/Yarmouth Road intersection, including crosswalks, accessible ramps, and pedestrian signal indications, and providing a connection between the intersection and the existing sidewalks on Camp Street and Yarmouth Road south of Route 28.

Previous Barnstable Road Safety Audits

Audits listed below have been summarized in previous Regional Transportation Plans and are listed for convenience. Copies of Road Safety Audits are available from the Cape Cod Commission website at:

www.capecodcommission.org/safety

- Meetinghouse Way (Route 149)/Route 6 Ramps (2010)
- Route 28 (Falmouth Road)/Bearses Way (2009)
- Route 28 in Barnstable – Lane Departure Safety Audit (2007)

BOURNE ROADWAY SAFETY AUDITS

There have been two completed audits within the town of Bourne since 2012:

Route 28 between Bourne Rotary and Otis Rotary

Completed in 2013, the audit includes recommendations to improve bicyclist and pedestrian safety:

- As part of long-term reconstruction efforts, consider providing pedestrian and bicycle accommodations, such as the planned shared-use path parallel to Route 28.
- Consider pedestrian/bicycle crossing infrastructure in conjunction with the proposed Route 28 parallel shared-use path.

Sandwich Road at Cranberry Highway

Completed in 2012, the audit includes recommendations to improve bicyclist and pedestrian safety:

- Provide improved accommodation for pedestrians and bicyclists through roadway improvements or maintenance efforts.

DENNIS ROADWAY SAFETY AUDIT

The audit listed below has been summarized in a previous Regional Transportation Plan and are listed for convenience. Copies of Road Safety Audits are available from the Cape Cod Commission website at:

www.capecodcommission.org/safety

- Route 134 at the Route 6 Ramps (2009)

EASTHAM ROADWAY SAFETY AUDIT

Route 6 and Governor Prence Road

Completed in 2012, the audit includes recommendations to improve bicyclist and pedestrian safety:

- Consider a pedestrian beacon north of the intersection at the information booth.
- Discussion included the need for a sight distance measurement, and the possibility of a median in the vicinity to slow traffic at the Route 6 crossing.
- Consider improved bicycle/pedestrian accommodation when reconstruction for Route 6, or the intersection, is being considered.

MASHPEE ROADWAY SAFETY AUDITS

Mashpee has had three audits completed since 2007:

Nathan Ellis Highway (Route 151) at Old Barnstable Road Intersection

Completed in 2014, the audit includes recommendations to improve bicyclist and pedestrian safety:

- Realign the crosswalk on the northern leg to be parallel with Route 151; modify curbing on island to accommodate wheelchair users and meet ADA requirements.
- Replace pedestrian signal push buttons with APS vibro-tactile buttons (to accommodate senior residents.
- Schedule regular street sweeping to remove sand and debris from wheelchair ramps.
- Re-apply crosswalk markings.
- Consider construction of a crosswalk on Old Barnstable Road's southern leg to accommodate pedestrians traveling between the trailer park and the high school.
- During corridor-wide improvements, construct pedestrian and bicycle accommodations to the west of the intersection.

Previous Mashpee Road Safety Audits

Audits listed below have been summarized in previous Regional Transportation Plans and are listed for convenience. Copies of Road Safety Audits are available from the Cape Cod Commission website at:

www.capecodcommission.org/safety

- Great Neck Road North/Old Barnstable Road (2009)
- Route 130 Lane Departure Road Safety Audit (2007)

SANDWICH ROAD SAFETY AUDITS

Since 2009, two safety audits were completed in Sandwich. The audits listed below have been summarized in a previous Regional Transportation Plan and are listed for convenience. Copies of Road Safety Audits are available from the Cape Cod Commission website at:

www.capecodcommission.org/safety

- Cotuit Road/Harlow Road/South Sandwich Road (2009)
- Route 6: Major Highway Median Cross-Over Crashes (2009)

YARMOUTH ROAD SAFETY AUDITS

There have been two audits completed since 2010 in Yarmouth.

Route 6A – Willow Street to Union Street

Completed in 2013, the audit includes recommendations to improve bicyclist and pedestrian safety:

- Investigate adding additional signage to alert motorists to crosswalks throughout the RSA corridor.
- Repaint existing crosswalks and consider upgrading crosswalk to "piano key" design.
- Trim trees to increase visibility of crosswalks.
- Review appropriateness of sidewalk locations and relocate as needed (would require full ADA compliance for new crosswalks).
- Work with business owner at the Village Store to redesign site access using good access management principles.
- Evaluate the existing street lighting and the potential for additional street lighting, particularly for improved pedestrian safety.
- Investigate installing textured pavement crosswalks or raised crosswalks in select locations understanding that they would require special approval and careful considerations of all safety impacts.
- Relocate utility poles behind sidewalks and add curbs where needed.
- Consider geometric changes to the roadway such as bump outs to slow drivers down.
- Implement targeted police enforcement to address speeding and crosswalk compliance issues.
- Install gateway treatments to visually identify the heart of the village for drivers and consider additional streetscape improvements to create a village feel to cue in drivers that they are entering a more populated and pedestrian oriented area.

Previous Yarmouth Road Safety Audit

The audit listed below has been summarized in a previous Regional Transportation Plan and is listed for convenience. Copies of Road Safety Audits are available from the Cape Cod Commission website at:

www.capecodcommission.org/safety

- Old Townhouse Road/Forest Road (2010)

CAPE COD COMMISSION'S LOCATION-SPECIFIC SAFETY STUDIES

The Cape Cod Commission has completed several location-specific safety studies. The following is a summary of the locations that were studied and highlights of recommended safety improvements. Full reports are available on the internet:

www.capecodcommission.org/safety

WELLFLEET: ROUTE 6 SAFETY STUDY

This study, published in 2012, focused on four locations along Route 6:

- LeCount Hollow Road
- Cove Road
- Main Street

The study mainly focused on reducing vehicular conflict with general recommendations to evaluate bicycle and pedestrian accommodations.

DENNIS: ANALYSIS OF HIGH-CRASH LOCATIONS IN DENNISPORT

This study, published in 2012, focused on two locations in town:

- Upper County Road at Depot Street
- Main Street (Route 28) at Sea Street

The study mainly focused on reducing vehicular conflict with general recommendations to evaluate bicycle and pedestrian accommodations.

PREVIOUS CAPE COD COMMISSION LOCATION-SPECIFIC SAFETY STUDIES

The following studies have been summarized in a previous Regional Transportation Plan and are available on the Cape Cod Commission website at:

www.capecodcommission.org/safety

2009 Transportation Safety Report

- Eastham: Eastham Rotary
- Truro: Truro Central School Zone
- Provincetown: Route 6/Shank Painter Road

2008 Transportation Safety Report

- Eastham: Route 6/Brackett Road
- Sandwich: Route 6/Route 130 (Exit 2)

2006 Transportation Safety Report

- Bourne: Route 28 Otis Rotary
- Harwich: Route 137/Route 39
- Orleans: Route 6A/Route 28

BICYCLE AND PEDESTRIAN PLANNING

Bicycles are a low cost, non-motorized form of transportation. Bicycle infrastructure and facilities require smaller right-of-ways and less overall investment than roadways. There are three basic types of bicycle infrastructure: paths, lanes, and routes. Paths generally have their own separated right-of-way and follow certain standards for width, grade, and accessibility. Bicycle lanes are separate lanes within roadways marked for bicycle use. There are currently no bicycle lanes on Cape Cod. Bicycle routes are roadways with wide shoulders that have been designated for bicycle use. Pedestrians can access shared use paths and sidewalks. Pedestrian facilities support village centers and local businesses, and encourage travelers to walk instead of driving. According to the Rails to Trails Conservancy, bicycle and pedestrian facilities can increase property values and make areas more attractive to new residents, businesses, and tourists.

This report includes descriptions of the Cape's existing bicycle and pedestrian infrastructure, introduces tools for bike route planning, and a section of strategies to improve biking on Cape Cod.

The Commission is currently involved in bicycle/pedestrian planning efforts with several Cape Cod communities. It is anticipated that recommendations from these studies will yield projects for inclusion in the Regional Transportation Plan. Summaries of some of these efforts are included in this report.

A major transportation planning effort is underway by the Cape Cod National Seashore in partnership with the Cape Cod Commission. The effort includes outreach throughout Barnstable County to key stakeholders. One result is an "Integrated Bicycle Plan for Cape Cod/Bicycle Feasibility Study" released in 2010 and forms the basis of recommended projects included in this chapter.

As an overall framework, the following figure represents an overall vision for bicycle path connections to and within Cape Cod. The segments shown in green represent existing bicycle paths. Orange line segments represent generalized routes; detailed alignments are to be defined. This figure represents the Cape Cod Commission's vision for expansion of the Cape's bicycle path infrastructure.

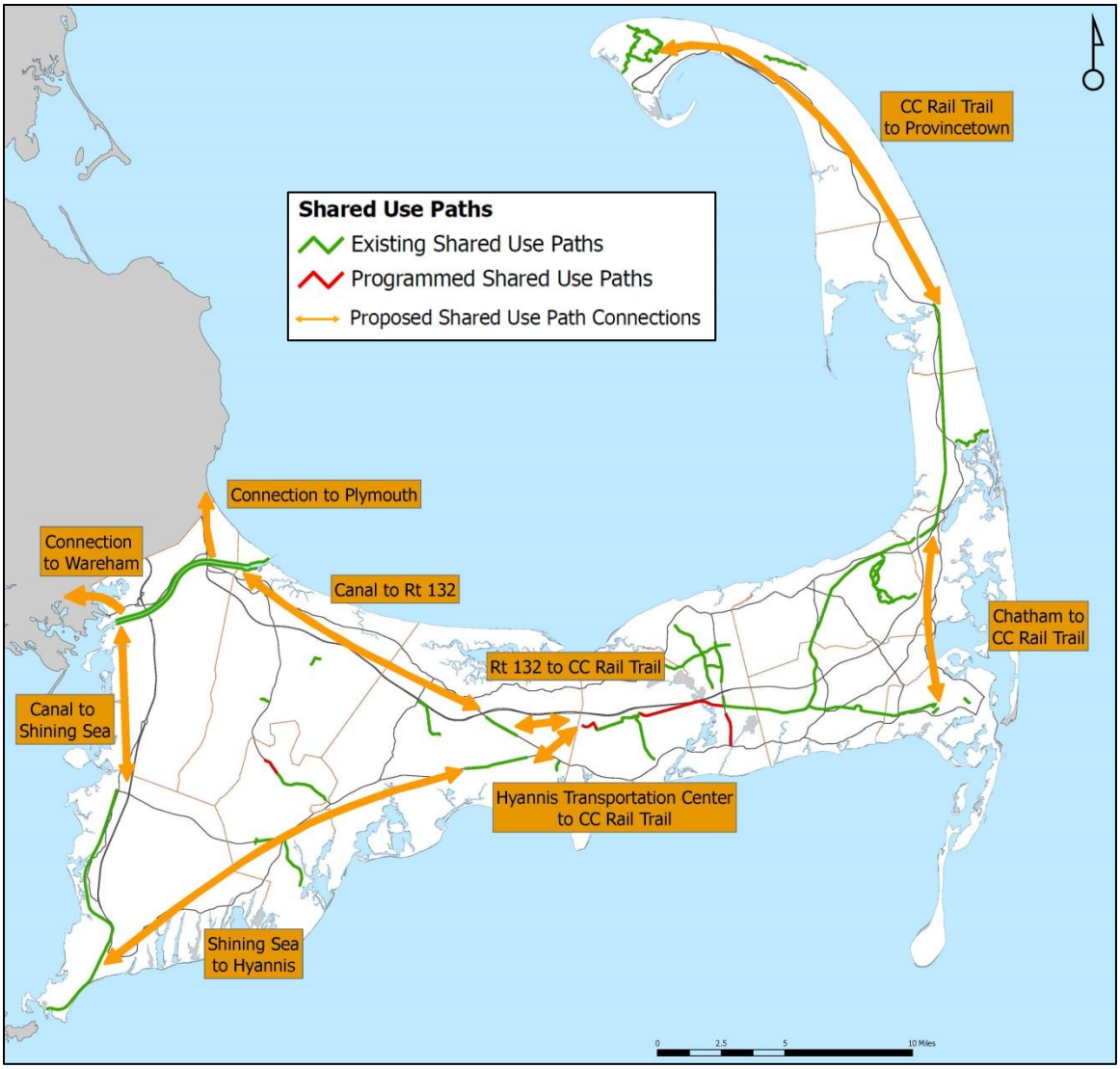

FIGURE 2 - SHARED USE PATH VISION MAP

The following subsections include text, figures and tables that define and describe the bicycle and pedestrian infrastructure of Cape Cod. This information forms the baseline of the existing system and helps planners identify gaps and opportunities to improve bicycling and walking on Cape Cod.

MULTI-USE PATHS

There are currently 91 miles of paved multi-use paths on Cape Cod.

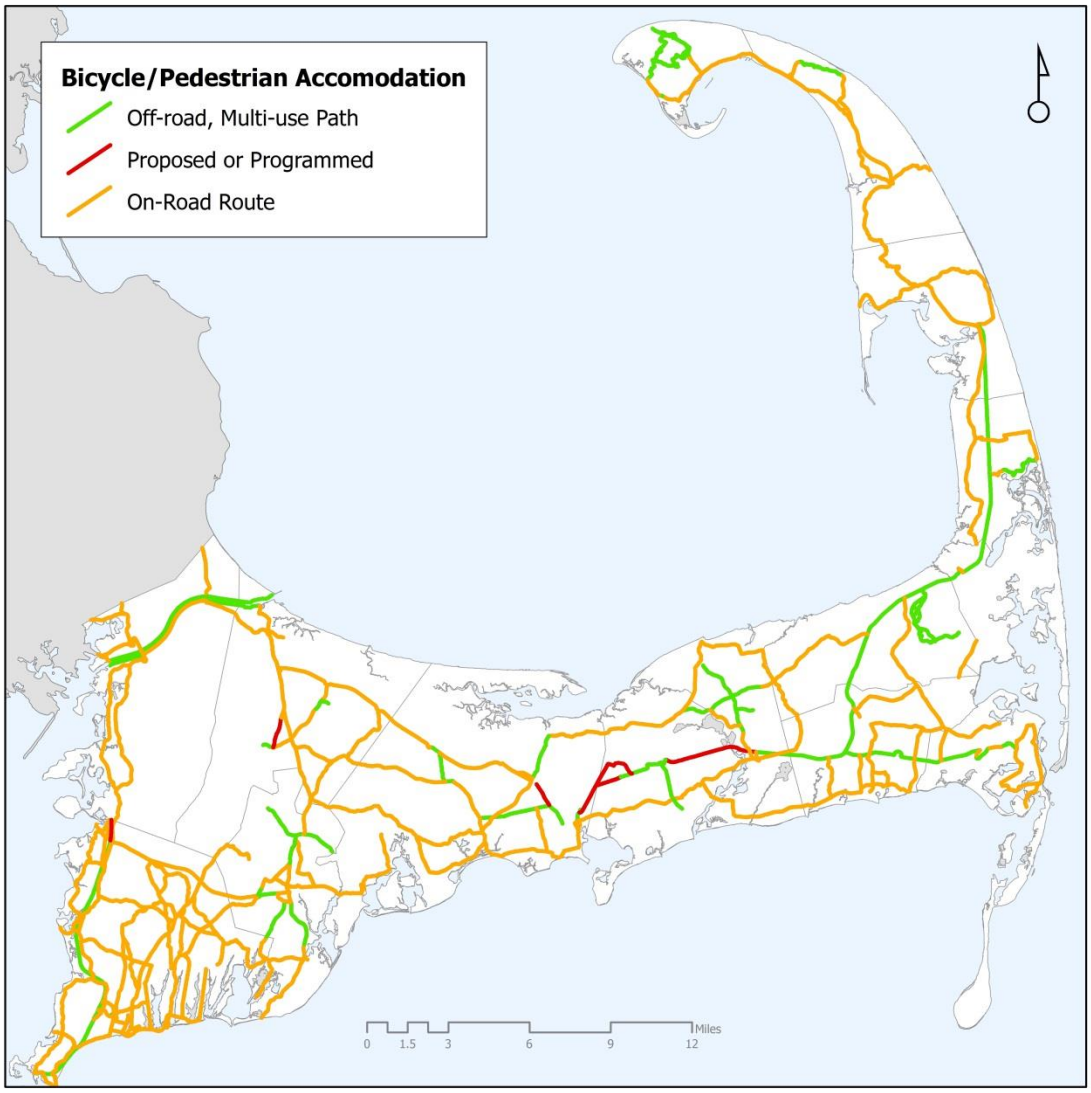

FIGURE 3 – MULTI-USE PATHS AND ROUTES ON CAPE COD

A multi-use path is a paved right of way, separate from roadways. A multi-use path (sometimes referred to as a bicycle path) is not a sidewalk. According to the American Association of State Highway and Transportation Officials (AASHTO), bicycle paths should have a paved surface 8-

10 feet wide, with a 4 inch wide center line. Shoulders of 2-feet should be placed on either side of the path, with signage placed no closer than 3 feet from the pavement. The cross slope of a bicycle path should be no more than 2%. Bicycle paths must also meet other standards for grading, accessibility, and roadway crossings that conform to AASHTO guidelines. There are many bicycle paths throughout Cape Cod. Some serve recreational needs, while others serve transportation needs.

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 completed around 2004 along the out-of-service Chatham Branch rail right-of-way. A bicycle roundabout was constructed at the intersection of the Rail Trail and the Harwich-Chatham extension. Currently, the main line of the Rail Trail is under renovation. The Rail Trail has been repaved and widened, graded to include a grassy shoulder and more amenities around 2007. A further extension of the Rail Trail from Route 134 to Peter Homer Park in Yarmouth is currently programmed in the TIP for FY 2015 (a crossing of the Bass River is included in the TIP for FY 2016). Continuation of the Rail Trail to Route 132 in Barnstable is programmed in the TIP for FY 2017. A further extension to the Hyannis Transportation Center is also under consideration and is a key recommendation of the Yarmouth Road Corridor Study Task Force.

The trail is currently 10 feet wide. The main line is 21.9 miles long, with 45 roadway crossings. The Harwich-Chatham Extension is 6.2 miles long with 15 roadway crossings. DCR estimates that 400,000 people use the rail trail annually. In addition, the rail trail is occasionally used for emergency vehicles. Given its length and location, the Cape Cod Rail Trail can be used to commute within the Lower and Outer Cape.

FIGURE 4 - CAPE COD RAIL TRAIL CROSSING AT MAIN STREET, HARWICHPORT

FIGURE 5 - CAPE COD RAIL TRAIL AT BRACKETT ROAD, EASTHAM

FIGURE 6 - HARWICH-CHATHAM RAIL TRAIL EXTENSION AT THE HARWICH-CHATHAM TOWN LINE

FIGURE 7 - END OF THE HARWICH-CHATHAM RAIL TRAIL EXTENSION AT CROWELL RD., CHATHAM

FIGURE 8 - BICYCLE ROUNDABOUT ON THE CAPE COD RAIL TRAIL, HARWICH

Cape Cod Canal Bike Paths

The Cape Cod Canal Bike Paths run along both sides of the Cape Cod Canal. The Army Corps of Engineers owns and maintains the paths as frontage roads for the Cape Cod Canal. Both sides have benches and sitting areas, and are lit at night. The southern-side path is 6.5 miles long, 8 feet wide and has 2 roadway crossings. The mainland-side path is 7 miles long, 8 feet wide and has 7 roadway crossings.

FIGURE 9 - SOUTHERN-SIDE OF THE CANAL BICYCLE PATH, EAST OF SAGAMORE BRIDGE

FIGURE 10 - MAINLAND-SIDE OF THE CANAL BICYCLE PATH, EAST OF RAILROAD BRIDGE

FIGURE 11 - SHINING SEA BICYCLE PATH AT TER HUEN DRIVE, FALMOUTH

FIGURE 12 - SHINING SEA BICYCLE PATH AT PALMER AVE., FALMOUTH

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. The bike path has been extended northward over a series of phases to its current terminus at County Road (Route 151). The trail is currently 10.6 miles long.

Provincelands Trails and Herring Cove Beach Path

The Provincelands Trails are the set of trails at Race Point in Provincetown. They provide a path from near Route 6 to the Provincetown beaches and the Provincetown Municipal Airport. Travelers primarily use the Provincelands Trails for recreation and not to commute. The paths were built in the 1960s before bicycle path standards were developed. As a result they have many steep slopes, sharp curves and other hazards. Bicycle traffic is restricted to 10 MPH travel for safety. The Provincelands Trails are owned by the Cape Cod National Seashore. There are a total of 7.6 miles of bicycle paths, with a paved surface 8 feet wide, and 4 roadway crossings.

The Herring Cove Beach Path serves as a connection between the Herring Cove Beach parking lot and Province Land Road in Provincetown. There is also a connection to the Provincelands Trails through the parking lot. The Herring Cove Beach Path is 0.1 miles long, 8 feet wide, and has no roadway crossings.

FIGURE 13 - PROVINCELANDS TRAIL AT THE RACE POINT VISITORS CENTER, FACING WEST

Setucket Road and Dennis Paths

Several paths exist in Dennis, creating a network for bicyclists and pedestrians. The longest path runs along Old Bass River Road from just south of Bob Crowell Road. The portion south of Mayfair Street is designated as Bicycle Route 1, part of the Claire Saltonstall Bikeway. The Old Bass River Road Path is 3.1 miles long, 8.5 feet wide, and contains 18 roadway crossings. Another nearby path is the Setucket Road Path, which begins in Yarmouth at Route 6A and ends west of Airline Road. The path crosses Route 134 and Old Bass River Road. The western section of path, until Mayfair Road, is also designated as Bicycle Route 1. The Setucket Road Path is 3.2 miles long, 8.5 feet wide, and contains 19 roadway crossings. The third path in Dennis is located on Old Chatham Road between Old Bass River Road and Route 134. The Old Chatham Road

Path is 0.7 miles long, 8.5 feet wide, and contains 1 roadway crossing. All of these paths are owned and maintain by the Town of Dennis except for the section of path in Yarmouth, which is owned and maintained by that town. They provide a network of bicycle transportation for residents of Dennis. In total, these three paths are 7.0 miles long, and contain 38 roadway crossings.

FIGURE 14 - SETUCKET ROAD PATH EAST OF NORTH DENNIS ROAD, LOOKING EAST

FIGURE 15 - SETUCKET ROAD PATH EAST OF NORTH DENNIS ROAD, LOOKING WEST

Nickerson State Park Trails

Several bicycle paths are located within Nickerson State Park in Brewster. These paths are used for recreation, offering a scenic ride through the park. They are owned by the Massachusetts Department of Environmental Management. There are a total of 6.8 miles of bicycle path, with six roadway crossings.

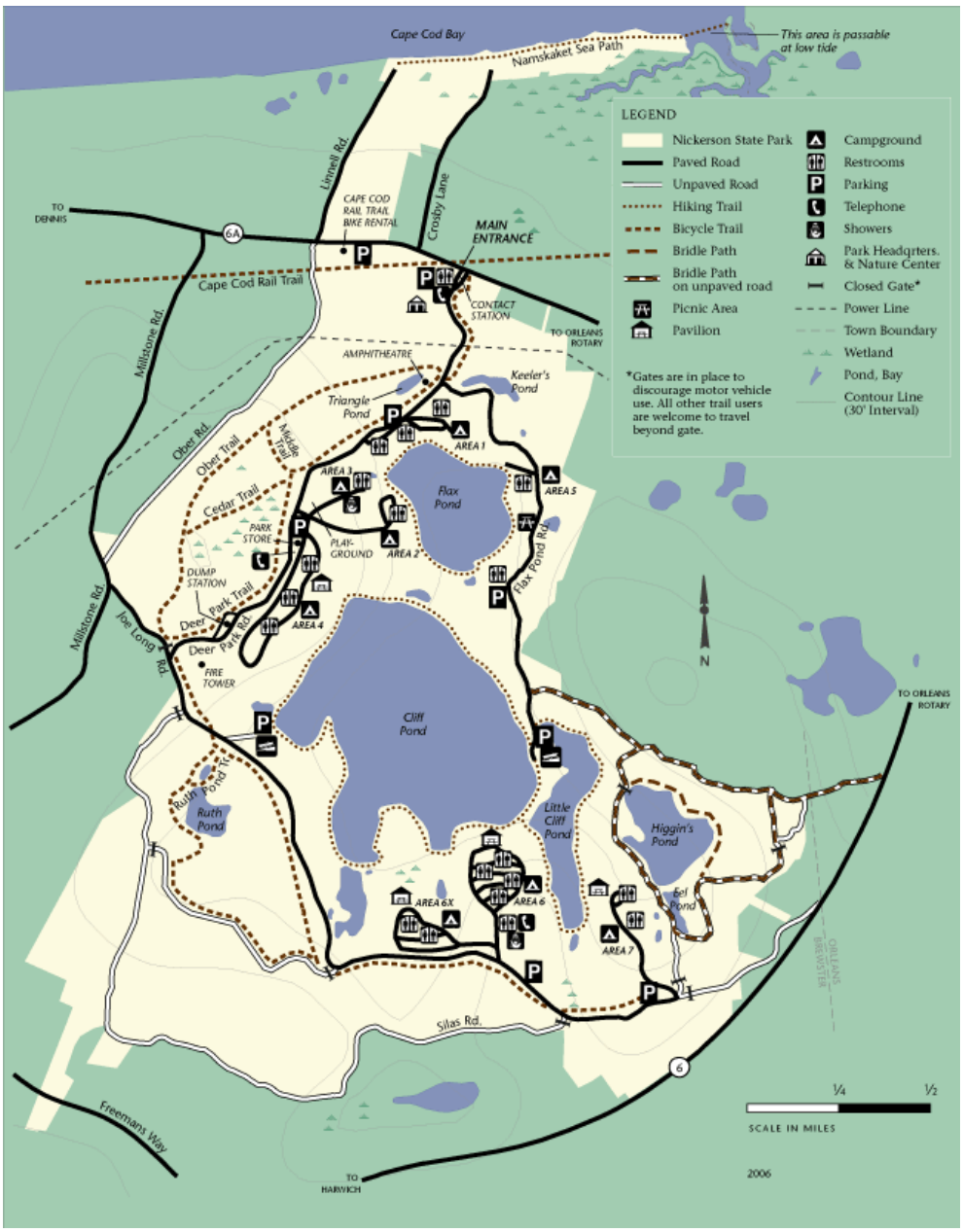

FIGURE 16 - MAP OF NICKERSON STATE PARK TRAILS
(Source: Massachusetts Department of Conservation and Recreation)

Nauset Trail

The Nauset Trail is located at the Cape Cod National Seashore in Eastham. It begins at Route 6 and the Salt Pond Visitors Center and runs to Coastguard Beach. A connection to the Cape Cod Rail Trail can be made via Bicycle Route 1. The Nauset Trail is owned by the Cape Cod National Seashore and used primarily for recreation. The Nauset Trail is 1.9 miles long, 8 feet wide, and has six roadway crossings.

FIGURE 17 - NAUSET TRAIL FROM THE SALT POND VISITOR'S CENTER LOOKING EAST

FIGURE 18 - NAUSET TRAIL FROM COASTGUARD BEACH PARKING LOT IN EASTHAM

Head of the Meadow Trail

The Head of the Meadow Trail is located in Truro in the Cape Cod National Seashore. It runs from Head of the Meadow Road to High Head Road in Pilgrim Heights. The trail is owned by the Cape Cod National Seashore. It is used primarily for recreational purposes. The Head of the Meadow Trail is 1.9 miles long, 8.5 feet wide, and has no roadway crossings.

FIGURE 19 - HEAD OF THE MEADOW TRAIL AT HEAD OF THE MEADOW ROAD, TRURO

Route 28 Path

The Route 28 Path runs along Route 28 in Barnstable from Bearses Way to Old Stage Road. The path was constructed in 1980 by the Town of Barnstable as a safe route to the middle and high schools. However, some sections of the path have not been designed to bicycle path standards, with narrow pavement, insufficient shoulders, and inadequate roadway crossings. The path is used primarily for commuting, as it connects residences, businesses, schools and other points of interest. The Route 28 Path is 2.5 miles long, 8 feet wide, and has 28 roadway crossings.

Route 130 Path

The Route 130 Path runs along Route 130 from Heritage Memorial Park to just north of Route 28 in Mashpee. The path is owned by the town of Mashpee. The Route 130 Path is 2.4 miles long and has 11 roadway crossings.

FIGURE 20 - LOOKING NORTH ON ROUTE 130 BICYCLE PATH AT LOVELLS LANE, MASHPEE

FIGURE 21 - LOOKING SOUTH ON ROUTE 130 BICYCLE PATH AT LOVELL'S LANE, MASHPEE

Old Townhouse Road Trail

The Old Townhouse Road Trail runs from near Station Avenue, along Old Townhouse Road, behind the Bayberry Hills Golf Course, to Higgins Crowell Road in Yarmouth. Currently, the Rail Trail Extension Feasibility Study being performed by the towns of Yarmouth and Dennis is looking at using the Old Townhouse Road Trail right-of-way to connect the Rail Trail to Hyannis and the Claire Saltonstall Bikeway. The Old Townhouse Road Trail is 2 miles long, 8 feet wide, and has three roadway crossings.

FIGURE 22 - OLD TOWNHOUSE ROAD PATH EAST OF WEST YARMOUTH RD., YARMOUTH

FIGURE 23 - OLD TOWNHOUSE ROAD PATH WEST OF WEST YARMOUTH RD., YARMOUTH

FIGURE 24 - OLD TOWNHOUSE ROAD PATH AT THE BAYBERRY GOLF COURSE IN YARMOUTH

FIGURE 25 - OLD STAGE ROAD PATH AT THE SERVICE ROAD IN BARNSTABLE

Old Stage Road Path

The Old Stage Road Path begins at Route 149 in Barnstable, continues along the Service Road, and then turns down Old Stage Road. The path ends at Oak Street, where travelers can continue by sidewalk to Route 28 and Centerville shopping areas. The path was constructed in the early 1980s and is owned by the Town of Barnstable. It is used for both recreation and commuting, connecting West Barnstable and Centerville. The Old Stage Road Path is 1.9 miles long, and has six roadway crossings.

Forest Road Path

The Forest Road Path was built alongside Forest Road in 2006. It runs from Old Townhouse Road to Winslow Gray Road in Yarmouth. Continuing south on Forest Road, users can reach South Yarmouth and Route 28. Although terminating at Old Townhouse Road, the Forest Road Path does not directly connect with the trail there. The Forest Road Path is 1.4 miles long, 8.5 feet wide, and has 8 roadway crossings.

FIGURE 26 - FOREST ROAD PATH, LOOKING NORTH

FIGURE 27 - FOREST ROAD PATH, LOOKING SOUTH

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 4 - BICYCLE PATH MILEAGE BY PATH

Path Name		Length in Miles	Width in Feet	Number of Roadway Crossings
Cape Cod Canal Bike Path	*Mainland*	7.0	8	7
	Cape Cod	6.5	8	2
	Total	13.6	8	9
Cape Cod Rail Trail	*Main Path*	21.8	8.5 / 10	45
	Harwich-Chatham Ext.	6.9	8.5	15
	Total	28.7	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		1.3	-	1
Route 28 Path		2.6	8	28
Setucket Road and Dennis Paths		7.0	8.5	38
Shining Sea Bikeway		10.6	8.5	16

Hyannis Transportation Center Path

The Hyannis Transportation Center Path runs from Route 28 in Barnstable to Main Street Hyannis. The trail was built during the construction of the Hyannis Transportation Center in 2002. The Hyannis Transportation Center Path is 0.4 miles long and has three roadway crossings.

Forestdale School Path

The Forestdale School Path is located in Sandwich. It connects Route 130 to the Forestdale School. Given that one can walk or bicycle from the nearby neighborhoods, the shared-use path serves the needs of students traveling to and from the school. The Forestdale School Path is 0.4 miles long, 10 feet wide, and has two roadway crossings.

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.

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.

Claire Saltonstall Bikeway

FIGURE 28 - SIGNAGE ON STATE BICYCLE ROUTE 1

The Claire Saltonstall Bikeway, or State Bicycle Route 1, is a series of bicycle paths and on-street routes that travel from Boston to both Provincetown and Woods Hole. The bikeway starts on Cape Cod at Route 3A in Bourne. It travels across the Sagamore Bridge, utilizing the bridge's sidewalk. After the Sagamore Bridge, the bikeway splits. One branch travels south, parallel to Route 28 and eventually joining with the Shining Sea Bikepath, until reaching Woods Hole. The main branch travels parallel to Route 6, joins with the Cape Cod Rail Trail, and then continues north to Provincetown. According to MassBike, the bikeway was mapped and established in 1978 by the Massachusetts General Court as a memorial to Claire Saltonstall, who died in a bicycle-motor vehicle accident. The Claire Saltonstall Bikeway, indicated by a green oval, is one of the best signed bicycle routes on Cape Cod. According to MassBike, however, many signs have disappeared and the route is impossible to follow without a map. The Cape Cod section of the Claire Saltonstall Bikeway is 98.3 miles in length. The Bourne to Provincetown portion is about 75.4 miles long, while the Bourne to Woods Hole portion is 22.9 miles long. Overall, the Claire Saltonstall Bikeway is about 165 miles long.

FIGURE 29 - CLAIRE SALTONSTALL BIKEWAY – CURRENT ROUTING

In February of 2015 the Cape Cod Commission published "Claire Saltonstall Memorial Bikeway: Cape Cod Segment –Recommended Route Revisions." The report is a result of collaboration between Commission staff and bikeway committee members in the affected towns.

The report includes recommendations to revise the route to create more comfortable conditions for bicyclists (e.g., lower volume roads, shared use paths). The report is available online at:
www.capecodcommission.org/bikeped

The following figures show details of the proposed realignment for the various segments of the route. The realignment maximizes use of shared-use paths where available and

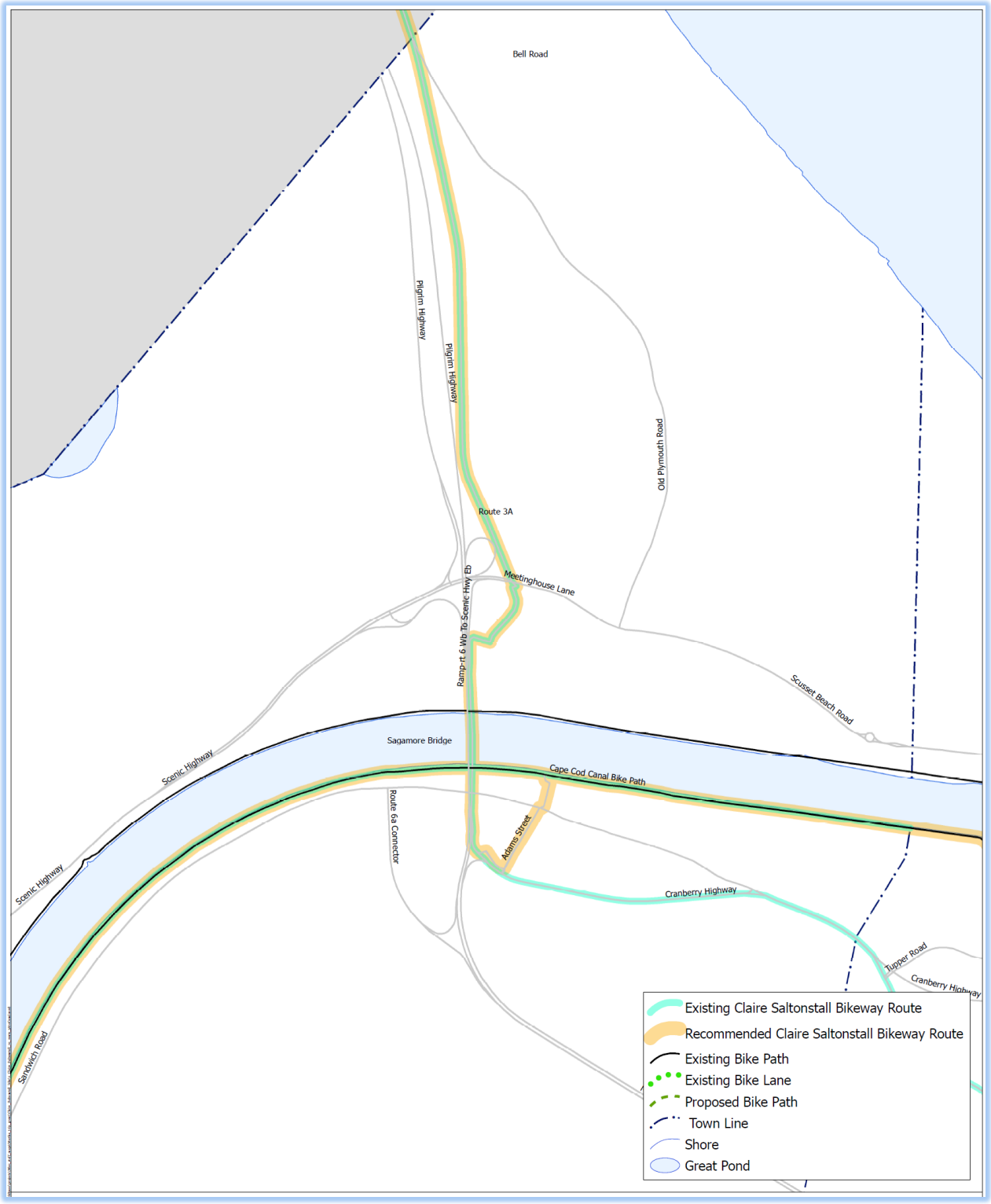

FIGURE 30 – RECOMMENDED SALTONSTALL ROUTE (BOURNE)

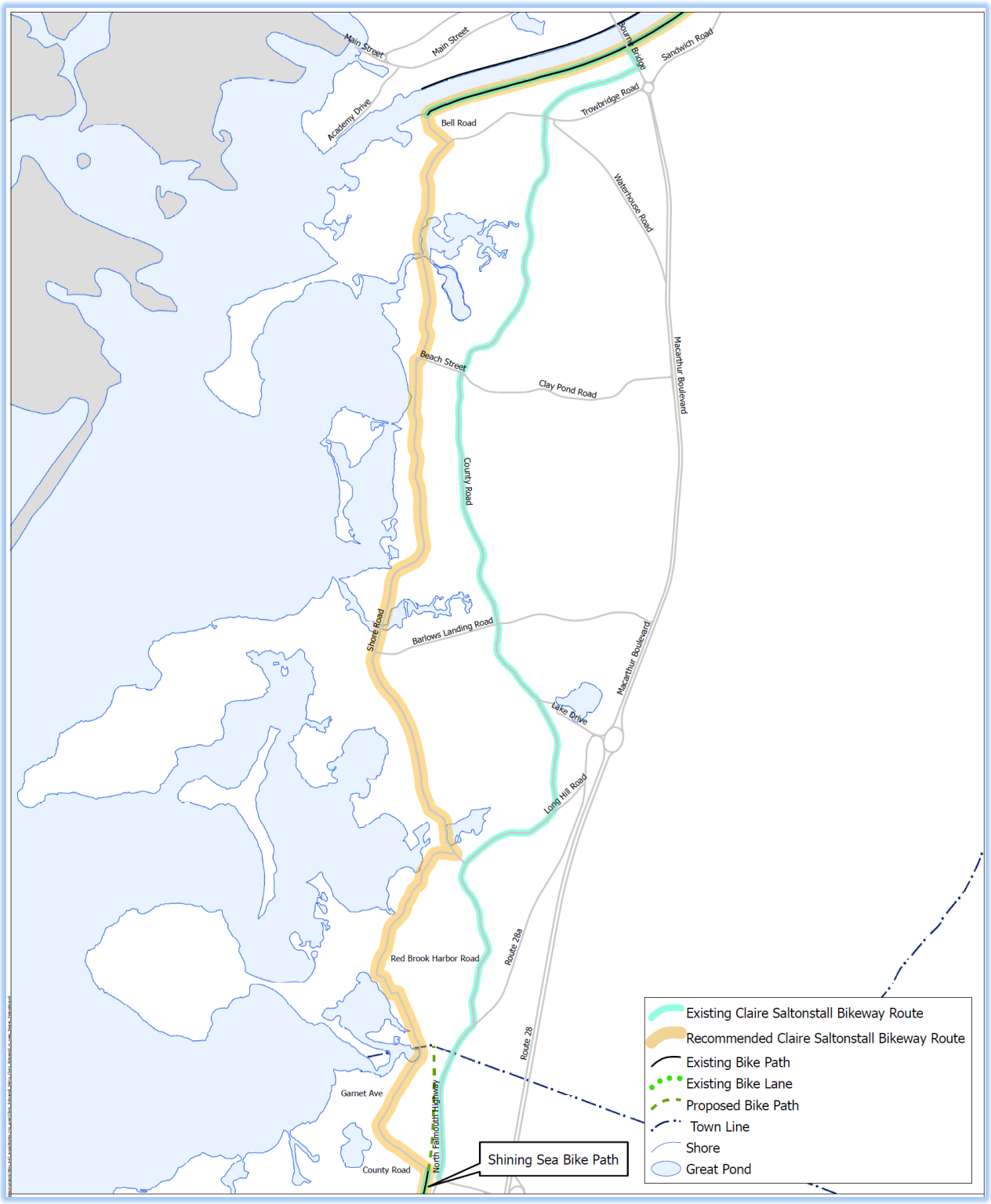

FIGURE 31 - RECOMMENDED SALTONSTALL ROUTE (BOURNE-FALMOUTH)

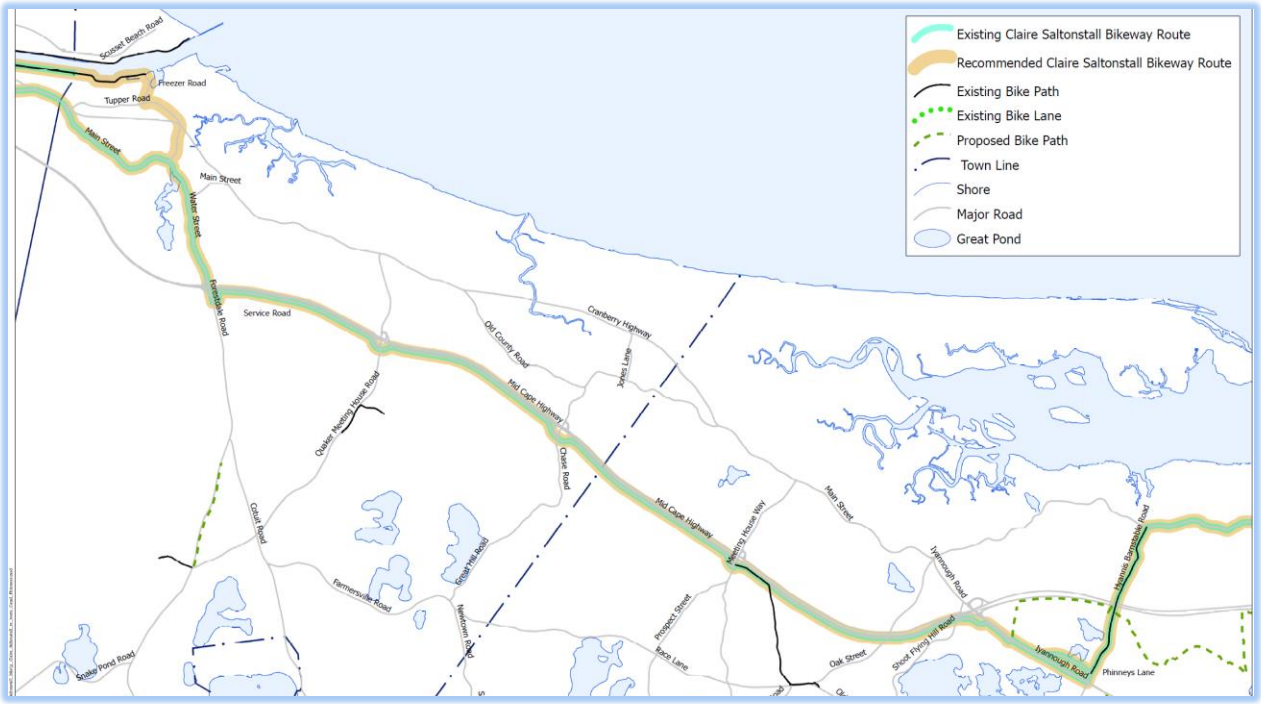

FIGURE 32 - RECOMMENDED SALTONSTALL ROUTE (BOURNE-SANDWICH-BARNSTABLE)

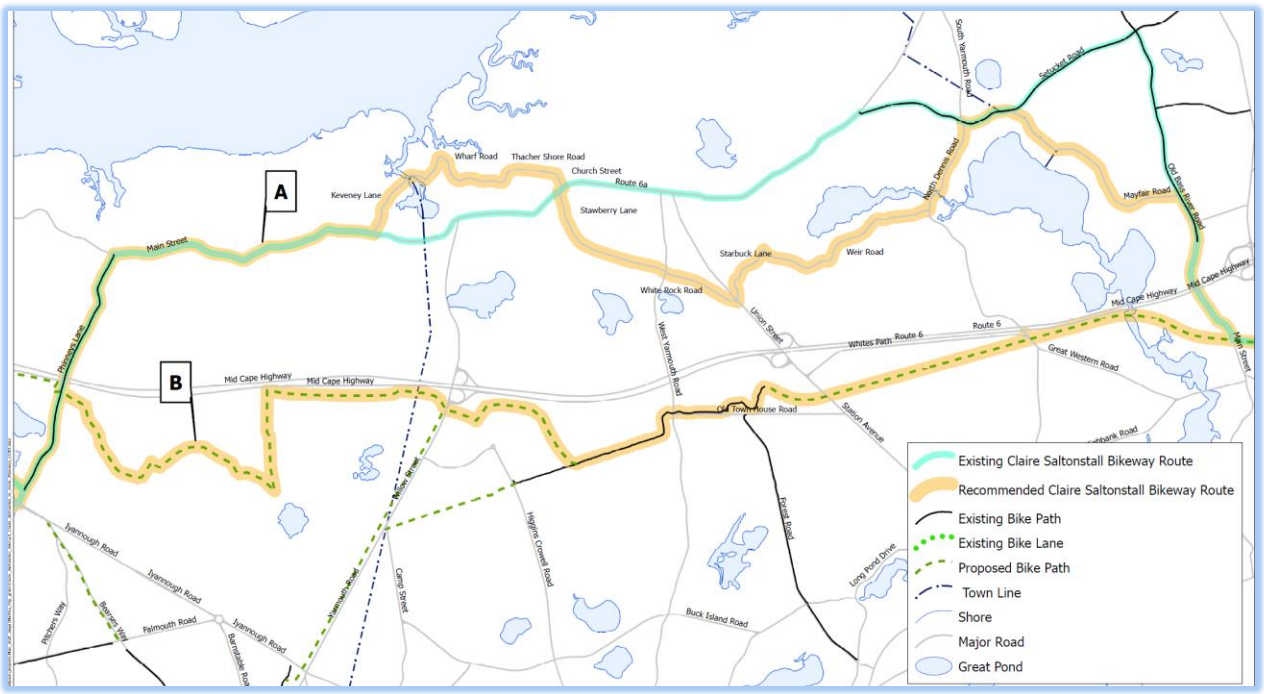

FIGURE 33 - RECOMMENDED SALTONSTALL ROUTE (BARNSTABLE-YARMOUTH-DENNIS)

FIGURE 34- RECOMMENDED SALTONSTALL ROUTE (DENNIS-HARWICH-BREWSTER-ORLEANS-EASTHAM)

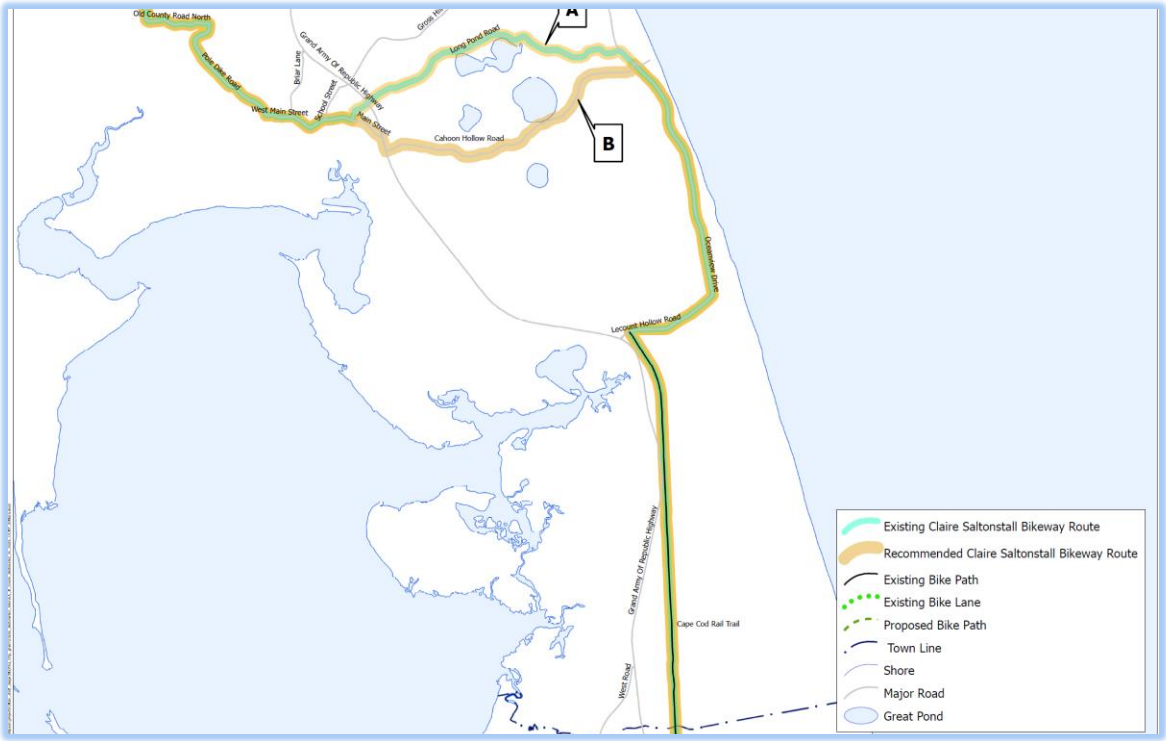

FIGURE 35 – RECOMMENDED SALTONSTALL ROUTE (WELLFLEET)

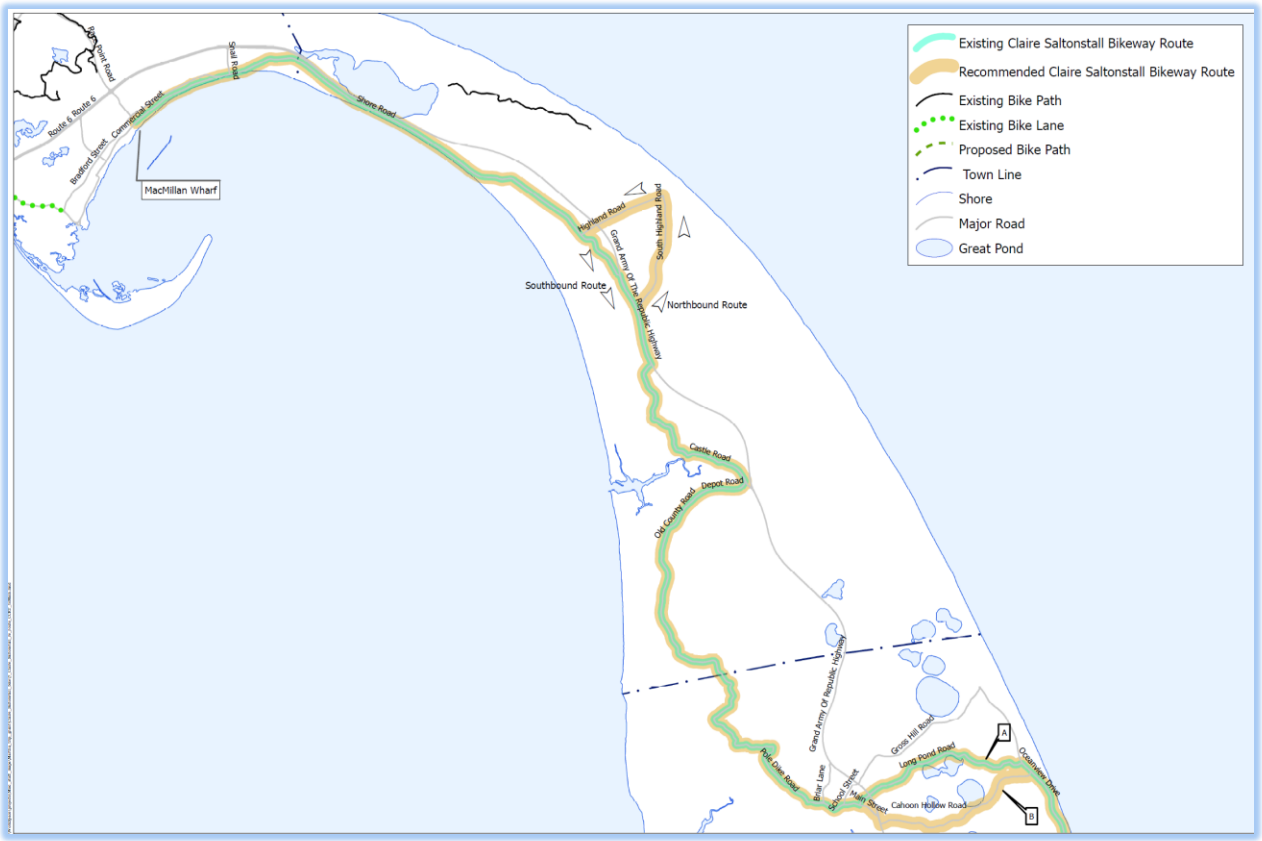

FIGURE 36 - RECOMMENDED SALTONSTALL ROUTE (WELLFLEET-TRURO-PROVINCETOWN)

State Bicycle Routes

MassGIS has also identified other bicycle routes throughout Cape Cod. Some examples are Buck Island Road in Yarmouth, Great Western Road in Dennis and Harwich, or Great Neck Road in. The Cape Cod Commission and AmeriCorps performed a survey of many of these roads in 2006. According to the survey, many of these roads are unsigned and some have sharp turns, no shoulders, or high traffic volumes. Evaluating existing bicycle routes, maintaining proper signage, and identifying possible new routes will help to encourage more bicycle use on Cape Cod, both commuter and recreational.

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 37 - ROUTE 28 NORTH OF THE DAVIS STRAITS INTERSECTION, A DESIGNATED BICYCLE ROUTE IN FALMOUTH

Low Volume Roads

Bicyclists and pedestrians can utilize low volume roads with minimal automobile conflicts. Cape Cod has 462.8 miles of major roads with summer average daily volumes (ADT) of 5,000 vehicles per day or less, and 91.2 miles of major roads with 1,000 vehicles per day or less. For reference, an ADT of 5,000 is equivalent to about one vehicle every seven seconds during daylight hours. An ADT of 1,000 is equivalent to about 1 vehicle every 35 seconds during daylight hours. Cape Cod also has about 1,803.4 miles of local paved roads that are suitable for safe bicycle and pedestrian traffic. These roads must be considered as part of the bicycle and pedestrian network, since trips usually begin or end on side streets or in low traffic residential neighborhoods.

FIGURE 38 - LOW VOLUME ROADS

SIDEWALK NETWORK

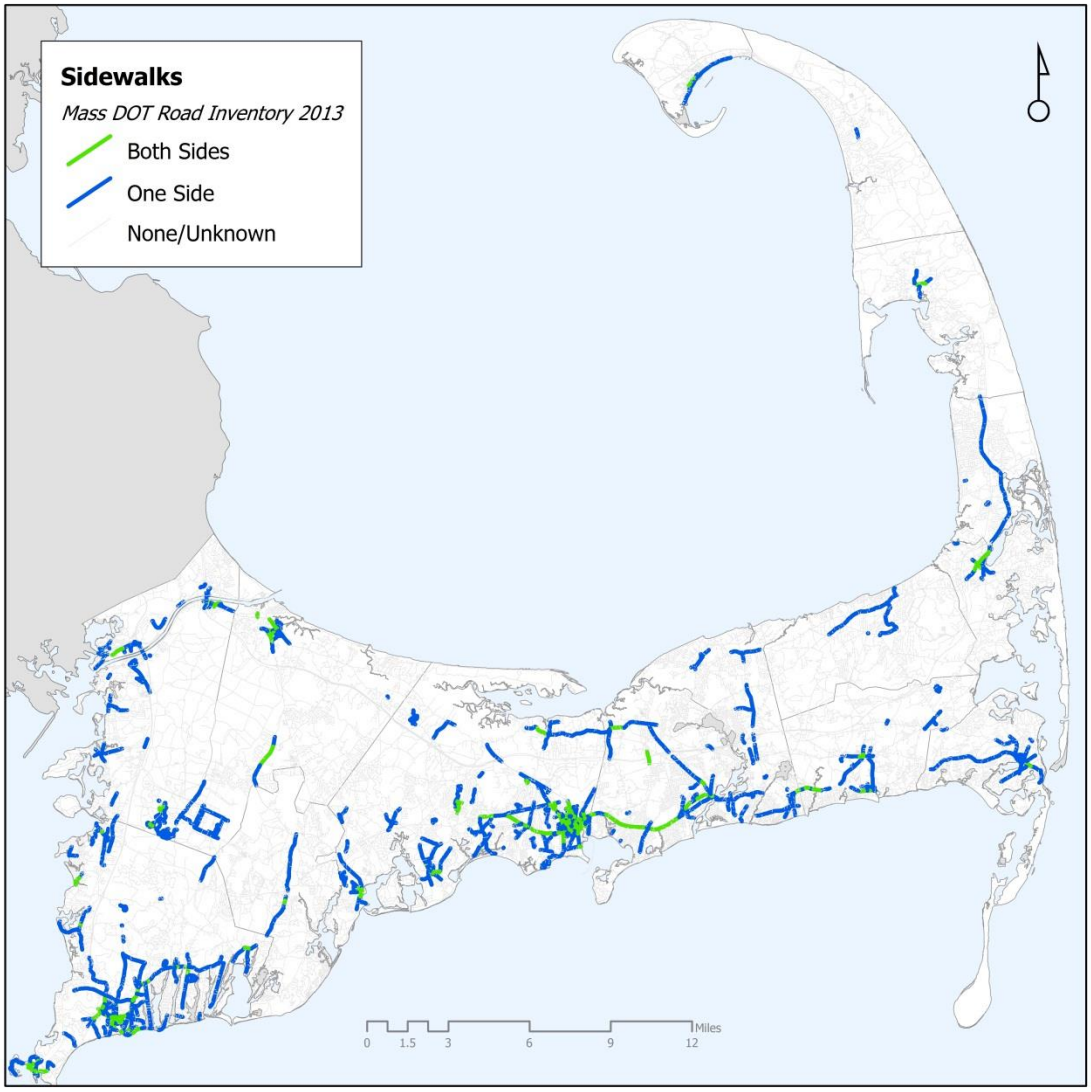

FIGURE 39 - SIDEWALK NETWORK

Sidewalks are paved surfaces, usually adjacent to roadways, which are designed primarily for pedestrian usage. Sidewalks are typically 4 to 6 feet wide, made with slabs of concrete, paved asphalt, bricks, or other hard substances. The Americans with Disabilities Act requires sidewalk curb cuts to be large enough and shallow enough for wheelchair usage. Telephone poles, road signs, and other architectural barriers must also be removed in order to create an unobstructed path for walking. In Massachusetts, bicyclists may ride on sidewalks outside business districts unless otherwise prohibited by local ordinances.

According to the 2008 Massachusetts Statewide Roadway Inventory File, there are 198.3 miles of sidewalk located on Cape Cod. In addition, 26.42 miles of road have sidewalks on either side.

These roads are concentrated primarily in Hyannis and downtown Falmouth. Of all paved roadways on Cape Cod, 5.1% have a sidewalk on at least one side. The average sidewalk width on Cape Cod by mileage is 4.4 feet.

All of these figures illustrate pedestrian issues that must be addressed by any review of bicycle and pedestrian transportation. Over 90% of Cape Cod roadways do not have sidewalks. While many of these streets are low volume and residential, some are not and do warrant sidewalks. On a street without sidewalks, pedestrians must walk in the shoulders or on private property. This is not only less safe, but it restricts access for the elderly and disabled. Moreover, some sidewalks on Cape Cod have architectural barriers, such as telephone poles, located within the sidewalk. Obstructions like these make sidewalk navigation more difficult, especially for the disabled. Expanding the existing sidewalk network and correcting improperly designed sidewalks will help to encourage pedestrian usage in, around, and between business and population centers.

The sidewalk network also includes crosswalks. Crosswalks provide a safe means for pedestrians and other sidewalk users to cross roadways. All crosswalks are marked on the roadway surface by white paint. Generally, crosswalks located on lower volume roads have no traffic control devices, or a sign telling motorists to yield to pedestrians. However, many crosswalks have crossing signals that stop traffic, allow pedestrians to cross, and warn pedestrians when traffic is about to resume. Typically, crossing signals are located with traffic signals at roadway intersections. However there are four pedestrian signals on Cape Cod that are not located at a roadway intersection. Ensuring that crosswalks are located at high pedestrian areas throughout Cape Cod will help to improve safety as well as access. Access can also be improved by ensuring that crosswalks accommodate all users, including the elderly and disabled. Properly designed curb cuts that are usable by wheelchairs, tones at crosswalk signals for the blind, and other amenities can significantly improve sidewalk access for the disabled.

CAPE COD PATHWAYS

The Barnstable County Commissioners and the Cape Cod Commission are working with citizens and organizations from across Cape Cod to create a Cape-wide network of walking trails. This network is called Cape Cod Pathways. When complete, Cape Cod Pathways will extend from Provincetown to Falmouth and Bourne and provide a connection between the Seashore and the Cape's wooded interior, between the peninsula's historic villages and remaining backcountry. Through the work of many volunteers and civic and environmental leaders, the Pathways east-west trail between Provincetown and the upper Cape is approximately now one-third dedicated.

Cape Cod Pathways was initiated in November 1993. Since then the project has garnered widespread support from the Barnstable County Assembly of Delegates, Cape Cod National Seashore, town officials, conservation organizations, businesses, and other groups. Trail planning currently under way in Cape Communities will result in newly dedicated trails in the years ahead.

The creation of a Cape-wide trail network is an ambitious undertaking that requires planning, mapping, community organizing, fundraising, special events, publicity, negotiation of land and easements, clearing, and construction work. More information about Cape Cod Pathways is available on the internet:

www.capecodcommission.org/pathways

Many of the trailheads have been mapped using Google mapping as shown in the following figure. The green trailhead symbols represent Cape Cod pathways that are accessible via public transportation. In addition to the larger goal of connecting trails throughout the Cape, natural attractions such as rivers, lakes and ponds are recognized as important features for the Pathways program to provide access.

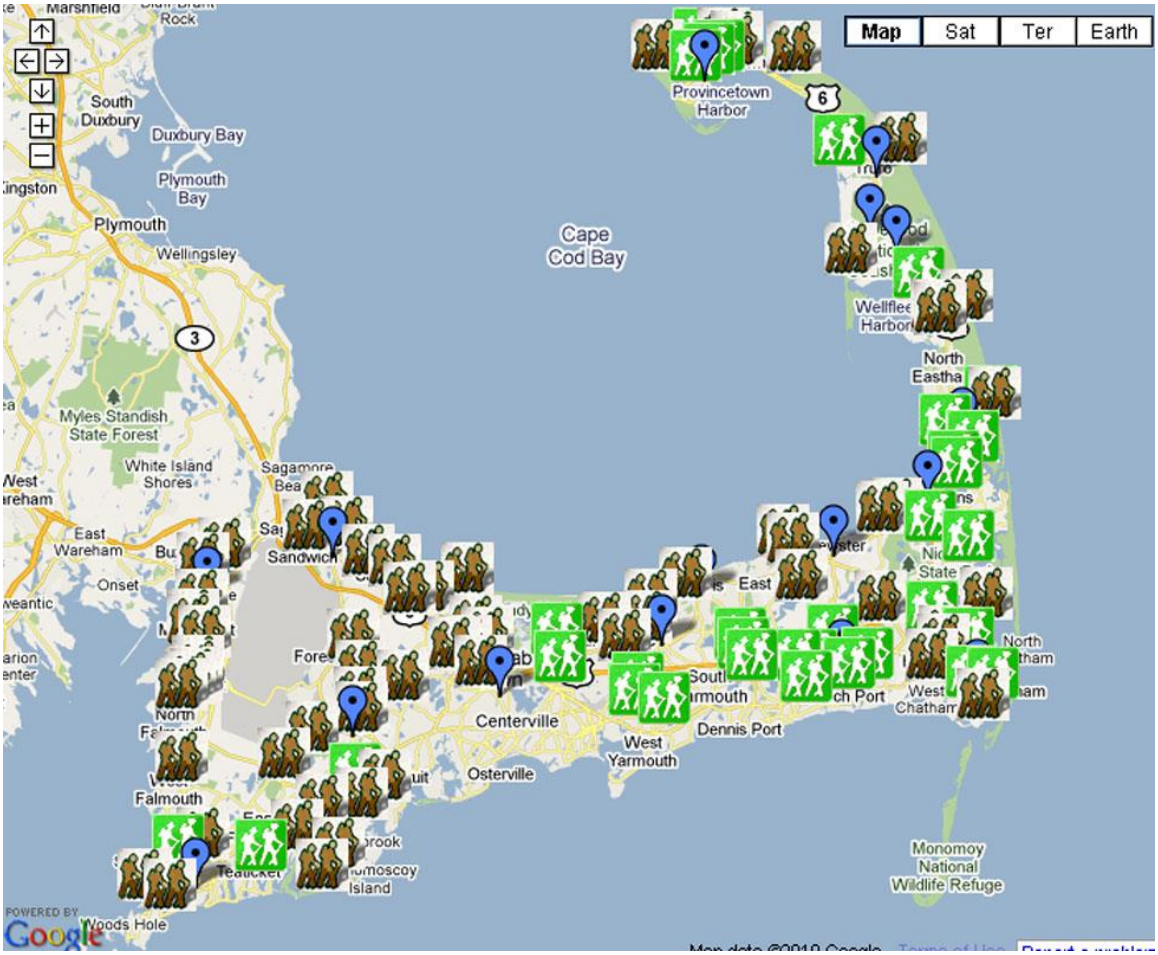

FIGURE 40 - CAPE COD PATHWAYS – Trail Head Locations/Transit Accessibility

BICYCLE AND PEDESTRIAN AMENITIES

Beyond bicycle and pedestrian infrastructure, there are various amenities that address the needs of the traveler. Employers and businesses almost always have enough automobile parking. The same does not always hold true for bicycles. Bicycle racks allow the traveler to securely park their property without fearing that it will be stolen or damaged. Water fountains, vending machines or nearby cafes provide the traveler with nourishment after their ride or walk. Public restrooms are also useful to both pedestrians and bicyclists. Showers and locker facilities allow employees to change into clean clothes. All of these amenities help to encourage non-motorized transportation.

There are many amenities available to bicyclists and pedestrians on Cape Cod. The Hyannis Transportation Center has bicycle racks, public restrooms, water fountains, vending machines and other user amenities. In addition, the Cape Cod Regional Transit Authority (CCRTA) offers bicycle racks with space for two bicycles on each CCRTA bus. Bicycle racks, restrooms, food, and other amenities are also available at the Exit 6 Rest Area near the Barnstable Park-and-Ride Lot. The Steamship Authority Piers in Hyannis and Woods Hole offer restrooms and vending machines to customers who arrive by bicycle. Moreover, some employers offer bicycle and pedestrian amenities to their employees. According to the Massachusetts State Bicycle Plan, all such amenities address the "destination barriers" that bicyclists and pedestrians perceive, such as not being able to safely park their bicycle, showing up to work sweaty, or arriving at their workplace hungry and thirsty. By making non-motorized travel more attractive to potential users, more people will be inclined to ride a bicycle and walk to work.

BICYCLE AND PEDESTRIAN FACILITY ACCESSIBILITY AND MOBILITY

Not everyone can ride a bicycle or walk as their primary mode of transportation. Users must live relatively close to where they work and shop in order to ensure a reasonable travel time. The low density of Cape Cod development is in this way not conducive to bicycle travel. Moreover, a certain level of fitness is necessary to deal with the physical exertion. On Cape Cod, where many residents are elderly, bicycling or walking may not be practical for some travelers. Despite these barriers, there are many potential users who can be targeted and encouraged to travel by bicycling or walking for its positive environmental, physical, and economic benefits.

Bicycle paths and routes can be made more accessible by ensuring that there are adequate entry points, safe roadway crossings, and proper signage. There is a tradeoff between entry points and roadway crossings, since roadways are often the place where bicyclists enter a bicycle path. As the number of entry points increase, so do the number of roadways bicyclists must cross in order to travel the path. Most Cape Cod bicycle path-roadway crossings have yellow stanchions or gates that encourage bicyclists to stop and watch for vehicles before crossing. Two roadway crossings of the Cape Cod Rail Trail in Harwich and Brewster have signals which warn oncoming vehicles when bicyclists or pedestrians are approaching the intersection. Signage is also important to accessibility, since it directs users to and along the path. Posted maps, street signs, and signs listing local points of interest also help to direct travelers to their destinations. By implementing safety and signage measures such as these, bicycle and pedestrian facilities can become more accessible to both first time and frequent users.

FIGURE 41 - WEST YARMOUTH ROAD CROSSING OF THE OLD TOWNHOUSE ROAD TRAIL

FIGURE 42 - MEETINGHOUSE ROAD CROSSING OF THE HARWICH-CHATHAM EXTENSION OF THE CAPE COD RAIL TRAIL

Bicycle paths on Cape Cod, with the exception of the Rail Trail and Shining Sea Bikepath, are generally too short, or the wrong location, to facilitate commuting. For example, the Nauset Trail only conducts travelers from Route 6 to the Cape Cod National Seashore. The Forest Road Path does not continue all the way to the commercial activity on Route 28. The key is to construct and connect paths in such a way as to link areas with residential, commercial, and recreational uses. Otherwise, bicyclists will only be able to use bicycle paths as part of a larger bicycle route or for recreational purposes.

Because bicycles are small and lightweight, they are very portable and easy to transfer from mode to mode. Bus services, such as the CCRTA, Plymouth and Brockton, and Peter Pan / Bonanza Bus Lines, can accommodate cyclists with racks and storage areas. The Steamship Authority and other ferry services allow passengers to bring their bicycles for a fee. Special reservations can also be made with air carriers in order to transport bicycles. For this reason, bicycle transportation can help to connect users to other modes of transportation.

BICYCLE AND PEDESTRIAN ROUTE PLANNING TOOLS

A key component of Cape Cod bicycle planning is to involve the public in identifying the “best” bicycle routes. The bikeways website includes links showing potential on-road bicycle routes connecting major destinations on Cape Cod using Google's mapping service. Some non-roadway alternatives (such as the Cape Cod Canal multi-use path are not shown). The goal of establishing these routes is to provide for the "best" bicycle travel within, among, and through the attractive areas of the Cape while avoiding narrow and busy roads such as Route 6A or Route 28.

These alternatives provides direct access to major roads and do not require cyclists to travel more than about one and a half times the distance that would be traveled if the cyclist stayed on

the major road. Additionally, the alternate route still provides a showcase for the scenic and historic qualities of the area.

Town planning officials and concerned citizens are invited to comment and provide suggestions on specific routing. The mid-term goal is to provide online maps and on-road signage to inform the public (both to help cyclists with way-finding and to alert motorists of potential bicyclists). Longer-term, those segments of the routes that pose the greatest difficulty in safely biking then will be considered for improvements or for the development of other alternatives. Two basic regional routes are explored: a Northside bike route complementary to Route 6A connecting the Cape Cod Canal in Bourne to Rock Harbor Road in Orleans (the so-called “Route 6B”); and, a Southside bike route complementary to Route 28 connecting Woods Hole in Falmouth to Chatham Light (the so-called “Route 28B”).

“ROUTE 6B” – NORTHSIDE BICYCLE ROUTE

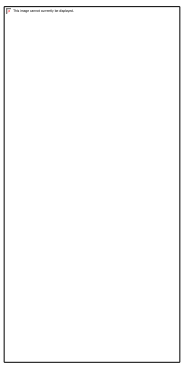

Figure 43 - Route "6B" logo

The following figure shows a potential on-road bicycle route from the Cape Cod Canal area in Sandwich to the area including the Eastham Rotary and Rock Harbor at the Orleans/Eastham town line. Some non-roadway alternatives (such as the Cape Cod Canal multi-use path are not shown). The goal of establishing the Northside Route is to provide for the "best" bicycle travel within, among, and through the areas north of Route 6 in the towns from Sandwich to Orleans - and to generally avoid the narrow and busy Route 6A.

This alternative provides direct access to Route 6A and does not require cyclists to travel more than about one and a half times the distance that would be traveled if the cyclist stayed on Route 6A. Additionally, the alternate route still provides a showcase for the scenic and historic qualities of the district.

This figure was developed as part of the Route 6A Corridor Management Plan update, released by the Commission in 2010. The maps indicate useful alternatives to Route 6A as well as connector routes. The sections of Route 6A identified in red indicate road segments where no viable alternative exists.

Town-by-town maps showing the main “Route 6B” route are shown in subsequent figures.

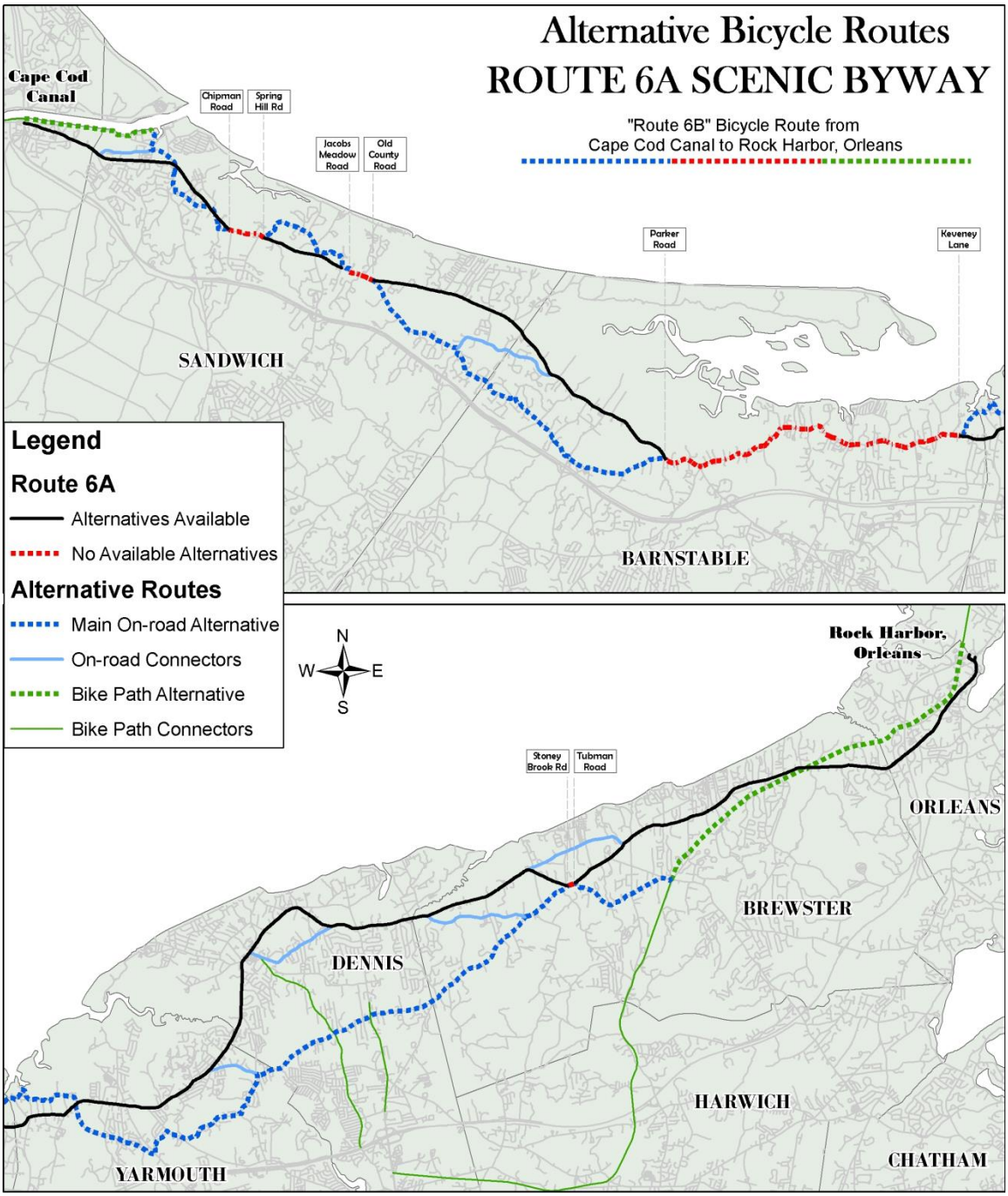

FIGURE 44 - ROUTE "6B" – NORTHSIDE BICYCLE ROUTE

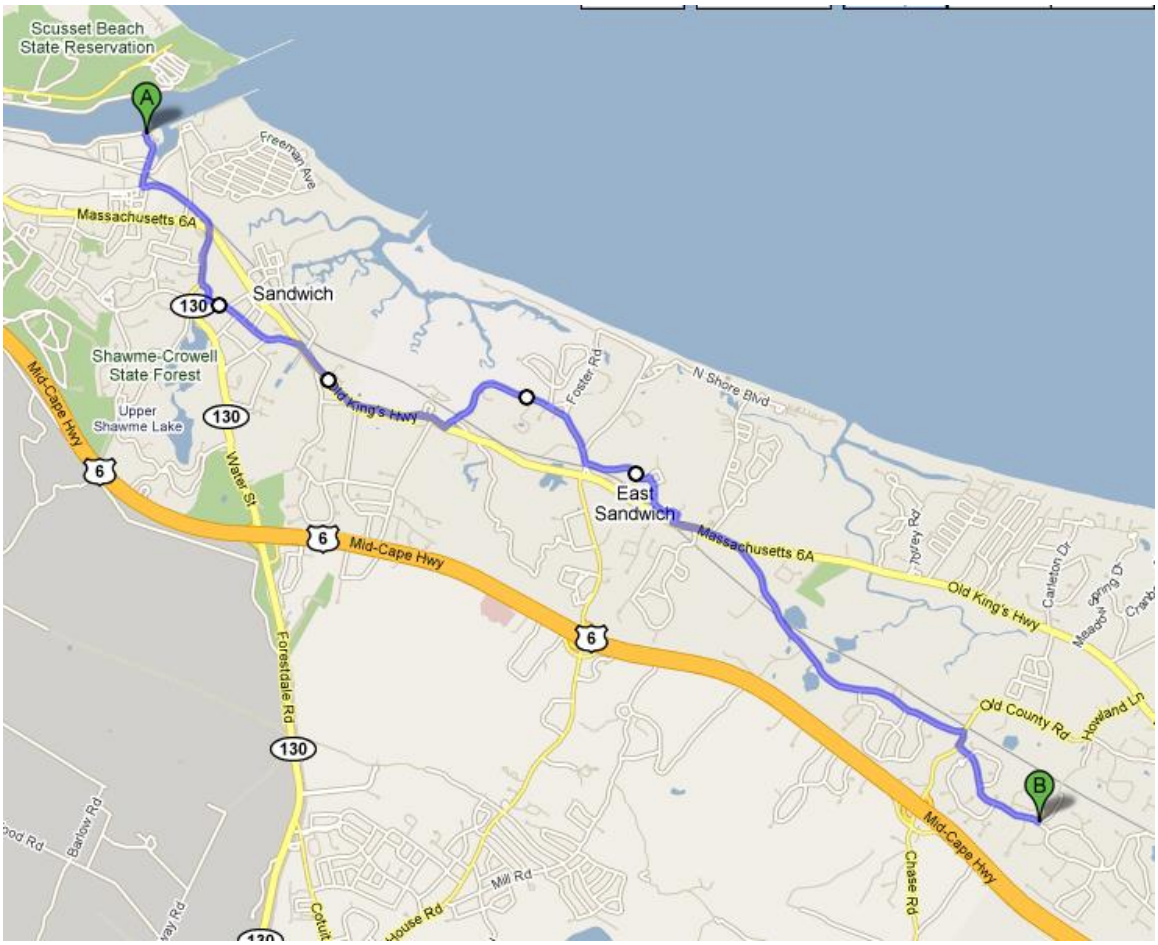

FIGURE 45 - POTENTIAL ROUTE "6B" IN SANDWICH
(Source: Cape Cod Commission, Google Maps)

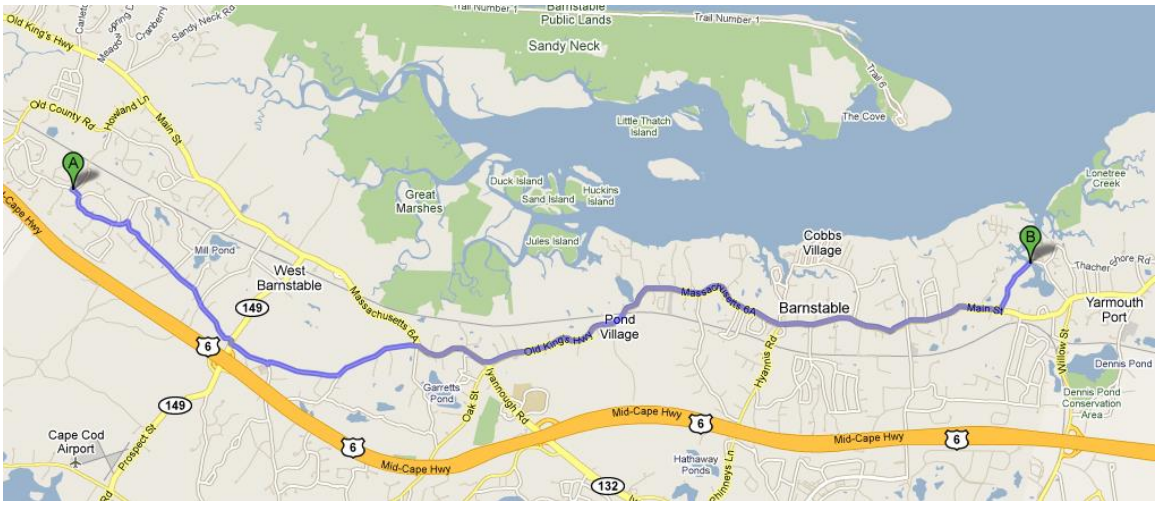

FIGURE 46 - POTENTIAL ROUTE "6B" IN BARNSTABLE
(Source: Cape Cod Commission, Google Maps)

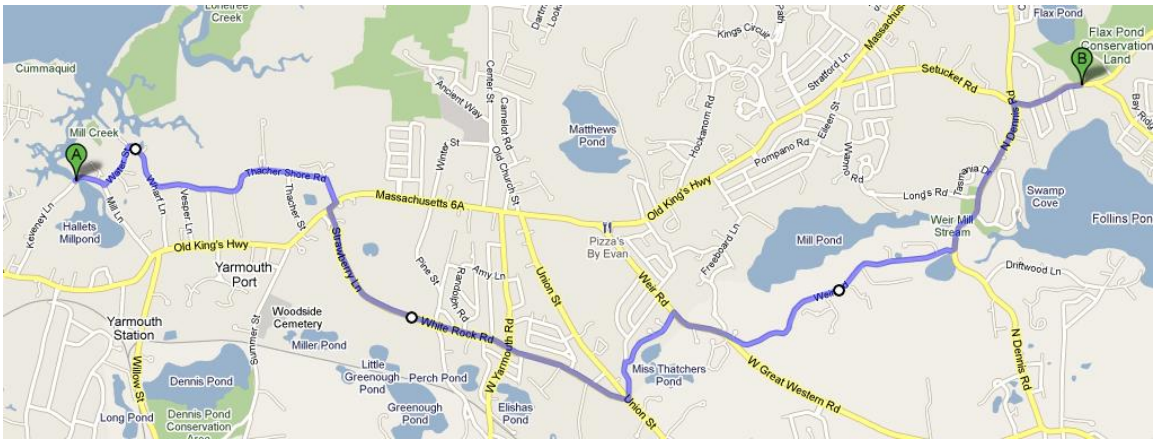

FIGURE 47 - POTENTIAL ROUTE "6B" IN YARMOUTH
(Source: Cape Cod Commission, Google Maps)

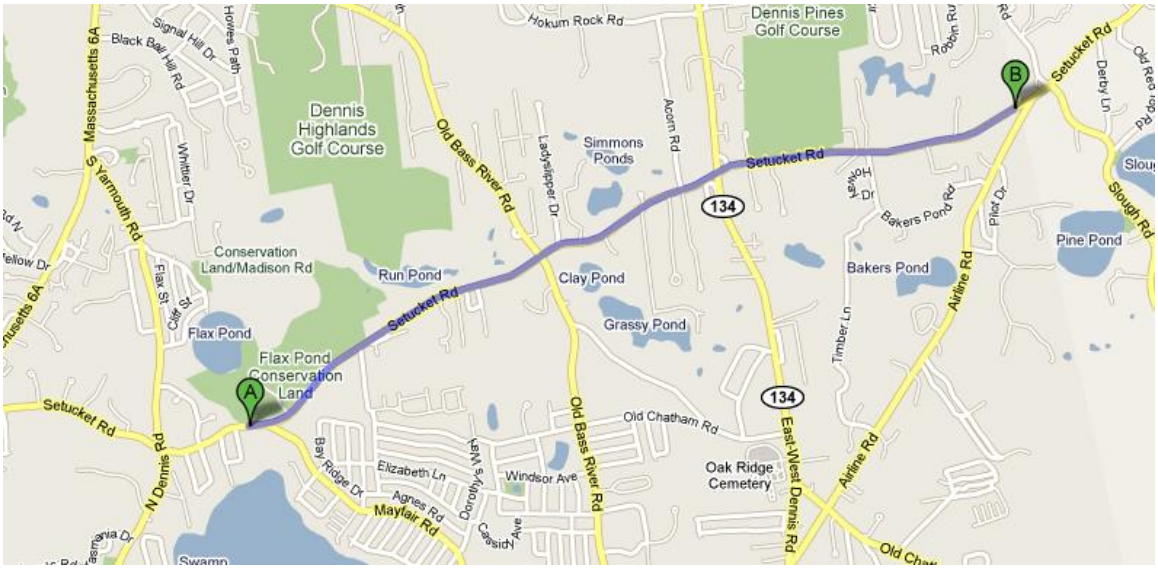

FIGURE 48 - POTENTIAL ROUTE "6B" IN DENNIS
(Source: Cape Cod Commission, Google Maps)

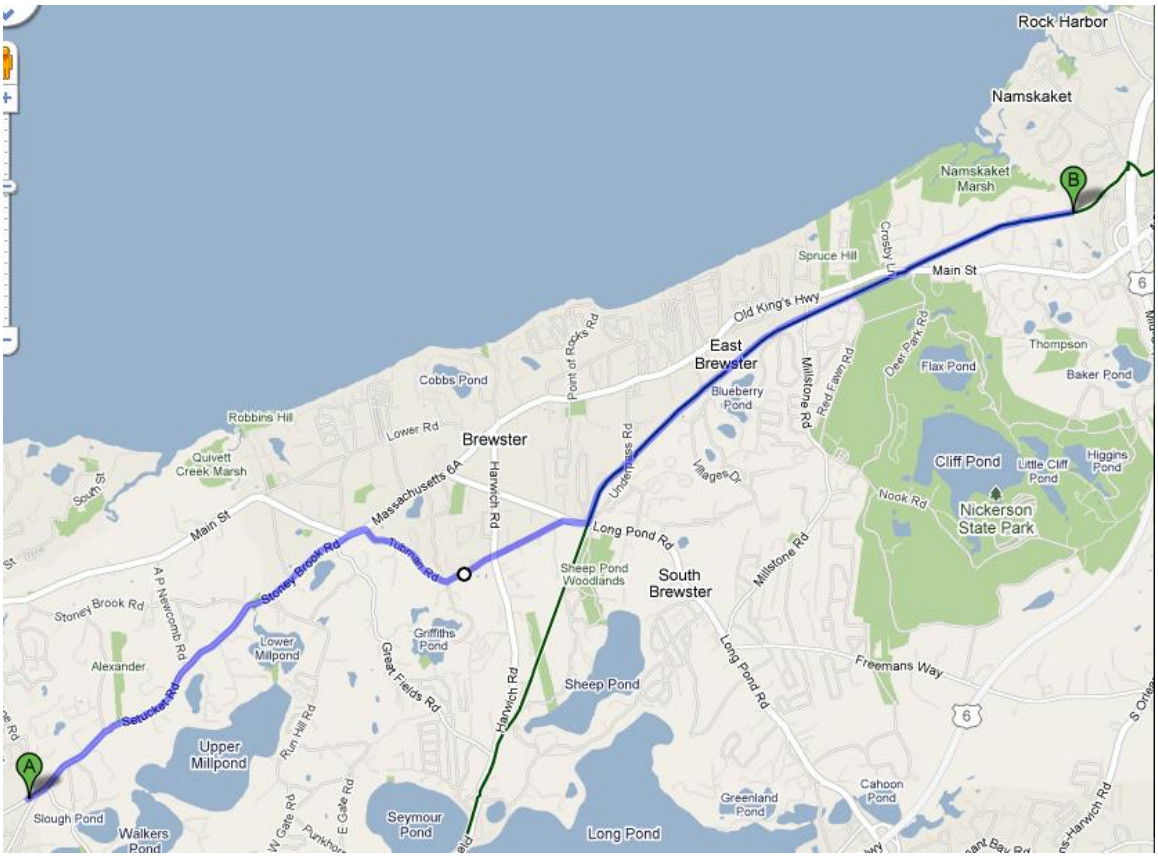

FIGURE 49 - POTENTIAL ROUTE "6B" IN BREWSTER
(Source: Cape Cod Commission, Google Maps)

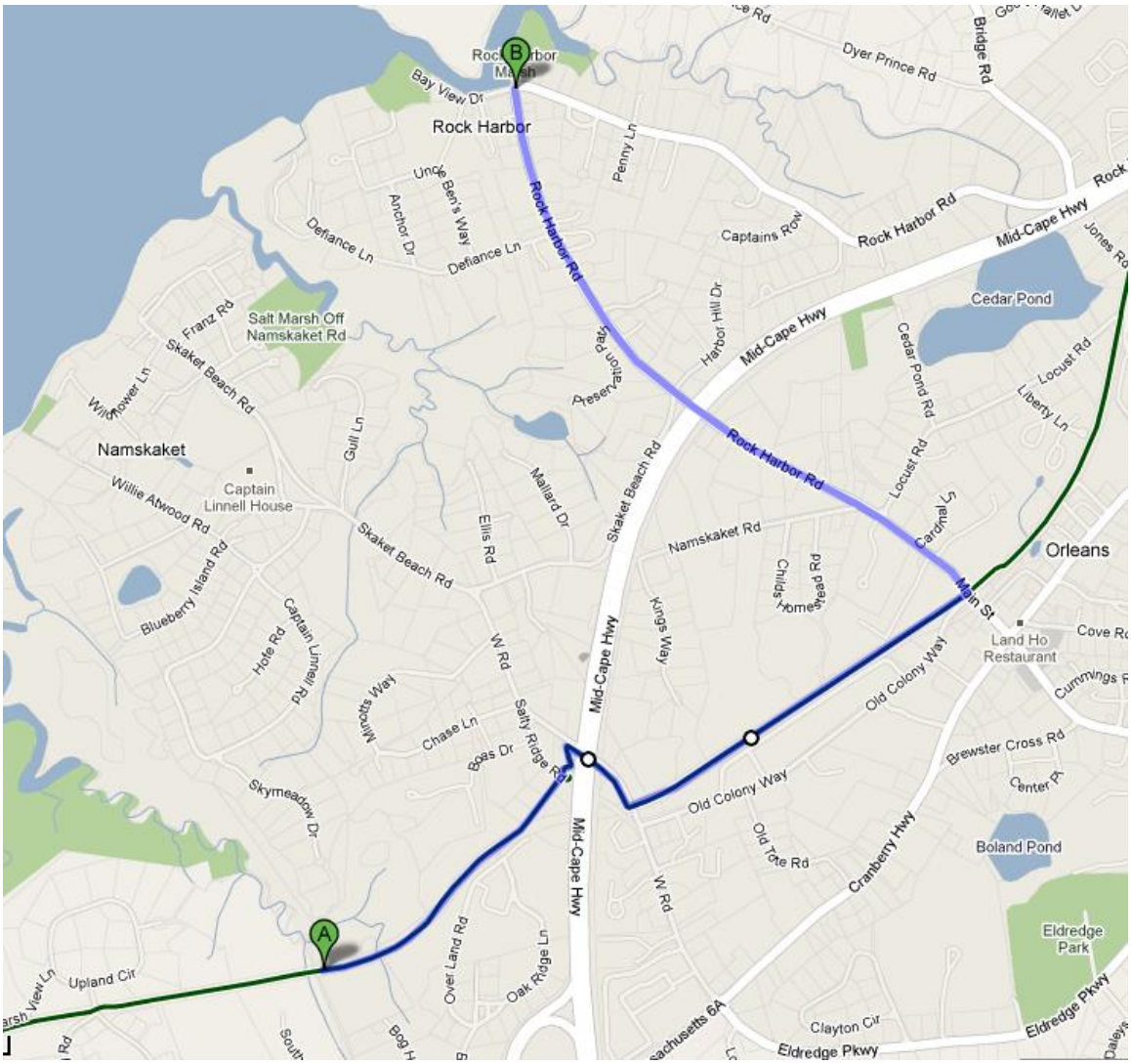

FIGURE 50 - POTENTIAL ROUTE "6B" IN ORLEANS
(Source: Cape Cod Commission, Google Maps)

"ROUTE 28B" – SOUTHSIDE BICYCLE ROUTE

Figure 51 - Route "28B" logo

The following figure**s** show a potential on-road bicycle route from the Woods Hole in Falmouth to Chatham Light. The goal of establishing the Southside Route is to provide for the "best" bicycle travel within, among, and through the areas south of Route 6 in the towns from Falmouth to Chatham - and to generally avoid the narrow and busy Route 28.

This alternative provides direct access to Route 28 and does not require cyclists to travel more than about one and a half times the distance that would be traveled if the cyclist stayed on Route 28. Additionally, the alternate route still provides a showcase for the scenic and historic qualities of the area.

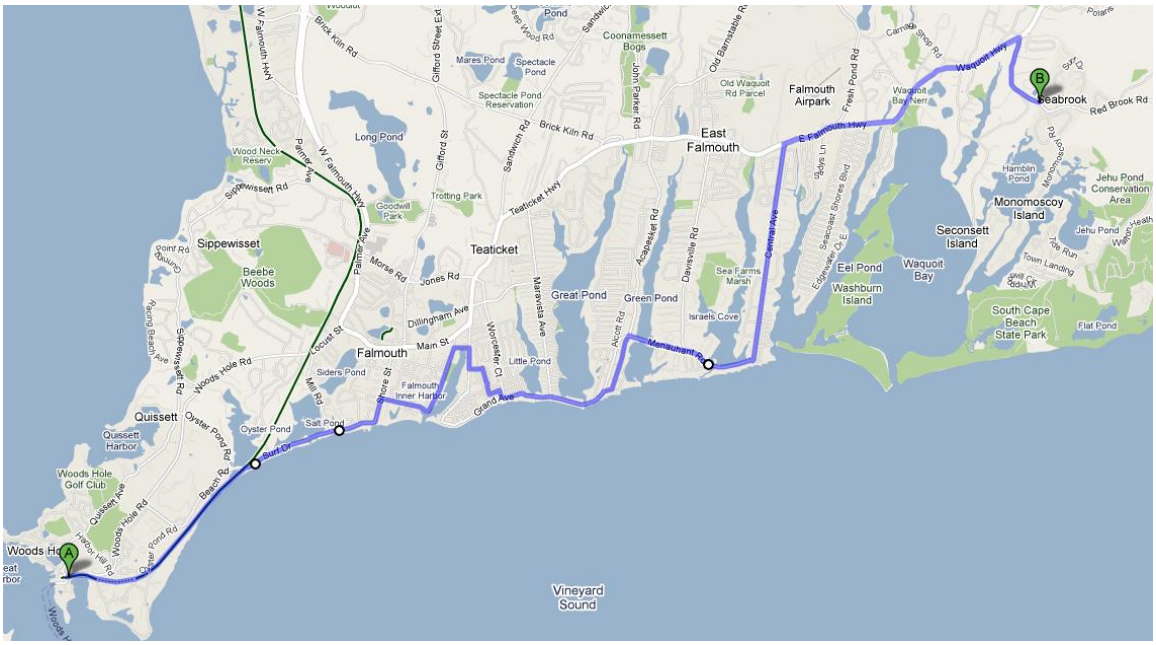

FIGURE 52 - POTENTIAL ROUTE "28B" IN FALMOUTH
(Source: Cape Cod Commission, Google Maps)

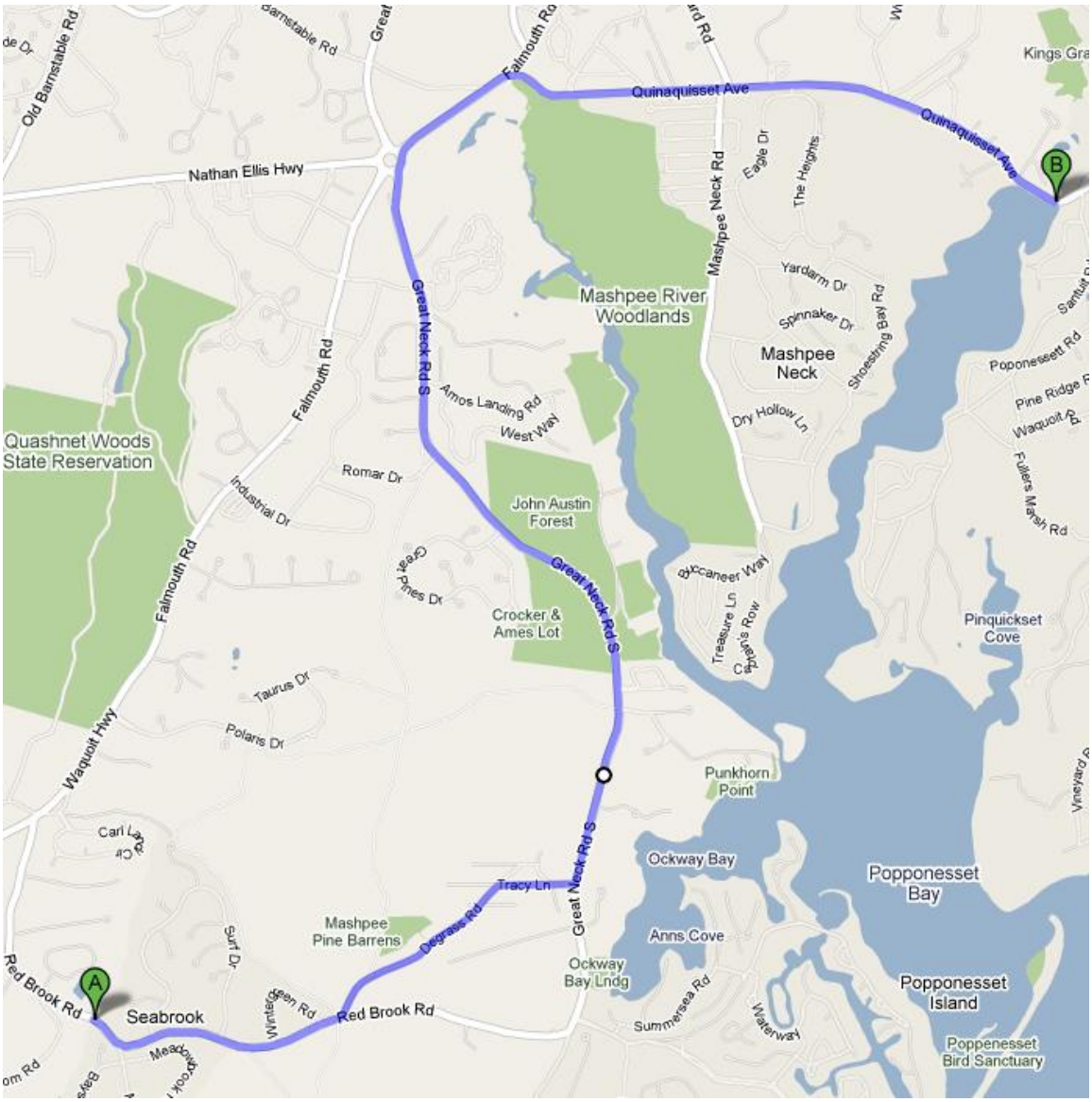

FIGURE 53 - POTENTIAL ROUTE "28B" IN MASHPEE
(Source: Cape Cod Commission, Google Maps)

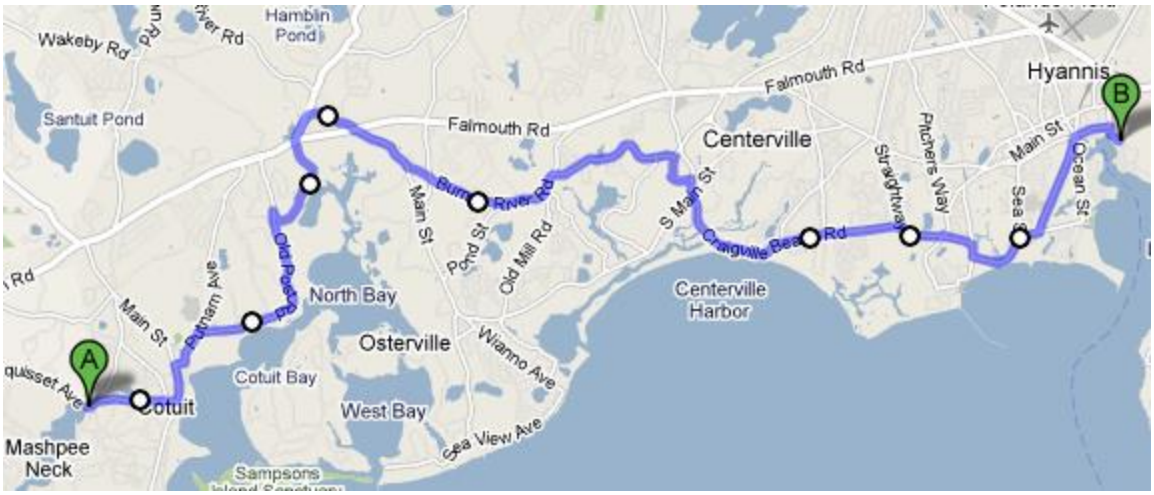

FIGURE 54 - POTENTIAL ROUTE "28B" IN BARNSTABLE
(Source: Cape Cod Commission, Google Maps)

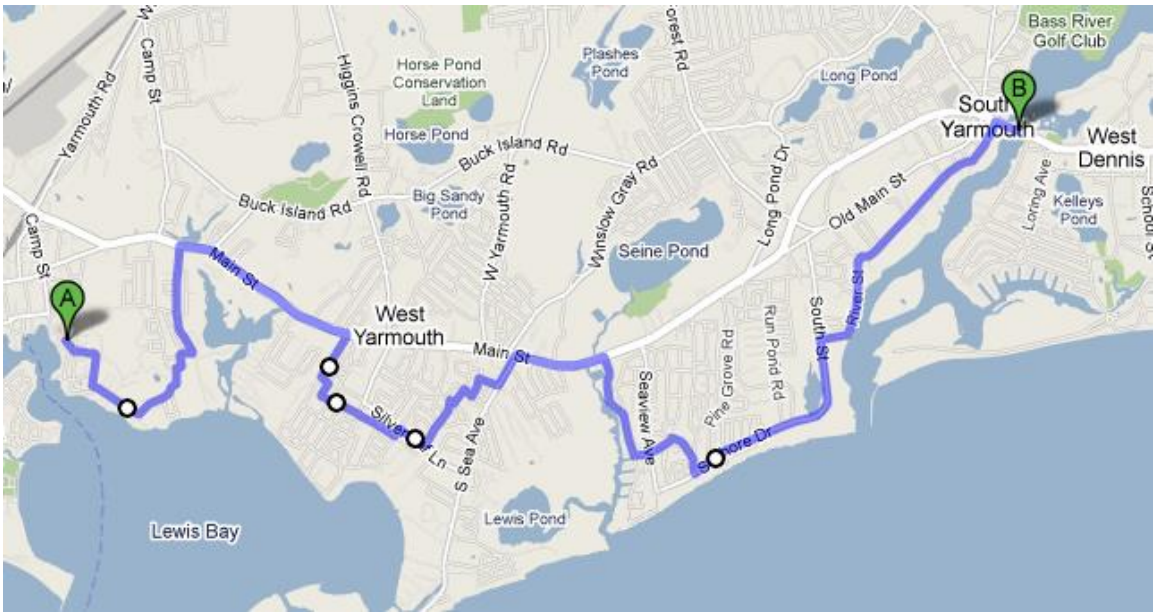

FIGURE 55 - POTENTIAL ROUTE "28B" IN YARMOUTH
(Source: Cape Cod Commission, Google Maps)

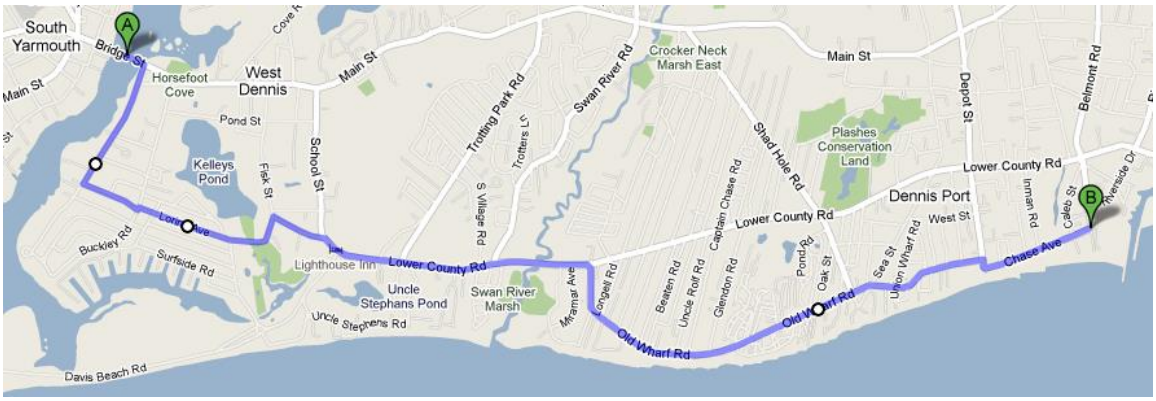

FIGURE 56 - POTENTIAL ROUTE "28B" IN DENNIS
(Source: Cape Cod Commission, Google Maps)

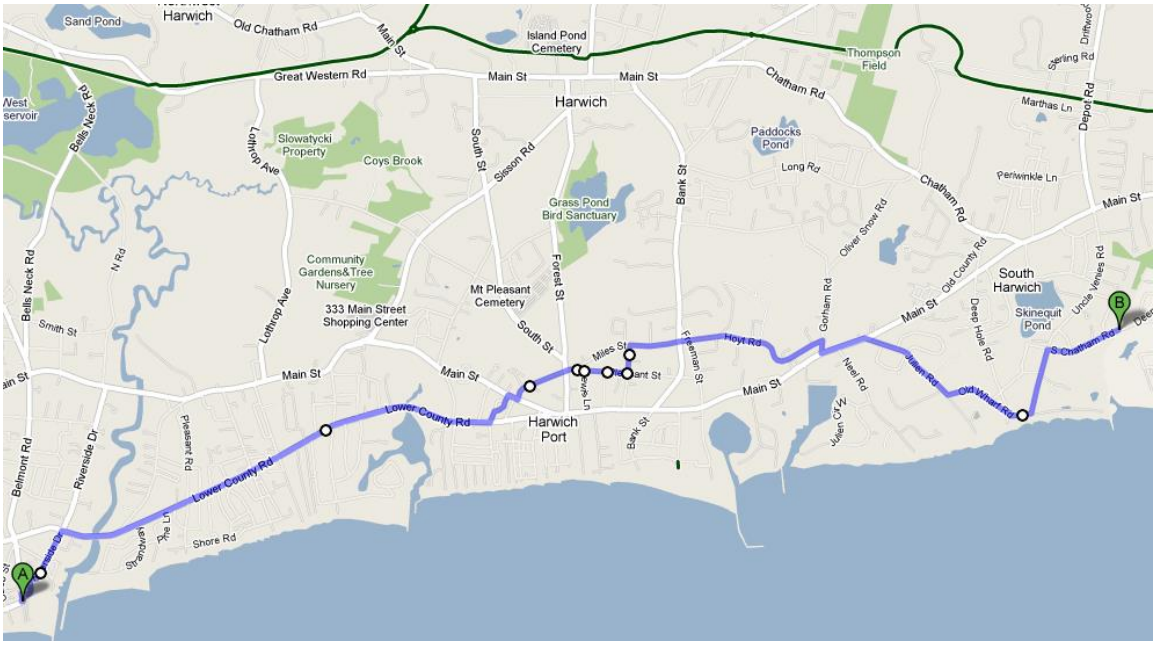

FIGURE 57 - POTENTIAL ROUTE "28B" IN HARWICH
(Source: Cape Cod Commission, Google Maps)

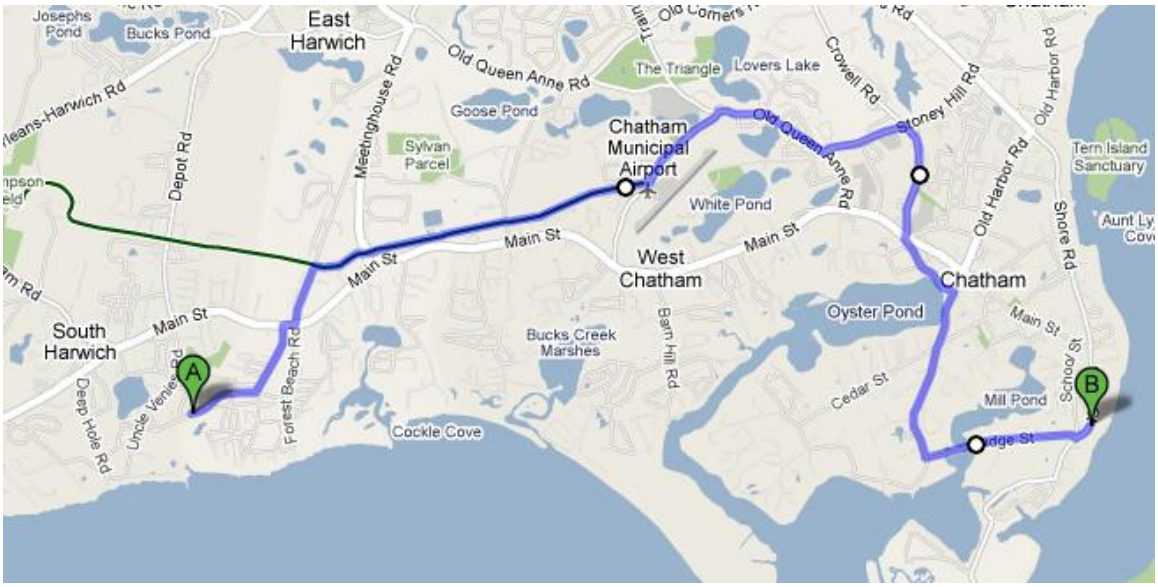

FIGURE 58 - POTENTIAL ROUTE "28B" IN CHATHAM
(Source: Cape Cod Commission, Google Maps)

RECENT & ONGOING BICYCLE/PEDESTRIAN PLANNING EFFORTS

This section summarizes recent and ongoing bicycle & pedestrian planning efforts underway by the Cape Cod Commission and/or bicycle planning groups in or adjacent to Barnstable County. More information is available for many of these efforts at:

www.capecodcommission.org/bikeped

CONNECTING TOWN CENTERS TO THE REGIONAL PEDESTRIAN & BICYCLING NETWORK ON CAPE COD

This study, produced in 2014 reviews connectivity between town center areas and existing bicycle paths and routes and includes identification of town center areas where sidewalks are needed. The purpose of the study is to identify key areas appropriate for new or improved bikeway connections, as part of the regional goal to facilitate bicycling and walking as viable transportation modes on Cape Cod.

The project team identified a "town center" location for each of the 15 Cape Cod towns and prepared maps of each location using Geographic Information Systems (GIS), to show existing bicycle paths, bicycle routes, and sidewalk (for main roads) data.

The following table presents a summary of recommended town center connectors to the existing bicycling network. (For town centers already connected to the existing network of bicycle routes or paths and no additional connection is identified, "N/A (Existing Connection)" is entered under Recommended Connectors column.

TABLE 5 - RECOMMENDED TOWN CENTER CONNECTORS

Town	Recommended Connectors	Description - Treatment	Notes
Barnstable	*Main Street/West Main Street* is shown as future multi-use path in town's bikeway network plan.	Proposed future multi-use path, but until then the connection is on road. Share the Road treatment options: signage (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence.	Downtown is connected to bike network but not on west end. This is an additional future connection.
Bourne	*Old Bridge Road* connects Cape Cod Canal bike path to Main Street.	0.3 mile segment length. Share the Road treatment options - signage (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence.	Main Street bypass is designated bike route. The town might want to consider designating Main Street as a designated on road route through Buzzards Bay instead.
Brewster	*Route 124 to Route 137* to CCRT. Connects Route 6A/town center to CCRT.	Approximately 1-mile connection (0.4 mile segment on Route 124, 0.6 mile segment on Route 137). Share the Road treatment options - signage (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence. .	Share the Road OK for experienced cyclists but less experienced might not feel comfortable without providing additional shoulder room which would require expansion of the road footprint. Lower volume/speed road connector is preferable but no such on-road connection from Route 6A in town center area.
	Underpass Road connects Route 6A to CCRT.	0.50 mile connection. Share the Road treatment options signage (vertical signs and/or pavement markings) to guide bicyclists and to	

Town	Recommended Connectors	Description - Treatment	Notes
		alert car drivers of cyclists' presence.	
Chatham	*Old Harbor Road - Depot Road - Hitching Post Road - Tip Cart Lane - Crowell Road* connects downtown to rail trail.	0.75 mile segment. Share the Road treatment options - signage (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence.	
	Chatham Bars Road connects downtown/Main Street to Shore Road/Road 28 bike route.	0.5 mile connection. Share the Road treatment options - signage, sharrows.	
Dennis	From *Sea Street/Route 28 – Upper County – Clipper –Stafford - Depot Street* to CCRT.	Share the Road treatment options: directional signage, (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence.	Speed limit on Depot Street is 30 MPH. Lacks room for adequate shoulders within existing road footprint. Combination of connected neighborhood streets provides partial alternative route to CCRT.
	Sea Street suggested connector between Route 28 and Lower County bike route.		
Eastham	*Samoset Road* connects town center/town hall area to CCRT.	Approximately 0.4 mile connection. Share the Road treatment options: signage (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence.	
Falmouth	N/A (Existing connection)		
Harwich	N/A (Existing connection)		
Mashpee	N/A (Existing connection)		
Orleans	N/A (Existing		

Town	Recommended Connectors	Description - Treatment	Notes
	connection)		
Provincetown	N/A (Existing connection)		
Sandwich	N/A (Existing connection)		
Truro	N/A (Existing connection)		
Wellfleet	N/A (Existing connection)		
Yarmouth	Connection from Route 28 to Forest Road bike path along low-volume neighborhood streets *Lyman lane, Mercury Drive, Hervey Lines Lane, Clifford Street and Historic Brook Road*.	Approximately 0.65 mile segment. Share the Road treatment options: signage (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence.	
	Additional connectors from Lyman Lane to Station Ave bike route: *Great Pond Drive –Icehouse Road –Wood Road – Lakeland Avenue – Indian Memorial Drive*.	Approximately 1 – mile segment. Share the Road treatment options: Signage (vertical signs and/or pavement markings) to guide bicyclists and to alert car drivers of cyclists' presence.	300 foot segment on Wood Road has sidewalk as an option for bicyclists not wanting to share the lane with cars.

SANDWICH PEDESTRIAN/BICYCLE PLANNING – IMPROVED PEDESTIRAN AND BICYCLE CONNECTIONS WITH THE CAPE COD CANAL MULTI-USE PATH

Released in early 2014, the goals of this effort included:

- Interpretive signage for the kiosk at the end of the Canal Path near the Marina.
- Completion of the bike route between the Canal and Tupper Road.
- Install a crosswalk across Tupper Road at Freezer Road.
- Develop the connection from Freezer Road to Route 6A.
- Strategies for Jarves Street need some more public discussion before a strategy can be developed. The proposed bike/pedestrian options for this roadway segment needs to be examined in terms of traffic and parking impacts.

As a result of the extensive public participation effort and refinement of alternatives by Cape Cod Commission Staff, a set of recommended improvements has been identified, according to the plan shown in the following figure:

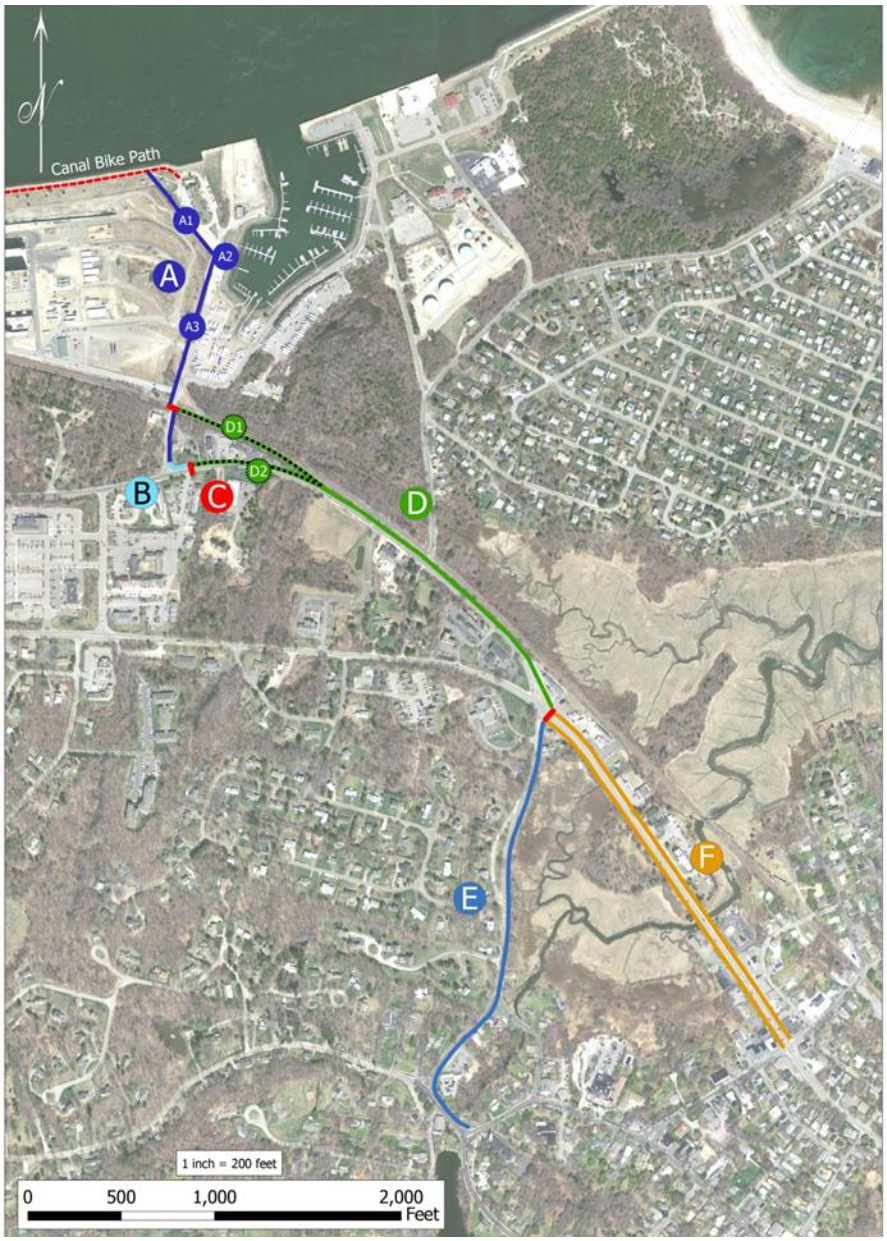

Figure 59 - Sandwich Bicycle/Pedestrian Planning - Recommended Routes

CLOSING THE GAPS: CONNECTING CAPE COD'S BICYCLE AND PEDESTRIAN NETWORK TO TRANSIT ROUTES

The purpose of this effort, released in late 2013, was to review connectivity of existing public transit (bus) routes with existing bicycle routes and paths and recommend improvements to eliminate gaps in connectivity. The review includes sidewalk accessibility along the bus routes. The report also provides an overview of bicycle and pedestrian planning on Cape Cod, building upon previous studies and plans and updating the region's bicycle route/path and sidewalk data. It includes town by town summaries of bicycle and pedestrian planning, accompanied by maps of transit routes, bicycle paths/routes, sidewalks and potential "connector" pieces.

The following table provides a compilation of potential transit route-bicycle path/route connectors.

TABLE 6 - TOWN SUMMARIES: RECOMMENDED BICYCLE CONNECTIONS TO TRANSIT ROUTES

Bike/Ped/Transit Connector	Description	Notes
Barnstable		
Route 28 sidewalks	Bus route pedestrian access	No sidewalks between Route 149 and Stop & Shop plaza or Marstons Mills Marketplace.
Bourne		
Perry Ave connector	Connects Canal bike path to Main Street (bus route). Share the road –striping, signage, sharrows.	Connects to 3 Mile Park, but not direct access to canal path.
Old Bridge Road connector	Connects Canal bike path to Main Street (bus route). Share the road –striping, signage, sharrows.	Direct connection.
County Road sidewalk	Bus route pedestrian access	Lacks sidewalks
Route 28A/Sandwich Road sidewalk	Bus route pedestrian access	Lacks sidewalk most of route.
Brewster		
Thad Ellis Road connector	Connects Route 6A (bus route) to CCRT. On road connection – striping, signage, sharrows. 1/4 mile direct connection.	
Underpass Road connector	Connects Route 6A (bus route) to CCRT. On road connection – striping, sharrows, signage	
Millstone Road connector	Connects Route 6A (bus route) to CCRT. On road connection – striping, sharrows, signage	
Route 137 connector	Connects Route 6A (bus route) to CCRT. On road connection – striping, signage, but paved shoulder may be feasible in sections	

Route 124 connector	Connects Route 6A (bus route) to CCRT. On road connection – striping, signage	
Route 137 sidewalk	Bus route pedestrian access	No sidewalks on Route 137
Chatham		

Bike/Ped/Transit Connector	**Description**	**Notes**
Route 137 connector	Connects Route 28 (bus route) to CCRT. On road, shoulders, striping, signage	
Sam Ryder Road connector	Connects Route 28 (bus route) to CCRT. On road connection – striping, signage, sharrows	
George Ryder Road connector	Connects Route 28 (bus route) to CCRT. On road connection with striping and shoulders or bike lane. Off road path may be feasible.	
Route 28 sidewalk	Connects Route 28 (bus route) to CCRT	Most of route has sidewalk but condition is poor in some locations. If enhanced could accommodate bikes.
Dennis		
Shad Hole Road connector	On road connection – striping, sharrows, signage	
Depot Street connector	Connects Route 28 (bus route) to Lower County Road bike route. On road connection – striping, sharrows, signage	
Sea Street connector	Connects Route 28 (bus route) to Lower County Road bike route. On road connection – striping, sharrows, signage.	
Route 134 sidewalk	Bus route pedestrian access.	Route 134 lacks sidewalk north of Patriot Square
Route 28 sidewalk	Bus route pedestrian access	Gaps in connectivity outside of Dennisport.
Eastham		
Governor Prence Road connector	Connects Route 6 (bus route) to CCRT. On road connection – striping, sharrows, signage. NPS received funding for flashing beacon crosswalk at Route 6 intersection for connection to Fort Hill.	
Samoset Road connector	Connects Route 6 (bus route) to CCRT. On road connection – striping, sharrows, signage	
Route 6 sidewalk	Bus route pedestrian access	East side of Route 6 lacks sidewalks, Town Hall and Brackett Road commercial areas are the bus stop locations.

Falmouth		
Bike/Ped/Transit Connector	**Description**	**Notes**
Route 151/Sandwich Road connector	Connects Route 151 (bus route) to Sandwich Road bike route. Signage to direct riders to bus stop location (at gas station set back from road).	
Harwich		
Route 28 sidewalk	Bus route pedestrian access.	Gaps in sidewalk connectivity outside of Harwichport to West Harwich. In 2010 bike/ped improvement plan.
Mashpee		
Route 28 sidewalk	Bus route pedestrian access	Some locations without sidewalk.
Route 151 sidewalk	Bus route pedestrian access	Sidewalk at school and Mashpee Commons. Town plans to extend bike path to Falmouth line.
Orleans		
Bay Ridge connector	Connects Route 6A (bus route) to CCRT. On road –striping, sharrows, signage.	Involves access through private property.
Route 28 sidewalk	Bus route pedestrian access	No sidewalks north of Finlay Road. Narrow shoulder width.
Main Street connector	Connects Route 6A (bus route) to CCRT. On road –striping, sharrows, signage	
West Road connector	Connects Route 6A (bus route) to CCRT. Also connects gap in bike path. On road –striping, sharrows, signage.	
Provincetown		
Shank Painter connector	Connects Shank Painter Road (bus route/stop) to Bradford Street bike route. On road. Bike lane or paved shoulders, striping.	Road lacks sidewalk in most locations Heavy volume of bike and pedestrian traffic.
Sandwich		
Merchants Square connector	Connects Route 6A bus route to proposed Tupper Road bike route. On road through plaza Signage, sharrows, striping	
Truro		
Route 6 sidewalk	Bus route pedestrian access	No sidewalks except for segment between school and police station. 4' shoulders along much of route. May be addressed in Outer Cape Bicycle Pedestrian Master Plan.
Wellfleet		
Bike/Ped/Transit Connector	**Description**	**Notes**

Old County/Blackfish Variety connector	Connects Route 6 (bus route) to CCRT. Crosswalk, striping to improve connection between CCRT and bus stop/Old County Road.	May be addressed in Outer Cape Bicycle Pedestrian Master Plan.
Springbrook connector	Connects Route 6 (bus route) to CCRT	Other options nearby to connect West Road and Audubon to CCRT cross private property.
Yarmouth		
Higgins Crowell connector	Connects Route 28 (bus route) to bike path and proposed CCRT extension. On road. Striping, sharrows, signage	

YARMOUTH ROAD CORRIDOR STUDY

Yarmouth Road in Barnstable experiences significant vehicle queues during peak hours of operation. The corridor is the primary access for some Cape towns to the Cape Cod Hospital. Seasonal and peak hour congestion often cause delays for emergency vehicles en route to the Hospital. The intersection of Yarmouth Road and Route 28 in Barnstable is a known high crash location and is identified in the Hyannis Access Study as an intersection in need of improvements. Yarmouth Road serves as an important access road into Hyannis Center, which accommodates both commercial and business development. Hyannis Center was recently approved as a Growth Incentive Zone. A viable Yarmouth Road corridor is significant for many modes of transportation, including walking, biking, automobile, transit and rail. The Hyannis Transportation Center is located off Route 28, a short distance from the Yarmouth Road/Route 28 intersection. The Yarmouth Road Corridor Study will examine each mode of transportation (walking, biking, automobile, transit and rail). Information on the study is available at:

www.capecodcommission.org/departments/technicalservices/transportation/projects/olderprojects

After many months of review and public input, one concept has been recommended: Concept 1a. This concept includes a multi-use path (bike path) connecting the Hyannis Transportation Center to a point just south of Route 6. The towns of Yarmouth and Dennis are currently planning to extend the existing Cape Cod Rail Trail just east of Willow Street (south of Route 6).

Concept 1a is a continuation of the four-lane divided Willow Street roadway that currently exists near Route 6 Interchange 7 to the Route 28/Yarmouth Road intersection in Barnstable and uses a westerly alignment at the Route 28/Yarmouth Road intersection. The cross section and concept plan are shown in the following figures:

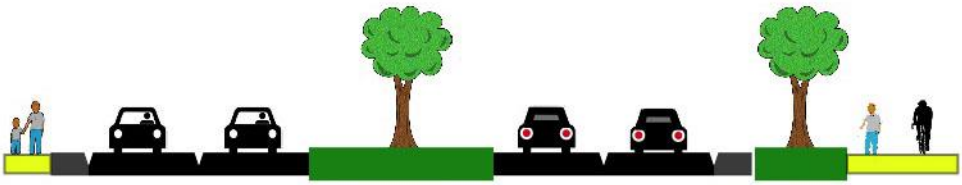

FIGURE 60 - YARMOUTH ROAD PROPOSED CROSS SECTION (LOOKING SOUTHERLY)

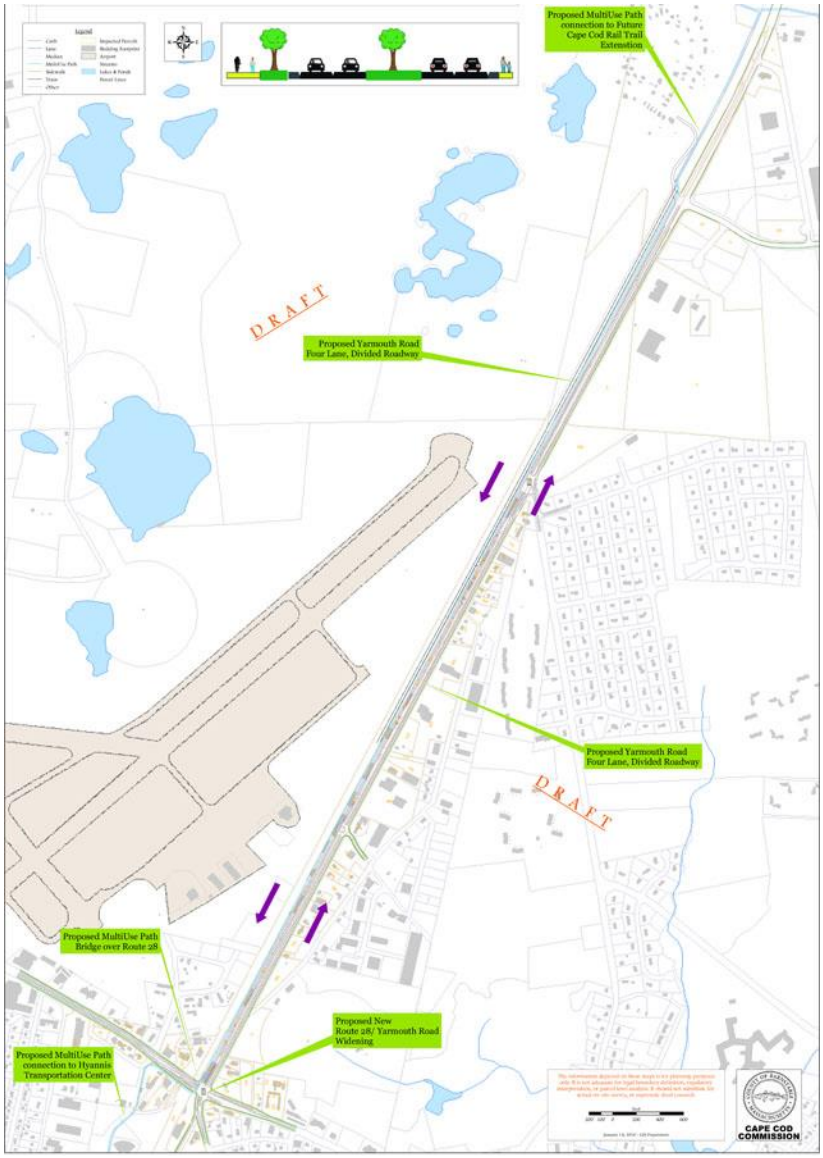

FIGURE 61 - YARMOUTH ROAD RECOMMENDED CONCEPT PLAN

HARWICH BICYCLE/PEDESTRIAN/TRANSIT

As part of an effort to enhance the economic development of Saquatucket Harbor in Harwich Port, the Town of Harwich is seeking to provide safe and effective pedestrian and bicycle facilities between the Cape Cod Rail Trail/Old Colony Rail Trail and Route 28, with a specific focus on a connection between Harwich Center and Harwich Port. In addition, the Town of Harwich is looking to provide safe pedestrian and bicycle connections as well as shuttle bus service between Wychmere Harbor and Saquatucket Harbor. A Cape Cod Commission/Town of Harwich effort is underway to meet the following goals:

- Identify safe and effective pedestrian and bicycle access between the Cape Cod Rail Trail/Old Colony Rail Trail and Route 28, with a specific focus on a connection between Harwich Center and Harwich Port.
- Identify safe and effective pedestrian and bicycle access between Wychmere and Saquatucket Harbors along Route 28 that would intersect with a connection to Harwich Center.
- Identify the potential for shuttle bus service between Wychmere and Saquatucket Harbors.
- Coordinate with the Regional Transportation Plan/Cape Cod Bike Plan. A goal of this effort is to construct new bicycle/pedestrian facilities using available funding sources source is the Cape Cod Transportation Improvement Program (TIP) administered by the Cape Cod Commission and funded by the Massachusetts Department of Transportation and Federal Highway Administration.
- Commission staff will work with the Town of Harwich to integrate these bicycle/pedestrian efforts into the current update of the RTP.

From public outreach to concerned citizens and input from town of Harwich officials, the following figure includes a summary of recommended bicycle and pedestrian enhancements in the study area:

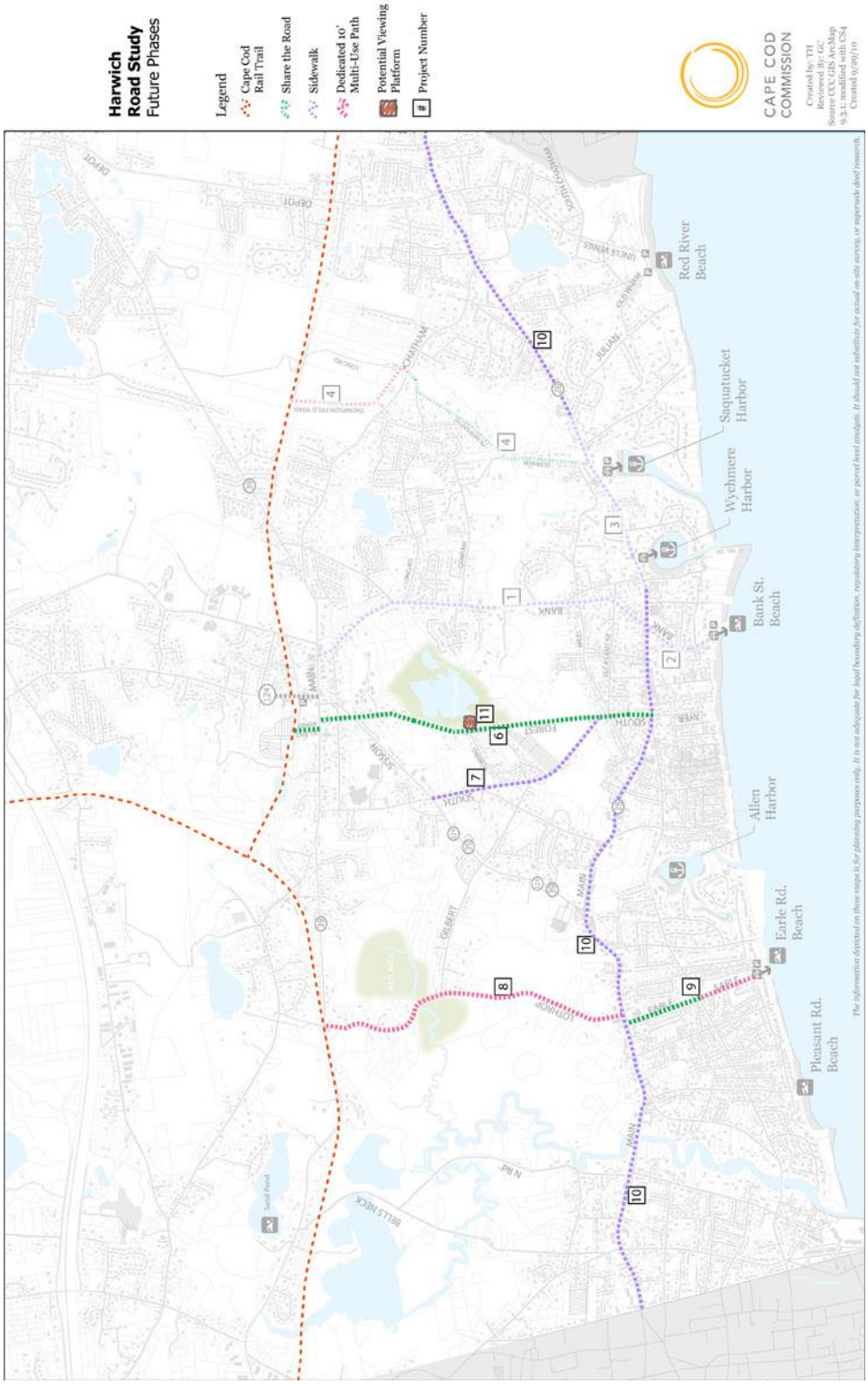

FIGURE 62 - HARWICH BICYCLE/PEDESTRIAN/TRANSIT STUDY RECOMMENDATIONS

BARNSTABLE

The town of Barnstable has a comprehensive Open Space and Recreation Plan. The plan is available from the Town of Barnstable's website at:

http://www.town.barnstable.ma.us/CommunityPreservation/CPA%20Plan.pdf

As part of this effort, town-wide mapping of existing and proposed improvements for bicycling & pedestrian accommodation are shown in the following figure:

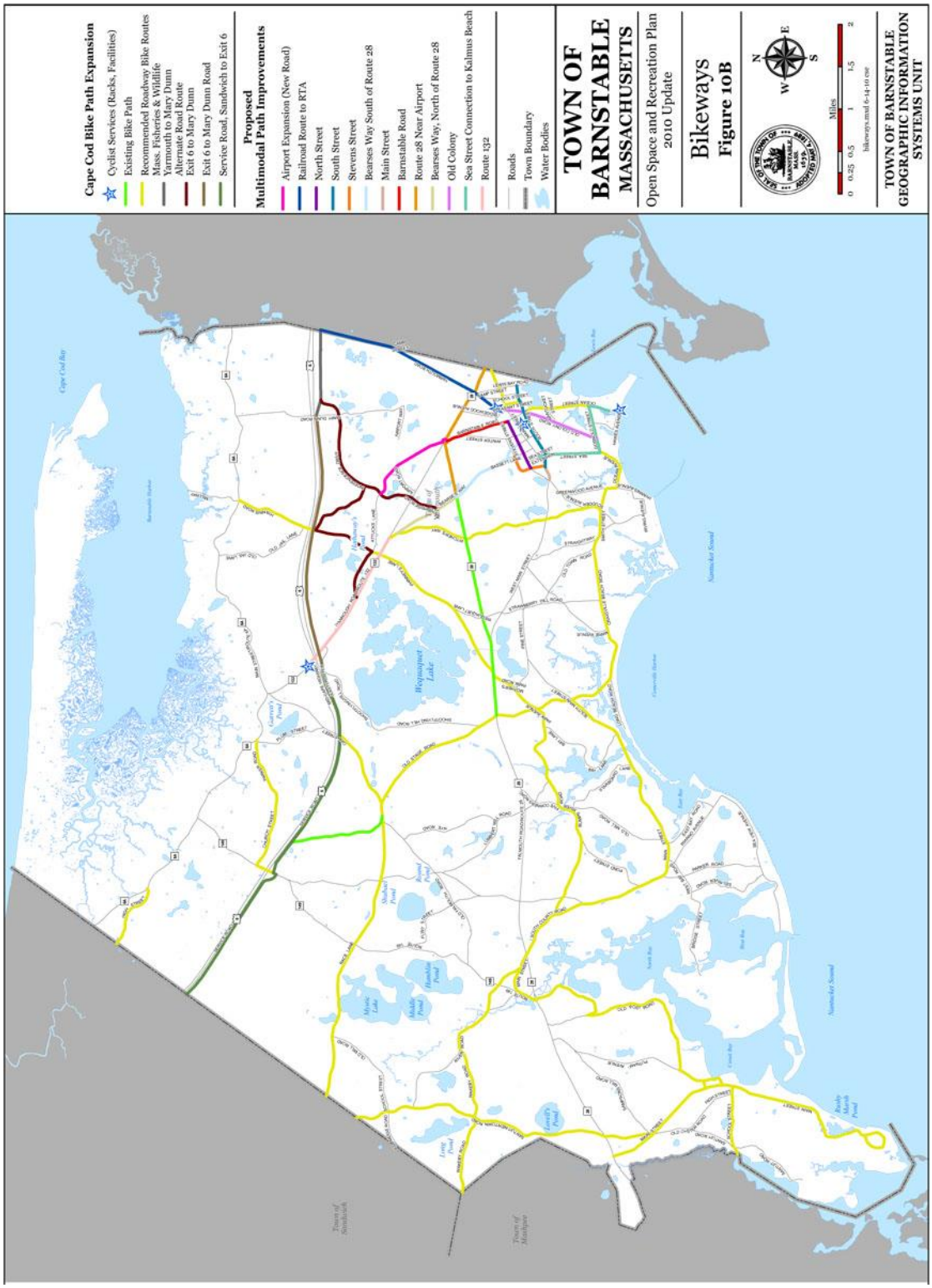

FIGURE 63 - BARNSTABLE BICYCLING & PEDESTRIAN PLANNING

DENNISPORT REVITALIZATION MASTER PLAN

The Dennis Port Revitalization Master Plan reflects the cumulative efforts of over two hundred individuals and over two years of effort. Looking forward 50 years, this plan is a road map and a critical resource for directing growth and rebuilding the heart of the community. Under the leadership of the Dennis Port Revitalization Committee, and with needed support from the Town of Dennis, this plan has taken shape. The Revitalization Master Plan illustrates physical solutions to Dennis Port's existing challenges, as related to the ten topic areas:

- transportation
- public safety
- economic development
- social services
- land use
- housing
- historic heritage
- arts & culture
- alternative energy
- stormwater & wastewater

Where possible, physical solutions have been incorporated into the Master Plan.

Implementation Strategies.

The Dennis Port revitalization planning effort focused on three primary nodes:

- the historic Village Center
- the hotel resort area along Chase Avenue
- the cottage colony resort area along Old Wharf Road

The design team also looked at the Route 28 corridor, to suggest interventions that could improve the character of this important gateway. While the provision of bikeways is the most visible element in any bikeway network, bicyclists must also have safe and convenient places to store their bicycles at a trip's end. Thus, providing bicycle parking and other "end-of trip" facilities is critically important in supporting bicycling as a viable mode of transportation. While parking solutions range from the basic bicycle rack to semi-enclosed bicycle shelters to full bicycle stations all bicycle parking facilities should be attractive and identifiable, space efficient and as close, if not closer, to the associated destination than any automobile parking. The Bike Way Plan also outlines several locations where the expansion of bicycle parking is needed for recreational and utilitarian use and is shown in the following figures:

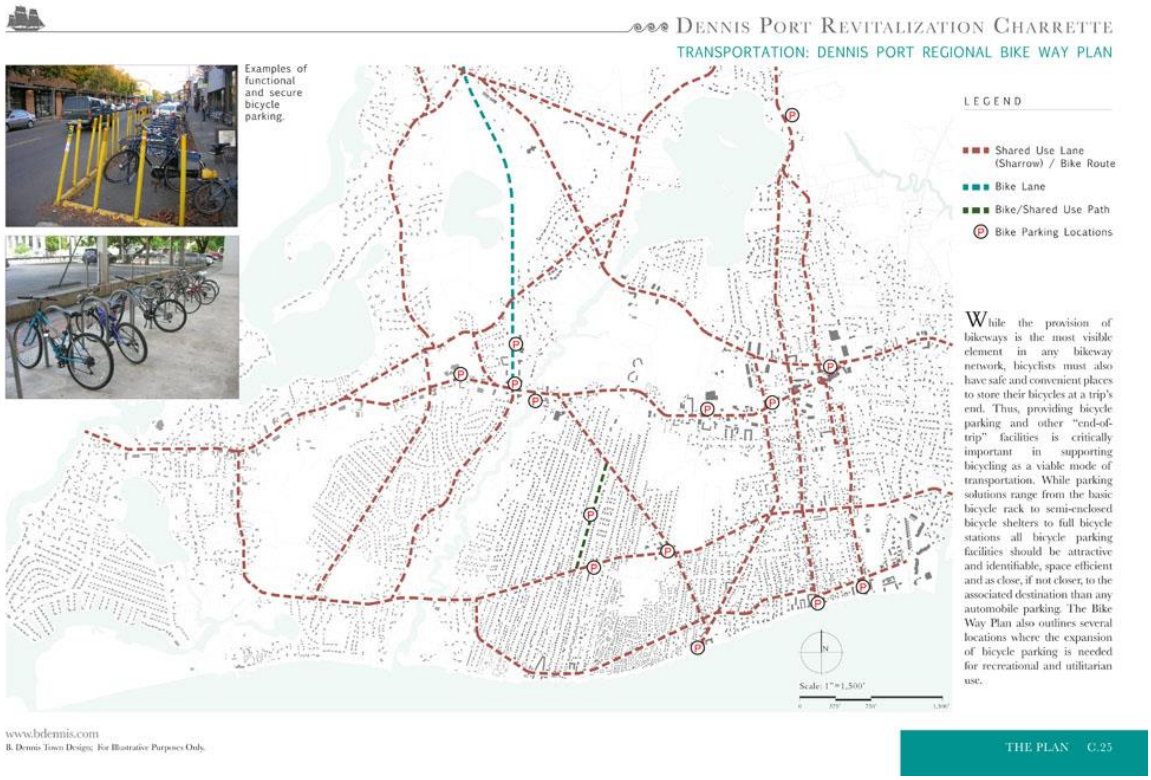

FIGURE 64 - DENNIS PORT REGIONAL BIKE WAY PLAN

ORLEANS ROUTE 28 BIKE PATH

The Town of Orleans recently completed a feasibility study for the creation of a safe and continuous bike and pedestrian facility that connects South Orleans to Orleans Center. Fay, Spofford, and Thorndike (FST) helped evaluate the Route 28 corridor and its potential to host such a facility. They met with members of the District 5 office to fully understand the challenges of constructing a facility of this type. At the completion of the study and after review and consideration of several off-road alternatives, the Town believes that the Route 28 corridor is the best option to connect the two villages. The study found that a Route 28 facility would be the most accessible bike and pedestrian facility and therefore serve the greatest number of residents and visitors. The following figure is a locus map showing select areas along the route that were examined closely. For each location, a conceptual cross section is included in the report showing both a shared use path and a side walk (some on either side of the road) to illustrate how it may work within the context of the road and its layout. A complete version of the report is available here:

www.town.orleans.ma.us/Pages/OrleansMA_Planning/bikefinal

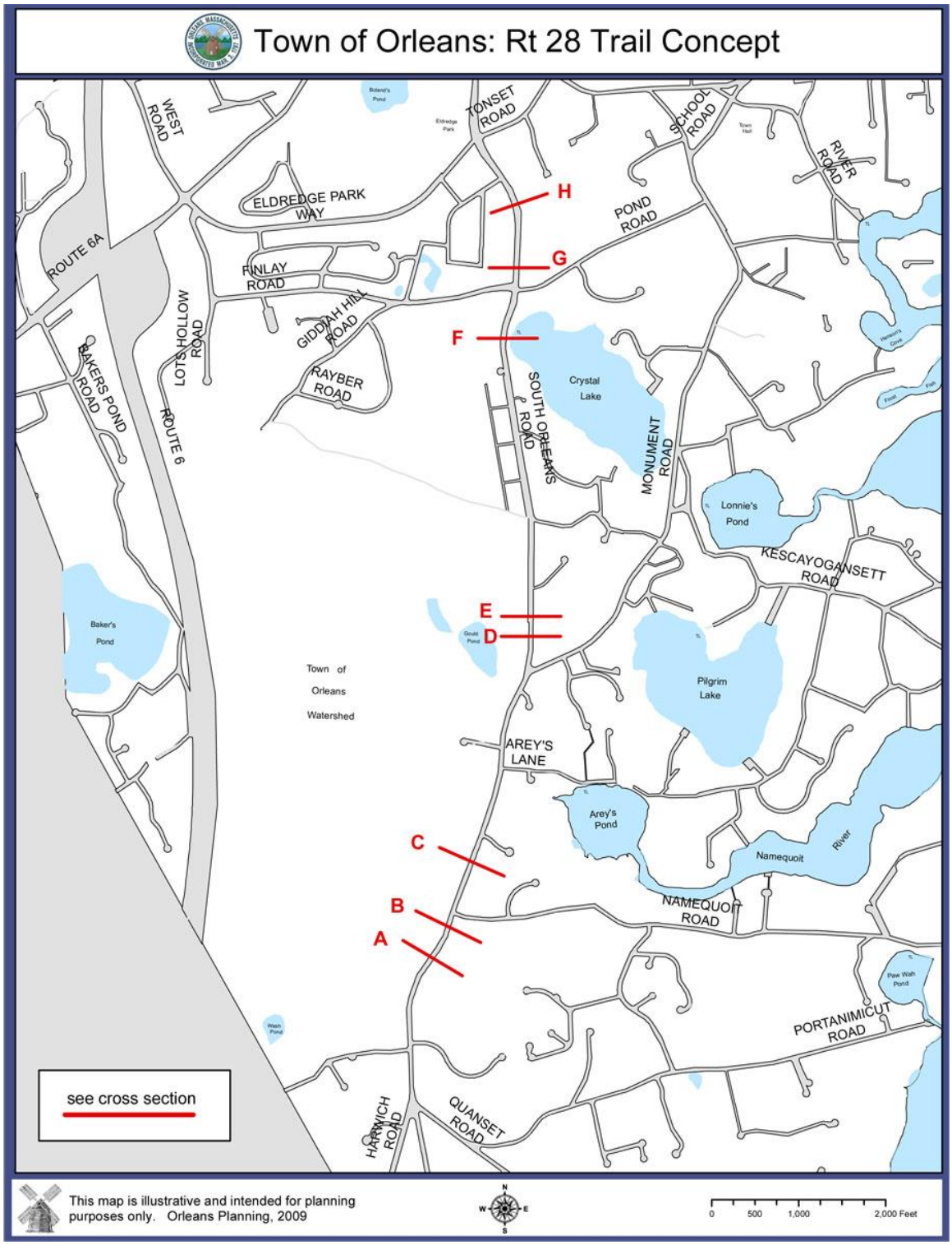

FIGURE 65 - ORLEANS ROUTE 28 BIKEWAY PROPOSAL

WAREHAM BICYCLE CONNECTIONS TO CAPE COD

A Bicycle planning committee for Wareham is proposing a connection from downtown Wareham to Buzzards Bay at the Route 6/28 crossing of Cohasset narrows. Information is available from the Wareham Community Pathway website:

http://www.warehambikepath.com

The following figure shows the potential alignment from Wareham to Buzzards' Bay:

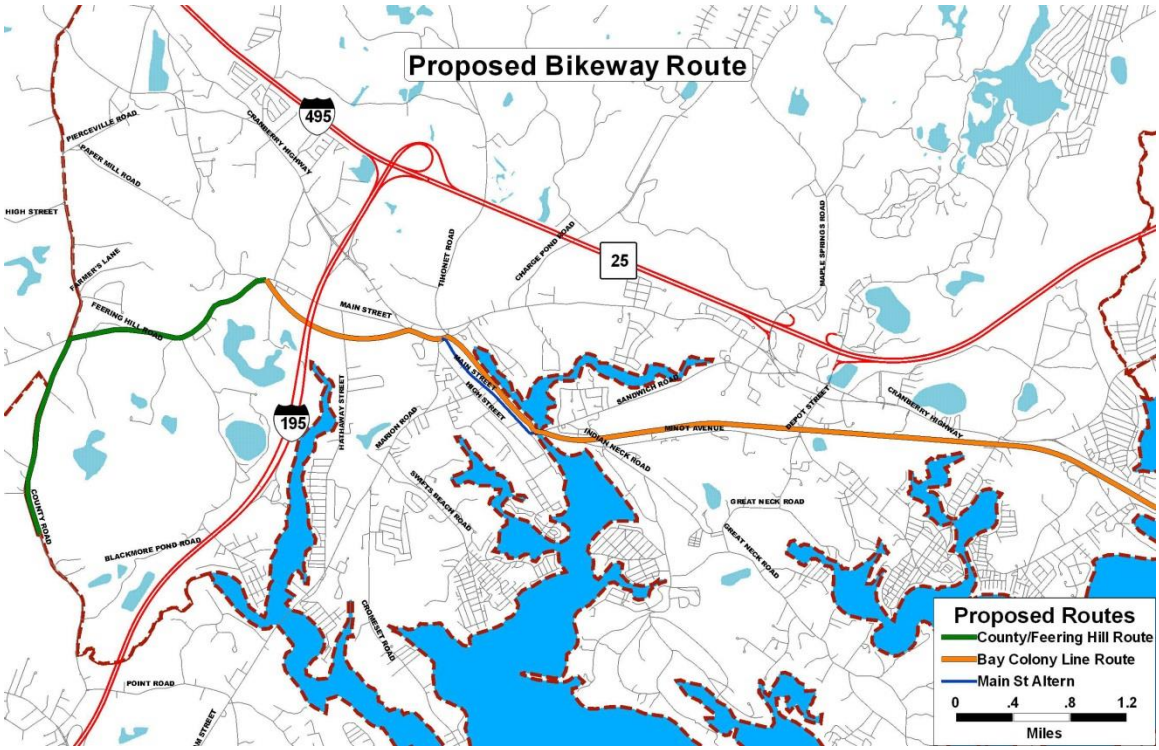

FIGURE 66 - POTENTIAL WAREHAM TO CAPE COD ROUTE

CCNS INTEGRATED BICYCLE PLAN FOR CAPE COD

In 2010, the Cape Cod National Seashore (CCNS) completed an Integrated Bicycle Plan ("Bicycle Feasibility Study") for Cape Cod. This feasibility study was undertaken by the National Park Service in partnership with the Cape Cod Commission to identify improvements necessary to develop an integrated bicycle network throughout Cape Cod. This approach will help to ensure an efficient, coordinated approach to addressing needed bicycle network improvements.

With active participation of Cape Cod Commission staff and many other stakeholders, the study helps lay the groundwork needed to improve bicycling conditions on Cape Cod by developing a comprehensive and connected bicycle network. Included are a list of both infrastructure improvements and programmatic initiatives to promote bicycling, enhance bicycle access and improve safety. This will help establish bicycling as a viable transportation option while reducing dependence on automobile transportation. This is to be accomplished by creating an integrated, multimodal transportation environment throughout Cape Cod. The study established an approach to identifying opportunities for projects and initiatives, and provides guidance on implementing them in an efficient and coordinated manner.

The three primary goals of the CCNS study are:

- To integrate regional planning and the regional bicycle network with Cape Cod bicycle facilities and CCNS attractions.
- To identify projects to improve Cape Cod bicycle facilities and facilitate integration with the regional bicycle trail network.
- To identify projects that would improve bicycle access to and within Cape Cod National Seashore (Seashore).

Projects and CCNS priority corridors are presented in maps at the end of this section. Links to the complete text of the CCNS report are available at:

www.capecodcommission.org/bikeped

DESCRIPTION OF PROJECT TYPES

The projects proposed to enhance the bicycling environment on Cape Cod were extremely varied in nature, ranging from programmatic initiatives such as education and outreach efforts and maintenance plans to infrastructure projects providing improvements to existing routes, as well as the construction of new facilities. The physical improvements themselves covered a broad spectrum of projects. They included improved signage, enhanced trail crossings at roadways, the creation of connector trails, and new facilities in corridors not currently served by bicycle routes or facilities. Three primary classifications were developed to categorize the proposed projects; improvements to existing facilities; new facilities; and other initiatives. These categories are described in more detail, as are the individual projects that were selected for inclusion in the study. Maps depicting the locations of the selected projects are included in this chapter along with a table for cross reference. Projects proposing regional corridor improvements have been mapped, however short corridor improvements with an undefined route have not been mapped. Several projects proposed development of routes following general corridors. Such routes have been depicted on the maps using broad arrows and do not indicate specific or preferred alignments, nor do they reflect environmental constraints or sensitive areas that may need to be avoided.

Improvements to Existing Facilities

The bicycling network on Cape Cod is comprised of many types of facilities of varying conditions. Though many miles of bicycling routes and paths exist many have deficient conditions relating to safety or usability by less experienced bicyclists such as basic wayfinding and signage, especially for visitors that may not be familiar with the Cape. Additionally, access to trip generators such as neighborhoods, major destinations, town centers, or commercial areas are often lacking. These elements would facilitate greater utilization of the bicycling network for travel throughout Cape Cod and less reliance on automobile travel. A number of proposed projects aim to improve the existing facilities on the Cape and to make uniform the conditions experienced by bicyclists, whether in the form of improved wayfinding signage, consistent pavement markings, improving on-roadway conditions along existing bike routes, or upgrading facility designs to current standards.

New Facility Construction

In order to provide for complete mobility for nonmotorized users a variety of new construction projects are needed to extend existing facilities, connect existing facilities to destinations and localities, close gaps in the bicycle network on Cape Cod, and enhance safety. This process has resulted in identifying many needed routes or facilities that will provide safer, more comfortable bicycling conditions for on-roadway routes, extend or connect facilities such as the Cape Cod Rail Trail extension and proposed spurs linking towns and destinations, and close gaps within the network by linking existing routes or facilities.

Other Initiatives – maintenance plans, new or revised programs and policies, outreach and education

Though a number of physical improvements have been identified to enhance and expand the network of bicycle routes throughout the Cape, many opportunities exist to improve bicyclist safety and to encourage the use of bicycling both for recreation and as a viable transportation option. Developing programmatic and policy elements will ensure a comfortable and consistent bicycling environment across the Cape for bicyclists of varying skills, abilities, and bicycling interests. Such programmatic elements will serve to address human factors, thereby creating a safer, more inviting bicycling environment, while also encouraging the use of a continually improving bicycle network as a means of routine travel throughout Cape Cod by both tourists and residents alike. Many of these proposed projects will work in tandem with projects aimed at improving infrastructure by ensuring awareness of bicycling transportation and recreation options, enhancing operational safety of bikeways and enhancing the utility of the bicycle network on Cape Cod. This will make the bicycle network more useable by a variety of visitors and residents, thereby alleviating the existing burden on the transportation network resulting from over-reliance on automobiles.

Selected Projects

The following lists of projects reflect those selected through the process described in Chapter 4 of the Feasibility Study. The sorting process did not assign a ranking or priority, but rather categorized them according to the level of benefit and the barriers to implementation. All proposed projects should be viewed as valid and potential projects that may be pursued for funding. Coordination between Cape Cod National Seashore, the Cape Cod Commission, and/or the respective municipality will need to coordinate selection and implementation of individual projects. A consolidated list of all proposed projects is included in the full report are available at:

www.capecodcommission.org/bikeped

Each of the 47 recommended projects listed here includes a basic project description, preliminary design concepts, a planning-level cost estimate, and recommendations for implementation. Some projects have more detailed cost estimates as a result of greater levels of detail relating to alignments, the type of facility, proposed configurations, and total distance. However many projects are merely conceptual, identifying only a corridor or general route in need of improvement without specifying the project length, type or level of accommodation to be provided. Estimates for general conceptual projects only include unit costs for the different types of possible accommodations and alignments that may be utilized.

The cost estimates were prepared in 2009/2010, based upon typical project costs in the Cape Cod region. Due to the variability of construction and materials costs over time, an appropriate inflation factor should be determined and applied when using these estimates in future years.

Each project will require varying levels of environmental compliance dependent upon the agency undertaking it and the scope of the project. An NPS Environmental Screening Form would be completed for any project arising from this study to determine the level of environmental compliance required. Projects undertaken within Cape Cod National Seashore would require NEPA (National Environmental Policy Act) and possibly MEPA (Massachusetts Environmental Policy Act) documents for environmental clearance; however the specific level of required compliance would be determined through the individual project scoping process. Projects developed by localities would comply with applicable environmental clearance requirements, also to be determined during the project scoping process.

The individual project descriptions included in this chapter are intended to provide stakeholders with a resource to be used in developing project proposals and funding requests through a variety of sources. Conceptual details and planning level cost estimates will provide a basis for further development of individual project scopes and proposals. A variety of funding opportunities exist, largely via state and federal grant programs. Some of the funding sources available include the NPS Park Roads and Parkways Program, Transportation Enhancement grants, Recreational Trails Program, Congestion Mitigation Air Quality, and several Federal Transit Administration programs, among others.

IMPROVEMENTS TO EXISTING FACILITIES

The following is a list of sixteen projects proposing improvements to existing facilities. This list was developed through an extensive public participation process involving all 15 Cape Cod towns and stakeholders including MassDOT. These projects are numbered 5.2.1 through 5.2.16.

Project 5.2.1: Design Alternatives for Cape Cod Rail Trail Extension to Provincetown

Project Description – The existing Cape Cod Rail Trail (CCRT), which is maintained by the Massachusetts Department of Conservation and Recreation, currently terminates in South Wellfleet, just north of the National Seashore Park headquarters. Bicycle and pedestrian access to the remainder of the Outer Cape is largely limited to US Route 6, the principal arterial providing motor vehicle (and motor freight) access to this region of the Cape. The estimated 400,000 annual users of the CCRT therefore have no access to the Outer Cape and many of the attractions within the National Seashore. Extending the CCRT to Provincetown would provide the following benefits:

- Continuity in access to over 40 miles of the Outer Cape by bicyclists and pedestrians
- Bicycle and pedestrian access to virtually all destinations and attractions within Cape Cod National Seashore

- Enhanced safety by eliminating the need for bicyclists and pedestrians to travel along Route 6 which has no accommodations for bikes or pedestrians.
- Provision of a transportation alternative that would facilitate nonmotorized mobility and access to a significant number of Outer Cape destinations, thereby reducing congestion, parking demand, and the associated environmental and sensitive lands impacts.

This project would include preparation of an environmental assessment (EA) in accordance with the National Environmental Policy Act (NEPA) process that includes a description of the proposed project; the reasonable alternatives under consideration; the social, economic and environmental impacts of the alternatives; mitigation measures and a section on comments and coordination. The project will evaluate alternative alignments and their respective costs, impacts, and connections/ accessibility provided.

Preliminary Design Concepts – The three alternative alignments and design concepts include:

- Eastern alignment
  - approximately 20 miles
  - largely through the National Seashore
  - consisting of both on-roadway and shared-use path segments
  - primarily undeveloped and natural environments
- Interior, or Bay alignment
  - mostly on secondary roadway alignments
  - via the towns and neighborhoods of Wellfleet, Truro, and Provincetown
  - primarily developed and largely residential) environments
- Abandoned railroad alignment
  - located along the western side of the Outer Cape
  - shared-use path with occasional road segments
  - a mix of natural landscapes in the National Seashore and developed areas of North Truro and Provincetown

Cost Estimate – Costs for 3 conceptual alignments

- Eastern Shore alignment: design cost $3,385,000
- Interior, or Bay alignment: design cost $1,100,000
- Rail alignment $2,911,000

Design cost estimates at 17% of NET construction costs

Recommendations for Implementation – The EA should be undertaken to fully determine the extent of all impacts associated with the three alternatives. A subsequent analysis of the alternatives to determine which, if any of the three options are feasible along with costs associated with possible right of way acquisitions, and public input should be undertaken to establish a preferred alignment. Mass DCR's maintenance responsibility for the CCRT requires close coordination between the state and CCNS.

<u>Project 5.2.2: Wayfinding Signage and Pavement Markings on CCRT</u>

Project Description – With an estimated 400,000 users annually the Cape Cod Rail Trail (CCRT) has the potential to serve as a significant alternative transportation facility, not merely a recreational route. Installation of consistent signage along the Cape Cod Rail Trail to include interpretive, directional, informational, and other wayfinding signage is needed to both enhance the trail user experience as well as facilitate use of the trail as a bicycle transportation corridor, especially by those that are not familiar with areas served by the facility. Additionally, improved pavement markings are needed, primarily at the 45 roadway crossings to enhance safety and communicate expected behaviors by both trail users and motorists at these conflict points. Motorist and trail user expectations and actions are not consistent, in part due to trail and roadway crossing designs that are inadequate and design treatments that are inconsistent and often don't comply with the MUTCD (the Manual on Uniform Traffic Control Devices) regulations or AASHTO guidelines.

Preliminary Design Concepts – The specific signage design and placement has to be determined, and avoidance of visual clutter is needed, however the primary information that needs to be considered for signage includes:

- Trail amenities including rest rooms & emergency services
- Historic resources
- Beaches
- National Seashore attractions
- Town centers and commercial destinations including restaurants, lodging, retail shopping, bike shops
- Distance signage (to destinations)
- Connections to intermodal transportation facilities including bus and ferry terminals
- Connections to other bicycle facilities & bike routes
- Communicating mobility issues for access by different users (including ADA issues)
- Safety information such as sand and other surface hazards

Cost Estimate – Complete signage at $18,400 per mile:
- $405,000.00 for the existing CCRT
- $129,000.00 for the Old Colony extension

Recommendations for Implementation – This approach will facilitate addressing the multiple locations that will be enhanced or addressed over time and in a phased manner, but this project provides a uniform protocol and design standards so that consistency is ensured.

Sign design, content, placement standards, measures to avoid visual clutter, installation and maintenance polices, and other considerations need to be established and agreed upon by stakeholders and responsible parties prior to implementation. The parties responsible for installation and maintenance need to be apprised of protocols including coordination of responsibilities when multiple agencies are involved. This needs to include entities with roadway construction authority so that roadway projects impacting trail crossings and intersections include appropriate and uniform design treatments and standards, regardless of locality. As development and implementation of Intelligent Transportation Systems occurs wayfinding resources could be added such as location-specific information via cell phone (based upon mile posts along bicycle routes and rail trails).

Project 5.2.3: Intersection Improvements on Setucket Road Path

Project Description – Intersection treatments along the Setucket Road and Old Chatham Road Paths are inconsistent and lacking in conspicuous pavement markings that comply with national standards and design guidelines. Designed primarily as a side path, there is a resultant 38 roadway crossings in only 7 miles, and as a result a need for high visibility crosswalks and other pavement markings to communicate to motorists and path users the presence of conflict points. Pavement markings and signage also communicate appropriate actions at intersections for both motorists and path users. Additionally, access to the paths needs to be upgraded to provide curb ramps and ADA-compliant detectable warning surfaces.

Preliminary Design Concepts – High visibility crosswalks and improved signage and intersection treatments that are consistent with MUTCD and ADA standards and AASHTO design guidelines need to be selected to be applied uniformly along the facility. Consideration should also be given to evaluating the existing configuration and geometrics for each of the intersections and changes made that will enhance safety. This review should include issues such as sight distance, bollard placement, path width, angle of approach/crossing (skewed crossings), etc.

Cost Estimate – Costs vary subject to existing conditions and improvements needed at individual locations. Unit costs for typical crossing improvements are provided.

- Residential Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection on two-lane roadway with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A complete review of the existing conditions should be conducted and documented and feedback from users should be collected to identify deficient conditions and desired improvements. Existing elements that are not consistent with MUTCD standards, AASHTO guidelines, and current best practices should be considered for retrofits and improvements. Regulatory and advisory signage should also be consistent with state law (such as the existing signage instructing bicyclists to dismount to cross intersections). A policy by which the selected improvements are installed and maintained needs to be established. Uniform design treatments need to be consistently applied throughout the length of the facility.

Project 5.2.4: Enhance Bicycling Conditions by Providing Paved Shoulders

Project Description – Multiple locations were proposed for shoulder widening or the addition of paved shoulders throughout Cape Cod along roads appropriate for on-road bicycling in order to provide safer, more comfortable bicycling conditions while also reducing conflicts with motor vehicles. Routes favored by bicyclists and those roadways that serve as connections to destinations, neighborhoods, and existing bicycle facilities should be considered for shoulder

improvements when traffic conditions merit. Adding paved shoulders has additional benefits including pavement edge stabilization, the addition of a recovery area which reduces roadway departure crashes, and a breakdown area that allows disabled vehicles to be moved out of the travel lane, thereby mitigating congestion impacts from such incidents. These all result in safety, operational, and maintenance benefits which yield long-term cost savings.

Preliminary Design Concepts – Widening or the addition of paved shoulders should consider the existing roadway geometrics. In order to be useful for bicycle travel shoulders and the adjacent travel lane need to be of adequate widths to provide a degree of separation between the two modes; otherwise safety can be impaired by inviting motorists to pass too closely to bicyclists that attempt to hug the outside edge of the roadway. In general a four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. On roads with curb and gutter, the gutter pan and the longitudinal joint effectively reduces the useable width of the shoulder and consideration needs to be given to the paved width of the shoulder exclusive of the gutter pan.

Cost Estimate – On-road improvements, unit costs per mile:

- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders along both sides of the road.

Recommendations for Implementation – A protocol for identifying and prioritizing roads that will receive shoulder improvements needs to first be established. Limited resources dictate that shoulder improvements need to be made to roads where the benefits are the most significant and needed. Conditions to be considered should include:

- Roads already heavily used by bicyclists
- Designated bike routes with unimproved conditions
- Roads connecting to destinations or bicycle facilities
- Roads that establish a network or close a network gap
- Motor vehicle and truck traffic volumes
- Possible alternate routes (that are more suitable or which can be improved at a lower cost)
- Existing right of way
- Need for relocation of ditches (trench widening or wedging)
- Concurrency (opportunities to include shoulders as part of planned or programmed road projects)
- Coordination across jurisdictions for route continuity

Following the identification of candidate roads opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Policies and procedures should be established to ensure that construction and maintenance projects determine whether a road is listed as a priority route for paved shoulders and then scoped to include the improvements. Routine pavement overlay and resurfacing projects should include shoulder paving for the identified routes. Consideration should be given to establishing a goal of spending a set percentage of maintenance and/or paving funds on adding shoulders for bicycle improvements. Maintenance needs to be considered so that the

functionality of shoulders for bicycling purposes is retained as the natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder.

Project 5.2.5: Identify Possible Sidewalks and Pedestrian Crossings near Brackett Road & Route 6

Project Description – Brackett Road in Eastham intersects with the Cape Cod Rail Trail and connects a largely residential area east of the trail to a commercial center at the intersection with Route 6, approximately ¼ mile to the west of the trail. Some pedestrian improvements are partially constructed, however further funding is needed for completion. Additional sidewalks and pedestrian crossings need to be identified and designed to develop a complete network of pedestrian facilities to provide access and improve safety within this corridor.

Preliminary Design Concepts – Sidewalks should be provided to establish linkages between the commercial trip generators along Route 6 with the Cape Cod Rail Trail and the residential neighborhoods accessed via Brackett Road. Depending upon traffic volumes, speeds, and location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

Cost Estimate – Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A gap analysis should be undertaken to identify and prioritize sidewalks and crossings needed to develop a complete network which integrates the existing pedestrian infrastructure (such as the CCRT) with the surrounding pedestrian trip generators including both residential and commercial origins and destinations. Safety countermeasures should be considered for locations where potential exists for vehicle/pedestrian collisions, primarily at the intersection with the CCRT and along Route 6 where pedestrian travel may present multiple conflict points with vehicle ingress and egress. Access management should be considered at these locations, and improvements along Route 6 should also seek to improve access to transit stops.

Project 5.2.6: Western Extension of CCRT through Independence Park

Project Description – Located along Route 6 in Barnstable, Independence Park, a commercial and industrial business center, lies just to the north of the Hyannis Transportation Center and the Barnstable Municipal Airport. Providing a connection to the CCRT would

facilitate greater utilization of the trail for bicycle commuting trips, especially if coordinated with access to the Hyannis Transportation Center. Multimodal commute options would be greatly expanded as a result.

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic. The proposed western extension of the CCRT linking the existing terminus in South Dennis to the Hyannis Transportation Center would likely utilize an alignment to the east of the regional airport that is proximate to Independence Park. A short spur, likely passing to the north of the airport would be needed to provide a connection between the business park and the extension of the CCRT. The actual alignment needs to be determined.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00

Recommendations for Implementation – This connection needs to be coordinated with planning or construction related to the western extension of the Cape Cod Rail Trail, most notably the extension to the Hyannis Transportation Center (Project 5.2.7) which would result in a CCRT alignment that is proximate to this location. Additionally, Project 5.2.13 should be considered for coordination since it may facilitate a logical termini for either a future extension of an off-roadway alignment linking the CCRT to the Cape Cod Canal Bikeway, or at least serving to access an on-roadway route.

Project 5.2.7: Western Extension of CCRT to Hyannis Transportation Center

Project Description – The current terminus of the Cape Cod Rail Trail in South Dennis lies approximately 8 miles to the east of the Hyannis Transportation Center. Connecting the CCRT to Hyannis is significant in that it is an urban center of Cape Cod with considerable population and commercial activity, and also the site of the Cape's primary multimodal center providing rail, air, bus, and ferry service. The CCRT serves as one of Cape Cod's primary bicycle facilities and by providing direct access to the transportation center bicycling can become a more integrated mode in the Cape's transportation network and linking the center and Hyannis to multiple communities and destinations in the Mid and Lower Cape.

Approximately 3.3 miles of the proposed extension are currently programmed, continuing along the existing abandoned rail bed. The proposed alignment could utilize the existing two mile long Old Townhouse Road Trail needing only to close a small .15 mile gap between those two alignments. Another 1.25 mile section of the Old Townhouse Road Trail is currently

programmed, which would extend the CCRT to Higgins Crowell Road leaving approximately a 2.5 mile gap to connect to the Hyannis Transportation Center. The most likely alignment from that point would continue along the Old Townhouse Road corridor and then in the proximity of Yarmouth Road which provides access the Hyannis Transportation Center. The proposed extension runs primarily through Yarmouth, with short segments at either termini in Dennis and Barnstable.

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic. Utilization of any existing path segments should consider retrofitting to ensure continuity in design, including intersection treatments.

Cost Estimate – Shared-use path cost:

- utilizing combination of alignments noted – $5,200,800.00

Recommendations for Implementation –The proposed corridor and specific alignments have undergone conceptual design but it may be necessary to determine potential gaps, notably if any existing facilities are to be used. Further, if existing facilities are to be utilized and integrated into the extension they need to be evaluated for retrofits or improvements to provide consistency and continuity with the design standards employed for the remainder of the CCRT. An environmental assessment is needed before final design and construction can proceed. The extension should also be coordinated with planning or construction related to Projects 5.2.6 and 5.2.13.

Project 5.2.8: Connect Chatham Municipal Parking Lot and Old Colony Rail Trail and Old Queen Anne Road via Route 137 Improvements

Project Description – The Old Colony Rail Trail in Chatham lies along the north side of Route 28 with a trailhead located near the intersection of Route 28 (Main Street) and Route 137 (Meetinghouse Road). Access north to East Chatham and Brewster is needed and is proposed via roadway improvements including the addition of 4' paved shoulders along approximately 1.25 miles of Meetinghouse Road between Main Street and Queen Anne Road.

Preliminary Design Concepts – Roadway improvements along Route 137 to provide 11' travel lanes and 4' paved shoulders. On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures would provide a convenient and comfortable route for cyclists of varying abilities. Specific design treatments should be sensitive to the particular needs and context of each road where improvements are made.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Routine pavement overlay and resurfacing projects should include shoulder paving for this route if adequate right of way exists or can be obtained. Maintenance needs to be considered so that the functionality of shoulders for bicycling purposes is retained since the natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder.

Project 5.2.9: Extension of the Old Colony Rail Trail from Volunteer Park to Schoolhouse Pond

Project Description – The existing Bicycle Spur from Volunteer Park is called the Old Colony Rail Trail and also the Chatham Spur. Currently the Chatham Spur ends in Chatham and utilizes a brief on-road alignment in the vicinity of the airport. In order to connect this trail to Schoolhouse Pond, an extension of the multi-use trail is required for a distance of approximately 3000 feet. Also, a "Share the Road" bike route or bike lane is required on Old Queen Anne Road for a distance of 4000 feet to make final connections to Sam Ryder Road, the access road to Schoolhouse Pond.

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Recommendations for Implementation – Landowner issues may present difficulty in acquiring the needed right of way for a trail alignment. Alternative alignments should be investigated to determine the most feasible connection.

Project 5.2.10: Connect Shining Sea Bikeway to Gifford Street

Project Description – This proposed connection has been conceived by the Falmouth Bikeways Committee. The goal is to provide bicycle access to Gifford Street, a major north/south local collector connection Brick Kiln Road to Main Street (Route 28). There are a number of local roads that can be used as a bike route to facilitate this connection including Pumping Station Road, Jones Road and Kathleen Lee Bates Road; the preferred alternative. The most challenging constrain is the crossing of State Highway Route 28. The Falmouth Bikeways Committee has made inquiries to MassDOT regarding this location to in hopes to having a pedestrian bridge constructed to facilitate a safe and convenient crossing.

Preliminary Design Concepts – The connection is envisioned to utilize local roads with several possible options including Pumping Station Road, Jones Road, and Katherine Lee Bates Road which is the preferred alternative. Two primary design issues entail identifying and designing a suitable crossing of Route 28, and access from the bikeway to Route 28 which may involve private property. Few streets provide a direct route from the bike way across Route 28 due to offset intersections. As a result a short shared-use path spur may be necessary to provide a connection between the bikeway and Route 28. Wayfinding signage should be installed along the selected route.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

Crossing improvements, unit costs:

- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – Some have advocated for a pedestrian bridge for the Route 28 crossing, however such structures require significant right of way and are very costly. Crossing improvements will be needed at the location chosen and specialized pedestrian crossing signals should be considered such as a HAWK or the rectangular rapid flash beacon (RRFB)both of which are only activated when a pedestrian or bicycle is present, otherwise allowing the uninterrupted flow of traffic. The preferred alignment along surface streets will dictate where the crossing of Route 28 will need to occur and an evaluation will be needed to

determine the appropriate type and level of crossing accommodation and countermeasures needed. The alignment options should also consider the potential need for a path connection and related expenses.

Project 5.2.11: Extend Shining Sea Bikeway through Bourne to Cape Cod Canal Bikeway

Project Description – This proposed connection has been conceived by the Falmouth Bikeways Committee. The Route 28 state highway layout is approximately 200 feet wide and contains a very wide, wooded median separating the northbound road from the southbound road. The Committee envisions bridging the southbound road way and construction of a multi-use path through the wooded median for a distance of approximately 6 miles to make a final connection to the Cape Cod Canal Bikeway. This will provide an alternate route to a branch of Bike Route #1, located on County Road in Bourne.

It is important to note that the Town of Bourne is in support of an alternate concept for the connection to the Canal which utilizes a 'rails-with-trails' design along the Old Colony tracks. (See Project 5.3.8)

Preliminary Design Concepts – The extension should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A spur linking the existing bikeway with the proposed alignment via the media will need to be identified, either within existing road right of way or along an independent alignment.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

Bike/pedestrian bridge, unit costs:

- Survey, design, geo-tech, permitting, etc. – $240,000.00
- Total lump sum (LS) construction – $1,200,000.00

Recommendations for Implementation – Due to the unique alignment through the Route 28 median Mass Highway Department will need to be consulted for approval of both the concept and specific design elements. Because of the cost of a flyover access to the median it will be important to indicate that this segment of the bikeway would have limited access points. Conceptual plans should incorporate at least a couple proposed access points to facilitate wider use of the corridor by bicyclists seeking to access nearby destinations. Routing of a shared-use path through an interchange can prove difficult and access to the median will also prove challenging. Opportunities such as utilizing the existing rail alignment south of Route 151 should be investigated to deem whether access could to the median could be achieved, mitigating the need for a flyover.

Project 5.2.12: Parking Improvements at Trailheads

Project Description – Significant usage of the trail facilities on Cape Cod results in inadequate parking capacity. Both existing and proposed facilities need to plan for and construct parking facilities for visitors accessing trailheads by car. Opportunities to utilize existing, but underused parking capacity should also be investigated.

Project Location Map – NA

Preliminary Design Concepts – Designs will be specific to individual trailheads, parking facilities, and parking demands.

Cost Estimate – Construction of parking lot at trailhead:

- $50,000.00

Recommendations for Implementation – Existing trailheads need to be identified which currently experience excessive parking demand and opportunities for expansion investigated. Possible locations of new trailheads where adequate right of way exists for parking should be identified. Opportunities for joint-use or facility sharing should be investigated. Cape Cod localities should investigate adoption of local ordinances to facilitate use of shared parking facilities. Model agreements and ordinances should be developed that can be shared among Cape Cod localities to facilitate use of shared facilities. This approach provides an opportunity for facility sharing which increases the utilization of existing infrastructure while reducing the need for construction of additional parking facilities, many of which will be unutilized much of the year.

Project 5.2.13: Connect Cape Cod Canal Bikeway to Hyannis Transportation Center

Project Description – Linking the developed areas of Bourne and Sandwich to the Hyannis Transportation Center, approximately 22 miles away would provide multimodal transportation options to the Upper Cape. Route 6 serves as the primary corridor facilitating travel between the Upper and Mid-Cape, though it is largely unsuitable to bicycle travel. Ultimately an extension of the Cape Cod Rail Trail along the entire length of Cape Cod is envisioned, though at this time that is not feasible due to costs and logistics. This project should identify off-roadway alignments to develop some shared-use path segments while utilizing secondary roads for other segments.

Preliminary Design Concepts – The design concepts are subject to determination of a feasible alignment, whether on-roadway or for share-use path segments. Since conditions will vary considerably throughout the region connections should consist of both on-road and shared-use path connections. The designs will need to consider the appropriate elements for the context in which the routing takes place. Secondary streets with low traffic speeds and volumes can provide adequate connections with minimal enhancements such as improved signage

and/or pavement markings. Shared-use path sections should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. Current practices also consider separation of bicycle and pedestrian modes by providing a wider trail surface and designation of walking and bicycling lanes to make for a safer and more enjoyable environment along segments where there is considerable mixing of bike and pedestrian traffic.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Recommendations for Implementation – Due to the length and multiple jurisdictions a coordinated planning effort will be required to identify a proposed route and facilities needed. A corridor approach should be adopted to identify potential shared-use path alignments throughout the region to ensure connectivity as the segments can be built in phases, perhaps by different agencies or municipalities. The desired conditions and accommodations to be provided along on-roadway segments need to be established and agreed upon by stakeholders so that conditions are consistent for bicyclists traveling between jurisdictions. Planning and construction should be coordinated with Projects 5.2.6 & 5.2.7 in order to link proposed projects and develop a wider bicycle network.

Project 5.2.14: Develop Plan for Intermodal Center in Falmouth

Project Description – This proposed connection has been conceived by the Falmouth Bikeways Committee. The intermodal center is proposed to be located at the former North Falmouth railroad station at the intersection of County Street with the Bay Colony Rail/ Commonwealth of Massachusetts Executive Office of Transportation Railroad right-of-way. At the present time this site is at the northern terminus of the Shining Sea Bike trail. This lot is unpaved and is currently used as a parking lot for trail users. The site supports an active section of Bay Colony Rail operations.

Preliminary Design Concepts – This lot is large enough to support a paved parking lot and bus stop operations. The improvement could include formal curb cuts, a paved parking field with internal circulation, a 'kiosk' type bus shelter mounted on a raised pedestrian island, and bike racks.

Cost Estimate – Multiple facility improvements:

- Parking lot – $50,000.00
- Bus shelters – $20,000.00
- Secure bicycle parking (unit cost)– $1,500.00

Recommendations for Implementation – Multiple entities need to coordinate efforts and agree upon the scope of the facility and operations proposed for the intermodal center. The specific configuration and ingress and egress to the facility would need to be evaluated and a possibly a traffic study conducted to determine traffic impacts. It has been proposed that the railroad could provide some level of funding for a shared facility.

Project 5.2.15: Improve Bicycle Facilities on Tupper Road South of Route 6A

Project Description – Tupper Road in Sandwich provides access to the terminus of the Cape Cod Canal Bikeway, paralleling much busier Route 6A which also serves as Mass Bike Route 1. Tupper Road then provides a north/south connection between Route 6A and Route 130, Main Street, but lacks any bicycle accommodations. Adding paved shoulders or other bicycle improvements would provide safer, more comfortable bicycling conditions while also reducing conflicts with motor vehicles. Adding paved shoulders has additional benefits including pavement edge stabilization, the addition of a recovery area which reduces roadway departure crashes, and a breakdown area that allows disabled vehicles to be moved out of the travel lane, thereby mitigating congestion impacts from such incidents. These all result in safety, operational, and maintenance benefits which yield long-term cost savings.

Preliminary Design Concepts – Road widening or the addition of paved shoulders should consider the existing roadway geometrics. In order to be useful for bicycle travel shoulders and the adjacent travel lane need to be of adequate widths to provide a degree of separation between the two modes, otherwise safety can be impaired by inviting motorists to pass too closely to bicyclists that attempt to hug the outside edge of the roadway. In general a four-foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. On roads with curb and gutter, the gutter pan and the longitudinal joint effectively reduces the useable width of the shoulder and consideration needs to be given to the paved width of the shoulder exclusive of the gutter pan. Realignment of Mass Bike Route 1 (the Claire Saltonstall Bikeway) onto this improved route, complete with appropriate signage would offer a more appealing route for long-distance bicyclists.

Cost Estimate – On-road improvements, unit costs per mile:

- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders along both sides of the road.

Recommendations for Implementation – Opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Routine pavement overlay and resurfacing projects should include shoulder paving for this route if adequate right of way exists or can be obtained. Maintenance needs to be considered so that the functionality of shoulders for bicycling purposes is retained since the

natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder. In order to further develop an improved corridor and continuous route, and perhaps a resultant realignment of the Claire Saltonstall Bikeway, any improvements should be coordinated with Projects 5.3.15 and 5.3.17.

Project 5.2.16: Evaluate Use of Unpaved Roads for Bike Path Connections in Cape Cod National Seashore

Project Description – Within the National Seashore a number of unpaved roads currently exist which could be utilized to provide bicyclists with access to several popular bicycle trails. This would result in establishment of a unified network without having to travel on the more heavily traveled roadways, particularly Route 6, and which could be accomplished with minimal improvements, resulting in a low cost enhancement to the existing, but fragmented bicycle network in the Seashore.

Preliminary Design Concepts – Design issues would largely be limited to providing adequate wayfinding signage to direct bicyclists through the Seashore to popular destinations and trails. Such signage should follow the standards and protocol established via Project 5.2.2 (if implemented) to maintain consistency with bicycle wayfinding signage throughout the region.

Cost Estimate – NA

Recommendations for Implementation –Possible connector routes via existing unpaved roads should be identified, especially those that are likely to have the least impact to sensitive environmental or historical features within the Seashore. Existing conditions should be evaluated for compatibility with bicycle use and any needed improvements should be documented for consideration in the planning process including grading and additional loads of surface material. Should unpaved roads be used for this purpose a maintenance policy will be needed to ensure conditions suitable for bicycling are maintained and wayfinding signage will be needed to direct bicyclists to destinations and trails within the Seashore.

NEW FACILITIES

The following is a list of twenty two projects proposing construction of new facilities. These projects are number 5.3.1 through 5.3.22.

Project 5.3.1: Evaluate Local Roads and Establish Bicycle Connections between Cape Cod National Seashore and Neighboring Communities

Project Description – A two-phase project proposing to develop planning alternatives to improve bicyclist safety and access by providing connections between Cape Cod National Seashore and six neighboring communities followed by a pilot project implementation component.

Component A – Feasibility Study to include

- General overview, project purpose and need, local and regional perspectives;
- Project Description, including locus map, major constraints and opportunities;
- Corridor Right of Way: public vs. private property;
- Resources: GIS level environmental resources such as waterways, wetlands, vernal pools, wildlife habitat, management/refuge areas, historic areas/districts/sites, contaminated sites;
- Trail or route design criteria;
- Structures required; and
- Route and trail amenities: parking, access to attractions, wayfinding & interpretive signing.

Component B – Implementation of pilot project on 1 roadway

Preliminary Design Concepts – Conceptual design would include typical sections, alignment, road/water crossings, structures, trail amenities, impacts & mitigation, ROW actions, permitting requirements, and construction. Final design would include construction plans, specifications, right-of-way plans, and bidding documents for advertising by MassDOT or the municipality.

This project proposal assumes a 2 mile pilot project for cost estimating purposes consisting of minor roadway widening, and intersection and traffic signal improvements.

Cost Estimate –

- Feasibility Study – $20,000
- Pilot project design and construction – $3,471,046.66

Recommendations for Implementation – Prior to evaluating local roads for suitable bicycling conditions it will be necessary to establish evaluation criteria and metrics. Roadway geometrics, traffic volumes, prevailing speeds, the presence of trip generators including residential origins, and directness of travel should be considered. Subsequently, selection of neighboring communities and potential connector routes or corridors is needed before any feasibility study and analysis can proceed. The list of potential routes should be inclusive of a variety of roadways and conditions so that alternatives can be established and evaluated to determine opportunities and barriers to implementation of improvements and connections. Off-roadway alignments should be considered and evaluated as well including abandoned rail lines, utility line easements, conservation lands, or other possible alignments. Demonstration of the improvements resulting from the pilot project requires the collection of baseline (current conditions) data for comparison after implementation. Data to be collected will need to be determined specific to the community and route selected, however the following should be considered:

- Route / facility usage (bike/pedestrian trips)
- Type of trips made via corridor / route

- Crash data
- Perceived level of safety among facility users
- Perceived level safety among motorists encountering bicyclists and pedestrians
- Ease of wayfinding

Project 5.3.2: Feasibility Study and Design of Bike Path along Route 6 from Herring Cove Parking Lot to Race Point Road

Project Description – A two-phase project to develop a bicycle path connecting the CCNS parking facilities at Herring Cove to other National Seashore facilities, including the Province Lands Bicycle Trail at Race Point Road. The first phase is to conduct a Feasibility Study coordinated between the Cape Cod Commission, the State of Massachusetts, the National Park Service, and the town of Provincetown to identify dedicated alignment within the existing right of way along the north Side of Route 6 from Herring Cove to Race Point Road.

Route 6 is a principal arterial that provides direct access between Herring Cove and the National Seashore attractions at Race Point, including the Province Lands Bicycle Trail. Completely lacking in bicycle and pedestrian accommodations, Route 6 has only minimally paved shoulders, significant traffic volume, truck traffic, and posted speed limits varying between 35 MPH and 45 MPH. Though Herring Cove and Race Point are connected via the Province Lands Bicycle Trail, it is a circuitous path and doesn't facilitate convenient and expedient bicycle and pedestrian mobility between the two points. Additionally, bicycle access to these two locations from the commercial center and the neighborhoods of Provincetown is not available. As a result nonmotorized modes cannot be comfortably utilized to reach these nearby destinations, resulting in greater reliance on automobile travel within this region of Cape Cod.

Component A – Feasibility Study to include

- General overview, project purpose and need, local and regional perspectives;
- Project Description, including locus map, major constraints and opportunities;
- Corridor Right of Way: public vs. private property;
- Resources: GIS level environmental resources such as waterways, wetlands, vernal pools, wildlife habitat, management/refuge areas, historic areas/districts/sites, contaminated sites;
- Trail or route design criteria;
- Structures required;
- Trail amenities: parking, access to attractions, wayfinding & interpretive signing;
- Trail access points providing connections to on-roadway bicycle and pedestrian routes in Provincetown;
- Needed facilities and retrofits to connecting bicycle and pedestrian routes within Provincetown;
- Conceptual Design including typical sections, alignment, road/water crossings, impacts & mitigation, permitting requirements, construction costs; and
- Operations & Maintenance requirements.

Component B – Class III design and construction plans

Design cost estimates at 17% of NET construction costs

Preliminary Design Concepts – Conceptual design would include typical sections, alignment, road/water crossings including trail access points at intersections that provide connections to neighborhoods and the commercial center of Provincetown, structures, trail amenities, impacts & mitigation, ROW actions, permitting requirements, and construction. Final design would include construction plans, specifications, right-of-way plans, and bidding documents for advertising by MassDOT or the municipality. The envisioned project would be approximately 2 miles long.

Cost Estimate –

- Feasibility Study – $20,000
- Class III Design & Construction – $3,456,085

Recommendations for Implementation – Coordination of stakeholder interests is needed to fully develop the scope of the feasibility study component. Existing plans should be consulted to determine how related projects can contribute to the overall development of a facility that is integrated into the existing bicycle and pedestrian network in Provincetown. Planned or programmed projects that have the potential to impact concurrency issues, notably those on connector routes providing access to the proposed path should be investigated to determine possible synergies and cost savings with minimal changes to scopes of work. Specifically any improvements should be coordinated with Project 5.3.12 to integrate efforts at developing linkages throughout Provincetown and the Province Lands attractions within the Seashore.

Project 5.3.3: Identify Possible Connections between the Cape Cod Rail Trail and Cape Cod National Seashore Trails

Project Description – Envisioned primarily in Eastham where the Nauset Trail is proximate, but not connected to the Cape Cod Rail Trail, connections between the CCRT and trails within the Seashore are needed. The CCRT, located to the west of Route 6 is approximately ½ mile from the Salt Pond Visitor's Center but requires crossing Route 6 to facilitate a direct connection. Just north of the Salt Pond Visitor's Center (site of the trailhead) the CCRT passes underneath Route 6 and on-roadway routes could be designated without the need to cross Route 6 at-grade, though they would provide less direct access.

Preliminary Design Concepts – The design concepts are subject to determination of a feasible alignment to connect Seashore trails to the Cape Cod Rail Trail. Since conditions will vary considerably at each location the connections could consist of both on-road and shared-use path connections the designs will need to consider the appropriate elements for the context in which the routing takes place. Secondary streets with low traffic speeds and volumes can provide adequate connections with minimal enhancements such as improved signage and/or pavement markings. Shared-use path sections could utilize a paved surface, or a natural surface. Unpaved roads should also be considered to establish connections.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Locust Road provides the most direct access between the visitor's center and the rail-trail, however access via this route requires and at-grade crossing of Route 6. The intersection is controlled by a signal however, and if chosen as the alignment the signal operation should be evaluated for compatibility with bicycles (bicycle detection, appropriate timing and clearance intervals). An alternative route would utilize the CCRT underpass beneath Route 6 to access the neighborhood streets to the east via Old Orchard Road and School House Road. This option would avoid an at-grade crossing of Route 6 but would result in a longer, more circuitous route. Existing conditions on all potential roadway segments should be evaluated to determine the most feasible routing requiring the least infrastructure improvements to keep costs low.

Project 5.3.4: Regional and local Pedestrian and Bikeway connectivity to Dennis Port

Project Description – The Town of Dennis, through its Dennis Port Revitalization Committee, has established a prime objective of making pedestrian and bikeway connections to key destinations in the region surrounding the Dennis Port Village. These connections include (among others); providing links to the hotel / motel district located on Lower County Road; the playgrounds and historic sites located in South Dennis; the Cottage Colony located between Lower County Road and the beach / waterfront area; and a combination of shared routes and/or multi-use paths to provide connections to the Cape Cod Rail Trail at Route 134, and the Old Colony Rail Trail in Harwich. The various desired connections are identified and illustrated in the Dennis Port Master Plan which may be found online at:

www.dennisportrevitalization.org

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes and safe roadway crossings to access the rail trails. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures would provide a convenient and comfortable route for cyclists of varying abilities. Sidewalks and improved crossings are needed

at various locations to establish pedestrian routes and connections. Specific design treatments should be sensitive to the particular needs and context of each road where improvements are made.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – The feasibility of adding paved shoulders or bicycle lanes and improving conditions to one or more roads needs to be determined. Multiple connections should be considered to provide for access to both rail trails and destinations along the potential routes should be considered when selecting alignments. Routes that serve to connect multiple trip generators would serve to increase the utilization of bicycling for utility trips and multiple connections would establish a more complete route network in the region. A four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane.

Project 5.3.5: Identify Regional Connections between Existing Paths and Locations with High Pedestrian Traffic

Project Description – Sidewalks or shared-use paths should be provided to establish connected and contiguous pedestrian access routes between the commercial trip generators, residential neighborhoods, and existing pedestrian facilities where pedestrian traffic is currently high or for which there is significant latent demand. Pedestrian networks should be established on a regional basis to connect villages and towns when density and proximity warrant.

Preliminary Design Concepts – Depending upon traffic volumes, speeds, and location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A gap analysis should be undertaken to identify and prioritize sidewalks and crossings needed to develop a complete network which integrates the existing pedestrian infrastructure including sidewalks, paths, and neighborhood streets with the surrounding pedestrian trip generators including both residential and commercial origins and destinations. Safety countermeasures should be considered for locations where potential exists for vehicle/pedestrian collisions, primarily at the intersections with arterial and collector roadways and where commercial entrances or lack of access management results in frequent conflict points. Access management should be considered at these locations, and improvements should also seek to improve access to transit stops when appropriate.

Project 5.3.6: Identify a "Shore Route" South of Route 28 from Woods Hole in Falmouth to Stage Harbor in Chatham

Project Description – Identification of a "Shore Route" of approximately 45 miles providing bicycle access and connectivity across a region comprised of eight localities would link the many destinations and villages of this heavily developed region of the Cape. Proposed as an on-roadway route, it would closely follow the coastline along Nantucket Sound. Limited route options in many locations result from a fragmented road network that would require use of Rte 28 in many locations. In developed areas where Route 28 lies farther from the coast, more route permeability typically exists, allowing for more routing options, though this is intermittent throughout the corridor from Falmouth to Chatham.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide a relatively direct, comfortable, and connected bicycle route south of the Route 28 corridor. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures should be utilized consistent with the context and conditions of the specific roadways where improvements are implemented. Because of the circuitous routing that would be required wayfinding is an essential element. Where the use of Route 28 is required careful consideration needs to be given to providing bicycle accommodations and countermeasures that facilitate bicyclists safely entering and departing this heavily traveled roadway.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to the regional nature of the proposed project, coordination among the eight localities and the Cape Cod Commission is needed. The large area and the lack of a connected network of candidate roadways pose significant barriers to implementation. Uniformity in accommodations through the corridor should be sought so that cyclists utilizing the route for travel across the Cape will encounter a unified and integrated route from one jurisdiction to the next. Local comprehensive plans and other local and regional plans should be reviewed and amended to reflect the proposed project, the desired level of accommodations, and means by which individual localities can implement improvements. The project should be coordinated with other proposed improvements where new routes might utilize Route 28 or parallel corridors such as the proposed improvement and designation of Route 28 as a bicycle route (Project 5.3.10) and the proposed "OBHC Triangle Route" (Project 5.3.18). Additionally, the improvements should be coordinated with the proposed connections between the Old Colony Rail Trail and Harwich Port and Dennis Port (Projects 5.3.9 & 5.3.4) in order to ensure linkages that will establish a connected network of bicycle routes.

Project 5.3.7: Identify a "Bay Route" from the Cape Cod Canal in Bourne to Orleans

Project Description – A "Shore Route" of approximately 30 miles is envisioned to provide continuous bicycle access and connectivity across the six localities along Cape Cod Bay. The route would link the villages and destinations of this developed region of the Cape similar to the proposed "Shore Route" paralleling it along the southern coast of the Cape. Likewise, the "Bay Route" is envisioned as an on-roadway route following the coastline along Cape Cod Bay, north of Route 6 and traversing the popular destinations along the coast. Limited route options in many locations result from a road network fragmented by both manmade and natural features, and which would require use of Route 6A in many locations. In developed areas where Route 6 lies farther from the coast more route options exist, most notably in West Barnstable and Dennis. Unlike the Rte 28 corridor of the "Shore Route" Route 6A parallels Route 6, providing a largely continuous route option with slower speeds and traffic volumes than the principal arterial Route 6, though it would still need infrastructure improvements to be a suitable route.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide a relatively direct, comfortable, and connected bicycle route north of Route 6. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures should be utilized consistent with the context and conditions of the specific roadways where improvements are implemented. Because of the circuitous routing that might be utilized along secondary and residential streets wayfinding is an essential element.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to the regional nature of the proposed project, coordination among the six localities and the Cape Cod Regional Commission is needed. The large area and the limited network of connected candidate roadways pose significant barriers to implementation. Uniformity in accommodations through the corridor should be sought so that cyclists utilizing the route for travel across the Cape will encounter a unified and integrated route from one jurisdiction to the next. Local comprehensive plans and other local and regional plans should be reviewed and amended to reflect the proposed project, the desired level of accommodations, and means by which individual localities can implement improvements. The project should be coordinated with other proposed improvements within or adjacent to the Route 6 corridor such as the proposed route through the Sandwich Historic District (Project 5.3.27) and the "OBHC Triangle Route" (Project 5.3.18).

Project 5.3.8: Relocation of Existing Rail Line and Conversion to Trail

Project Description – This 6 mile project in the Town of Bourne proposes to create a rails-with-trail facility from the northern terminus of the Shining Sea Bike Path to the Cape Cod Canal Bikeway via the existing MassDOT/Bay Colony railroad right-of-way (ROW). This existing rail corridor parallels Shore Road in Bourne. Although the title suggests that the tracks require relocation, it is possible that the railroad ROW maintains sufficient width to support a new multi-use trail without the need to move the tracks.

It is important to note that the Town of Falmouth is in support of an alternate concept for the connection to the Canal which utilizes the Route 28 median for construction of a multi-use path to make the connection from the Shining Sea bike path to the Cape Cod Canal. (See Project 5.2.11)

Preliminary Design Concepts – The trail should utilize current design guidelines for shared-use paths and rail-trails with a minimum 10' paved trail width. A wider paved surface should be considered along segments that are envisioned to have higher volumes of users. A number of at grade crossings will require individual consideration based upon the conditions present and safety countermeasures required.

Cost Estimate – Shared-use path, unit costs per mile:

- Along abandoned RR bed – $660,000.00

Crossing improvements, unit costs:

- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Rail relocation costs:

- TBD, if necessary

Recommendations for Implementation – Additional research is required to confirm the layout width of the railroad ROW. The project will also require the design of numerous at grade crossings at the various intersection with public and private streets. This would likely be a mega-project requiring significant funding and a phased approach. The initial phase should include linkages to existing trail or on-road routes to be an integrated facility, not a stand-alone facility.

Project 5.3.9: Connect Harwich Port to Old Colony Rail Trail

Project Description – Harwich Port is located approximately 1½ miles south of the center of Harwich and the Old Colony Rail Trail. Currently there are no bicycle routes or accommodations linking Harwich Port to the trail. Several potential routes exist, notably along Bank, Forest, and South Streets, that could be improved and designated by adding shoulders or bike lanes along with signage, including wayfinding aids.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes and safe roadway crossings to access the rail trails. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures will provide a convenient and comfortable route for cyclists of varying abilities. Specific design treatments should be sensitive to the particular needs and context of each road where improvements are made.

Cost Estimate – On-roadway improvements (1.5 miles):

- Signing and striping – $15,840.00
- Widening to add shoulders/bike lanes – $752,400.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – The feasibility of adding paved shoulders or bicycle lanes to one or more of the three likely candidate streets needs to be determined. Existing right-of-way, utilities, and/or the existence of undeveloped properties along the candidate routes will largely determine the preferred alignment of an improved bike route. A four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. Coordination with Project 5.3.4 and 5.3.6 seeking to improve bicycling conditions in the Route 28 corridor will help to ensure connectivity.

Project 5.3.10 Designate Route 28 as a Bike Route and Improve Conditions

Project Description – Though Route 28 is mainly a secondary highway it serves as the primary corridor along Nantucket Sound linking 8 towns through the Upper, Mid, and Lower Cape. Approximately sixty miles of Route 28 provides access to a number of destinations across the Cape including villages, town centers, the Hyannis Transportation Center, and the Cape Cod/Old Colony Rail Trail. Despite being the primary route through this heavily developed area of Cape Cod the road is mostly a two-lane, undivided road, often lacking paved shoulders, and is heavily congested during peak season. Improvements would provide bicyclists with a convenient and comfortable route linking the many towns, villages, and destinations along Nantucket Sound. Improvements would also reduce conflicts between bicyclists and motorists and reduce congestion, both by encouraging greater use of bicycling for transportation and by reducing vehicle where passing opportunities don't currently exist.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide a direct, comfortable bicycle route through the Route 28 corridor. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures should be utilized consistent with the context and conditions of the specific roadways where improvements are implemented. In some locations a shared-use path design may be appropriate or desirable if children and less experience adult bicyclists are intended users of the route.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Existing corridor (minor grading/clearing) – $792,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00

- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Due to the regional nature of the proposed project, coordination among the eight localities and the Cape Cod Regional Commission is needed. The large geographic area and the limited right of way in many locations pose many challenges to implementation. Uniformity in accommodations through the corridor should be considered so that cyclists utilizing the route for travel across the Cape will encounter a unified and integrated route from one jurisdiction to the next. Local comprehensive plans and other local and regional plans should be reviewed and amended to reflect the proposed project, the desired level of accommodations, and means by which individual localities can implement improvements. The project should be coordinated with other proposed improvements where new routes might utilize Route 28 or parallel corridors such as the proposed "Shore Route" (Project 5.3.6) and the proposed "OBHC Triangle Route" (Project 5.3.18).

Project 5.3.11 Establish Bicycle & Pedestrian Connections between Orleans Villages

Project Description – Sidewalks or shared-use paths providing connected and contiguous pedestrian access routes between the villages of Orleans and their respective trip generators will enhance mobility and increase safety. Bicycle connections also will facilitate greater mobility and less reliance on automobile travel, and the addition of on-road accommodations and shared-use path facilities should be considered based upon context and intended users. The Village Center, South Orleans, East Orleans, Rock Harbor, and Skaket need to be considered for both bicycle and pedestrian connections as called for in the Orleans Comprehensive Plan (OS22).

Preliminary Design Concepts – Depending upon traffic volumes, speeds, and the location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

On-roadway accommodations, shared-use paths and linkages, bike route signage, and roadway widening and striping should be considered to provide enhanced conditions for bicyclists. Due to right of way concerns, on-roadway alignments will likely prove the most feasible options and can utilize secondary and neighborhood streets with lower speeds and moderate traffic with minimal improvements while still providing an adequate level of accommodation for most bicyclists.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – A gap analysis should be undertaken to identify and prioritize sidewalks, crossings, shared-use paths, and on-roadway improvements needed to develop a complete bicycle and pedestrian network which links the villages of Orleans to one another and to existing bicycle and pedestrian trip generators. Safety countermeasures should be considered for locations where potential exists for conflict points with the addition of bicycle and pedestrian facilities.

Project 5.3.12 Connect MacMillan Pier to Cape Cod National Seashore Bicycle Paths

Project Description – MacMillan Pier in the heart of Provincetown serves as a multimodal center with local and regional bus service as well as ferry service to Plymouth and Boston. Bicycle travel on the commercial and residential streets of Provincetown is manageable with lower traffic speeds; however access to the National Seashore becomes more difficult requiring riding along and crossing collectors and arterials since limited routes exist to link the two destinations. Enhancing the ability to access the National Seashore bike paths from Provincetown, and specifically MacMillan pier will improve multimodal options and facilitate greater use of bicycling to access the Seashore without requiring reliance on automobiles.

Preliminary Design Concepts – On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle routes and safe roadway crossings. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures will provide bicyclists with wayfinding along a convenient and comfortable route for cyclists of varying abilities.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to the limited roads that will provide access to the Province Lands Bicycle Trail via Race Point Road several routing options should be established and existing conditions evaluated. Needed improvements should be determined and the most feasible route chosen for improvements. Coordination with Project 5.3.2, the proposed path linking Herring Cove's parking facilities with Race Point Road, will ensure that intersection improvements and logical connections between this on-road route and the proposed provide a continuous and integrated network linking Provincetown with the Seashore destinations. Coordination with Provincetown will be needed.

Project 5.3.13 Connect Province Lands Bicycle Trail and Head of the Meadow Trail

Project Description – The 7.6-mile Province Lands Bicycle Trail and the 2-mile Head of the Meadow Trail, two of the Seashore's most popular trails, lie approximately four miles apart on the Outer Cape. Currently the trails are not accessible from one another other than by transiting along Route 6. Though an alignment for a separate trail linking these two trails is desirable the dunes and other sensitive features make that difficult to achieve. Use of existing roads, paved or unpaved, is likely needed for at least part of the alignment. Connection of the two trails would reduce the need to access both trails by automobile, thereby helping to ease congestion and parking demand. If done in conjunction with proposed improvements to link the Province Lands Bicycle Trail with the commercial and residential center of Provincetown access throughout this region of the Seashore has the potential to significantly reduce reliance on automobiles for access to these Seashore trails.

Preliminary Design Concepts – The design concepts are subject to determination of a feasible alignment to connect the two trails. Likely consisting of both on-road and shared-use path connections, the designs will need to consider the appropriate elements for the context in which the routing takes place. If Route 6 is chosen appropriate accommodations and safety countermeasures will be needed due to the volume and speeds of traffic. Shared-use path sections could utilize a paved surface, or a natural surface, but any design chosen should provide a firm, stable surface that is compatible with bicycle use while also providing access to disabled visitors and complying with ADA.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Several existing unpaved trails located between the beach and the dunes, primarily in Truro, should be considered for enhancements to be made compatible with bicycle travel. However, the parabolic dunes and other sensitive natural features are of concern and impacts need to be avoided or mitigated. The paths could retain natural surfaces to avoid both visual and environmental impacts associated with hardening, though the environmental impacts of such use would need to be evaluated. Route 6 provides the only roadway alignment to connect the two trails and options to avoid an on-roadway facility should be considered since it would not be inviting to many less experienced bicyclists.

Project 5.3.14 Connect Truro Village Center to Truro Destinations

Project Description – Connecting the two villages and the destinations of Truro via a bicycle network is needed to facilitate nonmotorized mobility while also enhancing the visitor experience to this popular summer destination. Largely rural and comprised primarily of the National Seashore, Truro has a number of popular seasonal destinations including Head of the Meadow Trail, Coast Guard Beach, the Highlands Center, Hostel International, and three campgrounds. Truro's population and developed areas are largely located in two village centers; Truro and North Truro, both on Cape Cod Bay, and which are connected primarily via Routes 6 and 6A. Like many other parts of the Cape the developed areas are not well connected through a network of secondary roads suitable for bicycling, often requiring use of collectors and arterials for transit between destinations. Aside from destinations within the two village centers most of Truro's attractions are in the National Seashore and require access along and across Routes 6 and 6A. The village centers are currently connected via Mass Bike Route 1, primarily along Route 6A and Castle Road, both of which have minimal signage but no physical accommodations for bicycles.

Preliminary Design Concepts – Bicycle connections would largely consist of on-road improvements with some off-roadway alignments where needed, based upon the needs and bicycling experience of intended users. A number of unpaved roads within the Seashore could be utilized for connections with very low traffic volumes making bicycling comfortable for a variety of users; however hardening would be needed in some locations to provide an adequate surface, although annual grading would likely provide an acceptable surface on unpaved roads that experience very low vehicle use. Wayfinding signage should be added consistent with the protocols and designs developed elsewhere on the Cape.

Adequate shoulders exist on much of Route 6 in Truro, including the short section that is utilized for the Claire Saltonstall Bikeway (Mass Bike Route 1), but the shoulder with is reduced at the junction with Route 6A northward in North Truro. Though Mass Bike Route 1 diverts onto Route 6A at this point many bicyclists still use Route 6. Interchange improvements such as bike lane pockets and/or signage should be considered along Route 6 to mitigate potential for conflicts at these weave movements, including at this location which requires north-bound bicyclists to make a left turn at an uncontrolled intersection.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Coordination between Truro and the National Park Service will be needed to identify desired routes and to develop plans for connecting destinations within the village centers and the National Seashore. An Environmental Screening Form would need to be completed for the elements within the Seashore to determine the level of environmental compliance required. Because hunting is allowed in some parts of the Seashore consideration needs to be given to routing of bicyclists through those areas. Habitat fragmentation is also of concern to CCNS and needs to be considered. Coordination with Project 5.3.13 is needed to develop continuity between Truro destinations and the linkages that are proposed to provide access within the National Seashore and between the existing Seashore trails.

Project 5.3.15: Connect Shawme-Crowell State Forest to the Cape Cod Canal Bikeway

Project Description – Located in Sandwich, the Shawme-Crowell State Forest is proximate to the Cape Cod Canal Bikeway but lacks an improved route or facility to connect them. The forest has a variety of park and camping facilities and lies between Routes 6 and 6A with the main entrance off of Rte 130 (Main Street). The Claire Saltonstall Bikeway does pass the entrance to the forest though there are no bicycle accommodations or facilities.

Preliminary Design Concepts – The short linkage needed to connect the Cape Cod Canal Bikeway with the state forest allows for several design alternatives to be utilized. An unused alignment for Bayview Rd near the intersection of Route 6A and 130 could allow for a shared-use path that would access the back of the state forest. The alignment is currently cleared almost to the Cape Cod Canal Bikeway, though it would require access across a rail line. An on-road route could be established using secondary roadways, preferably with bicycle accommodations provided. The most likely alignment would utilize Tupper Road and Main Street although shoulders or bike lanes should be considered to improve the existing conditions to increase safety and reduce conflicts with automobiles on these narrow roads that lack paved shoulders. Other possible on-road routes could be utilized, but would be less direct. Any route established should utilize wayfinding signage to direct bicyclists to these two facilities.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00

- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation – Several improvements in or adjacent to this general area have been proposed and should be coordinated to develop a connected and integrated network of bicycle routes and facilities. Projects 5.2.15 (improvements on Tupper Rd. south of Rte 6A) and 5.3.17 (bicycle improvements through the Sandwich Historic District) propose improved bicycle facilities in this immediate area and could be combined into a larger project, especially if this proposed connection to the forest utilizes a route along Tupper Road. Data collected during this feasibility study also indicate that existing proposed improvements call for a shared-use path or on-road improvements on Route 6A which could also facilitate this needed connection. The Claire Saltonstall Bikeway should be realigned to utilize an improved route through this corridor if bicycle accommodations are provided as a result of these proposed projects.

Project 5.3.16: Connect Wellfleet Bay Wildlife Sanctuary to Cape Cod Rail Trail

Project Description – Mass Audubon's Wellfleet Bay Wildlife Sanctuary is located on Wellfleet Harbor and is a popular destination with 5 miles of natural walking trails. The sanctuary is approximately one mile due west of the Cape Cod Rail Trail at the point where the CCRT passes through the National Seashore, however the trail is located on the opposite side of Route 6. Further complicating connection of the CCRT to the sanctuary is the need for a connection across private property. Entrance Road provides access to the sanctuary and intersects Route 6 across from the Wellfleet Lodge and the Wellfleet Motel where the most direct connection could take place. However, the CCRT parallels Route 6 behind the hotels and access from the CCRT to Route 6 would require crossing private property.

Preliminary Design Concepts – A shared-use path design typical should be utilized to provide a short, approximately ¼-mile spur linking the CCRT to Route 6. More significantly consideration and installation the appropriate crossing treatments and countermeasures are needed at the intersection with Route 6. Route 6 is a 2-lane cross section with a posted speed of 45 MPH at this location. With the traffic volumes experienced during peak season and the bicycle and pedestrian access from the CCRT, significant bicycle/pedestrian conflicts with motor vehicles would likely result. Minor improvements might be needed along Entrance Road to include directional signage and possibly pavement markings to create awareness of a shared-road environment.

Cost Estimate – Shared-use path connection (0.25 miles):

- Path along new alignment – $217,800.00

On-roadway improvements (.35 miles):

- Signing and striping – $3,696.00

Improved crossing at Route 6:

- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – Construction costs associated with the short spur would be minimal, however access across private property (one of the two hotel properties) could potentially increase the costs significantly. A trail easement would allow access without the need for costly right of way acquisition and the adjacent properties of the two lodging properties would provide an alignment directly across from Entrance Road. The somewhat remote location of this proposed spur and the trail traffic generated by the sanctuary would likely minimize any potentially undesirable traffic across the properties. Additionally, some businesses have welcomed access to regional trail facilities, recognizing that it has the potential to serve to attract patrons. Pending development of the connection, an engineering study should be conducted to determine the appropriate level of accommodations needed to facilitate safe crossing of Route 6.

Project 5.3.17: Identify Potential Bikeway Alignment through Sandwich Historic District

Project Description – The Sandwich Historic District lies just to the east of the terminus of the Cape Cod Canal Bikeway, though there are no designated bike routes through Sandwich. A shared-use path through the district likely holds appeal to many, however such an alignment would prove difficult due to lacking right of way. Old King's Highway (Route 6A) borders the district to the south and is the primary route through Sandwich. Roadways along Cape Cod Bay are discontinuous and limit the availability of alternate routes through town.

Preliminary Design Concepts – Largely consisting of on-road bike routes the alignment should consider the existing conditions and whether shared-road conditions and geometrics are adequate or in need of improvements. At the least wayfinding signage is needed, especially for any alignment along secondary roads. Cul-de-sacs and dead-end residential streets may present challenges in identifying a route, however short connections between these types of streets should be considered where appropriate to facilitate bicycle and pedestrian route connections while still preventing automobile through traffic.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation –The route alignment should consider directness, ability to access destinations, and the possibility of short connections between streets that are not currently linked. The Claire Saltonstall Bikeway, also known as Mass Bike Route 1 follows Route 6 to the south of the Sandwich Historic District. Due to the existing conditions along Route 6 any improved alignment through Sandwich should consider the realignment of this long-distance bike route along an improved route. Coordination with Projects 5.2.15, 5.3.15, and particularly 5.3.7 (the proposed "Bay Route") will help to ensure continuity and establishment of a connected bicycle network. Projects providing regional connections may also be viewed more favorably with regards to obtaining funding and can be implemented by multiple localities.

Project 5.3.18: Identify and Implement "OBHC Triangle" Route

Project Description – Orleans, Brewster, Harwich, Chatham constitute a roughly triangular area that occupies the region where the Outer Cape begins. Limited route availability due to a lack of a network of secondary roads that connect these towns will make difficult the development of a suitable bicycle route of approximately 30 miles constituting the "OBHC Triangle". The towns are largely interconnected via routes 6A, 39, 28, 137, and 124; all of which have little to no accommodations for bicycles and which have considerable vehicular traffic, especially during peak season. Nickerson State Park lies in the center of the region further contributing to the traffic in the region.

Preliminary Design Concepts – Envisioned as an on-roadway route linking the four towns, a designated route will need to consider roadway improvements in order to adequately accommodate bicycle travel, especially by cyclists other than experienced cyclists comfortably riding in a shared-roadway environment. Some paved shoulders exist, though in most instances they are inadequate to serve as a bicycle accommodation and are discontinuous. Addition of paved shoulders or traffic control devices highlighting a shared-roadway condition should be considered. Such measures could include "share the road" signage or use of "sharrows" officially known as shared lane markings. Along roadway segments where adequate paved width exists or may be easily added, designated bike lanes may be considered as appropriate.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, signs, and pavement markings along both sides of the road.

Recommendations for Implementation – Due to limited routing options implementation will require selection of a route and evaluation of existing conditions to determine needed improvements and countermeasures. Coordination with Projects 5.3.6, 5.3.7 (the proposed "Shore" and "Bay" routes respectively), and 5.3.10 will ensure that proposed improvements are consistent throughout the region. Since those proposed routes are of a regional nature segments of the "OBHC" route that are coordinated with these projects will likely receive greater priority for funding. Emphasis of the efforts to integrate these proposed routes into a cohesive network linking towns and destinations would likely increase the potential for funding.

Project 5.3.19 Improve Bicycling Conditions on Route 130 in Sandwich

Project Description – Bicycling conditions along Route 130 (Forestdale Road/Water Street/Main Street) in Sandwich are currently challenging with little or no paved shoulder, significant traffic volume, and a posted speed limit of 40 MPH. Adding paved shoulders or other bicycle improvements would provide safer, more comfortable bicycling conditions while also reducing conflicts with motor vehicles. Route 130 provides connections to destinations, neighborhoods and the adjacent town of Mashpee. Adding paved shoulders has additional benefits including pavement edge stabilization, the addition of a recovery area which reduces roadway departure crashes, and a breakdown area that allows disabled vehicles to be moved out of the travel lane, thereby mitigating congestion impacts from such incidents. These all result in safety, operational, and maintenance benefits which yield long-term cost savings.

Preliminary Design Concepts – Widening or the addition of paved shoulders should consider the existing roadway geometrics. In order to be useful for bicycle travel shoulders and the adjacent travel lane need to be of adequate widths to provide a degree of separation between the two modes, otherwise safety can be impaired by inviting motorists to pass too closely to bicyclists that attempt to hug the outside edge of the roadway. In general a four foot shoulder is desirable to provide adequate operating space for a bicyclist while allowing motorists unimpeded travel within the adjacent lane. On roads with curb and gutter, the gutter pan and the longitudinal joint effectively reduces the useable width of the shoulder and consideration needs to be given to the paved width of the shoulder exclusive of the gutter pan.

Cost Estimate – On-road improvements, unit costs per mile:

- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders along both sides of the road.

Recommendations for Implementation – Opportunities should be sought to begin implementing improvements through coordination with other construction and maintenance projects. Routine pavement overlay and resurfacing projects should include shoulder paving for this route. Maintenance needs to be considered so that the functionality of shoulders for bicycling purposes is retained since the natural sweeping action of vehicles often results in debris accumulating in the untraveled shoulder.

Project 5.3.20: Improve Bicycling Conditions on Quaker Meeting House Road in Sandwich

Project Description – Sandwich Quaker Meeting House Road is located in a heavy residential area and the roadway currently has intermittent facilities with short segments of shared-use paths connecting some subdivision developments. The roadway geometrics consist of a two-lane secondary roadway with minimal paved shoulders. As a result, the discontinuous nature of the infrastructure makes travel by bicycle difficult for anyone not comfortable with riding in a shared travel lane with automobile traffic. There are numerous points of destination along Quaker Meeting House Road including Sandwich High School, Oak Ridge School, and a municipal complex that justify the need for bicycle accommodations. The town is currently constructing a continuous sidewalk along the entire length of Quaker Meeting House Road from Route 6A to Route 130. The Town desires to widen the existing roadway to provide 11' lanes and 4' shoulders in both directions in conformance to state requirements for bicycle accommodations. The proposed projects are fully designed and are "shovel ready" but are unfunded.

Preliminary Design Concepts – Roadway improvements along Quaker Meeting House Road to provide 11' travel lanes and 4' paved shoulders. On-roadway improvements and accommodations are needed to provide direct, comfortable bicycle access to the many destinations in this residential area. Shoulder widening, pavement markings, signage, intersection enhancements, and other safety countermeasures along with wayfinding measures would provide a convenient and comfortable route for cyclists of varying abilities.

Cost Estimate – On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00

Recommendations for Implementation – Identification of funding sources and programming of funds is needed to facilitate implementation since the projects are fully designed. Final designs should be reviewed for appropriate integration with the existing bicycle infrastructure on Quaker Meeting House Road and improvements to the existing infrastructure, if needed, should be considered in order to provide continuity in the accommodations.

Project 5.3.21: Establish a Bicycle & Pedestrian Connection from Fort Hill Area Trails to Governor Prence Road

Project Description – The Town of Eastham, through its Planning and Economic Development Department, has identified the Governor Prence Road, a major access to the Red

Maple Swamp and Fort Hill Trail, as the only major crossing of Route 6 that does not have a traffic signal. The Eastham Visitor's Center is also located at this intersection which maintains high traffic volumes, has significant left turns, and is a high crash location. As a result warrants should be easily met to justify a traffic signal. A pedestrian actuated traffic signal at this intersection will encourage residents and vacationers, who now drive to Fort Hill or Hemenway Beach to bike or walk to these popular destinations. Sidewalks or shared-use paths are needed to establish a connected and contiguous pedestrian access route between the Fort Hill trails and Governor Prence Road which intersects the Cape Cod Rail Trail less than one mile west of this intersection. Improved bicycle conditions linking the CCRT with Fort Hill are also needed.

Preliminary Design Concepts – Depending upon traffic volumes, speeds, and location of pedestrian trip generators, sidewalks should be considered along both sides of the street. Appropriate marked crosswalks and signage, consistent with the roadway geometrics and existing traffic patterns should be installed at intersections where the heaviest pedestrian movements are likely to occur. Additional pedestrian safety countermeasures should be considered where appropriate.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Sidewalks and crossing improvements, unit costs:

- 5' Sidewalks, bituminous, both sides of street – $120.00/linear foot
- 5' Sidewalks, concrete, both sides of street – $140.00/linear foot
- Marked Crossing – $1,500.00
- Signalized Crossing – $70,000.00

Assumes installation of signalized intersection with mast arms, signal heads, pedestrian signals, pavement markings, and appropriate pedestrian upgrades such as curb cuts and ADA curb ramps.

Recommendations for Implementation – Gaps within the existing pedestrian and bicycle network should be identified for improvements concurrent with the installation of a traffic signal. Appropriate safety countermeasures should be considered for locations where potential exists for vehicle/pedestrian collisions, primarily at the intersection of Governor Prence and Route 6, as well as along Governor Prence if a connection to the CCRT is desired. Improvements should also seek to improve access to transit stops when appropriate.

Project 5.3.22: Define Loops and Connections to Develop a "Grand Cape Tour" Along the Cape Cod Rail Trail

Project Description – The Cape Cod Rail Trail currently serves as a major bicycle facility stretching twenty two miles across six of Cape Cod's municipalities. Proposed extensions to the north and west would provide access to four additional localities. A Grand Cape Tour would provide visitors to Cape Cod with bicycle access to towns and Seashore destinations with the CCRT serving as the spine route. Loop routes and spurs that provide direct bicycle access would also result in a connected bicycle network throughout much of the lower and outer Cape that could be used for utility trips as well.

Preliminary Design Concepts – Loop routes and access routes would likely consist of on-road bike routes and shared-use paths depending upon the specific conditions. Each proposed alignment should consider the existing conditions and whether shared-road conditions and geometrics are adequate or in need of improvements, or whether a shared-use path would be most appropriate for the intended and likely user. Wayfinding signage is needed, especially for any alignment along secondary roads.

Cost Estimate – Shared-use path, unit costs per mile along varying alignments:

- Adjacent to roadway with utility relocation – $765,600.00
- Along new alignment – $871,200.00
- Existing corridor (minor grading/clearing) – $792,000.00
- Along abandoned RR bed – $660,000.00

On-road improvements, unit costs per mile:

- Signing and striping – $10,560.00
- Widening to add shoulders/bike lanes – $501,600.00

Assumes adding shoulders, striping and signage along both sides of the road.

Recommendations for Implementation –The route alignments should consider directness, ability to access destinations, and the potential to integrate with the larger bicycle network envisioned for Cape Cod. Though intended to serve as a contiguous route throughout the entire area of the existing and proposed CCRT, such a network would facilitate bicycle use for commuting and routine utility trips in addition to recreation and tourism. Linkages therefore should consider popular tourism sites as well as town centers and commercial areas. Coordination with projects that are proximate to the existing CCRT, as well as future extensions would ensure development of a connected network of bicycle routes and facilities. Coordination of multiple localities, the Cape Cod Commission, and Massachusetts Department of Conservation and Recreation will be required.

OTHER INITIATIVES

The following is a list of nine projects proposing various initiatives to support and improve bicycling on Cape Cod. These projects are number 5.4.1 through 5.2.9.

Project 5.4.1: Bike Route Brochure & Wayfinding Map

Project Description – A multi-phase project proposing to develop and maintain a brochure, including a wayfinding map that describes the primary destinations accessible by bicycle including recreation features of pocket parks, beaches, town landings, shopping districts, hiking areas, bike paths, and other facilities and attractions followed by a subsequent implementation phase with wayfinding improvements along a pilot route.

Currently inconsistent signage and pavement markings throughout the Cape results in impaired safety and a poor visitor experience. Destination access is difficult due to the lack of wayfinding and directional signage which contributes to low use of bicycling and bicycle facilities for basic mobility and transportation to access destinations, resulting in over-reliance on autos, especially by visitors not familiar with Cape Cod. This in turn contributes to congestion and excessive parking demand. By encouraging and facilitating the use of bicycling as an alternative transportation mode improvements to air quality (all of Cape Cod is a non-attainment area), reduced congestion, and reduced impacts to sensitive lands and natural features resulting from illegal spillover parking, especially in the National Seashore, can be achieved.

The project will also yield safety improvements by addressing existing conditions which include lacking or inconsistent signage, pavement markings, and inadequate design treatments at intersections. Motorist and bicyclist/pedestrian expectations and actions are not uniform, crossings are often inadequate, and design treatments are inconsistent and often don't comply with MUTCD (the Manual on Uniform Traffic Control Devices) standards.

Component A – Conduct a Pilot Study to apply signage to one connector route. This proposed element is a follow-on to Project 5.2.2 and would utilize the wayfinding standards and protocols established via that project.

This component would require the following steps:

- Identify candidate routes that facilitate mobility and connection to multiple destinations
- Identify the pilot route for implementation
- Establish baseline data collection needs for comparison after pilot implementation
- Collect baseline data

Component B – Implement signage and pavement markings along pilot route

Component C – Develop six wayfinding itineraries with maps for bicycling experiences on Cape Cod to facilitate connection via bike or walking to destinations and attractions within Seashore and local communities, to include:

- Cape historic resources
- trail amenities including restaurants, rest rooms, accommodations, retail shopping area, bike repair/rental shops and emergency services
- connections to intermodal transportation facilities including bus and ferry terminals/connections
- Sand (surface hazard) and other cautionary items
- connections to other bicycle facilities including the Pan Mass Challenge Route and the Mass Bike Route 1 (Claire Saltonstall Bike Route)

- connections to primary destinations (Seashore attractions, town centers)
- communicating mobility issues for access by different users (ADA issues)
- coordination of all 6 regions to create larger overall "regional experience"

The data collection needed for Component A should also consider surveying bicyclists and users of bicycle routes and facilities regarding needed or desired content and the ease with which they can currently navigate the bicycle network on Cape Cod.

Preliminary Design Concepts – Installation of signage and wayfinding amenities should follow the protocols and guidance established as a result of Project 5.2.2 for existing facilities, relating to signage and wayfinding on the CCRT. Wayfinding itineraries and maps should be printed on water resistant stock and be either pocket-sized allowing use by bicyclists or pedestrians. Maps and related print documents should be made available in electronic format as well and updated regularly. Electronic versions have the added benefit of being able to provide more current content, and even real-time information such as trail closings and conditions, and links to transit schedules.

Cost Estimate –

- Signage installation on pilot route – $18,400 per mile
- Maps and wayfinding itineraries – $120,000

Recommendations for Implementation – Signage, wayfinding, and pavement marking guidelines and protocol need to be established prior to implementation, either via Project 5.2.2 associated with signage of the CCRT, or as a separate effort. Pilot route selection should follow the implementation guidance established in Project 5.3.2 by identifying potential connector routes or corridors, evaluating the alternative, and determining the specific pilot route. It will also be necessary to determine the baseline data that needs to be captured or collected, and the process by which that will be accomplished before the second phase involving signage installation can proceed. Additionally, data collection should include bicyclist's perception of current wayfinding resources and their needs or desires for content in the printed product. An opportunity for feedback on the printed product should be included such as a survey or an online form that can capture impressions of the quality of the guide/map and needed changes or suggested improvements. Due to the regional focus and the implications for towns, coordination is needed between towns as well as with the Massachusetts Office of Travel and Tourism (MOTT). Coordination with Intelligent Transportation Systems could provide real-time information and enhance wayfinding and transit service integration.

Project 5.4.2: Establish Nonprofit for Stewardship of the Cape Cod Rail Trail

Project Description – Form a nonprofit 501(c) 3 alliance for stewardship of the entire & future Cape Cod Rail Trail. The CCRT currently provides a continuous 22 mile facility that serves as bike and pedestrian corridor through the Outer and Lower Cape, providing access to

communities and attractions on Cape Cod, including the National Seashore. However visions exist for a facility that will extend throughout the entire length of the Outer and Lower Cape, connecting Hyannis to Provincetown, and providing multimodal access to much of Cape Cod. A facility of this size would benefit from the guidance and stewardship of a nonprofit organization to ensure proper care and maintenance, address operational and safety considerations, especially those related to improvements and physical extensions to service new locations, and to help remove or reduce barriers within the community to expanding the facility to serve additional towns and destinations on Cape Cod via advocacy and generating support for the expansion of the facility.

Preliminary Design Concepts – NA

Cost Estimate –

- $70,000.00

Recommendations for Implementation – The primary focus of the no-profit needs to be established and a commensurate framework for the organization developed. Similar organizations have been developed for other trail facilities with widely varying missions, from safety patrols, to routine maintenance and caretaking efforts such as "adopt a trail" efforts, to broader advocacy and stewardship endeavors aimed at enhancing and expanding a facility and serving to raise funds and support from the local community, including elected officials and business leaders.

The scope of the organization needs to be determined along with establishment of a governing body to ensure proper management of both the organization as well as to provide direction for a course of action to be taken and sustained. A board or other body that is assembled for this purpose should consider carefully the makeup (members) needed to adequately address and achieve the desired functions.

Project 5.4.3: Cape Cod Nonmotorized Master Plan

Project Description – Develop a nonmotorized transportation master plan for Cape Cod that consolidates and integrates facilities, routes, and accommodations for bicyclists and pedestrians, including those owned or managed by localities, the National Park Service, and nonprofit organizations (such as conservation groups) into a single coherent network. Existing route and network plans, proposed facilities, identified gaps and gap analyses, policies for addressing the needs of bicyclists and pedestrians, and a prioritized list of projects and supporting initiatives across jurisdictions and stakeholder agencies needs to be established in order to adequately integrate and coordinate bicycle accommodations throughout Cape Cod.

Preliminary Design Concepts –The development of a master plan should seek to establish uniformity in standards and design guidelines, as well as consistency of policies and approaches to providing bicycle and pedestrian accommodations across Cape Cod. The plan should ensure continuity both in developing and connecting bicycle and pedestrian networks and in the actual design and construction of facilities, especially when they cross jurisdictional boundaries in

order to facilitate mobility and access by bicyclists and pedestrians as well as to provide a consistent level of service.

Cost Estimate – Subject to scoping details

Recommendations for Implementation – Of primary importance is coordination across municipalities, including funding requests and applications and regional prioritizing of projects. Existing plans should be evaluated for shared visions and desired projects, as well as to establish consistency in facility design especially at jurisdictional boundaries to ensure continuity of infrastructure and accommodations along bicycle routes.

Project 5.4.4: Development of Trail Access Parking Agreements

Project Description – Develop agreements with schools to use school parking lots during off-times for trail parking to in order to alleviate parking demands resulting from trail use. With limited parking available and thousands of daily users of trail facilities on Cape Cod during peak summer season, parking demand can create problems with finding adequate parking at or near trailheads. The use of public parking infrastructure at schools during non-school hours will mitigate excessive parking demand while also utilizing existing parking facilities, thereby eliminating the need to construct additional capacity specifically for trail access. Shared parking efforts similar to this have eliminated added expenses while also increasing the utilization of an existing public resource.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – A model agreement should be developed that can be shared among Cape Cod localities. Standard signage and policies should be developed to ease implementation and retain uniformity at multiple locations. Local political issues will need to be addressed, however this approach provides an opportunity for facility sharing which increases the utilization of existing infrastructure while reducing the need for construction of additional parking facilities, many of which will be unutilized much of the year. Use of school facilities could be limited to time of day and/or time of year to provide additional parking capacity during peak season which coincides with school closures for summer break.

Project 5.4.5: Safety Education & Outreach

Project Description – Develop and implement an education and outreach initiative aimed at bicyclists and motorists with the intent of improving safety for bicyclists. With bicycling on Cape Cod being popular for both recreation and transportation there is a significant need to ensure safety is improved by addressing the human factors related to bicycle crashes, bicycle/motor vehicle collisions, and interactions between roadway users. Since human factors are a major contributor to bicycle/motor vehicle crashes this is a low cost/high value project.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – Education and outreach initiatives can comprise a broad range of strategies. Cape Cod stakeholders should develop a strategic approach to developing and deploying resources by identifying the primary issues that need to be addressed, target populations, and the commensurate strategies that should be investigated. Overly broad approaches are likely to be less effective than those aimed at addressing specific challenges and problems that currently exist. A number of safety and educational initiatives and corresponding materials currently exist around Massachusetts and the U.S. Existing resources should be evaluated to determine which, if any can serve as a template for the materials and initiative to be utilized by Cape Cod communities.

Project 5.4.6: Maintenance Program Development & Implementation

Project Description – Develop and implement a maintenance program to ensure appropriate and routine maintenance is provided for bicycle facilities and accommodations. Because bicycle facilities and accommodations are often outside of the road right of way or at the least are located along the margins of transportation facilities, they often do not receive the maintenance that is provided to roadway networks. Additionally, bicycle facilities will have maintenance needs that are different than those of roadways by virtue of their use and operation. On-roadway facilities such as bike lanes and shoulders often accumulate debris as a result of the natural sweeping action of motor vehicles pushing debris outward from the travel lanes, but not beyond the shoulder or bike lane. On roads with shoulder typical sections debris, notably loose soils and sand, tends to encroach and collect on the shoulder as well. As a result the bicycle accommodation can become virtually impassable while also constituting a crash or tire puncture hazard.

Drainage grates also pose a significant hazard to bicyclists as a result of raised vertical edges which can damage tires and wheels or deflect a wheel sideways causing a crash. Worse are grates with longitudinal openings that can trap a bicycle wheel, throwing the rider from the bike. Grate installation, repair, and replacement policies and practices should utilize bicycle-friendly grate designs, location outside of the bicycle path of travel if possible, and maintenance which maintains a smooth, flush transition from pavement to grate.

Shared-use paths and rail-trails outside of road rights of way often do not receive routine maintenance. As a result conditions often deteriorate to the point that the facility is not inviting or perhaps even results in compromised safety. A routine maintenance program and budgeting enhances the utility of a facility and can serve to expand the service life through preventive maintenance.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – The many bicycle accommodations on Cape Cod are the responsibility of a variety of entities, including state and local government. Coordination between stakeholders, memorandums of understanding, and identification of funding sources will be needed in addition to the development of the policies and programmatic elements. If development of a 501(c)3 nonprofit trail advocacy group proceeds their role in maintenance should be incorporated into these efforts. Routine evaluation of conditions and planning for maintenance should be incorporated into other infrastructure maintenance policies, activities, and budgets.

Project 5.4.7: Interpretive Film Promoting Cape-Wide Bicycle Network and Bicycle Safety

Project Description – Many of the attributes that make Cape Cod a popular destination are accessible and enjoyable by bicycle. As efforts to expand the bicycle network on Cape Cod continue, bicycling as both recreation and a transportation mode on the Cape will continue to grow in popularity. Currently many of the bicycling resources on the Cape are not widely known and an interpretive film could serve to both increase awareness of bicycling options on the Cape, as well as aiding people navigate the Cape's bicycle network and utilize it for accessing destinations and increasing their mobility on the cape without reliance on automobiles. Additionally, interactions with pedestrians on shared-use paths and motorists on shared roadways results in unsafe conditions at times. Incorporating bicycle safety content into the film provides an opportunity to present safety information in a medium that would likely be better received than that of a stand-alone safety message.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – The proposed film should be available as an online resource and opportunities should be identified to publicize links to the website. MassBike, other bicycle advocacy or safety organizations, and bicycle clubs could assist in disseminating information on the availability of this resource once it is developed and available.

Project 5.4.8: Enhance Bicycle Shuttling Opportunities

Project Description – As a result of the many gaps in the existing bicycle infrastructure on the Cape, there is a need for convenient and widely accessible bicycle shuttling between destinations. Currently there are a number of transit services on Cape Cod and most buses and transit vans are outfitted with bicycle racks that can accommodate up to two bicycles. Long headways, infrequent service, and occasionally heavy demand during peak season however can significantly reduce the utility of these transit services, especially when considering the need for a family or group of bicyclists to use shuttle services. Increased capacity and more frequent service, especially in the areas of greatest demand is needed.

Preliminary Design Concepts – NA

Cost Estimate – NA

Recommendations for Implementation – This project would assume that bicycle shuttling is limited to bus services. The Cape Cod Regional Transit Authority should work with localities and the National Park Service to identify destinations, routes, and service times that are in need of augmentation. Options for outfitting shuttle vehicles with increased bicycle capacity should be investigated.

Project 5.4.9: Utilize Utility Easements and Infrastructure projects to Establish Bicycle Routes and Corridors

Project Description – Use of utility rights of way and easements for bicycle routes and corridors has the potential to both increase the options for bicycle routes, while also reducing costs related to acquisition of right of way. Existing utility corridors are also already free of many of the physical barriers that can make difficult the development of a bicycle network. Such corridors are often already cleared and may also have some degree of access, often in the form of unpaved roads or trails that are used for utility maintenance. Use of theses corridors also have the benefit of providing bicycle facilities that are largely free of conflicting vehicle movements as occur at intersections with roadways and commercial entrances when a path is located beside a roadway. In some instances utility corridors are the only feasible connections between communities and existing or proposed bicycle facilities, such as the proposed route across Harwich. There are numerous examples of co-use of utility corridors for transmission and recreational use including several in Massachusetts. Many utility corridors are currently used informally for recreational activities, however in most cases they are private property owned by the respective utility company or utility easements on private property. Several factors need to be considered when evaluating co-use of these corridors including:

- Public exposure- State and federal laws govern the separation distance between people, equipment and some utilities especially electrical transmission lines.

Recreational use cannot create additional risk of damage to utility structures or transmission facilities. Activities cannot preclude future construction or expansion of the utilities within the right-of-way. Access to/from, and along the right-of-way for maintenance, emergency repairs or future expansion cannot be impeded by recreational use. Recreational use must include a management plan that addresses trash collection and prevention/repair of erosion. Additional impacts to sensitive environmental resources will be viewed as a negative.

Preliminary Design Concepts – NA

Cost Estimate – variable

Recommendations for Implementation – Use of utility corridors can require complex legal agreements. Additionally, in some instances the utility has an easement but does not own

the right of way, requiring the involvement of multiple parties to include the actual land owner. Conservation easements should also be investigated to determine if these can be used to encourage dedication of right of way in the existing utility corridors, whether from the utility company or a third part landowner. Paved trails may enhance maintenance access in some corridors, thereby yielding a positive benefit to the utility company. The 48-mile W&OD Trail in northern Virginia is a prime example of a long-distance bike path that can be facilitated through the use of a utility corridor.

TABLE 7 - LIST OF MAPPED PROJECTS

Project	Project Description
5.2.1	Proposed shared-use path corridor for CCRT Extension to Provincetown
5.2.3	Setucket Road Path intersection improvements
5.2.5	Brackett Rd & Rte 6 sidewalks and improved crossings
5.2.6	Cape Cod Rail Trail extension to Independence Park
5.2.7	Cape Cod Rail Trail extension to Hyannis Transportation Center
5.2.8	Connect Old Colony Rail Trail and Old Queen Anne Road via Route 137
5.2.9	Old Colony Rail Trail extension from Volunteer Park and access to Schoolhouse Pond
5.2.10	Connect Shining Sea Bikeway to Gifford Street via on-road route
5.2.11	Extend Shining Sea Bikeway through Bourne to Cape Cod Canal Bikeway
5.2.13	Connect Cape Cod Canal Bikeway to Hyannis Transportation Center
5.2.14	Develop Plan for Intermodal Center in Falmouth
5.2.15	Improve Bicycle Facilities on Tupper Road South of Route 6A
5.3.2	Feasibility Study & Design of Bike Path along Route 6 from Herring Cove Parking to Race Point Road
5.3.3	Identify Possible Connections between the Cape Cod Rail Trail and National Seashore Trails
5.3.6	Identify a "Shore Route" South of Route 28 from Woods Hole in Falmouth to Stage Harbor in Chatham
5.3.7	Identify a "Bay Route" from the Cape Cod Canal in Bourne to Orleans
5.3.8	Relocation of Existing Rail Line and Conversion to Trail
5.3.9	Connect Harwich Port to Old Colony Rail Trail
5.3.10	Designate Route 28 as a Bike Route and Improve Conditions
5.3.12	Connect MacMillan Pier to National Seashore Bicycle Paths
5.3.13	Connect Province Lands Bicycle Trail and Head of the Meadow Trail
5.3.16	Connect Wellfleet Bay Wildlife Sanctuary to Cape Cod Rail Trail
5.3.17	Identify Potential Bikeway Alignment through Sandwich Historic District
5.3.18	Identify and Implement "OBHC Triangle" Route
5.3.19	Improve Bicycling Conditions on Route 130 in Sandwich
5.3.20	Improve Bicycling Conditions on Quaker Meeting House Road in Sandwich
5.3.21	Establish a Bicycle & Pedestrian Connection from Fort Hill Trails to Governor Prence Road

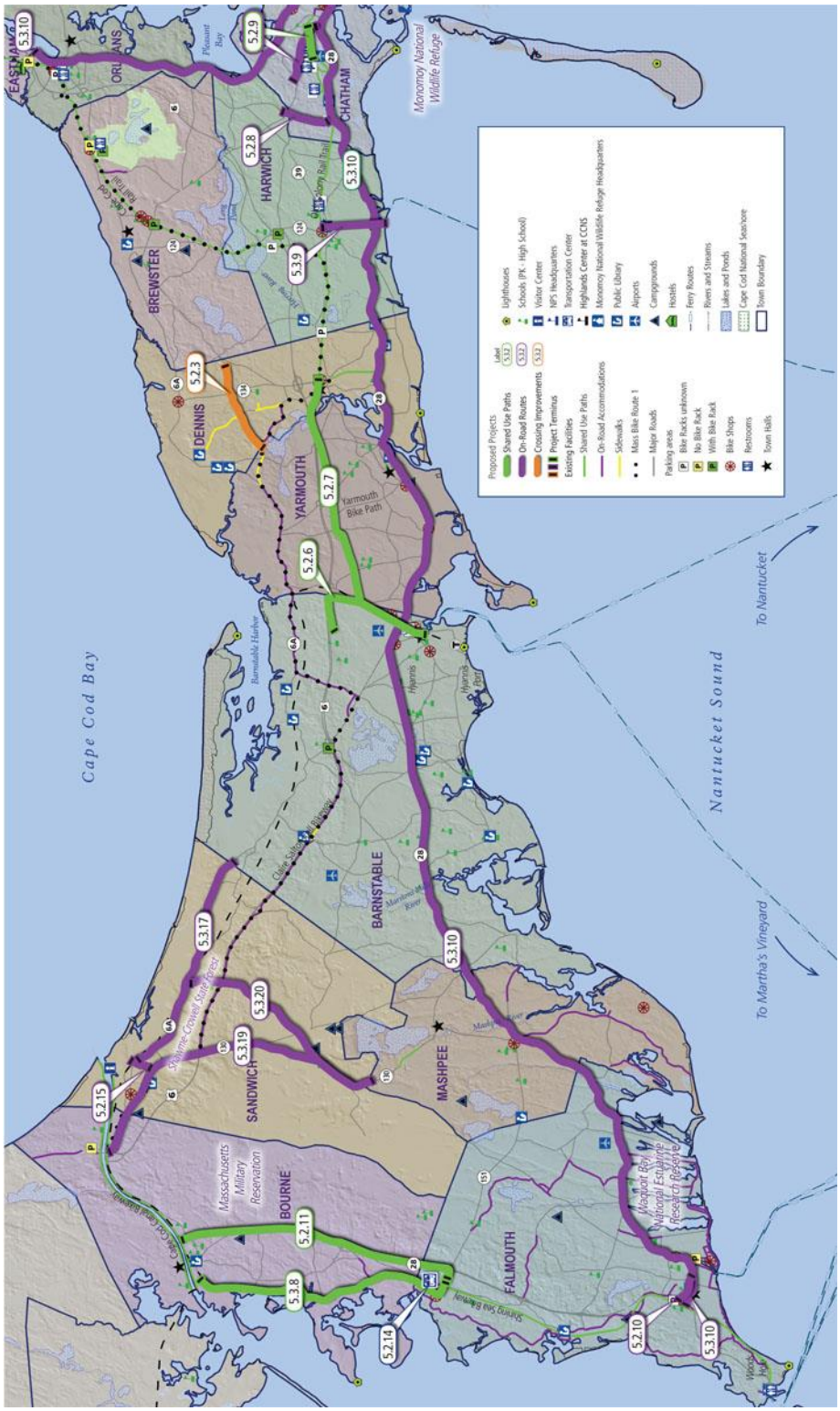

FIGURE 67 – CCNS UPPER/MID-CAPE MAPPED PROJECTS

FIGURE 68 - CCNS LOWER/OUTER-CAPE MAPPED PROJECTS

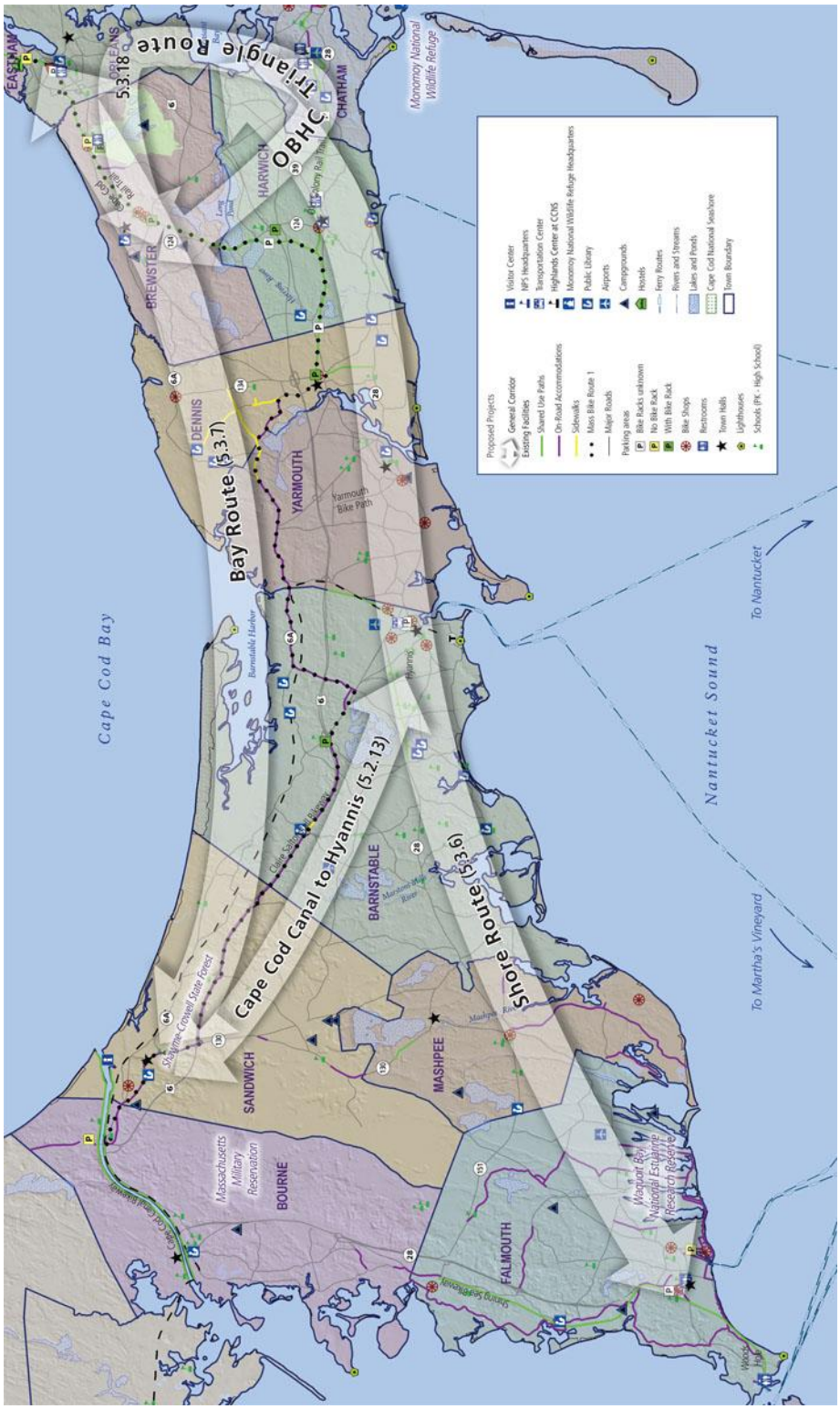

FIGURE 69 - CCNS UPPER/MID-CAPE PRIORITY CORRIDORS

FIGURE 70 – CCNS LOWER/OUTER-CAPE PRIORITY CORRIDORS

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.

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.

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.

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.

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