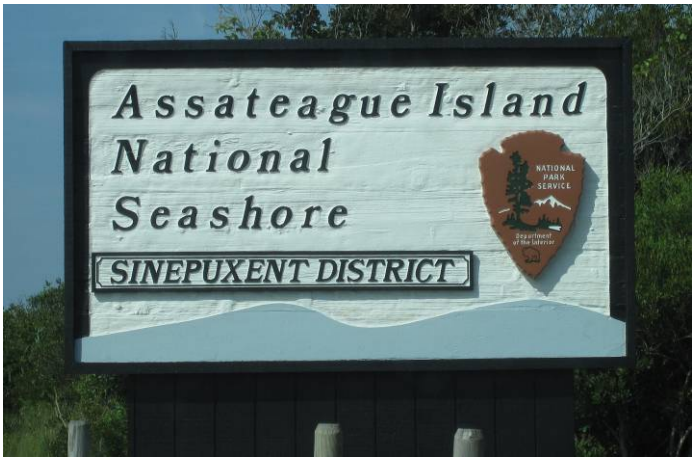
National Park Service
U.S. Department of the Interior

Assateague Island National Seashore
Berlin, Maryland

Assateague Island National Seashore
Alternative Transportation Systems Planning Study and Business Plan for Alternative Transportation



Source: Volpe Center Photographs, July 2009

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John A. Volpe National Transportation Systems Center

U.S. Department of Transportation
Research and Innovative Technology Administration

Report Notes

This report was prepared by the U.S. Department of Transportation John A. Volpe National Transportation Systems Center, in Cambridge, Massachusetts. The project was led by Lindsey Morse of the Transportation Planning Division. The project team included Jonathan Frazier, Frances Fisher, Alisa Fine, and Michael Kay of the Transportation Planning Division with support from Kathleen Sylvester, Catherine Duffy, Kirsten Holder, and Ingrid Bartinique of the Macrosys Corporation.

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1. Introduction

The National Park Service (NPS) Assateague Island National Seashore (NS) received funding in 2008 and 2009 to conduct planning to (1) study the potential expansion of existing alternative transportation systems (bicycle facilities) and development of new alternative transportation systems in and around the Maryland District of Assateague Island NS and (2) develop a business plan for implementation of a new alternative transportation system (transit). Assateague Island NS received the funding from the NPS Park Roads and Parkways (PRP) Alternative Transportation Program (Category III funding), an element of the Federal Highway Administration (FHWA) Federal Lands Highway Program, and selected the Volpe National Transportation Systems Center (the Volpe Center) to conduct the planning study.

Study Area

Assateague Island is a 37-mile barrier island off the Eastern Shores of Maryland and Virginia. The National Park Service (NPS) oversees the administration of Assateague Island NS, which encompasses Assateague Island and the surrounding waters. Assateague Island NS includes 49,950 acres, of which 18,029 acres are dry land. The island is approximately 1.5 miles across at its widest point.[1] Assateague Island NS has two separate districts, the Maryland District and Virginia District, which are defined by where the state borders cross the island. Approximately two-thirds of the island is in Maryland and one-third is in Virginia. Figure 1 shows the NPS map of the island and a close-up of the Maryland District.

Two other agencies share jurisdiction of Assateague Island with Assateague Island NS. Within the Virginia District, the U.S. Fish and Wildlife Service (FWS) manages the Chincoteague National Wildlife Refuge (CNWR), and within the Maryland District, the Maryland Department of Natural Resources owns and manages Assateague State Park (see Figure 1). CNWR and ASIS share management responsibility in Virginia, with the NPS primarily managing the public recreational beach and the surrounding waters. NPS also owns the Assateague Channel Bridge, located between Assateague and Chincoteague Islands. Assateague State Park manages its jurisdiction independent of Assateague Island NS but the two entities coordinate closely under concurrent jurisdiction.

This study only covers the Maryland District of Assateague Island NS, the island's connections to the nearby towns of Ocean City and Berlin, and the major access routes to these areas. It is not possible for the public to travel directly between the Maryland and Virginia sides on Assateague Island and the travel distance between the two mainland access points is approximately 50 miles along mainland routes. Consequently, though related, the two districts have distinct and separate transportation issues. A separate Alternative Transportation Study, funded by the Federal Transit Administration (FTA) Paul S. Sarbanes Transit in Parks Program, was completed by the Volpe Center in April 2010 for CNWR and the Virginia District of Assateague Island NS.[2]

For the purposes of this study, and consistent with the primary management responsibilities, "Assateague Island NS" will refer to facilities and conditions in the Maryland District unless otherwise specified.

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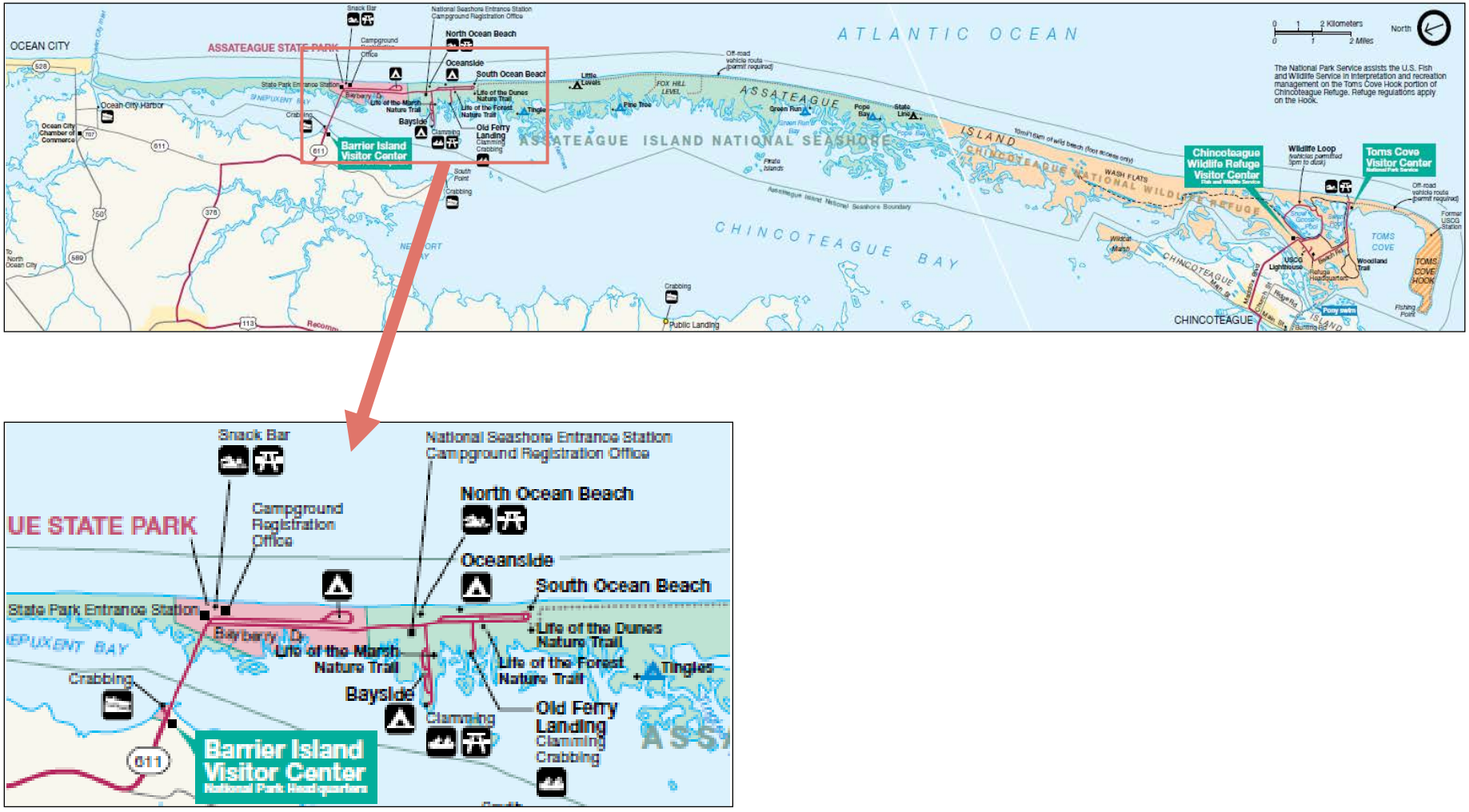
[1] National Parks Conservation Association. State of the Parks: Assateague Island National Seashore. August 2007. http://www.npca.org/stateoftheparks/assateague/assateague_csotp.pdf

[2] Volpe National Transportation Systems Center, U.S. Department of Transportation. Chincoteague National Wildlife Refuge Alternative Transportation Study. April 2010. http://www.fws.gov/northeast/chinco/alternativetransp.html

Figure 1
Map of Assateague Island NS, Assateague State Park, and CNWR
Source: NPS



Project Background

3039 Study

Section 3039 of the Transportation Equity Act for the 21st Century (TEA-21), required the Secretary of Transportation and the Secretary of the Interior to "undertake a comprehensive study of alternative transportation needs in national parks and related Federal Lands." One of the sites included in the study was Assateague Island NS. The resulting 2001 field report assessed the need for expanded transit to Assateague Island NS.[3] The report recommends expanding a then-existing express bus service linking Assateague Island NS, Assateague State Park, and Ocean City from three round trips per day to once every one to two hours. This shuttle is no longer in service. The report also recommends operating a shuttle from the NPS Barrier Island Visitor Center to Assateague Island NS during periods of high day-use visitation. The report stated that increased alternative transportation could have the potential to increase the use of Assateague Island NS and enhance visitor experience. The report contributed to the rationale for conducting the current study and related recommendations are considered, although the study also considers other alternative transportation solutions and addresses concerns about the risks for future access to the island.

General Management Plan (GMP)

The update to the Assateague Island NS General Management Plan (GMP) is currently underway. According to the NPS Park Planning Program Standards (2004), the purpose of the GMP is "to ensure that park managers and stakeholders share a clearly defined understanding of the resource conditions, opportunities for visitor experience, and general kinds of management, access, and development that will best achieve the park's purpose and conserve its resources unimpaired for the enjoyment of future generations." The current GMP was completed in 1982, and Assateague Island NS staff, in coordination with the NPS Northeast Regional Office, is working on a new GMP that will guide management decisions for resource protection, facility development, and visitor activities for the next twenty years. To date, the GMP process has conducted scoping and initial public outreach (2009) and has developed draft alternatives, which were released to the public in July 2011. NPS is currently reviewing public comments, revising the draft alternatives, and preparing the draft GMP.

Project Approach

Problem Statement

The Maryland District of Assateague Island NS experiences approximately three-quarters of a million visits (850,000) annually. Visitation is concentrated in July and August and is focused on the beach, leading to congestion and parking capacity issues that negatively affect the visitor experience and natural resources. In addition to summer beach parking, Assateague Island NS experiences challenges around signage, on-sand vehicle zone access, and bicycle and pedestrian access. Assateague Island also faces challenges as a barrier island and is likely to experience an increasingly dynamic land base on the island as a result of storms, natural shoreline processes, and sea level rise and other climate change effects. These changes raise questions about cost, sustainability, and access, and may challenge Assateague Island NS's ability to provide traditional transportation infrastructure and to support vehicular access in the future. The GMP is considering the issue of climate change in its alternatives and this study will similarly make recommendations about how best to prepare for possible future scenarios involving changes in access.

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3 Field Report: Chincoteague National Wildlife Refuge. Federal Lands Alternative Transportation Systems Study (3039). Prepared by Cambridge Systematics, Inc. for Federal Highway Administration and United States Forest Service. January 2004.

Goals

Assateague Island NS considers many goals important for transportation within and to the park. The funding program that supported this study includes the following goals:

- Protect natural, historic, and cultural resources;
- Improve the visitor experience;
- Reduce congestion and pollution;
- Improve visitor mobility, safety, and accessibility; and
- Ensure access to all, including persons with disabilities.

In addition to these goals, the park and its partners identified the following goals for the study at a kick-off meeting for the study in August 2008:

- Improve environmental sustainability;
- Encourage sustainable financial management;
- Increase off-peak visitation; and
- Inform and coordinate with GMP process.

As indicated in the problem statement, this study was intended to both improve current transportation conditions and to plan for potential changes to transportation resulting from storms, natural shoreline processes, and sea level rise and other effects of climate change.

Tasks

The study consists of an assessment of current and future conditions and needs as they relate to transportation within and to the Maryland District of Assateague Island NS. Included in the assessment is the identification of stakeholders, including potential partners, as well as limited stakeholder outreach, consisting of an initial kick-off meeting and subsequent phone calls. The study developed and assessed potential strategies to address needs identified, including travel demand management, information systems, and transit, among others. The study also developed and evaluated various transit options based on visitor use patterns and demand, possible future access scenarios, and potential partnerships. From this transit feasibility assessment, the study recommends a transit option for consideration and provides a business plan for its implementation. The business plan includes a detailed analysis of service characteristics, financial considerations, and vehicles.

Data Sources and Limitations

The data in this report comes from existing studies and literature, NPS data collection, and personal communication with stakeholders and park staff. The Volpe Center study team did not collect any primary field data and was reliant on outside sources to conduct the research and analysis. There is limited data available on parking occupancy and visitation patterns, so various assumptions were made that are explained in subsequent sections.

Report Structure

The report consists of four main sections in addition to the introduction and conclusion: Existing Conditions, Needs Assessment, Analysis and Assessment of Transportation Elements, and Transit Feasibility Assessment. In addition to the main body of the report, there are ten appendices that provide supplemental information on strategies considered, transit options, and vehicle selection.

2. Existing Conditions

This chapter presents data and information about Assateague Island NS and its regional context, with a particular focus on transportation system characteristics. The purpose of this chapter is to provide a basic understanding of Assateague Island NS, how visitors access it, and an overview of significant regional characteristics, including transit providers and key stakeholders. In addition, this chapter outlines the unique ecological nature of a barrier island, which has implications for access to the island and the development and maintenance of its transportation infrastructure.

Access and Transportation Infrastructure

This section describes visitor access to Assateague Island NS and supporting infrastructure. There are three subsections that focus on vehicular, bicycle and pedestrian, and water access.

Vehicular Access

Most visitors arrive by private vehicle,[4,5] although a growing number of senior citizens arrive by motor coach and many school groups also visit by bus.[6] In 2009, nearly 50,000 people arrived by bus (approximately 1,500 buses, assuming 60 individuals per vehicle) to both the Maryland and Virginia Districts.[7] While school programs account for a very small percentage of all Assateague Island NS visitors (approximately 0.4 percent), the majority of students arrive by bus rather than private vehicle. For example, in 2002, approximately 9,000 students arrived at Assateague Island NS in school buses.[8]

Maryland's Eastern Shore has limited access due to its location on the Delmarva Peninsula, which consists of Delaware and parts of Maryland and Virginia. Major roads in the region include U.S. Route 50, U.S. Route 13, U.S. Route 113, and Maryland Route 90, each of which brings visitors to Assateague Island. From there, several feeder routes provide access to Route 611, which leads directly to the Verrazano Bridge, which connects the Maryland side of Assateague Island to the mainland.

The primary access route from Washington, D.C. and Baltimore, the two closest major metropolitan areas, is the Chesapeake Bay Bridge along U.S. Route 50 near Annapolis. Other driving options from the north include the Cape May-Lewes Ferry, which connects southern New Jersey to Delaware north of Ocean City, and Delaware Route 1 from the north, which connects with Interstate 95 in Wilmington, Delaware. From the south, the only access route to the Virginia and Maryland Eastern Shores is via the Chesapeake Bay Bridge-Tunnel, which connects the Delmarva Peninsula to Norfolk, Virginia, and U.S. Route 13, which runs the entire length of the peninsula until it merges with Delaware Route 1.

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[4] Assateague Island National Seashore. Long Range Interpretive Plan. 2002. http://www.nps.gov/asis/parkmgmt/upload/lripscreen.pdf

[5] Assateague Island National Seashore. Visitor Survey. January 16, 2007. Eppley Institute for Parks and Public Lands, Indiana University. (provided by park)

[6] Assateague Island National Seashore. Long Range Interpretive Plan. 2002. http://www.nps.gov/asis/parkmgmt/upload/lripscreen.pdf

[7] National Park Service Public Use Statistics Office. http://www.nature.nps.gov/stats/

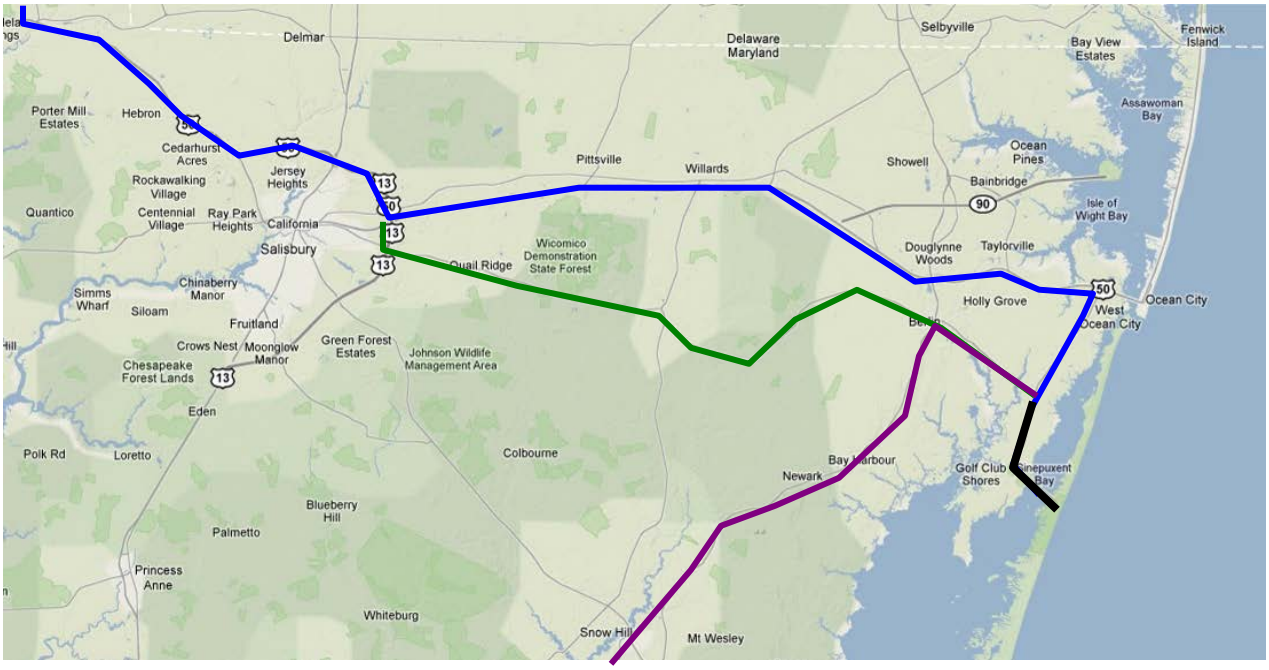
[8] In 2002, an additional 2,000 students were turned away due to lack of facilities, including lack of a spacious indoor venue for educational programs (Assateague Island National Seashore. Long Range Interpretive Plan. 2002. http://www.nps.gov/asis/parkmgmt/upload/lripscreen.pdf).

Access onto Assateague Island is also limited. There are two access points for vehicles, one in Maryland and one in Virginia. In Maryland, the Verrazano Bridge (also known as the Route 611 Bridge) is located eight miles south of Ocean City and crosses the Sinepuxent Bay to provide access to the Assateague State Park as well as the Maryland District of Assateague Island NS. The second access point, in Virginia, is via Route 175, which connects the mainland to Chincoteague Island, from which the Assateague Channel Bridge connects to the Virginia District of Assateague Island NS.

Visitors cannot travel between the two districts of Assateague Island NS on Assateague Island. To travel from the Maryland District to the Virginia District of Assateague Island NS, visitors using private vehicles must use Routes 611, 376, and 113 through the town of Snow Hill. From Snow Hill, visitors can take state Route 113 to U.S. 13 or travel on Routes 12, 679 to access Route 175, which provides access to the island and town of Chincoteague, CNWR, and the Virginia District of Assateague Island NS. The trip is approximately 50 miles.

Figure 2 shows the main access routes taken by visitors to the Maryland District of Assateague Island NS. Regardless of origin, visitors to the Maryland District from the north access Assateague Island NS from U.S. Route 50, either via Berlin using Routes 346 and 374 (green route) or via West Ocean City using Route 611 (blue route). From the south, visitors access Assateague Island NS using U.S. 113 and Route 374 via Snow Hill and Berlin (purple route). All visitors ultimately use Route 611 (black route), the only access road to the Maryland District, and the Verrazano Bridge (or the adjacent bicycle-pedestrian bridge), which connects the mainland to Assateague Island.

Figure 2
Map of Major Access Routes to the Maryland District of Assateague Island NS
Source: Google Maps and Volpe Center



Bicycle/Pedestrian Access

The number of visitors who access the Maryland District on foot or by bicycle is also not known. Anecdotally, some visitors bicycle from Ocean City and other nearby communities, but few if any visitors enter the Maryland District on foot.[9]

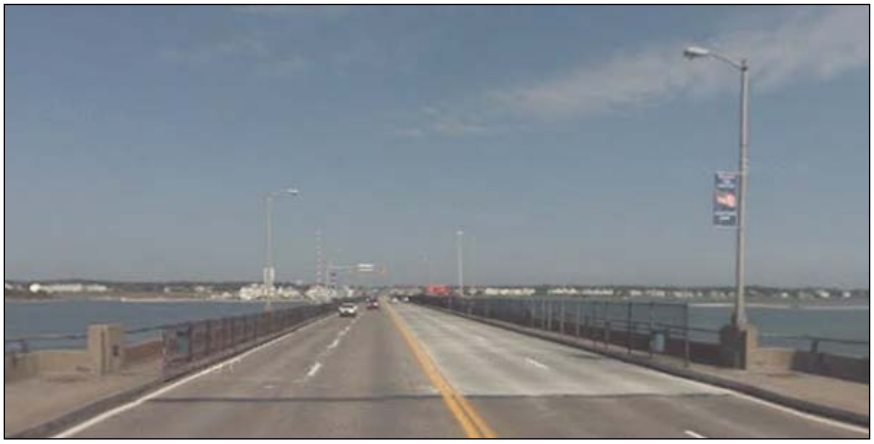
Worcester County and Ocean City have developed bicycle maps that identify several bike routes that provide access to Assateague Island NS. Bike routes include portions of Routes 611, 50, 90, 628, 364, 354, 12, and 346. Some of these routes have limited bicycle and pedestrian infrastructure in the form of wide shoulders and striping for bicyclists. Route 611, the route that all visitors must take to access to the Maryland District, has this type of infrastructure and as such is more suited to experienced bicyclists (see Figure 3). The nearest activity centers are in Berlin and Ocean City, each located about eight miles from the Barrier Island Visitor Center. Casual bikers or families might not want to bike this distance and the distance is typically too long for pedestrians. There are also safety concerns along parts of the bicycle route between Ocean City and Assateague Island NS. In particular, the bridge along U.S. Route 50, which provides the most direct route to reach Assateague Island NS, has a narrow shoulder and sidewalk, which is often frequented by fishermen (see Figure 4). There have been a number of bicyclist fatalities along the U.S. Route 50 bridge.[10]

Figure 3
Bicyclists on Route 611 near the Visitor Center
Source: Volpe Center photographs, July 2009

[9] Personal communication with Assateague Island NS staff.

[10] Dahl, Cara. Route 50 Bridge Biking Questions Raised. Maryland Coast Dispatch. 3 July 2009. http://www.mdcoastdispatch.com/article.php?cid=30&id=6503

Figure 4
U.S. Route 50 Bridge
Source: Google Streetview



Bicycles and pedestrians can access the Maryland District via a bicycle and pedestrian bridge that is adjacent to the Verrazano Bridge (see Figure 5). There used to be a designated bicycle and pedestrian parking area on the mainland with direct access to the bicycle and pedestrian bridge, but that area is now part of the new visitor center parking area. The impact of the loss of this parking area on bicycle and pedestrian activity using the bridge is not yet known.

Figure 5
Bicycle and Pedestrian Bridge and Sign for Bridge Parking
Source: Volpe Center photograph.

Once on the island, an off-road, paved bicycle path runs parallel to the main access road and two similar paths run along Bayberry Drive (see Figure 6) and the state park road through its campgrounds.[11] On Assateague Island NS, the Life of the Forest, Life of the Marsh, and Life of the Dunes nature trails offer visitors the opportunity to explore each of the primary features of the island on foot. Each trail is a 0.5-mile loop.[12] Visitors can rent bicycles by the hour, day, overnight or weekend, from a recreational rental facility operated by the Maryland Coastal Bays Program, a non-profit partnership between the towns of Berlin and Ocean City, Worcester County, NPS, the U.S. Environmental Protection Agency (EPA), and the Maryland Departments of Natural Resources (DNR), Agriculture, Environment, and Planning,[13,14] on the bayside of Assateague Island, near the Bayside campgrounds.

Figure 6
Bicycle Trail parallel to Bayberry Drive
Source: Volpe Center photograph, July 2009

Nonmotorized Water Access

Canoes and kayaks may be launched from designated areas at Assateague Island NS, including the Old Ferry Landing (see Figure 7). In addition to bicycle rentals, the Maryland Coastal Bays Program facility also offers canoe and kayak rentals by the hour, day, overnight, or weekend (see Figure 8). Several local

11 Assateague Island National Seashore website. http://www.nps.gov/asis/planyourvisit/things2do.htm

12 Assateague Island National Seashore website. http://www.nps.gov/asis/planyourvisit/hiking.htm

13 Assateague Island National Seashore website. http://www.nps.gov/asis/planyourvisit/things2do.htm

14 Maryland Coastal Bays website. http://www.mdcoastalbays.org/who-we-are

outfitters currently also offer canoe and kayak rentals and tours with varying schedules, fares and shuttle configurations.

Figure 7
Kayaking Tour, Bayside
Source: Volpe Center Photograph, July 2009

Figure 8
Maryland Coastal Bays Program rental facility at Assateague Island National Seashore
Source: Volpe Center photograph, June 2010

Motorized Water Access

There are currently few options for motorized water transport to the Maryland District of Assateague Island NS. The only motorized boat launching infrastructure within the Maryland District of Assateague Island is at Assateague State Park. There are several water tour companies based out of Ocean City that pass by Assateague or dock on the island for brief periods of time. For example, the Assateague Adventure tour company offers several cruises a day to the island (adult fares are $17, including a landing fee of $1) as well as private 90-minute and two-hour chartered cruises. The company advertises several activities, including wild horse-watching, bird watching, and clam dredging, as part of the island cruise packages.

These water transport operations are tourism-based and are not to transport visitors to Assateague Island NS who might wish to spend extended time on the beach or carry recreational equipment such as surfboards or camping gear.

Assateague Island NS staff report that private boaters use the northern tip of Assateague Island as a destination, for fishing and recreation. This region of Assateague Island is not accessible except by boat or foot. The 1982 Assateague Island NS GMP noted that several individuals used surfboards to travel across the Ocean City inlet to the north end of the island, but that boat transport was much more prevalent.[15] Boating into the north end of the island has become extremely popular, especially on summer weekends. This has prompted the park to look at management options as part of the current GMP process.

Stakeholders interviewed for this study expressed concerns about the viability of a water transport operation from neighboring regions to Assateague Island. Water transport in the region has typically appealed to a select audience. The cost of creating water transport-related infrastructure for regular trips and conflicts with existing county and state use policies and regulations have prevented large-scale operators in the region from entering the market.[16]

Overview of Assateague Island National Seashore

This section describes facilities, management, and visitation, with a focus on the Maryland District.

Facilities

Assateague Island NS has numerous facilities to accommodate visitor activities, which include camping, swimming, surfing, hunting, biking, horseback riding, hiking, surf fishing, shellfishing, canoeing, kayaking, and over-sand vehicle (OSV) usage.[17] Assateague Island NS Maryland District infrastructure includes a Ranger Station (opened spring 2012), visitor center, bicycle and walking trails, parking lots, campgrounds, and restroom and bath facilities. Assateague Island NS also has 158 walk-in and drive-in campsites located on the island's bay and ocean sides; backcountry camping in the OSV zone is also allowed.

OSV Zone

OSV usage is limited to the beach in the OSV zone. The entrance to the zone is located 1.5 miles south of the Assateague Island NS entrance booths. The OSV Zone extends approximately 12 miles south to the Maryland-Virginia border. The OSV zone is also accessible to hikers, fishermen, sunbathers, and horseback riders, but is off limits to vehicles other than OSVs.[18]

[15] Assateague Island National Seashore. General Management Plan. June 1982. Denver Service Center. (provided by park)

[16] November 2009. Nancy Powell. "County sinks amphib. [sic] boat tour proposal." Ocean City Today. Available at http://www.oceancitytoday.net/news/2009/1120/business/041.html

[17] Assateague Island National Seashore website. http://www.nps.gov/asis/

[18] Assateague Island National Seashore website. http://www.nps.gov/asis/planyourvisit/horseback-riding.htm and http://www.nps.gov/asis/planyourvisit/upload/OSVmap.pdf

Visitor Center

Assateague Island NS operates two visitor centers, one in Maryland and one in Virginia. In the Maryland District, the Barrier Island Visitor Center is located on the mainland off state Route 611 near the Verrazano Bridge, which connects the mainland to Assateague Island. A new Barrier Island Visitor Center was constructed and opened to the public in October 2010 (see Figure 9) at the site of the former bicycle and pedestrian parking lot on Route 611 near the Verrazano Bridge.

The need for the new visitor center was cited in the Assateague Island NS General Management Plan (GMP) in 1982 and an environmental assessment was completed in 2003.[19] The former visitor center was constructed in 1970, with some minor modifications since then, and was determined to provide insufficient accommodation for both the number of visitors and for the type of interpretive exhibits that are desirable. The former visitor center building and parking is being utilized as an environmental education center. The new visitor center provides additional space, a theater, and additional parking (increasing parking from 41 to 104 plus space for 8 buses or RVs).

Figure 9
New Visitor Center
Source: Assateague Island NS, August 2010

[19] Assateague Island National Seashore. Facility Improvements to the Headquarters Complex: Environmental Assessment. October 2003.

Parking Areas

The Maryland District of Assateague Island NS has 10 parking areas open to the general public, meaning day-trip visitors, as well as additional parking facilities for employees and for campers. One of the parking areas is on the mainland and provides access to the visitor center. It has 104 parking spaces plus space for 8 buses or RVs). The former visitor center, co-located with the maintenance facility and administrative offices, has 41 spaces that can be used for overflow from the new visitor center.

Information, including location and size, for the parking areas on the island can be found in Figure 11. The vast majority of the parking on the island (over 80 percent) serves the beach but several additional lots provide access to bayside activities, trails, and a historic boathouse (see Figure 10 for photographs of the two beach parking areas).

Assateague Island NS recently completed an expansion and reconfiguration of the North Beach parking lot, which involved reclaiming dune vegetation and moving the parking west, increasing parking capacity, adding a boardwalk between the beach and new parking, and construction of new bathhouses.[20]

Figure 10
North Ocean Beach Parking Area (top) and South Ocean Beach Parking Area (bottom)
Source: Volpe Center Photograph, July 2009

[20] National Park Service. Finding of No Significant Impact/Decision Notice: Improvements to Island Facilities and Infrastructure – Assateague Island National Seashore. June 30, 2006.

Figure 11
Parking Areas in the Maryland District of Assateague Island NS: Location and Number of Spaces
Source: Parking Area information provided by Assateague Island NS staff; map from Google Maps

Key	Location	Single	Long / Pull-Through	Handicap	Total
A	Ranger Station	23	11	2	36
B	North Ocean Beach Parking	512		11	523
C	Bayside Picnic Area	46	14	3	63
D	Life of Marsh Trail	11		3	14
E	Lifesaving Boathouse	9	3	1	13
F	Old Ferry Landing	19	5	1	25
G	Life of Forest Trail	9	3	1	13
H	Life of Dunes Trail	11	3	1	15
I	South Ocean Beach Parking	65		1	66
	Total	705	39	24	768

Management

The NPS is responsible for managing Assateague Island NS but works with several partners, including the FWS and the Maryland DNR. Coordination with FWS focuses on CNWR on the southern end of the island while coordination with the Maryland DNR focuses on Assateague State Park on the northern end. Management plans and documents, staffing, and fee structure and booths are important elements of Assateague Island NS management to consider for transportation.

Management Plans and Documents

The existing GMP (1982) outlines and prioritizes several projects to update park facilities and provide more accessible facilities. The report notes, however, that analysis and public review found no immediate need for a public transit system providing access to the Assateague Island NS Maryland District. Most of the facility development mentioned in the GMP, such as upgrades to nature trails, was completed in fiscal year 1989.[21]

The current Assateague Island NS long-range interpretive plan was developed in 2002. The plan focuses on establishing priorities, strategies, and action for educational and interpretive programs over a five- to seven-year timeframe. The plan outlined the need for improved orientation, information, and wayfinding to enhance visitors' educational park experiences. The plan acknowledged that visitation to the parks and the visitors' centers was increasing without a corresponding increase in staff resources or facilities. As a result of parking congestion, the plan noted that some visitors bypass both the Maryland District and Virginia District visitor centers, missing important opportunities for learning more about Assateague Island NS. Finally, the plan acknowledged the "explosive growth" of Worcester County and potential impacts of this growth on Assateague Island NS.

Staffing

Staffing has historically been a challenge for Assateague Island NS due to limited funds. In 2007, due to lack of funding, Assateague Island NS was unable to fill nine staff positions or add new positions.[22] Resource protection, maintenance, and provision of visitor services have been affected as a result of funding shortfalls and associated staffing difficulties. While there are general challenges to resource management, Assateague Island NS has identified particular difficulties with assessing and managing cultural resources, including archaeological sites, archives, and historic structures. In 2007, Assateague Island NS identified a need for at least two full-time cultural resources staff to adequately address historic and cultural resource management.[23] In 2008, Assateague Island NS employed a total of 137 permanent, term, and seasonal staff.

In the absence of a sufficient number of permanent staff, Assateague Island NS has relied heavily on the contributions of volunteers. In 2006, 348 volunteers contributed more than 12,156 hours of service to

[21] Assateague Island National Seashore. Long Range Interpretive Plan. 2002. http://www.nps.gov/asis/parkmgmt/upload/lripscreen.pdf

[22] National Parks Conservation Association. State of the Parks: Assateague Island National Seashore. August 2007. http://www.npca.org/stateoftheparks/assateague/assateague_csotp.pdf

[23] National Parks Conservation Association. State of the Parks: Assateague Island National Seashore. August 2007. http://www.npca.org/stateoftheparks/assateague/assateague_csotp.pdf

visitor education programs, beach cleanup, campground operations, and other projects.[24] In 2008, 1,280 volunteers contributed 1,280 hours to the park.[25]

Fee Structure

Entrance and recreation fees provide a vital source of revenue for improving facilities and services for Assateague Island NS visitors. Assateague Island NS receives 80 percent of the fees it collects and uses them to support visitor service projects, maintenance and enhancement of facilities, trails, and roads, and lifeguarding, collection costs. The remaining 20 percent of fees collected goes to the NPS Headquarters offices to support national initiatives and special park requests.[26]

Several entrance fee options are available (see Table 1) and visitors may also use the America the Beautiful National Parks and Federal Recreational Lands Annual Pass[27] or the FWS Duck Stamp.[28] Assateague Island NS also charges fees for its campgrounds and for use of its OSV zone.

According to a 2007 visitation survey, approximately half of Maryland Assateague Island NS visitors purchase a weekly pass, one-quarter purchase an annual pass, and one-quarter use a national pass (America the Beautiful, Senior, or Access Pass).[29]

Table 1
Visitor Fee Schedule (effective February 1, 2012) for Assateague Island NS Maryland Entrance
Source: Assateague Island National Seashore

Type	Timeframe	Fee
Foot/Bicycle	N/A	Free
Individual (16 years or older; entering by taxi, bus, or van)	Daily	$3
Motorcycle	Weekly (7 days)	$10
Vehicle	Weekly (7 days)	$15
Vehicle	Annual Park Pass (1/1 through 12/31)	$30
Developed Area Camp Site	Per night	$20 (10/16-4/14) or $25 (4/15-10/15)
Group Camp Site (7-25 people)	Per night	$40
Horse Camp Site (6 people / 6 horses)	Per night	$30
Backcountry Camping Permit	Per person	$6
OSV Permit (MD)	Valid one year from month of purchase	Ranges from $90 - $150, depending on the type of access and location desired

[24] National Parks Conservation Association. State of the Parks: Assateague Island National Seashore. August 2007. http://www.npca.org/stateoftheparks/assateague/assateague_csotp.pdf

[25] Assateague Island NS 2008 Accomplishments. http://www.nps.gov/asis/upload/ASIS_DR_2008.pdf

[26] National Park Service Recreation Fee Program. http://www.nps.gov/feedemo/

[27] The annual pass costs $80 and is valid for one year. The pass is $10 for seniors and free for people with disabilities. The $10 and free pass have lifetime validity.

[28] The FWS Duck Stamp is $15 and can be used as an annual entrance pass, but Assateague Island NS requires a supplementary beach parking fee of $15.

[29] Assateague Island National Seashore. Visitor Survey. January 16, 2007. Eppley Institute for Parks and Public Lands, Indiana University. (provided by park)

Entrance Booths

To enter the Assateague Island NS Maryland District, visitors pass through one of two entrance or fee booths (see Figure 12) located two miles down Bayberry Road, the primary thoroughfare for visitors to access the vehicle-accessible facilities on Assateague Island NS (e.g., campgrounds, beaches, and nature trailheads). One of the booths is staffed during daytime hours; the other is commonly left unstaffed, allowing visitors with annual passes to swipe their pass through a card reader to enter. This structure was designed to benefit annual pass holders by allowing them to bypass traffic at the staffed booth. However, much of Bayberry Drive is a two-lane road. The road widens to three lanes (one outgoing, two incoming) approximately 200 feet before visitors arrive at the entrance booth. When more than ten vehicles are in line to pass through the entrance booth, visitors will experience traffic regardless of whether they have an annual pass.

Figure 12
Entrance Booths for Maryland District of Assateague Island NS
Source: Volpe Photograph, July 2009.

Given the wait time and congestion that can occur at the entrance booths, Assateague Island NS has considered several options for reconfiguration or relocation of the entrance booths. In 2003, Assateague Island NS hired a consultant to complete an evaluation[30] of several possible alternative locations for the entrance station, including locations on either side of the Verrazano Bridge, which would require Assateague State Park and Assateague Island NS to jointly manage the booths. The report recommended locating the booths on the mainland; however, legal issues regarding allowed use on the recommended site, concerns about access to the public bridge, and logistical issues about joint management have to date prevented Assateague Island NS from pursuing this recommendation. Assateague Island NS has built a new ranger station adjacent to the existing entrance booths and is planning to reconfigure the entrance area. The reconfiguration would move the booths west and south to allow for a third entrance booth and to lengthen the section of road with two entrance lanes to facilitate having one lane designated to annual pass holders.

[30] National Park Service, Assateague Island National Seashore Entrance Station Alternatives Evaluation. Johnson, Mirmiran & Thompson, December 2003. (provided by park)

Visitation

Information on annual and seasonal visitation and visitor demographics to the Maryland District as well as all of Assateague Island NS are presented below.

Annual Trends

Since the early 2000s, Assateague Island NS has experienced approximately 2 million visits annually in both the Maryland and Virginia Districts. Of the over 390 national parks in the NPS system, Assateague Island NS was the 40th most visited in 2009 and represented 0.75 percent of all visitation to national parks.

In 2009, approximately 850,000 people visited the Maryland District and 1.3 million people visited the Virginia District.[31] This is consistent with visitation counts over the past decade. While more visitors access the Virginia District, a 2007 visitor survey conducted by the NPS indicated that for repeat visitors, approximately one-third had visited both park districts, about one-third had visited only the Maryland District, while only a small percentage (approximately 15 percent) of visitors had visited only the Virginia District. However, the percentage of respondents reporting that they had visited only the Maryland District could be over-represented due to the fact that there were more survey sampling sites on the Maryland side of the park and more visitors returned surveys in the Maryland District than in the Virginia District.

Visitor counts to the Maryland District Assateague Island NS are determined by using traffic counters installed on Bayberry Drive. The total visit count is reduced for the number of counted buses, and an estimated number of non-recreational vehicles and non-reportable vehicles. Since 1989, the reduced traffic count has been multiplied by a persons-per-vehicle (PPV) figure of 2.9 for the Maryland District. It is important to note that because of the counting method, repeat visitors are counted for each visit, so total counts might not necessarily reflect the actual number of unique visitors arriving to Assateague Island NS.

Visitation to Assateague Island NS has increased over time, although the rate of increase has not been consistent and the two districts have experienced different patterns. In 1967, the year that Assateague Island NS visitation records were first available, visitation was over 700,000, with visits split evenly between Maryland and Virginia. Virginia's visitation began to surpass Maryland's in the early 1970s, when both received approximately one million visits. After falling to 500,000 in the mid-1980s, visitation to Maryland peaked in the late 1980s at just over 1.1 million and then decreased over the following decade to 500,000 again. Since 2000, the annual visitation rate has hovered around 700,000 to 850,000. Visitation rates for 2010 are expected to increase by approximately 1.2 percent.[32] Figure 13 shows annual recreation visitation statistics for each district and combined.

Seasonal Trends

The primary visitor season occurs during the summer from Memorial Day through Labor Day, peaking in July and August (see Figure 14). In 2009, approximately 44 percent of all visits to the Maryland District occurred in July and August, about eight percent occurred in the winter months of January, February,

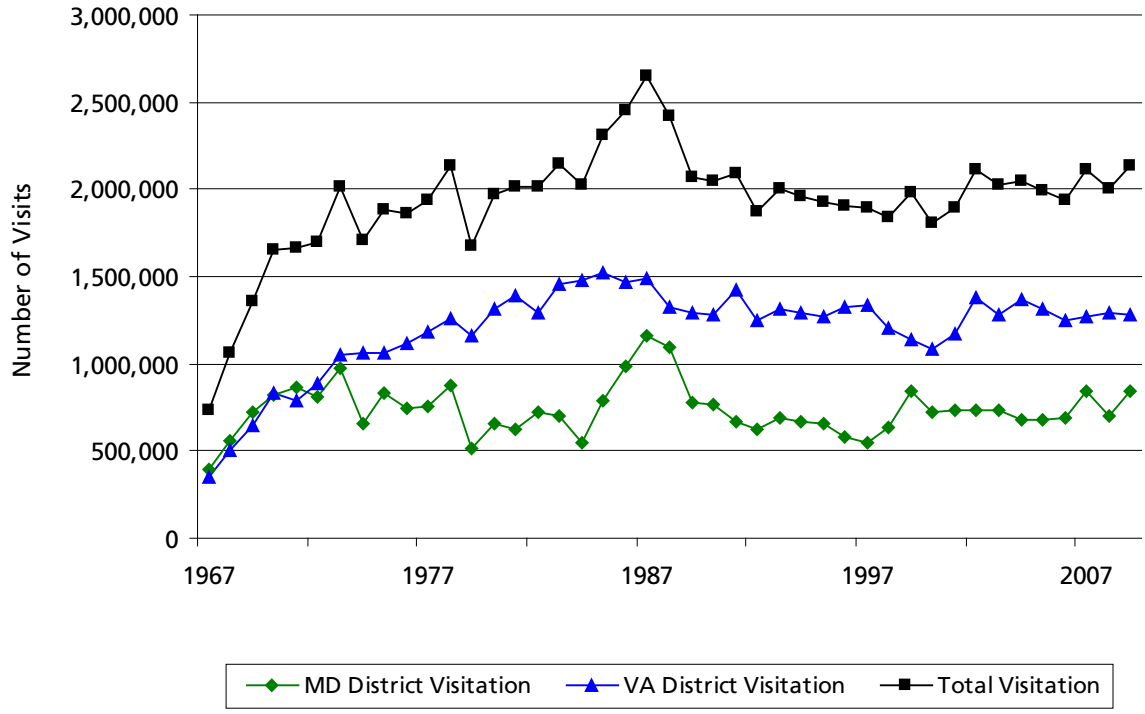
[31] National Park Service Public Use Statistics Office. http://www.nature.nps.gov/stats/

[32] All visitation statistics in this paragraph and the above paragraph are from the National Park Service Public Use Statistics Office, http://www.nature.nps.gov/stats/.

November, and December, and the remainder (almost half) occurred in the shoulder seasons (fall and spring).[33]

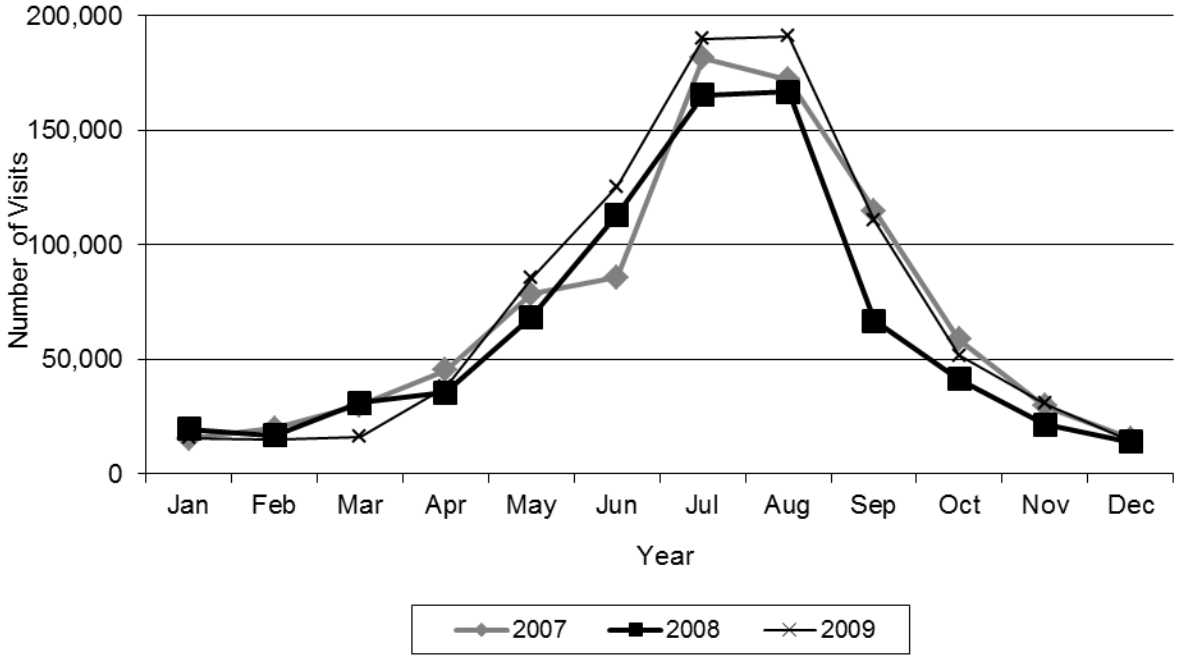
Figure 12
Total Annual Recreation Visitation (1968-2009)*

Source: NPS Public Use Statistics Office.



[33] Assateague Island National Seashore. Long Range Interpretive Plan. 2002. http://www.nps.gov/asis/parkmgmt/upload/lripscreen.pdf

Figure 13
Monthly Visitation for the Maryland District of Assateague Island NS: 2007-2009.
Source: NPS Public Use Statistics office.



Visitor Demographics

Findings from a 2007 visitation survey[34] provide a more multi-faceted understanding of the Assateague Island NS visitor. The findings indicated that the typical summertime Assateague Island NS visitor was a repeat visitor and was part of larger family group with an average size of five. The average age of respondents was 46, and the majority of visitors surveyed (64 percent) were female. The majority of visitors reported that they were not local. The primary visitor feeder states included Maryland, Pennsylvania, New Jersey, Virginia, Delaware, and New York.

While the 2007 survey helps to provide more information about Assateague Island NS visitor demographics, the study has some limitations (e.g., it was conducted in the summer during a two-week period and likely over-represents the numbers of families visiting the park). Nevertheless, the 2007 snapshot appears to be fairly consistent over time. For example, the 1982 Assateague Island NS GMP noted that nearly half of visitor groups came with children and that groups were comprised of five or more individuals. A visitor survey conducted in 1985-1986 found that visitors to Assateague Island NS area

[34] This survey was conducted over a two-week period in July and August; nearly 1,600 surveys were distributed to visitors and 1,016 surveys were returned (59 percent response rate).

were primarily from mid-Atlantic states, were repeat visitors, and came in large groups (nearly 40 percent of visitors came in a group of 6-10 people, and 64 percent came in family groups).[35]

Some individuals interviewed for this study suggested that most park visitors arriving in the spring, fall, and winter are families that have young children not yet of school age. Senior citizens also make up a larger proportion of Assateague Island NS visitors during these shoulder and off-peak months. Moreover, anecdotal evidence corroborates the 2007 survey findings that visitation is both seasonal and regional, with the majority of visitors coming from the Washington, D.C., Baltimore, Annapolis, and Philadelphia metropolitan areas.

Regional Context and Major Entities

Tourism, agriculture, and poultry production have historically been the most important contributors to the economy of Maryland's Lower Eastern Shore, which includes Somerset, Wicomico, and Worcester Counties.[36] This area has in the past received the highest average trip expenditures of any region in Maryland and also attracted the longest trip durations (just over three nights), 29 percent higher than the state average.[37] Eco-tourism and heritage tourism—which promotes enhancement of communities' unique cultural and natural resources—are emerging trends growing in importance at the regional and county levels.

Assateague Island NS itself plays a large role in attracting visitors to the area but there are a number of other attractions and destinations. Each destination within the region offers different visitor experiences, with the largest contrast existing between the beach environments at Assateague Island NS and Ocean City. For example, Assateague Island NS beaches have no development other than parking and restroom facilities, while Ocean City beaches are lined by hotels, restaurants, and stores. That said, according to the 2007 visitation survey, nearly half of summer respondents visited both Assateague Island NS and Ocean City's boardwalk.

This section identifies major stakeholder entities with interest in and relevance to Assateague Island NS, including its transportation issues. These entities are primarily public jurisdictions but also include nonprofits interested in tourism and education.

Assateague State Park

Assateague State Park occupies 859 acres; it is surrounded by the Assateague Island NS jurisdiction although road access is provided by a state road that connects the Verrazano Bridge to Assateague State Park (see Figure 1 above and Figure 15 below). Assateague State Park is the second-most visited park in the Maryland state park system, drawing nearly one million visitors every year. Its attractions include its public beach, kayaking, wildlife, and campgrounds. Access and use of such attractions require payment of a fee (see Table 2). Assateague State Park has 400 lined spaces in its day use parking area as well as an additional 300 unlined spaces in its overflow parking area, located at the campground entrance (see Figure 16, Figure 17, and Figure 18).

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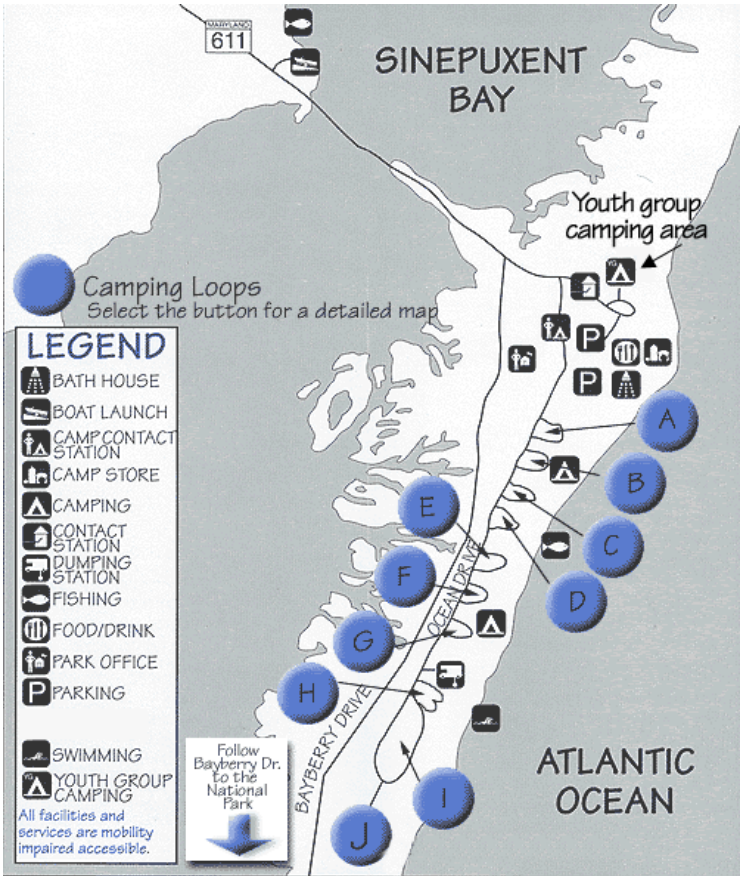
[35] Wright, Pamela A., Gary W. Mullins, and Merle J. Van Horne. Public Area Recreation Visitor Survey: Characteristics and Expenditures of Visitors to the Assateague Island National Seashore. Ohio State University School of Natural Resources/OSU Research Foundation. 1985-6. (Provided by park)

[36] Worcester County, Maryland. The Comprehensive Development Plan. March 14, 2006. http://www.co.worcester.md.us/cp/finalcomp31406.pdf; See also the Tri-County Council for the Lower Eastern Shore of Maryland's Comprehensive Economic Development Strategy (CEDS) at http://www.lowershore.org/ceds/index.html

[37] Ferguson. Anita. "Shore Tourism Outstrips state." Rural Development Center at the University of Maryland Eastern Shore. January 2003. Available at http://skipjack.net/article.Assateague state Park?StoryID=16

According to the Maryland DNR annual statistics report, from July 1, 2008, to June 30, 2009, approximately 60,000 visitors stayed overnight at Assateague State Park,[38] utilizing its 350 campsites.[39] Park statistics for 2007, the most recent year for which data was provided, indicated that Assateague State Park experienced over 850,000 day visitors.[40]

Figure 14
Assateague State Park Map
Source: Assateague State Park website (http://www.dnr.state.md.us/publiclands/maps/assateaguemap.html)



[38] MD DNR Statistics 2009: Assateague. (Provided by staff at Assateague State Park).

[39] Maryland Department of Natural Resources. Assateague State Park. http://www.dnr.state.md.us/PublicLands/Eastern/Assateague.html

[40] Information provided by Assateague State Park.

Table 2
Fee Schedule for Assateague State Park
Source: Assateague State Park website

Type	Timeframe	Fee
Day Use (per person)	Memorial Day – Labor Day	$3 ($4 for out-of-state residents)
Day Use (per vehicle)	Labor Day – Memorial Day	$3
Campsite (family or youth group)	Per night (4/28-11/1)	$30 ($40 with electric)
Boat Launch (per vehicle)	Daily	$10 ($11 for out-of-state residents)

Figure 15
Main Facilities at Assateague State Park
Source: Google Maps

Figure 16
Assateague State Park Day Use Parking
Source: Volpe Center Photograph (July 2009)

Figure 17
Assateague State Park Overflow Parking
Source: Volpe Center Photograph (July 2009)

Assateague Island Alliance

The Assateague Island Alliance is a non-profit established January 1, 2008, to support Assateague Island NS and its goal of providing an enjoyable and hands-on learning experience for millions of visitors each year.[41] The Alliance is one of many park friends groups, which assist parks in supporting park programs and projects. The Alliance hosts events and activities throughout the year and in the summer of 2009 began operating a retail and snack bar concession in one of the former bath houses at the North Ocean Beach. Funding is provided through membership, donations, and proceeds from merchandise and other sales.

Berlin

The Town of Berlin is located eight miles northwest of Assateague Island, along one of the main access routes from the Washington, DC area and other points to the northwest. As of 2000, its year-round population was 3,491. Since the 1980s, Berlin has undertaken a large renovation of its historical downtown commercial district and adjacent areas and now offers an arts and entertainment district and historic attractions and stores. With this cultural rebirth, Berlin is now an alternative destination to Ocean City for visitors seeking a quieter, less resort-oriented experience.

Ocean City

Ocean City is a historic beach resort that is five square miles in size. It is located eight miles, or a twenty-minute car trip, north of the Assateague Island NS Barrier Island Visitor Center. Ocean City is a major attraction with approximately eight million visitors on an annual basis.[42] Within Worcester County, Ocean City attracts the highest number of visitors and visitor expenditures.[43] During the high-tourist season (Memorial Day through Labor Day), Ocean City becomes the second-largest city in Maryland, increasing from a year-round population of 8,000[44] to an estimated average population of 264,000 residents, overnight-, and day-visitors during the peak summer season weekends.[45,46] Seasonal population fluctuations have also generally increased in intensity over time.[47,48] However, due to the recent economic downturn, tourism in Worcester County decreased from nearly 18.9 million visitors in fiscal year 2008 to 17.5 million visitors in fiscal year 2009, representing just over a seven percent negative change.[49]

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[41] Assateague Island Alliance. http://www.assateagueislandalliance.org/about.html

[42] Fitch Rates the Town of Ocean City, MD's $12.9MM GOs 'A+'; Outlook Stable. 16 November 2009.

http://www.smartbrief.com/news/aaaa/industryBW-detail.jsp?id=F3D391CF-F457-43B1-9435-3E9B7FACA852

[43] McGill, Kenneth. 2007 Tourism Satellite Account for the State of Maryland and its Counties. (Provided by Lisa Challenger, Worcester County Tourism).

[44] Comprehensive Plan: Town of Ocean City, Maryland. http://oceancitymd.gov/Planning_and_Zoning/pdfs/2006OCCompPlan.pdf

[45] See above.

[46] Ocean City DemoFlush Visitation Estimates. Based on wastewater flow data from the Ocean City Wastewater Division and calculated by the Ocean City Public Relations Office. Available through Ocean City Chamber of Commerce newsletters (http://www.oceancity.org/chamb_newsletter.php)

[47] Worcester County, Maryland, Parks, Recreation and Land Preservation Plan. 2006. http://www.co.worcester.md.us/cp/2005LPRfinal406.pdf

[48] Seasonal visitation to the region as a whole has been estimated by wastewater flow (DemoFlush Visitation Estimates) and by use of hotel room tax revenues. Both of these methods can help to estimate seasonal visitation—which, due to its variability—might not be captured by census data.

[49] 2009 Maryland Tourism Development Board and The Maryland Office of Tourism. Tourism Development Annual Report. Available at http://www.emarketingmd.org/pubs/documents/TourismDevelopmentAnnualReportFY2009.pdf

Popular recreational activities in the immediate Ocean City area are visiting the beach and boardwalk. Other recreational opportunities include shopping, amusements, golfing, fishing, other sports activities, museums, and historic attractions.

Ocean City's major access routes are U.S. Route 50 and Maryland State Route 90 The main commercial street in the beachfront area is Maryland State Route 528, also known as the Coastal Highway or Ocean Highway. At the southern end of town, the Coastal Highway becomes a southbound one-way thoroughfare named Philadelphia Avenue, with a parallel northbound road named Baltimore Avenue. Transit services are provided by Ocean City Transit.

Worcester County

Worcester County is the easternmost county in Maryland. It encompasses Assateague Island and virtually all points within a 20-mile radius of the island, including Berlin and Ocean City. The U.S. Census Bureau estimates Worcester County's 2008 population at 49,274.[50]

Within Worcester County, tourism and agriculture are the most important industries. Just over half of employed Worcester County residents (approximately 15,000 people) work in the tourism industry.[51] According to the Worcester County Parks, Recreation, and Land Preservation Plan (2006), "tourism, and specifically eco-tourism, is an important economic activity" in the county.[52] To address the growing need for eco-tourist infrastructure, Worcester County plans to focus on building linkages between greenways, county parks, and public recreational lands through a network of waterways, hiking, and biking trails. A variety of area non-profit organizations and coalitions also focus on promotion of natural and cultural preservation. For example, in 2001, the Lower Eastern Shore Heritage Committee developed a Management Plan for the Lower Eastern Shore Area, which includes Assateague Island. The executive summary of the plan states a strategy to develop heritage tourism in the area and identifies target markets, including Ocean City visitors, nature tourists, and regional weekend visitors. Some planned action steps to support a vision for heritage tourism include the development of new welcome sites, an enhanced wayfinding system, and the promotion of connectivity between designated scenic roads.

Major highways in Worcester County include U.S. Routes 50, 13, and 113, as well as Maryland state Routes 90 and 12. Transit services are provided by Ocean City Transit, Shore Transit, and Greyhound Bus Lines. The Ocean City Municipal Airport is located three miles south of Route 50 in Ocean City, but it is used by private aircraft and has no scheduled commercial service.

Worcester County Tourism

The local tourism bureau, Worcester County Tourism, promotes activities and encourages visitation throughout the region, including at Assateague Island NS. Operators of the website www.visitworcester.org, Worcester County Tourism hosts an events calendar, feeds to social media sites, and recommendations on dining, lodging, and attractions.

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[50] U.S. Census Bureau state & County QuickFacts: Worcester County, Maryland.http://quickfacts.census.gov/qfd/states/24/24047.html

[51] Personal communication with Lisa Challenger, Director of Worcester County Tourism.

[52] Wicomico County Department of Recreation, Parks, and Tourism. 2005 Land Preservation, Parks, and Recreation Plan. February 2006. http://www.wicomicocounty.org/departments/planning_zoning/Publications/LPPRP.pdf

(page 69).

Wicomico County

Wicomico County is located approximately 25 miles northwest of Assateague Island. Salisbury, the largest city on Maryland's Eastern Shore with a population of almost 24,000, is located in Wicomico County. Wicomico County has focused on promoting tourism by leveraging existing recreational opportunities, including activities such as biking, fishing, boating, and special events (e.g., a wine festival), and promoting the area as a weekend or one-day destination. Currently, however, tourism does not represent a significant part of the Wicomico County economy, other than its civic center, but it does experience significant through-visitors on their way to Ocean City and Assateague Island NS.[53] [54]

U.S. Routes 13 and 50 intersect in Salisbury. Both routes are primary connectors to Assateague Island for visitors coming from the metropolitan regions of Washington, Baltimore, Philadelphia, and New York City. Wicomico County is home to the Salisbury-Ocean City Wicomico Regional Airport, the only commercial airport on the Delmarva Peninsula. The airport is the operational headquarters of US Airways Express carrier Piedmont Airlines, which operates five daily round-trip flights to Philadelphia, and twice-daily round-trips to Charlotte.[55][56] Transit service in Wicomico County is provided by Shore Transit.

Salisbury/Wicomico Metropolitan Planning Organization (MPO)

The Salisbury/Wicomico (S/W) Metropolitan Planning Organization (MPO) is a regional planning agency whose coverage area includes the city of Salisbury and surrounding jurisdictions.57 Established in 2004, the S/W MPO is responsible for the area's Long-Range Transportation Plan and a multi-year Transportation Improvement Program that is updated annually. The primary governing body of the MPO is the Council, comprised of local governments and agencies.

Tri-County Council for the Lower Eastern Shore of Maryland

The Tri-County Council for the Lower Eastern Shore of Maryland was established in 2001 to facilitate regional planning and development in Somerset, Wicomico, and Worcester counties.[58] Membership is comprised of municipal, county, and state elected officials, as well as the county administrators from the three counties. The Council has an Executive Board and five other committees, focusing on such areas as Geographic Information Systems and wastewater. The regional bus operator Shore Transit became part of the Tri-County Council in 2004.[59] Prior to then, each county had its own transit agency and operated its services independently.

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[53] See above.

[54] Ferguson. Anita. "Shore Tourism Outstrips State." Rural Development Center at the University of Maryalnd Eastern Shore. January 2003. Available at http://skipjack.net/article.asp?StoryID=16

[55] Salisbury Area Chamber of Commerce: Transportation. http://www.salisburyarea.com/bizgov/transportation.html

[56] U.S. Airways. http://www.usairways.com/

[57] Salisbury-Wicomico Metropolitan Planning Organization. http://www.swmpo.org/default.asp

[58] Tri-County Council for the Lower Eastern Shore of Maryland. http://www.lowershore.org/Home.html

[59] Personal communication with Riggin Johnson, Shore Transit, September 11, 2009, by phone.

Maryland State Highway Administration

Assateague Island NS is located in District 1 of the Maryland state Highway Administration (MDSHA), part of the Maryland Department of Transportation (MDOT) (see Figure 19).[60] This office comprises Dorchester, Somerset, Wicomico, and Worcester Counties. The MDSHA is responsible for the maintenance of the roads and bridges in the region, including the Verrazano Bridge and extension of Route 611 onto the island. MDSHA is also tasked with completing an annual update to the Consolidated Transportation Program, a detailed list and descriptions of the capital projects that are proposed for construction or for development and evaluation over the next six-year period.[61] Assateague Island NS coordinates on a regular basis with MDSHA District 1. Current coordination efforts with MDSHA have focused on improving state Route 611 to enable safer bicycle and pedestrian access to the park.\

Other important MDOT entities include the MDSHA Office of Safety and CHART (Coordinated Highways Action Response Team), a joint effort of MDOT, the Maryland Transportation Authority (an independent agency responsible for managing, operating, and improving Maryland's toll facilities) and the Maryland state Police, in cooperation with other federal, state and local agencies.

Figure 18
MDSHA District 1
Source:MDSHA website (http://www.sha.maryland.gov)

[60] Maryland Department of Transportation State Highway Administration: Contact Us. http://www.marylandroads.com/pages/Contactus.aspx?CatId=1

[61] Maryland Department of Transportation Consolidated Transportation Program (CTP). http://www.e-mdot.com/Planning/Plans%20Programs%20Reports/Programs/Index.html

Local and Regional Transit Providers

The region has a number of public and private transit providers, but none directly serve Assateague Island NS currently. This section identifies the region's existing and previous transit services and network.

Ocean City Transit

Ocean City offers a variety of transit services for both visitors and residents.

Boardwalk Tram

A new tram serves the entire length of the City's 2.5-mile boardwalk, providing a 30-minute ride from end to end. At a cost of $3.00 per ride, riders may flag down the tram virtually anywhere along the route. Discount cards offering eight rides for $20 are also available.

Coastal Highway Transit Bus

Ocean City's municipal bus system is known as the Coastal Highway Transit Bus (see Figure 20). It travels along Route 528, the Coastal Highway, which runs north-south through Ocean City, 24 hours a day, seven days a week. The service runs from the South Division Street Transit Center, at the southern end of the peninsula, to the North End Transit Center at 144th Street. A $2 all-day pass allows passengers to ride from 6:00 a.m. until 6:00 a.m. the following day. The all-day pass allows for free transfer to buses that travel to the West Ocean City Park & Ride (P&R) facility, where passengers can either park for free or make connections to other regional and national bus services.

Figure 19
Coastal Highway Transit Bus
Source: http://oceancitymd.gov/Public_Works/transportation.html

West Ocean City Park & Ride

The West Ocean City Park & Ride (P&R) currently serves Ocean City visitors who are interested in a car-free journey into Ocean City. The facility is located one-half mile west of downtown Ocean City on Route 50, and offers over 400 spaces of free parking, which is approximately only one-quarter full during peak season except for several special events (e.g., two car cruising events, Springfest, Sunfest) and the 4th of July, when it is typically filled.[62] Most public and private parking lots in Ocean City quickly fill up during peak season. Some lots cost $2 per hour.[63]

[62] Personal communication with Brian Connor, Transportation Division, Ocean City Public Works (2/2/10), by email.

[63] Town of Ocean City: Public Works Department. http://oceancitymd.gov/Public_Works/inlet_parking.html

A shuttle bus operates between the P&R and the South Division Street Transit Center in downtown Ocean City. The shuttle also makes a stop at the nearby Ocean City Factory Outlets. The shuttle bus costs $1 for a 24-hour period and operates approximately every 20 minutes from 6:00 a.m. until 3:00 a.m.

Special Event Trolley

During Springfest and Sunfest, two of Ocean City's largest annual festivals, Ocean City operates an additional express trolley service from its 40th Street South Convention Center parking lot (see Figure 21). The fare is $2 and is transferable to the Coastal Highway and Park and Ride Buses. The service operates every 20 minutes from 10:00 a.m. until 11:00 p.m. during the multi-day festivals.

Figure 20
Special Event Springfest/Sunfest Trolley
Source: http://oceancitymd.gov/Public_Works/transportation.html

Shore Transit

Shore Transit operates regional bus services in the three counties within Maryland's Eastern Shore: Worcester, Wicomico, and Somerset.[64] These services encompass ten bus routes in total. While none of the ten routes directly serves Assateague Island NS, two routes serve nearby communities, including Berlin, Pocomoke, and Ocean City. These routes also serve the West Ocean City P&R facility, where riders can make connections to Ocean City Transit and Greyhound bus services. A single ride on Shore Transit costs $3 and a seven-day pass costs $25.

Transit Services to Assateague State Park

Assateague State Park is currently served by shuttles operated by nearby commercial campgrounds and has previously experimented with special event transit and a seasonal pilot service to Ocean City.

Commercial Campground Bus Shuttles

The Assateague Island NS GMP (1982) recommended that a bus shuttle system be implemented to connect commercial campgrounds on state Route 611 to Assateague Island NS. Today, two local commercial campground sites, Frontier Town and Castaways RV Resort and Campground (formerly

[64] Personal communication with Riggin Johnson, Shore Transit, September 11, 2009, by phone.

Eagle's Nest), provide shuttle service to Assateague Island for their guests[65] (see Figure 21). However, service is provided only to Assateague State Park and the shuttles do not serve Bayberry Drive or Assateague Island NS.

Castaways provides shuttle buses to both Ocean City and Assateague State Park daily from Memorial Day through Labor Day and Saturdays year-round.[66] The authority to operate the service is granted through a contract that Castaways has with Assateague State Park directly.[67] The state of Maryland authorizes Assateague State Park to administer a special use permit, which allows the state park to collect smaller entrance fees from those who enter the park by bus than by personal vehicle. Visitors who use the bus shuttle are charged $1, instead of the usual $3 per person charged for visitors arriving in personal vehicles. The shuttle operates from 10:00 a.m. until 9:00 p.m., alternating destinations by hour (for example, the 10am shuttle serves the state park while the 11am serves Ocean City). The bus has a capacity of approximately 50 passengers and is generally at least half-full, if not entirely full, during the summer. Castaways offers the service for free, but passengers still pay the $1.00 day use fee to Assateague State Park. The bus drivers collect the day use fee from passengers and present the payment to the attendant at the Assateague State Park gate.

Assateague State Park also has a shuttle contract in place with Frontier Town, another local campground site.[68] Frontier Town's shuttle operates daily mid-June through Labor Day and Saturday only during the rest of the year.[69] There are trips to Ocean City throughout the day and two trips to Assateague State Park each day. There are no passenger counts, although Frontier Town reports that the shuttle is full each day.[70]

Figure 21
Frontier Town Shuttle (left) and Castaways shuttle (right)
Source: Volpe Center Photograph, July 2009 / Castaways website

[65] Assateague Island National Seashore. General Management Plan. June 1982. Denver Service Center. (provided by park) pg. 45.

[66] Castaways RV Resort & Campground. Tel (410) 213-0097. 12550 Eagles Nest Road
Berlin, MD 21811. Website: http://www.castawaysrvoc.com/

[67] Personal communication with Mike Riley, Assateague state Park, September 17, 2009, by phone.

[68] Personal communication with Mike Riley, Assateague State Park, September 17, 2009, by phone.

[69] Frontier Town website. http://www.frontiertown.com/frontier-town/law-of-the-land.cfm

[70] Information is from a phone conversation with office staff at Frontier Town, tel 1-800-228-5590 on February 17, 2011. Website: http://www.frontiertown.com/frontier-town/

Maryland Coast Day Shuttle

Maryland Coast Day is an annual festival at Assateague State Park that draws about 3,000 visitors each September.[71] In some years, there has been a need for overflow parking. One year, Assateague State Park entered into an agreement with a local golf cart vendor to provide a shuttle from two designated satellite parking lots to the state park.[72] The two parking areas included the former Assateague Island NS bicycle and pedestrian parking area near the bridge and Assateague State Park's boat or marina parking area, also near the bridge but on the opposite site of Route 611. The vendor volunteered time in exchange for the ability to advertise on the passenger golf carts (there were between six and eight carts in use). Another year, Assateague State Park entered into an agreement with Ocean City Transit to provide a special bus service from the satellite parking lots to the festival.

Pilot Bus Route

According to the 2001 Federal Transit Administration/Federal Highway Administration Field Report and validated by several stakeholder accounts, in the late 1990s a seasonal bus service called the Worcester County Ride linked the Assateague Island NS and Assateague State Park campgrounds with the South Division Street transit center in downtown Ocean City.[73][74] The bus service, which utilized a 15-passenger van, offered three daily round-trips for a $2.00 round-trip fare.[75] According to the Field Report, in 1998, an average of three to five passengers rode the bus per day.[76] There was an increase in daily average ridership in 1999: between five and 10 passengers rode the bus per day. The evening return trips from Ocean City to Assateague State Park appeared more popular, with the van occasionally full. Among the concerns noted by members of the local community was traffic circulation patterns, pick-up and drop-off points, noise levels at night, and worries for visitors who missed the final shuttle off the island.[77]

DART / Delaware Transit Corporation

DART First State and the Delaware Transit Corporation is an operating division of the Delaware Department of Transportation. DART provides regional bus service throughout the state of Delaware and provides opportunities for car-free travel from Maryland to Delaware and beyond; the DART services connects to the Cape May-Lewes Ferry, which connects Delaware and New Jersey, as well as both regional and national (Amtrak) train networks out of Wilmington, Delaware. DART connects with transit services in Maryland in two locations. One of its routes, the Seaford-Laurel-Delmar Shuttle, stops in Delmar, a town on the Delaware-Maryland state line also served by Shore Transit.[78] Several other routes stop at Ocean City's North End Transit Center at 144th Street, which is served by the Coastal Highway Transit Service, which in turn can provide access via a shuttle to the West Ocean City Park and Ride and Shore Transit.

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[71] Maryland Coastal Bays Program Blog. "Maryland Coast Day Coming Soon." 9 September 2009. http://mdcoastalbays.blogspot.com/2009/09/maryland-coast-day-coming-soon.html

[72] Personal communication with Mike Riley, Assateague state Park, September 17, 2009, by phone.

[73] Personal communication with Hal Adkins, Town of Ocean City, September 14, 2009, by email.

[74] Personal communication with Mike Riley, Assateague state Park, October 12, 2009, by email.

[75] Federal Highway Administration and Federal Transit Administration. Federal Lands Alternative Transportation Study: Field Report – Assateague Island National Seashore. 2001.

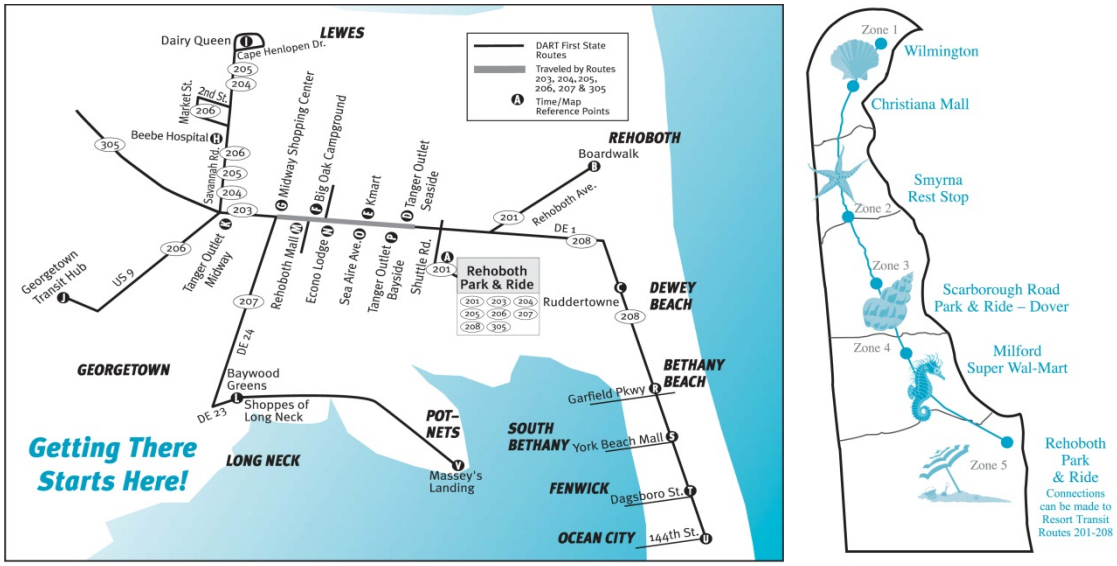
[76] See above.

[77] Personal communication with Hal Adkins, Town of Ocean City, September 14, 2009, by email.

[78] Delaware Transit Corporation. Seaford-Laurel-Delmar Shuttle brochure (route and schedule). December 2008. http://www.dartfirststate.com/information/routes/pdfs/seaford_laurel_delmar_dec08.pdf

One of the DART routes that serves Ocean City is part of its Resort Transit system, which transportation residents and visitors during the summer between towns throughout Delaware to resort towns and beaches in the southeastern portion of the state. The Resort Transit system includes routes 201 and 203-208 (see Figure 22), for which DART operates a total of 22 buses, and route 305, for which DART operates two buses. Routes 201 and 203-208 operate daily from late May through early September. In 2010, there were 363,530 passenger trips for these routes. Route 305 is ninety miles each way and takes about two hours. Route 305 operates each Friday, Saturday, Sunday, and holiday Mondays in the summer. In 2010, there were 4,716 passenger trips on route 305.[79] The buses are first come first served for both residents and visitors. All resort transit buses include bicycle racks and the Route 305 buses include luggage racks.

Figure 22
DART 2010 Resort transit map, Route 201-208 and beach connection Route 305
Source: DART website (http://dartfirststate.com/information/programs/beachbus/index.shtml)



Greyhound Bus Lines

Greyhound Bus Lines offers twice daily round-trip service from Ocean City to Salisbury, with connecting service to New York City, Philadelphia, Baltimore, and Norfolk, Virginia. Buses depart Ocean City at 11:05 a.m. (except Wednesdays) and 5:45 p.m. (except Tuesdays). Connections to each of the aforementioned destinations depart Salisbury at 12:01 p.m. and 6:40 p.m., respectively. The one-way fare to Salisbury is $17.[80]

[79] Phone and email correspondence with Jacqueline Bailey Secretary, Planning & Marketing, Delaware Transit Corporation, 119 Lower Beech Street, Wilmington, DE 19805 (tel) 302-576-6001.

[80] Town of Ocean City: Public Works Department. Greyhound Customer Notice. http://oceancitymd.gov/Public_Works/Greyhound%20Notice%20-%20Fall-Winter-Spring%20Operating%20Schedule.pdf

Barrier Island Dynamics

The future maintenance and sustainability of infrastructure on Assateague Island is subject to the unique geological dynamics of a barrier island environment. As on all barrier islands, constant erosion and shifting occurs due to wind, tides, and other factors affecting the shoreline. Understanding the environmental context of the transportation network can result in improved transportation facilities and operations that are better able to protect adjacent natural resources and can be maintained and sustained over the long term.

Shoreline Changes

As a barrier island, Assateague Island experiences major, long-term physical environmental changes along the shoreline that could adversely affect the public beach, adjacent parking lots, and nearby campgrounds and other visitor infrastructure. Change to the shoreline is a natural phenomenon and shoreline erosion generally occurs at a known rate. For example, according to the 2005 Assateague State Park Land Unit Plan,[81] shoreline erosion rates were:

- 1.48 feet/year for the Eastern Shoreline of the island bordering the Atlantic Ocean.
- .024 feet/year for the western shoreline of the island border Sinepuxent Bay.
- .53 feet/year for the mainland shoreline west of Sinepuxent Bay.

Assateague Island NS has been monitoring the movement of the island for decades. As indicated in Figure 23, Assateague Island and Fenwick Island, where Ocean City is located, used to be connected as one continuous barrier island. In August 1933, a major hurricane separated the barrier island into two sections and created a natural inlet allowing access between the Atlantic Ocean and the coastal bays.

Inlet Construction and Sand Restoration Project

In September 1933, construction began on two stone jetties to maintain the newly formed inlet for navigation between the ocean and the bays. The jetties have had significant unintended effects related to erosion and shoreline migration. The structures have trapped sand as it naturally migrates along the coast, interrupting the longshore transport of sand to the south and "starving" the northern portion of Assateague Island of sand. As a result of this sand starvation, Ocean City shores have migrated seaward while Assateague Island shores have migrated landward and the northern end of Assateague Island has become a low-lying area vulnerable to overwash.

The U.S. EPA discussed the history and ongoing efforts to restore the northern area in a 2009 report on the Mid-Atlantic region.[82] To mitigate the effects of the jetties, the NPS began working with the U.S. Army Corps of Engineers in 1990 on a restoration plan for the northern end of Assateague Island. The first phase, completed in 2002, provided a one-time placement of sand to replace a portion of sand lost over the past 60 years due to the formation of the inlet and subsequent jetty stabilization efforts. The second phase has focused on re-establishing a natural sediment supply by mechanically bypassing sand from the inlet and tidal deltas into the shallow nearshore areas that have been starved of their natural sand supply. Annual surveys indicate that the project has been successful and current plans call for continued efforts.[83]

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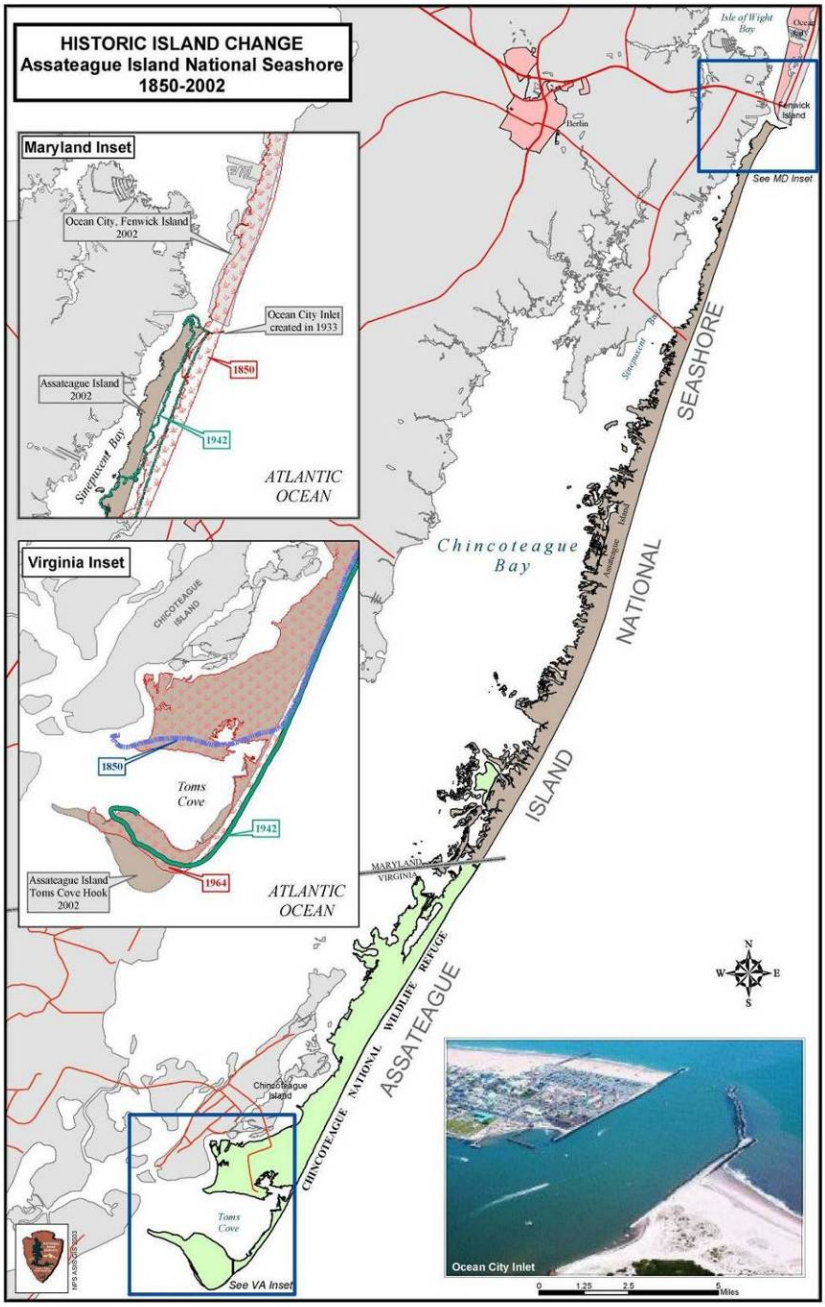
[81] Assateague State Plan Land Unit Plan. October 2005. http://www.dnr.state.md.us/irc/docs/00011180.pdf

[82] Coastal Sensitivity to Sea-level Rise: A Focus on the Mid-Atlantic Region. January 15, 2009. U.S. Environmental Protection Agency. http://www.climatescience.gov/Library/sap/sap4-1/final-report/sap4-1-final-report-FrontMatter.pdf

[83] See above.

Figure 23
Historic Island Change – Assateague Island National Seashore 1850-2002
Source: Assateague Island NS staff



Storm Events

Storms frequently occur along Maryland's Eastern Shore; major storms can very quickly and significantly affect the island ecology as well as existing infrastructure. In March 1962, a major, three-day storm caused significant damage across the island, ripping most homes then in existence in the Maryland District off their foundations and destroying many of the dunes and the island's main road.[84] As a result of the March storm, the feasibility of private development on the island—which had been occurring throughout the 1950s and early 1960s—was reevaluated.[85] Ultimately, this reassessment resulted in the recommendation by the Department of the Interior, the NPS, and others to preserve the island as a national park.

The major storm events affecting Assateague Island over the last fifteen years include:

> January and February 1998: major storms occurred over the island, before the implementation of the sand restoration plan. Waves of 7 meters were recorded off the coast of Ocean City and threatened to breach the jetties. To ensure that a breach would not occur in the future, an emergency storm berm was built on the northern end of Assateague Island. [86]
>
> November 2009: Tropical Storm Ida combined with a nor'easter over the Atlantic coast, causing major damage to Assateague Island as well as coastal areas in New Jersey, Virginia, and North Carolina. Damage within the Maryland District of Assateague Island NS included flooded campsites, broken boardwalks, and beach erosion (see Figure 24 and Figure 25). Approximately 2000 tires washed ashore, remnants of man-made reefs that had been built off the coast of Ocean City.[87] Damage to the Virginia District of Assateague Island NS and CNWR was more severe, with significant amounts of debris and overwash.[88]

[84] Mackintosh, Barry. Assateague Island National Seashore: An Administrative History. 1982. History Division, National Park Service, Department of the Interior. http://www.nps.gov/asis/parkmgmt/upload/asisadminhistory.pdf

[85] Assateague Island National Seashore. General Management Plan. June 1982. Denver Service Center. (provided by park)

[86] Assateague Island National Seashore: North End Restoration Project Introduction. NPS. (N.D.). At http://www.nps.gov/asis/naturescience/upload/ProjectIntroduction.pdf

[87] "East Coast Storm Damage Tops $100 Million." Associated Press. November 18, 2009. At http://www.msnbc.msn.com/id/34016803/ns/weather/#storyContinued . See also Polk, Charlene. "Assateague sees little damage, some benefit, from storm." Salisbury, Maryland, Daily Times. November 22, 2009. At http://74.125.47.132/search?q=cache:7WnbrjWCHS0J:www.delawareonline.com/article/20091122/NEWS02/911220336/Assateague-sees-little-damage--some-benefit--from-storm+assateague+Delmarva+Ida&cd=6&hl=en&ct=clnk&gl=us

[88] Fahrentholt, David. "Part of Assateague Reeling from Ida's Wallop." Washington Post. November 17, 2009. At http://www.washingtonpost.com/wp-dyn/content/article/2009/11/16/AR2009111603095.html. Also see Burnett, Jim. "Storm Damage Update for Gulf Islands and Assateague Island National Seashores." November 20, 2009. At National Parks Traveler at http://www.nationalparkstraveler.com/2009/11/storm-damage-update-gulf-islands-and-assateague-island-national-seashores4963

Figure 24
Boardwalk Damage in the Maryland Assateague Island NS District after Ida.
Source: Assateague Island National Seashore website

Figure 25
Beach Erosion in the Assateague Island NS Maryland District after Ida.
Source: Assateague Island NS website

Climate Change Issues and Projections

The historic storm events described above clearly demonstrate the threat of storm damage to the parking lots and beaches, a threat that is likely to grow with the sea level rise and intensified storms predicted as a result of climate change. The potential impacts of climate change on transportation infrastructure, shoreline erosion, and weather, tidal, and wave patterns make these issues important in transportation planning.

Relevant work on climate change for the study area includes:

National Parks in Peril: The Threats of Climate Change Disruption,[89] a 2009 report by the Rocky Mountain Climate Organization and the Natural Resources Defense Council that identifies 25 national parks, including Assateague Island NS, as most at risk to climate change impacts. The report recommends that parks focus on reducing emissions of NPS operations and visitor activities, in particular due to transportation through demonstrating model programs and becoming climate-neutral.

Sea Level Rise and Coastal Habitats in the Chesapeake Bay Region,[90] a 2008 report by the National Wildlife Federation, used the Sea Level Affecting Marshes Model (SLAMM)[91] to predict coastal changes, including impacts on coastal wildlife habitats, in the Chesapeake Bay region over the 21st century. The report notes that because of its expansive coastline, low-lying topography, and growing coastal population, the Chesapeake Bay region is one of the most vulnerable places in the nation to the impacts of sea level rise. Many places along the Chesapeake Bay have seen a one-foot increase in relative sea level rise over the 20th century, including six inches due to global warming and six inches due to naturally subsiding coastal lands. In looking at the Chesapeake Bay area, the report concluded that there would be significant inundation of dry-land and conversion to marshes by 2100 (see Figure 26). CNWR commissioned a similar study by the National Wildlife Refuge System Conservation Biology Program. The 2009 report, *Application of the Sea-Level Affecting Marshes Model (SLAMM 5.0.2) in the Lower Delmarva Peninsula*,[92] projected the effects of sea-level rise on barrier islands extending from Ocean City Inlet, Maryland to Fisherman Island, Virginia in the Delmarva Peninsula with a main focus on habitat within CNWR.

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[89] National Parks in Peril: The Threats of Climate Change Disruption. state Fact Sheet: Maryalnd Virginia. 2009. Rocky Mountain Climate Organization and the Natural Resources Defense Council. http://www.rockymountainclimate.org/website%20pictures/ParksinPeril_MD-VAFacts.pdf

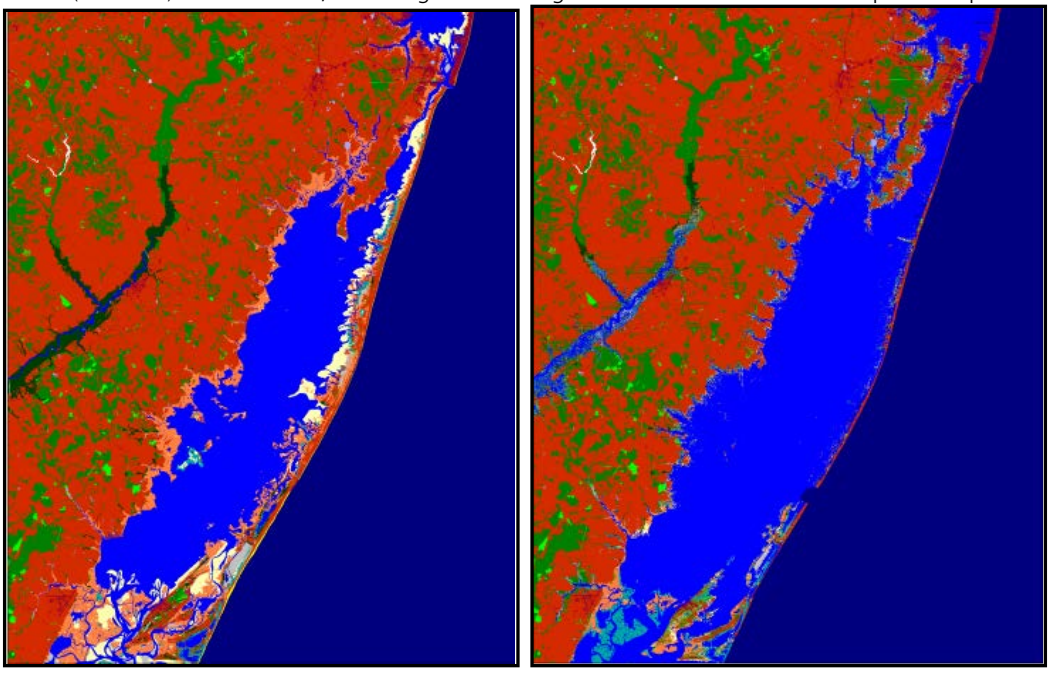
[90] National Wildlife Federation. Sea Level Rise and Coastal Habitats in the Chesapeake Bay Region. May 2008. http://www.nwf.org/Global-Warming/Effects-on-Wildlife-and-Habitat/Estuaries-and-Coastal-Wetlands/~/media/PDFs/Global%20Warming/Reports/FullSeaLevelRiseandCoastalHabitats_ChesapeakeRegion.ashx

[91] SLAMM is one of the models used to study the impact of coastal processes, such as sea level rise, on an area and simulate the dominant processes and forecast long-term effects. SLAMM takes into account five processes that determine the impact of sea level rise impact on wetlands: inundation: (the rise of water levels and the salt boundary); erosion; overwash (beach migration and transport of sediments); saturation (migration of coastal swamps and fresh marshes onto adjacent uplands due to the water table responding to rising sea level); and accretion (vertical rise due to buildup of organic and inorganic matter).

[92] Nieves, Delissa Padilla. Application of the Sea-Level Affecting Marshes Model (SLAMM 5.0.2) in the Lower Delmarva Peninsula (Northampton and Accomack counties, VA / Somerset and Worcester counties, MD). National Wildlife Refuge System Conservation Biology Program. Arlington, VA. August 26, 2009.

Figure 26
SLAMM Analysis for Assateague and Chincoteague Islands
Source: National Wildlife Federation. Sea Level Rise and Coastal Habitats in the Chesapeake Bay Region. 2008.

Initial Condition (ca. 1990) vs. Year 2100, assuming 1 meter of global sea level rise with developed land protected.



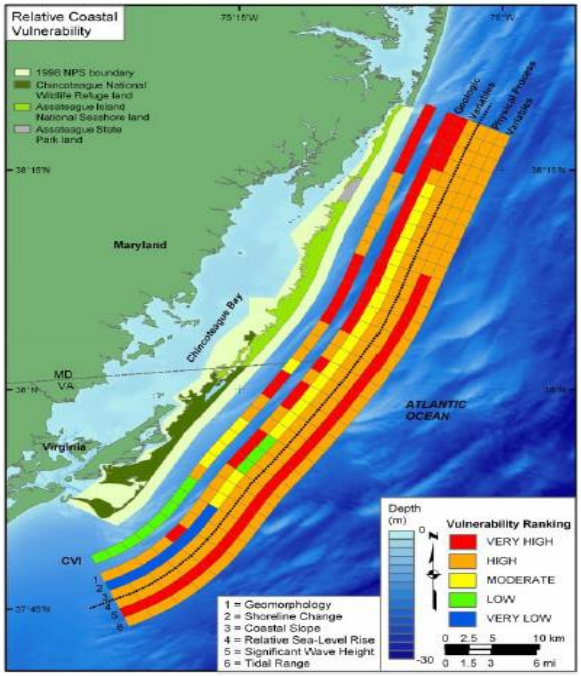
Maryland Climate Action Plan,[93] a 2008 report released by the Maryland Commission on Climate Change, a coalition appointed by the Governor of Maryland, assessed the likely consequences of climate change on state industry, ecology, and human health. Sea level rise is one of the climate change impacts evaluated in the plan. The plan notes the general vulnerability of low-lying areas, such as barrier islands, to sea level rise. Under a high-emission scenario in which sea level rises by five millimeters per year, the plan predicted that Assateague Island could 'fragment' into several smaller islands with new inlets creating connections between the ocean and the coastal bays. This type of major change would have significant impacts for both the island's ecology as well as infrastructure on the island and transportation to, from, and within the island.

Coastal Vulnerability Assessment of Assateague Island National Seashore to Sea Level Rise,[94] a 2004 report by the U.S. Geological Survey, used a coastal vulnerability index to map those portions of Assateague Island considered most significantly threatened by sea level rise. The report found that approximately 30 percent of the total island shoreline had a "very high" vulnerability to sea level rise, meaning that shoreline erosion could be greater than 2 meters per year. Some of the areas of greatest vulnerability were located on the northern end of the island (see Figure 27).

[93] Maryland Commission on Climate Change. Climate Action Plan. http://www.mde.state.md.us/Air/climatechange/index.asp

[94] Pendleton, Elizabeth A., S. Jeffress Williams, and E. Robert Thieler. U.S. Geological Survey. Coastal Vulnerability Assessment of Assateague Island National Seashore to Sea Level Rise. 2004. http://pubs.usgs.gov/of/2004/1020/

Figure 27
Coastal Vulnerability Index Map of Assateague Island
Source: U.S. Geological Survey. Coastal Vulnerability Assessment of Assateague Island National Seashore to Sea Level Rise. 2004



Conclusion

This chapter provided context for the study area and region that informed the remaining tasks of the study. Key conclusions that were drawn from this report and applied to next steps of the study include:

- Access to Assateague Island NS is limited due to its location, geological nature, and existing transportation infrastructure. In addition, there are significant distances between Assateague Island NS facilities, in particular the mainland Barrier Island Visitor Center and the rest of the facilities on the island (over three miles).

- Assateague Island NS is currently not served by any public transportation. However, the broader region has an extensive existing network of transit services, public and private, which may offer opportunities for connections between Assateague Island NS and local communities as well as to other states and larger transportation networks.

- Assateague Island NS and Assateague State Park have an extensive existing network of bicycle and pedestrian paths that are connected to the mainland by a designated bicycle and pedestrian bridge; however, bicycle connections from throughout the region to Assateague Island are only appropriate for experienced cyclists. In addition, the mainland parking area for bicycle and pedestrian access to Assateague Island was removed during the construction of the new Visitor Center so there may be a need to address unmet demand.

- Nearly half of visits to Assateague Island NS occur in July and August each year, resulting in short-term demand for a level of infrastructure that is not needed year-round.

- Assateague Island NS and Assateague State Park appeal to similar visitors and share common facilities and context; the relationship between Assateague Island NS and Assateague State Park will also play an important role in planning for future transportation services. The location and configuration of Assateague Island NS entrance booths, especially in regard to the mainland and potential partnership with Assateague State Park, has been considered in the past and is open to further study.

- Both Assateague State Park and Assateague Island NS have significant transportation and other infrastructure in place on the island that are at risk from barrier island environmental dynamics; understanding the environmental context is important in planning for future maintenance and development of infrastructure on Assateague Island.

- Assateague Island NS plays an important role in the economy of the region but Ocean City has an equal if not more significant role in drawing visitors and in providing economic tourism opportunities; the differences as well as the relationship between Assateague Island NS and Ocean City will play an important role in planning for future transportation services.

The next chapter identifies and describes the transportation issues based on the existing conditions described in this chapter, followed by a two chapters that identify and assess solutions to address those issues.

3. Needs Assessment

Assateague Island NS experiences a range of transportation issues including congestion at the entrance booths, illegal parking, limited wayfinding, challenges to emergency evacuation, lack of alternative transportation, and difficulties in the management of the OSV zone. This chapter presents the primary transportation issues facing Assateague Island NS, as identified by the existing conditions review, a visitor survey completed in 2007, public comments from 2009, and conversations with Assateague Island NS staff and area stakeholders [95] It provides supplemental information to the existing conditions review and establishes a basis by which to identify potential alternative transportation solutions (a draft list of which is provided in Appendix A).

Several projects are underway or planned that will affect some of these issues, and may create new transportation opportunities and/or issues. These projects and their anticipated impacts on transportation issues are described throughout this document. Regional trends that help create a picture of the future at Assateague Island NS are presented to guide thinking about how these transportation issues may change over time. In addition, Assateague Island NS policies and management decisions related to the park's carrying capacity are particularly important to the transportation analysis.

Public Comments on Assateague Island NS Transportation Issues

Comments on transportation to and from Assateague Island were solicited during public scoping activities in summer and fall 2009. These activities were conducted as part of the development of the Assateague Island NS General Management Plan and occurred in both the Maryland and Virginia Assateague Island Districts. Public stakeholders were asked to respond to the question: "How can we make it easier to get onto and around Assateague Island NS?"

In response to this question, Assateague Island NS Headquarters received 118 comments, which were analyzed for the purposes of this study. 68 comments relating to the Maryland District or generally applicable to Assateague Island NS were included in the analysis; the remaining comments were specific to the Virginia District and not included. Several recurring themes were observed in the public comments, including:

- *Overall satisfaction with transportation conditions (82 percent of comments—56 comments total).* The majority of comments indicated overall satisfaction with the current transportation situation to Assateague Island NS and within the park, but offered some suggestions for improvement. Several of the comments expressed clear positive sentiment. For example, one stakeholder commented that "we are happy with the present arrangements" or that the situation was "perfect the way it is." Other comments were more neutral but still expressed overall satisfaction. For instance, several comments noted that transportation was "fine as is," that is was already "pretty easy to access everything," or that transportation "seems OK" and no additional changes should be made.

- *Desire for alternative transportation (26 percent of comments—18 comments total).* The most frequently mentioned suggestion in this category was the development of shuttle service from the mainland to the island. Many stakeholders also commented on the importance of improving pedestrian and bicycle infrastructure in the park and vicinity.

[95] Includes documentation of comments received during Assateague Island NS General Management Plan Public Scoping meetings, provided October 2009 and additional staff and stakeholder interviews conducted by project team between July and November 2009.

- *Over-sand vehicles (OSV) (22 percent of comments – 15 comments total).* Several comments focused on the OSV zone within Assateague Island NS. Most of these (10) advocated expanding and/or improving the OSV facilities. Other comments (5) focused on improving education about appropriate use of the OSV facilities and increased enforcement in the area.

- *Congestion at Assateague Island NS entrance booth (21percent of comments—14 comments total).* Comments in this category focused on expediting entrance to Assateague Island NS by several means, including implementation of automatic payment capabilities at the entrance booth and creation of a separate entrance lane for annual pass-holders (especially during high traffic periods). Others suggested increasing the number of entrance booths, increasing the number of employees available to take payments at the booths, or adding another entrance lane to accommodate more vehicles. In addition to suggestions about booths and lanes, stakeholders also commented on the desire for increased wayfinding assistance, mentioning that Assateague Island NS maps could be provided at ticket booths or rangers could provide better direction regarding parking options, helping visitors more efficiently navigate to their specific destinations in the park.

- *Visitor experience and carrying capacity (18 percent of comments—12 comments total).* Comments in this category indicated concern about facilitating transportation to and from Assateague Island NS. The primary concerns were related to overcrowding, safety, and the overall visitor experience. For example, one stakeholder mentioned that "making it [transportation to Assateague Island NS] too easy will create the crowds we do not enjoy." Other comments suggested additional education and enforcement to protect the natural resources at the seashore.

- *Traffic management and traveler information. (12 percent of comments—8 comments total).* Comments in this category included suggestions for developing specific signage to instruct visitors to pull over when watching wildlife to allow more efficient movement of vehicles. Other comments focused on general wayfinding. One comment suggested a telephone line that would provide advanced traveler information about open and closed facilities, peak travel times and weather.

- *Parking (10 percent of comments—7 comments total).* Increasing the number of parking spaces, particularly pull-offs spaces for wildlife viewing, was most frequently suggested. Another suggestion focused on implementation of limited-time parking at campground offices.

Traffic Congestion

Traffic congestion can be an issue on the regional scale, at the entrance booths to the Maryland District of Assateague Island NS, and within the Maryland District.

Regional Traffic Conditions

Regional traffic congestion is primarily associated with beach traffic accessing Ocean City. Route 50 becomes congested on summer weekends; signage directs Assateague Island NS travelers to use Routes 113 and 376 to separate Assateague Island NS traffic from Ocean City traffic but it is unclear what percentage of visitors use the alternate route.

Entrance Booth Congestion

Traffic congestion approaching the Assateague Island NS fee booths has been a persistent issue on peak weekend days for a number of years. Most of Bayberry Drive is a two-lane road except for the 200 feet to the north of the entrance booths, where the southbound lane widens to two lanes. The queue of vehicles waiting to enter the park can stretch back more than one-quarter of a mile (see Figure 28).

Figure 28
Congestion approaching entrance booths at Maryland District of Assateague Island NS
Source: Volpe Center photograph, July 2009.

Many visitors noted this as an important transportation issue, and Assateague Island NS is currently working on resolving the issue by pursuing a phased program that consists of the following:

- Replacement of the fee booths (completed in 2009).
- Construction of a new ranger station, located to the southwest of the fee booths (completed in spring 2012).
- Reconfiguration of the entrance area including relocation of the fee booths and the addition of a third fee booth and entrance lane.

The most recent configuration is shown in Figure 29. The schematic shows the former ranger station, which used to be at the southern end of the North Beach parking and has been demolished, and the location of the new ranger station, at the former Recycling Center, southwest of the entrance booths. The entrance lanes would be extended and expanded from two to three and the circulation would allow for visitors to exit the park immediately after the booths if desired. Staff parking and parking for trailers and recreational vehicles would be provided within the new configuration.

These improvements should help relieve delay at the entrance booths; however, additional physical and/or procedural changes may be helpful as well. Outstanding issues related to entrance booth operations and congestion include:

- Visitor confusion and inefficiencies related to operating separate entrance gate and fee facilities for Assateague Island NS and Assateague state Park.
- Feasibility of relocating the entrance booths to the mainland side of the Verrazano Bridge.[96]
- On-site impacts of increasing entrance station throughput.

[96] ASIS procured a study of potential improvements in 2003 (Assateague Island National Seashore Entrance Station Alternatives Evaluation. Johnson, Mirmiran & Thompson. December, 2003). The study recommended relocating the fee booths to the mainland near the visitor center. ASIS is currently pursuing Island-side improvements due to legal constraints associated with mainland operation.

Figure 29
Proposed reconfiguration of Maryland District entrance
(yellow designates existing areas to be reconfigured and black, blue, and red designate existing and future)
Source: NPS Assateague Island NS staff.

Assateague Island NS Traffic Circulation

Two main challenges with traffic circulation within the Maryland District of Assateague Island NS are visitors looking for parking and an issue that is locally referred to as a "pony jam".

Assateague Island NS policy is to allow visitors to enter the park even when it is known that all parking is full; this leads to visitors driving around in search for parking. In addition, even when some parking is available, there is no system in place to direct visitors to available parking.

Pony jams are caused when wild horses enter a parking lot or road right of way or when visitors pull to the side of the road or stop in the road to observe wild horses adjacent to the road (see Figure 30). Creating a few designated pull-off areas for wildlife viewing might improve traffic circulation on the island.

Figure 30
Examples of pony jams
Source: Volpe Center photograph (July 2009)

Parking

The two main parking issues at the Maryland District of Assateague Island NS are illegal parking, and uneven and surplus demand for parking.

Illegal Parking

Assateague Island NS experiences problems with illegal parking, or parking outside of designated parking areas, during peak times. Illegal parking creates safety hazards and impacts Assateague Island NS's resource protection goals. Illegal parking primarily occurs in and around the traffic circle at the southern end of Bayberry Drive (see Figure 31) and on Bayberry Drive between the ranger station and traffic circle. According to park staff, visitors park illegally in these places because there is a desire to access the south beach, which has more space for visitors to spread out and is served by significantly less parking than the North Beach. Thus, even when parking is available in the North Beach Parking Lot, visitors still choose to park at the southern end of Bayberry Drive closer to the south beach. Illegal parking at the traffic circle is the park's primary concern because of the safety hazards it can present.

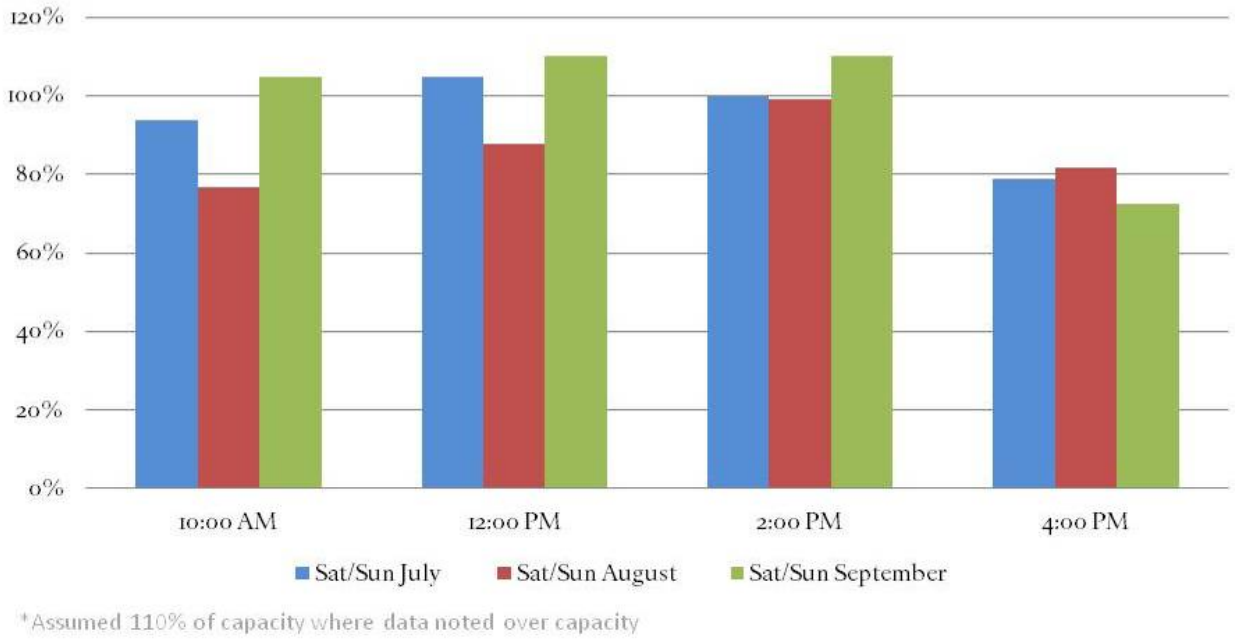
Figure 31
Illegal parking near Assateague Island NS Maryland District traffic circle
Source: NPS Assateague Island NS staff photograph, July 2008.

Over the past five years, Assateague Island NS staff has instituted a variety of measures to reduce illegal parking. In 2005, Assateague Island NS placed cinderblocks along the edge of Bayberry Drive but replaced these with split rail fencing the following year for aesthetic reasons. The fencing was installed only in select locations due to maintenance staff concerns about additional work from cutting grass and clearing sand. In 2007, the park placed small "No Parking" signs on every third section of fence to provide probable cause to write parking tickets. The split rail fences only stopped visitors from parking in areas directly adjacent to the signs. In 2008, illegal parking was so bad that it obstructed traffic. In 2009, Assateague Island NS was fairly successful in managing illegal parking through a combination of education, signage and posts, and on-site patrol. The new signs and posts consisted of plastic Carsonite posts and "No Parking" and "No Motorized Vehicles" signs. The signage creates some visual intrusion on the natural landscape but Assateague Island NS has decided that the 2009 strategy is sustainable for the future.

Parking Demand

While Assateague Island NS has implemented strategies to manage the illegal parking issue, the pressure for more convenient parking remains, leading some visitors to choose to park illegally. As noted in the Existing Conditions chapter, Assateague Island NS has about 770 parking spaces for recreational day-visitors. The number of visits – an estimated 2,000 recreational day-use vehicles – on a peak day indicates that current parking capacity is insufficient but observed parking occupancy shows that there is some available capacity even at peak times. This issue will be explored further in a parking demand analysis. Observed parking occupancy, along with observations by park staff, also shows that not all parking is equally desirable to visitors. For example, the South Beach parking lot fills first and its popularity and small capacity is the main contributor to illegal parking. Figure 32 shows average weekend occupancy of the South Beach parking lot by time of day for July, August, and September of 2009. Use of the North Beach parking lot is heavily influenced by the circulation patterns of entering cars and the location of access points to the beach. A new pedestrian boardwalk, opened in 2010, links the northern end of the North Beach parking lot directly to the beach and has improved parking patterns.

Figure 32
Assateague Island NS South Beach parking occupancy survey
Source: NPS Assateague Island NS staff, summer 2009.



An analysis of the supply and demand for parking would help identify additional strategies to help manage these parking demand issues. Such strategies will become more critical when a third entrance gate is added (see above) as that will increase the rate at which vehicles enter Assateague Island NS.

Wayfinding and Traveler Information

There are opportunities for improvements in wayfinding and traveler information at both the regional and park level.

Regional Wayfinding and Traveler Information

There are some opportunities to improve both wayfinding and traveler information on the regional level. In terms of signage along highways, there has been an effort to direct traffic away from MD 50, which is one of two main roads to Ocean City. Signs on MD 50 at 113 direct visitors to use MD 376, rather than 50 to access the park. In terms of other types of information, such as information on the OSV Zone (open or closed), parking availability, weather (beach closure, surf, storm activity), and other time-dependent park conditions, there may be opportunities for web, radio, and phone systems as well as collaboration with the state of Maryland to use state-owned variable message signs (VMS).

On-site Wayfinding and Traveler Information

There may be opportunities for improvements in wayfinding and traveler information provision at Assateague Island NS, both on the mainland and on Assateague Island. Visitors have expressed frustration with the lack of information about the OSV Zone occupancy status, weather-related beach and park closures, parking availability, and congestion leading to the park and in the parking lots. The park has recently purchased and installed two permanent and two mobile VMS. These VMS will be placed at the

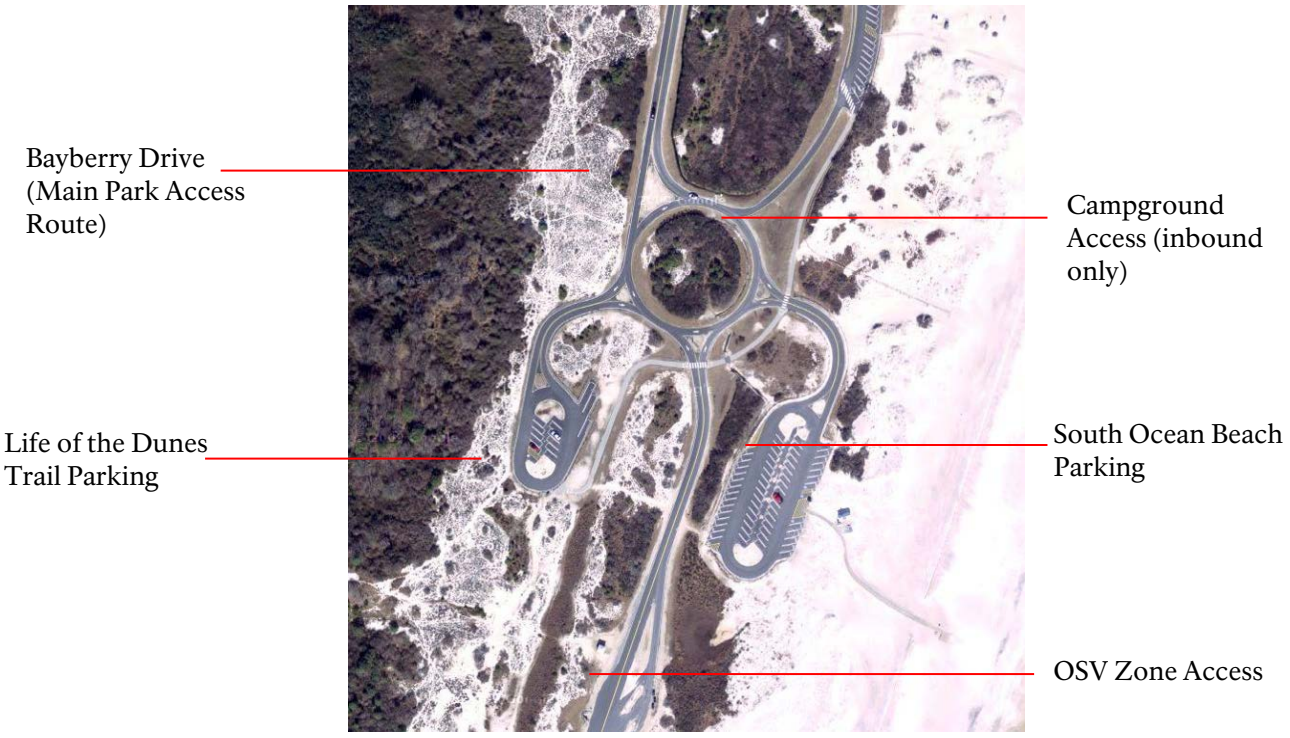
entrance stations on the island to provide OSV and parking information to arriving motorists. These signs could be complemented by information provided on the mainland, by the Visitor Center, and information provided via phone, radio or web systems. Such information, especially if real-time, would reduce visitor frustration from lack of information on parking and OSV Zone availability as well as weather, event, and other park information.

There may also be an opportunity for improvements to the signage near the parking lots on Assateague Island. Currently, signage directing visitors to parking immediately after the entrance booths is both inadequate and confusing. Figure 33 indicates areas in need of signage improvements at the north end of Assateague Island NS, based on observations from a study team visit to Assateague Island NS.

Inadequate signage at the traffic circle at the south end of Bayberry Drive (see Figure 34) leads to driver confusion and misdirection as well and may benefit from improvements (see Appendix C : Assateague Island NS Traffic Circle Wayfinding And Flow Memo).

Figure 33
Confusing signage spots
Source: Google maps, modified by U.S. DOT Volpe Center project team / Volpe Center Photographs (July 2009)

Figure 34
Assateague Island NS Bayberry Drive Traffic Circle
Source: Google Maps, modified by U.S. DOT Volpe Center project team.



Alternative Transportation

The vast majority of visitors arrive to Assateague Island NS in private vehicles. Lack of alternative transportation options limits access to the park by people without a vehicle; stresses entrance gate and parking capacity; and may lead to more environmental disruption than a multimodal access system. Alternative transportation – including transit, bicycle, and water transportation – may help to address some of the existing transportation issues as well as future access issues.

Dependence on Private Vehicles

Though there are several transit services operating in the region, no bus or shuttle service is currently available at Assateague Island NS. Two commercial campground sites, in the area provide shuttle service to Assateague State Park, but the shuttles do not serve Bayberry Drive or Assateague Island NS. In 2009, an estimated 50,000 visitors (about 7 percent) arrived on tour buses.[97] The number of visitors who access Assateague Island NS on foot or by bicycle is not known as there is no systematic way to count these visitors. Anecdotally, visitors bicycling from Ocean City and other nearby communities arrive on a somewhat frequent basis, but very few visitors enter the Maryland District on foot.[98]

[97] National Park Service Public Use Statistics Office. http://www.nature.nps.gov/stats/

[98] Personal communication with ASIS staff.

Reducing reliance on the automobile to access the park by providing alternative transportation options could mitigate many of the transportation issues Assateague Island NS experiences. It could help reduce entrance station congestion, improve parking availability, and reduce the environmental impact of Assateague Island NS visitation. Alternative transportation would also create visitation opportunities for people who are not able to drive to Assateague Island NS. This may become increasingly important as the regional population ages. The park is several miles from the nearest destinations, so pedestrian access is not a viable option for most visitors. Bicycle and transit access, however, are worth exploring. Both park staff and visitors have expressed interest in improved alternative transportation systems to relieve congestion and offer more environmentally friendly options for accessing Assateague Island NS.

Transit Service

A transit connection would need to attract sufficient ridership to make it financially viable and environmentally beneficial. It must also be designed to preserve the nature-oriented recreation experience at Assateague Island NS. In addition, shuttle service planning would need to include plans for emergency evacuation and/or sheltering of transit riders.

The new visitor center on the mainland west of Assateague Island offers a logical connection point where visitors could park and take a shuttle or ride a bike to access the island (they could also walk, but the distance is farther than most visitors may be willing to walk). Additionally, nearby campgrounds, Berlin and Ocean City in Maryland, and Chincoteague National Wildlife Refuge in Virginia are potential regional connection points for shuttle service to Assateague Island NS. There is already an existing transit service offered by two campgrounds that provide service to the Assateague State Park and Ocean City.

Bicycle Network

Assateague Island NS has a fairly connected network of bicycle facilities, including a separate bicycle and pedestrian bridge that connects the mainland to the island, a separated multi-use path along Bayberry Drive, and bicycle parking throughout the park. Some visitors have indicated a desire for additional bicycle facilities. There are safety concerns along parts of the bicycle route between Ocean City and Assateague Island NS, as described in the Existing Conditions chapter.

The Maryland State Highway Administration (MDSHA) is currently planning and implementing improvements to Routes 113 and the Route 50 bridge that address both traffic congestion and road safety, in particular in regard to bicycle access. The state of Maryland is working towards improving and completing its bicycle network. Improvements to roads in Worcester County reflect this commitment to making Maryland more bike friendly. There are no specific bicycle/pedestrian projects, aside from widening of U.S. 113, however, it should be noted that biking has been called a state priority and may feature in future projects.

Additional analysis of regional bicycle connections and park facilities may reveal opportunities to improve the bicycle network and attract additional biking to and within the park. This could include exploring bike rental options, bike parking, additional and/or improved bike trails.

Water Access

There are currently few options for water transport to the Maryland District of Assateague Island NS, as described in the Existing Conditions chapter. The only boat landing infrastructure within the Maryland side of Assateague Island is at Assateague State Park. Existing water transport operations are tourism-based and are not designed to transport visitors to Assateague Island NS who might wish to spend extended time on the beach or carry recreational equipment. Stakeholders interviewed for this study expressed concerns about the viability of a water transport operation from neighboring regions to Assateague Island NS. They cited the cost of creating water transport-related infrastructure and conflicts

with existing county and state use policies and regulations as having prevented large-scale operators in the region from entering the market.

Over-sand Vehicle (OSV) Management

The Over-Sand Vehicle (OSV) Zone is used by visitors who want to explore further south on the island in a vehicle, mainly for fishing or camping activities. There is currently a limit of 145 vehicles allowed in this area at a time. There are mixed opinions among visitors and stakeholders about whether this limit is appropriate. Some support a lower limit to reduce stress on wildlife and the island topography. Others support a higher limit to accommodate demand during peak periods. The limit will be addressed in the ongoing GMP process.

From a transportation perspective, keeping accurate track of the vehicles in the area and communicating this to the public is important to prevent congestion and confusion at the OSV Zone entrance. Currently, the vehicles are counted by an automated gate system that closes when the 145 vehicle limit is reached and converts to a "one on, one off" system. When the capacity is reached, OSVs are allowed in on a "one out, one in" manner.

Barrier Island Dynamics

As a barrier island, Assateague Island NS experiences major, long-term physical environmental changes along the shoreline that could adversely affect the public beach, adjacent parking lots, and nearby campgrounds and other visitor infrastructure. Because of its expansive coastline, low-lying topography, and growing coastal population, the Chesapeake Bay region is one of the most vulnerable places in the nation to the impacts of sea level rise.[99] The Assateague Island shoreline is receding at a rate of approximately one meter per year.[100] A report by the National Resources Defense Council, National Parks in Peril, predicted an increase in storm activity along the Assateague coast.[101] Major storms can very quickly and significantly affect the island ecology as well as existing infrastructure, and the northern end of Assateague Island is vulnerable to overwash.

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[99] National Wildlife Federation. Sea Level Rise and Coastal Habitats in the Chesapeake Bay Region. May 2008. http://www.nwf.org/

[100] National Park Service. Finding of No Significant Impact/Decision Notice: Improvements to Island Facilities and Infrastructure – Assateague Island National Seashore. June 30, 2006.

[101] National Parks in Peril: The Threats of Climate Change Disruption. state Fact Sheet: Maryalnd Virginia. 2009. Rocky Mountain Climate Organization and the Natural Resources Defense Council. http://www.rockymountainclimate.org/website%20pictures/ParksinPeril_MD-VAFacts.pdf

Vulnerable Infrastructure

Both Assateague State Park and Assateague Island NS have significant transportation and other infrastructure in place on the island that is at risk from barrier island environmental dynamics. Historic storm events clearly demonstrate the threat of storm damage to the parking lots and beaches, a threat that is likely to grow with the sea level rise and intensified storms predicted as a result of climate change. The Maryland Climate Action Plan,[102] predicted that, under a high-emission scenario, Assateague Island could 'fragment' into several smaller islands with new inlets creating connections between the ocean and the coastal bays.

Island dynamics place infrastructure in jeopardy as the shoreline recedes closer to the facilities raise and may challenge Assateague Island NS's ability to provide traditional transportation infrastructure and support vehicular access in the future. Assateague Island NS' reconfiguration of the North Beach parking lot incorporated these considerations by moving the parking west and restoring the former eastern third of the parking lot to natural conditions with swales to protect the new parking area from storm surges.

Plans and investments in infrastructure for Assateague Island NS should be compatible with natural coastal processes and help the island adapt to erosion and storm damage. For example, in addition to the immediate parking issues discussed above, Assateague Island NS may need a strategy for shifting most parking to the mainland due to barrier island dynamics and the vulnerability of island parking and infrastructure to storm damage. Such a strategy would significantly change the role of alternative transportation, especially transit, for access to Assateague Island NS.

Emergency Evacuation

As mentioned above, Assateague Island and the Eastern Shore of Maryland and Virginia are very vulnerable to storms, making emergency evacuation an important transportation issue. Route 611 is a designated evacuation route for both Assateague Island and Ocean City; however, it is also located in a flood zone (see Figure 35). Emergency evacuation planning needs to ensure that the evacuation routes can accommodate the total anticipated visitors to the area.

Shelter on the island is also needed to accommodate people in the event of a sudden storm. Currently, there are no buildings in the Maryland District of Assateague Island NS that are recommended for emergency shelter.

An additional issue with emergency evacuation involves the merging of traffic from Assateague Island NS and from Assateague State Park to exit off the island (see Figure 36). Assateague Island NS visitors must take a left turn to merge into the access road leading to the Verrazano Bridge from Bayberry Drive, while vehicles departing from Assateague State Park have the right of way in proceeding straight. This issue could be addressed by employing NPS and Assateague State Park staff to direct traffic in the event of evacuation, reconfiguring or redirecting traffic to improve the merge, or reversing the eastbound lane across the Verrazano Bridge.

[102] Maryland Commission on Climate Change. Climate Action Plan. http://www.mde.state.md.us/Air/climatechange/index.Assateague state Park

Figure 35
Flood zones in Maryland near Assateague Island
Source: Zou, Nan, et al. "Simulation-Based Emergency Evacuation System for Ocean City, Maryland, During Hurricanes" University of Maryland, 2005.

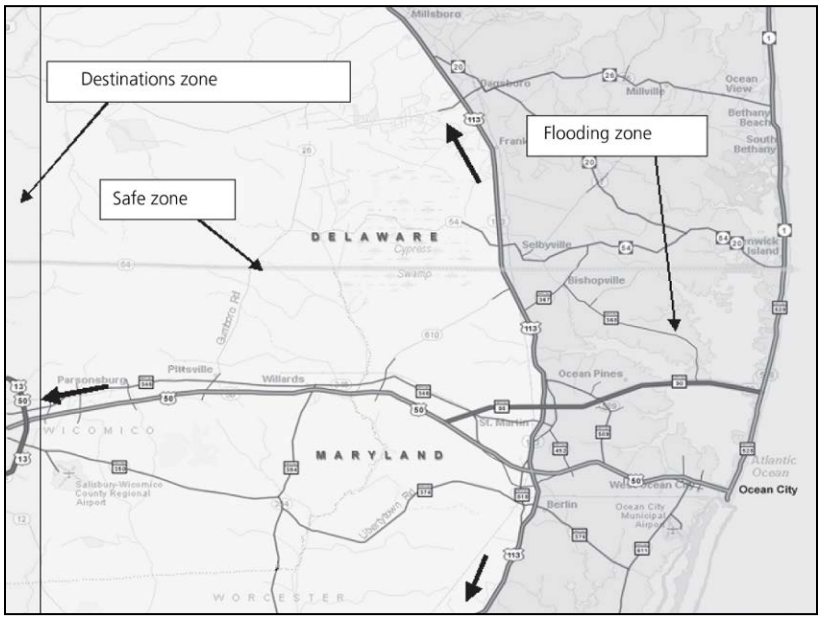


Figure 36
Intersection of Bayberry Drive and Assateague state Park access
Source: Google Maps modified by U.S. DOT / Volpe Center project staff.

Future Regional Transportation

Future anticipated changes to the transportation systems have implications for planning visitor transportation to Assateague Island. Congestion and road design will play a role in assessing demand and route planning for public transportation, bicycle and pedestrian routes, and signage strategies.

Traffic volumes on major roadways near Assateague Island NS are expected to increase anywhere from 30 to 200 percent over the next twenty years (see Figure 37).[103] Such congestion would have an impact on visitor access to Assateague Island NS as well as the service of any potential transit options. The largest traffic growth is expected along US 113 largely due to a planned 946-acre mixed-use development in Snow Hill. However, ongoing expansion of U.S. 113 from a 2-lane to a 4-lane divided highway is expected to provide adequate capacity to mitigate the increase in traffic.

U.S. 113 Expansion

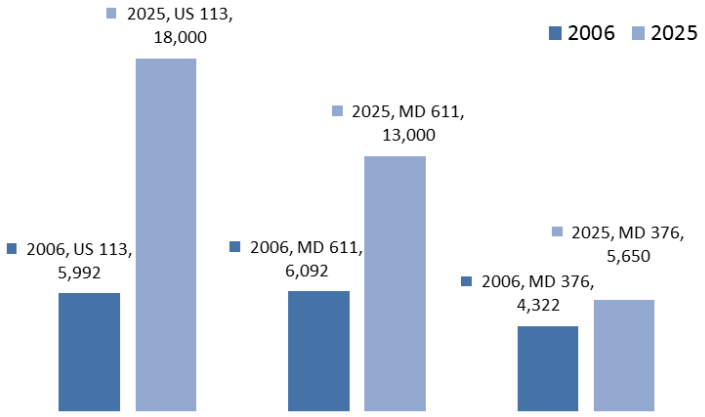
Sections of U.S. 113, which runs from Snow Hill to the Maryland-Delaware border and provides access to Assateague Island NS from the south, are currently being widened from a two-lane highway to a four lane divided highway. The new road design will include grass medians, left-turn bays, and acceleration/deceleration lanes. Direct access to private residents will be removed from the highway and a service road will be installed with access to these properties. The highway will include wide shoulders to better accommodate cyclists and pedestrians. The portion of US 113 in closest proximity to MD 376 (the route from Berlin to access Assateague Island NS) already is a four lane divided highway.

U.S. 50 Crossing Study

MDSHA is currently conducting a project planning study on the U.S. 50 crossing of the Sinepuxent Bay in Worcester County to develop a transportation solution that addresses the structural, operational, and safety deficiencies associated with the existing bridge. The bridge connects West Ocean City on the mainland with Ocean City and as such, is an important access route for Assateague Island NS visitors who live or are staying in Ocean City. Several alternatives were presented at a public workshop in June 2006, after which MDSHA reevaluated the alternatives based on public input and an evaluation of impacts. The revised list of alternatives include no build, rehabilitation of the existing bridge, connecting at 1st Street, or adding a parallel bridge to the south or north. Consideration of shoulders and sidewalks will also be made.

[103] Personal communication with Maryland state Highway Administration staff.

Figure 37
Traffic Projections near Assateague Island NS
Source: Maryland State Highway Administration



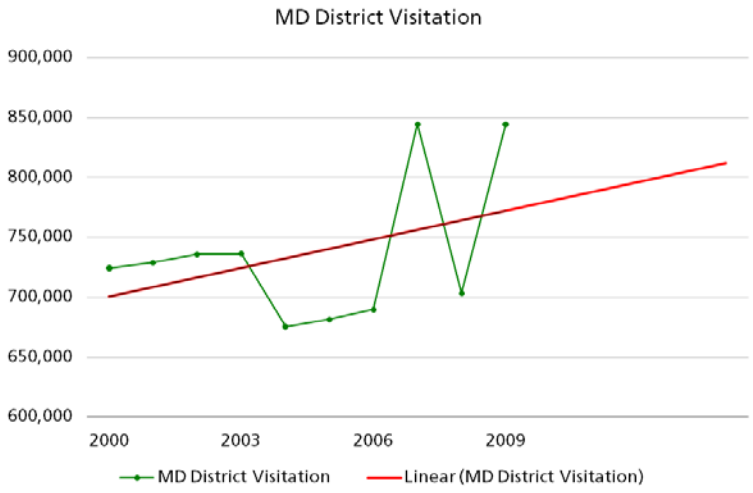
Future Visitation and Carrying Capacity

Due to limited data on visitors and driving factors for visitation rates, it is difficult to forecast visitation to recreational sites like Assateague Island NS, but some assumptions can be made based on historic visitation, regional population growth, and park management decisions. Two other important factors to consider in considering future visitation are demographic changes and carrying capacity of the site.

Future Visitation

An analysis of historic visitation counts over the past decade (2000 to 2009) indicates that if visitation growth continues at the same rate (one percent over 10 years), visitation to Assateague National Seashore will increase by approximately 8,000 visitors per year (see Figure 38).

Figure 38
Assateague Island NS Maryland District Visitation Projections
Source: National Park Service Public Use Statistics



Regional population growth likely plays a role in Assateague Island NS visitation increases; however, the exact impact is unclear. An NPS visitor survey[104] conducted in 2006 indicated that the majority of Assateague Island NS visitors do not self-identify as local residents (87 percent) but that most visitors come from the mid-Atlantic region (see Figure 39). While it is not clear exactly how population growth will affect visitation, it is reasonable to assume that population growth in areas from which most Assateague Island NS visitors originate will be correlated with increased visitation.

[104] Assateague Island National Seashore. Visitor Survey. January 16, 2007. Eppley Institute for Parks and Public Lands, Indiana University. (provided by park)

Figure 39
Visitor Origins

Source: Assateague Island National Seashore. Visitor Survey. January 16, 2007. Eppley Institute for Parks and Public Lands, Indiana University. (provided by NPS Assateague Island NS staff)

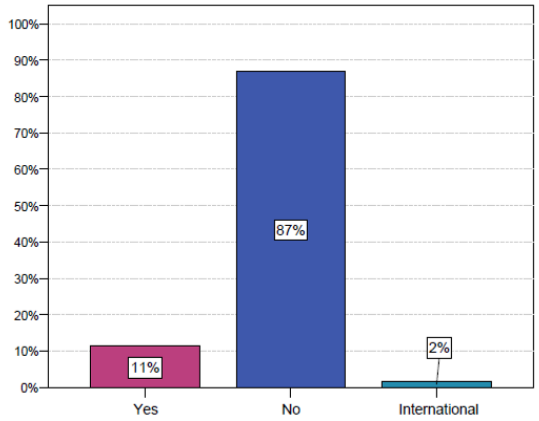


FIGURE 11. LOCAL RESIDENT

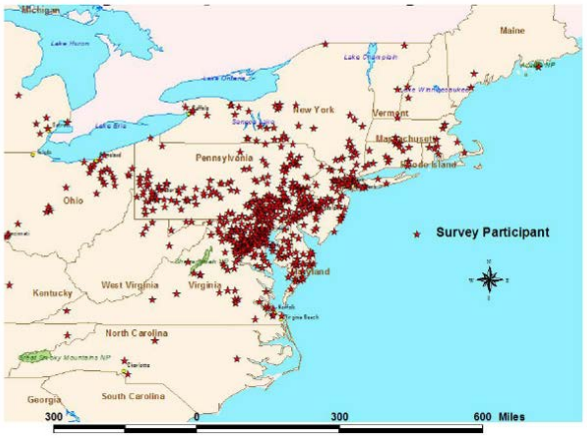


FIGURE 12B. CLOSE-UP OF EASTERN UNITED STATES SURVEY RESPONDENTS BY ZIP CODE

The primary states from which Assateague Island NS visitors originate (Maryland, Virginia, Pennsylvania, Delaware, New York, Ohio and New Jersey) have averaged a six percent increase in population from 2000 – 2009 (compared to eight percent in the U.S. as a whole[105]). This rate of increase is significantly greater than the one percent increase seen in Assateague Island NS visitation. Although there is not a known direct relationship between the regional population and the visitation rate, it can be assumed that continued growth in the mid-Atlantic population may generate more visitation to Assateague Island NS.

The population of Worcester County is expected to grow from approximately 50,000 individuals in 2010 to 60,000 individuals in 2030, or a 20 percent increase. While Worcester County residents make up a small portion of Assateague Island NS visitors, it can be assumed that some percentage of new residents will be attracted to the Worcester area because of its proximity to the park and Ocean City and that regional growth may be associated with increased visitation at Assateague Island NS. More year-round residents may lead to an increase in shoulder season visitation, rather than just adding to peak visitation.

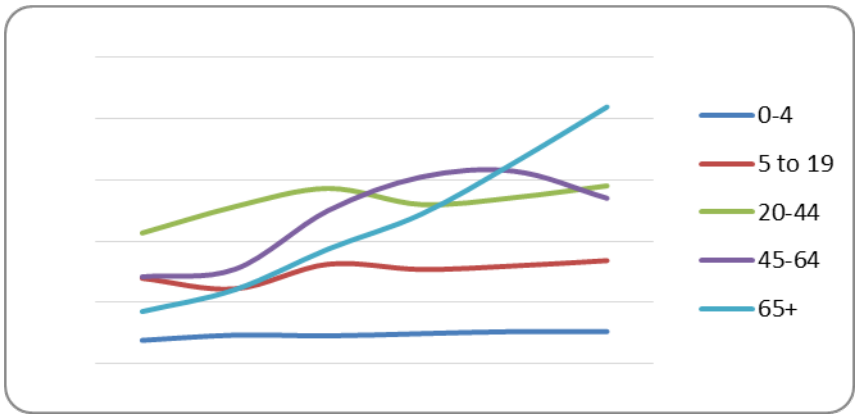
Projected Regional Demographics

Within the state of Maryland, the largest percentage growth in future population will occur in the 85+ group.[106] The majority of these seniors will be located in Calvert, Charles and St. Mary's Counties,[107] located across the Chesapeake Bay from the Eastern Shore. However, Worcester County will also experience an increase in its elderly population; currently, individuals over 65 outnumber those under 18, and this level will rise over time (see Figure 40). The expected increase in the regions' senior population, many who may have limited mobility, may lead to higher demand for alternative transportation such as shuttle bus service.

[105] U.S. Census. http://www.census.gov/

[106] Maryland Department of Planning, Maryland state Data Center. http://www.mdp.state.md.us/Msdc/
[107] Maryland Department of Aging. http://www.mdoa.state.md.us/

Figure 40
Worcester County resident age projections
Source: Maryland Department of Planning, Maryland State Data Center. http://www.mdp.state.md.us/Msdc/



Carrying Capacity

An assessment of carrying capacity – the number of persons who can use a site at a given time without causing deterioration of the natural attributes of the sites or impeding each users' ability to fully enjoy the setting – is critical to understanding future visitation and developing transportation strategies for Assateague Island NS. Park management decisions related to the park's carrying capacity may reinforce or counteract the trend in visitation growth. While Assateague Island NS can currently accommodate more visitors at off-peak times, its ability to accommodate more visitors at peak times without improvements to staffing, facilities, or parking is unclear. Based on the limited available visitor survey data, visitors seem evenly split between indicating the park is close to capacity and indicating interest in how the park could accommodate more people.[108] Carrying capacity will be addressed as part on the ongoing General Management Plan (GMP) process. Park management and policy decisions related to carrying capacity are very important to the evaluation of potential transportation system improvements.

Conclusion

This chapter builds upon the existing conditions chapter to describe the primary transportation issues facing Assateague Island NS and establish a basis by which to identify potential alternative transportation solutions. Key conclusions that were drawn from this report and applied to next steps of the study include:

- Assateague Island NS experiences a range of transportation problems, including congestion at the entrance booths, illegal parking, dependence on private vehicles, management of the Over-Sand Vehicle (OSV) Zone, and vulnerability to storms and sea level rise. In addition, there are deficiencies in the pedestrian and bicycle networks, the directional signage, and traveler information systems that could also be resolved. Although GMP comments were generally

108 Assateague Island National Seashore. Visitor Survey. January 16, 2007. Eppley Institute for Parks and Public Lands, Indiana University. (provided by park) (Inferred from responses, question was not asked directly)

favorable toward the current transportation conditions at Assateague Island NS, they also covered issues identified by the park and study observation, such as entrance booth congestion, wayfinding and traveler information, and parking.

- In part to address the issues identified, the park has pursued several projects, such as the new visitor center and reconfiguration of the entrance booths, that will create new transportation conditions that will need to be considered.
- Many of the transportation challenges are symptoms of the basic issue that vehicular demand exceeds roadway and parking capacity at peak times. Congestion approaching the entrance booths is common, and without vigilant enforcement hundreds of vehicles would be parked illegally on peak days. At least one of the beach parking lots was full or over capacity on 35 of 48 total days monitored last summer. While entrance station capacity will increase when a third entrance lane is added in 2011, parking on the island will not increase.
- In addition to current demand and capacity issues, there is the potential for reduction of parking or access due to storm damage and/or sea level rise in the future.

As a result of this chapter, a draft list of potential solutions (Appendix A: Potential Solutions to Explore) was developed and then revised based on feedback from Assateague Island NS staff. The next chapter evaluates each remaining potential solution on transportation objectives developed from the needs identified and on a number of implementation characteristics.

4. Analysis and Assessment of Transportation Elements

This chapter presents an assessment of individual transportation interventions, or "elements," with potential to address one or more of the identified transportation needs for Assateague Island NS. The study team developed an initial list of about 30 elements as part of the Needs Assessment (see Appendix A). Some of these elements are quite simple (e.g., adding a crosswalk), and some are quite complex (e.g., implementing a comprehensive traveler information system). In addition, some elements are mutually exclusive, while others may be complementary. Park staff reviewed the initial list and provided guidance about priority elements and elements that the park is not currently interested in pursuing. Ultimately, the decision to implement various transportation elements will be made by park staff and based on the priorities articulated through the GMP process, which is currently underway.

This chapter documents the study's investigation and initial evaluation of the identified elements. The chapter provides a functional description of each element, including implementation needs and cost, and applies evaluation criteria based on identified transportation goals and implementation feasibility. The framework for this assessment is described below. The evaluation criteria are used to determine which elements are recommended and which are not recommended. For those elements that are more complex, additional information is provided in the appendices or, in the case of transit, the subsequent Transit Feasibility Assessment chapter.

Evaluation Framework

Based on the Needs Assessment chapter, reducing the number of vehicles on the island at peak times is critical to addressing current and future transportation challenges for Assateague Island NS. Currently the number of vehicles on the island exceeds parking and entrance station capacity, which creates congestion, delay, and problems with illegal parking. In the future, vehicle access to the island may be substantially reduced, either as a result of discrete events like storms in the short term or of long term trends such as sea level rise and other effects of climate change, and safely accommodating alternative access to the island may become essential. In addition, the park seeks enhancements to travel facilities to provide a safe and convenient visitor experience for all travel modes, and seeks to minimize visitor vulnerability and financial losses associated with storm damage and sea level rise.

Thus, the most important transportation objectives of Assateague Island NS are to:

- Reduce the number of vehicles on the Assateague Island NS Maryland District portion of the island at peak times, while continuing to provide visitor access.
- Enhance the travel experience for all modes (e.g., wayfinding, traveler information, facilities and amenities).
- Improve transportation system resiliency to storm damage and sea level rise.

These objectives are mutually supportive. The first reduces the number of vehicles on site and, in turn, reduces congestion and confusion and eases the management of on-site travel. The second enhances travel facilities and provides better information for the traveler, thus encouraging visitors to rely less on personal vehicles. Elements that improve system resiliency in most cases also address at least one of the first two objectives. However, all of the objectives must be met to fully address all of the transportation challenges.

The evaluation criteria chosen for this analysis are based upon:

- The three Assateague Island NS transportation objectives;
- The NPS programmatic goals of resource protection and partnership building; and
- Practical implementation matters, including financial feasibility, technical complexity, and public acceptance.

Table 3 shows the evaluation criteria and scoring system for individual transportation elements. Each criterion has positive, neutral, and negative outcomes, for which the scores are 1, 0 and -1, respectively. The exception is financial feasibility, for which "low", "medium", and "high" ranges are defined.

As a result of the analysis and evaluation, the study team placed each element into one of three categories:

- Recommended for further consideration,
- Not recommended at this time, and
- Needs further evaluation.

The first category of elements has the potential to help achieve the Assateague Island NS transportation goals and appears feasible to implement. The second category of elements either does not fit with the Assateague Island NS transportation goals or is not feasible at this time. The final category of elements consists of those that can only be fully evaluated in a system context, that is, as part of a coordinated management strategy. These elements are highly dependent on Assateague Island NS management decisions and an overall approach or strategy for transportation. For example, the feasibility and value of initiating transit service depends on the park's long term strategy for managing visitation. This chapter documents an initial evaluation of these elements; however, the elements in this category are best evaluated in the broader context of integrated strategies for transportation management. This group of elements is further investigated in appendices or, in the case of transit, the next chapter.

Table 4 summarizes the evaluation ratings for the elements that can be evaluated individually and organizes the elements into three categories described above.

Table 3
Objectives, Evaluation Criteria and Rating System

	Objective	Evaluation Criterion Description	Rating Description	Rating
Transportation Objectives	Reduce vehicles on the island at peak times.	Effectiveness in reducing the number of vehicles on the Maryland district of the island.	Significantly reduces vehicle load No significant change Increases vehicle load	1 0 -1
	Enhance the travel experience for all modes.	Impacts on the efficiency and safety of traffic flow and circulation patterns, including traveler information.	Improves travel experience No change Degrades travel experience	1 0 -1
	Improve transportation system resiliency to storm damage and sea level rise.	Considerations related to short-term impacts of storm damage and long-term management of shoreline change and sea level rise, in particular the possibility of relocating much of the island's permanent infrastructure to the mainland over time.	Improves resilience No change Increases vulnerability	1 0 -1
NPS Programmatic Objectives	Enhance the visitor experience.	Impacts on recreation and interpretation opportunities.	Improves experience No change Degrades experience	1 0 -1
	Protect the park's natural, cultural and historic resources.	Impacts on the natural, cultural and historic resources, and the island's natural systems.	Improves resource protection No change Degrades resource protection	1 0 -1
	Build local partnerships and integrate seamlessly with Assateague state Park (Assateague State Park).	Opportunities to partner with local agencies and organizations that might enhance the visitor experience and/or cost efficiency of travel to and within Assateague Island NS.	Creates new or enhanced partnership opportunities No changes Degrades partnership opportunities	1 0 -1
Implementation Considerations	Financial feasibility	Capital expenses All cost estimates are intended to provide planning guidance only. Refined cost estimates based on more detailed research and analysis would be needed in advance of budgeting, procurement and/or implementation of any of the proposed strategies.	<= $5,000 $5,001 - $50,000 > $50,000	Low Med High
		Annual operations and maintenance costs, including staff time required.	<= $5,000 $5,001 - $50,000 > $50,000	Low Med High
	Technical complexity	Assessment of the complexity of implementation, including anticipated engineering and design complexity, the length of time required for implementation, and availability of the needed technology.	Minimal difficulty Moderate difficulty Technically challenging	1 0 -1
	Public acceptance	Assessment of how an element is likely to be received by Assateague Island NS visitors and other local stakeholders.	Public support Public indifference Public opposition	1 0 -1

Table 4
Transportation Elements Evaluation Summary

#	Element	Assateague Island NS Transportation Objectives			NPS Programmatic Objectives			Implementation Considerations			
		Reduce Vehicle Load on Island	Travel Experience	Transportation System Resilience	Visitor Experience	Resource Protection	Partnership Opportunities	Capital Cost	Operating & Maintenance Cost	Technical Complexity	Public Acceptance
Recommended for Consideration											
1	Develop a Traveler Information System	0	1	1	1	0	1	Med	Low	1	1
2	Revise Emergency and Hurricane Plans and Take Actions to Better Accommodate Bicyclists and Transit Riders	0	1	1	0	0	1	High	Low	0	0
3	Improve Park Map	0	1	0	1	0	0	Low	Low	1	0
4	Construct Wildlife Viewing Pull-Over Areas	0	1	0	1	1	0	Med	Low	0	1
5	Offer Beach Equipment Rental Concessions	0	0	0	1	0	1	Low	Low	1	1
6	Offer Bicycle Rentals at the Visitor Center	0	1	1	1	1	0	Low	Low	1	1
7	Improve Bicycle Racks, Air Pumps, Bicycle Repair Facilities within the Park	0	0	0	1	0	0	Med	Low	1	1
8	Support Regional Bicycle Network Development	0	1	0	0	0	1	Low	Low	0	0
9	Improve Signage at Bayberry Drive Traffic Circle	0	1	-1	1	0	0	Low	Low	1	1
10	Improve Directional and Parking Signage Near Entrance Station	0	1	0	1	0	0	Low	Low	1	0
11	Construct Additional Access in the North Beach Parking Area	0	1	0	0	0	0	Med	Low	1	0
12	Relocate and Improve Crosswalk between MD Boat Launch Facility and New Visitor Center	0	1	1	0	0	1	Low	Low	0	0
13	Encourage Rideshare/Carpool to Assateague Island NS	0	0	0	1	0	1	Low	Low	1	1
Not Recommended At This Time											
14	Facilitate Online OSV Pass Purchases and Reservations	0	0	0	1	1	0	Un-known	Un-known	-1	1
15	Reconfigure Bayberry Drive Traffic Circle	0	1	-1	1	0	0	High	Low	0	0
16	Increase Entrance Station Capacity Using Pass Readers and/or Additional Staff	-1	-1	0	-1	0	0	Med	Low	0	0
17	Institute an Automated Parking System	-1	-1	-1	-1	0	0	High	Med	0	0

#	Element	Assateague Island NS Transportation Objectives			NPS Programmatic Objectives			Implementation Considerations			
		Reduce Vehicle Load on Island	Travel Experience	Transportation System Resilience	Visitor Experience	Resource Protection	Partnership Opportunities	Capital Cost	Operating & Maintenance Cost	Technical Complexity	Public Acceptance
18	Use Congestion Pricing to Shift Demand to Off-Peak Times	1	1	0	0	1	0	Med	Med	0	Un-known
Further Evaluation Needed											
19	Build Combined Assateague Island NS and Assateague State Park Entrance Station on the Mainland	0	0	1	0	1	1	High	Low	-1	0
20	Institute Reciprocal Fees with Assateague State Park	0	1	0	0	0	1	Un-known	Un-known	-1	1
21	Develop Policy to Temporarily Close the Park to Entering Traffic when Parking is Full	1	0	-1	0	0	0	Un-known	Un-known	0	-1
22	Provide Additional Parking on Mainland	1	1	1	0	1	0	Un-known	Un-known	Un-known	0
23	Provide Shuttle Services to/from Visitor Center/Mainland Parking	1	1	1	1	Un-known	1	Un-known	Un-known	0	Un-known
25	Provide Shuttle Bus Services to/from Regional Destinations	1	1	1	1	Un-known	1	Un-known	Un-known	0	Un-known
26	Provide Water-Based Transit	1	1	1	1	Un-known	1	Un-known	High	-1	1

Elements Description and Evaluation

This section provides a description of each of the elements in the order they are presented in Table 4. Elements that are recommended for consideration are marked (RC), those that are not recommended at this time are marked (NR), and those that require further evaluation are marked (FE).

1. Develop a Traveler Information System (RC)

Assateague Island NS would develop a coordinated traveler information system (TIS) that provides emergency messages, directional information, special event announcements, traffic information, OSV Zone status, parking status, and transit information to visitors both on-site and in advance of visitation. Maryland State Highway Administration (SHA) has an expansive traveler information system known as CHART, which Assateague Island NS would use to deliver information via off-site variable message signs, radio, web and an information phone line. There are also opportunities for enhanced use of the Assateague Island NS website and social media, such as Twitter,[109] to alert visitors of beach conditions and special events. Other National Park Service sites have employed multimedia approaches to inform and engage visitors; for example, Glacier National Park in Montana has accounts with Twitter (news announcements), Facebook (social networking website for information and discussion), flickr (image sharing), and YouTube (free videos).[110]

Appendix B: Traveler Information Delivery describes some key considerations and components of a system for disseminating traveler information and Appendix D: OSV Zone Access Management Memo contains an OSV Zone Management Memorandum that includes recommendations about coordinating such a system with a larger TIS.

Table 5
Traveler Information System Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on island	0	A TIS would help park staff alert visitors to congested conditions and parking availability. A small number of visitors may use this information to shift the timing of their trip to Assateague Island NS to avoid congestion, but unless the TIS is coupled with new management policies or transit service, it would not significantly reduce vehicle load on the island.
Travel experience	1	A TIS would alert travelers to hazardous conditions. It would also support traffic management policies such as a parking reservation system and facilitate emergency evacuation.
Transportation system resilience	1	A TIS would help park staff manage variable access conditions that are expected as storm damage and sea level rise impact the island.
Visitor experience	1	Visitors would be able to better prepare for their trip and get information about beach conditions from a variety of sources.
Resource protection	0	A TIS would have no direct effect on Assateague Island's resources.
Partnership opportunities	1	Opportunity to partner with SHA to use the CHART system.

[109] Twitter is a social networking and blogging service in which users can send and view short (140 character) messages. Individuals as well as businesses, organizations, and government agencies use Twitter for socializing, news, publicity, advertising, and other purposes.

[110] Glacier National Park. "Social Networking Media." http://home.nps.gov/glac/parknews/socialnetworking.htm

Capital cost	High	Assateague Island NS can use elements of the SHA CHART system, which would reduce the need to purchase and maintain its own equipment. Developing a TIS plan would require some staff time and may require consultant assistance. TIS plans for other National Park Service units have cost $100,000 to $300,000[111]. However, the cost to Assateague Island NS could be lower because of the ability to benefit from the existing CHART system framework and use its components. New equipment, software and hardware purchases would depend on the requirements outlined in the plan. Some components, such as website upgrades, may be able to occur in the short term, be low cost, and may only require a small amount of additional staff time. More advanced systems, like parking or OSV reservations, are much more complex and could be quite costly. Assateague Island NS recently purchased two portable variable message signs for $19,000 each.
Operating & maintenance cost	Medium	Message feeds would have to be updated regularly (at least 15-20 minutes of staff time once every few days) to remain useful and relevant. Managing a website would cost between $6,000-$35,000112 annually in regular updating and annual maintenance. Ongoing staff time and equipment maintenance costs would probably be modest.
Technical complexity	0	Disseminating more accurate and timely information to visitors is technically feasible, though it may require some additional training of staff members. Developing the system involves some complexities, but pays off by assuring interoperability of components that are implemented incrementally.
Public acceptance	1	It is anticipated that the public would respond positively to dissemination of more accurate and timely information.

2. Revise Emergency and Hurricane Plans and Take Actions to Better Accommodate Bicyclists and Transit Riders (RC)

Assateague Island is vulnerable to large storm events, such as hurricanes as well as sudden or intense storms such as thunderstorms, particularly during the summer season. Such storms have implications for visitor safety that relate to transportation operations, traveler information, and access to transportation. Assateague Island NS currently has in place an Emergency Operations Preparedness Plan (EOPP) and a Hurricane Plan. Under the current plan and in practice, it is assumed that as the majority of visitors arrive by personal vehicle, visitors will be able to take temporary refuge in their vehicles and evacuate the island by vehicle. This evacuation protocol does not account for the need to provide assistance to bicyclists who currently arrive to the island without a vehicle or travel through the park by bicycle or foot. If the number of visitors on the island without vehicles increases in the future, either due to the introduction of transit or an increase in non-motorized access, it will be increasingly important for Assateague Island NS to take further steps to ensure the sheltering and evacuation of such visitors. Consequently, this strategy recommends that Assateague Island NS revise the Emergency Operations Plan and Hurricane Plan to ensure language incorporates bicyclist and transit riders needs and take actions to better serve these populations during an emergency.

Appendix D: Multi-Modal Emergency Evacuation Plan describes strategies on how the park can communicate general and acute risks prior to a storm, what to do in case of an emergency, and necessary

[111] Reflects typical range of consulting fees for several NPS unit ITS and TIS plans developed by the Volpe Center.

[112] "How Much Should a Website Cost?" WebpageFX. http://www.webpagefx.com/How-much-should-web-site-cost.html

considerations for evacuation, rescue procedures, and sheltering-in-place to visitors , especially those who are not accessing the park by personal vehicle. The appendix includes next steps for the park to coordinate with regional and state emergency personnel and local transit providers.

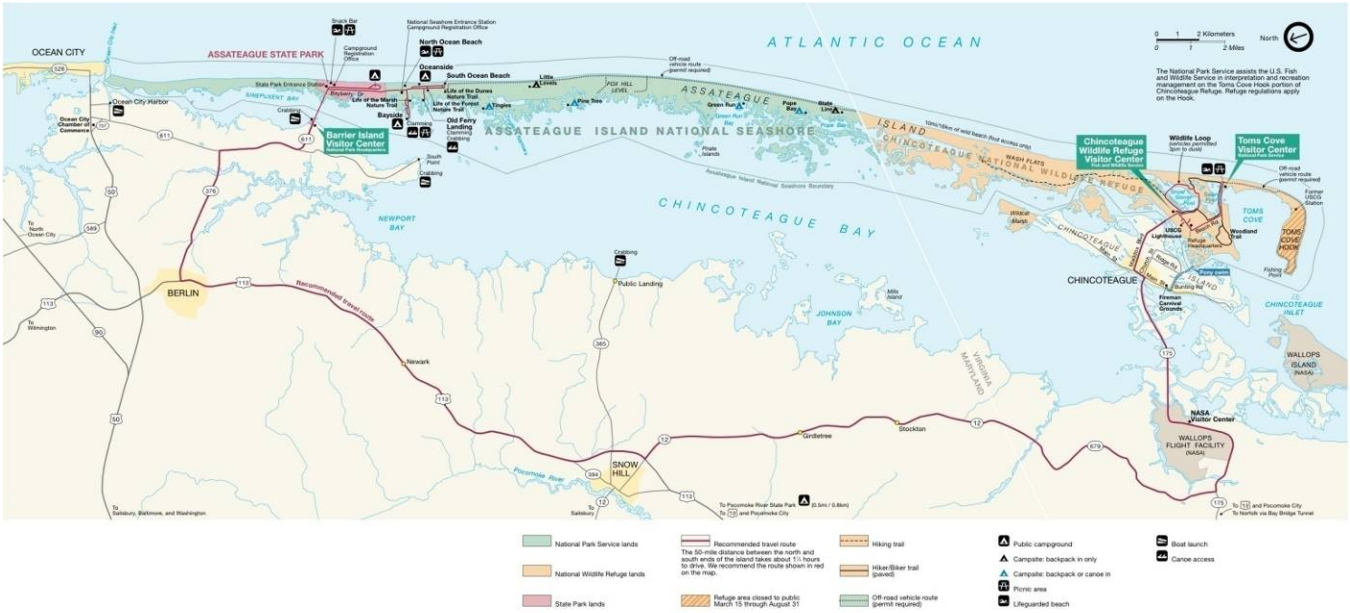
Table 6
Emergency Plan Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	Revising the emergency plans and taking actions to improve visitor safety would not directly reduce vehicle load on the island, though it may facilitate future access by bicycle and transit.
Travel experience	1	Revising the emergency plans would help to minimize disruption caused by storms and other disasters and facilitate evacuation, rescue, or sheltering in a safe, orderly manner and provide visitors with safety assurance.
Transportation system resilience	1	Revising the emergency plans is an important element of adapting to the potential for more and more severe storms that are anticipated in the future.
Visitor experience	1	Revising the emergency plans would not impact visitors on a regular basis, but would assist those on the island during a storm or disaster, especially those without access to a vehicle.
Resource protection	0	Revising the emergency plans itself would have little consequence to the environment, though physical improvements resulting from the plan such as signage, alert systems, and sheltering components may affect the natural environment. Similarly, the plan itself would not impact the cultural or historic resources.
Partnership opportunities	1	Coordinating with the Maryland CHART system and with Assateague State Park would be appropriate. Other potential partners include the National Weather Service, public transportation providers, and local emergency responders. In addition, the park should work with existing concessions, such as the Maryland Coastal Bays Program, which rents bicycles, kayaks, and canoes, and future concessions, such as the private campgrounds, to provide emergency pick-up services and shelter options for those using transit or non-motorized vehicles.
Capital cost	Low to High	The recommended actions do not involve many capital expenses, other than possible intersection improvements and shelters, which the transit business plan will consider this in more detail.
Operating & maintenance cost	Low	The recommended actions would require staff time and resources to coordinate and implement them, especially initially. These activities would need to be revisited if bicycle use increases and/or transit service is introduced.
Technical complexity	0	The short-term recommendations are technically feasible and could be in place within 6-months to 1-year. Feasibility of additional safety infrastructure would have to be considered further.
Public acceptance	0	These actions are not likely to generate public reaction, although hopefully they would provide visitors with a more positive experience. Its creation is necessary and should not be dependent on public enthusiasm.

3. Improve Park Map (RC)

The current park map (Figure 41) covers both the Maryland and Virginia districts of Assateague Island and provides a good snapshot of all the jurisdictions and destinations that compose the island and its surroundings. However, at this scale, it is difficult for visitors to understand the details of the Maryland District of Assateague Island NS. A more detailed map would assist visitors at the time of their visit as well as during advance planning by visitors.

Figure 41
Assateague Island Map
Source: NPS



Assateague Island NS offers a more detailed printed map (Figure 42) of the Maryland District of Assateague Island NS at their Maryland Barrier Island Visitor Center, which is more useful for identifying the location of various park facilities and provides information on the back of the map about each site. The map was funded with the support of Eastern National, a National Park Service non-profit cooperating association that operates the Assateague Island NS Visitor Center gift shop. While generally helpful, this map could be further improved by:

- Adding a scale marker
- Noting walking and biking distances and travel times between popular facilities
- Noting bicycle parking facilities

In addition, safety information, such as designated first aid stations and shelters, could be added to the map. The detailed map should be made available on the Assateague Island NS website.

Figure 42
Detailed Assateague Island NS Maryland District map (front)
Source: Assateague Island NS Barrier Island Visitor Center (2010)

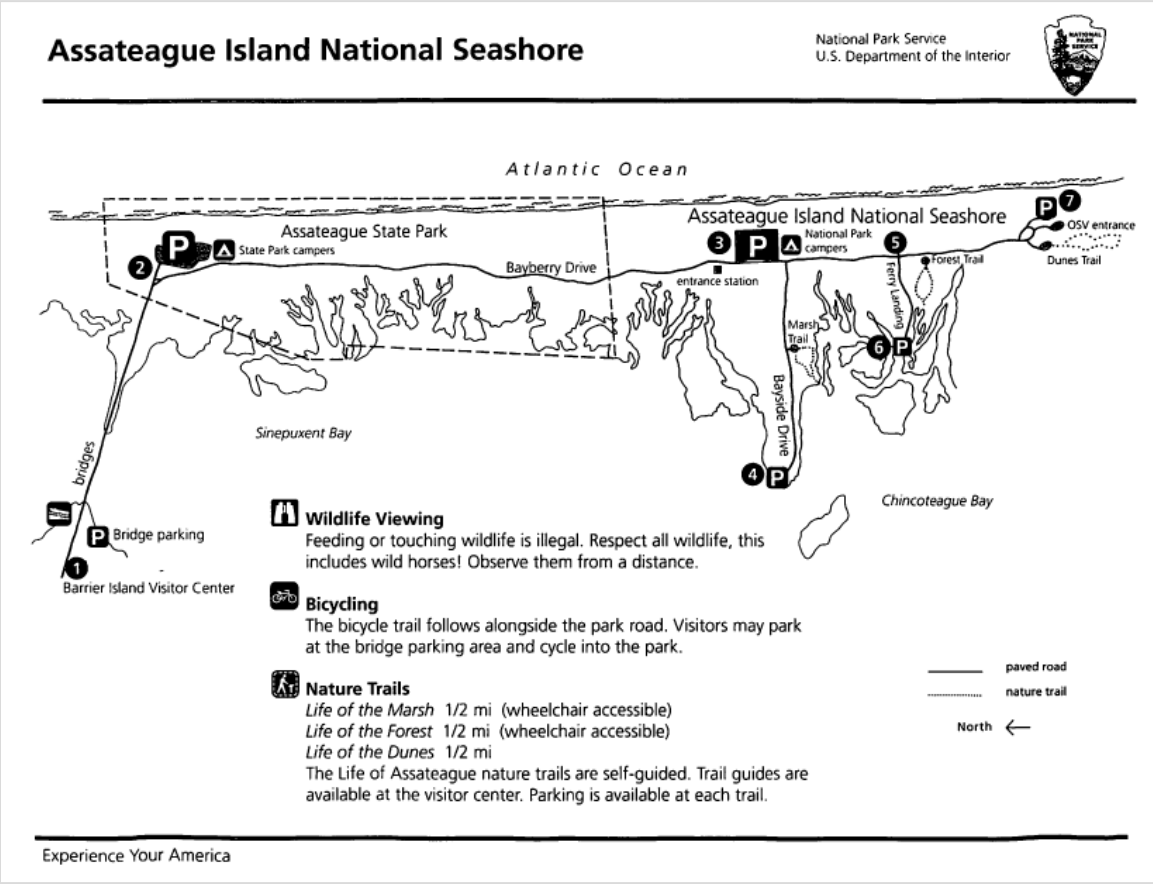


Table 7
Improved Park Map Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	No impact.
Travel experience	1	May improve efficiency of travel by improving visitor understanding of parking lots and nearby amenities in the area. Could improve safety if emergency evacuation and shelter information were added.
Transportation system resilience	0	No impact.
Visitor experience	1	An improved park map would help orient visitors to the island and help them identify facilities or amenities they may wish to visit both in advance of the visit and during the visit.
Resource protection	1	An improved park map may reduce impact on Assateague Island NS's resources as visitors would be less likely to park illegally
Partnership opportunities	0	A revised park map would be undertaken by Assateague Island NS with support from Eastern National and Harpers Ferry Center.
Capital cost	Low	The costs for a modest redesign of the park map are expected to be less than $5,000.

Operating & maintenance cost	Low	Printing and distribution costs would not be affected by the redesign.
Technical complexity	1	NPS already has all the necessary information to include on the map so development should be fairly easy.
Public acceptance	0	The public may not notice a new map, but would respond favorably to an accurate, helpful map.

4. Construct Wildlife Viewing Pull-Over Areas (RC)

Park staff and visitors reported traffic congestion and safety issues related to motorists stopping in the road on the island to observe wild horses. Additional unpaved areas (see Figure 43) or areas paved with permeable materials, such as crushed shell could be constructed along the road in a few key wildlife viewing locations so that motorists would be less likely to stop in the middle of the road and cause safety and congestion problems. The pull-over areas could be constructed in areas where horses frequently congregate so that environmental impacts are avoided or minimized.

These areas would probably be about 10 feet wide and 50 to 100 feet long. Signage would be required to notify visitors of the location and purpose of these pull-over areas and to be alert for vehicles turning off and merging onto the road. In addition, such pull-over areas should be identified in the Assateague Island NS Maryland District map described above.

An ongoing NPS traffic safety study that began in April 2010 is investigating safety issues on the island and will consider the benefits and costs of constructing pull-over areas in more detail. An ongoing NPS congestion study also made note of this need.

Figure 43
Stabilized Grass Pull-Over Area in Great Smoky Mountains National Park
Source: Hatcher, Martin L. Federal Highway Administration, Eastern Federal Lands Highway Division. Construction of Stabilized Grass Pull-Offs Using Geo-Technology Along the Gatlinburg Spur. November 2004. http://www.efl.fhwa.dot.gov/files/technology/GRSM-Stabilized-Grass-Pulloffs-report.pdf.

Table 8
Pull-Over Area Construction Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	Constructing new pull-over areas would not reduce vehicle load on the island.
Travel experience	1	Pull-over areas could help prevent congestion and rear-end collisions caused by drivers stopping in the road to view horses.
System resilience	-1	Investment in infrastructure on the island that may be destroyed by a storm would be costly to replace.
Visitor experience	1	Providing places for viewing and taking photos would improve the visitor experience.
Resource protection	1	Providing pull-over areas would reduce the number of drivers pulling over onto unpaved shoulders, which would reduce damage to vegetation along the road.
Partnership opportunities	0	No partnership opportunities.
Capital cost	Med	Stabilized grass pull-over areas that could hold up to two vehicles cost $40 per square yard in Great Smoky National Park in 2004.[113] Adding design, engineering, inflation and contingency, the proposed pull-over areas may cost an estimated $6,000 to $8,000 each for Assateague Island NS.
Operating & maintenance cost	Low	The pull-offs would require maintenance in terms of mowing but such maintenance should not differ significantly from current maintenance of shoulders.
Technical complexity	0	Technically feasible. Assessment and reporting of environmental impacts would be required.
Public acceptance	1	This should be a well-received amenity.

[113] Hatcher, Martin L. Federal Highway Administration, Eastern Federal Lands Highway Division. *Construction of Stabilized Grass Pull-Offs Using Geo-Technology Along the Gatlinburg Spur*. November 2004. http://www.efl.fhwa.dot.gov/files/technology/GRSM-Stabilized-Grass-Pulloffs-report.pdf.

5. Offer Beach Equipment Rental Concessions (RC)

There may be existing and future demand for beach equipment rentals such as beach chairs, towels and umbrellas, especially for visitors who travel to Assateague Island NS by bicycle or public transit. This type of concession would need to be located on the island, ideally near the beach access points or on the beach. The park may consider approaching local private operators to participate in a pilot beach equipment rental program.

While no other national parks offering a service like this were identified, many hotels and other public beaches offer similar services. Castle in the Sand Hotel in Ocean City has a rental stand on the beach near their hotel, which offers beach chairs, boogie boards and beach umbrellas[114].

Table 9
Beach Equipment Rental Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	Offering beach equipment rentals on-site may make alternative transportation more feasible because visitors would not need to carry as much gear to and from the island, though it is not expected to significantly impact travel patterns.
Travel experience	0	No significant impact.
Transportation system resilience	0	No impact. The rental operation would be a temporary and/or mobile construction.
Visitor experience	1	This would be a benefit to visitors, who either forget or were unable to bring a beach gear.
Resource protection	0	The rental operation could be sited to have minimal impact on the park's resources.
Partnership opportunities	1	Assateague Island NS would likely partner with a concession agent.
Capital cost	Low	There should not be any cost to Assateague Island NS, aside from initial outreach to vendors.
Operating & maintenance cost	Low	Maintaining agreements with vendors would take a small amount of staff time.
Technical complexity	1	Implementation of a concession stand would be undertaken by the concession agent.
Public acceptance	1	The public would likely react favorably to this amenity. There may be some concern about commercialization of the beach but the Assateague Alliance snack and gift shop has been favorably received and so sets a precedent for such activity.

[114] *Castle in the Sand website. (http://www.castleinthesand.com), visited July, 2010.

6. Offer Bicycle Rentals at the Visitor Center (RC)

Assateague Island NS can allow and encourage a bicycle rental concessioner open a location near the Visitor Center. This rental facility would allow visitors to park at the Visitor Center and bike to Assateague Island NS. Bike rentals may be more attractive at this location than at the Maryland Coasts Bays site on the island because Assateague Island NS does not charge an entrance fee to cyclists. However, it would be important to keep in mind the ability of the Visitor Center's parking to accommodate such users in addition to those visiting the Visitor Center. It may be necessary to consider additional parking or the use of existing parking elsewhere.

In addition, working with the concessioner to install improved storage racks throughout the park or equip rental bicycles with baskets and trailers may make bicycle travel more practical and attractive for many visitors. In the event of an accident, such as a flat tire, or a sudden storm or other weather emergency, the park could work with the concessioner to ensure a vehicle could be employed for pick up of renters.

Table 10
Visitor Center Bicycle Rentals Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	Initially, the impact on vehicular load would probably be modest as only a small portion of visitors would be likely to switch travel modes. It is possible that if parking is constrained or If bicycle access is strongly encouraged, bicycle rentals at the Visitor Center could significantly impact vehicle load on the island.
Travel experience	1	Increasing bicycle access to the park could reduce vehicular congestion and provide a pleasant, safe travel experience for visitors choosing to bicycle. Shelter on the island and an evacuation plan for bicyclists would need to be addressed.
System resilience	1	Bicycle access to the island may be more practical to sustain through storm damage and sea level rise than vehicular access.
Visitor experience	1	Visitors choosing to rent a bicycle at the Visitor Center would be able to take advantage of the park's bicycle facilities, including the non-motorized portion of the Verrazano bridge. In addition, they would not be charged to enter the park.
Resource protection	1	Increasing bicycle arrivals to the park would reduce vehicle-miles traveled and could alleviate some illegal parking. The benefits would be directly related to the number of visitors choosing to rent bicycles.
Partnership opportunities	1	The park would expand its relationship with existing vendors, or develop new relationships with other vendors
Capital cost	Low	Encouraging the development of a satellite bike rental facility at the Visitor Center would have no cost to Assateague Island NS.
Operating & maintenance cost	Low	A small amount of staff time would be needed to manage the concession contract.
Technical complexity	1	Modifying the concession agreement and facilitating bike rentals near the Visitor Center would be straightforward. Sufficient parking, especially in terms of competing with parking for the Visitor Center, would be an important consideration.
Public acceptance	1	Expected to be favorably received by the public.

7. Improve Bicycle Racks, Air Pumps, Bicycle Repair Facilities within the Park (RC)

Simple, uncovered bicycle racks are located at each of the major destinations and parking areas throughout the Maryland District. The racks are functional although some have become slightly buried in sand. Providing additional bicycle facilities and amenities, such as air pumps, shared bike tools, and covered bike racks would improve the visitor experience for visitors on bicycles and may also encourage other visitors to consider bicycling on future trips. Air pumps and shared bike tools could be provided at the ranger station and/or at the rental facility, while the bike racks could replace those already in place throughout the park.

Table 11
Improved Bicycle Facilities Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	Facilities and amenities for bicycles may encourage a few more visitors to travel by bicycle, but is not likely to significantly impact vehicle load on the island.
Travel experience	1	Would enhance travel experience for visitors who bicycle on the island (even those that park on the island, and then bicycle around it).
Transportation system resilience	0	Modest investment in equipment that would be located on the island may be vulnerable to damage.
Visitor experience	1	Better facilities and amenities would improve the recreational experience for cyclists on the island.
Resource protection	0	If properly sited and designed, there should be no adverse impact on the park's resources.
Partnership opportunities	0	A bicycle rental concessioner may be involved, but this would predominantly be an Assateague Island NS effort.
Capital cost	Med	Bike racks cost less than $500. For example, a Rolling Rack Mini, from Dero Bike Rack Co., holds 5-7 bikes and costs $175,[115] or approximately $25-$35 per bike. Covered bike racks range from $1,000 – $15,000 per rack.
Operating & maintenance cost	Low	Maintenance costs are minimal.
Technical complexity	1	It should be simple to install new bike racks and air pumps.
Public acceptance	1	Public response is anticipated to be positive to this concept.

[115] Dero Bike Rack Co, Rolling Rack Mini, http://www.dero.com/products/rolling_rack_mini/rolling_rack_mini.html

8. Support Regional Bicycle Network Development

Assateague Island NS is in a rural area, where transit options are limited and most travel requires a personal vehicle. Development of a regional bicycle network would allow local residents and visitors to explore the area in an active, low impact way. The distance between regional destinations is too great for many casual cyclists (Assateague Island NS is about 8 miles from Ocean City and about 8 miles from Berlin, MD), but is very reasonable for tour and exercise oriented cyclists. The flat terrain and low traffic volumes in the region are conducive to cycling as well.

Bicycling in the area already attracts many cyclists. Over 6,000 cyclists participate in the "Sea Gull Century" ride each fall, which travels to Assateague Island State Park,[116] and was named one of the ten best century rides by Biking Magazine[117] (see Figure 44). Worcester County also advertises a 100-mile cycling route beginning in Berlin and traveling throughout Worcester County called the "Viewtrail 100."[118]

Some recreational cyclists may be intimidated by sharing the road with high-speed traffic without designated bicycle facilities. By advocating for the development of a connected regional network of bicycle facilities, Assateague Island NS may be able to increase its non-motorized visitation. For example, MD 376 east of MD 113 in Berlin has no shoulders or designated bicycle facility for about 1.3 miles. Heading further east toward Assateague Island NS, it has wide shoulders and "share the road" signs. Filling this gap in the network would make it easier for cyclists to travel between Berlin and Assateague Island NS. Other potential bicycle projects that may help connect Assateague Island NS to regional destinations include a separated bicycle facility along Highway 611 and improved bicycle connections as part of the planned replacement of the Ocean City bridge.

Next steps for this element would include participating in bicycle planning and long- and short-term transportation planning efforts in the region. Assateague Island NS and regional partners may be able to advance implementation by developing a coordinated list of priorities. The Lower Eastern Shore Heritage Council, a nonprofit organization dedicated to economic development and conservation in the region,[119] may be able to help coordinate advocacy for development of a bicycle network that highlights regional recreational and historic attractions.

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116 http://www.seagullcentury.org/satridedetails.html

117 Reported on Lower Eastern Shore Heritage Council website. http://www.skipjack.net/le_shore/heritage/

118 http://visitworcester.org/printables/Viewtrail100-2010.pdf

119 http://www.skipjack.net/le_shore/heritage/

Figure 44
Seagull Century Bicycle Route

Source: http://www.seagullcentury.org/docs/SGC_AssateagueCentury_CUE_2010.pdf

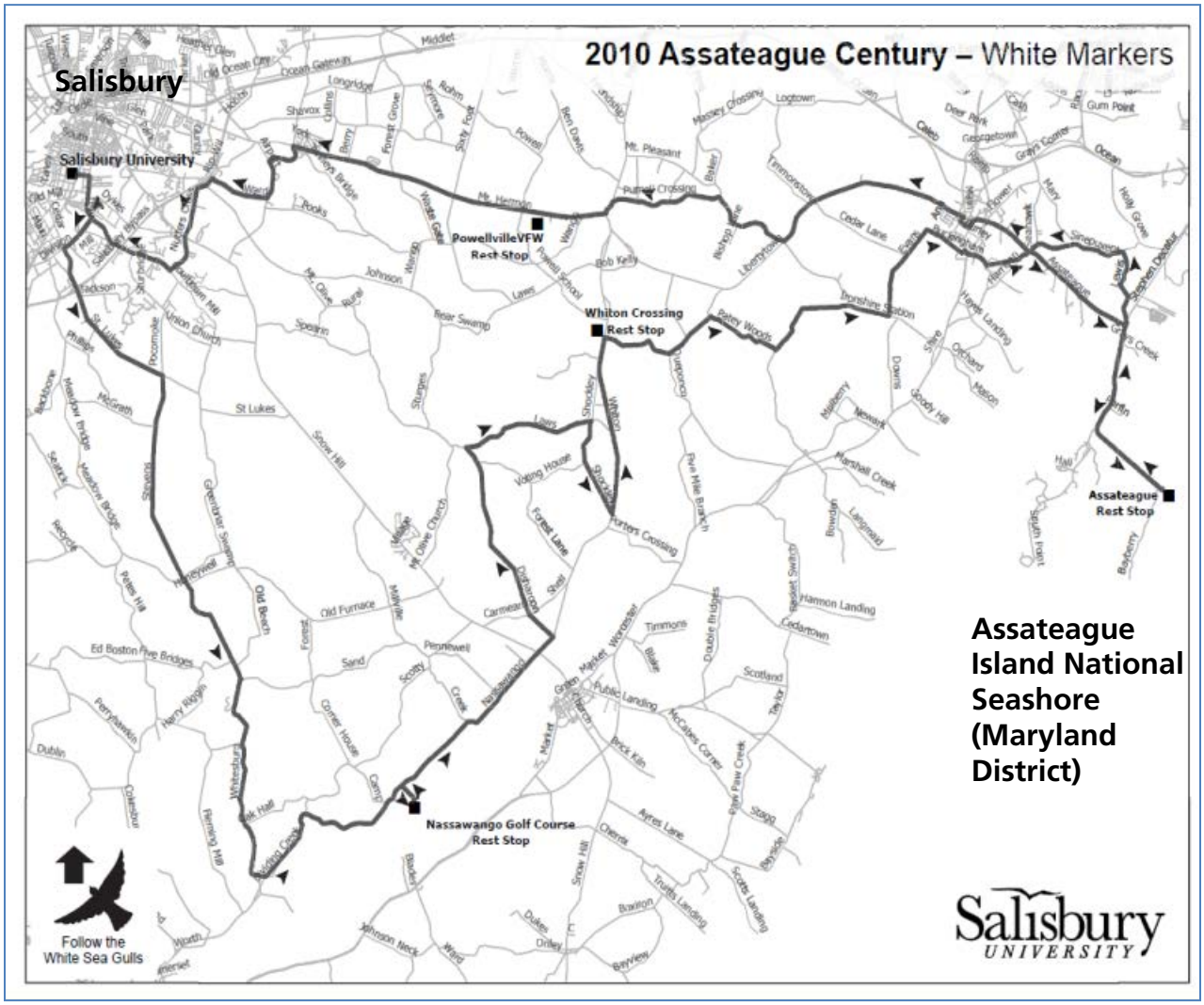


Table 12
Regional Bicycle Network Support Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	A bicycle network would not likely displace a significant number of visitors from personal vehicles to bicycles.
Travel experience	1	The impact on traffic congestion would probably be imperceptible. Developing a continuous cycling network would provide a better travel experience for visitors who choose to bicycle in the area.
Transportation system resilience	0	Providing alternatives to automobile travel is an important element to adapting to climate vulnerability, but a regional bicycle network, by itself, is unlikely to have a significant impact on Assateague Island NS travel patterns or infrastructure needs on the island.
Visitor experience	0	Linking Assateague Island NS to a regional cycling network would enhance recreational opportunities for some visitor, though the enhancements are beyond the boundaries of the park.
Resource protection	0	Assateague Island NS resources would be unaffected by this element. It is possible that more visitors would chose to bike to Assateague Island NS if the regional bicycle network was improved, which could reduce vehicle emissions.
Partnership opportunities	1	Presents many opportunities to partner with regional organizations and attractions.
Capital cost	Low	Planning, design, construction and maintenance costs for this element would be borne by Maryland SHA and local governments.
Operating & maintenance cost	Low	Costs would include staff time to attend planning events.
Technical complexity	0	Bicycle improvements to the surrounding road network are technically feasible. Implementation would be led by SHA.
Public acceptance	0	Response within the bicycle community is expected to be positive. Response outside this community is expected to be ambivalent.

9. Improve Signage at Bayberry Drive Traffic Circle (RC)

Poor signage and a lack of positive guidance at the traffic circle on Bayberry Drive create safety hazards and visitor confusion. Several options and recommendations for reconfiguring the traffic circle and signage are presented in the Traffic Circle Memorandum, attached as Appendix C. Additional recommendations are being prepared as part of the ongoing NPS traffic safety study by CH2M Hill. The sign designs should be consistent with the National Park Service Sign Standards Reference Manual (the UniGuide Sign Program) and Director's Order 52C.120

Additionally, "No Parking" signs in this area should be consolidated. There are currently 30-40 "No Parking" signs in the park, creating visual clutter on the island.

Table 13
Traffic Circle Signage Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	No impact on vehicle load.
Travel experience	1	Appropriate signage would improve traffic flow and pedestrian safety and would reduce confusion and misdirection.
Transportation system resilience	-1	Additional infrastructure in the vulnerable area that may need to be replaced after storm damage.
Visitor experience	0	More signage may interfere with visual experience.
Resource protection	0	Minimal impacts.
Partnership opportunities	0	Design, construction and funding would be managed by Assateague Island NS.
Capital cost	Low	Estimated cost for about 5 new guide signs is about $3,000.
Operating & maintenance cost	Low	Periodically signs need to be replaced.
Technical complexity	1	Technically feasible.
Public acceptance	1	Expected to be well-received by visitors.

[120] See http://www.nps.gov/hfc/products/uniguide.htm#

10. Add Directional and Parking Signage Near Entrance Station

As noted in the Needs Assessment chapter, signage directing visitors to parking immediately after the entrance booths is both inadequate and confusing. Figure 45 indicates areas in need of signage improvements at the north end of Assateague Island NS, based on observations from a study team visit to Assateague Island NS.

Figure 45
Confusing signage spots
Source: Google maps, modified by U.S. DOT Volpe Center project team (July 2009)

Table 14
Improved Signage Near Entrance Station Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	No impact on vehicle load on the island.
Travel experience	1	Improved signage for parking lots would help reduce visitor confusion about parking options. This should reduce congestion near parking lot entrances, reduce the number of visitors who may miss the North Beach parking and thus have to turn around or drive further to the South Beach parking, and, by alerting drivers to the overflow parking lot, would help deter illegal parking.
Transportation system resilience	-1	Additional infrastructure in the vulnerable area may need to be replaced after storm damage.
Visitor experience	0	No impact on recreational or interpretation experience.
Resource protection	1	Directional signage to overflow parking can help prevent illegal parking, which damages natural resources.

Evaluation Criterion	Rating	Comments
Partnership opportunities	0	No partnership opportunities.
Capital cost	Low	Inexpensive. $500 - $1500 to replace three signs.
Operating & maintenance cost	Low	Periodically signs may need to be replaced.
Technical complexity	1	Assateague Island NS has experience installing signage in this area.
Public acceptance	1	Should be well received.

11. Construct Additional Access Points in the North Beach Parking Area (RC)

Assateague Island NS is proceeding with the reconfiguration of the entrance and ranger station consistent with the Preferred Alternative identified in the 2006 Improvements to Island Facilities and Infrastructure Environmental Assessment[121]. Assateague Island NS already reconfigured the North Beach parking lot to retain approximately the same number of spaces by reducing its width orientation, and extending it longitudinally north along Bayberry Drive, as shown in Figure 46 (left image). In the next phase, which is underway, the entrance lanes will be extended to the west with a third lane, the entrance fee booths will be moved, and the ranger station (moved, spring 2012) and associated parking will also be moved (right image). This element consists of adding an exit-only lane and an additional entrance / exit access point as part of the next phase of reconfiguration as shown in the right image.

The new configuration of the entrance will result in the need for visitors to merge within 200 feet south of the entrance fee booths and to make decisions about their destination.

Care should be taken to simplify operations in this area to ensure safety and avoid confusion. An exit-only driveway could be constructed at the north end of the parking lot to facilitate traffic flow. This would reduce the number of vehicles traveling through the busier driveway to the south. The exit-only driveway would need to be signed to clearly alert travelers there is no return to Assateague Island NS without re-entering through the entrance station. In addition, the driveway geometry would need to prevent entering visitors from trying to enter through it to avoid the entrance station queue or fee.

Table 15
North Beach Northern Exit Evaluation

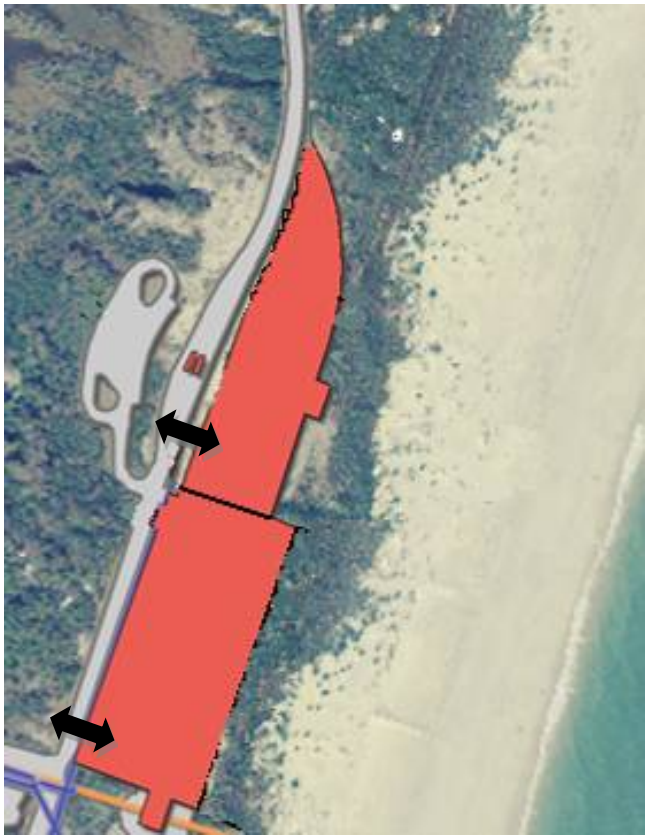
Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	No impact on the vehicle load on the island.
Travel experience	1	May improve travel flow in and around the North Beach parking lot.
Transportation system resilience	0	No impact.
Visitor experience	0	No impact on recreational or interpretive opportunities.
Resource protection	0	No additional impacts.
Partnership opportunities	0	No partnership opportunities.
Capital cost	Med	If constructed as part of the planned reconfiguration of the parking lot, the added cost would be minimal.
Operating & maintenance cost	Low	Additional maintenance cost would be minimal.

[121] ASIS Improvements to Island Facilities Environmental Assessment (February 2006)

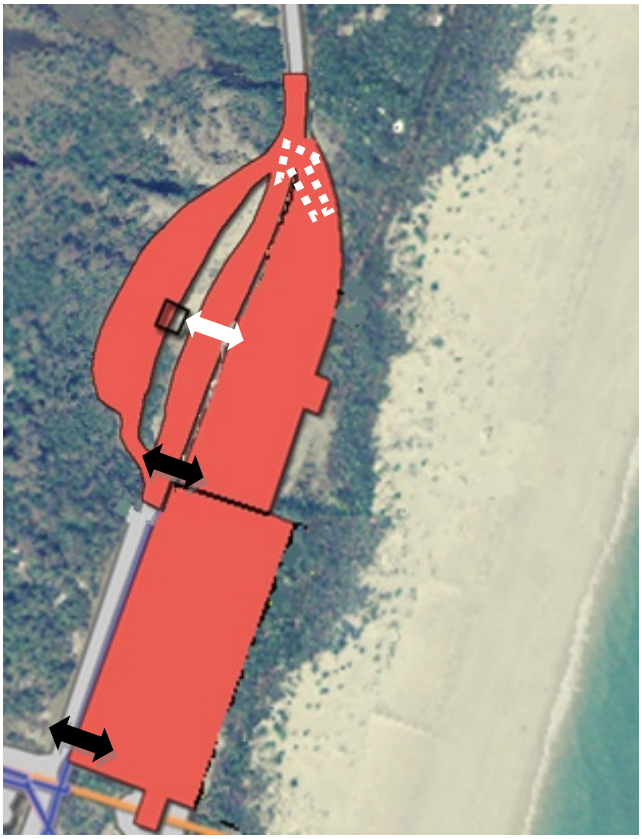
Evaluation Criterion	Rating	Comments
Technical complexity	1	Design to prohibit entering through this driveway and signage to clearly indicate that it is a park exit are technically feasible.
Public acceptance	0	No likely to draw any public reaction.

Figure 46
Reconfiguration of North Beach Parking Lot
Source: Assateague Island NS Improvements to Island Facilities Environmental Assessment image (February 2006) modified by Volpe Center

Current Condition



Planned Reconfiguration with Proposed Access



Red block area indicates parking area; black arrows indicate parking access points; white arrow indicates proposed access; dashed white indicates proposed exit-only.

12. Relocate and Improve Pedestrian Crosswalk Between the MD Boat Launch Facility and the Visitor Center (RC)

The study team identified the lack of a safe crossing on Route 611 from the Visitor Center to the state boat launch parking lot across the street as a potential safety problem. There is a marked crossing at the mainland end of the Verrazano Bridge (see Figure 47), but this is several hundred feet from the vehicular entrance to the boat launch parking area, which is the only access point for vehicles or pedestrians, and there is no sidewalk connecting the crosswalk to the parking area. There is a significant ditch between the road and the state boat launch parking area, which prevents pedestrians from accessing the parking lot closer to the crossing. There is also a slope and high grass along the road, making it an uncomfortable walking area for pedestrians. Relocating this crossing to provide a direct crosswalk between the boat launch parking area and the Visitor Center parking lot is an important safety amenity, particularly if boat launch parking becomes an official overflow parking area for the Visitor Center. Alternatively, a pedestrian path connecting the existing crosswalk and the entrance to the boat launch parking lot would improve pedestrian safety.

Figure 47
MD 611 Near Visitor Center and Boat Launch
Source: Volpe Center, April 2010

There are several pedestrian crossing options that may be appropriate:

- A paint or raised crosswalk
- A signalized, push-button activated pedestrian crossing (such as the PELICAN or HAWK signals used in Tucson, Arizona)[122]
- Advanced pedestrian crossing signs

As Route 611 is a state highway, coordination with Maryland State Highway Authority would be necessary.[123]

[122] City of Tucson, Arizona Pedestrian Traffic Signal Operation: http://dot.tucsonaz.gov/traffic3/tspedestrian.php.

[123] MD SHA's pedestrian and bicycle design guidelines are available online at: http://www.sha.state.md.us/oots/Chapter%2011%20-%20Ped%20Signs%20and%20Signals.pdf.

Table 16
Boat Launch/Visitor Center Pedestrian Crossing Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	The improved crosswalk would not directly reduce vehicle load on the island.
Travel experience	1	Properly designed pedestrian crosswalks improve safety for all travelers. Ensuring adequate advanced warning and sight distance are important to avoid rear-end and pedestrian collisions. The crossing may be a nuisance to drivers, but would be a benefit for pedestrians and would facilitate use of this parking lot for overflow parking.
Transportation system resilience	1	No direct impact, though facilitating use of the boat launch parking area can be part of a strategy to shift vehicular infrastructure from the island to the mainland.
Visitor experience	0	No impact.
Resource protection	0	No impact.
Partnership opportunities	1	Requires coordination with Assateague State Park and SHA.
Capital cost	Low	Some Assateague Island NS staff time would be needed to participate in planning and design of the crosswalk. Design and construction costs would be borne by SHA. Cost for a simple reflective-paint crosswalk is less than $500[124], while cost for a signalized mid-block crossing can be $80,000 to $150,000.[125]
Operating & maintenance cost	Low	SHA would maintain the pedestrian crossing.
Technical complexity	0	Technically feasible. Un-signalized pedestrian crossings can be controversial because of the safety and driver expectancy issues involved. Given that this crosswalk would replace the existing crosswalk a few hundred feet closer to the bridge, it should be acceptable.
Public acceptance	0	Public may dislike the temporary disruption caused by construction, but is expected to support a safer pedestrian crossing.

13. Encourage Rideshare/Carpool Access (FE)

Assateague Island NS could encourage ridesharing and carpooling with little expense, effort or risk by the park. No costs are incurred by the park for this strategy, unless a coordinated discount program is established. The success of such a program for a rural, recreational destination such as Assateague Island NS would probably be minimal, however.

Coordinating with ridesharing organizations, such as "GoLoco" or the Maryland SHA Commuter Assistance Office, would likely be more effective than trying to manage ridesharing internally. It would be important to identify a successful ridesharing organization, as visitors would be disappointed if they are directed by the park to a ridesharing organization that is not able to meet their ridesharing needs.

[124] http://www.walkinginfo.org/engineering/crossings-crosswalks.cfm.

[125] http://www.mtc.ca.gov/planning/bicyclespedestrians/tools/highIntensityActivatedXwalk/index.htm

Table 17
Ridesharing/Carpool Encouragement Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	Encouraging ridesharing can lead to fewer cars entering the park, with minimal effort on behalf of the park, though it is not expected to significantly reduce the vehicle load.
Travel experience	0	The park would not have control over the ridesharing organization and can make no guarantees of safety or efficiency of each visitor's travel experience.
Transportation system resilience	0	It would not reduce the need for any of the permanent infrastructure on the island.
Visitor experience	1	Choosing to share a ride is completely voluntary. A ridesharing program would be viewed as a benefit by some visitors, and not noticed by others.
Resource protection	0	No impact.
Partnership opportunities	1	The park would need to identify a successful ridesharing organization, and provide accurate contact information to visitors.
Capital cost	Low	No costs would be incurred by the park for this strategy.
Operating & maintenance cost	Low	No costs would be incurred by the park for this strategy, unless a coordinated discount program is established.
Technical complexity	1	The park would need to identify ridesharing organizations or ask CHART to coordinate rideshares in Worcester county.
Public acceptance	1	The public would likely support the promotion of a voluntary alternative transportation measure.

14. Facilitate Online OSV Zone Pass Purchases and Reservations (NR)

The OSV Zone is overcrowded at peak times. Assateague Island NS recently installed a new gate and counter system to better track usage (see Appendix D: Osv Zone Access Management Memo). Introducing a reservation system would help to spread OSV arrivals throughout the day, reducing the number arriving at peak times, and would reduce delay and idling within this park. A reservation system for the OSV Zone would be somewhat complicated to implement, as there is no time limit for visitors to remain in the OSV Zone so it would be difficult to predict availability without exceeding the carrying capacity.

A parking or ITS professional should be consulted to develop the reservation system.

The requirements of this system are as follows:

- Visitors and staff should be able to make reservations through the phone or online.
- The system needs to not allow more reservations than the current limit of 145 cars in the zone.
- Some spots should be available on a "first come / first served" basis.
- The entrance gates need to determine who is allowed in the park (based on reservations).
- A time limit must be established for entry on a reservation (how long to hold the reservation).
- The system needs to determine the difference between day use and overnight reservations.

Assateague Island NS uses Reserve America to manage campground reservations. It may be possible to use this system for OSV Zone reservations, however, further consultation with Reserve America is necessary to understand their capabilities.

Table 18
Online OSV Zone Pass Purchase and Reservations Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	A reservation system may help stagger the arrival of OSV Zone users throughout the day, but this would not significantly impact overall vehicle load on the island.
Travel experience	1	Would reduce delay and improve safety within the OSV Zone staging area by reducing the number of waiting vehicles.
Transportation system resilience	0	No significant impact. Reservation system may also serve as an advanced traveler information system that would alert potential visitors to storm-related closures.
Visitor experience	1	Would improve recreational experience for OSV Zone users.
Resource protection	1	Would reduce noise and air pollution associated with idling vehicles waiting to enter the OSV Zone.
Partnership opportunities	0	No associated partnership opportunities.
Capital cost	Unknown	Cost would vary depending on whether the existing Reserve America system could be used.
Operating & maintenance cost	Unknown	Cost would vary depending on whether the existing Reserve America system could be used.
Technical complexity	-1	Technical complexity is not known, but is likely be high due to the necessary technology and software purchase, maintenance, and operation.
Public acceptance	1	According to comments from the GMP process and discussions with park staff, visitors have expressed interest in a reservation system.

15. Reconfigure Bayberry Drive Traffic Circle (NR)

The geometric design of the traffic circle on Bayberry Drive allows motorists to drive too quickly, causes confusion about legal turns and driving direction, enables illegal parking in the center island, and creates safety hazards for motorists and pedestrians. In the last decade, the Federal Highway Administration has supported the construction of roundabouts, in part, because their geometry helps address many of these issues. A roundabout intersection is much smaller than a traffic circle like the one on Bayberry Drive. The tighter geometry of a roundabout helps to slow traffic and provide clear indications of legal maneuvers.

A conceptual drawing of a roundabout reconfiguration of the Bayberry Drive is presented in Appendix C : Assateague Island NS Traffic Circle Wayfinding and Flow Memo. Construction of a roundabout would create traffic and safety benefits, along with improvements to the natural environment from reducing the footprint of the intersection. It would, however, have significant negative construction impacts, and would be a significant infrastructure investment in an area vulnerable to storm damage and overwash.

The park plans to pursue further plans and designs for reconstructing the traffic circle, using permeable materials that would be easier to relocate inland as erosion to the island occurs over time. Construction for the new traffic circle or roundabout can be put on hold until damage to the traffic circle occurs. In the meantime, other solutions to improve the safety of the traffic circle, such as improved signage, can be implemented.

Table 19
Traffic Circle Reconfiguring Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	No impact on vehicle load on the island.
Travel experience	1	Reconfiguring the intersection would improve the safety and efficiency of traffic flow, and wayfinding.
Transportation system resilience	-1	Investing in infrastructure on the island may not be a wise strategy given the vulnerability to sea level rise and storm overwash.
Visitor experience	0	No Impact.
Resource protection	0	Reducing the footprint of the intersection by about half would allow reuse of land for restoration. The positive impacts would be offset by negative impacts during construction.
Partnership opportunities	0	No partnership opportunities.
Capital cost	High	Reconfiguring the intersection could cost $200,000 to $500,000.
Operating & maintenance cost	Low	O/M costs would be similar to the existing intersection.
Technical complexity	0	Technically feasible. Consultant and contractor assistance would be needed to design and construct the intersection.
Public acceptance	0	Visitors would be inconvenienced during construction, but would probably support the project.

16. Increase Entrance Station Capacity (NR)

Existing entrance lanes will be extended and a third entrance lane will be added to the Assateague Island NS Maryland District entrance in 2013 (proposed). The additional capacity will help reduce delay approaching the entrance station at peak times. It is possible that upgrading the point-of-sale system, credit card processing system, and/or deploying additional staff to "work the line" and answer questions and help speed transactions at the entrance station could increase the processing capacity of the Assateague Island NS entrance.

Because demand for Assateague Island NS beach parking exceeds capacity frequently during the peak season, resolving the entrance station bottleneck will not solve the transportation delay problems. Increasing the rate at which vehicles enter the park will further stress the parking, leading to more vehicles circling while they search for parking, and may lead to undesirable or unsafe traffic conditions within the park. It may also increase illegal parking. The left turn after the entrance station into the North Beach parking lot may become particularly problematic if the rate of entry into the park is increased substantially.

Table 20
Increased Entrance Station Capacity Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	-1	Increasing entrance station capacity may increase vehicle load on the island.
Travel experience	-1	While increasing entrance station capacity would reduce delay approaching the entrance station, it could cause traffic congestion and safety issues within the park.
Transportation system resilience	-1	Equipment would be vulnerable to damage.
Visitor experience	0	Increasing entrance station capacity would increase crowding in the park, though this may not exceed the park's carrying capacity.
Resource protection	0	While increasing capacity may reduce emissions and noise approaching the park, it may increase emissions, noise, and illegal parking within the park.
Partnership opportunities	0	No partnership opportunities
Capital cost	Unknown	Costs would vary depending on the technologies and equipment used to increase capacity.
Operating & maintenance cost	Unknown	Costs would vary depending on the technologies and equipment used to increase capacity.
Technical complexity	0	Feasible to increase capacity, though complexity would depend on selected technologies and equipment.
Public acceptance	0	May be viewed as an improvement by the public, but may increase pressure for additional parking on the island.

17. Institute an Automated Parking System (NR)

An automated parking fee system could reduce or eliminate the need for fee booths by separating visitor facilities and fee collection. Assateague Island NS charges visitors entrance fees on a per-vehicle, not per-visitor, basis, thus from a revenue standpoint it would be simple to charge for parking rather than entry. Pine Island Park and Rogers Island Park in Florida recently approved a similar switch from staffed gatekeepers to automated parking meters this year as a cost savings measure.[i] The automated parking system would also allow visitors to verify payment in the case of long-term pass holders. It would provide proof of payment that visitors may leave in their cars.

Though the staffed entrance station provides a greeting function as part of the fee collection process, park staff would be able to welcome and assist visitors in other ways, such as staffing a remote information center, or holding a stronger presence on the beach. Some staff would continue to be employed to monitor cars, direct traffic and provide information to visitors. Automated fee collection could be used throughout the day, or only at off- peak times when staff time at entrance gates is underutilized. Park staff currently work in the entrance booths from 6:00 AM to 10:00 PM.

Table 21
Automated Parking System Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	-1	Would eliminate the metering function that the entrance station currently provides allowing more vehicles onto the island.
Travel experience	-1	An automated parking fee system that eliminates fee booths could relieve traffic congestion at the entrance to the park, because there is not adequate parking to meet demand, congestion within the park would result.
Transportation system resilience	-1	The equipment would be vulnerable to damage or destruction by storms.
Visitor experience	-1	Visitors would no longer be greeted by park staff, who are able to answer questions, however, such interaction would be provided elsewhere.
Resource protection	0	An automated parking system would have minimal impact on Assateague Island NS resources. It could shift vehicular noise and emissions impacts from outside the entrance station to inside it.
Partnership opportunities	0	None.
Capital cost	High	"Pay and Display" parking meters, which serve about 50 spaces each, cost approximately $15,000- $25,000 each126. Parking management software to support accounting for various pass types, ticket/fine payment would cost approximately $18,000-$25,000.[127]
Operating & maintenance cost	Med	Operating costs are approximately $75 per month per meter, and meters would likely need to be replaced in 10 years.[128] Machines would require periodic cleaning from sand and other elements. These costs would be partially offset by reduced costs for staffed fee collection, though some staff time would be required for monitoring and maintenance of the machines.
Technical complexity	0	Installing an automated parking management system is technically feasible. There are many available models for meters, some are solar powered.
Public acceptance	0	Public response would depend largely on the reliability and user-friendliness of the system. The system would be intuitive for visitors to use.

[126] "Pay and display parking stations costing approximately $15,000 each are recommended for the City of Bellingham, Washington" RITA. http://www.itscosts.its.dot.gov/its/benecost.nsf/o/228CAF6FAB8F52B98525732400472018?OpenDocument&Query=Home

[127] Conversation with Pat Fagan, Director Parks & Recreation of Hernando County, Florida, July 16, 2010.

[128] Phone communication with Ryan Bonardi, Cale Parking Systems (July 27, 2010).

18. Use Congestion Pricing to Shift Demand to Off-Peak Times (NR)

Peak pricing, or congestion pricing, is a market-based user fee strategy in which higher fees are charged at peak times (either times of day, or specific days – i.e. higher rates on weekends and holidays), and reduced fees are charged at off-peak times. Peak pricing would help distribute Assateague Island NS travel demand more evenly, allowing Assateague Island NS to accommodate the same total visitation while mitigating congestion issues at peak times. Peak pricing may be applied to all park admission, to overnight campers, to OSV visitors, or to any other subset of visitation. A differential fee structure could be implemented to be revenue neutral.

Peak pricing is used in many industries to help distribute demand more evenly. A familiar example of peak pricing is reduced prices for matinee movies as compared to evening show times. The same concept is used extensively in the airline industry, and is becoming more common in transit (eg. Washington D.C. Metro), toll roads (eg. Maryland Inter-County Connector), and parking garages.

Congestion pricing in National Parks has not yet been tested, though it is not a new concept to parks. According to the report, *Securing the Future of Washington's State Parks Market-Based User Fees and Privatization Can Solve Budget Strains*, market-based user fees would allow parks to charge higher admission during peak periods, leading to an overall increase in revenue collection and a decrease in congestion at peak periods.

It is unknown how the public would react to this strategy; however, linking any fee increases to park improvements may increase public acceptance. While peak pricing may help reduce cars during times of heavy congestion, Assateague Island NS would risk a negative public reaction.

Table 22
Congestion Pricing Evaluation

Evaluation criterion	Rating	Comments
Vehicle load on the island	1	This strategy could reduce the number of vehicles in the park at peak times.
Travel experience	1	Shifting some visitors from peak periods to less crowded periods would reduce illegal parking and idling.
Transportation system resilience	0	It would not reduce the need for any of the permanent infrastructure on the island.
Visitor experience	0	Visitors may not respond well to price discrimination on different days or at different times of the day. This may detract from the concept of the park as a national resource.
Resource protection	1	If peak pricing reduces traffic at peak periods, there would be less idling and less illegal parking, which would have a positive impact on natural, cultural and historic resources.
Partnership opportunities	0	There are no partnership opportunities.
Capital cost	Med	Costs would be limited to updating signage and price messages.
Operating & maintenance cost	Med	Fees would need to be monitored and managed to maintain desired results.
Technical complexity	0	This strategy would be easy to implement.
Public acceptance	Unknown	Peak pricing is a new concept for parks. It is unknown how the public would react to this strategy, however, linking any fee increases to park improvements may increase public acceptance.

19. Build Combined Assateague Island NS and Assateague State Park Entrance Station on the Mainland (FE)

Assateague Island NS has looked at the long-term effects of sea level rise and changing weather and erosion patterns on the island. The results indicate the need at some future date to relocate parking and/or the collection facilities to the mainland. Because of physical constraints and the existing roadway configuration at the most appropriate mainland location, it is evident that Assateague Island NS and Assateague State Park would need to share this facility. Appendix E: Entrance Station Relocation and Management identifies the considerations that Assateague Island NS would need to address in order to make this arrangement operationally workable, mutually beneficial, and optimal from the standpoint of visitor experience.

Table 23
Combined Entrance Station on Mainland Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	A combined entrance station would not have any impact on vehicle load on the island (unless intentionally designed with lower capacity than the existing entrance stations).
Travel experience	0	The travel delay and congestion at a combined entrance station would depend on the number of entrance lanes, the types of passes offered, and the extent of orientation provided.
Transportation system resilience	1	Moving the entrance station to the mainland is considered a long-term necessity because of vulnerability to storm damage and sea level rise of the existing entrance station.
Visitor experience	0	The location of the entrance station would not directly impact recreational or interpretive opportunities.
Resource protection	1	Moving the entrance station would shift noise and emissions associated with the vehicle queue off of the island.
Partnership opportunities	1	A combined entrance station would require a new level of partnership between Assateague State Park and Assateague Island NS.
Capital cost	High	Cost to construct a new shared facility would be substantial.
Operating & maintenance cost	Low	Operating and maintenance expenses would be comparable to the current situation. It is possible that there would be some cost savings associated with a shared facility.
Technical Complexity	-1	As described in Appendix D, there are several complex permitting and coordination issues to resolve.
Public Acceptance	0	The public would not likely have a preference regarding the location of the entrance station.

20. Institute Reciprocal Fees with Assateague State Park (FE)

While a combined facility may continue to administer two different fee structures for the state and NPS areas of the island, this may be confusing to visitors and difficult to manage and enforce. A shared entrance facility may be more successful if combined with a shared fee. Instituting a shared fee structure would be challenging, and is an important issue to begin discussing with Maryland Department of Natural Resources staff. Appendix E: Entrance Station Relocation and Management describes some key considerations related to sharing fees.

Table 24
Reciprocal Fees with Assateague State Park Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	0	No impact on vehicle load on the island.
Travel experience	1	Possibly reduced delay and confusion associated with simplifying fee options.
System resilience	0	No impact to Island infrastructure.
Visitor experience	0	Offers seamless visitor experience of the island, but reduces the ability to offer different interpretive experiences.
Resource protection	0	Park staff would need to coordinate on resource protection issues and carrying capacity.
Partnership opportunities	1	A reciprocal fee agreement would require a new level of partnership between Assateague State Park and Assateague Island NS.
Capital cost	Unknown	May require new revenue management software.
Operating & maintenance cost	Unknown	Some staff time may be required to manage revenue sharing.
Technical complexity	-1	May be difficult to reach agreement on fee model and revenue sharing. It would be challenging to determine if or how to honor NPS or state park passes, such as the Maryland Park Service Passport or the National Parks and Federal Recreational Lands Pass.
Public acceptance	1	The public is expected to support a simplified, seamless fee structure.

21. Develop Policy to Temporarily Close the Park to Entering Traffic when Parking is Full (FE)

A new management policy at Assateague Island NS may be to temporarily close the park entrance to private automobiles when parking lots are full, or when illegal parking begins occurring. Because different parking lots within Assateague Island NS are not in equal demand – bayside parking rarely fills, even when beach parking is severely overcrowded – waiting until all parking is full would not be effective. It would probably be more appropriate to use such a policy when the beachside parking fills. The policy could either use one-in/one-out management or could completely close the entrance for a fixed period of time (for example, one hour). Some visitors could be exempt, such as disabled visitors, seniors, OSV users, and/or visitors with overnight reservations.

The policy may be complicated to implement at Assateague Island NS where there are multiple parking lots, and the bayside parking lots rarely reach capacity. Determining appropriate trigger points for closing and re-opening, deciding which visitors would be exempt and how visitors denied entry should be directed, and establishing reliable communication to park staff and visitors would be required. Some monitoring of parking conditions would be needed. There may also be some lost revenue associated with deterring potential visitors.

Implemented alone, this policy basically shifts the transportation problems from inside the park to the outside of the entry gates, without really improving conditions, although it may encourage more visitors to park off-site and bike to the island. The policy would be more effective if coordinated with improved alternative transportation options and used to encourage visitors to shift travel mode. It would not reduce the need for any of the permanent infrastructure on the island.

Table 25
Temporary Closure of Assateague Island NS when Parking is Full Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	1	This policy would limit the number of vehicles permitted beyond the entrance station.
Travel experience	0	Reducing the number of vehicles circling the island looking for parking and further relieving illegal parking would improve travel safety and efficiency. However, this could worsen travel conditions outside of the park entrance.
Transportation system resilience	-1	It would not reduce the need for any of the permanent infrastructure on the island. New equipment could be added to manage the number of vehicles on the island, which would be in a high risk area.
Visitor experience	0	Denying or delaying entry to some visitors would negatively impact their experience. However, this would facilitate a more serene experience once inside the park.
Resource protection	0	Reducing traffic congestion and illegal parking within the park would have positive impacts. Yet, increased idling and travel outside the park entry could increase air and noise pollution.
Partnership opportunities	0	This policy would not create partnership opportunities.
Capital cost	Unknown	Some monitoring of parking conditions would be needed. This could be accomplished through a system of vehicle counters or through staff monitoring.
Operating & maintenance cost	Unknown	There may also be some opportunity cost associated with deterring potential visitors.
Technical complexity	0	Determining appropriate trigger points for closing and re-opening, deciding which visitors would be exempt and how visitors denied entry should be directed, and establishing reliable communication to park staff and visitors would be required.
Public acceptance	-1	Assateague Island NS visitors may not support this policy, as many travel from far away to visit the park. While Assateague State Park currently has a similar policy, visitors denied entry there may instead go to Assateague Island NS. If both parks denied entry the visitor reaction may be more negative. Some visitors may support this policy because it would reduce crowding in the park.

22. Provide Additional Parking on the Mainland (FE)

There are 104 parking spaces available at the Barrier Island Visitor Center, plus eight bus/RV parking spaces, and approximately 60 boat trailer parking spaces (able to accommodate approximately 120 small vehicles) in the state boat launch parking lot. Because Assateague Island NS is located in a fairly rural area where alternative transportation options are limited, the vast majority of visitors are likely to continue to arrive by personal vehicle. Additional remote parking on the mainland would be needed provide an alternative location to store vehicles in order to reduce the number of vehicles on the island. Assateague Island NS is currently considering options for its former Visitor Center and existing maintenance and office space as well as considering the need for future mainland infrastructure in its GMP process.

Table 26
Additional Mainland Parking Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	1	Because Assateague Island NS is located in a rural, auto-oriented area, providing additional parking on the mainland would be essential to significantly reduce the number of vehicles on the island. Parking on the mainland would only have an impact on the number of vehicles on the island if it is coupled with alternative transportation connections.
Travel experience	1	As noted above, mainland parking is essential to facilitating alternative transportation and resolving the congestion issues on the island.
Transportation system resilience	1	Satellite parking on the mainland is an essential component of the long-term transition away from dependence on parking on the island.
Visitor experience	0	Satellite parking would change the way visitors access the island but as long as that access is convenient, there should be minimum negative impacts and there may be opportunities for additional interpretation.
Resource protection	1	Satellite parking would help reduce illegal parking on the island (if coupled with alternative transportation mode connections).
Partnership opportunities	0	No new partnership opportunities.
Capital cost	Unknown	Cost could vary significantly depending on whether there are existing parking facilities that could be used by Assateague Island NS at peak times or whether new parking had to be constructed.
Operating & maintenance cost	Unknown	See above.
Technical complexity	Unknown	See above.
Public acceptance	0	The public is not expected to favor or oppose satellite parking in itself, as long as important or sensitive resources are not damaged on the mainland. Acceptance of transit shuttle access would depend on the characteristics and quality of the service provided.

23. Provide Shuttle Service to/from Mainland Parking (FE)

A shuttle to take visitors from the mainland parking lot to Assateague Island NS would encourage more visitors to park on the mainland, reducing vehicle load on the islands. Transit provides an opportunity to maintain visitor use of the island if/when roads, parking and other permanent infrastructure on the island are damaged or lost. Although a complex and costly process, establishing a parking shuttle would provide options for park access and reduce the number of cars entering the park. Parking shuttle options are discussed in detail in the Transit Feasibility Assessment chapter.

Table 27
Parking Shuttle Bus Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	1	A parking shuttle bus would reduce the vehicle load on the island.
Travel experience	1	Reducing the number of vehicles circling the island looking for parking and further relieving illegal parking would improve travel safety and efficiency.
System resilience	1	A parking shuttle would help sustain visitor access to Assateague Island NS in the event that parking is damaged or reduced.
Visitor experience	1	Shuttle service would provide an opportunity for an interpretive orientation. Additional visitors may result in overcrowding although additional visitation is expected to be minimal.
Resource protection	Unknown	Reducing traffic congestion and illegal parking within the park would have positive impacts. Idling of shuttle vehicles during stops could increase air and noise pollution. Shuttle service could increase visitation since it would not be limited by parking capacity and this could have negative impacts on resources.
Partnership opportunities	1	Possible partnerships with concessioner.
Capital cost	Unknown	Providing shuttle service is fairly expensive. Costs for various options are described in the Transit Feasibility Assessment.
Operating & maintenance cost	Unknown	Providing shuttle service is fairly expensive. Costs for various options are described in the Transit Feasibility Assessment.
Technical complexity	0	Determining routes, stop location and frequency are necessary to establish a shuttle system.
Public acceptance	Unknown	Public acceptance depends on the quality of service provided and whether shuttle use is voluntary or mandatory.

24. Provide Shuttle Service to/from Regional Destinations (FE)

The park can establish (through partnerships) a more complex regional system with connections to nearby towns such as Ocean City or Berlin. Regional shuttle options are discussed in detail in the Transit Feasibility Assessment chapter.

Table 28
Regional Shuttle Bus Service Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	1	A parking shuttle bus would reduce the vehicle load on the island.
Travel experience	1	Reducing the number of vehicles circling the island looking for parking and further relieving illegal parking would improve travel safety and efficiency.
Transportation system resilience	1	A transit network would help sustain visitor access to Assateague Island NS in the event that parking is damaged or reduced.
Visitor experience	1	Shuttle service may provide an opportunity for an interpretive orientation. Additional visitors may result in overcrowding although additional visitation is expected to be minimal.

Evaluation Criterion	Rating	Comments
Resource protection	Unknown	Reducing traffic congestion and illegal parking within the park would have positive impacts. Idling of shuttle vehicles during stops could increase air and noise pollution. Shuttle service could increase visitation since it would not be limited by parking capacity and this could have negative impacts on resources.
Partnership opportunities	1	The park could partner with established transit operators, such as Castaways Campground or Shore Transit.
Capital cost	Unknown	Providing transit is fairly expensive. Costs for various options are described in the Transit Feasibilty Assessment.
Operating & maintenance cost	Unknown	Providing transit is fairly expensive. Costs for various options are described in the Transit Feasibility Assessment.
Technical complexity	0	Coordination with potential partners to determining routes, stop location, frequency and cost sharing are necessary to establish a transit system.
Public acceptance	Unknown	Public acceptance depends on the quality of service provided and whether transit use is voluntary or mandatory.

25. Provide Water-based Transit (FE)

Public water-based transit may be a part of the long term solution to offer transportation alternatives and reduce vehicle traffic in the park. An in-depth study of water-based transportation options is beyond the scope of this study.

The first step for investigating this element would be to conduct a feasibility study that would identify and assess potential gateway and destination landings, route feasibility and limitations, and market potential. The second step would be the development of one or more service plans identifying schedule, seasonality of service, boat type(s), amenities, and crew requirements. The outcomes might include water taxi and ferry services, either local or regional (other Eastern Shore destinations) in scope. The analysis would include calculation of comprehensive annual operating costs and "break even" revenue analysis yielding the minimum ridership requirement.

Assateague Island NS has committed to maintaining surface transportation on the island as long as allowed by the physical conditions of the island, which may mean relocating infrastructure to the western portion of the island. Depending on the condition of the island, and the condition of the transportation infrastructure, water-based transit may be the only appropriate means of travel to the island. While water-based transit is not recommended at this time, it may be necessary in the future and should be re-evaluated at a later date.

Table 29
Water-Based Transit Evaluation

Evaluation Criterion	Rating	Comments
Vehicle load on the island	1	Facilitating water-based access to the island may reduce vehicle load on the island.
Travel safety and efficiency	1	Properly designed service would reduce congestion and delay, especially during peak times.
Transportation system resilience	1	Boat(s) can assist evacuation and carry supplies and personnel in case the roads are compromised or unavailable for use.
Visitor experience	1	Approaching Assateague Island NS over the water would provide a multi-faceted opportunity for interpretation, and a beautiful ride.

Evaluation Criterion	Rating	Comments
Resource protection	Unknown	No existing marine facilities in Assateague Island NS so some impact is likely for new dock infrastructure on bay side of Assateague Island NS, with good access to the beach and other park sites. Increased boat use in bay.
Partnership opportunities	1	New partnerships with boat operators, gateway landing owners, and others.
Capital cost	Unknown	Capital cost for NPS depends on infrastructure needs and whether boat would be contractor or Government owned. Likely need for costly new infrastructure (not possible to estimate cost at this time) A water-based transit feasibility study itself would be $75-100K.
Operating & maintenance cost	High	O/M costs would be high, whether contractor or Government operated and would be mitigated to an unknown extent by passenger revenues, to be determined.
Technical complexity	-1	Passenger boat service would probably require new or improved landing infrastructure, environmental impact assessment, purchase and operation of one or more boats, and either new NPS personnel, a new concession contract, or a new commercial use permit.
Public acceptance	1	Passenger service could be phased to fit public familiarity and acceptance.

Conclusion

This chapter describes the relevance of each identified transportation element to the primary transportation needs and program requirements of Assateague Island NS, develops and applies evaluation criteria for an initial assessment of those elements, and recommends which elements should be pursued, not pursued, or further evaluated. In addition, this chapter provides baseline information on more complex elements that are considered further in appendices and, in the case of transit, in the next chapter. The final chapter will present future phases and when different elements should be pursued.

The elements evaluation included how each of the Assateague Island NS transportation objectives can be achieved, while also maintaining or improving the NPS programmatic objectives. The findings related to each of the three transportation objectives are discussed below.

Four elements for future evaluation were identified with significant potential to reduce vehicle load on the island. They are:

- Develop a policy to temporarily close the park when beach parking is full.
- Provide parking shuttle bus service.
- Provide regional shuttle bus service.
- Provide water-based transit.

Each of these elements requires significant additional investigation. The first two elements are management decisions that will be considered in the final chapter that discusses implementation. The two shuttle bus service elements will be further investigated in the next chapter and associated appendices. In depth study of water-based transit is beyond the scope of this study, but it is recommended that Assateague Island NS conduct a water-based transit feasibility study to fully consider the possibilities and benefits of this element.

The analysis identified many favorable elements with potential to improve the travel experience for all modes, including:

- Develop a Traveler Information System

- Revise Emergency and Hurricane Plans and Take Actions to Better Accommodate Bicyclists and Transit Riders
- Improve the Park Map
- Construct Wildlife Viewing Pull-Over Areas
- Offer bicycle rentals at the Visitor Center
- Support Regional Bicycle Network Development
- Improve Signage at Bayberry Drive Traffic Circle
- Improve Signage near North Beach parking area
- Construct an Exit at the North End of the North Beach Parking Lot
- Relocate and Improve Crosswalk between MD Boat Launch Facility and Visitor Center

Most of the elements listed above have the potential to increase resiliency to storm damage and sea level rise by increasing access options and improving information but the elements on shuttle and water-based transit would have the most significant contribution to resiliency.

5. Transit Feasibility Assessment

The purpose of this chapter is to present the results of a transit feasibility assessment for Elements 23 (Provide parking shuttle bus service) and 24 (Provide regional shuttle bus service) described in Chapter 4 (Analysis and Assessment of Transportation Elements). To improve access within and to Assateague Island NS, transit should be considered in conjunction with the other alternative transportation strategies described in Chapter 4. Transit has the potential to address many of the transportation issues identified in Chapter 3 (Needs Assessment). Transit also has the potential to provide interpretive services to Assateague Island NS visitors.

Transit may ease automobile congestion within the park—both present and future—and accommodate additional demand for access to the park. In the event that storms or sea level rise result in the loss of parking or vehicular infrastructure on the island, transit may become essential for carrying visitors to the island. Loss of parking on the island due to storm damage or sea level rise is likely to occur at some point in the future, though the timeline for such loss is difficult to predict. In addition, vehicular access to the island may be restricted either temporarily or permanently if roadway infrastructure is damaged or lost. Reductions in vehicular access or parking on the island would increase the need for transit unless visitation was also restricted. The ongoing General Management Plan (GMP) process will help determine how Assateague Island NS will manage such losses and whether lost infrastructure will be replaced. If vehicular access to the island is lost, land-based transit would need to be replaced, or at least combined with, water-based transit. Water-based transit is outside the scope of this study; however, the demand and service characteristics of the land-based routes may be applicable to consideration of water-based transit.

This chapter consists of a section on the methodology used to conduct the transit assessment, a summary of an initial transit assessment of nine options, including five parking shuttle options and four regional shuttle options, and a transit business plan for the recommended option. A full description of each of these options is included in Appendices G and H. Because provision of transit services is a costly undertaking, requiring a significant investment of funds and staff time, it must be carefully analyzed prior to implementation. Transit planning is often an iterative process in which the most desirable service plan emerges as multiple possibilities are explored and refined. In order to evaluate and compare transit options, the staff of Assateague Island NS should weigh the benefits and costs of each and determine which, if any, best serve the interests of the park and its users.

Methodology

This section describes the assumptions made and methodology used in assessing the options 1-9 listed above for cost and demand. This section also includes a discussion of how transit options are assessed based on park goals for a transportation system: visitor experience, traffic efficiency, resource protection, and adaptation to storm and climate vulnerability. The initial transit assessment only assesses the options qualitatively for these impacts, while the transit business plan provides a more quantitative assessment.

Cost

The total cost of transit includes capital and operating costs. This analysis assumes that vehicles would be leased and contracted for service rather than operated by Assateague Island NS directly. The staffing expertise, access to maintenance facilities, and other infrastructural and organizational advantages of a lease and concession contract offer some cost-efficiencies and more flexibility to adjust service levels on demand and offer limited seasonal service.

The number of vehicles is the primary driver of transit costs. The service requires enough vehicles to accommodate peak load without exceeding funding limitations. Further analysis was performed for the recommended option in the transit business plan to find a balance between service levels and funding, which may result in visitors having to wait for the next bus. The number of vehicles operating at various times during the season is adjusted based on forecast demand. For example, for some transit options, fewer buses are needed during the week than on weekends. The analysis for all routes assumes a 45-passenger bus with standard features and amenities. A variety of vehicle types exists and several others may be appropriate for Assateague Island NS transit service. Other vehicle options and capacities are considered in the transit business plan for Option #2.

The cost of leasing and operating vehicles is calculated based on the number of vehicles required, the number of days of service, and the number of vehicle operating hours. According to standard U.S. General Services Administration (GSA) lease rates, the park would pay a monthly lease for each vehicle, based on cost per vehicle-day and cost per hour,[129] along with an operating cost per hour.[130]

GSA leases are not the only option for the park, which could also purchase and operate the vehicles in-house, purchase the vehicles and then lease operators, or lease vehicles from a local provider with potentially lower costs and more flexibility than a GSA lease. The GSA lease is used here as a base from which to easily compare costs between bus options. Operations, maintenance, and capital costs are refined and detailed further in the transit business plan for Option #2.

Estimating Transit Demand

Estimating ridership for each route is necessary for determining both benefits and costs. This analysis uses two steps to estimating demand for Assateague Island NS transit options:

1. Determine how many people visit the park and when they arrive and depart.

[129] 2010 GSA vehicle lease rates for full size school and cutaway buses, which include all maintenance and fuel expenses, range from $675 to $1,212 per month plus $0.42 to $0.58 per mile. $900 per month plus $0.50 per mile are assumed as reasonable rates for this analysis. An average of 12 miles per hour is assumed to translate the mileage cost into an approximate hourly cost of $6 per vehicle-hour.

[130] Federal Transit Administration, Technical Assistance Committee (FTA-TAC) Financial Sustainability Presentation reported operating costs ranging from $34 to $80 per vehicle-hour for federal land transit systems, July 2010.

2. Estimate the proportion of visitors who would use a particular transit option.

Multiplying these answers together produces an estimate of the demand for transit that can be used to develop an appropriate service plan and then to estimate the costs and benefits of the transit option.

Estimating use of a future transportation service—particularly one in an environment that has previously had only limited alternative transportation—is a challenging and inexact process, as there are many potential variables that can influence the proportion of potential riders who choose transit, also referred to as the capture rate. As noted below for the second step in estimating demand, a range of additional incentives and service attributes could increase transit ridership.

There are several challenges to developing such a forecast for Assateague Island NS, including: (1) a lack of visitor survey data to indicate transportation preferences, (2) a lack of data to differentiate the activity patterns of overnight and day-use visitors, (3) a lack of established techniques for understanding the demand for transportation services in recreational settings, and (4) the general inapplicability of standard home- to- work commuting models to National Park Service shuttle routes. As a result, the development of a demand forecast relies on available data and, when necessary, reasonable assumptions based on professional judgment. For the purposes of this feasibility analysis, each transit option is assumed to be a shuttle service running continuously throughout the day with fares low enough not to significantly reduce the capture rate. Specific considerations about the recommended vehicle type, amenities, fare, funding, and management policies and related changes in assumptions will be addressed in the section on the transit business plan for Option #2.

Step 1: Determine Current Patterns of Visitation

This analysis assumes that the transit options would not noticeably change visitation patterns. This means that transit would neither attract additional visitors nor would it deter current visitors. Much like increasing entrance fees, instituting a transit system could cause some would-be visitors to change their travel plans and choose another destination. Several other national parks, such as Cape Cod National Seashore, Point Reyes National Seashore, Harpers Ferry National Historic Park, and Devils Postpile National Monument have instituted mandatory transit systems without noticeably impacting visitation. Generally visitors have reported satisfaction with these systems and often appreciate benefits such as reduced congestion, noise, and the ability to relax and observe the scenery on the ride. This section documents the data used and assumptions made to deduce how many people visit the park by month, day and hour.

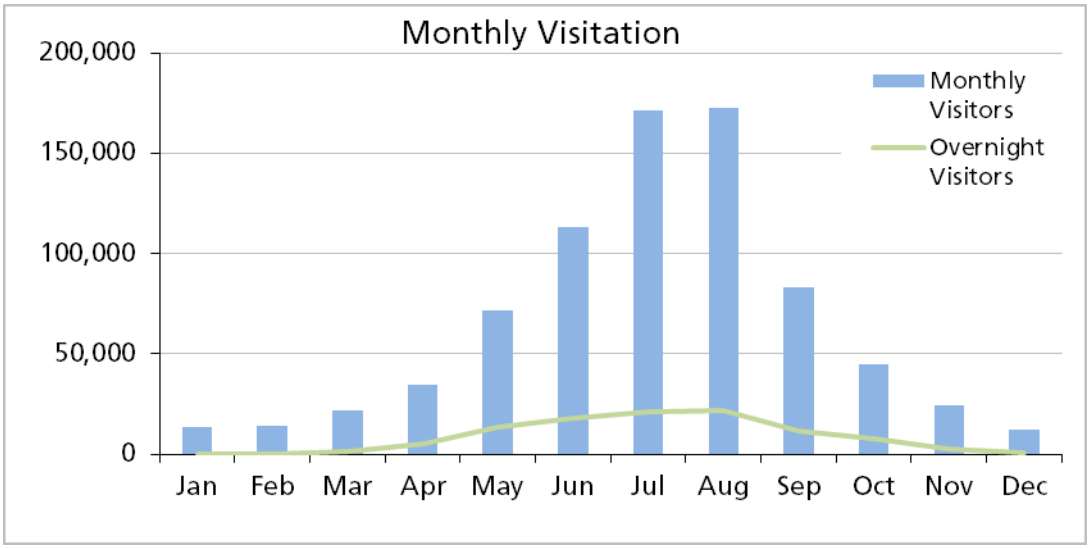
This analysis includes visitation to Assateague State Park for the regional transit options but not the parking shuttle options. Combining transit service to Assateague Island NS and Assateague State Park could reduce the average cost of transit service per passenger, increase the environmental benefits of transit service, and provide visitor flexibility. However, Assateague State Park currently relies on parking availability to limit its visitation to a level that can be accommodated by its sewer capacity. In addition, a joint transit service also raises many questions about coordination between the two parks and the desire to provide either distinct or seamless visitor experiences. Assateague State Park currently manages parking and visitation by closing its entrance when parking is full, while Assateague Island NS allows visitors to enter regardless of parking availability. Assateague State Park does admit the private campground shuttles when parking is full, but these carry a small number of visitors compared to a shuttle open to all visitors.

For this analysis, it was assumed that the Assateague State Park policies would not change due to the concerns about carrying capacity, so that transit riders would only be admitted to Assateague State Park when parking was not full, a situation in which visitors would most likely choose to drive rather than take transit. Based on this distinction, it was assumed that Assateague State Park would not be interested in participating in any of the parking shuttle options. The regional transit options, on the other hand,

provide opportunities for car-free access to the parks without significantly increasing peak visitation. Assateague State Park currently offers a reduced entry fee for visitors arriving on two private campground shuttles, demonstrating its support for these types of shuttles. This analysis assumes that the regional shuttle options would serve both Assateague State Park and Assateague Island NS. Future planning is needed to further investigate how and why visitors choose between Assateague Island NS and Assateague State Park and how fees could be coordinated. For this analysis, no changes to Assateague Island NS or Assateague State Park policies or fees are assumed. In addition, demand is estimated based on current visitation patterns for both parks.

Assateague Island NS reports daily visitation and overnight stays by month, as shown in Figure 48. Total annual visitation to the Maryland district of Assateague Island NS is approximately 845,000. The park experiences heaviest visitation during the summer months. Overnight visitors are excluded for the demand analysis because it is assumed that any would use the service because of the luggage and gear they are likely to be carrying and because campsites have dedicated, convenient parking available.

Figure 48
Assateague Island NS Maryland District Visitation, Total and Overnight Visitors
Source: NPS Public Use Statistics, 2008 and 2009 average



In order to estimate daily visitation, an understanding of visitation throughout the week is needed. Two data sources - 2001 daily traffic counts on Bayberry Drive and a 2009 parking study - help to better understand daily visitation patterns at Assateague Island NS, though they both have limitations.

Traffic counts recorded daily in July 2001 on Bayberry Drive showed fairly steady visitation throughout the week, with average weekend daily visitation approximately 25 percent higher than weekday visitation.[131] Data from an NPS parking occupancy study conducted from July to September 2009 showed that beach parking filled most days in July and August and most September weekends. On weekend days in July and August, Assateague Island NS beach parking stayed full for most of the day. It also showed that

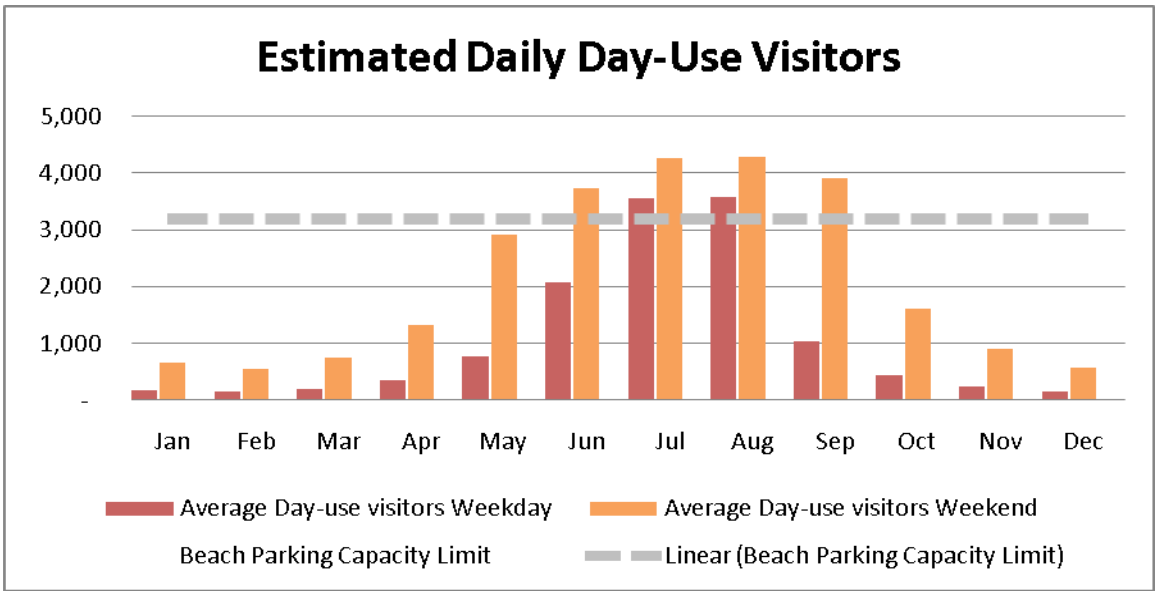
[131] Johnson, Mirmiran and Thompson for the National Park Service. Assateague Island National Seashore Entrance Station Alternatives Evaluation: Final Report. December 2003.

Assateague Island NS beach parking was most full on weekend days in September, while parking demand declined significantly on weekdays in September, most likely reflecting changes in visitation due to the start of the school year. Assateague Island NS staff agreed that this pattern reflected their observations.

Based on the 2001 daily traffic count and the 2009 parking study, daily visitation on weekdays and weekend days throughout the year were estimated, as shown in Figure 49. The 2009 parking occupancy study indicates that Assateague Island NS beach parking reaches capacity when day-use visitation is approximately 3,200.[132] These data indicate that parking demand exceeds capacity, and that transit service may be appropriate daily in July and August and weekend days in June and September. This is illustrated by the dashed line in Figure 49.

Beach parking capacity for this analysis is defined as 100 percent of the two beach parking lots and overflow lot (625) as well as 40 percent of other parking on the island (56).

Figure 49
Estimated Average Daily Visitation
Source: Volpe Center estimate and NPS Public Use Statistics



Transit and parking demand are both dependent on arrival and departure times. If, for example, 1,000 people visit the park on a particular day and they all arrive between 8:00 am and 10:00 a.m. and leave between 5:00 pm and 7:00 pm, a much higher capacity transit system would be needed (at the peak times) than if the same 1,000 people arrived and departed evenly throughout the day.

The 2009 parking occupancy study showed that parking demand is highest from 12:00pm to 2:00 pm throughout the week and that the most popular parking lots were frequently filled between 10:00 am and 12:00 pm, and remained full until 4:00pm. The daily arrival and departure patterns appear to be affected by the current limited parking supply. Because parking fills by mid-morning, it appears that there is a first

[132] This estimated link between day-use visitation and parking demand is approximate. Parking occupancy data and visitation can be roughly correlated; however, additional data would be needed to provide a precise correlation. Also the correlation varies daily depending on visit length and the number of visitors parking at the Bayside destinations.

peak of arrivals between 8:00 am and 10:00 am. As parking fills, arrivals taper during the mid-day. A second surge of arrivals appears to occur in the afternoon, between 2:00pm and 6:00pm, when earlier visitors depart and free up parking spaces for late-day visits. It's possible that by providing a shuttle service, the morning and afternoon surges in visitation may be slightly moderated since people could come when they want to instead of their arrivals being based on when parking is available. However, if the shuttle service were made mandatory for a certain time period of the day, it may result in visitors changing their arrivals and departures to avoid needing to take the shuttle.

Using the parking occupancy data and reasonable assumptions about daily travel patterns for day-use beach-oriented recreational trips, bounded by the approximate capacity of the entrance station to process arriving vehicles,[133] the study team estimated the hourly arrival and departure patterns for day-use visits (shown in Table 5). For example, on a weekend day in July when about 4,200 day-use visitors are expected, about 800 (19 percent of 4,200) of them are expected to arrive between 10:00am and 11:00am, while about 85 (2 percent of 4,200) are expected to depart during the same hour. The right-hand column shows that at 11:00 am, about 2,100 day-use visitors are expected to be at Assateague Island NS. This number indicates the parking demand throughout the course of the day as well (number of visitors at Assateague Island NS divided by average vehicle occupancy of 2.9).

Table 30
Estimated Day-Use Hourly Visitation Pattern
Source: The Volpe Center

Hour Beginning	Percent of Day-Use Visitors Arriving	Percent of Day-Use Visitors Departing	Percent of Day-Use Visitors On-Site
6:00 AM	2percent	0percent	2percent
7:00 AM	6percent	0percent	8percent
8:00 AM	12percent	1percent	19percent
9:00 AM	15percent	1percent	33percent
10:00 AM	19percent	2percent	50percent
11:00 AM	15percent	3percent	62percent
12:00 PM	5percent	3percent	64percent
1:00 PM	3percent	3percent	64percent
2:00 PM	4percent	4percent	64percent
3:00 PM	8percent	8percent	64percent
4:00 PM	5percent	12percent	57percent
5:00 PM	3percent	16percent	44percent
6:00 PM	2percent	15percent	31percent
7:00 PM	1percent	15percent	17percent
8:00 PM	0percent	12percent	5percent
9:00 PM	0percent	4percent	1percent
10:00 PM	0percent	1percent	0percent
Total	100percent	100percent	---
Maximum	19percent	16percent	64percent

[133] NPS Scholar study found entrance station capacity of about 112 vehicles per hour per lane. Cambridge Systematics 3039 study estimated 12 percent of daily arrivals during the peak hour. On peak days at Shenandoah National Park, 8-12 percent of daily arrivals occur during the peak hour.

Step 2: Estimate the proportion of visitors likely to use each transit option

The proportion of visitors that are likely to use a particular transit option, or the capture rate, depends on the quality of service relative to other travel modes – primarily private vehicles. Service that is inconvenient, uncomfortable, or expensive in comparison to other travel options will not attract many riders. Poor service on a mandatory transit service could lead travelers to choose other nearby beaches or other coastal regions with more convenient transportation options. Conversely, providing incentives for transit use – such as reduced or waived entrance fees, areas where transit vehicles can bypass queues of private vehicles, interesting or historic vehicles, convenient luggage/gear accommodation, and/or onboard interpretive services – can often attract significant ridership. In addition, service attributes—such as route, frequency, comfort, and cost—compared to available transportation alternatives can help determine whether a visitor will use the transit service. Finally, marketing and effective traveler information systems that fully inform visitors about transit options are necessary to attract riders.

This analysis assumes that there is a minor inconvenience to the visitor using transit service instead of a private vehicle. This means that there are some advantages, such as avoiding searching for parking, convenient pick-up and drop-off locations, comfortable service and/or interpretive services that help offset the increased travel time and/or inconvenience associated with transit, but that there are not significant incentives, such as reduced fees or express lanes for transit arrivals. These assumptions allow estimation of the expected capture rate and an evaluation of the service options. The assumed capture rate ranges from less than one percent for some of the regional routes to 90 percent for the mandatory parking shuttle.

Specific analysis and recommendations for management policies and service characteristics such as vehicle type and fare structure and the impact of such characteristics on ridership, are included in the section on a transit business plan for Option #2.

Impact of Transit on Park Goals

As described in the report's Introduction, the park has goals for any future transportation system to improve the visitor experience, protect resources, promote partnerships, and respond to anticipated storm, shoreline change, and sea level rise impacts. This section describes how the transit options considered broadly impact these goals. Further discussion is included in Appendices G and H and in the section on the transit business plan for Option #2.

Visitor Experience and Traffic Efficiency

If ridership and average passenger load are high, transit service can improve the visitor experience and traffic efficiency by reducing traffic delay and congestion; increasing parking availability; and creating new opportunities for interpretation. It can also negatively impact the visitor experience by limiting supplies that can be transported to the beach; introducing some inconvenience and waiting time; and raising safety implications for evacuation and storm shelter. Higher ridership and passenger load means that more visitors are diverted onto transit, which reduces congestion and beach parking demand. With low ridership, traffic congestion could be made worse by the addition of bus traffic without removing a significant amount of car traffic.

This analysis assumes that shuttle buses would not be able to bypass the queue of vehicles at either the Assateague State Park or Assateague Island NS entrance gate and thus would experience delays along with private vehicles. The delay is currently estimated to be 10-15 minutes based on observed and reported one-

third to one-half mile back-ups at the fee booths.[134] However, the shuttle buses would be able to use the pass-holder automatic entry gate currently available at Assateague Island NS; this gate will have slightly improved access in the near future when the fee booth area has been reconfigured for longer entrance lanes, the new Ranger Station, and a third fee booth, though it will still be limited by the one-lane access along Bayberry Drive. If the queue of private vehicles extended back to the one-lane section of Bayberry Drive, the bus would be caught in this queue. As the shuttle diverts more visitors from private cars the delays at the entrance booths would decrease, becoming approximately zero when shuttle service is mandatory. Depending on the design of the mainland parking area, cars and buses could instead experience delay when entering and navigating through the lot.

Resource Protection

Resource protection impacts of transit are closely linked to the reduction in personal vehicle trips and the addition of bus trips. Illegal parking, vehicle emissions, noise, and vehicle-animal collisions are all expected to be roughly proportional to the number and type of vehicles on the island. Transit positively contributes to a reduction in illegal parking regardless of its operating characteristics but the impact on vehicle emissions and noise depends on ridership as well as technology. The standard bus is considerably noisier and more polluting than an individual personal vehicle, but a popular transit service could divert enough visitors from cars to make result in lowered overall emissions, noise and wildlife strikes. Further discussion is included in the transit business plan for Option #2.

Partnership Opportunities

There are a number of partnership opportunities related to provision of transit services, in particular for the regional shuttle options; these are identified further in the next two sections. Partnerships help to leverage various funding sources and also improve coordination and resource efficiency. Local public transit operators, such as Shore Transit and Ocean City Transit, may provide opportunities for contracting vehicles and drivers, developing new routes or extending routes that serve the communities to Assateague Island NS. In addition, it may be possible to develop agreements with private operators who currently serve the local private campgrounds to Assateague State Park. Finally, companies or nonprofits may be interested in helping to fund a shuttle service for advertising and interpretive opportunities.

Adaptation to Storm and Climate Vulnerability

Only Option #4 (reduced access) and Option #5 (transit-access-only) directly address conditions that may occur due to storm damage or long term due to shoreline change and sea level rise impacts. However, once in place, any transit option would provide a starting point for expanding non-vehicular visitor access and could be adapted to deal with temporary reduced parking situations. In addition, none of the options require any major infrastructure to be built in vulnerable areas; any bus stops, signage, or shelters would be mobile and minimal. Shelters and evacuation were detailed previously in Element 2 and Appendix D.

[134] Assuming an average vehicle length of 15 feet and10 feet distance between vehicles, such that a one-third to one-half mile back-up consists of 70 to 100 cars, and assuming two booths and 20 seconds per vehicle.

Initial Transit Feasibility Assessment

In order to develop a preliminary evaluation of the transit options, estimated ridership demand, preliminary service plans, and cost estimates were developed for each of the nine options. This section summarizes the options considered and the findings of the assessment. Detailed analysis for each route is provided in appendices G and H. Transit service impacts on visitor experience and resource protection are expected to be proportional to ridership and are discussed qualitatively.

Parking Shuttle Options

Five parking shuttle were analyzed that would offer frequent connections between remote parking on the mainland and key destinations on the island:

1. Voluntary Parking Shuttle
2. Mandatory Parking Shuttle for All Day-Use at Peak Times
3. Mandatory Parking Shuttle for Non-Passholders at Peak Times
4. Reduced Island Parking, Maintain Visitation using Parking Shuttle
5. No Island Parking, Maintain Visitation using Parking Shuttle

All of the parking shuttles were assumed to travel the same route, stopping at (1) the mainland parking area, (2) North Beach, (3) the Bayside site near the Maryland Coastal Bays Program rental business, and (4) South Beach (see Figure 50). All of these options would require constructing or leasing additional parking on the mainland. The analysis of each of these options assumes that service is offered during the 80-day peak season (daily July and August plus weekends in June and September). Each regional shuttle option is assumed to serve Assateague Island NS, but not Assateague State Park. Service would be offered from 9am to 9pm at regular intervals of at least every thirty minutes, with more frequent service during the busiest times of day. Further details are provided in Appendix G.

A brief description of each of the five options analyzed is given below, followed by a summary table of service, demand, and cost characteristics (Table 6) and a table summarizing the key advantages and disadvantages of each option (Table 7). Depending on which option is selected, a parking shuttle could carry between 32,000 and 517,000 visitors and could cost between $153,000 and $931,000 for the 80-day peak season. In general, the cost per passenger decreases as more passengers are carried.

Figure 50
Parking Shuttle Route Map
Source: Google Maps and The Volpe Center

Option 1: Voluntary Parking Shuttle – No visitors are required to use the parking shuttle. At peak times when parking is full, some visitors choose to ride the shuttle to avoid searching for parking on the island and because the shuttle would drop them conveniently close to their destination. Capture rate would be directly tied to availability of beach parking, whose current status must be communicated to visitors arriving by car, probably using the VMS system recently purchased by Assateague Island NS. Although Option #1 is the cheapest parking shuttle option, it is the least effective at clearing congestion and preventing parking overflows. Implementing this option would allow the National Seashore to gauge the impact of a parking shuttle prior to implementing Option #2.

Option 2: Mandatory Parking Shuttle during Peak Times – The parking shuttle is mandatory for all day-use visitors except disabled visitors when the beach parking lots on the island are full. The mandatory shuttle remains in effect until mid-afternoon when visitors begin leaving the island and on-island parking has empty spaces. Disabled visitors would not be required to use the shuttle and could drive directly to the beach parking lots. Based on observed parking occupancy, the mandatory shuttle would be in effect from 11:30am until about 1:30pm, when parking could be reopened to arriving visitors. Shuttle service would continue until 9:00pm to carry departing visitors back to their vehicles. This option is recommended for implementation and received additional analyses detailed in the next section.

Option 3: Mandatory for Non-Pass-holders during Peak Times – A variation on Option 2, in which annual pass-holders would be exempted from the mandatory parking shuttle. The option is designed to

result in a capture rate higher than for Option #1 and lower than for Option #2. As a result, ideally enough vehicles would be removed from the island to address the transportation issues while limiting the number of buses required (and therefore total cost) to transport visitors between the mainland and the island. (There may be other methods for achieving similar capture rate, such as exempting senior citizens from the mandatory shuttle use or offering greater incentives for voluntary shuttle use.) Annual pass-holders, who currently make up 49% of visitors, would be allowed to park on the island throughout the day, and would fill parking spaces vacated by early departures. To manage parking demand in this way, the shuttle would be mandatory for non-annual pass-holders from approximately 11:30am until 4pm. As in Option #2, shuttle service would continue until 9pm to carry departing visitors back to their vehicles. This option may cause an increase in the number of annual pass-holders and thus fail to resolve transportation and parking issues. An annual pass currently costs $30, while a temporary vehicle pass valid for seven days costs $15.

Option 4: Reduced Island Parking – This option illustrates the level of transit service that would be needed to sustain current visitation in the event that half of the beach parking on the island is lost due to storm overwash and/or sea level rise. Daily visitation patterns are assumed to remain steady. Necessary management policies and traveler information systems to direct overflow parking to transit are assumed to be in place. The same assumptions for season and daily schedule were used for comparison to the other options; in reality, service would likely need to operate over a longer time period during the year and each day.

Option 5: No Island Parking – This option is designed to illustrate the level of transit service that would be needed to sustain current visitation in the event that all beach parking on the island is lost due to storm overwash and/or sea level rise. This scenario is not completely realistic – it is likely that were most parking on the island to be lost, visitation would change significantly as well – but it is designed to illustrate an upper bound for the transit capacity that could be needed. The same assumptions for season and daily schedule were used for comparison to the other options; in reality, service would need to operate year-round and for a longer time period each day.

Table 31
Assateague Island NS Parking Shuttle Summary
Source: The Volpe Center

Option	Total Seasonal One-Way Rides	Average Daily One-Way Rides	Average Capture Rate	Vehicles needed (45 pax buses)	Frequency* (# of buses per peak hour)	Total Seasonal Cost (Capital and Operating)	Cost per Passenger (round-trip)
1. Voluntary Parking Shuttle	32,000	400	5.5percent	3	2-3	$138,500	$9.60
2. Mandatory Parking Shuttle	113,000	1,400	17percent	13	2-12	$242,100	$3.65
3. Mandatory Parking Shuttle for Non-Passholders	77,000	960	13percent	5	2-5	$140,700	$3.70
4. Reduced Island Parking	302,000	4,000	60percent	18	2-20	$525,300	$3.50
5. No Island Parking	517,000	6,500	90percent	22	3-20	$805,900	$3.10

*Note, the frequency shown in Table 6 is the number of bus departures per hour at peak times. The maximum frequency is the number of departures per hour at the highest demand times when transit service is offered. The minimum frequency was limited to two departures per hour for the parking shuttle options in order to provide a reasonable level of convenience and service predictability at all times.

Table 32
Parking Shuttle Summary Comments
Source: The Volpe Center

Option	Advantages and Disadvantages
1. Voluntary Parking Shuttle Assateague Island NS Only	Low ridership would not resolve the congestion, delay and illegal parking issues. Lowest overall cost, but high cost per passenger.
2. Mandatory Parking Shuttle Peak Times	Mandatory for short-period of the day. Straightforward to manage. Beach parking spaces would be vacated and not refilled while mandatory shuttle is in effect. Many buses are needed at peak times. Could be difficult to find drivers for short shifts. Could cause negative visitor reaction if not implemented cautiously.
3. Mandatory Parking Shuttle for Non-Passholders at Peak Times	Mid-level capture rate resolves congestion and parking issues without requiring nearly as many buses at peak times. Mandatory shuttle would be in effect for more hours per day, but parking spaces on the island would be refilled by annual pass-holders during this time. May be difficult to communicate parking options to arriving visitors. Could cause negative visitor reaction.
4. Reduced Island Parking	Demonstrates the level of transit needed to accommodate visitation if ½ of beach parking is lost. Significant expense and high ridership, but necessary to maintain visitation.
5. No Island Parking	Demonstrates the level of transit needed to accommodate visitation if all beach parking is lost. Significant expense and high ridership. Probably not a realistic scenario. Represents upper bound of transit service that could be required.

Regional Shuttle Options

Four regional shuttle were analyzed that would provide alternative connections to other key destinations and help to reduce private vehicle access to Assateague Island NS:

1. Private Campground Regional Shuttle
2. Berlin Regional Shuttle
3. Chincoteague Regional Shuttle
4. Ocean City Regional Shuttle

The analysis of each of these options assumes that service is offered during the same 80-day peak as for the parking shuttle options. Each regional shuttle option is assumed to serve both Assateague State Park and Assateague Island NS. A brief description of each of the four options analyzed is given below, followed by a summary table of service, demand, and cost characteristics (Table 8Table 6) and a table summarizing the key advantages and disadvantages of each option and next steps (Table 9). Because the expected capture rates for the regional transit options are low, drawing ridership from both parks helps to make the services cost efficient. The service frequency for these options is lower than for the parking shuttle options because it is assumed that visitors would plan ahead for these longer, regional trips using a schedule. Further details and maps for the regional shuttle routes are included in Appendix H.

Option 6: Private Campground Shuttle – This option involves extending either of the private campground shuttles that currently serve Assateague State Park to Assateague Island NS. The option focuses on the Castaways Campground shuttle, but it is assumed that the Frontier Town shuttle could be similarly adapted. Assateague State Park offers a $2 discount on entry to visitors arriving on the shuttle, charging bus passengers $1 for entry. Offering a similar discount at Assateague Island NS may be appropriate to attract riders, but would require authorization under federal NPS fee policy and would result in a decrease in park revenue. Assateague Island NS charges $15 per vehicle, so that with an average

2.9 vehicle occupancy, the park collects approximately $5 per visitor. Based on the current ridership on the Castaways shuttle route and the expectation that extending the route to Assateague Island NS would increase ridership to Assateague Island by about 40 percent, it is estimated that approximately 45 people would use this option to access Assateague Island NS on a peak day. This estimate is further detailed in Appendix H. The additional demand could be accommodated without changing the shuttle schedule, and therefore with minimal additional cost. Additional information on ridership and costs are included in Appendix H.

Option 7: Berlin Shuttle – This option involves service from Assateague Island NS and Assateague State Park to the Berlin historic core and the Berlin Run Shopping Center. This service is expected to attract more overnight campers than day-use visitors. Campers staying on the island for a few days often make one or more shopping or recreational trips to Berlin. A small number of Berlin residents and visitors may choose to ride the shuttle to Assateague Island NS for a day-use trip as well. This option may require the identification of available overnight parking for those who intend to park in Berlin, take the bus to Assateague Island NS and spend the night.

Option 8: Chincoteague Shuttle – This option involves infrequent bus service between Assateague and Chincoteague. The route would serve Assateague Island NS, Assateague State Park, Chincoteague National Wildlife Refuge, and the town of Chincoteague, Virginia. The market for transit service on this 60-mile trip is expected to be limited. Charter bus style service with comfortable seating and luggage accommodation would be appropriate for this 60-mile trip. While the cost per passenger for this route is high, the cost per passenger mile is comparable to other options. Further details can be found in Appendix H.

Option 9: Ocean City Shuttle – Assateague Island offers a very different recreational experience from Ocean City, and there is a risk that linking to Ocean City could compromise the natural recreational experience on the island. However, it could also provide an opportunity for Ocean City visitors and residents and Assateague Island NS campers to have a different experience without having to rely on access to a personal vehicle or concerns about parking. In addition, Ocean City is linked to several regional transit systems including Shore Transit, Greyhound Bus Lines, and DART First State (Delaware's statewide transit system). Connecting to these systems would create new opportunities for primary transit access to Assateague Island NS.

Table 33
Regional Shuttle Summary
Source: The Volpe Center

Option	Total Seasonal One-Way Rides	Average Daily One-Way Rides	Average Capture Rate	Vehicles Needed	Frequency (# of buses per peak hour)	Total Seasonal Cost (Capital and Operating)	Cost per Passenger (round-trip)
6. Private Campground Shuttle	5,500	70	1percent	1	<1	$5,300 Added cost only	$1.50
7. Berlin Shuttle	22,000	280	0.5percent (+3percent campers)	1	<1	$65,800	$6.35
8. Chincoteague Shuttle	5,500	70	1percent	1	<1	$39,400	$14.35
9. Ocean City Shuttle	24,000	300	0.065percent (includes OC visitors)	1	<1	$65,800	$5.50

*Note, the frequency is the number of bus departures per hour at peak times. The maximum frequency is the number of departures per hour at the highest demand times when transit service is offered. All services require only one vehicle, as it is assumed that passengers for these services would plan their trips using a schedule.

Table 34
Regional Shuttle Summary Comments
Source: The Volpe Center

Option	Comments	Next Steps
6. Private Campground Shuttle	Little additional ridership is expected, as the shuttles already serve Assateague State Park. Route could be extended to Assateague Island NS without significantly changing the schedule and at minimal cost.	Contact Castaways and Frontier Town to discuss extending service to Assateague Island NS. Consider discounted entrance fee for shuttle riders.
7. Berlin Shuttle	Connection to Shore Transit route in Berlin. Provides primary access opportunity for local residents, though ridership is expected to be low. Provides opportunity for Assateague Island NS campers to take side trip to Berlin via transit.	Contact Shore Transit to discuss route and partnership opportunities.
8. Chincoteague Shuttle	Low ridership expected. Charter-bus style service would be appropriate for the long trip. High cost per passenger.	Probably not a feasible service.

9. Ocean City Shuttle	Connection to Shore Transit, DART, and Greyhound. Few Ocean City visitors are expected to ride. Different visitor experiences at the two sites. Not expected to have high enough ridership to significantly impact Assateague Island NS visitor experience.	Contact Shore Transit to discuss route and partnership opportunities.

Conclusion

The five basic parking shuttle options between Maryland District destinations and parking on the mainland were the following:

1. Voluntary Parking Shuttle
2. Mandatory Parking Shuttle for All Day-Use at Peak Times
3. Mandatory Parking Shuttle for Non-Passholders at Peak Times
4. Reduced Island Parking, Maintain Visitation using Parking Shuttle
5. No Island Parking, Maintain Visitation using Parking Shuttle

Based on the findings of the initial transit feasibility assessment and further discussion with Assateague Island NS staff, a subset of transit options were selected for inclusion in the transit business plan outlined in the next section. Overall, the study recommends that the park plan for implementation parking shuttles 1 and 2 as part of a two-phase plan. Options #4 and #5 are possible future scenarios in case storm damage or sea level rise destroys on-island parking capacity and demonstrate the potential level of transit service that would be required, assuming current visitation is sustained. Further analysis, including year-round service, is presented for Options #4 and #5 in the final chapter and Appendix J to fully understand the implications of changes to access. Option #3 is not recommended for implementation because it would fail to have sufficient impact on congestion for its cost and was not supported by park staff.

Four regional shuttles that connected Assateague Island NS with regional destinations such as campground and towns were assessed:

6. Private Campground Regional Shuttle
7. Berlin Regional Shuttle
8. Chincoteague Regional Shuttle
9. Ocean City Regional Shuttle

Based on the findings of this study and discussions with park staff, it is recommended that the park pursue partnerships to implement Options 6, 7, and 9, as well as consideration of service to Salisbury, for which park staff expressed interest. Option #8 was not regarded as desirable or feasible due to the long distance and anticipated lack of demand.

Transit Business Plan for Option #2

This section describes the recommended service characteristics of the proposed service, including route, schedule, and anticipated ridership; necessary capital investments, including vehicle type and parking; estimated costs; and potential sources of revenue. The analysis of Option #2 in this section of the report reflects several refinements from the transit feasibility analysis, including:

- **Route**: The parking shuttle route includes just three stops (Visitor Center/Mainland, North Beach, and South Beach). Stops at the Bayside and a second stop at North Beach were eliminated. Shortening the route in this way increases the efficiency and focuses use on the highest demand locations. It is assumed that visitors carrying oversized recreational gear, such as kayaks and windsurfing gear, would be permitted to drive and park at the bayside parking lots.

- **Service Speed**: Based on park staff comments, the average travel speed for the transit vehicle was increased from 12 mph to 20 mph. This results in a round trip travel time of 33 minutes, plus 7 minutes of schedule recovery, driver break and congestion time.

- **Service Hours**: The study team determined that there would be low and high peak service days, with different anticipated mandatory periods and demand. Since park staff commented that late day transit use would be low, the assumed service hours were reduced from 9pm to 8pm or 7pm. It is assumed that parking shuttle visitors wishing to stay late on the island can take the shuttle to mainland parking and drive in to beach parking once space has opened up.

- **Impact on Visitation and Arrival Times**: Initially it was assumed that introduction of a mandatory parking shuttle would not significantly change Assateague Island NS visitation. After a review of experience at Cape Cod National Seashore, Lewis and Clark National Historic Park, and Devils Postpile National Monument, and further discussion with Assateague Island NS staff, this analysis assumes that 20 percent of Assateague Island NS visitors who would normally arrive during the mandatory shuttle time shift their arrival earlier or later in order to avoid the shuttle and drive directly to the beach parking lots. Although a shift in visitation time is likely, a rise or fall in the number of visitors is not.

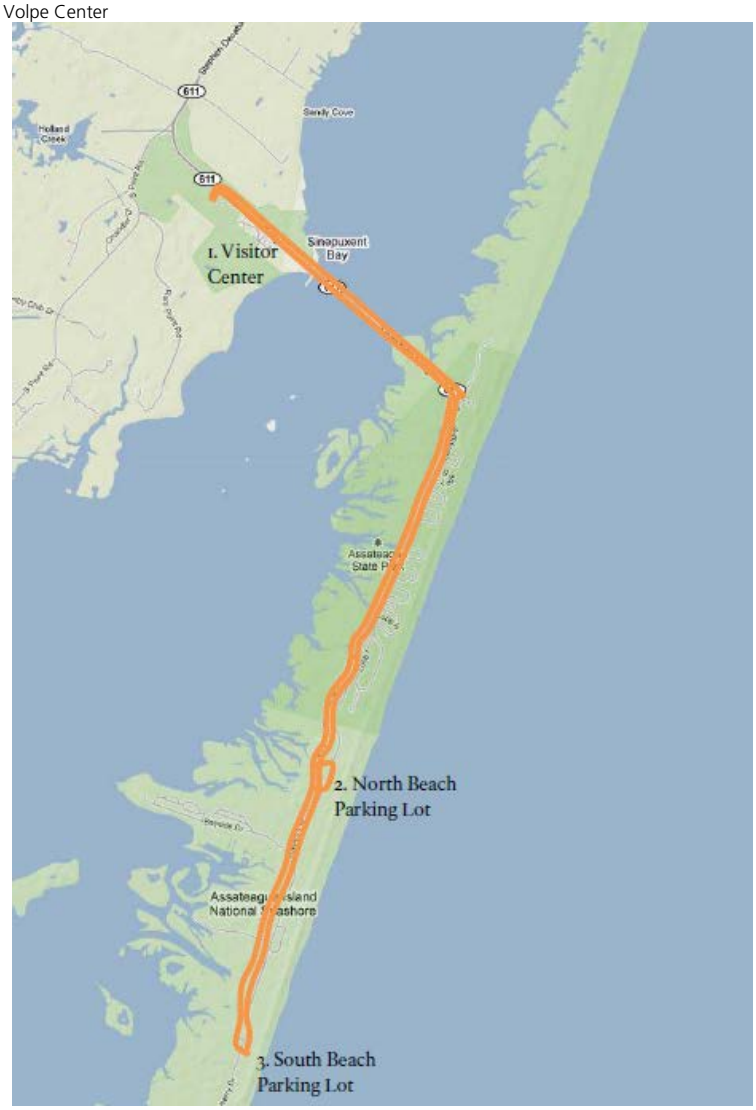
- **Cost**: Cost estimates were refined.

- **Vehicle**: Assateague Island NS expressed a desire for smaller transit vehicles rather than the large 45 passenger buses analyzed earlier. The transit business plan takes this into account and assumes vehicles with no more than 26 person capacity would be used. This allows cutaway shuttles buses to be used rather than traditional transit or school buses. However, this does have implications for the number of buses needed to provide sufficient supply for the demand.

Service Characteristics

The parking shuttle would operate on a 10-mile route, stopping at a mainland parking area, North Beach, and South Beach. The route is shown in Figure 51 below.

Figure 51
Proposed Parking Shuttle Route and Stops
Source: Google Maps and the Volpe Center



Consistent with Option #2 as described above and in Appendix G, the parking shuttle would be mandatory for most day-use visitors arriving when beach parking is full. Arriving visitors who do not have a reserved campsite, an OSV zone pass, or oversized sport gear or who are not legally handicapped would be required to park on the mainland and ride a shuttle to the island once beach parking on the island fills. Bus service would begin at 10:00 am or 11:00 am depending on anticipated demand for the day. It is estimated that to manage the parking demand, mandatory service would need to be in effect for two to four hours, and potentially up to six. Beach parking could then be re-opened, but shuttle buses would continue to circulate until 7pm to carry transit visitors back to their vehicles on the mainland. It is assumed that visitors arriving after the mandatory shuttle period has ended would be able to voluntarily park on the mainland and use the parking shuttle at no additional cost to Assateague Island NS. Following the analysis of Option #1 as described in the section above, 1-3% of visitors would choose to take a voluntary shuttle at any time, while at least 10% of visitors would choose to take the shuttle if they know beach parking is at 95% capacity or higher. The parking shuttle would offer riders a short interpretive orientation that may be recorded or live.

Service would be offered daily during July and August as well as weekends in June and September. Based on the analysis of parking occupancy and visitation data described earlier in this chapter, it is estimated that beach parking demand exceeds capacity by about 10 percent on weekdays in July and August; by about 20 percent on weekends in July and August; and by about 15 percent on weekends in June and September. The proposed transit service is designed to shift the excess parking demand to the mainland and provide a bus connection for those visitors to reach the beach.

Table 35
Service Levels by Day
Source: The Volpe Center

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Jun	None	None	None	None	None	High	High
Jul	Low	Low	Low	Low	Low	High	High
Aug	Low	Low	Low	Low	Low	High	High
Sep	None	None	None	None	None	Low	Low

June, July and August weekends would require the use of a "high" schedule, while September weekends and June, July and August weekdays would require the use of a "low" schedule. The high schedule operates more buses to provide higher passenger throughput in response to peak demand for beach access on summer weekends. These are the days when beach capacity is exceeded and are the days when the need for transit service to maintain access is the highest. The high schedule is costlier than the low schedule, which is used on summer weekdays and September weekends. The low schedule is a cost-saving measure to provide enough transit service to prevent capacity and congestion issues without exceeding reasonable costs. This system is summarized in Table 10 above.

As shown in Table 11, the round-trip route time is estimated to be about 33 minutes. This assumes that there is little or no congestion affecting the transit vehicles. Arriving vehicles would need to be intercepted and directed to mainland parking so that visitors do not attempt to drive onto the island, causing congestion and excess travel and delay.

Table 36
Service Characteristics
Source: The Volpe Center

	Stop 1: North Beach	Stop 2: South Beach	Stop 3: Visitor Center
Miles	3.75	1.25	5
Avg. Speed (mph)	25	15	20
Travel Time(min)	9	5	15
Stop Time (min)	1	1.5	1.5
Cumulative Running Time (min)	10	16.5	33

Cost estimates were developed assuming a maximum headway of about 30 minutes and building in approximately 7 minutes per trip for schedule recovery time, driver breaks and unforeseen delays and

congestion. The schedule would need to be refined based on actual travel times and driver staffing considerations.

The number of buses running throughout the day is dependent upon demand. Under the high schedule, buses run as often as every five minutes during the morning rush, every fifteen to thirty minutes during the midday and every ten minutes during the evening rush. This level of service is reflective of both the need to have a financially sustainable service with the need to provide convenient service for visitors.

At the service levels in Table 12 and Table 13 demonstrate, some people may need to wait for one or two buses to pass them by during the morning rush. Despite this delay, waits during the morning rush would be no more than thirteen minutes between when a person arrives at the bus stop on the mainland and when they can board a bus. The maximum wait of fifteen minutes occurs during the mid-day lull. The alternatives are either using larger buses, an option that does not meet stated Assateague Island NS preferences, or running more buses at an additional cost of at least $12,000 more per season.

Table 37
High Schedule
Source: The Volpe Center

Time	Entry Transit Demand (people)	Depart Transit Demand (people)	# buses running (buses)	Headway (minutes)	Average Wait Time to board a bus (minutes)
10:00 AM	757	0	6	5	6
10:30 AM	757	0	8	5	9
11:00 AM	757	0	8	5	13
11:30 AM	505	0	8	6	12
12:00 PM	235	0	6	10	11
12:30 PM	0	0	1	30	15
1:00 PM	0	42	2	15	8
1:30 PM	34	76	2	30	15
2:00 PM	34	76	2	30	15
2:30 PM	0	76	3	15	8
3:00 PM	8	151	3	15	8
3:30 PM	8	235	3	10	5
4:00 PM	0	252	3	10	5
4:30 PM	0	278	4	10	5
5:00 PM	0	328	4	10	5
5:30 PM	0	362	4	10	7
6:00 PM	0	362	4	10	10
6:30 PM	0	370	4	10	12
7:00 PM	0	303	4	10	9
7:30 PM	0	185	2	15	8

Table 38
Low Schedule
Source: Volpe Center

Time	Entry Transit Demand (People)	Depart Transit Demand (People)	# buses running (buses)	Headway	Average Wait Time
11:00 AM	212	0	5	6	6
11:30 AM	141	0	6	10	15
12:00 PM	1	0	3	30	17
12:30 PM	9	5	0	No service	No service
1:00 PM	7	10	0	No service	No service
1:30 PM	8	10	0	No service	No service
2:00 PM	9	10	2	15	8
2:30 PM	11	20	2	15	8
3:00 PM	1	30	2	15	8
3:30 PM	1	33	2	15	8
4:00 PM	1	36	2	15	8
4:30 PM	1	42	2	15	8
5:00 PM	1	47	2	15	8
5:30 PM	0	46	2	15	8
6:00 PM	0	45	2	15	8
6:30 PM	0	38	2	15	8
7:00 PM	0	32	2	15	8

Capital Investments

This section presents recommendations and considerations for capital investments, including the transit vehicle, parking, intermodal connections, and information systems.

Transit Vehicle

In selecting the appropriate vehicle, a number of factors need to be considered, such as vehicle requirements (based on amenity preferences, road and operating conditions, and capacity, among others), fuel type, and availability. For the purposes of this service, this study recommends a light-duty "cutaway" shuttle with capacity for up to 28 passengers, interior luggage racks, and durable seating options.

A low-floor option is available in the light-duty category but a similarly equipped model costs more than twice as much compared to its non-low-floor counterpart. The primary advantage of a low-floor vehicle is ease of access while loading and unloading passengers and it can accommodate handicapped visitors without requiring a wheelchair lift as access is achieved with a simple ramp for wheelchair loading.

In terms of providing access to visitors with disabilities, although it is assumed and recommended that Assateague NS continue to allow such visitors to access the island and use designated parking adjacent to

the beach, it is recommended that at least one transit vehicle be customized with the low-floor option or wheelchair lift and restraint systems. Such accommodation is consistent with NPS policy[135] and will be important if the demand for handicapped parking exceeds the capacity.

Hybrid-electric is recommended for fuel because it achieves fuel efficiency while being readily available from GSA for leasing and not requiring special infrastructure. Figure 52 shows one of the available GSA offerings in the light-duty category.

Appendix I provides more detail on the vehicle selection process for Option #2.

Figure 52
Glaval Entourage F550 Light-Duty Shuttle
Source: http://www.glavalbus.com/

Shuttle Stops

Bus stops would be required at the mainland visitor center park and ride, the north beach parking lot and the south beach parking lot. Because the time between buses in the mid-day can be as much as 30 minutes, these stops should be equipped with landing areas, benches, shelters and information. A paved landing area provides a solid and safe surface for visitors to wait for, enter, and leave buses. A curb attached to the landing pad also provides a surface to deploy ADA accessible bus ramps. Benches provide a welcome resting area at the end of a day of recreation. Shelters over the benches and standing area keep passengers dry during inclement weather. Information should include the times of the first and last buses, and either a bus schedule or a display of bus frequencies throughout the day. Provision of a landline, emergency phone is also recommended for visitors to contact the designated dispatcher who coordinates the shuttle to address any issues. The bus stops also provide a captive audience for static interpretive displays.

[135] NPS 2006 Management Policies. 9.1.2 Accessibility for Persons with Disabilities. (Also cross-referenced in Director's Order #42: Accessibility for Visitor with Disabilities in National Park Service Programs and Services; http://www.nps.gov/policy/DOrders/DOrder42.html).

Maintenance Facility

The availability of a nearby maintenance facility that can service the selected vehicles is a critical consideration. Specialized diagnostic and repair tooling that may not be available at nearby maintenance facilities can present a major challenge to providing uninterrupted service. A maintenance agreement with a nearby transit provider, such as Shore Transit, Ocean City, or DART either as part of a lease agreement or a separate contract may be a cost-effective way to manage vehicle maintenance.

Satellite or Visitor Center Parking

The recently completed visitor center Assateague Island NS has approximately 150 parking spaces on the mainland; however, these parking spaces fill with visitor center traffic and may not be available for shuttle riders. Additional parking on the mainland would be needed for each of the parking shuttle options. The amount of additional mainland parking needed varies depending on the level of ridership. Based on the estimated transit usage with current parking availability on the island, about 360 parking spaces would be needed in a park and ride lot on the mainland. Typical surface parking lots fit 100 to 150 spaces per acre, thus about 3 acres is needed to accommodate immediate demand. An additional 3 acres would be needed if half the beach parking is were lost. Room for expansion should be considered when siting the parking lot. Further information on parking costs is provided below in Table 15.

Intermodal Connections

As a parking shuttle, the proposed service is an intermodal system designed to reduce negative impacts of excess vehicles on Assateague Island while maintaining access to recreation. Other than providing a car to bus connection, the parking shuttle could be used to facilitate cycling, if the selected vehicles are equipped with external bike racks. These racks typically cost around $1,000 each and can carry three bicycles. If regional shuttles are pursued, then regional visitors would be able to transfer between those services and the parking shuttle in order to transfer from North to South beach.

Information Systems

This transit service proposal presents significant management challenges that would need to be carefully addressed. Properly communicating which visitors are exempt from the mandatory park and ride shuttle[136] would be challenging. If visitors are not properly directed in advance, and they drive on to the island before being redirected back to the mainland to ride the parking shuttle, the visitors would be frustrated and delayed, and the island would suffer unnecessary noise and emissions impacts from the added travel. Information systems, such as variable message signs on MD 611, would be needed to communicate shuttle and parking options to arriving visitors. This analysis assumes that appropriate communication systems are used. These systems would prevent confusion and congestion caused by drivers trying to enter the island during the mandatory shuttle time, and would convey parking information to drivers approaching the parking area.

Static signage would be required to mark the location of each stop, indicating to visitors where they can wait for the shuttle on the beaches and in the mainland parking lot. These signs would need to be visible from a distance and should have information about service frequencies at various times and a warning about the time the last bus leaves in the evening. If regional shuttles are pursued, it is likely they would share stops with the parking shuttles, and consequently clear branding must be used to prevent confusion about which bus goes to the beach and which bus goes to regional destinations. Uniform branding on

[136] Overnight campers, OSV Zone users, the handicapped, and Bayside recreational users.

printed materials, bus stops, and the vehicles themselves would help guide visitors to the correct stop and vehicle.

Ownership and Operation

A major consideration prior to the implementation of the ATS is the ownership of the vehicle, operation and management of the service, and responsibility for service provision and financial liability. One important consideration is whether the park considers itself responsible for providing the shuttle service rather than enabling it; in the case of a mandatory system, as recommended, the park would be responsible for providing the service. Due to this distinction, commercial use authorizations and concession contracts, which assign liability to the private operator, are not considered feasible. Parks can also share ownership and/or operations liability with a partner, such as a regional transit authority. Two other options for operation are a turn-key service contract in which either the park or contractor owns or leases the vehicles or an NPS-owned and operated service.

The proposed service requires that drivers work shifts ranging from two hours to all day, with different numbers of drivers and vehicles required on different days throughout a four month season. A contractor or transit operator is more likely to be able to hire drivers able to work these difficult hours and operate the vehicles at other locations when not being used than the park. In terms of ownership of the vehicles, although purchasing the vehicles can be pursued through non-unit funding sources, allowing the park to focus on covering operations and maintenance only, the fluctuation in need for fleet size for the proposed service would require the purchase and maintenance of a large fleet that would go unused for eight months of the year.

A non-NPS-owned, non-NPS-operated service contract has the least impact on park operations and would probably be the most feasible option. The park may continue to fulfill its resource and visitor experience missions while leaving operations of a transportation system up to an expert. The disadvantages of this model are that it can be more expensive than other models, high costs are passed on to riders and NPS, and the park would need to carefully manage the contract. It could be possible for the park to partner with a regional transit authority, which would have some of the flexibility of a contractor; however, Shore Transit and Ocean City Transit both already have broad geographic commitments and service demands on their operations and may not be interested in the short-term, high demand service required under this option.

For the financial analysis, this study assumes a turn-key service contract using GSA lease rates and operating costs.

Financial Plan

This section provides information on operating, maintenance, and capital costs, as well as potential funding sources.

Costs

Table 14 shows the estimated seasonal cost and cost per passenger for the mandatory parking shuttle. The estimated cost per (round-trip) passenger is $3.30 if vehicles are leased according to GSA models. The cost of leasing and operating service would be different than that outlined in Table 14 if a non-GSA lease is used. Possible contractors include Shore Transit, local school districts and private charter businesses. These rates may be cheaper than GSA, with Shore Transit reporting an hourly operating cost of $44.96 for

a transit vehicle, rather than GSA's hourly operating cost of $60 for a cutaway shuttle.[137] Private contractors may offer lower rates as well. However rates vary from operator to operator, with DART for example reporting an hourly operating cost of $105.36.[138] According to this study's estimates, Assateague Island NS would need to raise an estimated $153,225 to pay for the costs of driving, fueling and maintaining the shuttle. Several options for raising that revenue are discussed below.

Table 15 shows anticipated capital costs associated with the shuttle. It should be noted that these infrastructure and systems, including parking,[139] variable message signs,[140] and other information materials, would have operating and maintenance as well as capital costs. However, these costs vary greatly and are dependent on a park's current operations, so separate cost estimates are not included in this analysis.[141]

Table 39
Mandatory Mid-Day Parking Shuttle Cost Estimate
Source: The Volpe Center

	Units	Unit Cost	Total Cost
Seasonal Capital	6 vehicles, 4 months 2 vehicles, 3 months	$717/vehicle-month	$36,225[142]
	31,200 miles	$0.515/mile	
Seasonal Operating	2080 vehicle operating hours	$60/vehicle-hour	$117,000
Seasonal Maintenance	(Included in GSA lease)		
Total Seasonal Cost	**$153,225**		

Table 40
Capital Construction Costs Associated with Shuttle
Source: The Volpe Center

	Units	Unit Cost	Total Cost
Mainland Parking	360 spaces	$3,500 /space[143]	$1,260,000
Stops and Shelters	3	$5,000	$15,000
Variable Message Signs	2	$25,000	$50,000

[137] http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2009/agency_profiles/3096.pdf

[138] http://www.ntdprogram.gov/ntdprogram/pubs/profiles/2009/agency_profiles/3075.pdf

[139] http://www.vtpi.org/tca/tca0504.pdf

[140] http://www.psrc.org/assets/531/AppF-Operating_MaintenanceCosts.pdf

[141] Analysis conducted by the Volpe Center on several national parks in the Northeast Region indicated that such costs could range from $40 to $200 per square yard of facility.

[142] Also includes 500 miles per bus per season to include maintenance trips and travel to and from concessionaire's base at the beginning and end of the operating season.

[143]Transportation Cost and Benefit Analysis II. http://www.vtpi.org/tca/tca0504.pdf Victoria Transport Policy Institute.

Static Signs	10	$250	$2,500
Total Cost			$1,327,500
Estimated Annual Cost*			$69,750

*Parking costs distributed over 20 years, other capital costs over 10 years. Both include compounded interest rates of 4%

Operations & Maintenance Funding

The proposed annual operating and maintenance cost of $153,225 per year can be covered by base operating funds, general fee collection, or an additional fee applied as a separate fee or included in the entrance fee. The Assateague Island NS superintendent has said that revenue from the $15 weekly entry pass and the $30 annual entry pass have already been allocated for projects for the next several years. Because of this, additional revenue sources would need to be found to cover the operating costs of the proposed shuttle. NPS Director's Order 22 states that holders of interagency passes may not be charged a user fee for a transportation system that is mandatory to access a primary resource at a national park. The approximately 20% of visitors to Assateague Island who hold interagency passes thus cannot be charged their share of funding the service.

The two main funding authorities available to provide operating funds are the expanded amenity provision of the Federal Lands Recreation Enhancement Act (FLREA) and the transportation fee provision of NPS Management law 16 USC 79 § 5981.

Eighty percent of funds raised by FLREA remain at the unit collecting the amenity fee, while all of the funds raised as a transportation fee remain at the collecting park. Expanded amenity fees under FLREA are more flexible than transportation fees but are subject to an extensive public participation and WASO review process as detailed in Director's Order 75A. The Assateague Island NS superintendent has also said that she (like others in NPS) is concerned with the expiration of FLREA in 2014. The National Park Service may soon halt the review process for FLREA fees to prepare for reauthorization of the enabling legislation. Consequently, it is assumed that no existing revenue stream can cover the projected transit operating costs, but that FLREA may be reauthorized at least in some form to allow for continued fee collection. If the fee increment is charged as an expanded amenity fee under FLREA, then the fee would need to be increased to 20% beyond the cost of the shuttle service in order to cover the proportion of FLREA revenue returned to WASO for redistribution.

All of the fee revenue raised under NPS Management law 16 USC 79 § 5981 remains at the unit in which it was levied. Transportation fees require approval from the WASO Transportation Program, the WASO Fee Expenditures Program, and the WASO Fee Collections Program.

If the cost of providing shuttle service is bundled with the standard entrance fees and collected as one transaction, the total must be below the fee cap for the unit. Assateague Island NS is currently charging at its fee cap, so any increase would require an exemption must be obtained with approval from the Northeast Regional Director and the Associate Director of Business Services. Transportation fees or expanded amenity fees may be levied separate from entrance fees and are not subject to the cap, but introduce inconvenience and require more fee collection staff and infrastructure.

Whether the additional cost of the proposed shuttle service is charged as a transportation fee or an expanded amenity fee, there are several different options for how these funds can be raised. Four different funding models are proposed below to cover the costs of operating and maintaining the shuttle service. These models distribute the cost between visitors to Assateague Island NS in different ways and at different times.

Table 16 below details several potential funding models that could be used to support a parking shuttle at Assateague Island NS. These were developed by finding the exact fee required to meet a known yearly

cost given current visitation. Fees should be rounded to the nearest dollar or quarter to decrease transaction time from visitors paying with cash, and all fees could be refined if the average number of repeat visits by weekly and annual pass holders was known. Implementing Model 3 as a transportation fee under 16 USC 79 § 5981 is the recommended funding model.

Table 41
Fee Options for Balancing Total Shuttle Costs
Source: The Volpe Center

Fee Model	# of Payments	Fee increment
Model 1: Charge Bus Riders Directly	13,085	$11.71 per vehicle
Model 2: Charge All Visits by Weekly and Annual Passholders	207,821	$0.75 per vehicle
Model 3: Charge Weekly Pass Sales During Transit Season and Annual Pass Sales All Year	**96,068 weekly 54,207 annual**	**$1.03 weekly $1.25 annual**
Model 3 Variant: Charge Weekly Pass Sales During Transit Season	96,068 weekly	$1.59 weekly
Model 4: Charge All Vehicles for Beach Parking on Mandatory Transit Days	89,417	$1.71 per vehicle

Model 1 charges each visiting vehicle diverted onto transit its share of funding the shuttle service. This is one of the simpler models but would likely be enormously unpopular, especially if that fee was levied on top the entrance fee. Each visiting vehicle would essentially pay a fare that acts as a user fee, fully funding the cost of operating shuttle service. The FLREA may allow Assateague Island NS to charge a fare as an expanded amenity, and the fare would also be valid as a transportation fee. The fee would be approximately nine dollars per vehicle when distributed to all visitors. However, National Park Service policy prohibits charging interagency pass holders to use mandatory transportation system. Estimating that these users would make up about 20% of the shuttles ridership means that the fare charged to other passengers would need to be nearly twelve dollars per vehicle. This funding model would likely be enormously unpopular as it would require visitors to pay for a service they may not have intended to use.

Model 2 spreads the cost of the service to all day-use vehicles over the entire year. This option has the smallest per vehicle fee, but has several management complexities. Model 2 would require charging every vehicle entering the National Seashore approximately sixty cents per visit. Given that interagency pass holders would be exempt from this fee, the cost would increase to seventy five cents per visit. This would introduce delays as annual pass holders would have to stop and pay their fees on each visit, as would returning weekly pass holders. If the average number of return visits by weekly and annual pass holders was known then it would be possible to calculate the fee increase required to fund the service without charging returning passholders at each return visit. Instead, the fee increase would be levied during the sale of the pass. This variation would be the ideal implementation of model 2, as it would maintain the smallest possible per-vehicle fee yet would take into account return visits and thus remove the increased congestion and inconvenience associated with charging returning visitors.

Model 3 functions similarly to Model 2, but only charges the transportation or recreation fee to visitors who arrive during the months of June through September when transit is operating. This option avoids charging fall, winter and spring visitors for a service they do not directly benefit from, while still keeping a relatively low per-vehicle fee. If the fee was added onto weekly passes sold during transit season then the fee increment needed would be approximately $1.60. This fee could be reduced to approximately one dollar if the cost of an annual pass was increased by $1.25. The incremental increase of $1 to weekly passes and $1.25 to annual passes would be levied during the sale of the pass in a seamless transaction. Returning visitors would not have to pay as long as their pass was valid.

Model 4 covers the cost of operating a shuttle by charging for beach parking on days when the shuttle would be running. The charge would be approximately $1.75 per vehicle per day. This means that visitors

that arrive during the off-peak season do not subsidize visitation during the peak summer season. The cost could be collected as transportation or amenity fee bundled with the entrance fee, or it could be collected at the beach parking area.

Model 4 is the most straight-forward model and desirable in terms of the financial incentive it provides for using the shuttle rather than parking at the beach; however, parking fees have not been well received by NPS in the past, as there are concerns about fairness and equity. Consequently, the study recommends Model 3, which spreads the cost of the transit service to all who benefit from it when it is operating, but does not overly burden one particular user group. Additionally, this option avoids charging visitors during off-peak months who do not directly benefit from the shuttle service. Minor adjustments could be made to the model depending on input from the NPS National or Regional Fee Offices and the visiting and local public. The funding split and fee increase for option 3 between weekly and annual pass purchasers could, for example, place more of the cost burden on weekly or annual pass purchases.

Most NPS units cover the cost of operating ATS service by bundling an additional fee into the entrance fee. Cape Cod National Seashore, Harpers Ferry National Historic Park, Grand Canyon National Park, and Zion National Park operate mandatory services funded in this way. Models 2, 3 and 4 above use some variation of this funding strategy. In a few cases, a separate fee is charged only to those visitors using the transportation service. Point Reyes National Park and Kennesaw Mountain National Battlefield Park charge visitors to ride their mandatory bus systems, but neither of these parks charges an entrance fee. The cost to fund the transit service this way at Assateague Island NS would be prohibitively high, costing an additional twelve dollars per vehicle that parks on the mainland and uses the parking shuttle. Additionally, it is usually best to incentivize bus ridership by charging those riding the bus less, though this may be difficult to do because of the pass options and the flexibility people may need in riding the bus one day and parking the next.

Charging weekly pass purchases only may increase public support for the shuttle service among local residents and frequent visitors, as they would not need to pay for the shuttle yet still gain the parking and resource benefits it would provide. However, this option would raise the perceived value of holding an annual pass and may result in more annual pass sales. This would decrease the total pool of weekly pass visitors and require a higher per-vehicle fee.

Fee Collection

Collecting entrance fees from vehicles diverted to mainland parking and the shuttle would require additional fee collection infrastructure and staff. If procedures are not developed to collect entrance fees, Assateague Island would forego nearly $200,000 in weekly pass revenue alone during each transit season. This would mean that Assateague Island NS would need to increase fees to other users enough to raise an additional $200,000 per year on top of the cost of operating the shuttle.

A more affordable alternative would be to construct and staff an additional entrance at the mainland park and ride lot. Visitors arriving when mandatory transit service is in effect would enter the parking lot, pay the entrance fee or display their pass at a booth, park, and then ride the shuttle. The Central Federal Lands Highway Division estimates that the cost of constructing a basic entrance booth is at least $25,000 in 2005 dollars. Each booth can process approximately 100 vehicles per hour. A maximum arrival rate of 180 vehicles per hour during mandatory transit service means that two booths would be needed, otherwise the congestion the shuttle system is intended to reduce would instead be moved. Staffing the entrance booths would be an additional annual operating cost, which could be reduced if one Visitor Use Assistant on duty on the island moves to staff one of the mainland parking booths during the peak transit arrival time. The entrance demand on the Island during mandatory transit consists mainly of campers and OSV drivers, so two active island lanes during this time may prove redundant. One or both of the park and ride entrance booths could use an automated fee collection system. The machines recommended by

the Assateague Island National Seashore Fee Structure Analysis report in 2009 cost approximately $28,000 each and require only ongoing maintenance as an operating cost.

The construction of the park and ride is an opportunity to follow the recommendation of the 2003 Assateague Island National Seashore Entrance Station Alternatives Evaluation and move all of the fee collection booths off of the island and onto the mainland. All visitors would then stop, pay their fee and either continue on to the island or park and take the shuttle depending on their visit type and whether mandatory transit is active at the time. The initial set-up costs of this option are higher due to the increased number of booths and collection machines required, but would reduce the risk of storm damage to fee collection infrastructure and eliminate the inefficiency of collecting fees from two locations at once. Cost savings could be found by moving existing infrastructure off of the island if feasible.

Capital Sources of Funding

Included below are brief summaries of several federal programs that can be used to fund part or all of the $1,327,500 required to build the parking lot, signs, stops and shelters for the transit service.

Paul S. Sarbanes Transit in Parks Program (TRIP)
Congress established the Paul S. Sarbanes Transit in the Parks Program, formerly Alternative Transportation in Parks and Public Lands (ATPPL) Program, to enhance the protection of national parks and federal lands and increase the enjoyment of those visiting them. Administered by the Federal Transit Administration in partnership with the Department of the Interior and the Forest Service, the program funds capital and planning expenses for alternative transportation systems such as shuttle buses and bicycle trails in national parks and public lands. Funds may be used for projects that are located off-site, if there is an obvious connection to how they support access to the unit by alternate transportation. Funds for up to two years of operation of a pilot project may also be available. For more information see: http://www.fta.dot.gov/funding/grants/grants_financing_6106.html

Congestion Mitigation & Air Quality Improvement Program (CMAQ)
The Congestion Mitigation and Air Quality Improvement Program (CMAQ) provides funding for projects and programs in air quality nonattainment and maintenance areas for ozone, carbon monoxide (CO), and particulate matter (PM-10, PM-2.5) which reduce transportation related emissions. The proposed parking shuttle for Assateague Island would reduce emissions and on-Island congestion just by transferring visitors from private cars to a shuttle bus. It would also reduce emissions and congestion by reducing or eliminating the number of drivers circling Island parking lots searching for an empty space. Funds are eligible for projects that mitigate traffic congestion and improve air quality; transit projects and bicycle and pedestrian projects are eligible. Funds may be available for pilot transit operations projects. The Federal share is typically 80 percent, requiring a 20 percent local match. For more information see: http://www.fhwa.dot.gov/safetealu/factsheets/cmaq.htm

Public Lands Highways Discretionary (PLHD)
The Public Lands Highways – Discretionary (PLHD) Program provides funding for transportation planning, research, and engineering and construction of, highways, roads, parkways, and transit facilities that are within, adjacent to, or provide access to Indian reservations and Federal public lands, including national parks, refuges, forests, recreation areas, and grasslands. PLH funds can be used for any type of Title 23 transportation project providing access to or within Federal or Indian lands and may be used for the State/local matching share for apportioned Federal-aid Highway Funds, as described in 23 USC 120(l). The program is administered by the Federal Highway Administration's Federals Lands Highway Office. Eligible activities include operations and maintenance of transit facilities, parking areas, and provisions for pedestrians and bicycles. No local match is required, but projects with some funding already invested are more competitive. For more information see:
http://flh.fhwa.dot.gov/programs/plh/discretionary/

Surface Transportation Program (STP)
The Surface Transportation Program provides flexible funding that may be used by States and localities for projects on any Federal-aid highway, including the National Highway System, bridge projects on any public road, transit capital projects, and intra-city and inter-city bus terminals and facilities. The Federal share is generally 80 percent, requiring a 20 percent local match. For more information see: http://www.fhwa.dot.gov/safetealu/factsheets/stp.htm

Park Roads and Parkways Category III (PRP)
The Park Roads and Parkways Program (PRP) provides funding for the design, construction, reconstruction, maintenance, or improvement of roads, infrastructure and alternative transportation systems that provide access to or are within a unit of the National Park Service (NPS). PRP funds can be used for any type of Title 23 transportation project providing access to or within NPS lands and may be used for the State/local matching share for apportioned Federal-aid Highway Funds, as described in 23 USC 120(l). Eligible activities include operations and maintenance of transit facilities, parking areas, and provisions for pedestrians and bicycles. Category III of the Parks Roads and Parkways is specifically set aside to fund alternative transportation systems. Funds for this competitive program are allocated by WASO. For more information see: http://flh.fhwa.dot.gov/programs/prp/

The above programs are preferable from Assateague Island NS's point of view, as they do not directly burden visitors for startup costs. Noncompetitive, guaranteed funding can also be provided through expanded amenity fees or transportation fees, explained in detail in the next section. However, the above programs provide limited funds that cover capital and startup costs. Other sources of funding would be needed to sustain operations and maintenance.

Impact on Park Goals

The initial discussion of the transit parking shuttle alternative in Chapter 4 (Analysis and Assessment of Transportation Elements) predicted a mixed impact on park goals of travel efficiency, visitor experience, resource protection, resiliency to sea level rise and other effects of climate change, and partnerships. This section describes the impact of Option #2 on these goals.

Option #2 would eliminate parking and traffic congestion on average days during the peak season. Traffic congestion around the entry booths may still exist during the mornings before on-Island lots fill, but would not be an issue the rest of the day. The elimination of parking congestion would also eliminate the emissions and congestion impact of parking-seeking driving and the roadside damage caused by illegal parking.

Other resource and visitor experience impacts are emissions and noise. The parking shuttle would remove approximately 16,500 car trips onto the island per year and replace those with nearly 3,000 bus trips. Given the low reduction in vehicle miles traveled by cars and the need for regular bus service, the reduction in emissions would be minimal but would likely not increase.[144] However, total noise pollution at Assateague would be reduced. The sound equivalence level of a bus is estimated to be approximately four times higher than that of a car at 30 miles per hour.[145] The total net noise pollution impact would be equivalent to eliminating 5,200 car trips per year.

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[144] High-level estimate of emission reductions calculated using the EPA MOVES model but without detailed inputs in terms of idling and congestion of current vehicle traffic and other considerations.

[145] http://event.concepglobal.com/accounts/register123/concep/clientaccounts/ice/events/x2009tj01/paper_-_Comparion...Impacts.pdf

Implementation Considerations

Instituting parking shuttle service is recommended to address the congestion, delay and insufficient beach parking, and also as a step toward developing an alternative access system that would provide for visitor use in the event that parking or road infrastructure on the island is damaged or lost. Ideally, the parking shuttle should carry enough riders to address the transportation objectives and also maximize use of the convenient parking available on the island. However, mandatory shuttle service is a major undertaking requiring a large parking area on the mainland, new traveler information systems, staff responsibilities, and policies. Consequently, the study team recommends that Assateague Island NS phase in parking shuttle service, beginning with a pilot voluntary option. This approach would allow the park to test visitor response to transit service, and would allow a transition period during which route, schedule, staffing, marketing, traveler information, and other issues can be adjusted to provide high quality, reliable service.

As noted in the discussion of transit success factors, a voluntary service would be most successful if inconvenience is limited and incentives for shuttle use, such as interpretation or reduced fees, are offered. This analysis predicts that a voluntary shuttle would not attract enough ridership to resolve the transportation objectives, but after initiating the pilot voluntary shuttle service, Assateague Island NS should monitor congestion, illegal parking, and infrastructure damage to gauge the timeframe for implementing the mandatory parking shuttle.

Identification of next steps to pursue this transit service is included in the final chapter, including development of supporting infrastructure, pursuit of funding, and pursuit of NPS approvals.

Conclusion

As noted in Chapter 4 (Analysis and Assessment), the most important transportation objectives for Assateague Island NS are to:

- Reduce the number of vehicles on the Assateague Island NS Maryland District portion of the island at peak times.
- Enhance the travel experience for all modes (e.g., wayfinding, traveler information, facilities and amenities).
- Improve system resiliency to storm damage and sea level rise.

The transit options analyzed in this chapter help to address all of these objectives, but at significant cost and impact to the visitor experience. However, given the potential for storm overwash and loss of parking, developing an alternative access system is important for maintaining visitor use, both now and into the future.

This chapter described a methodology for cost, demand, and goal for transit; assessed nine possible transit options; and provided more detailed analysis for how one of the options could be implemented. This section provides a summary of the main conclusions. The next and final chapter presents recommended phasing and other considerations for implementation of transit as well as the other elements from Chapter 4.

Initial Transit Assessment

The five basic parking shuttle options between Maryland District destinations and parking on the mainland that were analyzed in this chapter were the following:

1. Voluntary Parking Shuttle
2. Mandatory Parking Shuttle for All Day-Use at Peak Times
3. Mandatory Parking Shuttle for Non-Passholders at Peak Times
4. Reduced Island Parking, Maintain Visitation using Parking Shuttle
5. No Island Parking, Maintain Visitation using Parking Shuttle

Options #4 and #5 were included to respond to possible future scenarios, not as recommendations for removal of parking. Based on the analysis of the other three options in this chapter and discussions with park staff, the study recommends that the park plan for implementation of Options #1 and #2 as part of a two-phase plan. Option #3 is not recommended for implementation because it would fail to have sufficient impact on congestion for its cost and was not supported by park staff.

Four regional shuttles that connected Assateague Island NS with regional destinations such as campground and towns were also assessed in this chapter:

6. Private Campground Regional Shuttle
7. Berlin Regional Shuttle
8. Chincoteague Regional Shuttle
9. Ocean City Regional Shuttle

Based on the findings of this chapter's analysis and discussions with park staff, the study recommends that the park pursue partnerships to implement Options 6, 7, and 9, as well as consideration of service to Salisbury, for which park staff expressed interest. Option #9 was not regarded as desirable or feasible due to the long distance and anticipated lack of demand.

Pursuing regional shuttle options with partners is recommended to enhance alternative access to Assateague Island NS and Assateague State Park, and provide visitation opportunities for people without access to a private vehicle. The ridership projections and cost for each of the regional shuttle options studied are much lower than for the parking shuttles, and marketing, scheduling, service reliability, and stop convenience are key to the success of these types of transit services. The parallel implementation of a parking shuttle and the regional shuttles may have a "network effect," by which more visitors would be willing to take a regional shuttle to Assateague Island NS if they know that the local shuttle can move them between the visitor center, north beach and south beach. The regional shuttle options would not be operated by Assateague Island NS but rather by a private provider, as a commercial use authorization or concession, or more likely, as a partnership with an existing regional transit provider to support the services.

Transit Business Plan for Option #2

Option #2 was further refined in this chapter to serve only the beach parking lots and to reflect park staff's comments on anticipated service speed, needed service hours, and desired vehicle size. The Option #2 service would be mandatory for most day-use visitors arriving when beach parking is full. Arriving visitors who do not have a reserved campsite, an OSV zone pass, oversized sport gear or are legally handicapped would be required to park on the mainland and ride a shuttle to the Island beginning once beach parking on the Island fills. Service would be offered daily during July and August as well as weekends in June and September and would follow either a low or high schedule. In general, the service would begin at 10:00 am or 11:00 am and mandatory ridership would need to be in effect for two to four hours, and potentially up to six. Beach parking could then be re-opened, but shuttle buses would continue to circulate until 7pm to carry transit visitors back to their vehicles on the mainland. The parking shuttle would offer riders a short interpretive orientation that may be recorded or live.

The service would require a varying number of buses throughout the day, with frequencies ranging from five to 30 minutes and wait times from zero to 15 minutes. This level of service is reflective of both the need to have a financially sustainable service with the need to provide convenient service for visitors. Lower wait times – and possible reductions in cost – could be possible by either using larger buses, an option that does not meet stated Assateague Island NS preferences, or running more buses at an additional cost of at least $12,000 more per season.

For the purposes of this service, this study recommends a light-duty "cutaway" shuttle with capacity for up to 28 passengers, interior luggage racks, and durable seating options. In terms of providing access to

visitors with disabilities, although it is assumed and recommended that Assateague NS continue to allow such visitors to access the island and use designated parking adjacent to the beach, it is recommended that at least one transit vehicle be customized with the low-floor option or wheelchair lift and restraint systems. Such accommodation is consistent with NPS policy[146] and will be important if the demand for handicapped parking exceeds the capacity. Hybrid-electric is recommended for fuel because it achieves fuel efficiency while being readily available from GSA for leasing and not requiring special infrastructure. The shuttle service would require several supporting facilities, including shuttle stops, maintenance facility, mainland parking, intermodal infrastructure, and information systems, as well as fee collection infrastructure.

The study recommends that the service be leased and operated via a service contract. The proposed service requires that drivers work shifts ranging from two hours to all day, with different numbers of drivers and vehicles required on different days throughout a four month season. A contractor or transit operator is more likely to be able to hire drivers able to work these difficult hours and operate the vehicles at other locations when not being used than the park.

The estimated operating and maintenance cost for the service is $153,225 per year, with up to $1.3 million capital costs for supporting infrastructure, though this cost could be significantly reduced if mainland parking is pre-existing or not a traditional asphalt surface. The park has indicated that current base operating funds and anticipated revenue from entrance fees are already committed to other projects and activities, so alternative funding would be needed. The study recommends charging a transportation or recreation fee to all visitors who arrive during the months of June through September when transit is operating. This fee can be split between weekly and annual passes at a cost of $1 and $1.25 respectively. This model spreads the cost of the transit service to all who benefit from it when it is operating, but does not overly burden one particular user group. Additionally, this option avoids charging visitors during off-peak months who do not directly benefit from the shuttle service.

Identification of next steps to pursue this transit service is included in the final chapter, including development of supporting infrastructure, pursuit of funding, and pursuit of NPS approvals.

[146] NPS 2006 Management Policies. 9.1.2 Accessibility for Persons with Disabilities. (Also cross-referenced in Director's Order #42: Accessibility for Visitor with Disabilities in National Park Service Programs and Services; http://www.nps.gov/policy/DOrders/DOrder42.html).

6. Next Steps and Conclusion

Chapters 4 and 5 identified and assessed actions and strategies for the park to take to improve the visitor experience to Assateague Island NS, reduce traffic congestion, and protect the park's natural and cultural resources. This chapter describes how those strategies apply to current transportation conditions and a set of potential scenarios, or alternative futures, for transportation to Assateague Island NS. This section also revisits the study goals and park transportation objectives.

The first section of this chapter details implementation steps for recommended actions, based first on current conditions and then on anticipated future conditions of the island. The timing for planning for and implementing these strategies depends on the conditions of the island. There are many strategies that the park can and should implement now to address current conditions, while other strategies require the park to start pursuing planning and funding in preparation for possible future conditions. This chapter provides further recommendations on next steps and provides a discussion of coordination with partners on several of the strategies.

Assateague Island NS staff have identified a high risk of the loss of infrastructure and access due to storms and sea-level rise. The timing and extent of this loss is unknown but changes to the island can occur at any time and NPS staff should be prepared for gradual or sudden changes. Some of the recommended actions below would help prepare park staff and visitors for upcoming changes. Implementation timelines for each of these actions illustrate how the park can prepare for changes to the island over time, creating a smooth transition for visitors in the way they access the park.

Strategies to Address Current Conditions

Elements #1-12, with the exception of #5, which is appropriate to coordinate with the introduction of a transit shuttle, are recommended for current implementation. Table 17 classifies these 11 strategies as short-term, mid-term, and strategies to pursue with partners. A sufficient level of detail is provided in Chapter 4 for implementation of recommended elements #1-12, although Table 18 also provides some recommendations for how best to coordinate with partners on these and other strategies in recognition that some of the recommended actions are outside of Assateague Island NS's jurisdiction and/or require others' participation. While another entity, such as the Maryland Coordinated Highway Action Response Team (CHART), Assateague State Park, or private vendors, may need to take the lead on certain recommended actions, Assateague Island NS can support these actions by initiating discussions, offering letters of support for grant applications, and communicating and coordinating any park activities that may have implications for others.

Table 42
Management Actions and Strategies based on Current Conditions

Management Actions	Short Term Strategies (0-1 year)	Mid Term Strategies (1-3 years)	Strategies to pursue with partners (0-5 years)
No shuttle Continue to keep park open when beach parking is full Move parking / roads west and replace with permeable materials	#3 Improve Park Map #4 Construct Wildlife Viewing Pullovers #7 Improve Bicycle Racks, Air Pumps and Bicycle Repair Facilities #9 Improve Signage at Bayberry Drive Traffic Circle #10 Improve Directional and Parking Signage Near Entrance Station	#6 Offer Bicycle Rentals at the Visitor Center #11 Construct and Exit at North End of North Beach Parking Area	#1 Develop Traveler Information System with (CHART / MDSHA) #2 Revise Emergency and Hurricane Plans and Take Actions to Better Accommodate Bicyclists and Transit Riders (MDSHA, CUA, other) #8 Support Regional Bicycle Network (MDSHA) #12 Relocate and Improve Crosswalk between MD Boat Launch Facility and New Visitor Center (MDSHA) #13 Encourage Rideshare/Carpool to Assateague Island NS (MDSHA / Ocean City) #25 Provide Shuttle Bus Services to/from Regional Destinations (Shore Transit, other)

Table 43
Partner Strategies and Actions

Partner Agency	Short Term	Long Term
Assateague State Park	▪ Potential use of parking facilities near the boat launch on the mainland for bridge access and voluntary shuttle. ▪ Coordination on improvements to emergency evacuation protocol.	▪ Potential coordination of parking, or land for parking, for shuttle as well as potential for extending shuttle service to state park visitors. ▪ Further consideration of shared entrance booths, especially based on mainland parking and shuttle infrastructure.
Maryland State Highway Authority (MDSHA)	▪ Provision of permits, oversight, and potential funding and technical assistance to construct the recommended crosswalk across Route 611. Crosswalk construction and signage would need to comply with MDSHA standards.	▪ Coordinate on shuttle operation on MD 611, including the Verrazano Bridge, and any construction permits or other regulations for mainland entrance booths or shared booths with Assateague State Park.
Maryland State Highway Authority Coordinated Highways Action Response Team (CHART)	▪ Park staff should meet with SHA / CHART to establish protocol for coordination of TIS. ▪ Park staff can work with CHART to develop standard and custom messages for visitors related to park conditions. ▪ See Appendix A of the Elements Section for further details	▪ Support Maryland Greenway network, especially the connection to Assateague Island. ▪ Park staff can meet with MDSHA Greenway committee to discuss ways to promote the Regional Bicycle Network and potential connections to Assateague Island. ▪ Coordinated grant applications, study proposals or general information dissemination are examples of partnership opportunities.
Ocean City Transit	▪ Coordination for emergency evacuation	
Shore Transit	▪ Coordination for emergency evacuation	▪ Possible route extension from Ocean City to Assateague Visitor Island
Castaways and Frontier Town Campground	▪ Coordination for emergency evacuation ▪ Extension of current service to Assateague Island NS north beach parking	
Coastal Bays or other CUA entity	▪ Coordination for emergency evacuation of visitors who rent bicycles and kayaks	▪ Provide opportunity for new rental facility at visitor center

Strategies to Prepare for Future Scenarios

This section describes four potential scenarios, or alternative futures, that this study references to provide recommendations for phasing of alternative transportation strategies. The study does not assume a specific schedule or order for these scenarios, other than recognizing that the scenario with no loss of parking represents current conditions.

Future Scenarios

No Loss of Parking

Current conditions of the park are described in detail in the Existing Conditions and Needs Assessment chapters of this report. To summarize, the park currently has the following transportation conditions:

- Existing road access to Assateague Island NS
- Existing parking for beach access and other destinations
- No public transportation or shuttle service
- Traffic congestion during peak visitation periods
- Illegal parking, due to full parking lots, or confusion over where to park

Partial Loss of Parking

With predicted land erosion, Assateague Island NS staff anticipates that the park may lose parking infrastructure on the island. As Assateague Island NS already experiences more parking demand than capacity, it is anticipated that the provision of alternative access would be necessary and that if not, illegal parking and resulting negative resource and visitor impacts would occur at an increased rate, as parking facilities decrease and the number of visitors increases over time. For this scenario, it is assumed that the roadway and bridge infrastructure remain intact.

Complete Loss of Parking

Assateague Island NS staff anticipates that the park may lose all parking facilities and infrastructure on the island within the next 50 years. In this scenario, it is assumed that the roadway facilities are intact, however, parking lots and park structures can no longer be supported by the island. Vehicular traffic would continue to use the bridge and parts of Bayberry Drive but access would be restricted to OSV visitors, campers (for undeveloped campsites), and those with kayaks and other equipment or access needs.

Complete Loss of Vehicular Access

Assateague Island NS staff has determined that there is a risk for a breach in the island to occur within the next 50 years, damaging Bayberry Drive and cutting off the park from vehicular traffic. The location at highest risk for a breach would likely not affect access to the State Park. This breach may occur before or after the loss of the parking facilities – the park should not assume a linear timeline of events, and should plan ahead for visitor accommodation, should a breach in the island occur.

Strategies and Next Steps

Table 19 identifies management actions and strategies required for each of the four future scenarios defined above. This section describes next steps on how the park may want to prepare for these scenarios and their associated strategies.

Table 44
Management Actions and Strategies based on Future Conditions

Condition	Management Actions	Strategies to prepare for Condition
No loss of parking	Provide voluntary shuttle for visitors Close park when beach parking is full (with exceptions)	#5 Offer Beach Equipment Rental Concessions #21 Develop Policy to Temporarily Close the Park to Entering Traffic when Parking is Full (with exceptions) #22 Provide Additional Parking on Mainland #23 Provide Shuttle Service from Mainland to Park
Partial loss of parking	Close park when beach parking is full (with exceptions) Provide mandatory shuttle for visitors when beach parking is full Move parking / roads west and replace with permeable materials	#21 Develop Policy to Temporarily Close the Park to Entering Traffic when Parking is Full (with exceptions) #22 Provide Additional Parking on Mainland #23 Provide Shuttle Service from Mainland to Park
Complete loss of parking	Provide shuttle access to visitors Allow OSV users access	#22 Provide Additional Parking on Mainland #23 Provide Shuttle Service from Mainland to Park
Loss of vehicular access	Provide water transit access to visitors Provide transit access around the island (trolley)	#22 Provide Additional Parking on Mainland #26 Provide Water Based Transit

No Loss of Parking

The Transit Business Plan section in Chapter 5 outlines the recommended shuttle service (Option #2) from the mainland to the island. Assateague Island NS can take the following steps to begin implementation of this service:

- Determine fee amount and fee collection process
  - Assateague Island NS would need to discuss the selected fee option with NPS Headquarters to ensure Assateague Island NS fee system complies with Federal policies and to conduct public outreach.
  - Assateague Island would need to construct two fee booths for the mainland parking, or consider automated parking system or other options. Consideration of the potential for a shared booth facility with Assateague State Park and/or moving the primary entrance booths to the mainland should be made in the design of the new fee booths.
  - While day use visitors would not have access via personal vehicle while the park is closed, campers, OSV zone users and Bayside recreational users with equipment would still need to access the park using the current entrance booths.

- Purchase/lease land to be used for parking on mainland near Visitor Center.
  - It is anticipated that 360 parking spaces, or approximately three acres, would be needed to accommodate peak excess demand while the shuttle is operating.
  - To prepare for the necessary additional mainland parking, Assateague Island NS could begin discussions with Assateague State Park to construct parking lots adjacent to the Assateague State Park boat launch parking lot, or to use some of the spaces in the boat launch parking lot in the interim while the pilot voluntary shuttle is operating.
  - Overflow parking options have been evaluated in the 2003 Environmental Assessment for the new Visitor Center and should be evaluated for this purpose.

- Purchase/locate VMS indicating status of parking for NPS and State Park on mainland.
  - Assateague Island NS would need to purchase and locate a VMS sign near the mainland parking lots to notify visitors when the island is closed due to beach parking lots being filled and to direct them to the mainland parking and shuttle.
  - Signage and other communication should be coordinated with strategy #1 Traveler Information System.

- Request funding for lease of bus service.
  - Assateague Island NS could submit an application to TRIP or ATP Category III to implement a pilot shuttle.

Partial Loss of Parking

If this scenario occurs, additional transit service in terms of number of buses and number of service days would be necessary, as well as additional mainland parking. Appendix J provides further analysis of the service that would be necessary assuming half of the beach parking is lost.

Complete Loss of Parking

If this scenario occurs, a year-round service and 1,050 mainland parking spaces total would be needed. Appendix J provides further analysis of the service that would be necessary. It is likely that were parking on the island became impossible, visitation would change significantly as well, but the analysis assumes current visitation levels. The analysis also assumes leasing of the vehicles and a service contract, but it may be cost-effective for the park to own at least one bus and for it to consider having a larger ownership and operational role in the system.

Loss of Vehicular Access

If this scenario occurs, the park should consider a ferry or water taxi system to transport visitors to the island. Due to the size of the park, an on-island transit system may also be considered to transport visitors to different sections of the park, depending on the condition of the land. For both the water transit option and on-island shuttle, additional feasibility studies must be conducted. The elements for a water transit feasibility study are described in Chapter 4. In addition, several of the assumptions about necessary mainland parking and service level are covered in Appendix J for parking shuttle Option #5, although it is unlikely visitation would continue at the current level. Access in this scenario may consist of smaller mainland parking lots spread along the mainland coast and served by small, pedestrian-only shuttles. Vehicle ferries could be considered but it is unlikely the cost and infrastructure investment would be feasible or sustainable.

Conclusion

As indicated in the problem statement in the Introduction, this study was intended to both improve current transportation conditions and to plan for potential changes to transportation resulting from storms, natural shoreline processes, and sea level rise. The study identified the following transportation objectives for Assateague Island NS in Chapter 4:

- Reduce the number of vehicles on the Assateague Island NS Maryland District portion of the island at peak times.
- Enhance the travel experience for all modes (e.g., wayfinding, traveler information, facilities and amenities).
- Improve system resiliency to storm damage and sea level rise.

By pursing the recommended strategies from this study, the park would help address each of these objectives, with benefits to the goals identified by the funding program and the park.

Some of the recommended strategies can be implemented by the park in the short term with low cost; others require longer-term planning and moderate costs or collaboration with partners. The parking shuttle requires the most significant investment by the park and the most change to the visitor experience and should be considered by the park in coordination with the General Management Plan and other management decisions. However, given the potential for storm overwash and loss of parking, planning for and beginning to develop an alternative access system is important for maintaining visitor use, both now and into the future.

National Park Service
U.S. Department of the Interior

Assateague Island National Seashore
Berlin, Maryland

Assateague Island National Seashore
Alternative Transportation Systems Planning Study and Business Plan for Alternative Transportation: Appendices

John A. Volpe National Transportation Systems Center

U.S. Department of Transportation
Research and Innovative Technology Administration

Table of Contents

Appendix A: Potential Strategies to Address Issues

The following table outlines potential solutions to Assateague Island NS's transportation needs.

	Transportation Issues											
	Traffic Congestion			Parking		Wayfinding and Traveler Information		Alternative Transportation	OSV Management	Barrier Island Dynamics		Short Term (ST) or Long Term (LT)
Potential Transportation Interventions	Regional traffic congestion	Entrance Booth Congestion	Internal Taffic circulation	Illegal Parking	Parking Demand	Outside the park	Inside the park	Accessibility / Dependence on private vehicles	OSV Management	Vulnerable infrastructure	Emergency evacuation	
Demand Management												
Develop Policy to Temporarily Close the Park to Entering Traffic when Parking is Full			x	x								ST
Use Congestion Pricing to Shift Demand to Off-Peak Times		x		x								ST
Encourage Rideshare/Carpool to Assateague Island NS	x	x		x	x	x		x				ST
Parking Management												
Institute an Automated Parking System		x	x									ST
Provide Additional Parking on Mainland		x		x	x							ST
Relocate and Improve Crosswalk between MD Boat Launch Facility and New Visitor Center								x				ST
Traffic Management												
Build Combined Assateague Island NS and ASP Entrance Station on the Mainland		x					x					LT
Increase Entrance Station Capacity Using Pass Readers and/or Additional Staff		x										ST
Construct Wildlife Viewing Pull-Over Areas			x									ST

	Transportation Issues											
	Traffic Congestion			Parking		Wayfinding and Traveler Information		Alternative Transportation	OSV Management	Barrier Island Dynamics		Short Term (ST) or Long Term (LT)
Potential Transportation Interventions	Regional traffic congestion	Entrance Booth Congestion	Internal Taffic circulation	Illegal Parking	Parking Demand	Outside the park	Inside the park	Accessibility / Dependence on private vehicles	OSV Management	Vulnerable infrastructure	Emergency evacuation	
Reconfigure Bayberry Drive Traffic Circle			x				x		x			LT
Construct Additional Access in the North Beach Parking Area			x									ST
Facilitate Online OSV Pass Purchases and Reservations			x						x			ST
Bicycle Access												
Support Regional Bicycle Network Development								x				LT
Improve Bicycle Racks, Air Pumps, Bicycle Repair Facilities within the Park								x				ST
Offer Bicycle Rentals at the Visitor Center			x		x			x				ST
Water Transportation												
Provide Water-Based Transit	x	x			x			x				LT
Transit												
Provide Shuttle Services to/from Visitor Center/Mainland Parking		x			x			x			x	LT
Provide Shuttle Bus Services to/from Regional Destinations	x	x			x			x				LT
Traveler Information												
Develop a Traveler Information System	x	x	x	x	x	x			x	x		ST
Improve Signage at Bayberry Drive Traffic Circle			x				x					ST
Improve Directional and Parking Signage Near Entrance Station			x				x					ST
Improve park map			x	x	x		x					ST

	Transportation Issues											
	Traffic Congestion			Parking		Wayfinding and Traveler Information		Alternative Transportation	OSV Management	Barrier Island Dynamics		Short Term (ST) or Long Term (LT)
Potential Transportation Interventions	Regional traffic congestion	Entrance Booth Congestion	Internal Taffic circulation	Illegal Parking	Parking Demand	Outside the park	Inside the park	Accessibility / Dependence on private vehicles	OSV Management	Vulnerable infrastructure	Emergency evacuation	
Other												
Offer Beach Equipment Rental Concessions								x				ST
Develop an Emergency Evacuation, Rescue and Communication Plan								x		x	x	ST
Institute Reciprocal Fees with Assateague State Park												ST

Appendix B: Traveler Information Delivery

Introduction

Whether planning a visit to Assateague Island, en route, or departing, visitors need and value having access to immediate information regarding park and travel conditions that would directly affect their decisions with regard to whether or not to travel, when to do so, and which routes and modes to select. This is true both under normal conditions, and perhaps even more when there is an imminent or actual emergency, such as an impending hurricane.

Around the country, states, metropolitan and rural areas, and national parks are meeting this need through the use of advanced traveler information systems (ATIS). ATIS enables the operator (the park, or a state agency) to employ a variety of networked telecommunications technologies (including Internet websites, web-enabled smart phones, telephone hotlines, television, and/or radio), according to a communication plan, to inform users of current and predicted conditions affecting their surface travel. This information is intended to enable the traveler, prior to setting out or en route, to make informed decisions regarding trip departure times, routes, and modes of travel. Such conditions, when they affect travel to and from Assateague, may be planned (for example, reduced speed in a work zone) or unplanned (e.g., a crash that necessitates rerouting traffic temporarily through a detour). Other conditions, such as beach closures, affect the visitor's experience on the island. ATIS is also a central component in emergency management.

At this time, Assateague Island NS does not have an ATIS over which to deliver real-time messages to potential visitors about traffic and beach conditions, emergencies, special notices or standard visitation. On its website, Assateague Island NS provides directions and standard information about the park, but not time-sensitive information or alerts. Currently, Assateague Island NS park staff use megaphones alert visitors to emergencies within the park. It should be noted that the park is already embracing certain communication enhancements that will enable it to convey traveler information electronically to its visitors. Assateague Island NS has purchased a portable variable message sign that it is currently using to monitor travel speeds as vehicles transition from the Verranzo Bridge to Assateague Island. Assateague Island NS would like to use this sign and others near the entrance booths to provide traffic, emergency and possibly OSV Zone information. In addition, the park is already on Twitter.[1] (There are Community Pages for Assateague Island National Seashore, Assateague Island, and Assateague State Park on Facebook but none of them are managed by Assateague State Park or Assateague Island NS.) With respect to displaying traveler alerts on the Assateague Island NS NPS webpage, NPS policy empowers the individual parks to program tailored messages.

In order to enhance the travel experience for all visitors, it is recommended that Assateague Island NS:

- Develop a formal relationship with the state of Maryland's traveler information system (CHART)
- Provide information to visitors appropriately through a defined range of communication channels and media.
- Coordinate with the adjoining Assateague State Park to provide a seamless travel experience for visitors.
- Provide potential opportunities for new policies and services to improve the visitor experience, such as OSV Zone reservations and parking status reports.

This appendix provides additional information on the first two recommendations and highlights where coordination with Assateague State Park may be particularly relevant. The fourth recommendation is covered by the wayfinding and signage improvements that are discussed in the main document as separate transportation elements.

[1] http://twitter.com/assateaguenps

The CHART Advanced Traveler Information System

The Maryland District of Assateague Island NS is fortunate to be in a state with an already established and extensive advanced traveler information system. This section provides information on this system and recommendations on how Assateague Island NS may pursue a formal relationship with the system to carry its messages.

The Maryland Coordinated Highway Action Response Team (CHART) is a joint effort of the Maryland Department of Transportation, Maryland Transportation Authority and the Maryland State Police, in cooperation with other federal, state and local agencies. CHART's mission is to improve Maryland's highway system real-time operations through teamwork and technology. This program started in the mid-1980s as the "Reach the Beach" initiative, focused on improving travel to and from Maryland's eastern shore. It is now a multijurisdictional and multidisciplinary program. Its activities have extended not just to the busy Baltimore-Washington Corridor, but into a statewide program.

To provide traveler information, CHART uses variable message signs, highway advisory radio stations and a traveler advisory telephone. CHART is also in the process of developing a 511 traveler information line. CHART can send alerts and information to any of these devices in close to real-time speed. All alerts are also posted to the CHART website.

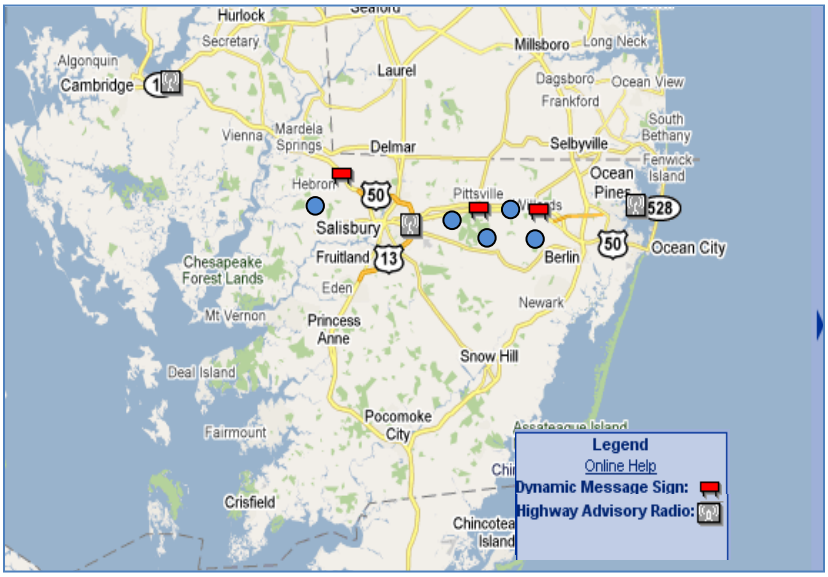
In addition, CHART Web Mobile is a site designed for use by Internet-accessible mobile devices that format the information found on http://chart.maryland.gov. The Maryland Department of Transportation provides real-time traffic and roadway information to the public in an effort to help commuters with incident and congestion management. Currently, limited travel information for the Eastern Shore is available; however, a 2007 Rural ITS Strategic Deployment Plan for the Maryland State Highway Administration[2] identified actions needed to incorporate the rural areas of the state, including the Eastern Shore, into the CHART system by 2013.

Assateague Island NS does not currently participate in the CHART system, Figure B-1 shows the position of CHART's changeable message signs, highway advisory radio, and video camera deployments on the Eastern Shore. A memorandum of understanding with the Maryland DOT and CHART would be needed to establish the operational specifics of the communications relationship to enable Assateague Island NS to communicate traveler information for broadcast by CHART. In this particular example, Assateague Island NS would send the message to the CHART Statewide Operations Center or a regional Transportation Operations Center for broadcast by CHART. It is equally probable that under emergency conditions for which the state is responsible for ensuring public safety, CHART would want to be able to take control of an Assateague Island NS changeable message signs.

Additional information, including contact information, on how Assateague Island NS can work with CHART is included in the following section.

[2] Rural M&O/ITS Strategic Deployment Plan, Technical Memorandum No. 3. March 2007. Available at: http://chart.maryland.gov/downloads/readingroom/Rural/Ruralpercent20MandO-ITSpercent20Strategicpercent20Deploymentpercent20Plan.pdf.

Figure B-1
CHART changeable message, highway advisory radio, and video camera locations
Source: CHART website, http://www.chart.state.md.us/MapNet, and Volpe Center



Visitor Needs and Message Development

In order to take advantage of the already existing ATIS infrastructure and potential future collaboration with CHART, Assateague Island NS needs to systematically define the messages that it wants to be able to convey through these means. A blueprint for approaching this decision is detailed below. There are a variety of options for delivering important information to visitors, depending upon its content and the time and place at which visitors need to receive it. Before adding new communication methods or equipment, it is helpful to systematically review the types of messages it needs to convey, to identify audiences and how they would use the information, and then develop a coordinated approach for communication delivery.

Conveying timely information about emergencies or beach and traffic conditions are especially important messages for visitors. The messages that Assateague Island NS would want to deliver to visitors fall under the following categories:

- Getting to Assateague
- Getting around Assateague
- Traffic conditions
- OSV entry status
- Special events or weather conditions affecting travel and access to Assateague Island NS
- Unplanned incident and emergencies effecting travel

For each message that travelers should receive, a plan for information delivery must be established. Multiple communication methods can be employed to reach each set of visitors in their unique location. In addition to newer communication methods, such as text messages or Twitter updates, the NPS website can be used to a greater extent in delivering messages, especially real-time messages and alerts.

The following questions should be considered when determining how to deliver a message:

- What is the message?
- Who needs to receive this message?

- When does the recipient need to receive the message?
- Where does the recipient need to receive the message?
- Does the message need to be customized, or can standard messages be used?
- How long/detailed must the message be?
- Is feedback or other two-way communication needed?
- What length of time would the message be valid / how frequently must the message be updated?

Based on answers to these questions, the set of communication methods can be established and roles for message delivery can be established.

Table B-1 outlines some key messages the park would need to deliver on a regular basis, and the tools it can use to convey these messages. The grey cells indicate methods already in use by Assateague Island NS. For all messages, except regarding the OSV Zone, there is an opportunity to work with Assateague State Park, as there are likely identical or similar message needs for each park (especially in regards to emergency messaging).

Table B-1
Message Type and Communication Methods
Source: Volpe Center / USDOT

Message Type	Traveler Information System Components					Additional Communication Methods		
	Website	Changeable Message Signs	Highway Advisory Radio	Phone info line (511)	Twitter / text messages	Static signs	Print Maps	Park staff
Getting to Assateague	X				X	X	X	X
Getting around Assateague	X				X	X	X	X
Traffic conditions	X	X	X	X	X			X
Emergencies	X	X	X	X	X			X
Special events / Announcements	X	X		X	X			X
OSV Zone status	X	X		X	X			X

**Shaded cells indicate methods currently in use by Assateague Island NS*

The following sections describe in detail the way in which communication methods are or can be used for the different types of messages described in Table 1.

Directions (to the park and within the park)

Visitors would need to obtain directions both to the park and around the park (e.g., parking lots and various destinations and facilities). The park should consider availability of information to visitors prior to visiting the park, when they are planning their trip, and once they are travelling to the park or within the park. The following message vehicles can be used to deliver directional information to visitors:

- NPS website: The website currently provides brief directions. A link to Google maps may be helpful for visitors planning their route. Specific information for bicycle travelers can also be added to the website. This addition, with distances and travel times, may be helpful for visitors and promote alternative options for travel. Directions and information about the State Park and

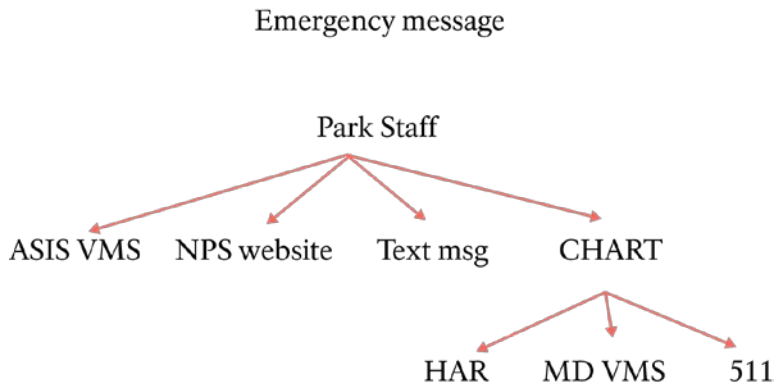
trails can be enhanced on the website.

- 511 phone line: Directions to the park can be made available on the 511 traveler information service.

Emergency Messages

The park would need to quickly deliver emergency messages about weather, traffic accidents, wildlife incidents, or other emergency or evacuation messages. While park staff would still be needed to announce emergency information at the beach, there are a variety of other electronic methods which can alert visitors of emergencies, both on and off the beach. Ideally, park staff should be able to send one message about emergencies that would trigger messages to all elements of the traveler information system. The following components (in addition to current staff practice of alerting visitors on the beach with a megaphone) would work together to deliver messages to visitors in all areas where they need to receive the information. Figure B-2 shows a conceptual emergency message deployment system in which Assateague Island NS staff could quickly broadcast a message via many systems in order to reach a broad audience.

Figure B-2
Emergency message deployment system
Source: Volpe / USDOT



- Changeable message signs: Assateague Island NS can work with CHART to use State variable message signs to display important information.
    - Park staff should contact CHART at 410-582-5676 to deliver important information for display on their VMS signs. Park staff should consider the following:
        - Assign one staff member to send the alert to CHART. This staff member must alert CHART when the emergency message is no longer valid, per CHART request.
        - Establish standard messages, such as "Assateague Seashore closed due to
            - weather." CHART VMS can display a maximum of three lines of text, 20
            - characters in each line
        - Use the same message on Assateague Island NS VMS.

- NPS website: The park can consider displaying emergency information on their website. Ideally, alerts sent to CHART can also be deployed to the NPS site. The website should be compatible with smart phone browsers.

- Highway Advisory Radio: As with CHART variable message signs, the park can use CHART's highway radio advisory system. The contact information is the same as above (VMS).

- 511 phone line: Maryland CHART is in the process of developing a 511 travel information telephone service for Maryland. CHART is currently choosing a consultant for this project, and is interested in working with Assateague to develop a means to convey park messages. The park can contact Theodore Valmas at tvalmas@CHART.State.md.us. Many other parks, such as Yellowstone and Acadia, have a dedicated option on their State's 511 line. There is a hotline listed on the NPS site, however, it may be more beneficial to list the 511 line for simplicity.

- Twitter / text messages: A system could be put in place such that visitors could sign up online to receive text alerts from Assateague Island NS. When messages are uploaded to the NPS site, an automatic message can be sent to visitors. Coverage on the island works best with the Verizon and Sprint network. Other carriers may have more limited coverage.

Special events / announcements

At times, the park may want to convey information about special events, such as NPS Free Entrance days. This information should be marketed and promoted, as well as listed.

- NPS website: The NPS website currently lists Free Entrance days. The Assateague page can highlight this information and list other events prominently on their park specific page.

- Twitter / text messages: As noted above under emergency messages, a system could be developed that would allow visitors to sign up online to receive text alerts from Assateague.

- 511 phone line: Temporary announcements about park events can be recorded on the 511 phone line. Assateague Island NS would need to discuss this in further detail with CHART as the state develops the 511 system.

OSV Zone Status

Visitors using the OSV Zone should be able to obtain information about peak hours, and status of the OSV Zone. The park is planning to purchase and install variable message signs to alert visitors of the status of the OSV Zone. Additional vehicles for conveying this information include:

- NPS website: Messages sent to the park VMS regarding status of the OSV Zone can also be sent to the NPS website. General information about peak hours and wait times (if available) can also be listed on the website.

- Twitter / text messages: As described above, OSV Zone users could sign up to receive text alerts.

Appendix C: OSV Zone Access Management Memo

TO: Ted Morlock, Pat Greer, and Trish Kicklighter (Assateague Island NS)

FROM: US DOT/Volpe Center

RE: Alternative Transportation Study – OSV Zone Access Management

DATE: April 28, 2010

This memo was prepared to provide technical assistance for the consideration of an Intelligent Transportation System (ITS) for management of the Over-Sand Vehicle (OSV) Zone within the Maryland District of the Assateague Island National Seashore (Assateague Island NS) (see Figure C-1). This memo is submitted with the understanding that Assateague Island NS is planning to submit a scope of work for such a system to the National Park Service Northeast Region contracting office by May 1, 2010. The Volpe Center can provide further assistance, in particular regarding technology options, upon request once Assateague Island NS has reviewed the considerations outlined in the memo and made additional decisions regarding the functional requirements of the system.

The memo consists of the following sections:

- Introduction
- Systems Engineering
- Overall System
- Traveler Information Subsystem
- Parking Management Subsystem

Figure C-1
Assateague Island NS OSV Zone Entrance
Source: U.S. DOT Volpe Center project team (July 2009)

Introduction

The Maryland District has a designated OSV Zone that extends along the ocean side of Assateague Island for 19 km between the entrance to the OSV Zone, at the end of Bayberry Drive, and the Virginia state line. Only those vehicles with appropriate permits may enter the OSV Zone. However, purchase of an OSV permit does not guarantee access to the OSV Zone at any particular time. The permissible maximum

number of vehicles in the OSV Zone at any time is 145; when this limit is reached, a closure goes into effect, and vehicle access is managed on a one in/one out basis. Furthermore, vehicle access may be curtailed or denied due to overwash, emergency conditions, or management constraints.[3]

At present, limitations on access are managed by Assateague Island NS staff, who are assigned during times of high visitation and use of the OSV Zone, to manually count vehicles at entry, verify permit compliance, and turn away vehicles; at these times, one is posted at the entry to the OSV Zone and another patrols the OSV Zone, checking vehicles for permits. This approach has to date resulted in the OSV Zone exceeding capacity, incurred payroll costs, and limited staff availability for alternative duties. Inaccurate counts mean that Assateague Island NS cannot have confidence in the fulfillment of its responsibility to protect the island environment. In addition, visitors at the head of the queue are unhappy when they see a car leave the OSV Zone but they are not permitted to enter because the OSV Zone is above capacity.

To address these issues, the Maryland District of Assateague Island NS would like to install and operate an intelligent transportation system (ITS) to automate the OSV Zone entry point to assure that vehicle access by visitors is held at all times to the desired maximum number appropriate to ambient conditions. Assateague Island NS would also like this automated system to communicate the OSV Zone's utilization and access status via changeable message signs (CMS) (also known as variable or dynamic message signs) in order to provide notice in advance of visitors' arrival at the entry point.

Assateague Island NS has asked the Volpe Center to provide background information on management, equipment, and technology options in relation to the desired ITS deployment. The purpose of this memo is to:

- describe the recommended approach to further planning,
- list the functional requirements of the system that Assateague Island NS has articulated to date,
- present considerations that drive possible additional requirements and that Assateague Island NS should address before committing to a particular system, and
- comment on the implications of the functional requirements in relation to a number of equipment and technology options.

The Recommended Implementation Approach: Systems Engineering

The Volpe Center recommends Assateague Island NS identify its requirements for the OSV Zone ITS based on a systems engineering approach, which would guide Assateague Island NS's identification of required components (physical elements and communications systems). Systems engineering promotes increased up-front planning and system definition prior to technology identification and implementation. Documenting needs, expectations, the way the system is to operate, and the system requirements, including maintenance, prior to implementation leads to improved system quality. Systems engineering also thereby reduces the risk of schedule and cost overruns, and increases the likelihood that the implementation would meet the user's needs.[4]

The systems engineering process is vital in large, complex systems but if scaled appropriately, can benefit relatively simple projects as well, such as the OSV Zone ITS. Essentially, a systems approach starts with coming to a clear understanding of the purpose, use, and ultimate value of the envisioned system to its owners and users. (This understanding is called the Concept of Operations.) What the system must do in order to satisfy this vision is then stated as a series of requirements. The requirements, in turn, drive the design of the system and the selection of appropriate technologies. In the case that a system consists of a number of subsystems, this same logic is to be applied to each subsystem as well. This memo begins to address some of the stems in the systems engineering process, namely vision and functional requirements.

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[3] http://www.nps.gov/asis/upload/OSV08-2.pdf

[4] http://ops.fhwa.dot.gov/publications/seitsguide/section2.htm#s2.1

From the standpoint of ITS planning and deployment, the overall OSV Zone access management system envisioned by Assateague Island NS involves two integrated subsystems: Parking Management and Traveler Information. The following discussion first looks at the overall system and then addresses each of the separate subsystems. In each case, the additional considerations that we present may define new requirements as well as refine those already recognized.

The Overall System: Functional Requirements and Additional Considerations

Functional Requirements. Assateague Island NS has said that it wants this system to:

- assure that vehicle access by visitors is held to the desired maximum year round (24 hours a day/7 days a week),
- allow NPS staff vehicles to enter the OSV Zone at any time regardless of vehicle count,
- communicate the OSV Zone's access status through messages displayed on CMS equipment located at two points upstream of the entry point (a possible future third sign would be positioned on the mainland at the Assateague Island NS Visitor Center on Rte 611), and
- have a centralized control mechanism (computer/interface) on site and remotely operable by Assateague Island NS personnel.

Additional Considerations for the Overall System. The Volpe Center recommends further consideration by Assateague Island NS of a number of additional factors:

- whether and how the system would verify that the entering vehicle has a valid permit;
- what connectivity options (e.g., cellular wireless, RFID, and satellite) exist to support information flow between the central computer, the gate equipment, and the signage where relative proximity of the elements may be an issue (when considering this point, Assateague Island NS should plan ahead for the third sign, if only to size other system components to accommodate future expansion);
- where the computer/interface should be located (connectivity may be a deciding factor), who would be responsible for operating it, and what training of these personnel would be necessary, depending upon the choice of system;
- how Assateague Island NS would monitor the access/counting equipment and CMS equipment to assure that they are functional (this may involve assigning staff or subscribing to a monthly service contract with a company to manage the system);
- whether Assateague Island NS wants to archive the count data for future analysis (if so, the detection system would have to be capable either of retaining its accumulated data for future download, or transmitting counts not only to the CMS equipment but to a remote server located at a point to be determined);
- whether Assateague Island NS wants the ability in the future to provide real-time information on the OSV Zone utilization and access status via other communication means (online, phone, radio);
- whether there are requirements that should be added to ensure compatibility with access management needs of the OSV Zone in the Virginia District;
- how the creation of a notification system should be coordinated with state and county emergency management entities (Maryland State Highway Administration and its Coordinated Highways

Action Response Team (CHART)[5], the Worcester County Emergency Operations Center, and the Worcester County DPW Office) so as to take advantage of other system's emergency and traffic information; and

- what the costs, savings, and overall benefits are in relation to the Assateague Island NS budget.

The Traveler Information Subsystem: Vision, Requirements, and Additional Considerations

The Vision. Assateague Island NS has said that it wants to position CMS equipment in two locations: one located on Bayberry Drive, a short distance north of the entrance booth and within NPS jurisdiction, to inform incoming visitors of OSV Zone conditions, and the other at the entrance to the OSV Zone (see Figure C-2). Assateague Island NS envisions signs that can display automatically transmitted real-time counts of vehicles present in the OSV Zone that have been, and manually entered, customized messages (such as beach conditions or weather updates).

For the future, Assateague Island NS is also contemplating a third sign, which would be placed on the mainland near the Assateague Island NS Visitor Center.

Figure C-2
Location of OSV Zone Signage
Source: Google Earth, modified by U.S. DOT/Volpe Center project team

Functional Requirements. Assateague Island NS has said that for this subsystem:

- signs must be capable of displaying real-time counts of vehicles present in the OSV Zone, as well as custom messages input by park staff;
- the CMS screens must be large enough to display both pre-determined and custom messages;
- the positioning of the signs should assure that, when the OSV Zone is closed to additional entrants, visitors can redirect themselves to other island attractions and/or reverse direction without impeding the flow of traffic to or within the park;

[5] The Maryland Statewide ITS Architecture (December 2009 version; at http://www.itsmd.org/index.php?page_id=996) provides detail on the present arrangement of organizations and information flowing among them for this purpose. Should all this come to pass, CHART, which is responsible for the maintenance and periodic update of the Statewide ITS Architecture, would at some scheduled future point add Assateague Island NS and its traveler information system to the document.

- the signs would need sufficient power to update vehicles counts in real time; and
- decisions regarding placement and size must be made to minimize compromising area aesthetics.

Additional Considerations. The Volpe Center recommends further consideration by Assateague Island NS of a number of additional factors:

- whether the displayed message should display not only the number of vehicles in the OSV Zone, but the maximum number permitted in;
- how best to accommodate potential for color blindness of some visitors in choice of text color; and
- what options for connectivity exist if Assateague Island NS wishes to transmit customized messages to the CMS equipment—for example, cellular wireless broadband connectivity, direct satellite transfer, or other possibilities and the associated costs;

Equipment Considerations. CMS equipment is often used to deliver messages along roads, highways or at the entrances to parks or buildings. Many CMS are equipped with custom keyboards; however, others can be used with cell phones or computers. The signs used for this project would need to communicate with a central computer to display text messages or send unique messages to each sign. Considerations for such technology are explored under Parking Management. For the CMS equipment:

- Assateague Island NS would have a choice of using **portable or fixed** CMS signage. Considerations for each include:
    - Fixed CMS equipment costs two to six times the cost of portable signage, and has installation costs associated with stringing or laying the power line underground. If the line is underground and a problem develops, it must be excavated for repair and reburied.
    - Portable CMS equipment is available with solar and back-up battery power; fixed signage typically requires a direct power line. The former needs periodic checking to assure that the solar units are functional and that the battery is charged; this monitoring could involve staff or it may be possible to do remotely if a suitable communications link exists. The solar and batter components are also potentially subject to vandalism and theft, so their protection becomes an operational consideration. Assateague Island NS should also consider the effect that the appearance of these equipment components has on the viewscape.
- The desire to have equipment that can separately and simultaneously receive and display both automated and manually transmitted messages may significantly constrain the range of choice. More complicated equipment also tends to be more expensive.
- In addition to placement and size, is appearance an aesthetic issue? The NPS Denver Service Center may be able to help with customized design if needed; whether it can help with both portable and fixed signage would have to be explored. Customization in either case would likely extend the project timeline.

The Parking Management Subsystem: Vision, Requirements, and Additional Considerations

The Vision. This system should limit the steady-state presence of non-NPS vehicles to 145 or a lower specified number and communicate counts in real time to CMS equipment.

Functional Requirements. Assateague Island NS has said that this system shall:

- accept alternative maximum capacity settings,

- permit vehicles to enter the OSV Zone,
- count entering vehicles,
- count exiting vehicles,
- calculate the net total number of vehicles in the OSV Zone at all times,
- prevent vehicles from entering the OSV Zone when it has reached a specified maximum,
- permit additional vehicles to enter when the OSV Zone vehicle count drops below the specified maximum,
- communicate counts in real time to the central computer, which can track counts and/or update a website or other informational device, and
- in real time, communicate the number of vehicles in the OSV Zone to CMS equipment.

Additional Considerations. The Volpe Center recommends further consideration by Assateague Island NS of a number of additional factors relative to system requirements:

- verify the validity of permits and differentiate between permits (Maryland ONLY, Virginia ONLY, Maryland & Virginia DAY, NIGHT, BULLPEN), and
- provide equipment with a two-way intercom with Help button with access to staff 24 hours.

Equipment Considerations. Automated entry control systems consist of the following components: involve some combination of gates, a sensor triggered by a reader (e.g., of a smart card, dashboard transponder, or bar code) that activates the gate; a separate sensor system that counts vehicles entering and exiting and calculates the net level of occupancy; and transmission capability, or communications, to transmit count/occupancy data to a remote service/central computer and/or directly to CMS equipment.

Each of these components and important considerations for each are addressed in more detail below.

Gates. A weather-resistant barrier gate can be used for this function. Gates should include breakaway arms, made of material appropriate to operating in beachfront conditions. Most standard barrier arms will work with vehicle counters but compatibility among all components of the system will be a key consideration.

Access sensors and *counter sensors* would need to be located at the point of entry and exit at the barrier gates; access ensors to verify permits and activate the gate to open to allow vehicles to enter and exit the OSV Zone and counter sensors to track the total number of vehicles within the OSV Zone at any given time. A painted stop line and sign or other visual indication would slow the pace of the entering vehicles and ensure sufficient notice when the OSV Zone reaches capacity. (See Figure C-3).

The technologies associated with *access sensors* typically involve:

- *A proximity sensor* that can read a swiped or waved smart card, or
- *automated vehicle identification (AVI)* technology using radio frequency identification (RFID), which involves a transponder, positioned on the dashboard of the vehicle, which is a read by a roadside sensor.

These technologies would satisfy the requirement to limit non-NPS access and permit unlimited NPS access. However, for such technologies to be feasible, a number of considerations would have to made, including:

- the additional cost of a gate/counter system that has this additional feature;
- the unit cost of the card or transponder, which is in part driven by the number of permits that are sold each year;
- whether the unit cost could/would be passed along to the permit holder; and
- characteristics of the physical environment – Assateague, like similar NPS locations such as Sandy Hook (NJ), challenges the robustness of sensors because of blowing sand, corrosive salt air, and

ambient noise. Sandy Hook, for example, has had unsatisfactory experience with certain detector configurations.[6] In this case, to monitor vehicle counts at the lowest possible cost, pneumatic tubes and wireless transmitters were installed at Sandy Hook. The park found that the tubes were subject to damage from external elements, and that basic wireless transmitters, while less expensive than other options, were subject to interference, and did not have the ability to conduct error checking to ensure data delivery to the ranger station.

Counter sensors would require that the vehicle pass through a non-discriminatory sensor, such as an inductive loop, magnetic or acoustic sensor, or pneumatic tube, depending on cost, environmental factors, and risk of damage or vandalism.

Figure C-3
Configuration of Proposed OSV Zone Entrance
Source: Google Earth, modified by U.S. DOT Volpe Center

[6] Lessons learned presentation (streaming) available upon request.

Communications. A number of commercially available parking access control systems are equipped with equipment that communicates availability and access status to CMS equipment.

If Assateague Island NS does not elect to procure a complete system, then this information could be transmitted to CMS equipment in a variety of ways: radio signal with either a repeater or wireless mesh; cellular network; or satellite communication. Assateague Island has fairly good cellular coverage with AT&T and Verizon, however, cellular service may be less reliable than a radio signal, and requires a monthly data plan. Satellite options are also available; however, the cost and slower speed may make radio the better option. Because the functionality of radio signals is highly dependent on the terrain of the island, a consultant would need to assess the area.

Reports Consulted

Coordinated Highways Action Response Team. Maryland State Highway Administration. Maryland Department of Transportation. *Maryland Statewide ITS Architecture Version: December 2009*. At http://www.itsmd.org/files/MDpercent20Statewidepercent20ITSpercent20Architecturepercent202009percent20Documentpercent20Final.pdf

US DOT Volpe Center for the National Park Service. *Gateway National Recreation Area – Sandy Hook Unit. Automated Fee Entrance Plaza and Intelligent Transportation System Technical Requirements*. January 2009. PMIS No. 16635B.

US DOT Volpe Center for the National Park Service. *Gateway National Recreation Area – Sandy Hook Unit. Automated Fee Entrance Plaza*. September 2007. PMIS No. 16635B.

Appendix D: Multi-Modal Emergency Evacuation Plan

This appendix provides more information on Element 2 and includes strategies on improving evacuation plans and coordinating with regional and state emergency personnel; partnering with local transit providers and others for evacuation; strengthening storm-related infrastructure for sheltering-in-place; and communicating general and acute risks prior to a storm. These strategies are focused on consideration of those who are not accessing the park by personal vehicle.

There are several recreational transit systems in regions prone to severe flooding or storm events, however, there is very little information available on transit rider evacuation plans. Other land managers plan to implement an emergency evacuation plan for visitors although very few formal plans have been documented. Other similar parks reported reliance on increased transit service, available shelter, and communication of forecast warnings. The park should address the following questions before implementing a new transit service or new limits on parking and park access.

- How should the park evacuate transit riders and bicyclists from the seashore when a large storm approaches or another emergency occurs?
- How should the park evacuate or assist visitors with special needs (people with disabilities, people with medical conditions, people with no access to a vehicle, people with service animals)?[7]
- How should the park protect Assateague visitors from short-term, sudden storm events if they do not have a vehicle in which to take refuge?

Evacuation Plans

This section examines current NPS, Maryland, and regional plans and procedures and makes recommendations for future improvements.

Assateague Island NS

According to the current NPS Hurricane Plan, visitors are kept informed of weather conditions, park status, and recommended actions during storm force winds. Visitors are evacuated during possible hurricane force winds or a couple of days before the landfall of a hurricane.[8] When the park evacuates, visitors will be directed to evacuation routes and/or established storm shelters. The park will provide directions and a map to visitors. In addition, the Hurricane Plan outlines instructions for NPS staff at each stage of a hurricane watch. As stated in the plan, staff instructions include:

- Hurricane season: Park staff should monitor NOAA weather forecasts.
- Storm alert or possible hurricane force winds: Park staff should inform visitors of weather conditions and prepare for the closure of park facilities. Within 72 hours of a hurricane, park staff should prepare park buildings and determine if it is appropriate to evacuate visitors.
- 48 hours before hurricane force winds: Park staff should evacuate visitors. Non-emergency NPS staff should be in storm shelters or evacuate the island.
- Hurricane landfall: Park staff should be in designated storm shelters or evacuation areas. The Incident Commander and Superintendent will issue release of park staff.

During an evacuation, park staff use megaphones to communicate with visitors, and traffic is directed off the island with Assateague State Park and Assateague Island NS vehicles alternating right-of-way onto the approach to Verrazano Bridge. There can be significant delay and congestion approaching the merge of traffic from the two parks.

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[7] US DOT Federal Highway Administration. "Evacuating Populations with Special Needs: Routes to Effective Evacuation Planning Primer Series." April 2009.

[8] National Park Service "Assateague Island National Seashore 2009 Hurricane Plan," approved by Ted Morlock and Trish Kicklighter.

Recommendations

Visitors to the island would not be able to evacuate under current procedures if they arrive by bicycle or transit or if there is little warning of a storm. While there are currently no transit connections to the park, there are some visitors who arrive to the park by bicycle who cannot evacuate or take refuge in their vehicles. While transit riders and bicyclists may be turned away from the park if a storm is approaching, these visitors may be affected by sudden, local storm events. Detailed communication procedures and local partnerships could improve the evacuation process for visitors. The other sections in this appendix include information and partnership agreements that could be incorporated into the next hurricane plan update.

Park staff should integrate consideration for visitors with special needs into future plans. While these visitors might make use of the handicapped parking on the island, they might need additional assistance to quickly access their vehicles or other shelter in the event of a storm. As parking becomes more limited on the island, shuttle service providers should accommodate visitors with special needs on the shuttles and park staff should plan for their evacuation during an emergency.

For vehicular evacuation (including transit), the park should conduct a traffic management plan to assess improvements to the intersection of Bayberry Drive and 611, where traffic from Assateague State Park and Assateague Island NS merge to evacuate. Possible improvements include employing NPS and/or Assateague State Park staff to direct traffic and/or install traffic signals that can be set for evacuation and reversing the eastbound lane across the Verrazano Bridge to a contraflow lane.

Maryland

The Maryland Emergency Management Agency (MEMA) Core Plan for Emergency Operations presents a coordinated management response by local, state, and federal agencies. This plan outlines the roles and responsibilities for federal and state agencies during a disaster or emergency response.[9] It is recommended that park staff inform the following agencies, for which a description of their emergency responsibilities is provided, of evacuation plans as changes are made.

Maryland Department of Transportation

The Maryland Department of Transportation (MDOT) is responsible for coordination, control, and allocation of transportation assets in support of the movement of emergency resources. MDOT is responsible for the evacuation of people and the redistribution of food and fuel supplies. MDOT will also provide transportation resources to assist in evacuation, communications support, and infrastructure repair.

Department of General Services

The Department of General Services (DGS) provides for roads, highways and bridge repairs, engineering, construction, repair and restoration of essential public works systems and services, and the safety inspection of damaged public buildings.

Maryland Emergency Management Agency

Maryland Emergency Management Agency (MEMA) collects, analyzes, creates and disseminates critical information on emergency operations for decision-making purposes.

[9] Maryland Emergency Management Agency. *Core Plan for Emergency Operations*. August 26, 2009. Document is available at http://www.mema.state.md.us/MEMA/content/pdf/The_State_of_Maryland_Emergency_Operations_Plan_26Aug09.pdf

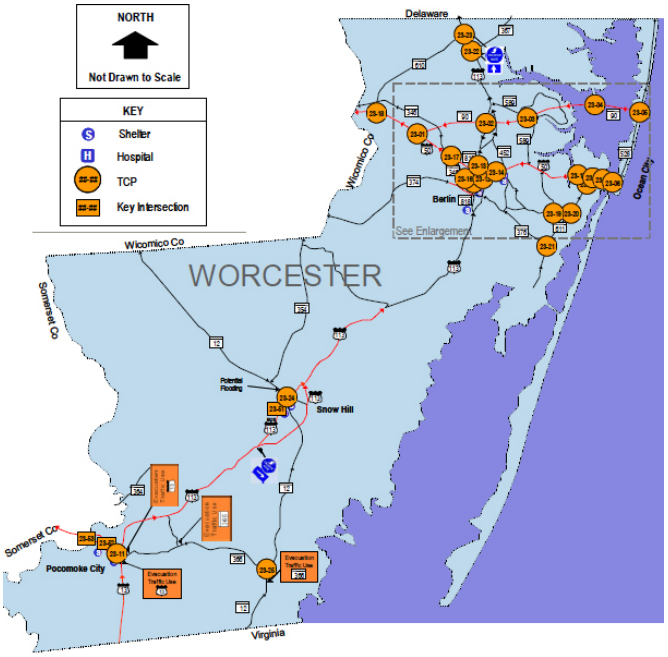
Maryland State Police and Department of Natural Resources Police

Maryland State Police (MSP) and Department of Natural Resources Police (NRP) provides resources for ground, water and airborne activities to locate, identify and remove from a stricken area, persons lost or trapped in buildings and other structures.

Delmarva

The Delmarva Hurricane Evacuation Study was produced by the US Army Corps of Engineers in 2006 and it includes the evacuation route for Delaware, Maryland, and Virginia.[10] The plan includes evacuation routes by county along with the number of vulnerable housing units. In addition to the county maps, the traffic control plans within each county are included. One of the study's Traffic Management Plan shows the evacuation route from the Eastern Shore of Maryland (see Figure D-1). The plan details evacuation routes and new intersection alignment during an evacuation. It is recommended that park staff inform all visitors of the evacuation route from Assateague Island.

Figure D-1
Maryland Eastern Shore Hurricane Evacuation Traffic Management Plan, Worcester TCP.
Source: US Army Corps of of Engineers, Delmarva Hurricane Evacuation Study (HES) Draft Maps and Data http://www.nap.usace.army.mil/HES/Delmarva/



[10] For more information on the Delmarva plan contact Robert Ward, Maryland Emergency Management Agency, Camp Fretterd Military Reservation, 5401 Rue Saint Lo Drive, Reistertown, MD 21136, rward@mema.state.md.us, 410-517-3606. Website: http://www.nap.usace.army.mil/HES/Delmarva/

Partnerships

This section identifies potential partners to assist Assateague Island NS with evacuation efforts.

Shore Transit

Shore Transit is the public transit agency for the Maryland counties of Somerset, Wicomico and Worcester. Shore Transit operates 45 vehicles including 15, 25, and 35 passenger buses, all of which are wheelchair-equipped. Shore Transit operates a paratransit service to residents in the region who require assistance. The park can benefit from further discussions with Shore Transit to receive assistance during an emergency evacuation or large storm event.

Shore Transit already partners with operation centers in Wicomico, Worcester, and Somerset counties for evacuation planning.[11] In these agreements, Shore Transit provides assistance and available resources to these counties. There are no designated pick up locations within the region and Shore Transit has not yet needed to participate in an evacuation of residents or visitors from the region. The current Memorandum of Understanding (MOU) for Community Emergency Management was established by the Tri-County Council for Lower Eastern Shore Maryland and Shore Transit and was agreed upon by each county (see Figure D-2 on the next page). The incident commander, director of the Tri-County Council for the Lower Eastern Shore of Maryland, and the director of Shore Transit would determine the transit agency's response in an emergency event. Shore Transit's support could include the transport of passengers north from Somerset, Wicomico and Worcester counties where they would transfer passengers to coach buses. Shore Transit could also assist in the evacuation of citizens, transport first responders, provide vehicles for staging areas, and evacuate elderly or persons with disabilities.

During a phone conversation, Shore Transit stated that they would consider an agreement with Assateague Island NS to provide assistance during an emergency evacuation. To establish an agreement, Shore Transit and the park would plan and develop an MOU to define the terms of the agreement. Shore Transit is somewhat limited during a storm event if winds are too strong for drivers to safely navigate and because of the limited carrying capacity of their fleet.

Ocean City Transit

Ocean City provides a variety of services to residents and visitors including a Boardwalk tram, Coastal Highway Transit bus, West Ocean City Park & Ride, and a Special Events trolley. Ocean City Transit could be a good partner for Assateague Island NS during an evacuation event because of their large fleet, variety of bus sizes, and long hours of daily operation.[12] However, the system would also need to meet Ocean City demands and travel from Ocean City to Assateague Island NS.

Campgrounds

Frontier Town

Frontier Town Campground operates a summer and Saturday shuttle service from the campground to Ocean City and Assateague State Park. It is located approximately three miles from the visitor center and bridge. During an evacuation event, Frontier Town reports that they transport all transit users to a safe location. Frontier Town reports that they might be able to assist the park with an evacuation and the park should contact Frontier Town directly for further discussion.[13]

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[11] Information is from a phone conversation with Riggin Johnson, Transit Director at Shore Transit Division, tel 410-632-3300 on February 2, 2011. Website: http://www.shoretransit.org/Home.aspx

[12] The Town of Ocean City Public Works Contact information is 410-524-7716 or 6501 Coastal Hwy. Ocean City, MD 21842. Website http://oceancitymd.gov/Public_Works/transportation.html

[13] Contact Frontier Town owner Mich Parker at 1-800-228-5590 to discuss evacuation assistance.

Figure D-2
Shore Transit MOU
Source: Shore Transit

MEMORANDUM OF UNDERSTANDING
SHORE TRANSIT AND EMERGENCY MANAGEMENT

Purpose: To establish specific agreement between transit agency staff and Community Emergency Management in the event of a community incident/emergency or an incident/emergency on board a transit vehicle or on transit agency property.

Policy/Authority: This Memorandum of Understanding is established by the Tri-County Council for the Lower Eastern Shore of Maryland and SHORE TRANSIT and covers and is agreed to by the following agency: Somerset County Department of Emergency Services.

Transit Authority of Command:

1. The authority of command at any incident/emergency will lie with the first transit representative on the scene until such time as the Transit Manager(s) arrives at the scene.

2. Whenever the Transit Director is not available, the SUCCESSION STANDARD applies.

Interface/Coordination with Transit Agency:

1. In the event of an incident/emergency on board a transit vehicle or on transit agency property, SHORE TRANSIT will follow established protocols.

2. In the event of a community incident/emergency The Tri-County Council for Lower Eastern Shore of Maryland and its division SHORE TRANSIT is available to assist as needed. This could include:
   - Assisting in the evacuation of citizens in the affected area,
   - Transporting First Responders to and from the scene
   - Using transit vehicles in the staging area as a protected environment for First Responders or victims of the incident/emergency
   - Evacuating the elderly and/or persons with disabilities to or from nursing home, or other care facilities
   - Other, as determined by agency management and/or the Incident Commander (IC).

3. The determination of the transit agency's response will be made by the Incident Commander in conjunction with the Director of The Tri-County Council for the Lower Eastern Shore of Maryland and the Transit Director of SHORE TRANSIT or his/her designee as per the SUCCESSION STANDARD.

[signature], Director of Emergency Services — 10/27/06
Signature and Title — Date

[signature] TCC — 11/1/2006
Signature and Title — Date

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Castaways

Castaways Campground operates a similar shuttle and is located six miles from the visitor center and bridge. In the event of an evacuation, Assateague Island NS could benefit from Castaways assistance in transporting visitors off of the island. Assateague Island NS should contact Castaways for further discussion and availability of the bus.

Concessionaires

The park should coordinate with the on-site bicycle rental concession and/or revise the Commercial Use Authorization to ensure that the concession would send a vehicle to collect bicyclists who call for pick-up or assemble at designated pick-up spots and that the concession provides bicyclists with information on storms, sheltering, and the evacuation process. These same protocols should be applied to any other commercial-use authorization – e.g., kayak concession or campground bus.

With several bicycle trails within the park and the bicycle-pedestrian bridge, the number of bicyclists who arrive to the island may increase in the future. The park and concessionaires should provide evacuation assistance to bicyclists. In addition, the park can provide bicyclists with temporary shelter during a storm.

Storm Infrastructure

Shelter

The park can provide visitors with temporary protection from thunderstorms, wind, and rain with storm shelters or bus shelters. While Assateague Island NS should arrange to evacuate visitors during a large storm event, temporary shelters could provide visitors with refuge during the smaller or more frequent storm events. Shelters could be particularly beneficial to bicyclists or hikers who do not have immediate access to a private vehicle. The park could install shelters near the existing parking lots, at beach entrances or along bicycle routes. In the future, storm shelters would provide visitors who arrive by transit temporary protection from a storm. Below ground storm shelters and permanent buildings are not advisable due to the changing factors of land conditions. Prior to selection and installation of a storm shelter, the park should consider the visual and environmental impacts of a new shelter as well as initial capital and maintenance costs and resiliency of the shelter to barrier island conditions.

Storm Shelter

There are several options for above ground storm shelters. For instance, Rubb Building Systems distributes the THA type shelter, which is a Steel Frame Supported PVC Coated Fabric Shelter that is designed for extreme site locations.[14] These structures range in size from 19.7'-0" by 20'-0" to 39.4'-0" by 30'-0". Safe Zone Shelters Inc. distributes fiberglass and steel storm shelters.[15] These shelters can be installed above or below ground and vary in size and capacity. Some of the above ground structures are designed to withstand winds up to 250 mph as well as debris from a storm. These shelters can come with accessories such as power, light, and generators. Below ground structures are more resilient to wind although they could have impacts on the surrounding environment.

Bus Shelter

If the park decides to implement a transit shuttle service there should be a number of shelters to designate the shuttle pick up and drop off locations. These shelters can vary in size, material, and installation. Bus shelters can provide visitors with a temporary protection from a storm. Figure D-3 shows two examples. Handi-Hut Bus stop passenger shelter with barrel roof. A 10'x5' shelter is $2,900 and a 15'x7.6' shelter is $6,500.[16] The Duo-Guard shelter provides several structures including a 10'x30' structure is that is $5,000-

[14] Information is from a phone conversation with a sales representative on October 27, 2009. Website: http://www.rubb.com.

[15] Information is from company website http://www.safezonesheltersinc.com/index.html, accessed February 9, 2011.

[16] Handi-Hut Bus stop passenger shelter, website: http://www.handi-hut.com/index.php. Site accessed February 17, 2011. Pricing information is from GSA Advantage, website: https://www.gsaadvantage.gov/advantage/main/home.do

$15,000.[17] Prior to purchasing storm or bus shelters, the park should decide how many people to accommodate in the shelters. Shelters can be designed with bicycle racks, benches, and evacuation information in a central location.

Figure D-3
Handi-Hut Bus shelter (left) and Duo-Guard shelter (right)
Source: http://www.handi-hut.com/ and http://www.duo-gard.com/products/bus-shelters

Communication

During storm events, lifeguards currently announce an evacuation with megaphones. At this time, lifeguards leave the beach and visitors are encouraged to seek shelter. These events are typically short term and the park typically re-opens. During an emergency evacuation event, the park should use the communication methods outlined in Appendix B: Traveler Information Delivery. These strategies state that emergency updates should be updated and communicated on changeable message signs, the NPS website, Highway Advisory Radio, 511 phone line, and Twitter. In addition, the park can include the evacuation route and procedure on its website and map to inform visitors of the potential risk. These maps can include instructions and park procedures for evacuation during storm events.

Siren Notification

The park can install a siren notification system to alert visitors of severe weather conditions. A siren would allow park staff to instantly inform visitors from a central location. Park staff could provide assistance to park visitors. The American Signal Corporation has two types of siren systems. The Tempest is a tone only system that ranges from $10,000 to $35,000.[18] These range in distance from a half mile to a four mile radius. The EClass is a tone and voice system that ranges in price from $9,000 to $18,000. These come with one or eight horns. Solar power is available for poth systems. The park should consider how many sirens they want to install, how large of an area they want to reach, and what kind of system they prefer prior to purchasing sirens.

[17] Duo-Guard bus stop shelter, website: http://www.duo-gard.com/. Site accessed February 17, 2011. Pricing information is from GSA Advantage, website: https://www.gsaadvantage.gov/advantage/main/home.do

[18] Information is from American Signal Corporation, website: http://www.americansignal.com/outdoor_warning.php Accessed October 27, 2009. POC: Duncan Kasukonis, Project Manager. Installation (solar option) would be $3500-$4,000. TEMPEST (Tone only) option ranges from $10,000 to $35,000. T 112 – ½ mile to ¾ mile $10,000, T 121 – 1 mile radius $12,000, T 128 – 1 to 1 ½ mile radius $17,000, T 135 – 4 miles radius ($35,000). ECLASS (Tone & Voice) options range from $9,000 to $18,000(used for Tsunami warnings), ECLASS 1 (1 horn) $9,000, ECLASS 8 (8 horns) $18,000

Appendix E: Traffic Circle Wayfinding and Flow

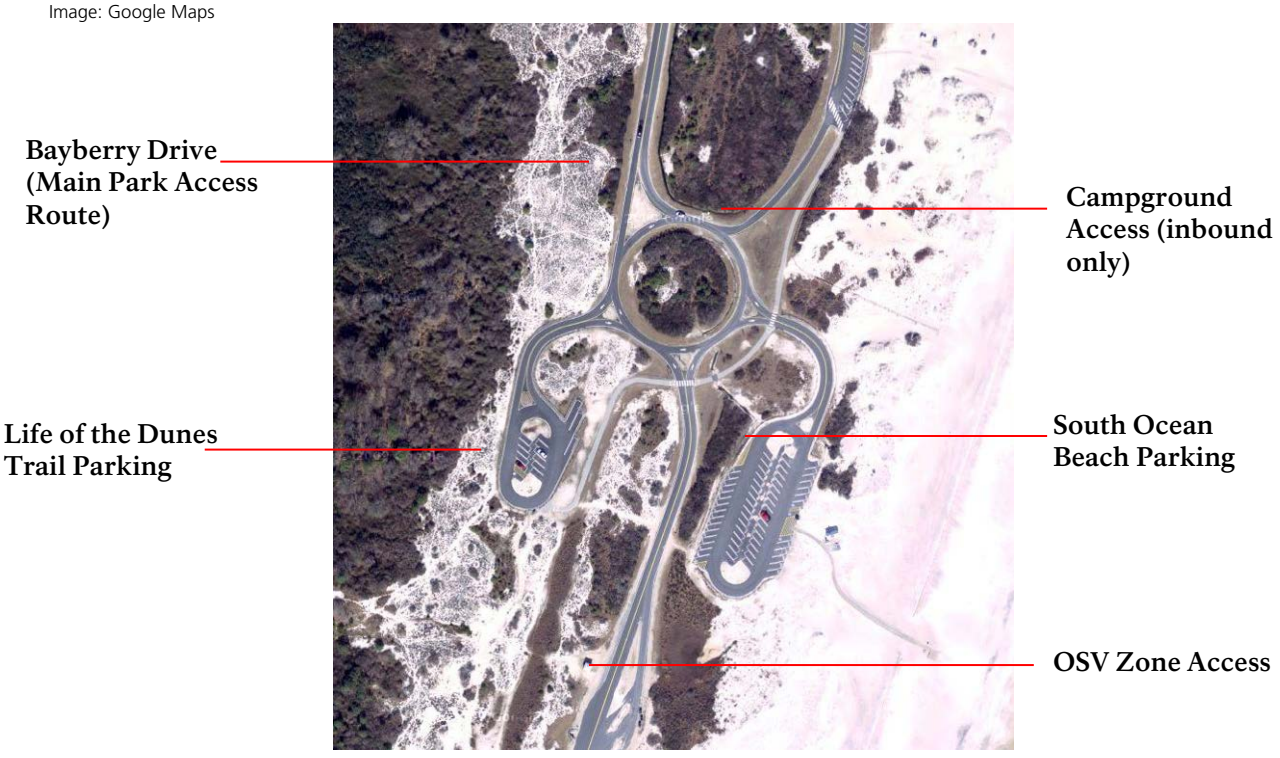
TO:	Ted Morlock and Trish Kicklighter (Assateague Island NS)
FROM:	US DOT/Volpe Center
RE:	Alternative Transportation Study – Traffic Circle Signage
DATE:	April 23, 2010

This memo recommends new signage for improving traffic flow and wayfinding at the traffic circle at the south end of Bayberry Drive in the Maryland District of Assateague Island National Seashore. Currently, there are problems related to wayfinding and illegal parking at the traffic circle.

Existing Conditions

The traffic circle is at the south end of Bayberry Drive and provide s access to the Life of the Dunes Trail and Parking area; the Over-Sand Vehicle (OSV) Zone; South Ocean Beach parking area; Bayberry Drive; and provides inbound-only access from the campground access road (see Figure E-1). Signs directing entering vehicles to yield are the only traffic signs currently in place at the intersection.

Figure E-1
Assateague Island NS Traffic Circle
Image: Google Maps



Park staff report that many drivers are confused and unsure of where to go when driving through the intersection. Many drivers trying to go to the South Ocean Beach parking exit at the OSV Zone access. They must then find a place to turn around, creating safety hazards. In addition, drivers sometimes try to exit onto the campground access road, which is a one-way inbound road. Wayfinding problems are

exacerbated by illegal parking in the intersection, which obstructs sightlines and creates additional safety hazards.

No traffic volume data are available for the traffic circle; however, based on park visitation data, the intersection may accommodate about 1400 trips in the peak hour.[19] While based on very limited data, this indicates that the intersection probably has ample capacity to accommodate the traffic demand.[20]

Recommendations

Adding signage at the traffic circle to provide information and guidance to various destinations could improve operations quickly and at a low cost – on the order of 3,000 dollars. The sign designs should be consistent with the National Park Service Sign Standards Reference Manual (the UniGuide Sign Program) and Director's Order 52C.[21] Recommended sign locations and content are shown in Figure E-2. Signs #1 and #3 are the highest priority, while #2, 4 and 5 are recommended, but may be less critical to improving wayfinding.

Adding the recommended signs at the traffic circle should improve operations. If problems persist, the park may wish to consider reconfiguration of the intersection into a more compact roundabout. Reconfiguring the roundabout would provide positive guidance to drivers by clearly indicating appropriate speed, direction, and approach type. The reconfiguration would also reduce the possibility of wrong way traffic entering the outbound campground road and would reduce the footprint of the intersection substantially. Figure E-4 below shows a rough sketch of one possible roundabout configuration overlaid on the existing traffic circle. Currently, the diameter of the intersection is approximately 200 feet. The diameter required for a roundabout is largely dependent upon the turning requirements of the design vehicle types and speed. The sketch shows an approximately 100 foot diameter, which would likely be appropriate to accommodate buses and single-unit trucks.[22]

[19] Conservatively assuming an average of two trips through the intersection during the peak hour for every visit.

[20] Capacity is measured at each entry, and is based on frequency of gaps in the circulating flow of traffic large enough for vehicles to enter the stream of traffic safely. Depending on speed, geometry and portion of yielding traffic, capacity of a single entry generally ranges from about 1200-1500 vehicles per hour. See *Roundabouts: An Informational Guide*. Federal Highway Administration. 2000.

[21] See http://www.nps.gov/hfc/products/uniguide.htm#

[22] See *Roundabouts: An Informational Guide*. Federal Highway Administration. 2000. Inscribed Circle Diameter size range recommended to accommodate single-unit trucks and buses at a single-lane roundabout is 80-100 feet. A variety of other factors, including the entry and exit angles, vertical design and sight distance also affect the required size of a roundabout.

Figure E-2
Assateague Island NS Traffic Circle Recommended Signage
Image: Google Maps

1. Intersection Schematic: Directional sign on the Bayberry approach about 250 feet north of the intersection with traffic circle image and direction to OSV and parking areas. The concept would be similar to the sign shown in Figure E-3, except on brown signboard.
2. Life of the Dunes Trail Parking: With just 13 parking spaces, this exit handles a small volume of traffic. A sign marking the exit would help visitors locate the trailhead, and reduce mistaken exits into this parking area.
3. Over-Sand Vehicles Only: Many drivers mistake this exit as the South Ocean Beach Parking exit. Clearly signing the exit for OSV *only* would reduce this confusion and reduce resulting safety hazards in the OSV area.
4. Do Not Enter: This approach is inbound only, but the geometry is unclear, and drivers sometimes try to use it as an exit. A Do Not Enter sign (MUTCD R5-1) posted would reduce this problem.
5. South Ocean Beach Parking: A simple directional sign (MUTCD D1-1) pointing to the exit for the parking area would help visitors identify this destination.

Figure E-3
Sample Traffic Circle Sign
Image: Manual on Uniform Traffic Control Devices, Destination Sign for Roundabouts D1-5a. http://mutcd.fhwa.dot.gov/pdfs/2009/part2d.pdf

Figure E-4
Modern Roundabout Sketch
Image: Google Maps

Appendix F: Entrance Station Relocation and Management

This appendix reviews several considerations related to future repositioning of the Assateague Island NS entrance station to the mainland and managing the station in coordination with Assateague State Park.

Background

In 2003, Assateague Island NS contracted a study to examine different opportunities to consolidate the Assateague Island NS and Assateague State Park fee collection facilities in order to better educate visitors as they entered the parks, eliminate patron confusion, and get visitors into the park as safely and efficiently as possible. The contractor developed and assessed three entrance station alternatives; in all cases the assumption at the time was that Assateague Island NS and Assateague State Park would come to a common revenue sharing agreement.

Three alternative locations—one on the mainland contiguous to the Assateague Island NS Headquarters and Maintenance Area, the other two at points on the island —were designed and the plans were subjected to an impact analysis of issues involving the environment, maintenance, operations, design superiority, and cost. The mainland alternative was found to be compellingly superior to the other two locations on these grounds.[23] However, it was discovered that Maryland state Highway Administration (SHA) policy would not support the collection of fees on a state road. Negotiations to resolve this issue within current state law have been unsuccessful.

In the period since the 2003 study, Assateague Island NS has looked at the long-term effects of sea-level rise and changing weather and erosion patterns on the island. The results indicate the need at some future date to relocate parking and/or the collection facilities to the mainland. Because of physical constraints and the existing roadway configuration at the most appropriate mainland location, it is evident that Assateague Island NS and Assateague State Park would need to share this facility. This attachment therefore identifies the considerations that Assateague Island NS would need to address in order to make this arrangement operationally workable, mutually beneficial, and optimal from the standpoint of visitor experience.

Resolving the Regulatory Impasse

The issue of fee collection on a state highway must be resolved to accommodate the ultimate and unavoidable need to move and merge the collection facilities to the mainland.

The key challenge related to relocating the entrance station on the Mainland is that the Verrazano Bridge and MD 611 are part of Maryland's state highway network. Collecting fees on a state highway property for non-transportation purposes is prohibited by state law. Park staff has already begun to investigate solutions to this problem. Currently the most promising solution would involve the Maryland Legislature authorizing an exception for this particular case.

Another option that may be worth investigating would involve transferring the land where the entrance station would be located either to the Maryland Department of Natural Resources or to the National Park Service with a permanent easement for the state highway. Travelers wishing to simply cross the Verrazano Bridge and not visit either park would be entitled to do so without paying. Assateague Island NS would have to give all visitors a pass for spot checks on the island to ensure people do not bypass the entrance stations and enter the park. It is possible that if the property was no longer owned by state highway and if users were not tolled for use of the state roadway, a fee could be charged for park entry while complying with the letter of the law. Consultation with state highway officials would be an appropriate next step to investigate the feasibility of this option.

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[23] Johnson, Mirmiran and Thompson for the National Park Service. *Assateague Island National Seashore Entrance Station Alternatives Evaluation: Final Report*. December 2003.

Making the Shared Facility Work

The basic management questions related to reconfiguring the entrance station that Assateague Island NS and Assateague State Park would need to resolve are:

1. Given present visitation to the two parks, what configuration would be needed to minimize wait times and queue lengths for entry to and exit from the island?
2. Would some form of reciprocal admission and/or shared revenue be preferable to the current separate fees?
3. How should the facility be configured to support emergency evacuation conditions and possible contra-flow plans?

Discussion

Managing Queue Length

On peak weekend days, the queue of cars waiting to pay the entrance fee at the two-lane Assateague Island NS entrance station can extend over a quarter of a mile. Assateague Island NS has plans underway to improve throughput by adding a third entrance lane in 2011.

Assateague State Park reports queue backups at its single-lane entrance station, though delay is thought to be less severe than at Assateague Island NS.

Queue length depends on the processing capacity of the entrance station. Assuming no changes to the way that individual transactions are processed, the physical location of the entrance station should not affect the queue length.

Based on the visitor numbers at the time, the 2003 study estimated that having a three-lane entrance station serving both Assateague Island NS and Assateague State Park visitors would yield a back-up of no more than one-fifth of a mile. This estimate should be recalculated based on current and projected future vehicle counts.

Increasing the speed of transactions at the entrance station, for example by simplifying payment options or providing more orientation information in advance, would help to reduce queue length.

Separate vs. Shared Admission/Revenue

The two parks have different models for entrance fees; Assateague Island NS offers annual and weekly passes, and charges by the vehicle, not individual, whereas Assateague State Park offers day and annual passes, and charges entrance fees per visitor, not vehicle. Assateague State Park fees distinguish between residents and non-residents of the state, but charge the same daily amount to both. The Assateague Island NS fee strategy appears to target vacationers by offering weekly passes that are a cost savings over daily per-person charges. About half of Assateague Island NS visitors use a weekly or annual pass, while only about 5 percent of Assateague State Park visitors do so. In addition, each park offers special permits for activities such as boat launching, camping, or use of the OSV Zone (Assateague Island NS). The parks also issue special passes to youth groups, seniors, and people with disabilities. Table F-1 shows the current day use entrance fees for the two parks.

Table F-1
Entranc Fees for Assateague Island NS and Assateague State Park

	Assateague Island NS	Assateague State Park
Individual day use – Non-motorized entry	Free	$3 Maryland residents; $4 non-residents)
Individual day use – Motorized entry	No day use pass; week pass only	$3 Maryland residents; $4 non-residents)
Week – Motorcycle	$10	No weekly pass
Week – Vehicle	$15	No weekly pass
Annual – Vehicle for this park only	$30 (Assateague Island NS only)	No annual pass
Annual – Vehicle (All NPS or MD parks)	$80 for all NPS and Federal Lands parks (admits pass holder, and guests in a non-commercial vehicle in parks that charge per vehicle, or pass holder plus 3 adults. in parks that charge per person. Accompanying children under 16 are free.	$75 Maryland residents; $100 non-residents (day use only, includes up to 9 guests in one vehicle, and boat launching at all MD state parks)

While a combined facility could continue to administer two different fee structures for the state and NPS areas of the island, this could be confusing to visitors and difficult to manage and enforce. Visitors would need to declare which park they were visiting at the entrance station and then purchase or use an appropriate pass for that park. Different parking permits would need to be issued and displayed on their vehicle as proof of purchase for a particular park. Park staff would need to monitor and enforce use of these permits.

A shared facility may be more successful if combined with a shared fee. Instituting a shared fee structure would be challenging, and is an important issue to begin discussing with Maryland Department of Natural Resources staff. Table F-2 summarizes some key considerations related to shared fees.

Table F-2
Shared Fee Considerations

Consideration Category	Impact
Traffic Delay	Possibly reduced delay associated with simplifying fee options, particularly with shared entrance facility
Infrastructure Vulnerability	May overburden remaining natural resources in the event of partial storm damage. Managing carrying capacity would require coordination between both park managements.
Visitor Experience	Offers seamless visitor experience of the island, but reduces the possibility for different interpretive experiences.
Implementation	May be difficult to reach agreement on fee model and revenue sharing. It would be challenging to determine if or how to honor NPS or state park passes, such as the Maryland Park Service Passport or the National Parks and Federal Recreational Lands Pass. Identifying the percentage of visitors who enter using those passes currently would provide important clarification on the impact of these passes on a shared fee.

Consideration Category	Impact
Summary	Would provide a seamless visitor experience and is more compatible with a shared entrance station arrangement; however, this would require extensive coordination between the two agencies both to establish the fee structure and revenue sharing agreement and to manage interpretation, resource protection and carrying capacity issues.

Assuming the parks shared fees, they would need to establish how to divide the revenue. The 2003 study report stated that Assateague Island NS had proposed the installation of loop detectors that would capture the count of vehicles choosing to enter the Assateague State Park and Assateague Island NS sides of the island; revenue was to be apportioned on this bSome other parks have reached fee-sharing agreements. Two examples are provided below, with relevant contact information:

- Muir Woods National Monument (California) has a reciprocal fee agreement with the John Muir Historic Site. Visitors can visit both areas with admission to either park, however, revenue is not shared between parks. The Friends of the Golden Gate Conservancy, a cooperating association, which assists NPS with park operations, interpretation and fund-raising, manages the fee collection for both parks.
    - Mia Monroe, Muir Woods National Monument, (415) 388-2596, mia_monroe@nps.gov

- Preservation Virginia owns 22 acres of land within Colonial National Historic Park (CNHP). Visitors can enter the park through either of two fee booths staffed and operated by CNHP. 50percent of revenue collected from the fee booth closest to the Preservation Virginia land and30percent of revenue collected from the fee booth further from the Preservation Virginia land is allocated to Preservation Virginia. From the visitor's perspective, the management of the two areas is seamless.
    - Chris Bryce, Colonial National Historical Park, 757-898-3400, chris_bryce@nps.gov

An alternative option to consider is the use of a pass that can be honored at both parks. Visitors can continue to choose to pay only for use of a single park, but a dual park pass can be an additional offer to gain access to both parks for a reduced cost. Some state parks and NPS facilities have instituted this arrangement.

Emergency Considerations

If for any reason the island must be evacuated at a time of maximum usage, the emergency management plan might specify the designation of contra-flow reverse lanes. The facility should be configured in such a way as to support this use.

Summary of Benefits and Challenges

Table F-3 summarizes the benefits and challenges of the two main management options for relocating the entrance booths to the mainland.

Table F-3
Benefits and Challenges of Management Options

Management Option	Benefits	Challenges
Shared Facility on the Mainland, Separate Admission	- Share infrastructure and fee collection costs - Retain independent management decision making and control over visitor experience	- Enforcement on Island - Communicating the choices and rules to visitors - Managing accounting and money handling
Shared Facility on the Mainland, Shared Admission	- Share infrastructure costs and fee collection costs - Offer flexible, seamless visitor experience of the island	- Reconfigure fee structure and anticipate revenue impacts for both parks - Difficult to maintain distinct interpretive experiences and resource management priorities

Appendix G: Assessing the Options for Transit, Mainland Parking Shuttle

Parking Shuttle Overview

Five parking shuttle options were analyzed that would offer frequent connections between remote parking on the mainland and key destinations on Assateague Island:

1. Voluntary Parking Shuttle
2. Mandatory Parking Shuttle for All Day-Use at Peak Times
3. Mandatory Parking Shuttle for Non-Passholders at Peak Times
4. Reduced Island Parking, Maintain Visitation using Parking Shuttle
5. No Island Parking, Maintain Visitation using Parking Shuttle

All of the parking shuttles were assumed to travel the same route, stopping at a mainland parking area, Assateague Island NS North Beach, Assateague Island NS South Beach, and the Assateague Island NS Bayside trail head near the concessioner business. The analysis assumes that overnight campers and OSV Zone visitors would not use any of the parking shuttle options.

The analysis for all options assumes that service would be offered during the 80 day peak season (July and August plus weekends in June and September). Service would be offered from 9am to 9pm, ensuring that visitors arriving by transit would be able to depart late in the day. Service would be offered at least twice per hour with more frequent service during the busiest times of day.

Information systems, such as variable message signs on MD 611, would be needed to communicate shuttle and parking status and options to arriving visitors. This analysis assumes that appropriate communication systems are used.

The following stop locations were assumed for all of the parking shuttle options:

1. Mainland Parking (assume one-stop rather than vehicle pick-up/drop-off service)
2. Assateague Island NS North Beach near boardwalk
3. Assateague Island NS Bayside
4. Assateague Island NS South Beach near boardwalk

Figure G-1 shows the parking shuttle route and stop locations.

The round-trip route length is about 11 miles. Assuming an average speed of 15 mph, 2 minutes at each stop, the base round-trip route time is 52 minutes. Between 5 and 15 minutes of delay time is added to the travel time for each option. The amount of added delay time depends on the anticipated traffic conditions associated with the option. More delay is added for options with low ridership; less delay is added for options with high ridership. Currently, with no transit service, delay approaching the entrance station at peak times is estimated to be 15 to 20 minutes.

Figure G-1
Proposed Parking Shuttle Route and Stops
Source: Google Maps and Volpe Center

Option 1: Voluntary Parking Shuttle

Option #1 is a voluntary parking shuttle operating on the route described above. At peak times when parking is full, some visitors choose to ride the shuttle to avoid searching for parking on the island and because the shuttle would drop them conveniently close to their destination, reducing the distance they would have to carry their gear.

Capture Rate and Ridership

Other National Park transit systems provide some indication of reasonable demand estimates, though each system is unique. There is no data indicating Assateague Island NS visitors' attitudes toward transit. Evaluations of other National Park transit use have found capture rates for voluntary transit systems ranging from 3 percent for the Cape Cod Provincetown Shuttle to 40 percent for the Yosemite Area Regional Transit Systems (YARTS).[24]

Given that the main benefit of this shuttle option would be reduced time and frustration related to searching for parking on the island, the capture rate was assumed to be related to beach parking

[24] US DOT Federal Transit Administration. *Transportation Planning Process for Transit in Federal Land Management Areas*. Volume III, Table A-3. April 2008.

availability. It was estimated that 1-3 percent of arriving visitors would choose to use the shuttle when Assateague Island NS beach parking is less than 95 percent full, and 10-20 percent of arriving visitors would choose to use the shuttle when Assateague Island NS beach parking is at least 95 percent full. Applying these capture rates to the estimated daily and hourly visitation patterns results in an overall capture rate of 5.5 percent, or 250 to 525 daily one-way transit rides, with a maximum load point[25] of 100 rides in an hour. The total seasonal one-way passenger trips is expected to be between 22,000 and 42,000.

Preliminary Service Plan

Based on the low capture rate, this option is not expected to significantly improve traffic congestion approaching the entrance station. The round-trip route time, including traffic delay, is estimated to be 65 minutes at peak times.

Three 45-passenger buses would be needed to accommodate the estimated peak demand. Two buses could accommodate demand at most times (at many times one vehicle would be sufficient, but it was assumed that two vehicles would operate throughout the day in order to provide service at least twice per hour). Table G-1 shows the preliminary service schedule.

Cost

Table G-2 shows the estimated seasonal cost and cost per passenger for the Voluntary Parking Shuttle. The estimated cost per (round-trip) passenger is between $6.60 and $12.60.

Table G-1
Voluntary Assateague Island NS Parking Shuttle Preliminary Service Plan

Hour Beginning	Weekend Service	Weekday Service
9:00 AM	2	2
10:00 AM	2	2
11:00 AM	3	2
12:00 PM	2	2
1:00 PM	2	2
2:00 PM	2	2
3:00 PM	2	2
4:00 PM	2	2
5:00 PM	2	2
6:00 PM	2	2
7:00 PM	3	2
8:00 PM	2	2
Daily Vehicle Hours	26	24
Days per Season	35	45
Operating Hours	910	1,080
Total Operating Hours	1,990	

[25] Maximum load point is the maximum number of transit rides on any segment in one hour. This number is used to determine the capacity that is needed to accommodate the peak demand.

Table G-2
Voluntary Assateague Island NS Parking Shuttle Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	3 vehicles x 80 days	$30/vehicle-day	$7,200
	1,990 vehicle operating hours	$6/vehicle-hour	$11,900
Seasonal Operating Cost	1,990 vehicle operating hours	$60/vehicle-hour	$119,400
Total Seasonal Cost			$138,500
Seasonal Passengers (Round-Trip Ridership)			11,000 – 21,000
Average Cost per Passenger (round-trip)			*$6.60 - $12.60*

Option 2: Parking Shuttle Mandatory for all Day-Use during Peak Times

This parking shuttle option assumes that Assateague Island NS institutes mandatory shuttle use once the beach parking lots on the island are full. Once parking fills, the mandatory shuttle would remain in effect until mid-afternoon when parking would be re-opened for the remainder of the day. Shuttle service would continue until 9pm to carry departing visitors back to their vehicles. OSV Zone users, overnight campers, visitors with heavy recreational equipment and disabled visitors would be exempted from the mandatory shuttle bus. All other visitors arriving at peak times would be required to use the shuttle.

Capture Rate and Ridership

Much like increasing entrance fees, instituting a mandatory transit system could cause some would-be visitors to change their travel plans and choose another destination. Several other national parks, such as Cape Cod National Seashore, Point Reyes National Seashore, Harpers Ferry National Historic Park, and Devils Postpile National Monument have instituted mandatory transit systems without noticeably impacting visitation. Generally visitors have reported satisfaction with these systems and often appreciate benefits such as reduced congestion, noise, and the ability to relax and observe the scenery on the ride.

It is difficult to predict the impact of a mandatory system on overall visitation and daily use patterns (e.g., more visitors arrive earlier to avoid using transit). Some Assateague visitors could choose to visit Assateague State Park or Ocean City instead of Assateague Island NS so that they could drive directly to the beach. However, both Assateague State Park and Ocean City have limited parking as well, so a significant shift in visitation is not likely. Consequently, this analysis assumes that introduction of a mandatory transit system would not significantly change Assateague Island NS visitation.

A 90 percent capture rate for day-use visitors (excluding OSV Zone users) arriving during the mandatory shuttle hours was applied based on an assumption that exemptions from the mandatory service for day-use visitors with disabilities or special circumstances would constitute about 10 percent of visitors. Applying this capture rate to the portions of peak-season days when parking is full results in an overall capture rate of 17 percent for the 80-day transit season.

An average of 1,400 daily transit rides are expected, with a maximum load point[26] of 495 rides in an hour. The total seasonal one-way passenger trips is expected to be approximately 113,000.

Preliminary Service Plan

Based on observed parking occupancy, the mandatory shuttle would operate from about 10:30am on summer weekends and by about 11:30am on summer weekdays until about 1:30pm when parking could be

[26] Maximum load point is the maximum number of transit rides on any segment in one hour. This number is used to determine the capacity that is needed to accommodate the peak demand.

reopened to arriving visitors. The mandatory hours would be adjusted based on actual parking occupancy, which would affect the ridership. Shuttle service would continue until 9pm to carry visitors back to their vehicles.

By redirecting the vast majority of arriving vehicles to mainland parking at peak times, this option would essentially eliminate delay approaching the entrance station at these times. The round-trip route time, including traffic delay, is estimated to be 55 minutes at peak times.

Thirteen 45-passenger buses would be needed to carry the arriving visitors from mainland parking to the island on busy weekend days. Because visitor departures are expected to be spread throughout the afternoon and evening, fewer vehicles would be needed later in the day. The assumed service plan is shown in Table G-3. Mandatory service hours are highlighted in green.

Cost

Table G-4 shows the estimated seasonal cost and cost per passenger for the Mandatory Parking Shuttle. The estimated cost per (round-trip) passenger is $3.65.

Table G-3
Mandatory Parking Shuttle for all Day-Use during Peak Times Preliminary Service Plan
*Green highlight indicates mandatory service hours

Hour Beginning	Weekend Service	Weekday Service
9:00 AM	0	0
10:00 AM	13	0
11:00 AM	13	11
12:00 PM	5	4
1:00 PM	2	3
2:00 PM	2	2
3:00 PM	2	2
4:00 PM	3	2
5:00 PM	4	2
6:00 PM	5	3
7:00 PM	7	3
8:00 PM	4	2
Daily Vehicle Hours	54	29
Days per Season	35	45
Operating Hours	1,890	1,305
Total Operating Hours	3,195	

Table G-4
Assateague Island NS Parking Shuttle Mandatory for all Day-Use during Peak Times Shuttle Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	13 vehicles x 80 days	$30/vehicle-day	$31,200
	3,195 vehicle operating hours	$6/vehicle-hour	19,200
Seasonal Operating Cost	3,195 vehicle operating hours	$60/vehicle-hour	$191,700
Total Seasonal Cost			$242,100
Seasonal Passengers (Round-Trip Ridership)			66,500
Average Cost per Passenger (round-trip)			***$3.65***

Option 3: Parking Shuttle Mandatory for all Non-Pass-holders during Peak Times

Option #3 presents a variation on Option #2, in which annual pass-holders would be exempted from the mandatory parking shuttle. This option is designed to result in a capture rate higher than for Option #1 and lower than for Option #2, in order to remove enough vehicles from the island to address the transportation issues, while limiting the number of buses required (and therefore total cost) to transport visitors between the mainland and the island. Annual pass-holder would be allowed to park on the island throughout the day, and would fill parking spaces vacated by early departures.

Exempting annual pass-holders is one approach to achieving this mid-level capture rate, though it may be controversial from a park management perspective and may result in more visitors opting to purchase the annual pass, thus reducing this option's effectiveness. There may be other methods for achieving a similar capture rate, such as exempting senior citizens from the mandatory shuttle use or offering greater incentives for voluntary shuttle use. This option is an example of the costs and benefits of a parking shuttle with a mid-range capture rate.

Capture Rate and Ridership

About half of Assateague Island NS visitors are annual pass-holders, either for national access or specifically for Assateague Island NS. The same 90percent capture rate was assumed as in Option #2, but in this case pass-holders were exempted. This results in an overall day-use visitor capture rate of 40percent during the mandatory hours and 13percent overall for the 80-day transit season. An average of 960 daily transit rides are expected, with a maximum load point[27] of 255 rides in an hour. The total seasonal one-way transit trips is expected to be between about 77,000. In practice, this option could result in some visitors changing from the weekly pass ($15 per vehicle) to the annual pass ($30 per vehicle) in order not to take the shuttle.

Preliminary Service Plan

To manage parking demand in this way, the shuttle would be mandatory for non-annual pass-holders from approximately 10:30am on summer weekends and 11:30am on summer weekdays until 4pm, when parking could be reopened to all arriving day-use visitors. As in Option #2, shuttle service would continue until 9pm to carry departing visitors back to their vehicles.

[27] Maximum load point is the maximum number of transit rides on any segment in one hour. This number is used to determine the capacity that is needed to accommodate the peak demand.

Shifting 40 percent of arriving visitors from cars onto buses at peak times would greatly reduce congestion approaching the entrance station. The round-trip route time, including traffic delay, is estimated to be 60 minutes at peak times.

Five 45-passenger buses would be needed to carry the arriving visitors from mainland parking to the island on busy weekend days. Visitor departures are expected to be spread throughout the afternoon and evening, and so fewer vehicles would be needed later in the day. The assumed service plan is shown in Table G-5.

Cost

Table G-6 shows the estimated seasonal cost and cost per passenger for the Option #3. The estimated cost per (round-trip) passenger is $3.70.

Table G-5
Parking Shuttle Mandatory for all Non-Pass-holders during Peak Times Preliminary Service Plan

Hour Beginning	Weekend Service	Weekday Service
9:00 AM	0	0
10:00 AM	5	0
11:00 AM	5	3
12:00 PM	2	2
1:00 PM	2	2
2:00 PM	2	2
3:00 PM	3	2
4:00 PM	2	2
5:00 PM	2	2
6:00 PM	3	2
7:00 PM	4	2
8:00 PM	2	2
Daily Vehicle Hours	30	20
Days per Season	35	45
Operating Hours	1,050	900
Total Operating Hours	1,950	

Table G-6
Assateague Island NS Parking Shuttle Mandatory for all Non-Pass-holders during Peak Times Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	5 vehicles x 80 days	$30/vehicle-day	$12,000
	1,950 vehicle operating hours	$6/vehicle-hour	$11,700
Seasonal Operating Cost	1,950 vehicle operating hours	$60/vehicle-hour	$117,000
Total Seasonal Cost			$140,700
Seasonal Passengers (Round-Trip Ridership)			38,000
Average Cost per Passenger (round-trip)			***$3.70***

Option 4: Reduced Island Parking

This option illustrates the level of transit service that would be needed to sustain current visitation in the event that half of the parking on the island is lost due to storm overwash and/or sea level rise. Visitation is assumed to remain steady. For comparison to the other transit options, this analysis considers just the 80-day peak season. In reality, if parking were reduced, transit service may be required for a longer season.

This option focuses on the transit capacity that would be needed to accommodate current visitation levels with half as much beach parking. Necessary management policies and traveler information systems to direct overflow parking to transit are assumed to be in place.

Determining how best to direct the appropriate number of visitors to transit would need to be determined as part of future planning efforts.

Capture Rate and Ridership

In order to accommodate excess parking demand, approximately 50 percent of peak season, day-use visitors would need to ride transit, which would be an average of 4,000 daily transit rides, with a maximum load point[28] of 780 rides in an hour. The total seasonal one-way passenger trips would be about 302,000.

Preliminary Service Plan

The service plan for this option would depend on the policies used to direct visitors to transit. In general, more buses would be needed if remaining Island parking was allowed to fill completely and then transit service was made mandatory than if half of arriving visitors were directed onto transit throughout the day. As noted, the policies to achieve the needed level of ridership would need to be determined as part of future planning. For this analysis, it is assumed that half of arriving visitors ride the parking shuttle throughout the day.

Reducing Island traffic by half would significantly reduce congestion approaching the entrance station. The round-trip route time, including traffic delay, is estimated to be 60 minutes at peak times.

Eighteen 45-passenger buses would be needed to carry the arriving visitors from mainland parking to the island on at peak times. Visitor departures are expected to be spread throughout the afternoon and evening, and so fewer vehicles would be needed later in the day. The assumed service plan is shown in Table G-7.

Cost

Table G-8 shows the estimated seasonal cost and cost per passenger for the Option #4. The estimated cost per (round-trip) passenger is $3.50.

[28] Maximum load point is the maximum number of transit rides on any segment in one hour. This number is used to determine the capacity that is needed to accommodate the peak demand.

Table G-7
Assateague Island NS 50percent Reduced Parking Shuttle Preliminary Service Plan

Hour Beginning	Weekend Service	Weekday Service
9:00 AM	11	6
10:00 AM	18	15
11:00 AM	13	12
12:00 PM	4	3
1:00 PM	2	2
2:00 PM	2	2
3:00 PM	4	4
4:00 PM	6	5
5:00 PM	8	7
6:00 PM	12	9
7:00 PM	14	11
8:00 PM	8	7
Daily Vehicle Hours	102	83
Days per Season	35	45
Operating Hours	3,570	3,735
Total Operating Hours	7,305	

Table G-8
Assateague Island NS 50percent Reduced Parking Shuttle Cost Estimate

	Units	**Unit Cost**	**Total Cost**
Seasonal Capital Cost (lease cost)	18 vehicles x 80 days	$30/vehicle-day	$43,200
	7,305 vehicle operating hours	$6/vehicle-hour	$43,800
Seasonal Operating Cost	7,305 vehicle operating hours	$60/vehicle-hour	$438,300
Total Seasonal Cost			$525,300
Seasonal Passengers (Round Trip)			151,000
Average Cost per Passenger (round-trip)			***$3.50***

Option 5: No Island Parking

This option is designed to illustrate the level of transit service that would be needed to sustain current visitation in the event that all parking on the island is lost due to storm overwash and/or sea level rise. This scenario is not completely realistic – it is likely that were parking on the island to be lost, visitation would change significantly as well – but it is designed to illustrate an upper bound for the transit capacity that could be needed.

To be comparable to the other transit options, this analysis considers just the 80-day peak season. In reality, if parking were lost, transit service would be required year-round.

Capture Rate and Ridership

A capture rate of 90percent was applied, assuming that a small number of visitors could be exempt from the transit requirement and that bicycle access could increase somewhat to accommodate some access.

An average of 6,500 daily transit rides is expected, with a maximum load point[29] of 1,000 rides in an hour. The total seasonal one-way passenger trips is expected to be about 517,000.

Preliminary Service Plan

Traffic congestion would be eliminated in this option. The round-trip route time is estimated to be 52 minutes.

Twenty-two 45-passenger buses would be needed to carry the arriving visitors from mainland parking to the island on busy weekend days. Visitor departures are expected to be spread throughout the afternoon and evening, and so fewer vehicles would be needed later in the day. The assumed service plan is shown in Table G-9.

Cost

Table G-10 shows the estimated seasonal cost and cost per passenger for the Option #5. The estimated cost per (round-trip) passenger is $3.10.

Table G-9
Assateague Island NS No Island Parking Preliminary Service Plan

Hour Beginning	Weekend Service	Weekday Service
7:00 AM	6	5
8:00 AM	11	9
9:00 AM	13	12
10:00 AM	17	14
11:00 AM	13	12
12:00 PM	5	4
1:00 PM	3	3
2:00 PM	4	3
3:00 PM	7	6
4:00 PM	9	8
5:00 PM	13	11
6:00 PM	19	16
7:00 PM	22	19
8:00 PM	13	11
Daily Vehicle Hours	155	133
Days per Season	35	45
Operating Hours	5,425	5.985
Total Operating Hours	11,410	

[29] Maximum load point is the maximum number of transit rides on any segment in one hour. This number is used to determine the capacity that is needed to accommodate the peak demand.

Table G-10
Assateague Island NS No Island Parking Shuttle Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	22 vehicles x 80 days	$30/vehicle-day	$52,800
	11,410 vehicle operating hours	$6/vehicle-hour	68,500
Seasonal Operating Cost	11,410 vehicle operating hours	$60/vehicle-hour	684,600
Total Seasonal Cost			$805,900
Seasonal Passengers (Round-Trip)			258,000
Average Cost per Passenger (round-trip)			*$3.10*

Appendix H: Assessing the Options for Transit, Regional Shuttle Routes

Four regional shuttle options were analyzed that would provide alternative connections to other key destinations and help to reduce private vehicle access to Assateague Island NS. The analysis of each of these options assumes that service is offered during the same 80-day peak as for the parking shuttle options. Each regional shuttle option is assumed to serve both Assateague State Park and Assateague Island NS. Because the expected capture rates for the regional transit options are low, drawing ridership from both parks helps to make the services cost efficient. The service frequency for these options is lower than for the parking shuttle options because it is assumed that visitors would plan ahead for these longer, regional trips using a schedule.

Option 6: Private Campground Shuttle

This option involves extending either of the private campground shuttles that currently serve Assateague State Park to Assateague Island NS. The option focuses on the Castaways Campground shuttle, but it is assumed that the Frontier Town shuttle could be similarly adapted. Assateague State Park offers a $2 discount on entry to visitors arriving on the shuttle, charging visitors arriving on the bus $1 each. Offering a similar discount at Assateague Island NS may be appropriate to attract riders, but would require authorization under Federal NPS fee policy.

Route Description

The Castaways shuttle offers three drop-off and three pick-up times at Assateague State Park from Memorial Day through Labor Day.[30] The proposed extension of the route, shown in Figure H-1, would have the following stop locations:

1. Private Campground (Castaways)
2. Assateague State Park parking
3. Assateague Island NS North Beach parking lot
4. Private Campground (Castaways)
5. Ocean City

The total round-trip route length would be 25-miles. Assuming an average speed of 15 mph, 2 minutes at each stop, and 15 minutes of delay time, the estimated round-trip route time is 90 minutes.

[30] "Shuttle Schedule." Castaways website. http://www.castawaysrvoc.com/bus.php

Figure H-1
Private Campground Shuttle Route and Stops
Source: Google Maps and Volpe Center

Ridership

To estimate potential ridership for this option, ridership on the current route was first estimated and then additional expected demand related to the addition of a stop at Assateague Island NS was estimated. It was assumed that ridership between Assateague State Park, Castaways Campground, and Ocean City would hold steady if an Assateague Island NS stop was added to the route.

Currently the shuttle schedule is not designed to accommodate through trips between Ocean City and Assateague State Park. Depending on the schedule for the extended route, some Ocean City and Assateague Island NS overnight visitors might take advantage of the route to travel between Ocean City and Assateague Island NS. Because this is not a priority for Assateague Island NS, and because it would probably also not appeal to Castaways Campground, it was assumed that the route would not be designed to accommodate these through-trips.

Assateague State Park and Castaways staff reported that the shuttle is usually more than half-full and sometimes completely full. Assuming 75 percent average occupancy on the current route and schedule,

daily ridership is estimated to be about 690 one-way trips, with one-third of these on the Castaways-Assateague State Park link and 2/3 on the Castaways-Ocean City link. Castaways has about 370 campsites, and probably has close to 1,500 campers on most nights during the peak season. Based on the current ridership estimate, about 7.5 percent of Castaways campers use the shuttle to access Assateague State Park on any given day, and about 15percent use it to access Ocean City.

Based on the current ridership on the Castaways shuttle route and the expectation that extending the route to Assateague Island NS would increase ridership to Assateague Island by about 40 percent, it is estimated that approximately 45 people would use this option to access Assateague Island NS on a peak day. This is equivalent to 3 percent of Castaways campers.It is difficult to predict the additional ridership without understanding why visitors choose Assateague Island NS versus Assateague State Park. If visitors view the Assateague Island parks as complete substitutes, no additional ridership would be expected with the route extension. If, on the other hand, visitors view the two parks as completely different destinations, an additional 7 percent of Castaways campers could be attracted to use the shuttle (based on overall visitation at the two parks). The 3percent estimate represents a middle ground between these two extremes that is expected if some visitors take each of the two views of the two parks.

The estimated added demand is about 90 daily trips (45 round-trips), or about 1 percent of Assateague Island NS visitation on a peak day. The total seasonal added one-way passenger trips is expected to be about 7,200.

Assateague State Park offers a $2 discount on entry to visitors arriving on the shuttle, charging bus passengers $1 for entry. Offering a similar discount at Assateague Island NS may be appropriate to attract riders, but would require authorization under federal NPS fee policy and would result in a decrease in park revenue. Assateague Island NS charges $15 per vehicle, so that with an average 2.9 vehicle occupancy, the park collects approximately $5 per visitor. The additional demand could be accommodated without changing the shuttle schedule, and therefore with minimal additional cost.

Preliminary Service Plan

Castaways operates one bus traveling between Assateague State Park and Assateague Island NS. Service is offered three times per day and the schedule is designed to accommodate ½ day and day trips to the island. Extending the route to Assateague Island NS would add about 20 minutes to the round-trip route time, but no additional trips would be needed to accommodate the additional demand.

Cost

Table H-1 shows the total estimated seasonal cost for this option, though only a small portion of this is related to the extension to Assateague Island NS. The estimated added cost is $5,300. The cost below does not include any lost revenue that would result if Assateague Island NS offered reduced entrance fees for shuttle riders, although many of these riders may not have chosen to access the park otherwise. Assuming that half of the riders would have paid a weekly pass ($15), foregone revenue would equal approximately $5,700 in revenue if the park discounted the entrance fee for bus passengers to $1.

Table H-1
Castaways Campground Shuttle Added Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	0 vehicles x 80 days	$30/vehicle-day	$0
	80 added vehicle operating hours	$6/vehicle-hour	$500
Seasonal Operating Cost	80 added vehicle operating hours	$60/vehicle-hour	$4,800
Total Seasonal Cost			$5,300
Seasonal Passengers Added (Round-Trip)			3,600
Average Added Cost per Assateague Island NS Passenger (round-trip)			*$1.50*
Assateague Island NS foregone revenue			*$5,700*

Option 7: Berlin Shuttle, Assateague Island NS and Assateague State Park

This option involves service between Assateague Island and Berlin, Maryland. This service would provide a transit option for Assateague Island visitors (predominantly overnight campers) traveling to Berlin for a shopping or recreational trip, and for local residents and visitors to travel to Assateague Island without a personal vehicle.

Route Description

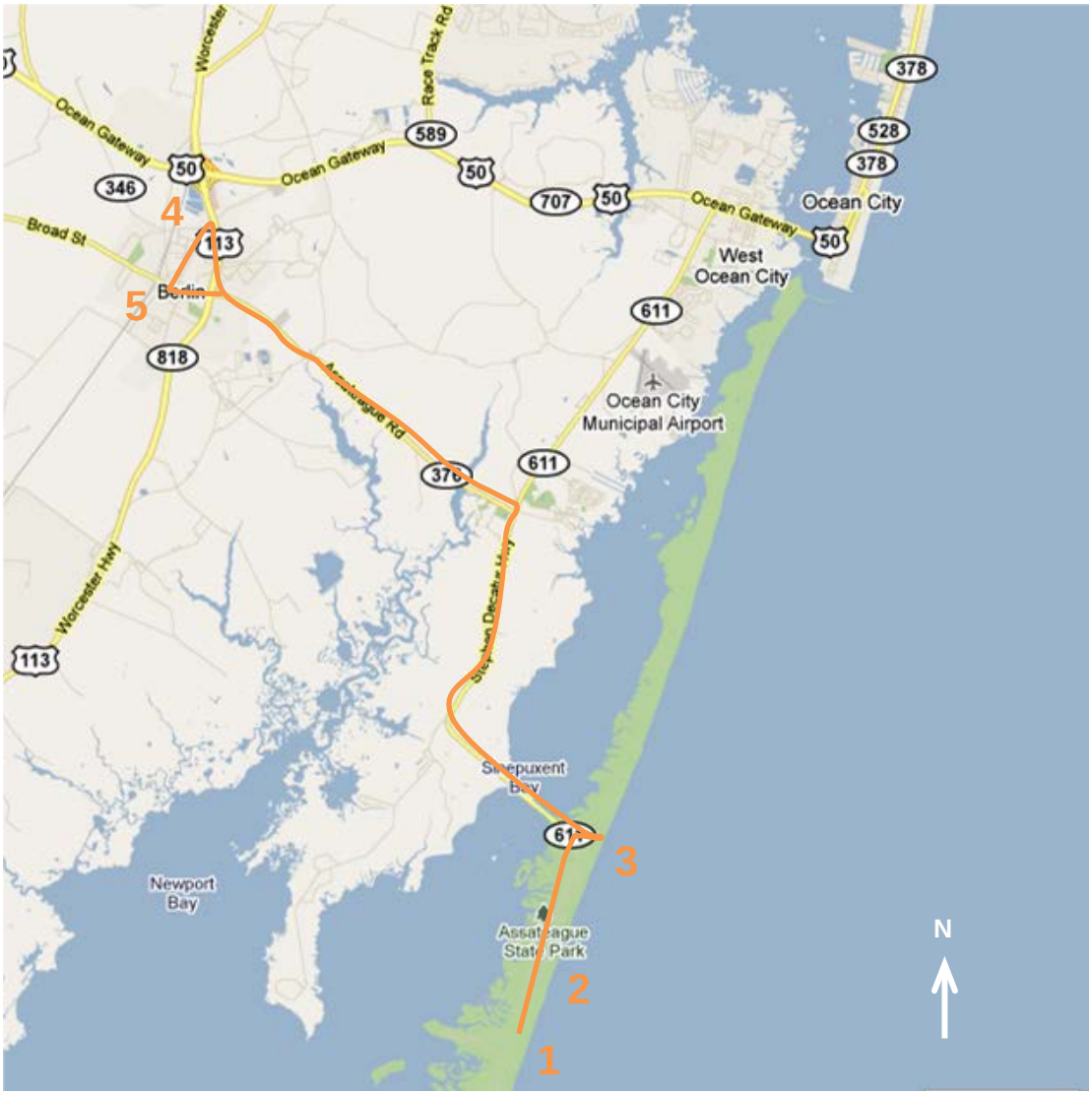
The route and stop locations for Option #7 are shown in Figure H-2. The following stop locations were assumed:

1. Assateague Island NS South Beach parking area
2. Assateague Island NS oceanside campsite loop
3. Assateague State Park Beach
4. Berlin Run Shopping Center
5. Berlin Commercial District and historic core

Assuming an average travel speed of 25 mph and 3 minutes at each stop, the estimated round-trip route time for the 25-mile route would be 75 minutes.

This option could be modified to serve all of the stops on the parking shuttle route, rather than just the two Assateague Island NS stops indicated above. The number of stops were limited based on the anticipated low demand for the Berlin transit connection; however, the route could serve a dual purpose as a parking shuttle with a Berlin extension, in which case demand would be higher and additional stops would be appropriate.

Figure H-2
Berlin Shuttle Route and Stops
Source: Google Maps and Volpe Center



Capture Rate and Ridership

With no data describing trips between Berlin and Assateague Island, the ridership for this potential route is based completely on reasonable assumptions. Two potential user groups for this service were identified:

- Assateague Island NS and Assateague State Park overnight campers
- Visitors from Berlin (or connecting to regional transit networks in Berlin)

It was assumed that this service would not be used by most day-use visitors. While some day-use visitors may stop in Berlin, they probably do not make return trips to Assateague Island, so would probably prefer to bring their vehicle rather than ride a bus.

Assuming that 15 percent of Assateague Island NS and Assateague State Park overnight campers make a trip to Berlin either to visit the historic main street area or to purchase groceries or supplies, and that 20 percent of these travelers would choose to make this trip via shuttle if a relatively convenient service was offered, the capture rate for this market would be 3 percent.

Assuming that 10 percent of Assateague Island NS and Assateague State Park day-use visitors either come from Berlin or travel through Berlin, and that 5 percent of these travelers would choose to access the island via the shuttle, the capture rate for day-use visitors would be 0.5 percent.

Applying these capture rates to the estimated daily and hourly visitation patterns results in an overall capture rate of 1.3 percent for the 80-day transit season. This capture rate includes day-use as well as overnight visitors.

An average of 280 daily transit rides are expected, with a maximum load point[31] of 24 riders in an hour. The total seasonal one-way passenger trips is expected to be about 22,000.

Preliminary Service Plan

Trips to and from Berlin are probably distributed throughout the day, with local residents traveling to the island in the morning, and Assateague campers traveling to Berlin in the afternoon and evening.

One 45-passenger bus operating on from 9am to 9pm could accommodate the forecast demand on this route. Scheduling a trip every 90-minutes would provide some flexibility in the schedule that would help maintain on-time departures and easy-to-remember departure times.

Cost

Table H-2 shows the estimated seasonal cost and cost per passenger for the Option #7. The estimated cost per (round-trip) passenger is $6.35.

[31] Maximum load point is the maximum number of transit rides on any segment in one hour. This number is used to determine the capacity that is needed to accommodate the peak demand.

Table H-2:
Berlin Shuttle Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	1 vehicle x 80 days	$30/vehicle-day	$2,400
	960 vehicle operating hours	$6/vehicle-hour	$5,800
Seasonal Operating Cost	960 vehicle operating hours	$60/vehicle-hour	$57,600
Total Seasonal Cost			$65,800
Seasonal Passengers (Round-Trip)			10,400
Average Cost per Passenger (round-trip)			***$6.35***

Option 8: Chincoteague Island Shuttle, Assateague Island NS and Assateague State Park

This option involves infrequent bus service between Assateague and Chincoteague. The route would serve Assateague Island NS, Assateague State Park, Chincoteague National Wildlife Refuge, and the town of Chincoteague, Virginia.

Route Description

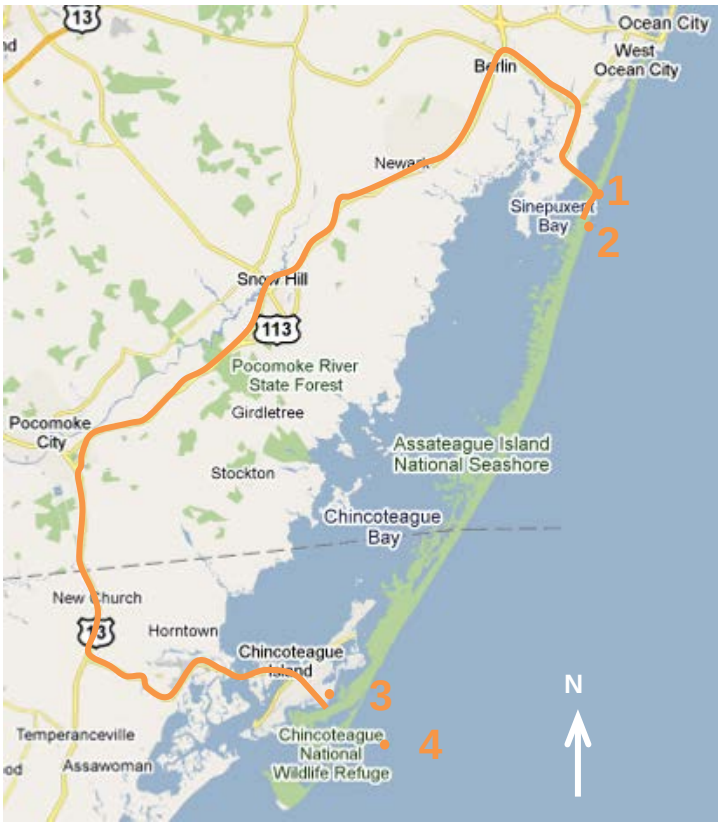
A shuttle service linking the Assateague and Chincoteague would be about 120-miles round-trip. The route and stop locations for Option #8 are shown in Figure H-3. The following stop locations were assumed:

1. Assateague Island NS North Beach parking lot
2. Assateague State Park parking
3. Downtown Chincoteague
4. Chincoteague National Wildlife Refuge

Assuming an average travel speed of 40mph and 3 minutes at each stop, the estimated round-trip route time is 3 hours 15 minutes. This bus service would need to offer luggage room and more comfortable seating to attract travelers to this relatively long route. The schedule should be designed to accommodate ½ day trips between the two locations.

It was assumed that this service would not be used by day-use visitors. While some day-use visitors may stop in both Assateague and Chincoteague, they probably do not make round-trip between the two, so it would not be practical to use a bus service.

Figure H-3
Chincoteague Shuttle Route and Stops
Source: Google Maps and Volpe Center



Capture Rate and Ridership

The market for transit service on this 60-mile trip is expected to be small. Charter bus style service with comfortable seating and luggage accommodation would be appropriate for the 60-mile trip. Two potential user groups for this service were identified:

- Assateague Island NS and Assateague State Park overnight campers
- Chincoteague overnight visitors

Assuming 5 percent of Assateague Island NS and Assateague State Park overnight campers make a trip to Chincoteague during their stay, and that 20 percent of these travelers would choose to make this trip via shuttle, results in a capture rate of 1 percent for this market.

Chincoteague NWR and the Virginia District of Assateague Island NS do not have overnight facilities. The town of Chincoteague, however, has an estimated 20 hotels and experiences a seasonal increase in population of about 10,000 people. Assuming that 25 percent of Chincoteague's summer population of 14,000 makes one trip to the Maryland District of Assateague Island NS during the season, approximately 45 people make a trip from Chincoteague to the Maryland District on a typical summer day. Assuming that 10 percent of these travelers would use transit, there would be about 10 one-way transit trips per day from this market.

An average of 70 daily transit rides is expected, for a total expected seasonal one-way passenger trips of about 5,500.

Preliminary Service Plan

One 45-passenger bus operating two round trips daily – one morning trip and one evening trip – could accommodate the forecast demand on this route. The schedule should be designed with regular departure times that would be easy for travelers to remember.

Cost

Table H-3 shows the estimated seasonal cost and cost per passenger for the Option #8. The estimated cost per (round-trip) passenger is expected to be $14.35. While the cost per passenger for this route is high, the cost per passenger mile is comparable to other options.

Table H-3
Chincoteague Shuttle Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	1 vehicles x 80 days	$30/vehicle-day	$2,400
	560 vehicle operating hours	$6/vehicle-hour	$3,400
Seasonal Operating Cost	560 vehicle operating hours	$60/vehicle-hour	$33,600
Total Seasonal Cost			$39,400
Seasonal Passengers (Round-Trip)			2,750
Average Cost per Passenger (round-trip)			***$14.35***

Option 9: Ocean City Shuttle, Assateague Island NS and Assateague State Park

Assateague Island offers a very different recreational experience from Ocean City, and there is a risk that linking to Ocean City could compromise the natural recreational experience on the island. However, it could also provide an opportunity for Ocean City visitors and residents and Assateague Island NS campers to have a different experience without having to rely on access to a personal vehicle or concerns about parking. In addition, Ocean City is linked to several regional transit systems including Shore Transit, Greyhound Bus Lines, and DART First state (Delaware's statewide transit system). Connecting to these systems would create new opportunities for primary transit access to Assateague Island NS.

Route Description

The route and stop locations for Option #9 are shown in Figure H-4. The following stop locations were assumed:

1. Assateague Island NS North Beach parking lot
2. Assateague State Park parking
3. Ocean City Transit Center

Figure H-4
Ocean City Shuttle Route and Stops
Source: Google Maps and Volpe Center

The round-trip route distance is 25 miles. Assuming an average travel speed of 25mph and 3 minutes at each stop, the estimated round-trip route time is 70 minutes.

Ocean City offers a free shuttle connecting the Ocean City Transit Center and the boardwalk, so riders would be able to easily connect to Ocean City attractions.

Capture Rate and Ridership

Three potential user groups for this service were identified:

- Assateague Island NS and Assateague State Park overnight campers
- Assateague Island NS and Assateague State Park day-use visitors
- Ocean City visitors

The table below summarizes the assumed capture rate for each market. An average of 300 daily transit rides are expected, for a total expected seasonal one-way passenger trips of about 24,000.

Table H-4
Ocean City Shuttle Estimated Capture Rates

Market	Market Size (average day during summer season)	Percent traveling this route	Percent who would use transit	Capture Rate
Assateague Island NS and Assateague State Park overnight campers	3,000	15percent	10percent	1.5percent
Assateague Island NS and Assateague State Park day-use visitors	10,000	5percent	10percent	0.5percent
Ocean City population	215,000	0.5percent	5percent	0.03percent
Total	228,000			0.065percent

Preliminary Service Plan

One 45-passenger bus cycling on this route every 90 minutes could accommodate the forecast demand.

Cost

Table H-5 shows the estimated seasonal cost and cost per passenger for the Option #9. The estimated cost per (round-trip) passenger is $5.50.

Table H-5
Ocean City Shuttle Cost Estimate

	Units	Unit Cost	Total Cost
Seasonal Capital Cost (lease cost)	1 vehicles x 80 days	$30/vehicle-day	$2,400
	960 vehicle operating hours	$6/vehicle-hour	$5,800
Seasonal Operating Cost	960 vehicle operating hours	$60/vehicle-hour	$57,600
Total Seasonal Cost			$65,800
Seasonal Passengers (Round-Trip)			12,000
Average Cost per Passenger (round-trip)			***$5.50***

Appendix I: Vehicle Selection Analysis

This appendix details the factors used to determine the suitable vehicle type for the proposed Assateague Island NS parking shuttle. In selecting the appropriate vehicle, a number of factors need to be considered, such as vehicle requirements, fuel type, and availability. This appendix considers these factors for Assateague Island NS and the proposed Option #2. This appendix does not cover vehicle procurement as the study recommends leasing vehicles; however, this information can be used for vehicle requirements to be included in a contract.

Vehicle requirements

Vehicle requirements include preferences for certain amenities as well as mechanical and operational characteristics necessary for certain road and operating conditions or capacity. Table A1 below summarizes the vehicle requirements for this service based on the assumptions made about service characteristics and discussion with the park on preferences.

Table I-1.
Vehicle Requirements

Characteristic	Duty Cycle Notes	Vehicle Requirements
Passenger Capacity	Mandatory period load = 330-475 passengers per hour Return trip average load = 75 passengers per hour The estimated average hourly passenger load during the mandatory period is 330 visitors per hour, and the estimated hourly passenger load during the remainder of the day is 75. On summer weekend days, an estimated 950 visitors would need to be carried from the mainland parking area to the island during the two hour mandatory period.	At least 26 seated. Higher capacity vehicles would reduce the number of vehicles needed during the mandatory period.
Average and maximum speed	Average = 20 mph Maximum = 55 mph (MD 611 speed limit is 50mph) Average operating speed is 20 mph; however the vehicle may operate up to the posted speed limit of 50 mph on the MD 611 bridge crossing and intermittent highway use may be required to access maintenance services and/or fuel.	Because of the low average speed, low-range gearing is desirable to extend the life of the vehicle transmission**.** However, the vehicle should be able to travel at highway speeds (approximately 55 mph).
Wear and tear	Total annual VMT = 25,000 to 35,000	Light- to Medium-duty vehicle(s) are appropriate
Route characteristics	The route is quite flat, with the exception of the Sinepuxent Bay crossing, which has a maximum grade of approximately 4%. The lane width along the route is approximately 12 feet. There are no overly restrictive horizontal curves but the vehicle would need to navigate through crowded parking lots.	No physical size restrictions, but smaller turn radius preferred for parking lot maneuvering may be favorable. Because the vehicle would operate on public roads, it must pass all pertinent federal motor vehicle safety standards.

Characteristic	Duty Cycle Notes	Vehicle Requirements
Road surface	Currently, the route is entirely paved, though it is possible that the shuttle would need to operate in muddy conditions or on a permeable surface such as a shell road in the future.	With a smooth, paved, flat route and warm-weather operation, high quality suspension and high traction tire treads are not required.
Fuel capacity	Vehicle may travel up to 200 miles per day.	Range must exceed 200 miles of low-speed, frequent stop travel.
Environmental operating conditions	The shuttle would operate during warm weather only. The average daily high temperature is over 80 degrees Fahrenheit, and temperatures can exceed 100 degrees.	Open windows may be preferable to air conditioning on most days, but air conditioning (A/C) should be available for particularly hot days. The ability to run A/C independently from the engine is not required.
Standees	10-15 minute one-way trip	Standees permitted, but plan to accommodate passengers in seats during non-mandatory hours.
Baggage accommodation	Passengers carrying beach gear	Luggage racks required
Accessibility and Floor Height	Visitors using a wheelchair or otherwise mobility impaired may park on the island. Vehicle needs to accommodate elderly visitors and visitors with strollers and gear.	Low-floor preferred
Public Announcement (PA) system	Short on-board interpretive orientation to the island is desirable, either recorded or live.	Hands-free head-set for if the driver would be the interpreter, or recorded messages may be used. Audio quality must be easily discernible by the visitor.
Fuel type	See alternative fuel discussion	
Interior accommodations	Users would have wet and sandy clothing, shoes, bags, and equipment.	Easily cleanable surfaces and flooring that would prevent slippage when wet (potential ability to be able to hose down entire interior)
Seating configuration		No preference although forward-facing may be best for capacity and viewing experience.
Driver workstation	Vehicles would operate continuously throughout the day, so driver workstation ergonomics should be optimized for safety and comfort	
Interior sound level	<65 dBA. Excessive vehicle noise inside the vehicle presents a challenge to onboard interpretation	
Doors		2
Tow Points		Front and rear
Exterior appearance		No preference
Exhaust temperature		No preference
Transmission		No preference
Delivery time		No restriction

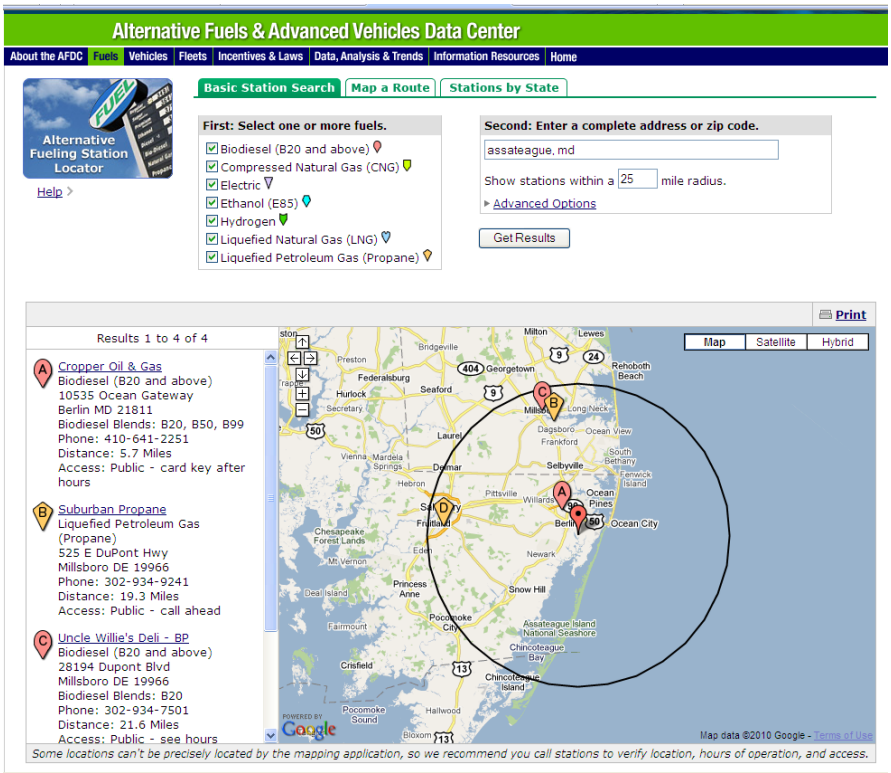
Alternative Fuels and Fuel Capacity

The Energy Policy Act of 1992 requires the National Park Service to use alternative fuel vehicles (AFVs) whenever possible. The use of AFVs is often in the best interest of parks, as they seek to reduce vehicle emissions and air pollution. Consequently, where practical, the NPS supports the use of alternative fuels as a component of sustainable alternative transportation. Alternative fuel is strongly preferred to the extent that it is feasible and economically sustainable.

This study evaluates a number of alternative fuel options as reasonable alternatives: biodiesel (B20 and B100), compressed natural gas (CNG), propane, hybrid-electric, and electric. The decision to select a particular fuel choice is dependent on several variables, including local availability (access to distributor with fuel selection), current infrastructure (ability to reasonably dispense fuel), environmental concerns, and vehicle availability and cost. Figure I-1 shows the availability of alternative fuels near Assateague Island NS. Table A-2, at the end of this appendix, provides a full assessment of alternative fuel options and vehicles for Assateague Island NS.

Hybrid electric vehicles (HEV), engine propane fuel (EPF), and compressed natural gas (CNG) are the only alternative fuel vehicles currently available through the GSA vehicle lease program. HEV options cost between $65,000-$81,000 more than conventional diesel engines[32] depending on the model chosen, and fuel efficiency is expected to be about 35 percent higher. Ethanol (E85 or E95), Hydrogen power, and Plug-in Hybrid Electric vehicles that meet the passenger load requirements are not currently commercially available.

Figure I-1
Availability of Alternative Fuels near Assateague Island NS
Source: NREL's Alternative Fuels & Advanced Vehicle's Data Center at http://www.afdc.energy.gov/afdc/locator/stations/.



[32] GSA Auto Choice

Vehicle Availability

In the United States, the bus industry segment that sells to public transit agencies produces approximately 5,000 vehicles ranging in size from 22 feet to 60 feet, with about 80 percent being 40-foot transit buses. The vehicle recommended for Assateague Island NS should be durable, but not over-designed to the operating conditions, as heavy-duty vehicles are more expensive to purchase, operate and maintain.

Federal agencies are required to purchase fleet vehicles through the General Services Administration (GSA). The GSA's vehicle purchasing portal Auto Choice[33] offers a web-based ordering process which provides for vehicle selection, configuration, selection of options, etc. Within Auto Choice, the following vehicle options most closely match the requirements outlined above.

Light-Duty Shuttle Bus

With passenger capacities up to 28 passengers, a light-duty shuttle would meet the minimum performance requirements outlined above. Models are available with wheelchair lifts and restraint systems (to meet ADA requirements), interior luggage racks and durable seating options. A low-floor option is available in the light-duty category only, however a similarly equipped model costs more than twice as much compared to its non-low-floor counterpart. The primary advantage of a low-floor vehicle is ease of access while loading and unloading passengers, particularly when accommodating handicapped visitors as no wheelchair lift is required (access is achieved with a simple ramp for wheelchair loading). The figure below is one of the available offerings in the light-duty category.

Figure I-2
Glaval Entourage F550 Light-Duty Shuttle
Source: http://www.glavalbus.com/

Medium-Duty Shuttle Bus

Medium-duty shuttle buses are available through the GSA in a variety of passenger capacities. For the purpose of this analysis, a 36-passenger (seated) bus was chosen and it is anticipated 8 seats would be removed for luggage racks yielding a 28-passenger (seated) capacity. There are six available buses meeting the above specification, all of which were priced with the same options as the light-duty vehicles above (wheelchair lift and restraints, interior luggage racks and transit-style durable seating). Pricing ranges from $121,350.49 to $151,983.79. Two models are available with a hybrid-electric drivetrain; when configured with the options from above resulted in pricing of $221,154.65 and $226,219.80, respectively. The figure below is one of the available options in the medium-duty category.

[33] GSA Auto Choice Home: http://www.gsa.gov/portal/content/100012.

Figure I-3
Glaval Concord II Medium-Duty Shuttle
Source: http://www.glavalbus.com/

Trams

Trams include any motor vehicle consisting of a tractor unit (with or without passenger accommodations) and one or more passenger trailer units. Another definition of a tram is a vehicle with an "open-air" passenger area, free of windows and enabling the passenger to experience a more intimate interaction with their surroundings. In 2010, the Volpe Center published a market assessment[34] for the Department of Interior (DOI) U.S. Fish and Wildlife Service (FWS) detailing the use of low-environmental-impact tram-vehicle needs of Federal Lands Management Agencies (FLMAs) and assessed the current tram-vehicle fleets as well as future fleet plans.

Most trams on the market today are electric-drive, are relatively small and are often restricted below 30 mph due to either design or technical limitations of the (electric) drive system. These options would not work for the operating requirements above, such as operating on MD 611, which has a 50mph speed limit.

There are traditionally-powered alternatives, which consist of a traditional heavy-duty truck chassis with open-air tram-style seating in lieu of an enclosed passenger area. Such a vehicle offers the open-air component to the visitor experience, with a power unit capable of achieving highway speeds. Specialty Vehicles offers two such models, the Tramstar LFT (available with a gasoline engine only) with a base price of $135,000; and the Classic American Tram (available with gasoline or diesel engines) and a base price of $74,900. Both options are shown in the figure below.

Figure I-4
Specialty Vehicles Tramstar LFT and Specialty Vehicles Classic American Tram
Source: Specialty Vehicles

[34] Low-Environmental Impact Tram Vehicle Study, U.S. Department of Transportation Research and Innovative Technology Administration John A. Volpe National Transportation System Center, February 2010.

Conclusion

For the purposes of this service, this study recommends a light-duty "cutaway" shuttle with capacity for up to 28 passengers and customization with wheelchair lifts and restraint systems (to meet ADA requirements), interior luggage racks and durable seating options. A low-floor option is available in the light-duty category but a similarly equipped model costs more than twice as much compared to its non-low-floor counterpart. However, the primary advantage of a low-floor vehicle is ease of access while loading and unloading passengers, particularly when accommodating handicapped visitors as no wheelchair lift is required (access is achieved with a simple ramp for wheelchair loading). Hybrid-electric is recommended for fuel because it achieves fuel efficiency while being readily available from GSA for leasing and not requiring special infrastructure.

Table I-2 Alternative Fuel Options for Assateague Island NS

	Biodiesel (B20)	**Biodiesel (B100)**	**Natural Gas (CNG & LNG)**	**Propane (EPF)**	**Hybrid Electric (HEV)**	**Electric**
Viable Fuel Option for Assateague Island NS?	Yes	No	No	No	Yes	No
General Notes	Existing on-site fueling station.	DOE's National Renewable Energy Laboratory does not recommend use of high-level biodiesel blends except where particulate matter is problematic.	Some natural gas vehicles (NGVs) have a more limited range or have reduced passenger or storage capacity due to fuel storage space requirements. Infrastructure and/or transport costs for CNG or LNG ful could be significant.	Fuel not readily available at Assateague Island NS.	Price-premium is a factor for consideration.	All-electric vehicles are not recommended for this application due to range, speed and reliability issues.
Vehicle availability	Blends up to 20% biodiesel (B20) are widely available and can be used in any diesel engine with few or no modifications to the engine or fuel system. Assateague Island NS light-duty vehicles currently use B20.	Modification of engine seal and gasket materials for diesel vehicles is required. Due to concerns regarding influence of biodiesel fuels on cold flow properties, material compatibility, maintenance intervals, fuel stability, biological growth, energy content, and emissions influence with higher concentration blends, the ASTM standard has only been approved for blends of biodiesel of B20 and lower.	A wide variety of medium- and heavy-duty NGVs and engines are currently on the market, both compressed natural gas (CNG) and liquefied natural gas (LNG). Natural gas vehicles (NGVs) are available as dedicated NGVs and bi-fuel NGVs, which operate on either natural gas or conventional fuel.	Propane engines and fueling systems are available for buses.	Hybrid electric: a variety of HEVs are available	Low-speed electric trams and buses are available.

	Biodiesel (B20)	Biodiesel (B100)	Natural Gas (CNG & LNG)	Propane (EPF)	Hybrid Electric (HEV)	Electric
Vehicle Options[35]	Any diesel bus	Any diesel bus with appropriate modifications	Champion CTS CNG FE (32p, 27-28' long) StarTrans President CNG (24-35p, cutaway) Many transit buses	StarTrans President (24-35p) Turtle Top Odyssey XL (up to 40p, cutaway)	**IC HC Diesel Hybrid** (36p, cutaway, 35% fuel economy increase) **IC CE Diesel Hybrid** (up to 52p, 13 to 23' long, 65% fuel economy increase) Turtle Top Odyssey XLT (up to 47p, cutaway) **Champion Defender** (30 to 39' long)	**DesignLine Eco-Smart 1** (28p, 35' long, up to 120 mile range, $600,000) **Ebus Electric** (22p+10standees, 22' long, up to 150 mile range, $325,000) **VanHool Fuel Cell** (28p, 40', 250-300 mile range, $2.5 million)
Fuel source availability and proximity	Assateague Island NS has an on-site B20 biodiesel fueling station. Cropper Oil & Gas, located in Berlin, MD, supplies B10, B20 and B50. www.mdbiodiesel.com	Cropper Oil & Gas can deliver any biodiesel blend of 150 gallons or more. Maryland Biodiesel in Berlin, MD produces 1500 gallons of B100 per day. www.mdbiodiesel.com	CNG is available from EarthTech in Ocean View, NJ about 70 miles from Assateague Island NS. LNG is not available locally. While public CNG refueling stations do exist, most fleets build their own infrastructure to meet their refueling needs.	Propane is normally supplied through distributors and is delivered to sites via ground transport. A propane fueling facility requires several systems including a cargo transfer/unloading system, storage tanks, piping, pumps, fuel transfer and dispensing systems, and safety systems. Propane fueling facilities are required to be outdoor facilities. Suburban Propane in Millsboro, DE and Fruitland, MD supply propane.	HEVs do not require electric charging stations.	Depending on the vehicle, common household electric circuits or higher voltage circuits may be used for recharging.

[35] http://www.afdc.energy.gov/afdc/vehicles/search/heavy/vehicles#filter%5Burl%5D=&filter%5Bparams%5D=vehicles%255Bmanufacturer_id%255D%3D%26vehicles%255Bfuel_id%255D%3D1%26vehicles%255Bapplication_id%255D%3D&pane=vehicles

	Biodiesel (B20)	Biodiesel (B100)	Natural Gas (CNG & LNG)	Propane (EPF)	Hybrid Electric (HEV)	Electric
Infrastructure needs	In general, the standard storage and handling procedures used for petroleum should be used for B20. The fuel should be stored in a clean, dry, dark environment.	Storage enhancing additives may be needed if B100 is to be stored for longer than 6 months.	Typically, CNG is sourced from the local gas utility line at low pressure, and then compressed and stored in storage tanks at high pressure. Design measures include providing adequate ventilation and air flow, removing potential ignition sources, and installing a combustible gas detection system.	Liquid propane is stored onboard vehicles in a tank pressurized to 300 psi. Certain design considerations for storage and maintenance facilities are required, such as providing adequate ventilation and air flow, and removing potential ignition sources.	No special infrastructure is required.	As noted above, higher voltage electric circuits may be required.
Maintenance and Workforce	Filters need to be closely monitored when switching from petroleum diesel to B20.	B100 can soften and degrade certain types of gaskets, hoses, and seal compounds.	Maintenance staff must be properly trained to safely work with high pressure natural gas valves and fittings.		Because the drive and electrical system of electric and hybrid vehicles differ from conventional vehicles, operators and maintenance staff must be trained on the new vehicle technology. The primary safety issue with electric and hybrid-electric vehicles is the risk of electric shock. These vehicles contain high voltage (300V to 600V) circuits that may be active even when the vehicle is not operating.	Electric vehicles have fewer moving parts than internal combustion engines. These vehicles do not have timing belts, water pumps, radiators, fuel injectors or tailpipes, nor do they require tune-ups or oil changes, which limit maintenance costs.

	Biodiesel (B20)	Biodiesel (B100)	Natural Gas (CNG & LNG)	Propane (EPF)	Hybrid Electric (HEV)	Electric
Cost	No vehicle modifications required. Price of B20 is comparable to conventional diesel.	B100 is about $0.10 to $1.00 per gallon more expensive than conventional diesel.	Natural gas-fueled heavy-duty vehicles can carry an incremental cost of $30,000 to $50,000 more than their conventionally-fueled counterparts. CNG fuel is about 20% less expensive than gasoline.	Propane fluctuates above and below the price of gasoline.	The incremental cost for a HEV compared to base models for the 2010 GSA shuttle bus options is $30,000 to $100,000. HEV captures energy from braking, reducing fuel costs.	Electric power is less expensive than gasoline.
Environmental Impact	The lifecycle GHG emission from biodiesel vary widely depending on the source. Soy-based biodiesel reduces CO, PM, and HC tailpipe emissions compared to conventional diesel by 10-20%.	Soy-based biodiesel reduces CO, PM, and HC tailpipe emissions compared to conventional diesel by 40-90%.	Emissions benefits of using CNG in heavy-duty vehicles varies depending upon the type of vehicle and drive cycle. In terms of lifecycle GHG emissions, various studies have found that natural gas vehicles emit 20-25 percent less GHG emissions than conventional petroleum vehicles.	Compared to gasoline, propane combustion emits fewer GHGs (12 percent), NOx (20 percent), hydrocarbons (60 percent), CO (60 percent), toxins and carcinogens (96 percent), PM (80 percent), and less noise as compared to diesel.	Hybrid vehicles capture braking energy that would otherwise be lost as heat, producing a new reduction in emissions from the use of gasoline or another fuel source. Battery toxicity is an additional impact.	All-electric vehicles have no tailpipe emissions; however, the complete emission impact depends on the method of electricity generation. Coal generation yields modest emissions reductions, while natural gas, nuclear, and renewable fueled electricity yield greater overall reductions. Noise is also greatly reduced. Battery toxicity is an additional impact.
Peer Experience	Assateague Island NS light-duty vehicles currently use B20.	Channel Islands National Park, CA using B100 since 2001. Yellowstone National Park concessioner collects oils locally to manufacture biodiesel.	Cabrillo National Monument, Lake Roosevelt Nat'l Recreation Area, Lake Mead Nat'l Recreation Area, and Grand Canyon Nat'l Park operate CNG fleets	Mammoth Cave National Park, Acadia National Park, and Zion National Park operate propane vehicles	Yosemite National Park operates 40-passenger HEV buses	Patuxent Wildlife Research Refuge operates a 40-passenger tram on a 2-mile route up to five times per day.

Appendix J: Further Analysis of Parking Shuttle Options #4 and #5

This appendix provides additional and updated analysis for parking shuttle options #4 and #5 based on the assumptions developed for the Transit Business Plan for Option #2 and extended beyond the 80-day schedule assumed for the initial transit feasibility assessment and comparison of options #1-9. This information is provided for the purposes of understanding the costs and service characteristics that may be required for future scenarios, as described in Chapter 6.

Option 4: Reduced Island Parking

This option illustrates the levels of transit service needed to sustain current visitation if half of the parking on the island was lost due to storm overwash and/or sea level rise. Visitation is assumed to remain steady, although damage to Assateague Island may result in decreased visitation. This option focuses on the transit capacity that would be needed to accommodate current visitation levels with 340 on-island beach parking spaces instead of the current 681 spaces, consisting of all beach and beach overflow parking and 40 percent of other island parking. Necessary management policies and traveler information systems to direct overflow parking to transit are assumed to be in place. This option assumes that OSV users and overnight visitors would continue to drive onto the island. However, severe sea level rise and storm overwash may result in damage to OSV areas or to campgrounds.

Preliminary Service Plan

Three levels of transit service would be needed to shuttle passengers to the island on days when on-island parking is estimated to be exceeded. There would be periods of mandatory transit usage from April through October on days when more than 475 vehicles attempt to park on the island throughout a day or 340 vehicles are estimated to be parked at one time. On-island parking is expected to fill as early as 8:00 AM during the peak summer weekends. Parking demand is not expected to be stressed from late fall until mid-spring, even with reduced parking on the island. The yearly span of the three operating schedules is detailed in Table J-1Table J-1.

The service plan for this option assumes that day-use visitors are allowed to drive and park on the island until capacity is nearly reached. At that point day users would have to park at a parking lot on the mainland and take a shuttle bus until earlier arrivals begin to leave and spaces open at the island parking lot. After that point, arriving visitors may choose to drive and park on the island or to park and ride the shuttle from the mainland. The shuttle would continue operating to return visitors to their cars until the evening. Daily schedules and the number of buses required to meet demand are detailed in Table J-2. Headways vary throughout the day, with the maximum number running during the morning peak, one or two buses running during the mid-day and two to six buses running during the evening peak. Congestion entering and exiting the island is assumed to be reduced, and so total travel time per trip is down to 35 minutes.

Cost

Table J-3**Error! Reference source not found.** explains operating costs for this option, while Table J-4 details capital costs. The total cost of operating the shuttle would be $271,985 per year. If a shuttle service and the associated infrastructure were implemented earlier, then half of the parking spaces and all of the stops, shelters and signage would already exist. The cost of building 340 new spaces would be $1,190,000, which could be annualized over twenty years to $59,500.

Table J-1
Service Levels by Day at Half Parking Capacity

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Apr	None	None	None	None	None	Shoulder	Shoulder
May	None	None	None	None	None	Low-Peak	Low-Peak
Jun	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	High-Peak	High-Peak
Jul	Low-Peak	Low-Peak	Low-Peak	Low-Peak	Low-Peak	High-Peak	High-Peak
Aug	Low-Peak	Low-Peak	Low-Peak	Low-Peak	Low-Peak	High-Peak	High-Peak
Sep	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	Low-Peak	Low-Peak
Oct	None	None	None	None	None	Shoulder	Shoulder

Table J-2
Daily Schedules at Half Parking Capacity

	Mandatory Hours	End of Service	Number of Buses	Frequency
Shoulder	9:30-11:00 AM	7:00 PM	3	10-30 minutes
Low Peak	8:30-11:30 AM	7:00 PM	5	5-30 minutes
High Peak	8:00-12:30 AM	8:00 PM	7	6-30 minutes

Table J-3
Operating Costs at Half Parking Capacity

	Units	Unit Cost	Total Cost
Seasonal Capital	7 vehicles, 3 months 5 vehicles, 2 months 3 vehicles, 2 months	$717/vehicle-month	$59,585[36]
	60,686 miles	$0.515/mile	
Seasonal Operating	3,540 vehicle operating hours	$60/vehicle-hour	$212,400
Total Seasonal Cost	**$271,985**		

[36] Also includes 500 miles per bus per season to include maintenance trips and travel to and from concessionaire's base at the beginning and end of the operating season.

Table J-4
Capital Costs at Half Parking Capacity

	Units	Unit Cost	Total Cost
Mainland Parking	700 spaces	$3,500 /space[37]	$2,448,706
Stops and Shelters	3	$5,000	$15,000
Variable Message Signs	2	$25,000	$50,000
Static Signs	10	$250	$2,500
Total Capital Cost			**$2,516,206**
Estimated Annualized Cost			**$129,185.32**

Option 5: No Island Parking

This option is designed to illustrate the level of transit service that would be needed to sustain current visitation in the event that all parking on the island is lost due to storm overwash and/or sea level rise. This scenario is not completely realistic – it is likely that were parking on the island to be lost, visitation would change significantly as well – but it is designed to illustrate an upper bound for the transit capacity that could be needed. Providing land transportation to and from the mainland would require at least one bus running year-round. It is assumed that day-users andcampers would be required to use the service at all times throughout the day.

Preliminary Service Plan

Five different service levels (see Table J-5) would be needed to match service to demand and avoid overcrowding and unnecessary expense. These increase with demand to provide year-round access while also adequately serving the peak summer demand.

Traffic congestion would be eliminated in this option. The round-trip travel time is estimated to be 34 minutes. All schedules would provide service from 6:00 AM to 10:00 PM, although these hours may be shortened due to the lack of both light and visitation during the winter months. Details on these schedules are included in Table J-6 below.

Cost

The costs for this scenario are detailed below in Table J-7 and Table J-8. Table J-7 describes operating costs and Table J-8 describes capital costs.

The total cost of operating the shuttle would be $1,056,583 per year. If a shuttle service and the associated infrastructure was to begin earlier, then half of the parking spaces, stops and shelters and signage would already exist. The cost of building 690 new spaces would be $2,415,000, which could be annualized over twenty years to $120,750. If this was the first implementation of shuttles, then the full infrastructure described above would need to be built, except for the Variable Message Sign. Because Assateague Island NS would be operating at least one bus year round, it may be cost-effective to own at least one bus. The above calculations assume that all buses are leased for comparison's sake. If damage is especially severe then land access to the island may be cut off, and new access routes would need to be built or ferries and personal watercraft would be the only access.

[37]Victoria Transport Policy Institute. "Transportation Cost and Benefit Analysis II." http://www.vtpi.org/tca/tca0504.pdf

Table J-5
Service Levels by Day with no Island Parking

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Jan	Basic	Basic	Basic	Basic	Basic	Basic	Basic
Feb	Basic	Basic	Basic	Basic	Basic	Off-Peak	Off-Peak
Mar	Basic	Basic	Basic	Basic	Basic	Off-Peak	Off-Peak
Apr	Basic	Basic	Basic	Basic	Basic	Shoulder	Shoulder
May	Off-Peak	Off-Peak	Off-Peak	Off-Peak	Off-Peak	Low-Peak	Low-Peak
Jun	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	High-Peak	High-Peak
Jul	Low-Peak	Low-Peak	Low-Peak	Low-Peak	Low-Peak	High-Peak	High-Peak
Aug	Low-Peak	Low-Peak	Low-Peak	Low-Peak	Low-Peak	High-Peak	High-Peak
Sep	Shoulder	Shoulder	Shoulder	Shoulder	Shoulder	Low-Peak	Low-Peak
Oct	Off-Peak	Off-Peak	Off-Peak	Off-Peak	Off-Peak	Shoulder	Shoulder
Nov	Basic	Basic	Basic	Basic	Basic	Shoulder	Shoulder
Dec	Basic	Basic	Basic	Basic	Basic	Basic	Basic

Table J-6
Daily Schedules with no Island Parking

	Number of Buses	Frequency	Daily Vehicle Hours	Days per Year
Basic	1	34 minutes	16	148
Off-Peak	2	15-34 minutes	20	61
Shoulder	4	7.5-34 minutes	43	70
Low Peak	9	3.3-34 minutes	80	61
High Peak	12	3-34 minutes	116	26

Table 2
Operating Costs with no Island Parking

	Units	Unit Cost	Total Cost
Seasonal Capital	12 vehicles, 3 months 9 vehicles, 2 months 4 vehicles, 3 months 2 vehicles, 2 months 1 vehicle, 2 months	$717/vehicle-month	$186,505.18[38]
	255,905 miles	$0.515/mile	
Seasonal Operating	14,501 vehicle operating hours	$60/vehicle-hour	$870,078
Total Seasonal Cost	**$1,056,583**		

Table 3
Capital Costs with no Island Parking

	Units	Unit Cost	Total Cost
Mainland Parking	1050 spaces	$3,500 /space[39]	$3,675,000
Stops and Shelters	3	$5,000	$15,000
Variable Message Signs[40]	2	$25,000	$50,000
Static Signs	10	$250	$2,500
Total Capital Cost			**$3,742,500**
Estimated Annualized Cost			**$190,500**

[38] Also includes 500 miles per bus per season to include maintenance trips and travel to and from concessionaire's base at the beginning and end of the operating season.

[39] Transportation Cost and Benefit Analysis II. http://www.vtpi.org/tca/tca0504.pdf Victoria Transport Policy Institute.

[40] Could be replaced by a cheaper static sign because parking operations would be the same every day.

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14. ABSTRACT

The purpose of this study was to (1) study the potential expansion of existing alternative transportation systems (bicycle facilities) and development of new alternative transportation systems in and around the Maryland District of Assateague Island National Seashore and (2) develop a business plan for implementation of a new alternative transportation system (transit). The park experiences congestion and parking capacity issues from its beach visitation, as well as challenges around signage, over-sand vehicle zone access, and bicycle and pedestrian access. Assateague Island also faces challenges as a barrier island and is likely to experience an increasingly dynamic land base on the island as a result of storms, natural shoreline processes, and sea level rise and other climate change effects. These changes raise questions about cost, sustainability, and access. The study consists of an assessment of current and future conditions and needs as they relate to transportation within and to the Maryland District of Assateague Island NS. including a transit feasibility assessment.

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