

Alternative Transportation Study Transportation Scholar Report



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Synopsis of HFNHP Transportation Study:

Execution of the Study: In February of 2011, Harpers Ferry National Historical Park Superintendent, Rebecca Harriett, commissioned the Park Transportation Committee. The mission of this committee was, as set forth by the Park General Management Plan, to study the existing Park transportation system, determine the feasibility of providing visitor transportation services to outlying Park sites, consider and develop additional transportation stops, loops, parking, and supporting infrastructure alternatives and cost estimates for the Park management team to consider. The Park also applied for and received through National Park Foundation, a transportation scholar that proved to be critical in the success of this Transportation Study. The Transportation Team met on May 4, 2011 and in partnership with the National Park Foundation and the Denver Service Center, began a very thorough and comprehensive study. The team met monthly to report on assignments, provide updates and focus on results. Three public meetings were conducted and the turnout and interest exceeded Park estimates. Local and county residents, merchants, county, state, and federal government officials, attended and provided valuable information in support of an expanded Park transportation system.

Bus Routes and Fleet Increase: Regarding the seven alternatives derived from this study, it is a future Park goal to maintain a minimum bus fleet of 13 vehicles (7-8 37 passenger buses and/or 4-5 12 passenger buses). This would be an increase of three vehicles to the existing number of ten buses/vans the Park is currently maintaining. The Superintendent will decide which alternatives are best for the park based on the findings of this document. Currently there is a need to have both 37 and 12 passenger buses to respond to the fluctuations in visitation and special events and the realities of navigating to outlying areas of the park on narrow paved and gravel roads. However, it has been proven that generally a transportation fleet using a single type of vehicle is more economical. Therefore, when the existing bus fleet nears retirement, the Park will explore advances in transportation technologies including hybrid, electric and higher bio performance power systems. Engineering advances could result in a one size-fits-all bus to service all Park locations.

Large buses will carry the majority of the visitors to the Lower Town seven days a week during the prime visitation season May-October. The smaller buses will carry fewer passengers to the outlying areas (battlefields) for special event weekends during the prime visitation season. During the winter months (the reduced visitation season) the smaller buses will replace the larger buses and act as the primary carrier from the Visitor to the Lower Town.

Bicycle and Hiking Routes Increase: In addition to the bus routes portion of the study there was significant emphasis on the development of new bicycle routes and hiking trails alternatives. The study identified five bike routes and seven hiking routes. It is understood that none of these routes will be excluded. All new biking and hiking trail will connect with existing or newly planned bike and hiking routes within Jefferson county, WV, Washington County MD, and Loudoun County, Virginia. As this portion of the study comes to fruition, the bike and hiking routes that need the least infrastructure improvements thus lower project costs will be added to the Park's over all transportation system first. The routes that require more planning and cost will be prioritized and completed over time.

Continuation of Trans Study related to Significant Transit Projects: The Transit Study supports the NPS project plans and design for the expansion of the Park's existing bus transportation facilities: i.e. HAFE Project PMIS 91113; and the development of bus transit destination points for public use: i.e. HAFE Project PMIS 155668. The new park transit facility developed by project PMIS 91113 should accommodate the vehicles recommended in the study and will be versatile enough to support future transit vehicle changes and improvements."

ABSTRACT

Harpers Ferry National Historical Park (HAFE) is located at the confluence of Potomac and Shenandoah rivers with part in West Virginia, Virginia and Maryland. During the past two decades, the park's acreage has increased by 60%. However, the park transit system did not grow in parallel with the park and no additional means of public transportation has been provided. Due to this, the 2010 General Management Plan (GMP 2010) indicated the need to provide enhanced visitor access to Camp Hill, Bolivar Heights and newly acquired areas of North and South Schoolhouse Ridge, and Murphy Farm. From June to December 2011, the National Park Transportation Scholar, Menasse Kumlachew, addressed this issue considering three alternative transportation systems: transit, bike, and trails. He recommended several alternatives for the expansion of the transit system and identified trails and bike routes that create connection between major resource sites in the park.

ACKNOWLEDGEMENT

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1. INTRODUCTION

Alternative Transportation Systems (ATS) play an important role in fulfilling the mission of the National Park Service. Nowadays, with the increase in visitation rates and people's desire to use personal vehicles, park resources are endangered and visitor experiences are affected in parks nationwide. ATS help to minimize these problems. A well organized and planned ATS with respect to accessibility, mobility and convenience helps to improve visitor experience and tell a story without affecting the natural and cultural resources in the parks. Transit systems, trails and bicycles are among the main ATS components that help to achieve this goal.

Currently, Harpers Ferry National Historical Park (HAFE) has a transit system. This study deals with the potential expansion of this transit system and ways of connecting major resources in the park with biking and hiking trails. It investigates the best routes to enhance visitor experience. The report covers an overview of the existing system and compares alternative routes based on affordability and provides recommendations based on how well they achieve park goals and objectives and value analysis results.

The final output of the project will serve as input for two upcoming projects: "Improving Existing HAFE Transit Maintenance Facility" and "Improve HAFE Park Transit Destination Points." It will also serve as the foundation for other projects to improve alternative transportation in the park.

1.1 Location

Harpers Ferry National Historical Park is located on the eastern part of the United States within the National Park Service's National Capital Region. It is located at the convergence point of three states: West Virginia, Virginia and Maryland. It is also located at the confluence of Potomac and Shenandoah rivers. Figure 1 shows a map of the park and surrounding areas.



Figure 1 Harpers Ferry National Historical Park Location (Source: HAFE website)

1.2 History and Resources

Harpers Ferry was an important manufacturing and commercial town during the late 1700's. It is named after Robert Harper who started a ferry business along the Potomac and Shenandoah rivers. In 1796, George Washington established the Federal Armory in Harpers Ferry that became the nation's second federal Armory when it began production. (1) Harpers Ferry also took significant part in Civil War History due to the John Brown's raid that was instrumental for the initiation of American Civil War. John Brown and his twenty one followers held the Federal Armory in Harpers Ferry for 36 hours.

During the Civil War, Harpers Ferry changed hands eight times between the Union and the Confederates armies. The town had strategic significance due to the Baltimore and Ohio (B & O) Railroad and the Chesapeake and Ohio (C & O) Canal that pass through the town, the town's manufacturing development and its location..

HAFE also has been a key place in the African American history. Storer College that was one of the first integrated colleges and the location for the second meeting of the Niagara Movement was important in the later establishment of National Association for the Advancement of Colored People (NAACP).

Due to these important historical events, (on June 30, 1944) congress authorized the establishment of Harpers Ferry National Monument. It was later renamed Harpers Ferry National Historical Park. Since its beginning, of 800 acres the park has grown in size to 3,645 acres through land purchases and donations.

At present, Harpers Ferry National Historical Park provides many cultural and natural resources for visitors. Cultural resources include Civil War battlefields, Lower Town historical structures and museum artifacts relating to the town's industrial period, the Civil War, and African American history. The natural resources include rivers, rare plant and animal species as well as rare vegetative habitats such as limestone red-cedar glades and low-elevation montane forests. (3)

The resources are interpreted at different locations in the park. For example, African-American History at Camp Hill, Murphy Farm and Lower Town; John Brown at Murphy Farm and Lower Town; industry and transportation at Lower Town; Civil War at Maryland Heights, Loudoun Heights, School House Ridge North and South etc. All resource sites in the park are a significant parts of the park's themes.

1.3 Project Background and Motivation

HAFE is one of the many national parks that provide transit for park visitors. The transit system stretches 1.9 miles from the visitor center (Cavalier Heights) to Lower Town. In the past two decades the park size has increased by 60%. However, the park transit system has not grown with the park and no additional means of public transportation has been provided. To balance the alternative transportation coverage with the increased size of the park (reaching additional

visitation areas and outlying battlefield areas) and enhance the visitor experience, the 2010 General Management Plan (a.k.a. GMP) recommended the expansion of the transit system and trails. Therefore, the motivation for this alternative transportation study is the GMP. The GMP identified the need to provide enhanced visitor access to Camp Hill, Bolivar Heights, Nash Farm and newly acquired areas of North and South Schoolhouse Ridge, and Murphy Farm.

1.4 Goals, Objectives and Performance Measures

This section provides the goals, objectives developed to address the transportation issue identified by the park. It was developed with an in depth discussion with the transportation committee in the park. The section also includes the performance measures developed to measure the extent to which the objectives were met.

Goal 1: Improve visitor experience by making it easier for visitors to understand and access park resources

Objective 1.1 – Visitors should have an opportunity to understand the historic significance of an area within a 0.5 mile walking distance in each direction (1 mile total) by 2014
Performance Measures – Walking distance required to understand each historic resource

Objective 1.2 – Increase the number of visitors who get interpretation at each park resource site by 2014
Performance Measures – Number of people who receive interpretation at each location.

Objective 1.3 – Minimize total vehicle miles travel by visitors to access the park by 2014
Performance Measures – Vehicle miles travel on park roads

Goal 2: Serve educational tours cost-effectively with minimal impact on park resources and other park transportation services

Objective 2.1 – Tour busses should not be in Lower Town bus terminal for more than 5 minutes when dropping passengers off by 2014
Performance Measures – Length of passenger drop-off time

Objective 2.2 – Tour busses should not be in Lower town bus terminal for more than 5 minutes when picking up passengers by 2014
Performance Measures – Length of pick up time

Objective 2.3 – Tour bus passengers will not need to use the park transportation system to access park resources.
Performance Measures – Use of park transportation system by tour bus passengers

Objective 2.4 – Tour busses should not be in Lower town for more than 15 minutes per visit by 2014
Performance Measures – Total tour bus dwell time in Lower Town

Goal 3: Reduce number of vehicles on park roads

Objective 3.1 – Reduce vehicles entering Lower Town, Schoolhouse Ridge, Murphy Farm Bolivar Heights, Nash Farm and Camp Hill by 20% from 2011 levels by 2014

Performance Measures – Traffic count east of High St. on Shenandoah St.

– Traffic count North of Hog Alley on Potomac St.

– Traffic count entering Schoolhouse Ridge North & South

– Traffic count entering Murphy Farm

– Traffic count at Lower Bolivar Height

– Traffic count at Nash Farm

– Traffic count at Camp Hill

Objective 3.2 – Provide access to Camp Hill using modes that can be accommodated by existing transportation infrastructure with the exception of basic supporting facilities

Performance Measures – Required new facilities

Objective 3.3 – Provide access to Lower Town using modes that can be accommodated by existing transportation infrastructure

Performance Measures – Required new facilities

Objective 3.4 – Provide access for the other areas using modes that can be accommodated by existing transportation infrastructure components without total reconstruction.

Performance Measures – Required new facilities

Goal 4: Provide sustainable (cost effective) access to park resources

Objective 4.1 - Provide access to each resource for less than \$2.00 per visitor by 2014

Performance Measures – Cost per visitors

Objective 4.2 – Provide access to all resources for less than \$500,000/ yr for operations and maintenance by 2014

Performance Measures – Annual operating and maintenance cost

Objective 4.3 – Provide access to all resources for less than \$750,000/yr life cycle costs (capital, operations and maintenance) by 2014

Performance Measures – Life Cycle cost

2. METHODOLOGY

This section includes the data collection, analysis and the different alternatives considered to achieve the goals of the project. It also includes the overview of the existing alternative transportation systems.

2.1 Data Collection

Data collection is an important step to achieve the goals of a project. Different techniques can be applied to collect data however, the first step is identifying new and existing data needed for the project. For this project, the required data was identified and availability was determined, based on the performance measures needed to evaluate the objectives. Table 1 shows the data needed for each performance measure.

Once the data needs and source were identified the data collection begun with identification of contact persons, selection of dates and methods for field observations, and preparation of field sheets. Examples of the field sheets used are attached in Appendix D

Table 1 Data Needs Based on Performance Measures

Performance Measures	Data Needs	Data Source (New/ Existing)
Walking distance required to understand each historic resource	1. Lower Town - Bus Shelter to The point 2. Bolivar Heights – Bus Stop/ Parking to the Crest loop trail 3. Murphy Farm – Parking to Foundation of John Brown’s Fort – Visitor Center to Foundation of John Brown’s Fort 4. Schoolhouse Ridge South – Parking to the top of the ridge (direct distance) 5. Schoolhouse Ridge North – Parking to the top of the ridge (direct distance) 6. Nash Farm – Visitor Center to the Overlook – Road at the house to the Overlook 7. Camp Hill – Bracket House to Jefferson Rock – Mather Training Center to Lockwood House	New New New New New New New New New
Number of people who receive interpretation at each location	1. Lower Town - The number of all visitors. 2. Bolivar Heights – Shuttle users from 10:00AM to 3:00PM. 3. Murphy Farm – The number of people involved in a scheduled tour. 4. Schoolhouse Ridge South – Assume no visitors are going there or very small number. 5. Schoolhouse Ridge North – Assume no visitors are going there or very small number. 6. Nash Farm – Assume no visitors are going there or very small number. 7. Camp Hill – The number of people involved in a scheduled tour. This data is available from Visitor Services.	NPS Reports website (Existing). Visitor Services (Existing). Visitor Services (Existing). Supporting Traffic count to be done Supporting Traffic count to be done Supporting Traffic count to be done Visitor Services (Existing) and supporting Traffic count to be performed
Vehicle miles travel (VMT) on park roads	1. For Buses (includes all buses) : VMT per year and number of bus users. 2. For Private Vehicles: Estimate VMT using Vehicle count in Old Town area	Visitor Services (Existing). Visitor Services (Existing).
Length of passenger dropping off time	Number of educational tour buses, date, time, from where (FY2011 & 2010) Take sample of the current tour bus passenger drop off time in Old Town	Visitor Services (Existing). New
Length of pick up time	Number of educational tour buses, date, time, from where (FY2011 & 2010). Take sample of the current tour bus passenger pick up time in Old Town	Visitor Services (Existing). New

Use of park transportation System by tour bus passengers	Number of educational tour buses, date, time, from where (FY2011 & 2010) Identify the current use of park transportation system by tour bus passengers	Visitor Services (Existing). Visitor Services (Existing).
Total tour bus dwell time in Lower Town	Number of educational tour buses, date, time, from where (FY2011 & 2010). Take sample of the total tour bus dwell time (pick up & drop off) per visit	Visitor Services (Existing). New
Traffic count east of High St. on Shenandoah St.	1. Traffic count east of High St. on Shenandoah St	Self (New)
Traffic count North of Hog Alley on Potomac St.	2. Traffic count North of Hog Alley on Potomac St	Self (New)
Traffic count entering Schoolhouse Ridge North and South	3. Traffic count entering Schoolhouse Ridge North and South	Supporting Traffic count to be done
Traffic count entering Murphy Farm	4. Traffic Count at Murphy Farm. Assume there is no traffic in this area or a very small number.	Supporting Traffic count to be done
Traffic count at Lower Bolivar Height	5. Bolivar Heights. Assume there is no traffic in this area or a very small number.	Supporting Traffic count to be done
Traffic count at Nash Farm	6. Traffic count to Nash Farm. Assume there is no traffic in this area or a very small number.	Supporting Traffic count to be done
Traffic count at Camp Hill	7. Camp Hill (it is difficult to discern visitor vehicle form residents and local employees). Assume there is no traffic in this area or a very small number.	Supporting Traffic count to be done
Required new facilities	Identify the existing facilities (size, appropriateness for different modes, parking areas, shelters, bus turn around, etc.) This data can be collected form field observations, measurements, maps, etc.	Field observations, measurements, maps, etc.
Required new facilities	Identify the existing facilities (size, appropriateness for different modes, parking areas, shelters, etc.) This data can be collected form field observations, measurements, maps, etc.	Field observations, measurements, maps, etc.
Required new facilities	Identify the existing facilities (size, appropriateness for different modes, parking areas, shelters, etc.) This data can be collected form field observations, measurements, maps, etc.	Field observations, measurements, maps, etc.
Cost per visitors	Annual number of paying visitors, annual operational and maintenance cost of the transit system. This data is available from HAFE ATS pro forma.	HAFE ATS pro forma.
Annual operating and maintenance cost	Annual operational and maintenance cost of the transit system. This data is available from HAFE ATS pro forma.	HAFE ATS pro forma.
Life Cycle cost	Capital, operations and maintenance cost of the transit system. This data is available from HAFE ATS pro forma.	HAFE ATS pro forma.

2.2 Data Analysis

2.2.1 Walking Distance

Table 2 shows the walking distance required to access and understand each resource sites. The distances were measured from potential/existing bus drop off points and the Visitor Center to reach the points identified by the interpretation staff as good locations to understand the sites. As can be seen from the table, all the distance from the Visitor Center to the locations identified at each resource sites are more than 0.5miles. This indicates that offering trail connections only may not provide the required understanding of the resource sites within a 0.5 miles walk.

Table 2 Walking Distance to Historic Resource

Data Needs	One-way Walking Distance (Mile)
1. Lower Town – Bus Shelter to The point	0.2
– Visitor Center to The Point	2.1
2. Bolivar Heights – Bus Stop/ Parking to the Crest Loop Trail	0.3
– Visitor Center to the Crest Loop Trail	1.0
3. Murphy Farm – Parking to Foundation of John Brown’s Fort	0.5
– Visitor Center to Foundation of John Brown’s Fort	1.0
4. Schoolhouse Ridge North – Parking to the top of the ridge (direct distance)	0.4
– Visitor Center to Schoolhouse Ridge North Parking	2.3
5. Schoolhouse Ridge South – Parking to the top of the ridge (direct distance)	0.3
– Visitor Center to Schoolhouse Ridge South Parking	2.2
6. Nash Farm – Road at the house to the Overlook	0.2
– Visitor Center to the Overlook	3.4
7. Camp Hill – Mather Training Center to Lockwood House	0.4
– Visitor Center to Lockwood House	1.9

2.2.2 Number of People Who Receive Interpretation at Each Location

Since HAFE interpretation staff intended to enhance interpretation at all locations served by alternative transportation system, the number of people who receive interpretation at each location is assumed to be equal to the number of people going to each location. For Bolivar Heights, it is observed that less than 1/3 of the shuttle passengers will get off and visit the area. However, since it is difficult to find out how many will get off and how many will continue, it is assumed that all the visitors going there on the bus will receive interpretation thorough the audio on the bus. For Murphy Farm and Camp Hill the numbers of people who participate on scheduled tours were taken. Currently, there are very small numbers of visitors going to SHRN, SHRS, Nash Farm, Murphy Farm and Camp Hill on self guided tours. This was confirmed by traffic counts taken at suggested peak hours by the interpretation division.

Table 3 Current Visitors at Resource Locations (FY 2011)

Location	Number
Lower Town	256663
Bolivar Heights	77512
Murphy Farm	379
School House Ridge North	None
School House Ridge South	None
Nash Farm	None
Camp Hill	417

2.2.3 Vehicle Miles Travel

Vehicle miles travel is the number of miles traveled on roads accessing Lower Town. These roads include Washington Street, Shoreline Drive, and Shenandoah Street. As can be seen on Table 4 the VMT for tour buses other than education does not exist because they use the HAFE shuttle buses. To estimate the VMT for private vehicles, a traffic count was conducted at Lower Town and it was assumed that it will vary in the same trend as the daily visitation or ridership. A distance of 2.5 miles was used to find the total VMT for private vehicles; this is the average length of the three roads on which the vehicles come into and leave the park.

Table 4 Annual FY 2011 Vehicle Miles Travel

Vehicle Type	VMT	Users
HAFE ATS Buses	62115	158,034
Educational Tour Buses	4359	21521
Other Tour Buses	0	6956
Private Vehicles	428967	341353

2.2.4 Number of Vehicles

As mentioned in section 2.2.2, peak hour traffic counts at locations other than Lower Town did not show a significant number of vehicles entering the sites. On the other hand Lower Town sees a lot of vehicles per day. Most of these vehicles are visitor vehicles. However delivery, commuters and park vehicles are also present. The traffic counts at all the sites except Lower Town were conducted based on the peak hours recommended by visitor services.

Table 5 Traffic Counts at Resource Locations

Location	Traffic Count	Date	Duration
East of High St on Shenandoah St	819	7/28/2011	8AM – 5PM
North of Hog Alley on Potomac St	478	7/28/2011	8AM – 5PM
Entering Schoolhouse Ridge North and South	0	7/31/2011	3 PM – 4PM
Entering Schoolhouse Ridge South	2	7/31/2011	11AM- 1PM
Entering Murphy Farm	5	7/30/2011	1 PM – 3PM
Bolivar Height	11	7/30/2011	4 PM – 6PM
Nash Farm	1	7/31/2011	4 PM – 5PM
Camp Hill	2	7/30/2011	3 PM – 4PM

2.2.5 Educational Tours

The park entertains about 25,000 educational tour visitors per year that include students, teachers and parents. Majority of these visitors come to the park on charter buses and school buses, some also use vans, sedans and walk in from the town's middle school. Educational tour buses arrival and departure is organized by the visitor services. When the buses arrive first they go to the Visitor center and then they will be led to Lower Town bus stop. At present, the visitor service assigns two rangers, one at Lower Town and one at Visitor Center, to organize the arrival and departure of buses to drop-off students at the Lower Town bus stop. For the pickup, they are, currently, trying to create coordination between the teachers and the bus drivers by making the teachers call the drivers when the students are ready to depart from Lower Town. This coordination helped to reduce the dwelling time of the buses at Lower Town. Table 6 shows a two day tour data sample to illustrate how the educational tour is coordinated.

Table 6 Two Days Educational Tour Data

Date	Bus	Drop off				Pick up				
		Arrival	Departure	Dwell Time	Comment	Arrival	Departure	Dwell Time	Total Students	Comment
9/19/2011	1	9:30	9:36	0:06	Four buses arrived in less than 30 seconds	3:24	3:37	0:13	248	Four buses departed in less than 30 seconds
	2	9:30	9:39	0:09		3:24	3:37	0:13		
	3	9:30	9:39	0:09	Within the first 2 min all the students got off the buses	3:24	3:37	0:13		Started loading after 5 min
	4	9:30	9:41	0:11		3:24	3:37	0:13		
	5	9:47	9:49	0:02		Unknown				
9/26/2011	1	9:44	9:48	0:04		3:31	3:45	0:14	248	Started loading after 4 min
	2	9:44	9:50	0:06		3:31	3:45	0:14		
	3	9:44	9:51	0:07	Four buses arrived in less than 30 seconds	3:31	3:45	0:14		Four buses departed in less than 30 seconds
	4	9:44	9:51	0:07		3:31	3:45	0:14		

During these two days, nine buses were served at LT and the maximum dwell time during drop off was 11 minutes and the maximum dwell time during pick up was 14 minutes.

The LT bus stop holds four educational tour buses without any problem. However, there are some days when there will be more than four buses scheduled to arrive and depart at the same time. According to visitor services, the reservations for educational tours are done through the park website, on the phone, or by filling forms and sending through mail or fax. They do not make any restrictions on the dates any group wants to visit the park. However, they offer different dates based on availability when a group asks for a ranger-guided curriculum program. Table 7 shows the percentage of days when different number of tour buses are present in the park. It shows that on 65.8% of the days, four or less educational tour buses were served in 2011. There were more than 13 educational tour buses on only two percent of the days. The numbers in the table show that as far as the buses do not spend long time at Lower Town there will be no problem during nearly 98% of the days. However, on the remaining two percent of the days it might be difficult to accommodate all the buses.

Table 7 FY 2011 Educational Tour Bus Service

No Educational Tour Buses/day	No of Days	Percentage of days when Educational Tour buses are present
1 to 4	100	65.8
5 to 8	42	27.6
9 to 12	7	4.6
13+	3	2.0

Source: Visitor Services

2.2.6 Operation and Maintenance Costs

Currently, the HAFE shuttle system operates year round and serves about 165,000 visitors. The system traveled about 64,690 miles and it operated 7,797 hours in FY 2010. Table 8 shows the cost per visitor, shuttle passenger, paying visitors and miles traveled for FY 2010 and 2011. For this cost estimate, a 2010 year actual costs were taken and projected for 2011 using inflation factors of 3% for general items, 2.68% for labor, and 6.25% for fuel. The cost estimate includes cost of drivers, automotive workers, off campus maintenance, fuel, insurance and consumables such as lubricant and tires.

Table 8 O&M Cost per Shuttle Passenger, Paying Visitor and Miles Traveled

FY	Cost	Cost per			
		Visitor	Shuttle Passenger	Paying Visitor	Mile Traveled
2010	306,587	1.16	1.86	1.93	4.74
2011	316,297	1.23	2.00	1.97	5.09

2.2.7 Parking, Shelter and Restrooms at Destination Points/Resource Sites

Parking, Shelters and Restrooms are essential elements of resource sites. These are available in different levels in the eight main destination points in the park. Table 9 shows the availability of parking, shelters and restrooms at each location. Parking spaces are available, although in limited numbers, at all destination points except Camp Hill. The number of parking spaces in Lower

Town is very limited in comparison with the number of visitors the area gets every day. In addition, the larger areas like the Train Station parking and River Access parking are reserved for other purposes. Train Station parking space is used by commuters during weekdays and park visitors on weekends. The River Access Parking is mostly used by local fishermen and for people boating on Shenandoah River. The Potomac Street Road Side Parking is a two hour limit parking and is also used by the employees of the concessioners in Lower Town.

Restrooms are available at LT, VC, SHRN and SHRS but shelters are available only at LT and the VC.

Table 9 Availability of Parking, Shelter, Restrooms and Turnaround

Resource Site	Parking Spaces	Surface Type	Shelter	Restrooms	Turn-around
Visitor Center	500+	Asphalt	Yes	Yes	Yes
Lower Town	Potomac St. Road Side Parking (2 hr limit) = 20	Asphalt	Yes	Yes	Yes
	Train Station (Weekend) parking = 92				
	River Access Parking = 36				
	Washington St. Road Side Parking = 4				
	Shenandoah St roadside parking (15 min limit) = 3				
Bolivar Heights	7	Asphalt	No	No	Yes
Murphy Farm	10	Gravel	No	No	Yes
Camp Hill	None	N/A	No	No	No
Nash Farm	3	Gravel	N/A	No	N/A
SHRN	7	Gravel	No	Yes	Partial
SHRS	7	Gravel	No	Yes	Partial

2.3 Overview of Current Alternative Transportation Systems

This section provides details on the existing conditions of the three ATS systems under consideration: transit, trails and bike routes.

2.3.1 Transit System

The HAFE transit system is a mandatory system that started functioning in June 1990, due to lack of parking in Lower Town, using six 40 foot buses and contracted drivers from the Eastern Panhandle Transit Authority (PanTran) (4). The system used two roads, Shoreline Drive and Shenandoah Street, stretching from the visitor service at Cavalier Heights to Lower Town.

At present, the transit service uses Washington Street, and Whitman Avenue in addition to Shoreline Drive and Shenandoah Street. Among these Shenandoah Street and Shoreline Drive

are owned by the park and 100% dedicated for park use. The lane on Shoreline Drive leading to Lower Town is dedicated for the buses up to the intersection with Shenandoah Street. However, the lane going back to the visitor center and the two directional lanes on Shenandoah Street are shared with other automobiles.

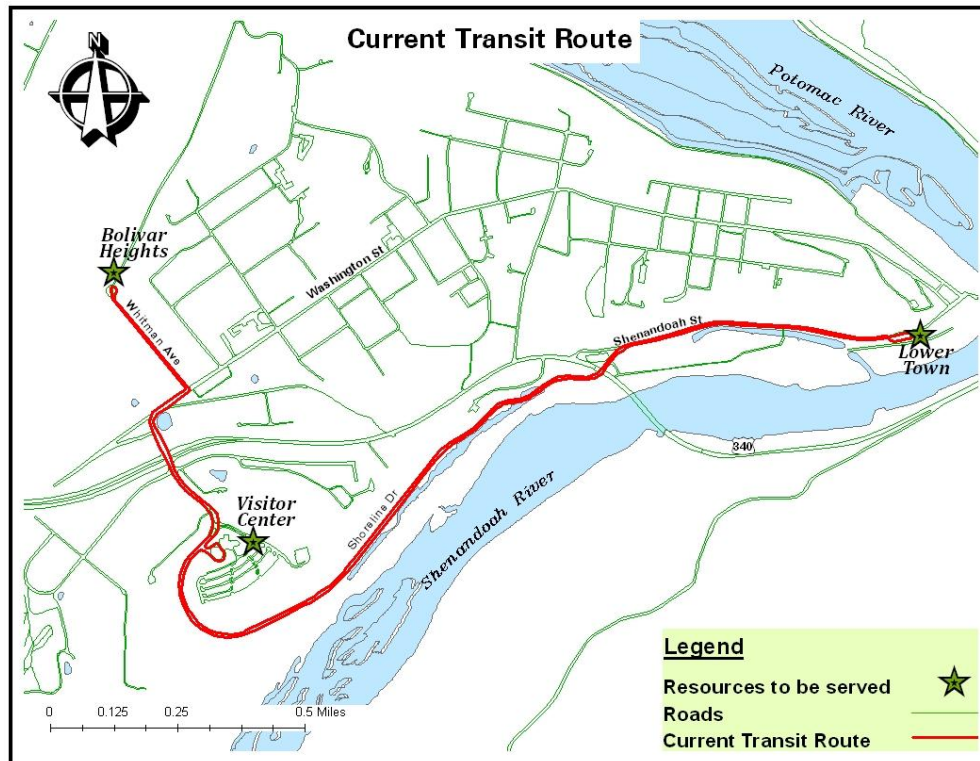


Figure 2 Current Transit Route

The current transit service serves three different times of the year. The first period is November 1st to June 11th with a route starting from the visitor center and going down Shoreline Drive and Shenandoah Street to get to the Lower Town bus turnaround and go back to the visitor center the same way. The second period is June 12th to September 30th which adds Bolivar Heights to the first route between 10:00am and 3:00pm. The third period is October 1st to 31st with the Bolivar Heights route added only on weekends.

The transit service is operated throughout the year with a change in the service span during peak and low visitation seasons. During summer (June 6 to October 31) the service span stretches from 8am to 6:45pm however, for the remainder of the year it operates 8am to 6pm.

2.3.2 Buses, Drivers and Automotive Worker Contract

The park currently has six 37 passenger buses, two 12 passenger buses and one 22 passenger bus. The remaining service life of the buses is 6 years for the 37 passenger buses, 2 and 5 years for the two 12 passenger buses. The park is currently planning to replace the 22 passenger bus since it has passed its minimum service life. All buses are B20 biodiesel buses.

Table 10 Bus Information

Bus Make	Capacity	No	Fuel Type	Fuel (MPG)	Purchase Year	Current Mileage	Minimum Life	
							Years	Miles
Gillig	37	6	Biodiesel (B20)	4.8	2006	62000-76000	12	200,000
Ford	12	1	Biodiesel (B20)	9.2	2002	29000	12	100,000
Ford	12	1	Biodiesel (B20)	9.2	2005	22000	12	100,000
Chevrolet	22	1	Biodiesel (B20)	8.5	1997	94000	12	100,000

Note: The 22 passenger bus is not included in further analysis since the park is considering replacing it.

To operate these buses, the park has a service contract in place with PanTran. The park provides the schedules and PanTran supplies the drivers. PanTran also provides mechanics who maintain the buses at the maintenance facility in the park. The cost of the drivers and mechanics is presented in the operational cost section.

2.3.3 Ridership and Visitation

The bus drivers conduct ridership counts every time they drive the shuttles. The driver counting sheet includes important information such as number of hourly riders, weather condition, bus number, starting time, beginning and ending miles. The ridership counts and the miles are used for this study. In FY 2011, a total ridership of 316,068 has been recorded which implies that close to 158,034 visitors rode the shuttle assuming one trip per visitor going and coming back from a resource site. Figure 3 shows a direct relationship between visitation and ridership. It also shows that even if the transit system is a mandatory it only served 60 to 70 percent of the total number of visitors. It also shows that in the past four years the ridership trend is almost constant but the passenger per visitor rate is less than the previous years.

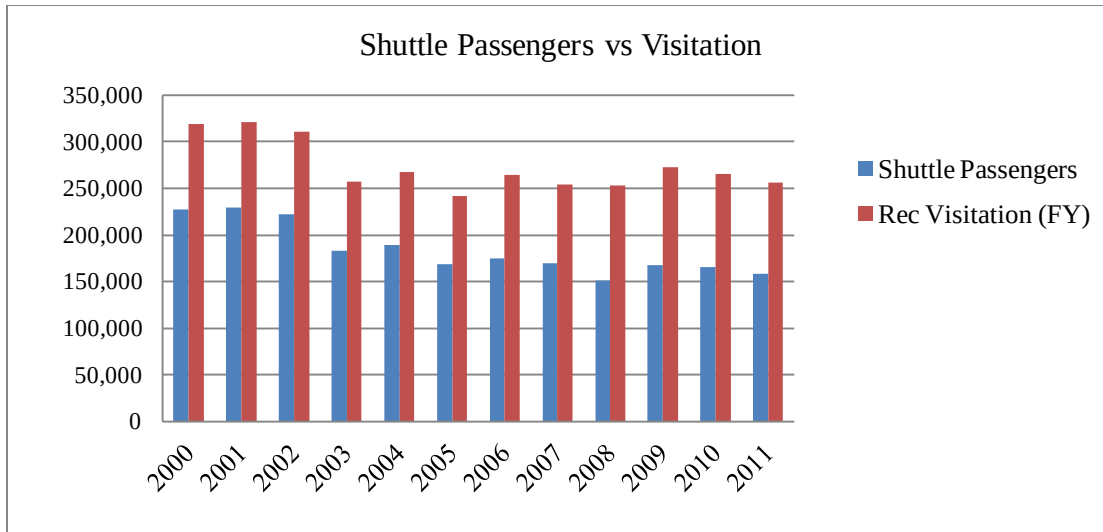


Figure 3 Shuttle Passenger vs Visitation

In FY 2011, the park transit system has seen a total of 316,068 ridership which is about 123 trips per hundred visitors. Looking at the monthly ridership and visitation pattern (Figure 4), July and October are the highest visitation and ridership months and December through February are the lowest. In the six month period starting from May through October, the monthly ridership is close to 30,000 and more.

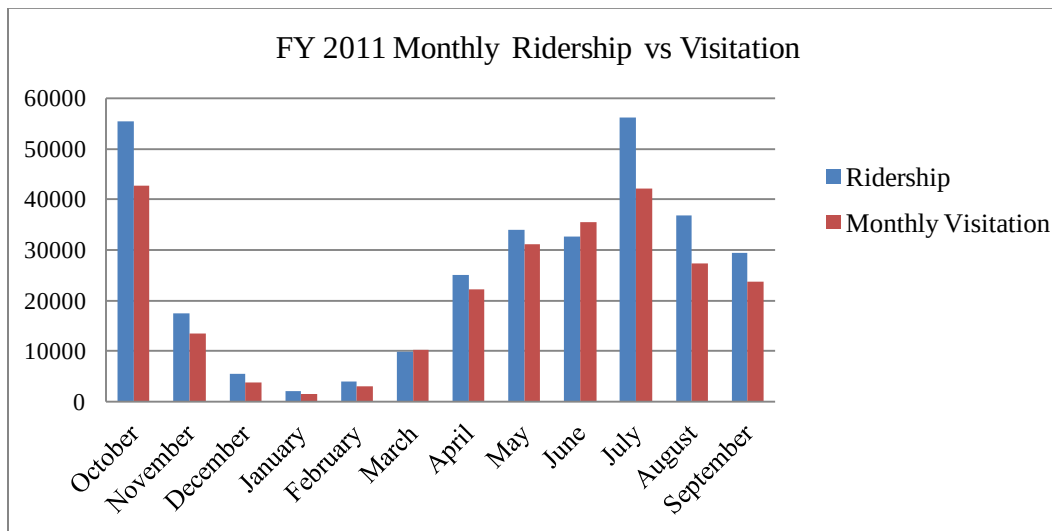


Figure 4 Monthly Ridership vs Visitation

Looking at daily ridership trends (Figure 5) for a typical week, weekends are the highest visitation days with more than 70 percent of the total weekly visitation. Saturday is the highest visitation day in a week.

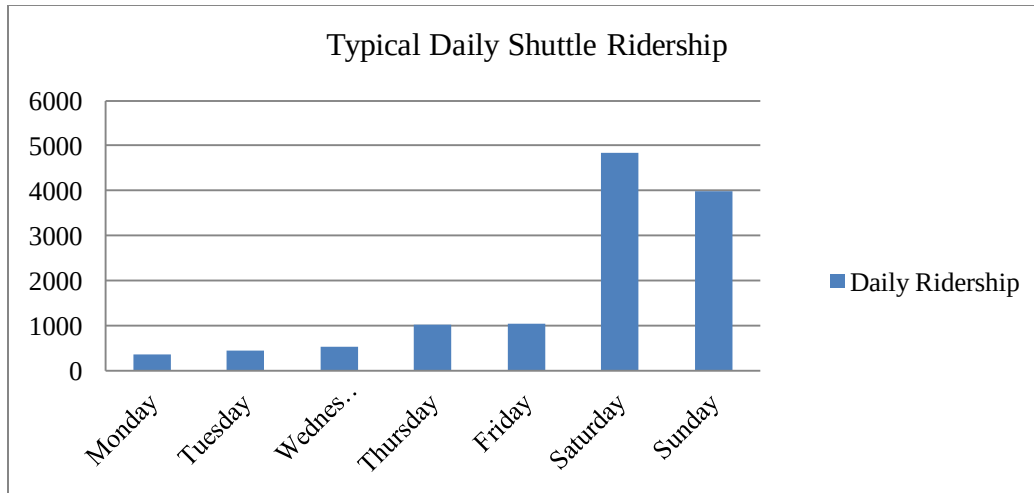


Figure 5 Typical Daily Shuttle Ridership

2.3.4 Guided Tours

The park conducts various guided tours starting from June 15 until August 31. The two major tours that use the shuttle system are “Civil War to Civil Rights” and “Harpers Ferry: From the Top Down”. Both guided tours use twelve passenger buses. The former is conducted twice a week taking visitors to Murphy Farm and the latter is conducted three times a week taking visitors from the visitor center to Bolivar Heights then to Camp Hill.

Table 11 Guided Tours

Date	Name	Location	Number of People	Number of Programs	Description
June 15 – August 31	Civil War to Civil rights	VC to MF	379	16	using 12pax and a 2mile guided hiking two days a week (Mon & Sat)
June 15 – August 31	Harpers Ferry : From The Top Down	VC to CH	417	28	Using 12pax and some people meeting them at Camp Hill, 3 days a week (Sun, Wed, & Fri)

As can be seen on Table 11, both tours have good number of visitors, which may indicate that there is a demand to go to these resource sites. It might also indicate the need for staffing resource sites since it gives the ability for people to hear some stories from the rangers and ask questions. Another example for this might be the number of visitors Bolivar Heights had during a two month test period in 2010. From June 14 to August 15, Bolivar Heights was staffed with rangers and the site had 8073 visitors which is more than what it is getting now.

2.3.5 Park Entrance Fee

The park collects an entrance fee of \$6 per vehicle and \$4.00 per individual (walk-ins/bicycle/non-commercial groups), Commercial Tour Groups (\$150-bus, \$60-minibus, \$50-van, \$25 + \$4.00 per sedan); Passes: IA Annual - \$80.00, IA Senior - \$10.00, Harpers Ferry NHP - \$25.00. Currently the park does not collect transportation fee.

2.3.6 Signage and Shuttle Service Info

HAFE uses different signs to guide visitors to the park and to the visitor center. These signs are found on Hwy 340, Washington Street and Shenandoah Street. The signs on Washington St indicate the direction to the visitor center parking (Figure 6). The sign on Highway 340 shows the park entrance however, it does not mention about the shuttle service and parking.



Figure 6 Washington St Sign

Information for the shuttle service is provided on the park website. It is located under the Plan our visit tab → Things to know before you come → Getting Around. The information included in the website includes a picture and the following explanation "A shuttle transportation system with handicapped accessible buses connect the Park Visitor Center with the Lower Town District." The information on the website does not state the waiting time, working hours and parking information and it looks hidden for a park with a mandatory shuttle system.

2.3.7 Biking

In previous years, bikers in HAFE were not seen frequently. The main reason for this might be the topography of the area. However, changes are being seen due to improvements in bike technology and the emphasis given to biking due to environmental considerations and promoting a healthy lifestyle.

In recent years there has been an increase in the number of bikes seen in the park. To facilitate the bikers need the park shuttles are equipped with bike racks. HAFE is mostly used as an access point to other biking destinations such as C & O Canal. It was also found out that HAFE is used as a starting and end point on different routes identified and posted on the web by people who rode them. Examples of some of these routes are Harpers Ferry to Antietam, Harpers Ferry to Purcellville, and Boonsboro to Harpers Ferry (6). Other than the people who pass through HAFE riding their bikes, HAFE has also been part of a biking tour such as the 2011 Tour Des Trees in which the riders came down Washington Street entering HAFE and rode on Shenandoah Street, Shoreline Drive and back to HWY 340.

There are four bike rental places near Harpers Ferry National Historical Park: The Outfitters, River and Trail Outfitters, River Riders, and KOA Campground. All these bike rental places use Harpers Ferry as a starting and end point for riding bikes on C & O Canal. This information can be found from the NPS Harpers Ferry National Historical Park Website. The website states that riding a bike on Shoreline Drive, downhill from visitor center is not allowed.

2.3.8 Trails

HAFE has more than 20 miles of hiking trails that connect major resources in the park. Most of the resource sites are connected with trail with one another. However, some places such as Schoolhouse Ridge South, and Nash Farm do not have any connection with the other sites. The GMP indicates the need for creating a trail connecting all the park resources. Figure 5 shows that SHRS is isolated from all resource sites. Schoolhouse Ridge North can be accessed from Bolivar Heights however Bolivar Heights has no connection with other resource site.



Figure 7 HAFE Existing Trails

2.4. Expansion of Alternative Transportation Systems

As mentioned in previous sections, the study revolves around three alternative transportation systems: transit system, trails and bike routes. This chapter discusses in detail the different alternatives to expand the current transit system and alternatives to connect main resource sites via trails and bike routes. The turnaround alternative for Camp Hill area is presented in this section. This section also discusses the analysis used to narrow down the number of potential alternatives.

2.4.1 Transit System

The alternative transportation study has identified sixteen potential shuttle routes with different bus size and operational characteristics. To come up with the list of alternatives, in-depth discussions were conducted within the transportation committee and the interpretation division in the park. The interpretation division staff suggested directions of the routes based on the story of each resource site and examined the historic significance of the Camp Turnaround alternative locations.

The bus sizes used for examining the expansion options are the 12 and 37 passenger buses from the current fleet. The operational characteristics included three types: loop, hub & spoke, and combination.

2.4.1.1 Fatal Flaw Analysis

The fatal flaw analysis is the methodology used to refine the potential list of alternatives prior to presenting them to the stakeholders and making further analysis. This analysis helped to eliminate alternatives that do not fulfill basic requirements. The potential alternatives subjected to this analysis include routes that start from Visitor Center (VC) and go to Lower Town (LT), Camp Hill (CH), Bolivar Heights (BH), Murphy Farm (MF), Nash Farm (NF), Schoolhouse Ridge North (SHRN) and Schoolhouse Ridge South (SHRS).

To evaluate these routes five criteria were used. These are:

1. General Management Plan (GMP) recommendation
2. Road condition (width, safety)
3. Development of Interpretation
4. Does not require major infrastructure work
5. Accommodates large buses to LT

As can be seen from Table 12, based on the five criteria, the analysis was performed and five alternative routes that did not meet one of the criteria were eliminated.

The first eliminated route was from the hub & spoke system, VC-NF-VC. This route failed three requirements: GMP does not recommend Nash Farm as a regular visitation area, Old Furnace

Road and Prospect Avenue are both very narrow and have limited sight distances at some locations along the route, and interpretation is not developed at the site.

The second route eliminated was from the loop system, VC-MF-SHRS-SHRN-BH-CH-LT-VC. This route was eliminated because it requires using small buses. The route includes Murphy Farm, which has a gravel road that causes problem for large buses.

The third route eliminated was from the loop system, VC-MF-SHRN-SHRS-BH-NF-CH-LT-VC. This route failed the same three requirements as the first eliminated route and inability to accommodate large buses to Lower Town.

The fourth route eliminated was from the loop system, VC-MF-BH-CH-LT-VC. This route was eliminated for the same reason as the second eliminated route.

The fifth route eliminated was from the loop system, VC-MF-SHRS-SHRN-LT-CH-BH-VC. This route uses Potomac Extended to get to Lower Town from SHRN. This route does not meet three of the requirements: first it requires major construction work to make Potomac Extended functional for vehicle use and second the viaduct connecting Bakerton Rd with Potomac Extended is very narrow. This viaduct can accommodate only one car at a time with limited sight distance, which makes it unsafe for passengers. The third reason is that it requires using small buses to Lower Town.

Based on this analysis four hub & spoke routes, one loop, and five combination routes passed the fatal flaw analysis. However, even if four hub & spoke routes passed the fatal flaw analysis, as a system they were eliminated from further consideration because of the following reasons: they require high operational cost, they increase miles traveled, they take longer time to get to different destinations, and plus each hub & spoke route will be part of the combination system. Therefore, one loop and five combination routes are retained for further consideration.

Table 12 Fatal Flaw Analysis

Alternative Routes	Basic Requirements					Result
	GMP Recommended Site	Road condition (width, safety)	Development of Interpretation	Doesn't Require Major Infrastructure Work	Accommodates Large Buses to LT	
Hub & Spoke System						
1. VC-CH-VC	Yes	Yes	Yes	Yes	N/A	Pass
2. VC-BH-VC	Yes	Yes	Yes	Yes	N/A	Pass
3. VC-LT-VC	Yes	Yes	Yes	Yes	N/A	Pass
4. VC-MF-VC	Yes	Yes	Yes	Yes	N/A	Pass
5. VC-SHRN-SHRS-VC	Yes	Yes	Yes	Yes	N/A	Pass
6. VC-NF-VC	No	No	No	Yes	N/A	Fail
Loop System						
1. VC-BH-CH-LT-VC	Yes	Yes	Yes	Yes	Yes	Pass
2. VC-MF-SHRN-SHRS-BH-CH-LT-VC	Yes	Yes	Yes	Yes	No	Fail
3. VC-MF-SHRN-SHRS-BH-NF-CH-LT-VC	No	No	No	Yes	No	Fail
4. VC-MF-BH-CH-LT-VC	Yes	Yes	Yes	Yes	No	Fail
5. VC-MF-SHRS-SHRN-LT-CH-BH-VC	Yes	No	Yes	No	No	Fail
Combination						
1. VC-BH-CH-VC + VC-LT-VC	Yes	Yes	Yes	Yes	Yes	Pass
2. VC-BH-CH-LT-VC + VC-LT-VC	Yes	Yes	Yes	Yes	Yes	Pass
3. VC-BH-CH-VC + VC-LT-VC + VC-BH-SHRN-SHRS-MF-VC	Yes	Yes	Yes	Yes	Yes	Pass
4. VC-BH-CH-LT-VC + VC-LT-VC + VC-BH-SHRN-SHRS-MF-VC	Yes	Yes	Yes	Yes	Yes	Pass
5. VC-MF-BH-CH-LT-VC + VC-LT-VC	Yes	Yes	Yes	Yes	Yes	Pass

Note: Loop 1 requires changing High Street into a One Way Street

2.4.2 Shuttle Route Alternatives

Six alternatives survived the initial review of alternatives, five combination systems and one loop system. The combination system is defined as a system that includes routes that travel between one destination and the visitor center plus routes that serve two or three destinations before coming back to the visitor center. The loop system goes to two or more resource sites before coming back to the visitor center. The alternatives considered start with one that serves as a basic building block and new destinations and routes are added for each of the other alternatives. All routes use the Visitor Center (VC) at Cavalier Height as a starting point.

Note: For consistency, in all alternatives serving Camp Hill, the Hartzog turnaround alternative (Alt. 1) in Camp Hill is used.

2.4.2.1 Alternative One

This alternative has two routes, which are shown in red and blue in Figure 8. The red route starts from the Visitor Center and goes to Bolivar Heights and Camp Hill and goes back to Visitor Center with a round trip distance of 3.9 miles. The blue route is the current route that goes to Lower Town and comes back to Visitor Center with a round trip distance of 3.7 miles. The total round trip travel time for the red route is 19 minutes. The bus reaches at Bolivar Heights in the first 4 minutes and arrives in Camp Hill in the next 5 later. A one minute dwell time is used for each destination. The dwell time is calculated using an average of 22 passengers per bus during a maximum visitation month (Appendix C). For the blue route it takes about 8 minutes to get to Lower Town with a total round trip travel time of 13 minutes. For this alternative, both the 12 passenger and 37 passenger buses can be used.

The main issue identified with this alternative is that people may not want to go on the red route because most of the visitors come to HAFE to visit Lower Town. This also raises the issue of improving, promoting and staffing of the newly served sites. Currently there is a trail leading from Lockwood House in Camp Hill to Lower Town that visitors can use to hike down to Lower Town without going back to the visitor center to ride on the blue route. Another trail connecting the Camp Hill area to the Appalachian Trail (AT), which leads to Lower Town is also considered in this study.

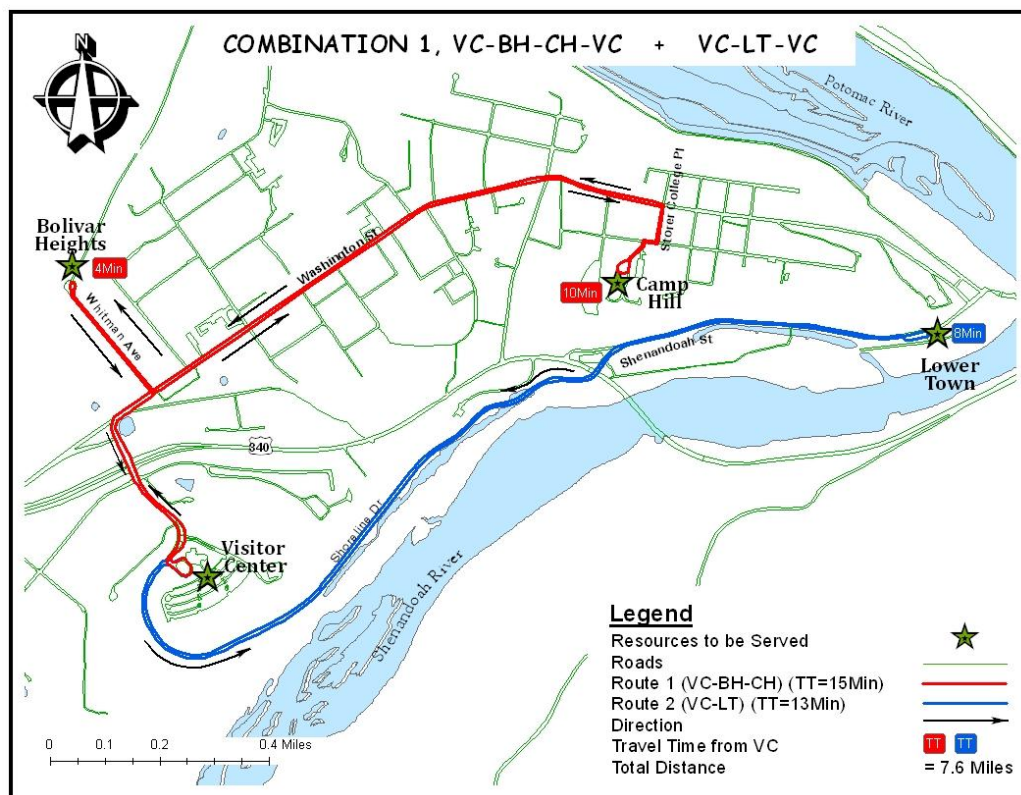


Figure 8 Alternative Route One

2.4.2.2 Alternative Two

This alternative also has two routes, however the red route will make a complete loop that starts at the Visitor Center, and then goes to Bolivar Heights, Camp Hill, Lower Town and back to Visitor Center with a total travel time of 24 minutes. This alternative has two advantages: It will encourage people to use the red route since they do not have to come back to the Visitor Center to go to Lower Town, and the red route will support the blue route by taking and bringing back visitors from Lower Town thus reducing the total number of bus trips per day. Figure 9 shows the path the red route would use in Lower Town. The bus would turn left on Hog Alley at Lower Town; avoiding the narrow High St-Shenandoah St intersection where there are many visitors crossing High St and many vehicles making left and right turns from Shenandoah St.

This alternative requires limiting deliveries on High Street to before 10:00am or after 5:00pm or based on the service span of the red route. For the red route in this alternative only 12 passenger buses can be used due to the narrow road width on High St.

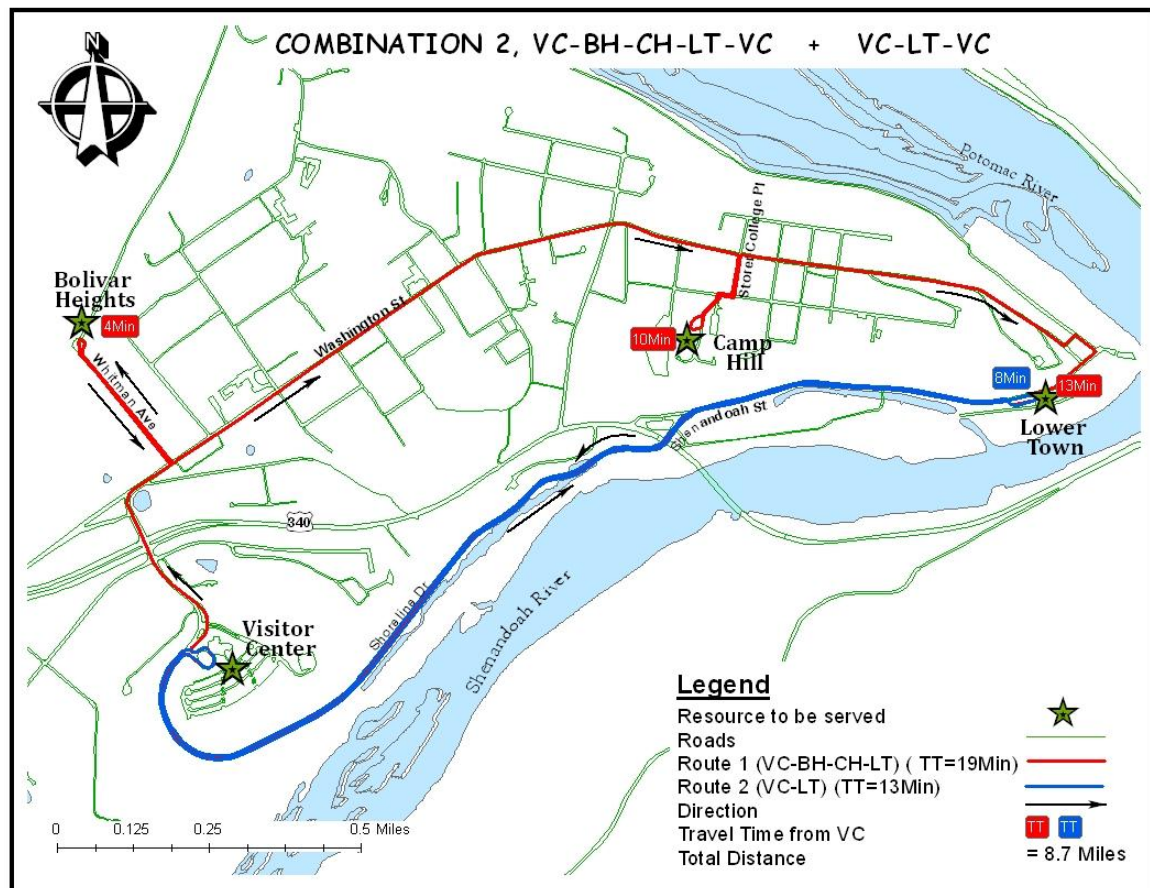


Figure 9 Alternative Route Two

2.4.2.3 Alternative Three

Alternative Three adds an additional route to alternatives one and two. This new route is the route shown with a golden color on Figure 10. The route goes to Bolivar Heights, School House Ridge North, School House Ridge South, and Murphy Farm, and then back to the Visitor Center with a total travel time of 32 minutes and a distance of 10.2 miles. For the golden route in this alternative, only 12 passenger buses can be used because of Murphy Road being a narrow gravel paved road that might not be suitable for the existing fleet of 37 passenger buses.

As can be seen on Figure 10, the buses in the golden route travel on HWY 340 and Bakerton Road and Millville Road to get to SHRN and SHRS. For safety reasons buses are required to make a right turn from Bakerton Road to Hwy 340 and Hwy 340/13 and use the next traffic light to go from SHRN to SHRS. This will add 1.8 miles of extra distance on the golden route.

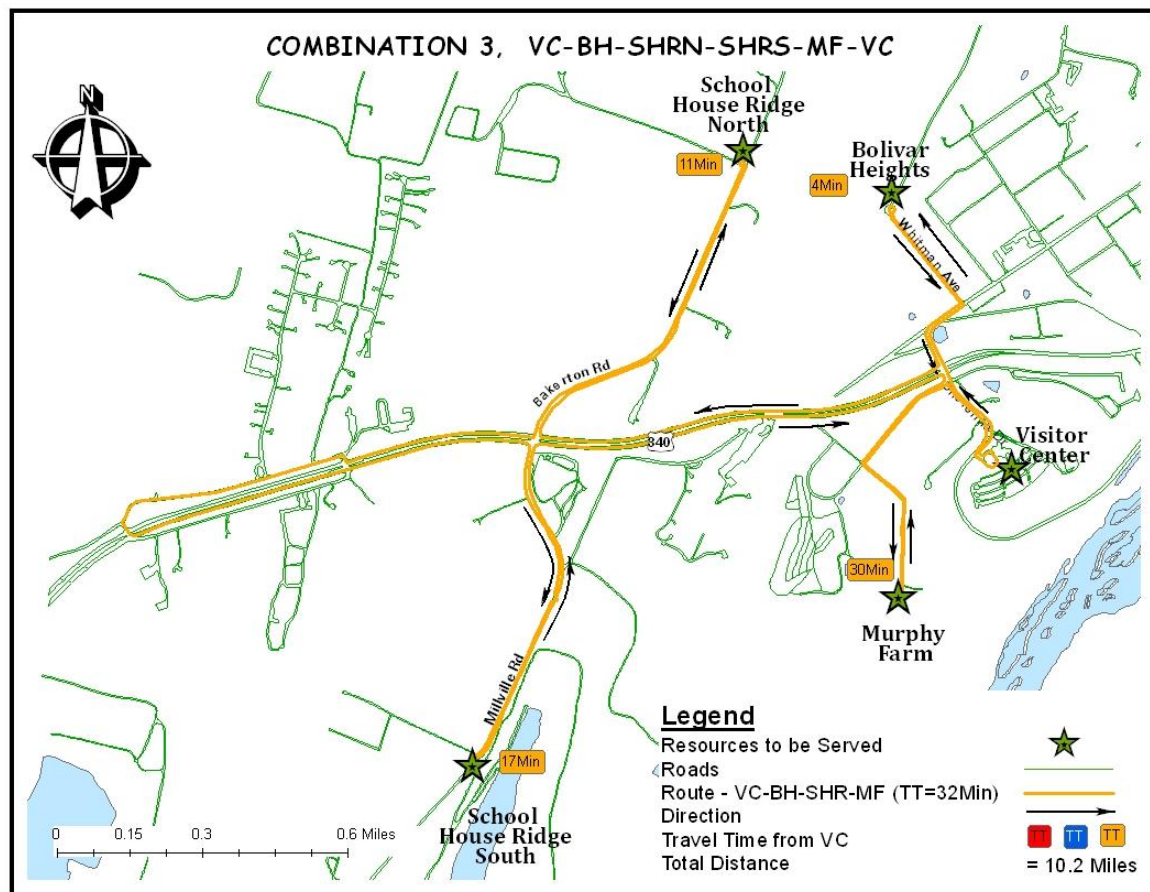


Figure 10 Alternative Route Three

2.4.2.4 Alternative Four

Alternative four, shown in Figure 11, is the same as alternative three except that the golden route does not include Murphy Farm. This makes the route eligible for using 37 passenger buses. It takes 27 minutes to complete this route.

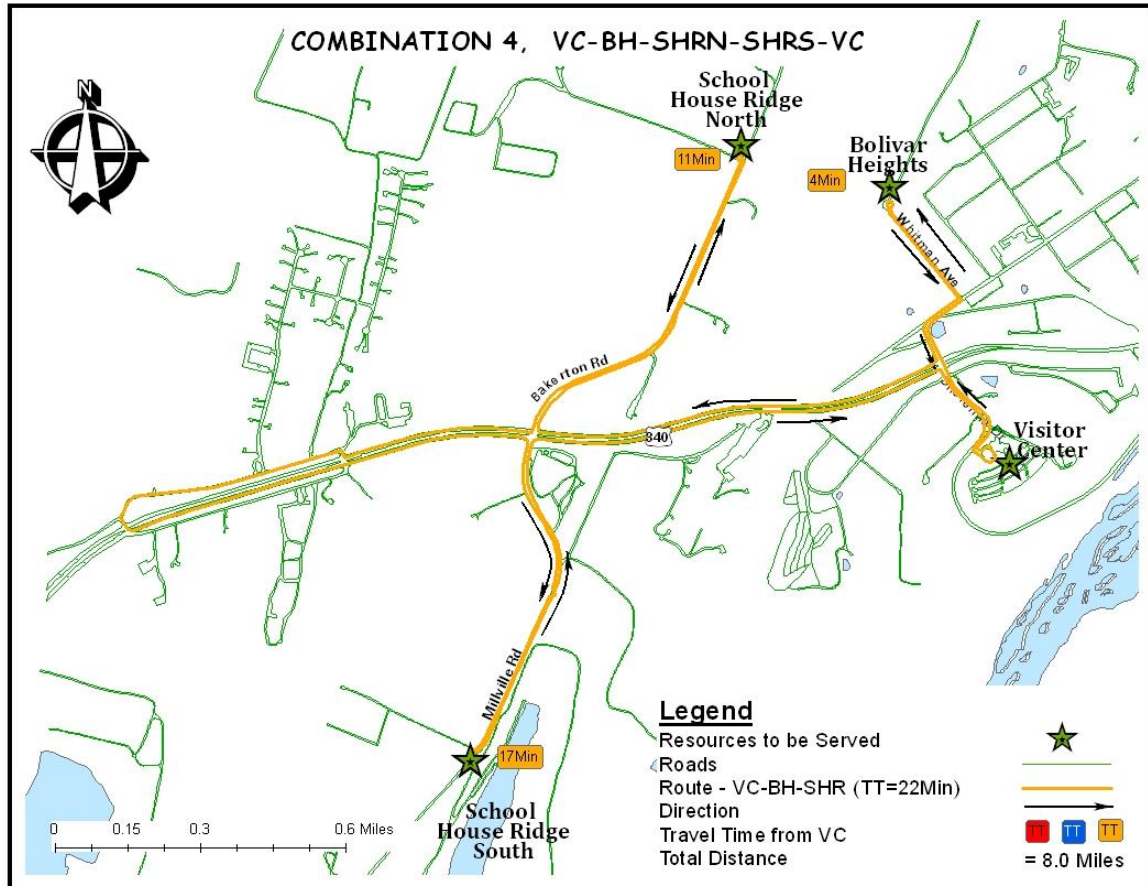


Figure 11 Alternative Route Four

2.4.2.5 Alternative Five

Alternative five is shown in Figure 12. The red route in this alternative gets to four resource sites (Murphy Farm, Bolivar Heights, Camp Hill and Lower Town) before coming back to the Visitor Center. The round trip for both red and blue routes for this alternative is 9.8 miles. The red route can only use 12 passenger buses from the current fleet for the same reason as the golden route in alternative three.

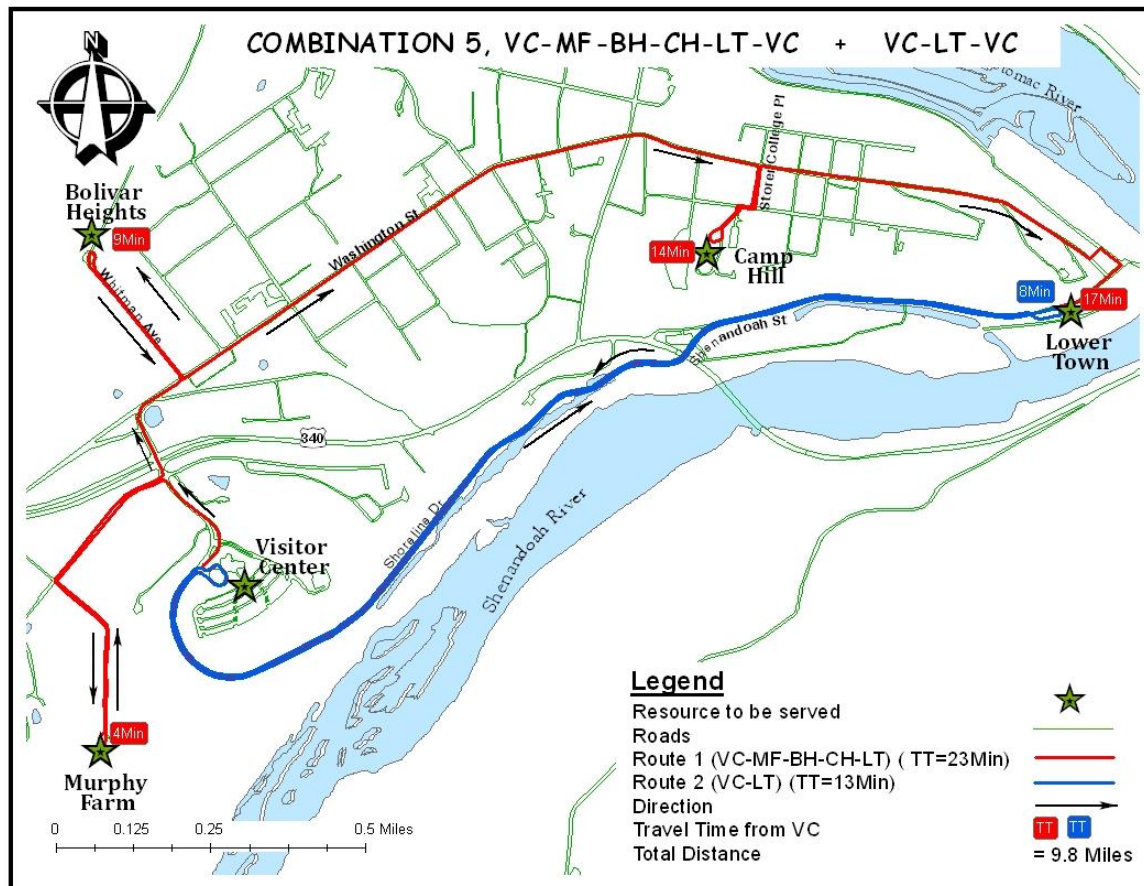


Figure 12 Alternative Route Five

2.4.2.6 Alternative Six

Alternative six is shown in Figure 13. This alternative includes a Loop system that starts from the Visitor Center and goes to three destinations: Bolivar Heights, Camp Hill, and Lower Town before coming back to the Visitor Center. For this alternative only 37 passenger buses can be used because it would be difficult to accommodate close to 160,000 riders per year with 12 passenger buses. This alternative requires changing High Street into one-way starting from the intersection with Church Street. In addition, it requires limiting truck deliveries using these roads to early morning hours or evenings, because High Street is a very narrow and cannot accommodate two large vehicles at the same location.

As can be seen from Figure 13, the full route takes 24 minutes including a driving time of about 20 minutes and a dwell time of 1 minute at each of the three destinations.

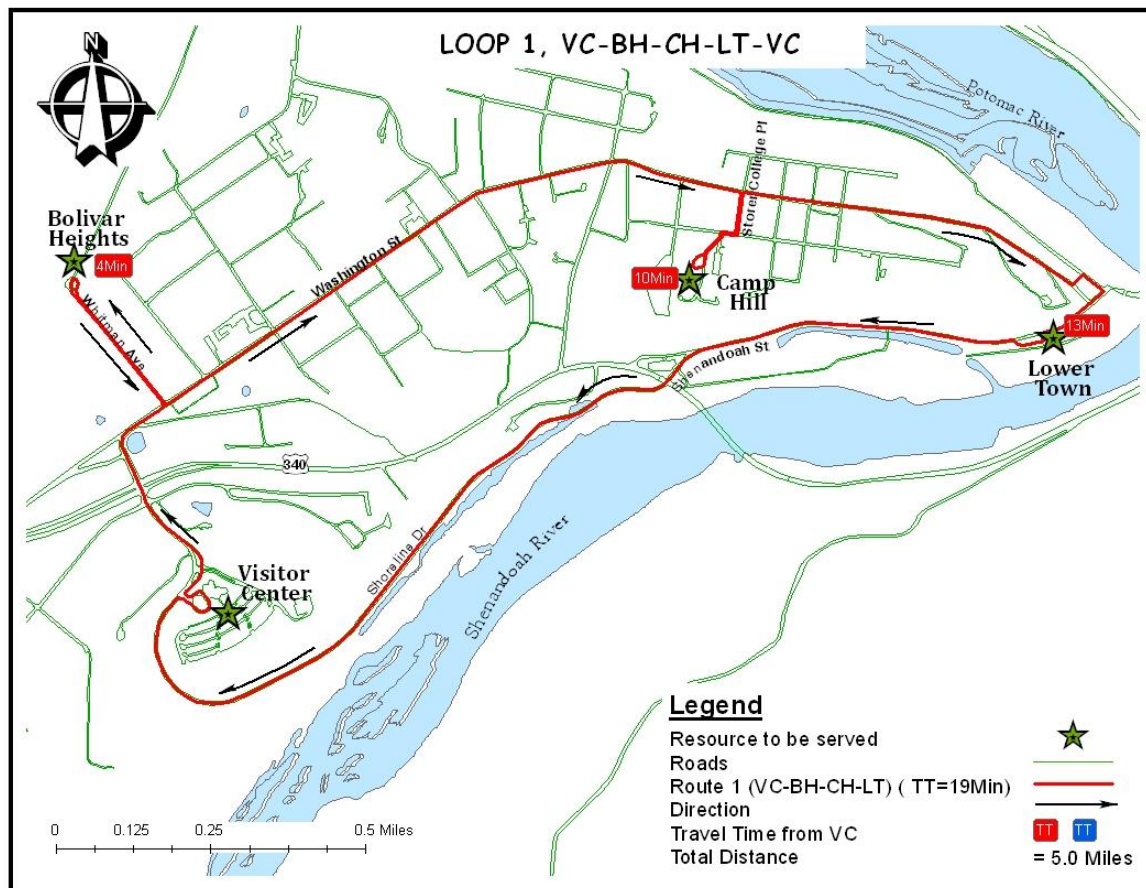


Figure 13 Alternative Route Six-change the turn on Hog Alley

2.4.3 Operation and Maintenance (O&M) Cost Estimate

To estimate the O&M costs, different assumptions were made based on the current system. First, the visitation months were divided into four groups based on the monthly ridership data from the NPS Stats website. Table 13 shows the average of the FY 10 & 11 monthly ridership. As can be seen in table 13 the highest ridership occurs between May and October. Due to this, it was assumed that the expanded system will work for six months (May-October).

Table 13 FY 2010 and 2011 Monthly Ridership

Year	Monthly Ridership											
	May	Jun	Jul	Aug	Sep	Oct	Dec	Jan	Feb	Mar	Apr	Nov
2011	34096	40224	56182	36796	30438	55494	5152	2134	4198	9896	24048	17410
2010	39854	37054	52910	38656	38710	47684	4388	3076	1536	18170	27556	20842
Average	36975	38639	54546	37726	34574	51589	4770	2605	2867	14033	25802	19126

Source: NPS Stats website

The number of buses needed to serve the desired headway and estimated passenger loads were calculated. The driving times were measured for each route and dwell times were added to find the time required to complete one full trip. This time was divided by the desired headway to determine bus requirements. Demand based headway was also calculated for the 95th percentile hourly demand. For this analysis it was assumed that there will be a 20% ridership increase with a better signage and advertisements and 75% of the riders are traveling in the peak direction during the peak hour. This number was divided by the capacity of buses assuming that 10% of the passengers would stand to determine the buses needed per hour and resulting headways.

The number of buses required for each route was calculated using desired headways and 95th percentile hourly demand for weekday and weekends under each group. Then the higher of the two values was used to estimate the number of driver hours required to provide the service. Vehicle Miles Traveled were calculated using trips per hour, miles per trip, and hours of operation for each day.

To estimate the costs, costs per mile and per hour of the existing system were calculated and inflated by 6.25% for fuel, by 2.68% for labor and by 3% for all other items. Then, these costs were multiplied by the VMT and hours of operation for each alternative.

Table 14 and 15 show the O&M cost estimated using the above mentioned procedures. The two tables show the O&M cost when 12 and 37 passenger buses are used for the new routes. Some exceptions are: 37 passenger buses are used for alternative six since it is required to use large buses for Lower Town (because of high ridership); only 12 passenger buses are used for the new routes for alternatives two, three, and five (due to roadway limitations).

Alternative seven shown in Table 14 and 15 is the current system which is the blue route only and its cost estimate are calculated with similar assumptions as the other alternatives. When this cost is compared to the actual cost of the system it is different by about \$50,000. The difference

in cost might be a result of the addition of the Bolivar Heights route for six months and assumption of 20% ridership increase.

Table 14 O&M Costs Using 12 Passenger Buses for New Routes

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Current Condition	\$306,600	\$316,300	\$326,600	\$337,300	\$348,400
Comb 1 (Alt 1)	-	-	\$678,000	\$701,400	\$725,700
Comb 2 (Alt 2)	-	-	\$678,300	\$701,700	\$726,000
Comb 3 (Alt 3)	-	-	\$375,900	\$389,300	\$403,400
Comb 4 (Alt 4)	-	-	\$360,600	\$373,200	\$386,400
Comb 5 (Alt 5)	-	-	\$779,700	\$806,600	\$834,600
Loop 1 (Alt 6)	-	-	\$423,500	\$437,700	\$452,500
Current (Alt 7)	-	-	\$378,500	\$391,500	\$405,100

Table 15 &M Costs Using 37 Passenger Buses for New Routes

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Current Condition	\$306,600	\$316,300	\$326,600	\$337,300	\$348,400
Combination 1	-	-	\$479,100	\$495,170	\$511,800
Combination 2	-	-	\$678,300	\$701,700	\$726,000
Combination 3	-	-	\$375,900	\$389,300	\$403,400
Combination 4	-	-	\$207,500	\$214,100	\$220,900
Combination 5	-	-	\$779,700	\$806,600	\$834,600
Loop 1	-	-	\$423,500	\$437,700	\$452,500
Current (Alt 7)			\$378,500	\$391,500	\$405,100

The number of buses required for each alternative is shown in Table 16. A large number of buses is required when 12 passenger buses are used for the new routes. For example, alternative one requires only seven 37 passenger buses, however if 12 passenger buses are used, it may require ten 12 passenger and four 37 passenger buses. This will have a significant impact on the operational cost since more drivers will be needed to work at a time. The cost estimate results in a difference of \$200,000 between these two options..

Table 16 Number of Buses Required

Alternatives	Red Route		Gold Route		Blue Route	Total Bus Needs				
	37 Pax	12 Pax	37 Pax	12 Pax	37 Pax	37 Pax		12 Pax		37 Pax
Current Condition	-	-	-	-	6	6	OR	-	+	-
Comb 1 (Alt 1)	3	10	-	-	4	7		10		4
Comb 2 (Alt 2)	-	12	-	-	2	-		12		2
Comb 3 (Alt 3)	-	-	-	8	-	-		8		-
Comb 4 (Alt 4)	-	-	2	8	-	2		8		-
Comb 5 (Alt 5)	-	15	-	-	2	-		15		2
Loop 1 (Alt 6)	6	-	-	-	-	6		-		-
Current (Alt 7)	-	-	-	-	5	5		-		-

2.4.4 Camp Hill Turnaround Alternatives

Among the resource sites under consideration for regular transit service, Camp Hill is the only location that does not have a turnaround. At present, the park uses the employee parking space on Fillmore Street to drop off shuttle tour passengers and turn around. The buses use a backing maneuver that is not recommended for buses on regular basis. Therefore, to facilitate the expansion of the transit system, the study identified different turnaround alternatives for the Camp Hill area and reduced them down to the following four alternatives. Each alternative has its own characteristics and demand in terms of the infrastructure requirements. All alternatives require some sort of facility to be built such as shelters, turnaround, walkway and landing pad although the level varies from one alternative to another.

2.4.4.1 Alternative One (Hartzog Road)

This alternative uses a green space available west of the Stephen Mather Training Center (MTC). In the Hartzog Road alternative, the buses will come on Storer College Pl then make right on Fillmore St then left on Hartzog Road then turn around and go back the same way. This alternative has many advantages among which is it will have lesser disturbance to the residents in the area since there are no people living on Storer College Pl, this section of Fillmore St or Hartzog Road. The bus will use Storer College Pl, which is wide enough for two-way traffic and has already gone through an upgrade to carry large loads. Nevertheless, eliminating the roadside employee parking might be necessary. The green space where the turnaround will be built is previously disturbed from a mission 66 facility that makes it easier to pass compliance requirements.

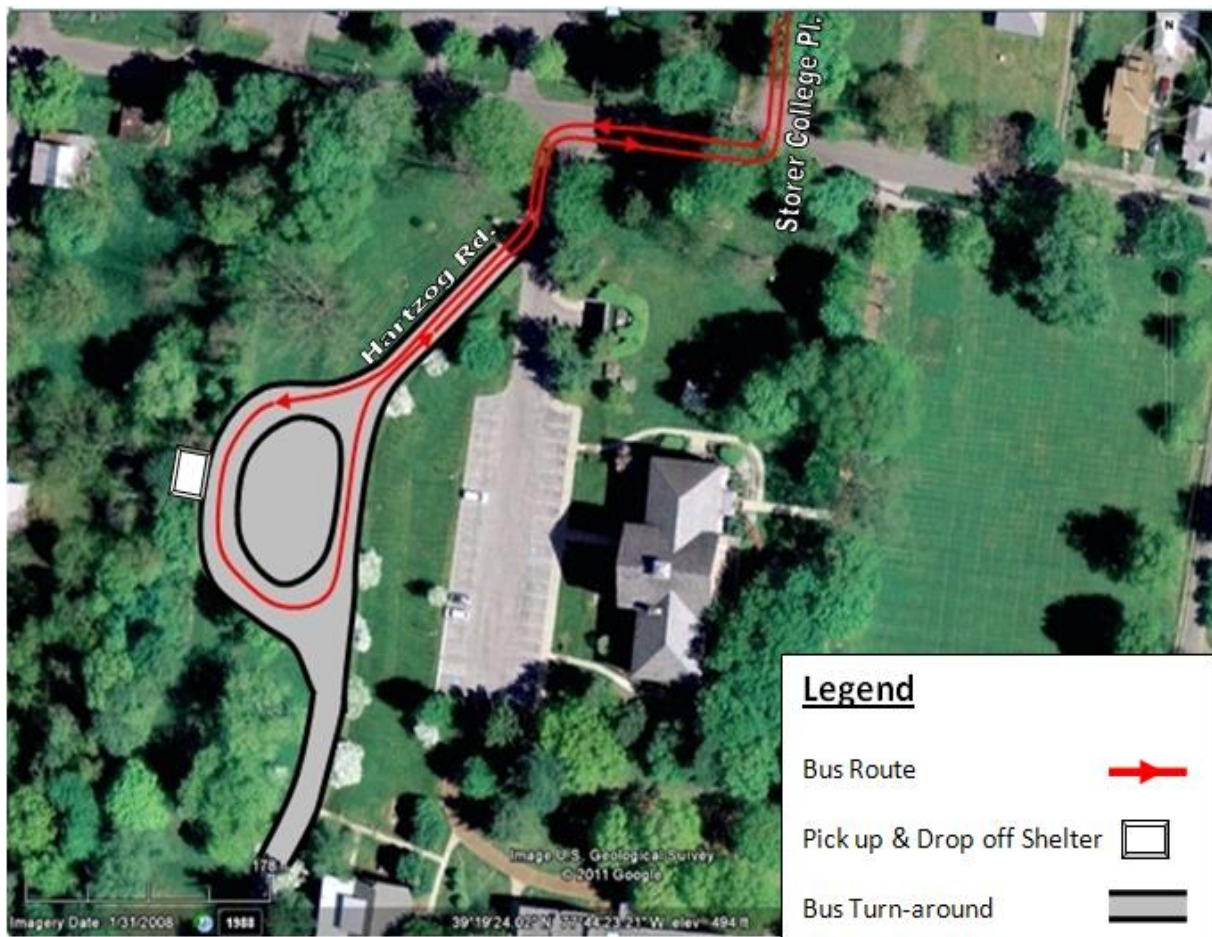


Figure 14 Alternative One (Hartzog Road Turnaround)

2.4.4.2 Alternative Two (Fillmore/McDowell Stop)

Alternative two uses the corner of Fillmore Street and McDowell as a drop off and pick up location. The buses will come on Storer College Pl and make a left on Fillmore Street then drop off/pick up visitors and make a left on Gilmore Street to go back to Washington Street. This will require changing Gilmore Street into one-way going out. This alternative may create relatively high disturbance to the residents since the bus passes by many houses in Camp Hill and the bus stop is in front of a residence. The main advantage of this stop is that it is closer to Lock Wood House than the other alternatives.



Figure 15 Alternative Two (Fillmore/McDowell Stop)

2.4.4.3 Alternative Three (Lincoln Ave Stop)

The third alternative is at the gate of Storer College. This alternative has entertained some conflicting ideas. Some say building a shelter at the gate may affect the sentimental value of this place while others say having the shelter and drop off/pick up point here might give the place more visibility and attractiveness. This alternative uses the same route as alternative two however the drop off/pick up point is not in front of peoples' houses.



Figure 16 Alternative Three (Lincoln Ave Stop)

2.4.4.4 Alternative Four (Upper Shipley Stop)

This stop is also another alternative that has less effect on the residents. The buses will come on Zacry Taylor Street and make a left on Fillmore Street drop off/pick up passengers at Upper Shipley Stop and go back to Washington Street on Storer College Pl. It requires changing Zacry Taylor Street into one-way coming to Fillmore Street. This change might affect traffic from the park maintenance facility and houses at the corner of Fillmore Street and Zacry Taylor Street.



Figure 17 Alternative Four (Upper Shipley Stop)

2.4.4.5 Cost Estimate of Turnarounds

The details of a class C costs estimate and needs for each alternative is presented in Table 17. As can be seen from the table, Hartzog turnaround is the most costly alternative compared to the others followed by alternative four. All alternatives need a walkway built to get to Lockwood House. However, people can also take the AT trail to get to Lockwood House. Alternatives two, three and four can use Lincoln Avenue or McDowell Street to connect with AT where as for

Hartzog stop a new connecting trail (South Cliff Street trail) is proposed. The detail for this trail is presented in the trail section.

Table 17 shows a cost with mark up that includes mobilization, survey, testing, erosion control, clearing and grubbing, traffic control and field offices. However, it should also be noted that the cost does not include 25% contingency, 15% for Overhead and Profit (OH&P), 2.5% for insurance, 18% for Design and Construction Management and 20% for project management, contracting and oversight.

Table 17 Camp Hill Turnaround Cost Estimates

Need	U/M	QTY	Unit Cost	Cost w/Mark up	Amount	Amount w/Mark up
Alternative 1 (Hartzog Road)						
Shelter	EA	1	\$8,150	\$11,106	\$8,150	\$11,105
Walk Way(Hartzog Stop to Existing Walkway to MTC)	SY	78	\$60	\$80	\$4,679	\$6,223
Walkway between Lockwood and Hartzog	SY	668	\$60	\$80	\$40,080	\$53,306
Landing Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Shelter Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Turnaround (Road)	SY	163	\$347	\$462	\$56,561	\$75,226
Turnaround Fill	CY	720	\$108	\$143	\$77,760	\$102,960
Total					\$189,410	\$251,720
Alternative 2 (Fillmore/McDowell Stop)						
Shelter	EA	1	\$8,150	\$11,106	\$8,150	\$11,105
Landing Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Shelter Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Walkway between Lockwood and Hartzog	SY	668	\$60	\$80	\$40,080	\$53,306
Total					\$50,410	\$67,311
Alternative 3 (Lincoln Ave Stop)						
Shelter	EA	1	\$8,150	\$11,106	\$8,150	\$11,106
Landing Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Shelter Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Walkway between Lockwood and Hartzog	SY	668	\$60	\$80	\$40,080	\$53,306
Total					\$50,410	\$67,311
Alternative 4 (Upper Shipley Stop)						
Shelter	EA	1	\$8,150	\$11,106	\$8,150	\$11,106
Walk Way(Upper Shipley Stop to Existing Walkway to MTC)	SY	45	\$60	\$80	\$2,675	\$3,558
Landing Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Shelter Concrete Pad	EA	1	\$1,090	\$1,450	\$1,090	\$1,450
Walkway between Lockwood and Hartzog	SY	668	\$60	\$80	\$40,080	\$53,306
Total					\$53,085	\$70,870

2.4.5 Bikes Routes

The study has identified five bike routes which connect the major resource sites in the park.

1. Potomac Extended Route: - The town of Harpers Ferry allows biking and hiking on Potomac Street Extended. It is also used by River Riders, a concessioner, as a way to connect their water front campground with Lower Town HAFE and C & O Canal. The town has put signs allowing bikers and pedestrians on this road. However, this road is in a bad condition with many potholes. The majority of Potomac Extended is owned by the Town of Harpers Ferry, which leased part of it to River Riders. Some part of it is owned by HAFE.

The study identified this route as a low-hanging fruit. With some maintenance to the road surface and partnership with the town and River Riders, this road can be used for the enjoyment of the park visitors. The Potomac Extended route is also in sync with the RTCA plan of connecting community to parks. The RTCA proposal includes Bakerton Road (County Route 28), which makes Potomac Extended a good way of connecting the route with the park.

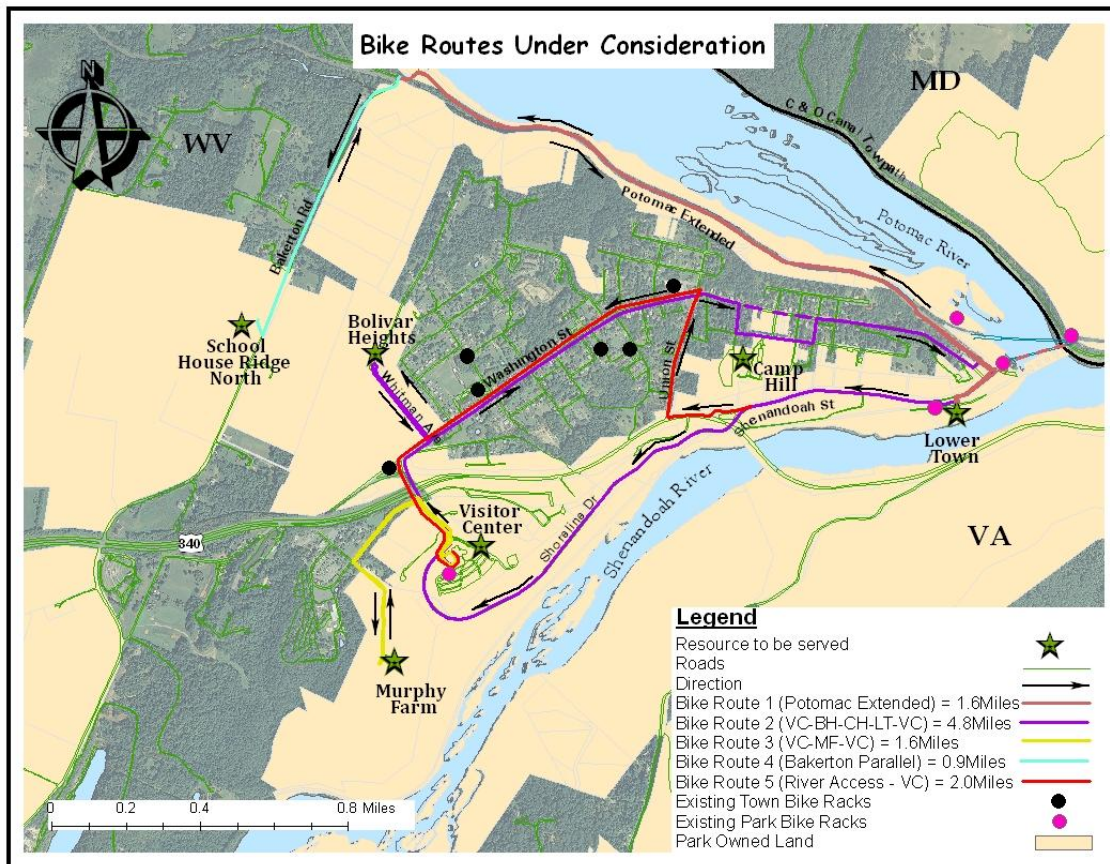


Figure 18 Bike Routes

2. Washington Street Loop: - this bike route starts from the Visitor Center, crosses Hwy 340 and continues on Washington Street to Lower Town. The return to the visitor center uses Shenandoah Street and Shoreline Dr. This is a one directional route because Shoreline Dr is believed to be unsafe with its accident history and the curvy nature of the road. This route includes a 2600 ft of 8 % downhill grade on Washington Street and upward grade on Shoreline Dr. However, the AASHTO recommended distance for 8% grade is only 800 ft. The steepness makes it hard for bikers to climb and may cause riders to travel downhill at a speed at which they cannot control their bicycle.
3. Murphy Farm Route: - this bike route connects Murphy Farm with the Visitor Center. To protect the resources such as the river vista and John Brown's Fort foundation, bikers will not be allowed to go beyond the parking lot. To enforce this, signs are required and creating a difference between the road surfaces might be necessary.
4. Bakerton Parallel: - this is a bike route that can connect Potomac Extended with SHRN.. This route is the most challenging to translate into reality. Bakerton Road (County Route 27) is a 45 mph road with limited vertical sight distance. Allowing bikers to ride on this road will be unsafe therefore building a bike lane will be necessary. It may be possible to build a separated bike path for most of this route on Park property and within the right-of-way of the road. In addition to this, passing through a viaduct will be necessary to go from Potomac Extended to Bakerton Road. The existing narrow viaduct serving vehicles can only accommodate one car at a time and since the cars cannot see each other before passing through they are required to honk their horns. To reduce the safety concern at the viaduct, it may be possible to use an aqueduct that is parallel to the viaduct. An elevated platform could be built in this aqueduct that would allow bicycles to pass from Potomac extended to a new trail parallel to Bakerton Road.
5. River Access-Union Street Connector:-this bike route is proposed as a way to avoid the hill on Shoreline Dr in the Washington Street loop route. This route includes climbing a 300 ft of 13% grade and riding on Hwy 340 for about 600ft before turning right to Union Street. This segment of Hwy 340 has a shoulder width of more than 6ft that makes this connection possible. However, the AASHTO recommended distance for 11% grade is only 50ft and travel on the 340 shoulder may not be advisable without some separation from motor vehicles.

Table 18 shows the needs and Class C cost estimate of the bike routes. All the bike routes require signs such as "Share The Road", "Pavement Ends", "Steep Road" etc. The table also shows that all the bike routes except the River Access - Union Street Connector require bike racks. The table shows a cost with mark up that includes mobilization, survey, testing, erosion control, clearing and grubbing, traffic control and field offices. However, it should also be noted that the cost does not include 25% contingency, 15% for Overhead and Profit (OH&P), 2.5% for insurance, 18% for design and construction Management and 20% for project management, contracting and oversight.

Table 18 Needs and Cost Estimates for Bike Route

Bike Route 1 (Potomac Extended)						
Need	U/M	QTY	Unit Cost	Cost w/Mark up	Amount	Amount w/Mark up
Trail (Road)	SY	13235	56	74	735612	978365
Catch basin medium Size	EA	1	2270	3019	2270	3019
Storm Water Piping dug at a depth of 4' & trench 3.5' wide in bed rock	LF	14	299	398	4186	5567
Signs	SF	12	15	20	180	239
Wooden Post	EA	4	28	37	112	149
Bike Racks	EA	1	780	1037	780	1037
Total					743140	988377
Bike Route 2 (Washington Street Loop)						
Signs	SF	18	15	20	270	359
Wooden Post	EA	6	28	37	168	223
Bike Racks	EA	2	780	1037	1560	2075
Total					1998	2657
Bike Route 3 (Murphy Farm)						
Signs	SF	9	15	20	135	180
Wooden Post	EA	3	28	37	84	112
Bike Racks	EA	1	780	1037	780	1037
Total					999	1329
Bike Route 4 (Bakerton Parallel)						
Bike Lane	SY	5386	347	462	1868803	2485508
Signs	SF	15	15	20	225	299
Wooden Post	EA	5	28	37	140	186
Bike Racks	EA	2	780	1037	1560	2075
Total					1870728	2488069
Bike Route 5 (River Access - Union St Connector)						
Signs	SF	9	15	20	135	180
Wooden Post	EA	3	28	37	84	112
Total					219	291

2.4.6 Trails

The study identified seven trails which improve or create connection between the main resource sites in the park. Among these trails, only Potomac Extended trail (discussed in the Bike Route section) is a hiking and biking trail. All other trails are for hiking only. This is due to the topography of the trails, erosion control and resource protection.

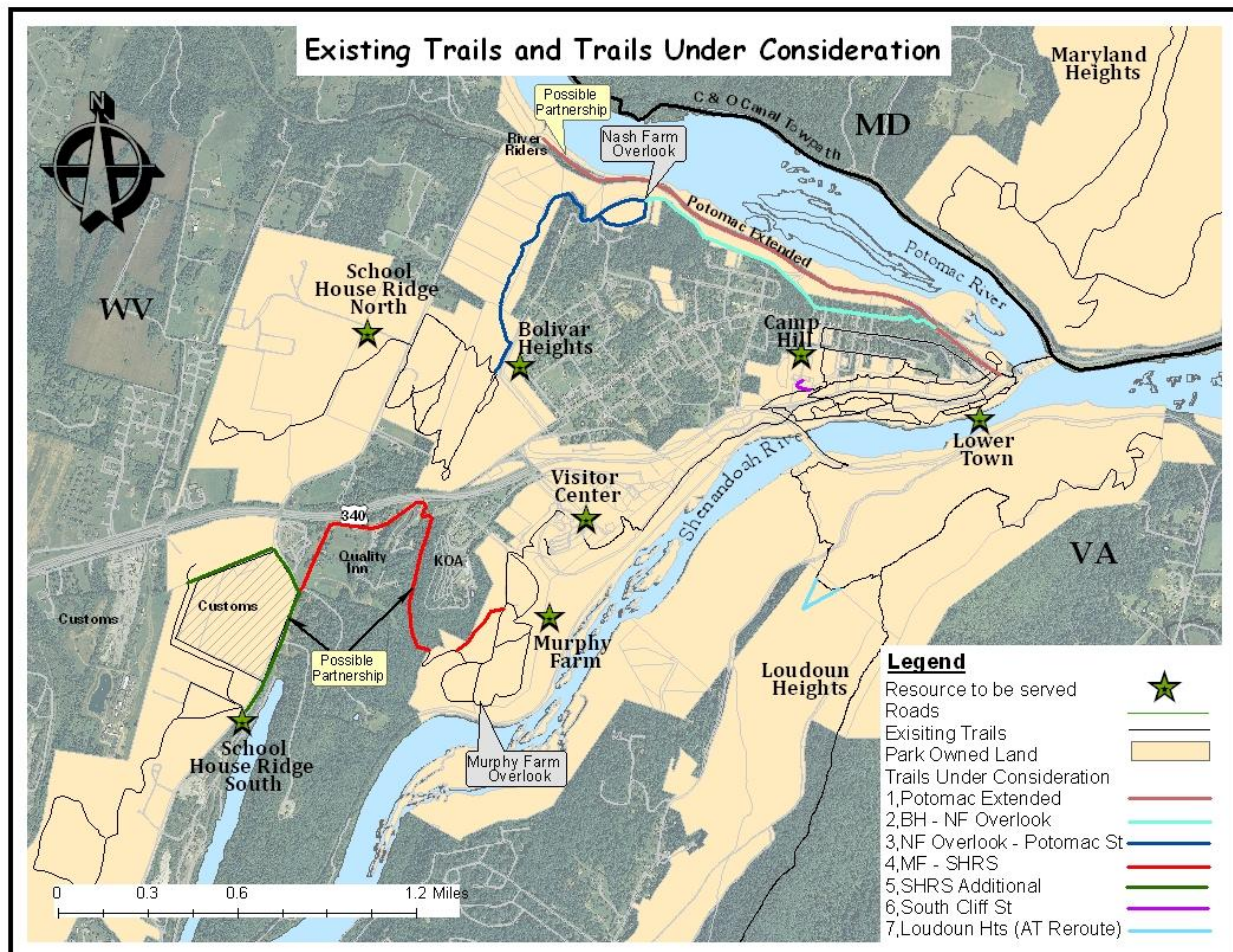


Figure 19 Trails

1. Potomac Extended trail – discussed in bike section
2. BH-NF Overlook trail is an existing trail that needs some maintenance work, identifying park property line and cultural resource investigation. During the study it was identified that the property line switches back and forth along the trail. A probable civil war earthwork was also identified which might need confirmation and investigation from archeology department in the park.

3. NF Overlook-Potomac Street trail connects Nash Farm with Lower Town. This trail starts from Nash Farm overlook and follows a Paper Street, owned by the town, and connects to Ridge Street then passes through a land owned by Cliff Side to connect with Potomac Street at Lower Town. The other option for this trail would be, from Ridge Street to take Colombia Street and come out to Washington Street and then to Lower Town using a sidewalk.
4. MF-SHRS trail - The main purpose of this trail is to create a connection for SHRS with the rest of the park. MF-SHRS trail passes through land belonging to the Quality Inn and KOA. Part of this trail is an already existing trail with proper maintenance and lighting. Part of this trail also passes on Alstead Hill Road, which is a low volume county road.
5. SHRS additional trail – this trail extends the MF-SHRS trail to Schoolhouse Ridge South with a trail on the side of Millville Road. Part of the land on the side of Millville road is owned by Customs. also passes through land belonging to Customs.
6. South Cliff Street trail is a trail that helps to connect the MTC area of the park with Lockwood House and Lower Town. This trail will only be about 500 ft long that gently slopes down and meets with the AT segment that continues to Lockwood House, Jefferson Rock and then Lower Town.
7. Loudoun Height trail (AT Reroute) is an improvement to existing trail. This trail reroutes segment of the AT that is currently very steep. This reroute helps to reduce erosion and difficulty level for hikers.

With the implementation of these trails, getting to all park resources on foot will be possible, satisfying one of the main themes of the GMP. The cost estimates for the trails are presented in Table 19. The table shows a cost with mark up that includes mobilization, survey, testing, erosion control, clearing and grubbing, traffic control and field offices. However, it should also be noted that the cost does not include 25% contingency, 15% for Overhead and Profit (OH&P), 2.5% for insurance, 18% for design and construction Management and 20% for project management, contracting and oversight.

Table 19 Need and Cost Estimates of Trails

1. Potomac Extended						
Need	U/M	QTY	Unit Cost	Cost w/Mark up	Amount	Amount w/Mark up
Trail (Road)	SY	13235	56	74	735612	978365
Catch basin medium Size	EA	1	2270	3019	2270	3019
Storm Water Piping dug at a depth of 4' & trench 3.5' wide in bed rock	LF	14	299	398	4186	5567
Total					742068	986951
2. BH - NF Overlook						
Trail	LF	6864	8	11	56422	75041
Posts (Carsonite)	EA	21	11	15	241	320
Symbol stickers (6 per Sheet)	Sheet	21	6	7	116	154
Waysides	EA	1	15000	19950	15000	19950
Total					71778	95465
3. NF Overlook - Potomac Street						
Trail	LF	5808	8	11	47742	63497
Posts (Carsonite)	EA	18	11	15	206	274
Symbol Stickers (6 per Sheet)	Sheet	18	6	7	99	132
Waysides	EA	1	15000	19950	15000	19950
Total					63047	83853
4. MF - SHRS						
A. New						
Trail	LF	1050	8	11	8631	11479
Posts (Carsonite)	EA	4	11	15	46	61
Symbol Stickers (6 per Sheet)	Sheet	4	6	7	22	29
Waysides	EA	1	15000	19950	15000	19950
Total					23699	31520
B. Improvement						
Need	U/M	QTY	Unit Cost	Cost w/Mark up	Amount	Amount w/Mark up
Trail	LF	6336	8	11	52082	69269
Posts (Carsonite)	EA	20	11	15	229	305
Symbol Stickers (6 per Sheet)	Sheet	20	6	7	110	147
Total					52421	69720
5. SHRS Additional Trail						
Trail	LF	4752	8	11	39061	51952
Posts (Carsonite)	EA	15	11	15	172	229
Symbol Stickers (6 per Sheet)	Sheet	15	6	7	83	110
Total					39316	52290
6, South Cliff Street Trail						
Trail	LF	528	8	11	4340	5772
Posts (Carsonite)	EA	2	11	15	23	30
Symbol Stickers (6 per Sheet)	Sheet	2	6	7	11	15
Total					4374	5818
7, Loudoun Heights (AT Reroute)						
Trail	LF	1584	8	11	13020	17317
Posts (Carsonite)	EA	5	11	15	57	76
Symbol Stickers (6 per Sheet)	Sheet	5	6	7	28	37
Total					13105	17430

2.5. Partnerships

Partnerships are a great way to achieve goals with a limited amount of fund and resources. Partnership is collaboration with interested parties, federal, local and regional government agencies, etc with a desire to share risks and responsibilities. Sometimes conditions like resource needs and right of way issues make partnerships absolutely necessary.

The study identified several partnerships needed to realize the transit system expansion alternatives, Camp Hill turnaround, and improved trails and bike routes. Some of the partnerships needed are the following:

Alternative six for the transit system expansion requires partnership with the Town of Harpers Ferry for making High St into one way during certain periods. In addition, all the transit alternatives need some form of collaboration with Town of Bolivar, Harpers Ferry and Jefferson County since the buses will be passing through the towns and residential areas.

Similarly, all the turnaround alternatives except Hartzog turnaround need changing streets into one way, which will require the consent of the residents and local government officials. All these alternatives also need partnership with the Stephen T Mather Training Center (MTC).

All the trails and bike routes considered also need collaboration with the two towns and the county. However, some of them need specific partnerships with different organizations. For example, for Potomac Extended Biking/ Hiking trail with River Rides, for NF Overlook-Potomac Street trail with Hill Top House/Swan Corporation, for MF- SHRS Trail with KOA, Quality Inn.

2.6. Alternatives Public Workshop

The alternatives public workshop was held following the alternatives phase of the study and concentrated on gathering valuable ideas for expanding the shuttle system as well as improving trail and bike route connections in the park. At this workshop the six alternative transit routes, five potential new trails and five bike routes as well as Camp Hill turnaround alternatives were presented.

The public workshop was held in an open house format on October 18, 2011 at MTC. The presentations were divided into six stations: introduction slide presentation, bus routes alternatives, considered but eliminated bus route alternatives, turnaround alternatives, trails and bike routes, comment station and community/park connections station which was included in the workshop from related Rail to Trail Conservancy project (RTCA). The RTCA project deals with creating trail linkages between HAFE and the greater local community, which could use the same audience as the alternative transportation study

Invitations in the form of newsletter were sent to more than 300 stakeholders and adjacent land owners. News releases were sent to county news papers. The newsletter was also uploaded to the park website. As an introduction to the public workshop two meetings were held with the Harpers Ferry Town Council and Bolivar Town Council on October 3rd and 4th, respectively. All these information dissemination effort helped to get a turnout of more than 40 people on the 18th of October.

Attendees were given the opportunity to give comments on the spot using comment cards, maps, and stickers. Also additional information was available on the NPS Planning, Environment & Public Comment (PEPC) website where people could comment within the public comment period that was open until November 3rd 2011. Figure 20 below is a snap shot from the meeting showing guests and a park staff member in the middle of a discussion.

Summary of public comments can be found in Appendix F



Figure 20 Camera shot from Public Meeting

2.6.1 Field Visit to Colonial National Historical Park

On October 19th and 20th, 2011, the transportation scholar (myself) and project manager visited Colonial National Historical Park (Colonial NHP). The purpose of the visit was to learn from their experience in seasonal service, driver contracts, bus types, schedules etc.

Colonial NHP is located in the eastern part of US in Yorktown, VA. The park gets about 3.4 million visitors per year, which is thirteen times more than HAFE's visitation. The Colonial NHP

shuttle system was established in 2004 to ease traffic congestion and improve visitor mobility. It serves main visitor attractions sites including Colonial Williamsburg, Historic Jamestown, and the Yorktown Battlefield.

During the visit we talked to the Colonial NHP Natural Resource Specialist (Ms. Dorothy Geyer), the Colonial Williamsburg Foundation (CWF) transportation supervisor (Mr. Lee Whitby) and First Transit General manager (Mr. David Tetreault.) In addition to this, I rode on the shuttles from Colonial Williamsburg Visitor center to Historic Jamestown and Jamestown area loop.

The shuttle service was established in 2004 to ease traffic congestion and improve visitor experience. The park charges \$10 per person for seven day pass; however it does not use the entrance fee to fund the shuttle service. The service starts at the beginning of spring break every year and ends on October 31st. The shuttle routes are:

Historic Triangle Shuttles (HTS)

- Colonial Williamsburg to Jamestown (10.2miles one-way) with two stops
- Colonial Williamsburg to Yorktown (13 miles one-way) with two stops
- Jamestown Area Shuttle (JAS)
- Jamestown Area Loop (5.5 miles)

The HTS depart Colonial Williamsburg every half hour starting form 9:00am until 3:30pm. The return service is between 9:30am and 4:00pm every half hour with a final pick up at 5:15. Two buses are used for each route. The JAS makes a loop every 10-15 minutes between Historic Jamestown Visitor Center, the James Town Glasshouse and the Jamestown settlement with one bus. The routes are displayed with a rolling LED signs on the front and side of buses.

The buses used for these routes are owned by Williamsburg Area Transit Authority (WATA). Colonial Williamsburg Foundation (CWF) leases the buses from WATA and Colonial NHP contracts with CWF to operate the shuttles. FTA covered the capital cost (about 2,500,000) for the purchase of the 7 buses with a 20% matching form CWF. The buses are Orion Shuttles with John Deer engines running on Compressed Natural Gas (CNG).

The operational and maintenance costs are about \$650,000 per year with salaries and benefits making up to 40% of the cost. These costs are funded by congressional appropriations. Maintenance of the buses is performed by First Transit along with other CWF & WATA buses.

Some of the findings about the buses, maintenance facility and drivers are as follows:

- The buses are equipped with an audio that interprets the history of the sites. The audio is loud and clear even with the high noise level in the buses. The drivers also have a printed copy of the audio on the shuttles for hearing-impaired people.
- It takes about 4hours to fill up a bus with CNG that requires filling station for each bus and they are filled overnight.

- Drivers are trained and expected to pass exams about the attractions and information about each destination.
- Drivers put “Last Bus Departed” sign after final pick up.
- The maintenance facility has 1 drive through wash bay and 3 drive through maintenance bays.
- The maintenance facility uses a wireless portable power lift system.
- The maintenance facility gives service to about 300 buses.
- The buses will be parked overnight on the space next to the maintenance facility (no bus parking bays). They believe using engine block heater is cheaper than building a bus parking bay that also requires a heating system.

2.6.1.1 Cost and Ridership comparison

Table 20 shows that HAFE’s transit system attracts more riders per 100 visitors than Colonial NHP’s system. The main reason for this might be HAFE’s system is mandatory where as Colonial’s is discretionary. Based on this data HAFE’s existing system looks significantly cost effective than Colonial’s even with the HAFE system being year round.

Table 20 Cost and Ridership Comparison for FY2009

Park	O&M cost	Trip per 100 Visitors
HAFE	\$228,700	123
Colonial NHP	\$657,385	28

Data source: HAFE ATS Performa and Colonial NHP ATS Evaluation & Business Plan

2.7 Alternatives Analysis

This section evaluates to what extent the alternatives have met the objectives established at the beginning of this report. Each alternative is evaluated based on the performance measures outlined. The alternative analysis is performed for the transit system expansion alternatives only.

2.7.1 Evaluation of Objectives

For Objective 1.1, which is to provide an opportunity for visitors to understand the historic significance of an area within a 0.5 mile walking distance in each direction, it was found that alternatives 1, 2, 5 and 6 met the objective for Lower Town, Bolivar Heights and Camp Hill. Alternatives 3 and 5 met the objective for Murphy Farm and Alternatives 3 and 4 met the objective for Schoolhouse Ridge North and South. In addition, it was also found that adding alternative 3 to alternatives 1, 2, 5 or 6 allows those alternatives to meet the objective for all the sites.

Table 21 Walking Distance (One-way) to Historic Resources Evaluation for Transit System

Alternatives	Lower Town	Bolivar eights	Murphy Farm	Camp Hill	SHRN	SHRS	Nash Farm
Comb 1 (Alt 1)	0.2	0.3	1	0.4	2.3	2.2	N/A
Comb 2 (Alt 2)	0.2	0.3	1	0.4	2.3	2.2	N/A
Comb 3 (Alt 3)	2.1	1.0	0.5	1.9	0.4	0.3	N/A
Comb 4 (Alt 4)	2.1	1.0	1	1.9	0.4	0.3	N/A
Comb 5 (Alt 5)	0.2	0.3	0.5	0.4	2.3	2.2	N/A
Loop 1 (Alt 6)	0.2	0.3	1	0.4	2.3	2.2	N/A
Current (Alt 7)	0.2	0.3	1	1.9	2.3	2.2	N/A

For Objective 1.2, which is to increase the number of visitors who receive interpretation at each resource site by 2014, it was found that none of the alternatives have an effect on Lower Town and Bolivar Heights. To estimate the number of visitors who receive interpretation, it was assumed that 50% of the current bus riders will go to Murphy Farm and Camp Hill and 25% will go to School House Ridge if a bus access provided. Table 22 shows that all six alternatives increased the number of visitors who receive interpretation at Camp Hill. Alternative 3 and 5 increased the number of visitors at Murphy Farm and alternative 3 and 4 increased the number of visitors at Schoolhouse Ridge North and South. In addition, it was also found that adding alternative 3 allows those alternatives to meet the objective for all the sites. Assuming

Table 22 Increase in Number of Visitors Who Receive Interpretation

Alternatives	Lower Town	Bolivar eights	Murphy Farm	Camp Hill	SHRN	SHRS	Nash Farm
Comb 1 (Alt 1)	0	0	0	79017	0	0	N/A
Comb 2 (Alt 2)	0	0	0	79017	0	0	N/A
Comb 3 (Alt 3)	0	0	39509	0	39509	64166	N/A
Comb 4 (Alt 4)	0	0	0	0	39509	64166	N/A
Comb 5 (Alt 5)	0	0	79017	79017	0	0	N/A
Loop 1 (Alt 6)	0	0	0	158034	0	0	N/A
Current (Alt 7)	0	0	0	0	0	0	N/A

For Objective 1.3, which is to minimize total vehicle miles traveled by visitors to access the park by 2014, it was found that only alternative 3 met the objective for more than two resource sites. For this analysis, the total VMT is calculated assuming the same number of people who are expected to ride the buses will be driving to each site if buses are not provided. Based on this, no change was found on Lower Town and Bolivar Heights for all alternatives. However, Schoolhouse Ridge North and South showed reduction in VMT with alternatives 3 and 4; Murphy Farm with alternatives 3 and 5; Camp Hill with alternatives 1, 2, 5 and 6. Adding alternative 3 allows those alternatives to meet the objective for all the sites.

Table 23 Reduction in VMT to Access Each Resource Site

Alternatives	Total VMT to Access Each Resource Site					
	LT	BH	MF	CH	SHRN	SHRS
Comb 1 (Alt 1)	0	0	0	323888	0	0
Comb 2 (Alt 2)	0	0	0	323888	0	0
Comb 3 (Alt 3)	0	0	69546	0	322894	322894
Comb 4 (Alt 4)	0	0	0	0	263283	263283
Comb 5 (Alt 5)	0	0	139093	323888	0	0
Loop 1 (Alt 6)	0	0	0	647775	0	0
Current (Alt 7)	0	0	0	0	0	0

For Objectives 2.1, 2.2, 2.3 and 2.4 related to educational tour buses, it was found that none of the alternatives have an impact on the educational tour buses. Therefore, these objectives are not met by any alternatives.

For Objective 3.1, which is to reduce the number of vehicles entering Lower Town, Bolivar Heights, Murphy Farm, Camp Hill and Schoolhouse Ridge by 20% from 2011 levels by 2014, it was found that all of the alternatives do not have any effect on LT and BH. As in the VMT the total number of vehicles is calculated assuming the same number of people who are expected to ride the buses will be driving to each site if buses are not provided. Based on this, alternative three met the objective for Schoolhouse Ridge North and South; alternatives 1, 2, 5, & 6 met the objective for Camp Hill; alternatives 3 and 5 met the objective for Murphy Farm. Adding alternative 3 allows those alternatives to meet the objective for all the sites.

Table 24 Reduction in Personal Vehicles Entering Resource Sites

Alternatives	Personal Vehicle Reduction					
	LT	BH	MF	CH	SHRN	SHRS
Comb 1 (Alt 1)	0	0	0	99352	0	0
Comb 2 (Alt 2)	0	0	0	99352	0	0
Comb 3 (Alt 3)	0	0	49676	0	49676	49676
Comb 4 (Alt 4)	0	0	0	0	49676	49676
Comb 5 (Alt 5)	0	0	99352	99352	0	0
Loop 1 (Alt 6)	0	0	0	198704	0	0
Current (Alt 7)	0	0	0	0	0	0

For Objective 3.2, which is to provide access to Camp Hill using modes that can be accommodated by existing transportation infrastructure with the exception of basic supporting facilities, it was found that alternatives 1, 2, 5 and 6 can provide access to Camp Hill without requiring new infrastructure.

For Objective 3.3, which is to provide access to Lower Town using modes that can be accommodated by existing transportation infrastructure, it was found that all alternatives can provide access to Lower Town without requiring new infrastructure.

For Objective 3.4, which is to provide access to the other areas using modes that can be accommodated by existing transportation infrastructure without total reconstruction, it was found that all the alternatives can provide access to all the sites included in their routes without requiring new infrastructure.

For Objective 4.1, which is to provide access to each resource for less than \$2.00 per visitor by 2014, different results were found when 12 passenger buses or 37 passenger buses are applied for the new routes. Applying 12 passenger buses for the new routes, alternatives 1, 2 and 5 did not meet the objective however, when 37 passenger buses are used for new routes only alternative 2 and 5 did not meet the objective. (See table 13)

Table 25 FY 2014 O&M Cost and Cost per Visitor

Alternatives	12 Passenger buses for new routes		37 Passenger buses for new routes	
	O&M Cost	Cost Per Visitor	O&M Cost	Cost Per Visitor
Comb 1 (Alt 1)	\$725,704	\$2.74	\$511,808	\$1.94
Comb 2 (Alt 2)	\$726,048	\$2.75	\$726,048	\$2.75
Comb 3 (Alt 3)	\$403,372	\$1.53	\$403,372	\$1.53
Comb 4 (Alt 4)	\$386,388	\$1.46	\$220,868	\$0.84
Comb 5 (Alt 5)	\$834,624	\$3.16	\$834,624	\$3.16
Loop 1 (Alt 6)	\$452,546	\$1.71	\$452,546	\$1.71
Current (Alt 7)	\$405,063	\$1.53	\$405,063	\$1.53

For Objective 4.2, which is to provide access to each resource for less than \$500,000/yr for operations and maintenance by 2014, it was found out that alternatives 1,2 and 5 did not meet the objective in both cases.

Additional Considerations

A number of additional considerations are worth pointing out to facilitate decision making. Some of them are discussed next;

- Alternative 6 requires changing High Street into one-way going down from the intersection with Church St. This will have effect on the residents and businesses on High Street and also commuters who leave the train station on weekdays. Even with a change to one-way, it is required to limit delivery times for large trucks.
- Alternatives 3 and 4 are additional systems serving the outlying battlefield areas and they can be added on the other alternatives. This will drive up the cost of the alternatives to large amount. For instance, if alternative 3 is added on alternative 1 the transit system will be able to cover all the resource sites under consideration. However, the O&M cost

will be estimated to be \$1, 129,076 if 12 passenger buses are used for the new system or \$915,180 if 37 passenger buses are used.

- Using 12 passenger buses usually drives the costs up due to the additional drivers and trips needed to meet demand. Nonetheless, it might be unavoidable in some of the alternatives since some of the new locations require use of 12 passenger buses due to road width and road surface condition.

2.8. Value Analysis

Value Analysis (VA) in the NPS is described as “A process of arriving at an optimal solution to a complex issue through a structure and reasoned analysis of the factors and functions related to the issues.” It is a process performed by a team with guidance of a trained person in value analysis techniques.

The VA for this study was conducted for two days, November 8th and 9th. It was directed by Lilly Hardin from Denver Service Center (DSC). The team included the HAFE transportation committee members and Anne O’Neal from RTCA as an independent team member to reflect new viewpoint and insights to the study.

Choosing By Advantage (CBA) method was used to select and rank alternatives based on their relative advantages and cost. Essential data and alternatives were documented before the VA and presentations were made in the information phase. Recommendations were developed after passing through the functional analysis, creativity, evaluation, development phases. Detailed analysis steps and information can be found in the Value Analysis Report (VA report documentation ongoing by Lilly Hardin and will be available at a later date).

The VA was performed for the transit system expansion alternatives, turnaround alternatives, potential trails, and potential bike route. The analysis was applied on transit system and turnaround alternatives to find the best alternative. However, for trails and bike routes the method was used to rank the potential trails and bike routes. In this report, the finding of the VA for the transit system is presented.

Transit System

Figure 21 shows the value of each alternative compared to their cost. The graph shows that alternative six is the best value for the cost with alternative one second to best and alternative seven in third place.

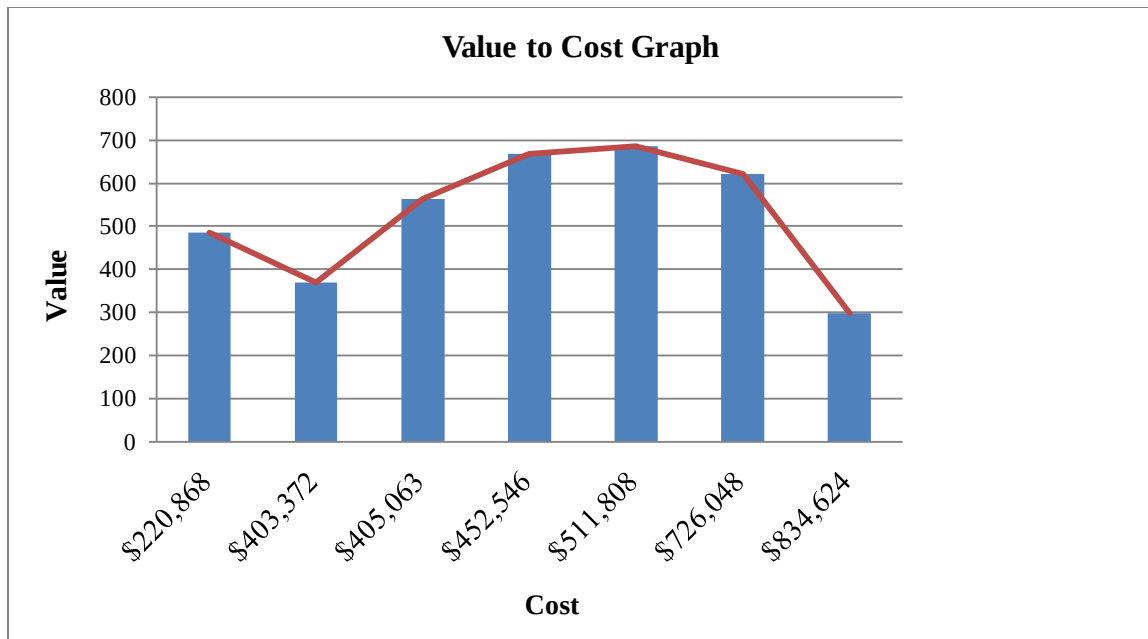


Figure 21 Transit System Value to Cost

Note: At the time of completion of this report, the VA result for turnarounds, trails and bike route was not completed. Therefore, the detailed results of the bikes routes and trails will be included in the VA report.

3. CONSTITUENCIES

The visitors are the most affected group by the problem being addressed. The park owns a variety of resources such as artifacts and exhibits from the town's industrial period, different structures from African American History, and battlefields and exhibits from the American Civil War. These resources are scattered in different parts of park land where the visitors do not have access or means of transportation to the sites. Therefore, this problem is solved in this study by providing access to most of the sites through buses, trails, and bike routes.

The park is also greatly affected by this problem due to the inability to use the lands it acquired through purchase or donations. This study provides opportunity for the park to offer improved visitor experience and help distribute visitors to different areas of the park to reduce overcrowding in Lower Town area. The study results will also help to improve the shuttle ridership that will help the park to capture fees from increased number of visitors. The park was involved greatly in the project through a transportation committee that included professionals from different divisions in the park. The park staff was also involved in supplying the data needed, and participated in sharing their perspectives on the shuttle routes, trails and bike routes.

The businesses, residents, and local government officials of Bolivar and Harpers Ferry also played a role in providing ideas through the public workshop and meetings conducted with each town council members. The study results will have economic benefits for the towns and the businesses by giving them more exposure and introducing them to visitors.

4. RECOMMENDATIONS AND CONCLUSIONS

This section highlights the conclusions and recommendations based on the results from the VA, public comments, and evaluation of the alternatives based on the performance measures. It also includes some ideas based on observations and discussions with in the transportation committee.

4.1 Conclusion

Transit System Expansion

In order to achieve the goals set at the beginning of the project, six new alternative routes for the expansion of the transit system were considered. Among these, alternative six has the best value for the cost based on the VA result. This alternative met the objectives of providing access to the new sites with an O&M cost less than \$500,000 and a cost per visitor for less than \$2.00. This alternative also met all the other objectives for Camp Hill. It also does not have effect on the current condition of Lower Town and Bolivar Heights, which is the case for all alternatives. Due to this, alternative six is considered the best alternative. However, the need to make High Street one-way for driving large buses through the towns regularly requires acceptance from the community might make this alternative difficult to implement.

The second ranked alternative is alternative one which has two routes: one route serving Camp Hill and Bolivar Heights, and another serving Lower Town. The VA result for this alternative showed a very small increase in value relative to the cost. This alternative met all the objectives alternative six met except the \$500,000 O&M cost. This alternative might be a good replacement for alternative six if it was less expensive however, having two routes might confuse visitors; it might also be difficult to make visitors use the red route since most of them come to the park to visit Lower Town.

Alternatives three and four include only Murphy Farm, Schoolhouse Ridge North and South. These alternatives are considered as options that can be added on alternatives one, two, five, and six. The VA result showed that alternative four has a better value for the cost than alternative 3. In general the results from the VA showed that these alternatives add very small value for their cost compared to the other alternatives. The O&M cost of adding these alternatives on alternative 1, 2, 5 and 6 showed that the whole system would be uneconomical. Discussions with in the transportation committee also showed that expanding the transit system to outlying battlefield areas of Schoolhouse Ridge North and South is not a wise use of resource and money. Providing a shuttle service to Murphy Farm was also found impractical unless Murphy Road is widened and paved or another alternative access road is built. Therefore, for these resource sites encouraging auto tours, and bus tours on special events, related to the sites, was found to be a better way to improve visitor experience.

The maximum number of buses required for any of the alternatives is seven if 37 passenger bus is used. . Whereas, the maximum number of total buses required will be 17 when 12 passenger buses are used for the new route. The O&M cost calculations were performed using 12 passenger buses, and 37 passenger buses for the new routes. The cost estimate result showed that using 12

passenger bus increases the O&M cost considerably. Therefore, using larger buses is advisable unless geometry of the roads warrant use of smaller buses or unless the demand is too low.

Note: At the time of completion of this report the VA results for the turnarounds, trails and bike route was not complete. Therefore, for complete conclusion VA document should be consulted.

Camp Hill Turnaround

Among the turnaround alternatives, alternative one requires major construction. Nonetheless, it is the most favored alternative by the transportation committee since it has lesser disturbances to the residents in the area and it does not require major changes to the accessing street (Storer College Pl).

Trails & Bike Route

The trails identified make the connection between most resource sites in the park possible. BH-NF overlook, South Cliff and Loudoun Heights AT reroute trails are all on park land. However, all the other trails require partnership with one or more land owners.

Potomac Extended biking/ hiking trail, and Murphy Farm biking route has little or no safety related issues. However, Washington St Loop, River Access-Union St Connector and Bakerton Parallel bike routes have significant safety related issues.

4.2 Recommendation

Transit System Expansion

- Selecting alternative six which resulted in a higher value for the cost is recommended.
- Expanding the transit system to Bolivar Heights and Camp Hill is recommended
- For Murphy Farm, Schoolhouse Ridge North and South, encouraging auto tours and special events shuttle tours to the sites is recommended.
- Before implementation, pilot testing the selected alternative is recommended. However, this should be conducted with improved visitation sites and for a number of days that can depict the reality.
- The cost estimate assumes a 20% ridership increase in the future and a 50% share of ridership demand for the red routes which might not happen in the first few months of implementation. Therefore, using a combination of 12 passenger buses and 37 passenger buses or using 12 passenger buses and upgrading to the 37 passenger buses based on demand might be a practical and sensible option. However, this option does not work if alternative 6 is implemented since it will receive similar ridership as the existing system as soon as it starts.
- Experience from BH shows that staffing the new sites for some time might be necessary to promote them.

- Providing access to the new sites alone may not improve visitor experience. It should be supported with improved access of exhibits, artifacts with waysides and interpretive signs.
- It is recommended that the next purchase of park transit system fleet should have one type of fleet with a width and size appropriate for all roads. This will also make the implementation of the best alternative easier.

Other transit related recommendations

- Providing shuttle information on the front page of the park website may help improve ridership. As an example; Zion National Park has the shuttle system link on the front page under quick links.
- Improving the current signage on Highway 340 and Washington Street will help to direct more visitors to the visitor center before they arrive to Lower Town. This will have advantage in reducing the number of vehicles coming to Lower Town and it may also help capture more entrance fees. Variable message sign on Hwy 340 may also be considered for peak visitation days if found cost effective.
- Strengthening partnership ties with Harpers Ferry and Bolivar, is necessary since the alternatives require passing through the towns and may require changing some of the roads into one-way.
- If buses go regularly to SHRS & SHRN the bus stop should be widened because at its current size it would not be possible for the buses to turn around.
- Improving the audio system on the buses is recommended. Improving and adding new audio interpretation based on selected alternative routes is also necessary.
- Providing applications and podcasts for self guided tours is recommended.

Note: At the time of completion of this report the VA results for the turnarounds, trails and bike route was not complete. Therefore, for complete recommendation VA document should be consulted.

Camp Hill Turnaround

- It is recommended that alternative two, three, or four (with small improvement) should be used temporarily to study the demand and the continuity of the new routes before constructing turnaround. To determine the best alternatives and the temporary alternative the VA document should be consulted.

Trails and Bike routes

- Both the Washington St loop and River Access Union St connector routes has issues related to safety. Due to these issues this study recommends a detailed safety committee review before any kind of implementation.
-

Educational Tours

In section 2.7.1 it was mentioned that the alternatives identified do not have any effect on the educational tours. However, based on observation and the data presented in section 2.2.5 the following two recommendations were made.

- Creating a system of reservation based on availability is recommended. This also helps to reduce the impact of overcrowding in Lower Town area.
- Using automated system to manage the arrival and departure of educational tour buses at Lower Town and Visitor Center might help to reduce the cost of using visitor service staff.

4.3 Recommendation for upcoming projects

This section includes recommendation related to HAFE PMIS 91113 (Improve Existing HAFE Transit Maintenance Facility) and HAFE PMIS 155668 (Improve HAFE Park Transit Destination Points)

For HAFE PMIS 91113, the required inputs from this project are number and size of buses. Since the final decision on the park's preferred alternative is not made, the number and sizes of the top three alternatives based on the VA result are presented below.

1st ranked alternative – Alternative Six

- Buses Required – 6
- Size 37 passenger buses

2nd ranked alternative – Alternative One

- Buses Required – 7
- Size 37 passenger buses

OR

- Buses Required – 14
- Size – 4 -37 passenger buses
– 10 -12 passenger buses

3rd ranked alternative – Alternative Seven (Current System)

- Buses Required – 5
- Size 37 passenger buses

It should be noted that alternatives six and one do not include routes to Murphy Farm, Schoolhouse Ridge North and South. To incorporate these locations into the system, alternative three or four need to be added on alternative six and one. This will require additional 8 12-passenger buses if alternative three is added; additional 2 37-passenger buses or 8 37-passenger buses if alternative four is added.

For HAFE PMIS 155668, the required improvements and new facilities include shelters, rest rooms, walkways and turnarounds. This study identified the availability of shelters, restrooms and turnarounds for eight destination points in the park. In addition to this, the required walkway lengths based on Camp Hill turnaround alternatives were identified. Since it is difficult to cover all the improvements and new facilities needed for each destination points, this study recommends a separate and detailed study for the destination points.

5. NEXT STEPS / IMPLEMENTATION

The first step of the implementation process is developing/improving the resource sites and preparing an interpretation plan. This may vary based on what is available at each site and the recommendation of the GMP. For example, for Camp Hill, the GMP recommends that the first floor of Lockwood House be restored for increased interpretation; a room in Mather Hall be open to public and building exterior interpretation through signs; for Schoolhouse Ridge North and South the transportation committee identified the need for improved interpretive signs with a proper orientation.

The next step is to ensure the new routes work through pilot testing before making any major investments on bus purchases or turnaround improvements. This step also helps to gain the support of the community by showing them the effect of the new system.

This study has received considerable amount of involvements from the park staff and different stakeholders. Likewise, going forward will require extensive amount of partnerships, and involvements from different government agencies (local/regional), adjacent landowners and stakeholders.

The major performance measures for implementation will be the ridership of the new routes, the number of passengers alighting at resource sites, visitor satisfaction and acceptability of the routes and bus stops by the adjacent land owners and the community as a whole.

The implementation of trails and bike routes requires partnerships with different stakeholders. Creating these partnerships and getting funding to add or improve the bike routes and trails will be the next step for the implementation. The amount of usage will be the performance measure for this.

6. CONNECTION TO WIDER TRANSPORTATION COMMUNITY

A range of transportation issues that are prevalent to the wider transportation community were entertained in this project. The major issues considered in this project are related to accessibility and connectivity. Accessibility was considered in terms of providing alternative modes of transportation while connectivity was considered with respect to creating safe connection between sites.

Nowadays, people have varying demand for alternative transportation modes. The various demands might be the result of economical conditions, environmental protection issues and/or preference. On the other hand transportation communities would resort to different alternative modes due to congestion, limited parking space, and environmental protection issues. Providing the alternative modes faces different challenges such as narrow roads, unavailability of pedestrian and bike lanes, and of course funding restrictions.

Harpers Ferry is an old town and the existing roads are narrow and that create challenge for large buses to navigate through. The load carrying capacity of the roads could also be additional concern. These challenges can be overcome with the selection of appropriate bus sizes to safely operate in the current roads, by changing two-way roads into one-way, and by upgrading the roads to provide sustainable transportation system. These solutions require collaboration with the local residents, businesses and local government.

Providing safe connections with bikes and trails also faces obstacles such as topography and riding on and crossing high speed roads which is the case in most urban and rural areas. Advancement in bike technologies plays a big role in solving the topography issue. However, providing bike lanes and barriers to separate the bikers may be necessary. The study came across different studies to facilitate biking and hiking in the Harpers Ferry area. For example, the Byron Bridge Study to solve the issue of carrying bikes on Byron Bridge staircase going from HAFE to C&O Canal towpath; the RTCA study to create linkage between HAFE and local community through hiking and biking routes.

7. THE NPS TRANSPORTATION LANDSCAPE

The NPS transportation landscape covers a wide range of issues in the parks nationwide. One observation, not necessarily challenging, identified during this study is the lack of coordination among different projects and inability to identify sequence of projects. One example is the bus barn project which has already completed the schematic design. Although the project deals with the inadequacy of the existing barn with regard to safety, ADA accommodation, and energy conservation, it requires inputs from this study such as number and size of buses. It is believed that the barn project should have been preceded by this study. Another example is the implementation of the on-demand demand river access stop. Identifying additional stops for on-demand river access stop is part of the scope of this project. Therefore, creating coordination between projects and providing NPS wide guidelines on sequence of planning would help to avoid redundancy and unnecessary costs.

8. PROFESSIONAL DEVELOPMENT

The transportation scholar program offers an invaluable opportunity for transportation professional's career development and growth. My journey as a NPS scholar, starting from the five day training at Denver Service Center which was supported by presentations from previous scholars, professionals with different background from NPS, Volpe, TRIPTAC, FHWA followed by field visit to Rocky Mountain National Park was full of new experiences and learning.

The training was helpful tool to learn about NPS as a whole and importance of interpretation, partnership and building good relationship with the park staff. It was also helpful for identifying resource persons in different areas.

The transportation Scholar program enabled me to diversify my knowledge of transportation in different areas. Although my graduate study was transportation engineering emphasis, alternative transportation modes were not core focus. My assignment gave me a great chance to learn and explore about the importance of alternative transportation systems.

The program also gave me the opportunity to work independently as transportation professional of course with the support and guidance from my mentor, supervisor and project manager.

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9. APPENDICES

Appendix A

Appendix

A. Considered but Eliminated Shuttle Route Alternatives

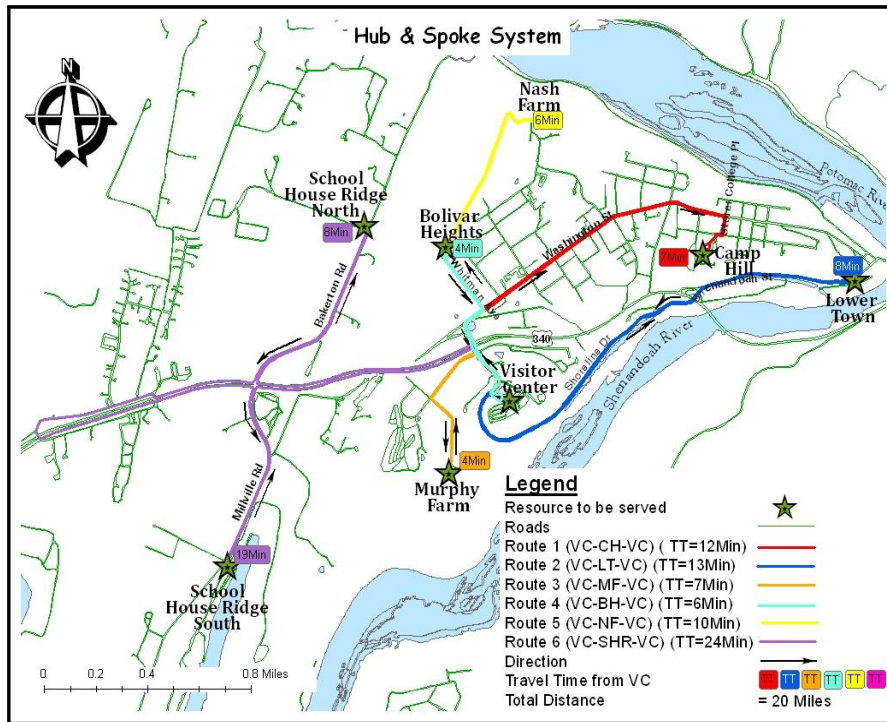


Figure 1, Hub & Spoke System

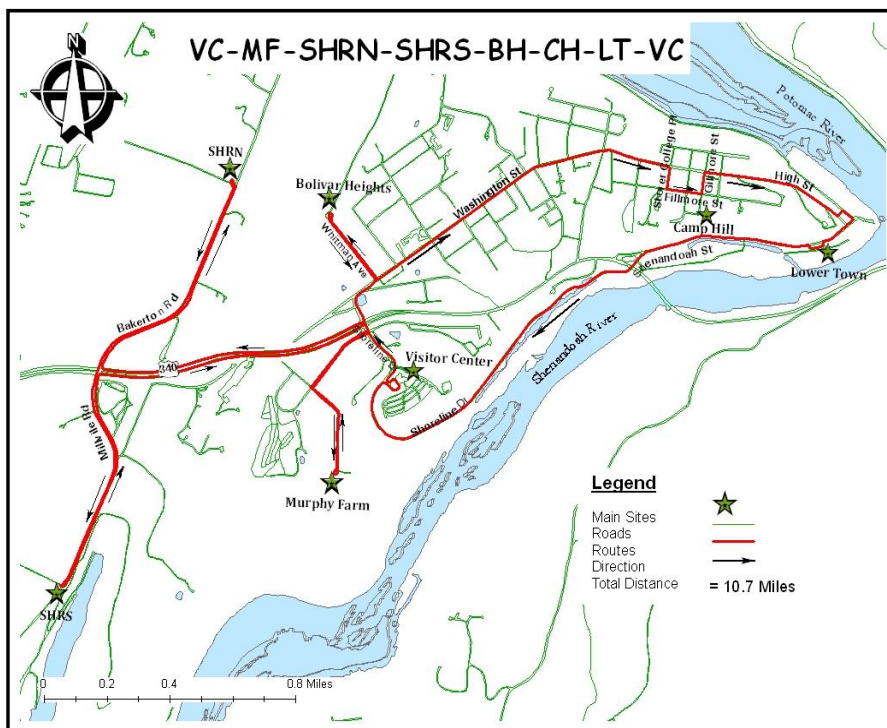


Figure 2, Loop 2 VC-MF-SHRN-SHRS-BH-CH-LT-VC

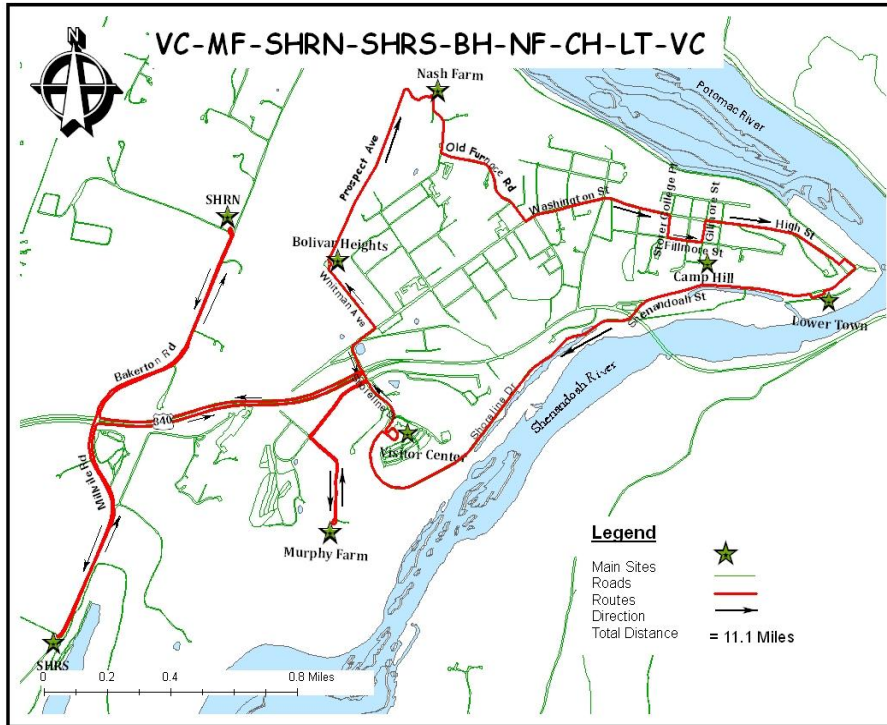


Figure 3, Loop 3 VC-MF-SHRN-SHRS-BH-NF-CH-LT-VC

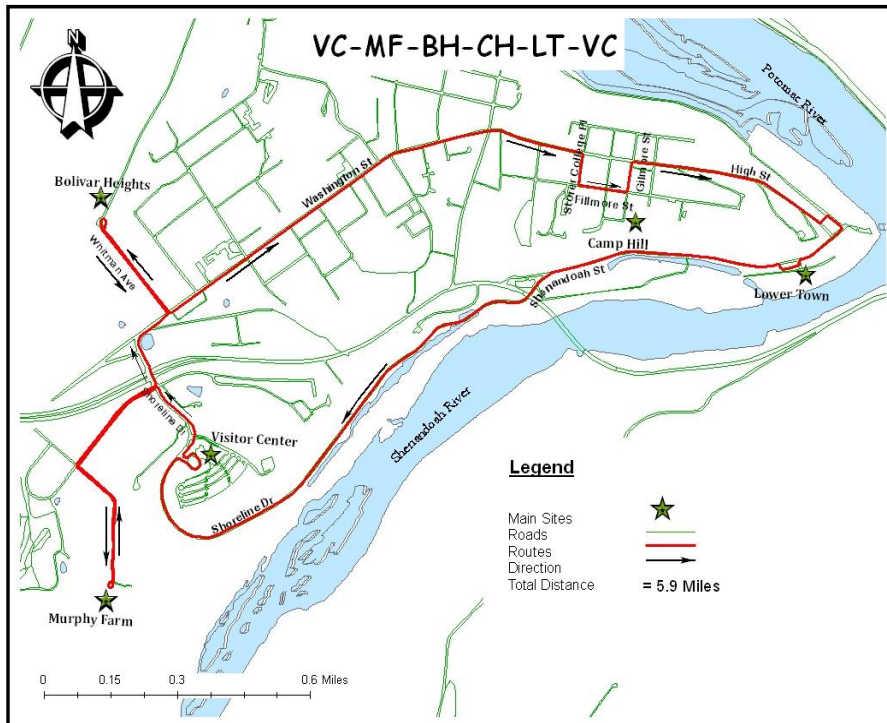


Figure 4, Loop 4 VC-MF-BH-CH-LT-VC

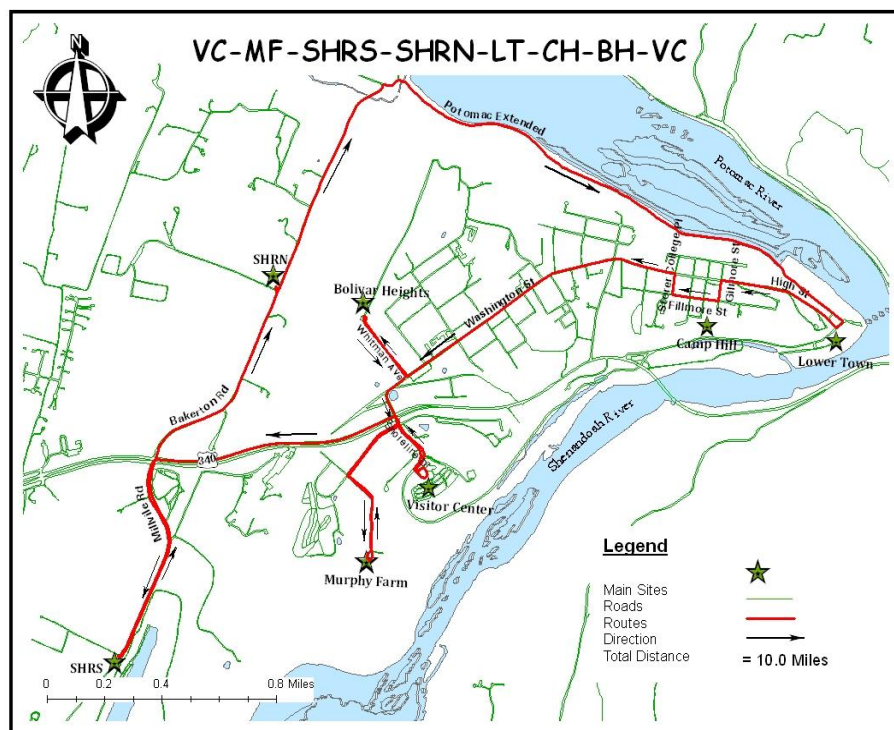


Figure 5, Loop 5 VC-MF-SHRS-SHRN-LT-CH-BH-VC

Appendix B

B. Cost Estimate and Schedule

Headway and Number of Bus Calculation

May - October (Weekday)

12 Pax for new Route

Bus Schedule

Assumptions

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT- VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF- VC (Gold)	VC-BH-SHRN-SHRS- VC (Gold)	VC-MF-BH-CH- LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Round Trip Distance (Miles)	3.9	3.7	5.0	3.7	9.1	8.0	6.1	3.7	5.0	5.0
Average dwell time per stop (minutes)	1	1	1	1	1	1	1	1	1	1
Average driving time (minutes)	15	11	19	11	26	22	23	11	19	17
Number of stops	3	2	4	2	5	4	5	2	4	3
Time to complete one full Route (minutes)	19	13	24	13	31	26	29	13	24	20
Time used	20	14	24	14	30	30	30	14	24	20
Headway (Assumption)	10	10	10	10	15	15	10	10	10	10
Minimum buses required	2	2	3	2	2	2	3	2	3	2
Load Factor (Assumption)	1	1	1	1	1	1	1	1	1	1
Bus Capacity	12	37	12	37	12	12	12	37	37	37
95 percentile hourly ridership	197	197	197	197	197	197	197	197	197	197
20% Ridership Increase (Assumption)	236	236	236	236	236	236	236	236	236	236
Ridership Proportion (Assumption)	50%	100%	50%	50%	25%	25%	50%	50%	100%	100%
Adjusted Ridership for each route	89	178	89	89	45	45	89	89	178	178
Bus per Hour (trip per hr)	7.4	4.4	7.4	2.2	3.8	3.8	7.4	2.2	4.4	4.4
Headway based on demand	8.1	13.7	8.1	27.4	16.0	16.0	8.1	27.4	13.7	13.7
Headway used	8.0	10.0	8.0	20.0	15.0	15.0	8.0	24.0	12.0	12.0
Number of Bus for demand	3	2	3	1	2	2	4	1	2	2
Number of Buses (Max)	3	2	3	2	2	2	4	2	3	2
Number of Buses per Alternative	5		5		2	2	6		3	2

37 Pax for new Route

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT- VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF- VC (Gold)	VC-BH-SHRN-SHRS- VC (Gold)	VC-MF-BH-CH- LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Round Trip Distance (Miles)	3.9	3.7	5.0	3.7	9.1	8.0	6.1	3.7	5.0	5.0
Average dwell time per stop (minutes)	1	1	1	1	1	1	1	1	1	1
Average driving time (minutes)	15	11	19	11	26	22	23	11	19	17
Number of stops	3	2	4	2	5	4	5	2	4	3
Time to complete one full Route (minutes)	19	13	24	13	31	26	29	13	24	20
Time used	20	14	24	14	30	30	30	14	24	20
Headway (Assumption)	10	10	10	10	15	15	10	10	10	10
Minimum buses required	2	2	3	2	2	2	3	2	3	2
Load Factor (Assumption)	1.1	1.1	1	1.1	1	1	1	1.1	1.1	1.1
Bus Capacity	37	37	12	37	12	37	12	37	37	37
95 percentile hourly ridership	197	197	197	197	197	197	197	197	197	197
20% Ridership Increase (Assumption)	236	236	236	236	236	236	236	236	236	236
Ridership Proportion (Assumption)	50%	100%	50%	50%	25%	25%	50%	50%	100%	100%
Adjusted Ridership for each route	89	178	89	89	45	45	89	89	178	178
Bus per Hour (trip per hr)	2.2	4.4	7.4	2.2	3.8	1.2	7.4	2.2	4.4	4.4
Headway based on demand	27.4	13.7	8.1	27.4	16.0	49.3	8.1	27.4	13.7	13.7
Headway used	25.0	10.0	8.0	20.0	15.0	15.0	8.0	20.0	12.0	12.0
Number of Bus for demand	1	2	3	1	2	2	4	1	2	2
Number of Buses (Max)	2	2	3	2	2	2	4	2	3	2
Number of Buses per Alternative	4		5		2	2	6		3	2

May - October (Weekend)

12 Pax for new Route

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT- VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF- VC (Gold)	VC-BH-SHRN-SHRS- VC (Gold)	VC-MF-BH-CH- LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Round Trip Distance (Miles)	3.9	3.7	5.0	3.7	9.1	8.0	6.1	3.7	5.0	5.0
Average dwell time per stop (minutes)	1	1	1	1	1	1	1	1	1	1
Average driving time (minutes)	15	11	19	11	26	22	23	11	19	17
Number of stops	3	2	4	2	5	4	5	2	4	3
Time to complete one full Route (minutes)	19	13	24	13	31	26	29	13	24	20
Time used	20	14	24	14	30	30	30	14	24	20
Headway (Assumption)	10	10	10	10	15	15	10	10	10	10
Minimum buses required	2	2	3	2	2	2	3	2	3	2
Load Factor (Assumption)	1	1.1	1	1.1	1	1	1	1.1	1.1	1.1
Bus Capacity	12	37	12	37	12	12	12	37	37	37
95 percentile hourly ridership	650	650	650	650	650	650	650	650	650	650
20% Ridership Increase (Assumption)	780	780	780	780	780	780	780	780	780	780
Ridership Proportion (Assumption)	50%	100%	50%	50%	25%	25%	50%	50%	100%	100%
Adjusted Ridership for each route	293	585	293	293	147	147	293	293	585	585
Bus per Hour (trip per hr)	24.4	14.4	24.4	7.2	12.3	12.3	24.4	7.2	14.4	14.4
Headway based on demand	2.5	4.2	2.5	8.3	4.9	4.9	2.5	8.3	4.2	4.2
Headway used	2.0	4.0	2.0	8.0	4.0	4.0	2.0	8.0	4.0	4.0
Number of Bus for demand	10	4	12	2	8	8	15	2	6	5
Number of Buses (Max)	10	4	12	2	8	8	15	2	6	5
Number of Buses per Alternative	14		14		8	8	17		6	5

37 Pax for new Route

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT- VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF- VC (Gold)	VC-BH-SHRN-SHRS- VC (Gold)	VC-MF-BH-CH- LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Round Trip Distance (Miles)	3.9	3.7	5.0	3.7	9.1	8.0	6.1	3.7	5.0	5.0
Average dwell time per stop (minutes)	1	1	1	1	1	1	1	1	1	1
Average driving time (minutes)	15	11	19	11	26	22	23	11	19	17
Number of stops	3	2	4	2	5	4	5	2	4	3
Time to complete one full Route (minutes)	19	13	24	13	31	26	29	13	24	20
Time used	20	14	24	14	30	30	30	14	24	20
Headway (Assumption)	10	10	10	10	15	15	10	10	10	10
Minimum buses required	2	2	3	2	2	2	3	2	3	2
Load Factor (Assumption)	1.1	1.1	1	1.1	1	1	1	1.1	1.1	1.1
Bus Capacity	37	37	12	37	12	37	12	37	37	37
95 percentile hourly ridership	650	650	650	650	650	650	650	650	650	650
20% Ridership Increase (Assumption)	780	780	780	780	780	780	780	780	780	780
Ridership Proportion (Assumption)	50%	100%	50%	50%	25%	25%	50%	50%	100%	100%
Adjusted Ridership for each route	293	585	293	293	147	147	293	293	585	585
Bus per Hour (trip per hr)	7.2	14.4	24.4	7.2	12.3	4.0	24.4	7.2	14.4	14.4
Headway based on demand	8.3	4.2	2.5	8.3	4.9	15.1	2.5	8.3	4.2	4.2
Headway used	8.0	4.0	2.0	8.0	4.0	15.0	2.0	8.0	4.0	4.0
Number of Bus for demand	3	4	12	2	8	2	15	2	6	5
Number of Buses (Max)	3	4	12	2	8	2	15	2	6	5
Number of Buses per Alternative	7		14		8	2	17		6	5

November & April (Weekday)**37 Pax for Blue Route**

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6) (Replaced by VC-LT-VC)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)
Round Trip Distance (Miles)	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Average dwell time per stop (minutes)	-	1	-	1	-	-	-	1	1	1
Average driving time (minutes)	-	11	-	11	-	-	-	11	11	11
Number of stops	-	2	-	2	-	-	-	2	2	2
Time to complete one full Route (minutes)	-	13	-	13	-	-	-	13	13	13
Time used	-	14	-	14	-	-	-	14	14	14
Headway (Assumption)	-	10	-	10	-	-	-	10	10	10
Minimum buses required	-	2	-	2	-	-	-	2	2	2
Load Factor (Assumption)	-	1	-	1	-	-	-	1	1	1
Bus Capacity	-	37	-	37	-	-	-	37	37	37
95 percentile hourly ridership	-	139	-	139	-	-	-	139	139	139
20% Ridership Increase (Assumption)	-	167	-	167	-	-	-	167	167	167
Ridership Proportion (Assumption)	-	100%	-	100%	-	-	-	100%	100%	100%
Adjusted Ridership for each route	-	126	-	126	-	-	-	126	126	126
Bus per Hour (trip per hr)	-	3.1	-	3.1	-	-	-	3.1	3.1	3.1
Headway based on demand	-	19.4	-	19.4	-	-	-	19.4	19.4	19.4
Headway used	-	15.0	-	15.0	-	-	-	15.0	15.0	15.0
Number of Bus for demand	-	1	-	1	-	-	-	1	1	1
Number of Buses (Max)		2		2				2	2	2
Number of Buses per Alternative	2		2		0	0	2		2	2

November & April (Weekend)**37 Pax for Blue Route**

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6) (Replaced by VC-LT-VC)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)
Round Trip Distance (Miles)	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Average dwell time per stop (minutes)	-	1	-	1	-	-	-	1	1	1
Average driving time (minutes)	-	11	-	11	-	-	-	11	11	11
Number of stops	-	2	-	2	-	-	-	2	2	2
Time to complete one full Route (minutes)	-	13	-	13	-	-	-	13	13	13
Time used	-	14	-	14	-	-	-	14	14	14
Headway (Assumption)	-	10	-	10	-	-	-	10	10	10
Minimum buses required	-	2	-	2	-	-	-	2	2	2
Load Factor (Assumption)	-	1.1	-	1.1	-	-	-	1.1	1.1	1.1
Bus Capacity	-	37	-	37	-	-	-	37	37	37
95 percentile hourly ridership	-	427	-	427	-	-	-	427	427	427
20% Ridership Increase (Assumption)	-	512	-	512	-	-	-	512	512	512
Ridership Proportion (Assumption)	-	100%	-	100%	-	-	-	100%	100%	100%
Adjusted Ridership for each route	-	385	-	385	-	-	-	385	385	385
Bus per Hour (trip per hr)	-	9.5	-	9.5	-	-	-	9.5	9.5	9.5
Headway based on demand	-	6.3	-	6.3	-	-	-	6.3	6.3	6.3
Headway used	-	6.0	-	6.0	-	-	-	6.0	6.0	6.0
Number of Bus for demand	-	3	-	3	-	-	-	3	3	3
Number of Buses (Max)		3		3				3	3	3
Number of Buses per Alternative	3		3		0	0	3		3	3

March (Weekday)**37 Pax for Blue Route**

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6) (Replaced by VC-LT-VC)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT- VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF- VC (Gold)	VC-BH-SHRN-SHRS- VC (Gold)	VC-MF-BH-CH- LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)
Round Trip Distance (Miles)	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Average dwell time per stop (minutes)	-	1	-	1	-	-	-	1	1	1
Average driving time (minutes)	-	11	-	11	-	-	-	11	11	11
Number of stops	-	2	-	2	-	-	-	2	2	2
Time to complete one full Route (minutes)	-	13	-	13	-	-	-	13	13	13
Time used	-	14	-	14	-	-	-	14	14	14
Headway (Assumption)	-	14	-	14	-	-	-	14	14	14
Minimum buses required	-	1	-	1	-	-	-	1	1	1
Load Factor (Assumption)	-	1.1	-	1.1	-	-	-	1.1	1.1	1.1
Bus Capacity	-	37	-	37	-	-	-	37	37	37
95 percentile hourly ridership	-	149	-	149	-	-	-	149	149	149
20% Ridership Increase (Assumption)	-	179	-	179	-	-	-	179	179	179
Ridership Proportion (Assumption)	-	100%	-	100%	-	-	-	100%	100%	100%
Adjusted Ridership for each route	-	135	-	135	-	-	-	135	135	135
Bus per Hour (trip per hr)	-	3.3	-	3.3	-	-	-	3.3	3.3	3.3
Headway based on demand	-	18.1	-	18.1	-	-	-	18.1	18.1	18.1
Headway used	-	16.0	-	16.0	-	-	-	16.0	16.0	16.0
Number of Bus for demand	-	1	-	1	-	-	-	1	1	1
Number of Buses (Max)		1		1				1	1	1
Number of Buses per Alternative	1		1		0	0	1		1	1

March (Weekend)**37 Pax for Blue Route**

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6) (Replaced by VC-LT-VC)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT- VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF- VC (Gold)	VC-BH-SHRN-SHRS- VC (Gold)	VC-MF-BH-CH- LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)
Round Trip Distance (Miles)	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Average dwell time per stop (minutes)	-	1	-	1	-	-	-	1	1	1
Average driving time (minutes)	-	11	-	11	-	-	-	11	11	11
Number of stops	-	2	-	2	-	-	-	2	2	2
Time to complete one full Route (minutes)	-	13	-	13	-	-	-	13	13	13
Time used	-	14	-	14	-	-	-	14	14	14
Headway (Assumption)	-	12	-	12	-	-	-	12	12	12
Minimum buses required	-	2	-	2	-	-	-	2	2	2
Load Factor (Assumption)	-	1.1	-	1.1	-	-	-	1.1	1.1	1.1
Bus Capacity	-	37	-	37	-	-	-	37	37	37
95 percentile hourly ridership	-	411	-	411	-	-	-	411	411	411
20% Ridership Increase (Assumption)	-	493	-	493	-	-	-	493	493	493
Ridership Proportion (Assumption)	-	100%	-	100%	-	-	-	100%	100%	100%
Adjusted Ridership for each route	-	370	-	370	-	-	-	370	370	370
Bus per Hour (trip per hr)	-	9.1	-	9.1	-	-	-	9.1	9.1	9.1
Headway based on demand	-	6.6	-	6.6	-	-	-	6.6	6.6	6.6
Headway used	-	6.0	-	6.0	-	-	-	6.0	6.0	6.0
Number of Bus for demand	-	3	-	3	-	-	-	3	3	3
Number of Buses (Max)		3		3				3	3	3
Number of Buses per Alternative	3		3		0	0	3		3	3

December - February (Weekday + Weekend)

37 Pax for Blue Route

Bus Schedule

	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6) (Replaced by VC-LT-VC)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)
Round Trip Distance (Miles)	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Average dwell time per stop (minutes)	-	1	-	1	-	-	-	1	1	1
Average driving time (minutes)	-	11	-	11	-	-	-	11	11	11
Number of stops	-	2	-	2	-	-	-	2	2	2
Time to complete one full Route (minutes)	-	13	-	13	-	-	-	13	13	13
Time used	-	14	-	14	-	-	-	14	14	14
Headway (Assumption)	-	14	-	14	-	-	-	14	14	14
Minimum buses required	-	1	-	1	-	-	-	1	1	1
Load Factor (Assumption)	-	1.1	-	1.1	-	-	-	1.1	1.1	1.1
Bus Capacity	-	37	-	37	-	-	-	37	37	37
95 percentile hourly ridership	-	68	-	68	-	-	-	68	68	68
20% Ridership Increase (Assumption)	-	82	-	82	-	-	-	82	82	82
Ridership Proportion (Assumption)	-	100%	-	100%	-	-	-	100%	100%	100%
Adjusted Ridership for each route	-	62	-	62	-	-	-	62	62	62
Bus per Hour (trip per hr)	-	1.5	-	1.5	-	-	-	1.5	1.5	1.5
Headway based on demand	-	39.4	-	39.4	-	-	-	39.4	39.4	39.4
Headway used	-	30.0	-	30.0	-	-	-	30.0	30.0	30.0
Number of Bus for demand	-	1	-	1	-	-	-	1	1	1
Number of Buses (Max)		1		1				1	1	1
Number of Buses per Alternative	1		1		0	0	1		1	1

Miles and Hours Operated

12 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	3	2	3	2	2	2	4	2	3	2
Hours of Operation	11	11	11	11	11	11	11	11	11	11
Number of Days	131	131	131	131	131	131	131	131	131	131
Mile per Trip	3.9	3.7	5	3.7	9.1	8	6.1	3.7	5	5
Trip per Hour	7.4	4.4	7.4	2.2	3.8	3.8	7.4	2.2	4.4	4.4
VMT	41681	23318	53437	11659	49174	43230	65193	11659	31511	31511
Total Vehicle Hour Operated	4323	2882	4323	2882	2882	2882	5764	2882	4323	2882

37 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	2	2	3	2	2	2	4	2	3	2
Hours of Operation	11	11	11	11	11	11	11	11	11	11
Number of Days	131	131	131	131	131	131	131	131	131	131
Mile per Trip	3.9	3.7	5	3.7	9.1	8	6.1	3.7	5	5
Trip per Hour	2.2	4.4	7.4	2.2	3.8	1.2	7.4	2.2	4.4	4.4
VMT	12289	23318	53437	11659	49174	14021	65193	11659	31511	31511
Total Vehicle Hour Operated	2882	2882	4323	2882	2882	2882	5764	2882	4323	2882

May - October (Weekend)

12 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	10	4	12	2	8	8	15	2	6	5
Hours of Operation	11	11	11	11	11	11	11	11	11	11
Number of Days	53	53	53	53	53	53	53	53	53	53
Mile per Trip	3.9	3.7	5	3.7	9.1	8	6.1	3.7	5	5
Trip per Hour	24.4	14.4	24.4	7.2	12.3	12.3	24.4	7.2	14.4	14.4
VMT	55516	31005	71175	15529	64990	57134	86833	15529	41899	41899
Total Vehicle Hour Operated	5830	2332	6996	1166	4664	4664	8745	1166	3498	2915

37 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	3	4	12	2	8	2	15	2	6	5
Hours of Operation	11	11	11	11	11	11	11	11	11	11
Number of Days	53	53	53	53	53	53	53	53	53	53
Mile per Trip	3.9	3.7	5	3.7	9.1	8	6.1	3.7	5	5
Trip per Hour	7.2	14.4	24.4	7.2	12.3	4.0	24.4	7.2	14.4	14.4
VMT	16368	31005	71175	15529	64990	18530	86833	15529	41899	41899
Total Vehicle Hour Operated	1749	2332	6996	1166	4664	1166	8745	1166	3498	2915

November & April (Weekday)

37 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	-	2	-	2	-	-	-	2	2	2
Hours of Operation	-	10	-	10	-	-	-	10	10	10
Number of Days	-	42	-	42	-	-	-	42	42	42
Mile per Trip	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Trip per Hour	-	3.1	-	3.1	-	-	-	3.1	3.1	3.1
VMT	-	4811	-	4811	-	-	-	4811	4811	4811
Total Vehicle Hour Operated	-	840	-	840	-	-	-	840	840	840

November & April (Weekend)

37 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	-	3	-	3	-	-	-	3	3	3
Hours of Operation	-	10	-	10	-	-	-	10	10	10
Number of Days	-	17	-	17	-	-	-	17	17	17
Mile per Trip	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Trip per Hour	-	9.5	-	9.5	-	-	-	9.5	9.5	9.5
VMT	-	5950	-	5950	-	-	-	5950	5950	5950
Total Vehicle Hour Operated	-	510	-	510	-	-	-	510	510	510

March (Weekday)

37 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	-	1	-	1	-	-	-	1	1	1
Hours of Operation	-	10	-	10	-	-	-	10	10	10
Number of Days	-	42	-	42	-	-	-	42	42	42
Mile per Trip	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Trip per Hour	-	3.3	-	3.3	-	-	-	3.3	3.3	3.3
VMT	-	5155	-	5155	-	-	-	5155	5155	5155
Total Vehicle Hour Operated	-	420	-	420	-	-	-	420	420	420

March (Weekend)

37 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	-	3	-	3	-	-	-	3	3	3
Hours of Operation	-	10	-	10	-	-	-	10	10	10
Number of Days	-	17	-	17	-	-	-	17	17	17
Mile per Trip	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Trip per Hour	-	9.1	-	9.1	-	-	-	9.1	9.1	9.1
VMT	-	5718	-	5718	-	-	-	5718	5718	5718
Total Vehicle Hour Operated	-	510	-	510	-	-	-	510	510	510

December - February (Weekday + Weekend)

12 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
Number of Buses (Max)	-	1	-	1	-	-	-	1	1	1
Hours of Operation	-	10	-	10	-	-	-	10	10	10
Number of Days	-	42	-	42	-	-	-	42	42	42
Mile per Trip	-	3.7	-	3.7	-	-	-	3.7	3.7	3.7
Trip per Hour	-	1.5	-	1.5	-	-	-	1.5	1.5	1.5
VMT	-	2367	-	2367	-	-	-	2367	2367	2367
Total Vehicle Hour Operated	-	420	-	420	-	-	-	420	420	420

Total VMT & Hours of Operation

12 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
FY VMT	97197	78324	124612	51189	114164	100364	152026	51189	97410	97410
FY VMT For Alt	175521		175801		114164	100364	203215		97410	97410
FY Hous of Operation	10153	7914	11319	6748	7546	7546	14509	6748	10521	8497
FY Hours of Operation	18067		18067		7546	7546	21257		10521	8497

37 Pax for new Route	Comb 1 (Alt 1)		Comb 2 (Alt 2)		Comb 3 (Alt 3)	Comb 4 (Alt 4)	Comb 5 (Alt 5)		Loop 1 (Alt 6)	Current (Alt 7)
	VC-BH-CH-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-SHRN-SHRS-MF-VC (Gold)	VC-BH-SHRN-SHRS-VC (Gold)	VC-MF-BH-CH-LT-VC (Red)	VC-LT-VC (Blue)	VC-BH-CH-LT-VC (Red)	VC-BH-LT-VC (Blue)
FY VMT	28657.6	78324	124611.7	51189	114164.1	32550.5	152026.2	51189	97410	97410
FY VMT For Alt	106982		175801		114164	32550	203215		97410	97410
FY Hous of Operation	4631	7914	11319	6748	7546	4048	14509	6748	10521	8497
FY Hours of Operation	12545		18067		7546	4048	21257		10521	8497

Cost of Alternatives

Current cost and hours of operation	FY 2010		FY 2011		
	37 pax Mileage	12 pax Mileage	37 pax Mileage	12 pax Mileage	
Total Shuttle Miles	60665	4025	56367	5748	Existing Data
Avg Fuel Price/Gal	\$3.50	\$3.50	\$4.00	\$4.00	
MPG	4.8	9.2	4.8	9.2	
Gallons used	12639	438	11743	625	
Total Fuel Cost	\$44,235	\$1,531	\$46,973	\$2,499	for check
FY Total Fuel Cost	\$45,766		\$49,472		
Consumables (eg. Fuel/Lub/Tires...)	\$57,000.00				
Off Campus Vehicle Maintenance	\$7,680.00				
Total FY miles traveled	64690		62115		
Total FY Hours Operated	7797				
Total FY Automotive Worker Hours	2214				

Calculated VMT and Driver Hours

VMT and Driver Hours	12 Pax for new Route	37 Pax for new Route
Combination 1 (Alt 1) Total FY VMT	175521	106982
Combination 1 (Alt 1) Vehicle Hours Operated	18067	12545
Combination 2 (Alt 2) Total FY VMT	175801	175801
Combination 2 (Alt 2) Vehicle Hours Operated	18067	18067
Combination 3 (Alt 3) Total FY VMT	114164	114164
Combination 3 (Alt 3) Vehicle Hours Operated	7546	7546
Combination 4 (Alt 4) Total FY VMT	100364	32550
Combination 4 (Alt 4) Vehicle Hours Operated	7546	4048
Combination 5 (Alt 5) Total FY VMT	203215	203215
Combination 5 (Alt 5) Vehicle Hours Operated	21257	21257
Loop 1 (Alt 6) Total FY VMT	97410	97410
Loop 1 (Alt 6) Vehicle Hours Operated	10521	10521
Current (Alt 7) Total FY VMT	97410	97410
Current (Alt 7) Vehicle Hours Operated	8497	8497

Current Condition

Cost Items	2010	2011	2012	2013	2014
Fuel (6.25% inflation)	\$45,766	\$48,627	\$51,666	\$54,895	\$58,326
Consumables Other than Fuel (3% inflation)	\$11,234	\$11,571	\$11,918	\$12,276	\$12,644
Off Campus Vehicle Maintenace (3% inflation)	\$7,680.00	\$7,910	\$8,148	\$8,392	\$8,644
Insurance (3% inflation)	\$7,500.00	\$7,500.00	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$164,553.99	\$168,964.04	\$173,492.27	\$178,141.87	\$182,916.07
Automotive Worker Cost (2.68% inflation)	\$69,853.22	\$71,725.29	\$73,647.52	\$75,621.28	\$77,647.93
Total	\$306,587	\$316,297	\$326,596	\$337,282	\$348,373

Cost per Mile Traveled	\$4.74	\$5.09	\$5.26	\$5.43	\$5.61
Visitors per FY	265401	256663	259230	261822	264440
Shuttle passengers per FY	165218	158034	189641	227569	273083
Paying Visitors per FY	154059	155599	157155	158727	160314
Cost per Visitor	\$1.16	\$1.23	\$1.26	\$1.29	\$1.32
Cost per Shuttle passenger	\$1.86	\$2.00	\$1.72	\$1.48	\$1.28
Cost per paying visitor	\$1.93	\$1.97	\$2.02	\$2.06	\$2.11

Per mile and per hour cost

Fuel cost per mile (6.25% inflation) per mile	\$0.71	\$0.75	\$0.80	\$0.85	\$0.90
Driver Cost (2.68% inflation) per hr	\$21.10	\$21.67	\$22.25	\$22.85	\$23.46
Automotive Worker Cost (2.68% inflation) per hr	\$31.55	\$32.40	\$33.26	\$34.16	\$35.07
Off Campus Maintenace cost per mile	\$0.12	\$0.12	\$0.13	\$0.13	\$0.13
Consumables Other than Fuel (3% inflation) Per mile	\$0.17	\$0.18	\$0.18	\$0.19	\$0.20

Assumptions

Similar shuttle miles per FY as 2011 were assumed for FY 12,13 & 14

A 1% Visitor growth increase was assumed to project FY 2012,13 & 14

A 20% Shuttle Passenger growth increase was assumed for FY 2012,13,14

Similar Automotive Worker hours were assumed for FY 2011,12,13, &14

Cost per FY for Each Alternative	Using 37 pax for new route			Using 12 pax for new route		
	2012	2013	2014	2012	2013	2014
Combination 1 (Alt 1)						
Fuel (6.25% inflation)	\$85,442	\$90,783	\$96,457	\$140,183	\$148,944	\$158,253
Consumables Other than Fuel (3% inflation)	\$19,709	\$20,301	\$20,910	\$32,337	\$33,307	\$34,306
Off Campus Vehicle Maintenace	\$13,474	\$13,879	\$14,295	\$22,107	\$22,770	\$23,453
Insurance	\$7,725	\$7,957	\$8,195	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$279,141	\$286,622	\$294,303	\$402,012	\$412,786	\$423,848
Automotive Worker Cost (2.68% inflation)	\$73,648	\$75,621	\$77,648	\$73,648	\$75,621	\$77,648
Cost per FY	\$479,140	\$495,162	\$511,808	\$678,010	\$701,384	\$725,704
Combination 2 (Alt 2)						
Fuel (6.25% inflation)	\$140,406	\$149,181	\$158,505	\$140,406	\$149,181	\$158,505
Consumables Other than Fuel (3% inflation)	\$32,388	\$33,360	\$34,361	\$32,388	\$33,360	\$34,361
Off Campus Vehicle Maintenace	\$22,142	\$22,806	\$23,491	\$22,142	\$22,806	\$23,491
Insurance	\$7,725	\$7,957	\$8,195	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$402,012	\$412,786	\$423,848	\$402,012	\$412,786	\$423,848
Automotive Worker Cost (2.68% inflation)	\$73,648	\$75,621	\$77,648	\$73,648	\$75,621	\$77,648
Cost per FY	\$678,320	\$701,711	\$726,048	\$678,320	\$701,711	\$726,048
Combination 3 (Alt 3)						
Fuel (6.25% inflation)	\$91,179	\$96,878	\$102,932	\$91,179	\$96,878	\$102,932
Consumables Other than Fuel (3% inflation)	\$21,033	\$21,664	\$22,314	\$21,033	\$21,664	\$22,314
Off Campus Vehicle Maintenace	\$14,379	\$14,810	\$15,255	\$14,379	\$14,810	\$15,255
Insurance	\$7,725	\$7,957	\$8,195	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$167,907	\$172,407	\$177,028	\$167,907	\$172,407	\$177,028
Automotive Worker Cost (2.68% inflation)	\$73,648	\$75,621	\$77,648	\$73,648	\$75,621	\$77,648
Cost per FY	\$375,870	\$389,337	\$403,372	\$375,870	\$389,337	\$403,372

Cost per FY for Each Alternative	Using 37 pax for new route			Using 12 pax for new route		
	2012	2013	2014	2012	2013	2014
Combination 4 (Alt 4)						
Fuel (6.25% inflation)	\$25,997	\$27,622	\$29,348	\$80,157	\$85,167	\$90,490
Consumables Other than Fuel (3% inflation)	\$5,997	\$6,177	\$6,362	\$18,490	\$19,045	\$19,616
Off Campus Vehicle Maintenace	\$4,100	\$4,223	\$4,349	\$12,641	\$13,020	\$13,411
Insurance	\$7,725	\$7,957	\$8,195	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$90,073	\$92,487	\$94,965	\$167,907	\$172,407	\$177,028
Automotive Worker Cost (2.68% inflation)	\$73,648	\$75,621	\$77,648	\$73,648	\$75,621	\$77,648
Cost per FY	\$207,539	\$214,086	\$220,868	\$360,568	\$373,217	\$386,388
Combination 5 (Alt 5)						
Fuel (6.25% inflation)	\$162,301	\$172,445	\$183,223	\$162,301	\$172,445	\$183,223
Consumables Other than Fuel (3% inflation)	\$37,439	\$38,562	\$39,719	\$37,439	\$38,562	\$39,719
Off Campus Vehicle Maintenace	\$25,595	\$26,363	\$27,154	\$25,595	\$26,363	\$27,154
Insurance	\$7,725	\$7,957	\$8,195	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$472,993	\$485,669	\$498,685	\$472,993	\$485,669	\$498,685
Automotive Worker Cost (2.68% inflation)	\$73,648	\$75,621	\$77,648	\$73,648	\$75,621	\$77,648
Cost per FY	\$779,700	\$806,617	\$834,624	\$779,700	\$806,617	\$834,624
Loop 1 (Alt 6)						
Fuel (6.25% inflation)	\$77,798	\$82,661	\$87,827	\$77,798	\$82,661	\$87,827
Consumables Other than Fuel (3% inflation)	\$17,946	\$18,485	\$19,039	\$17,946	\$18,485	\$19,039
Off Campus Vehicle Maintenace	\$12,269	\$12,637	\$13,016	\$12,269	\$12,637	\$13,016
Insurance	\$7,725	\$7,957	\$8,195	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$234,104	\$240,378	\$246,821	\$234,104	\$240,378	\$246,821
Automotive Worker Cost (2.68% inflation)	\$73,648	\$75,621	\$77,648	\$73,648	\$75,621	\$77,648
Cost per FY	\$423,490	\$437,739	\$452,546	\$423,490	\$437,739	\$452,546
Current (Alt 7)						
Fuel (6.25% inflation)	\$77,798	\$82,661	\$87,827	\$77,798	\$82,661	\$87,827
Consumables Other than Fuel (3% inflation)	\$17,946	\$18,485	\$19,039	\$17,946	\$18,485	\$19,039
Off Campus Vehicle Maintenace	\$12,269	\$12,637	\$13,016	\$12,269	\$12,637	\$13,016
Insurance	\$7,725	\$7,957	\$8,195	\$7,725	\$7,957	\$8,195
Driver Cost (2.68% inflation)	\$189,068	\$194,135	\$199,338	\$189,068	\$194,135	\$199,338
Automotive Worker Cost (2.68% inflation)	\$73,648	\$75,621	\$77,648	\$73,648	\$75,621	\$77,648
Cost per FY	\$378,454	\$391,495	\$405,063	\$378,454	\$391,495	\$405,063

Number of Paying Visitors Calculation

Type of Pass	% of Total Revenue	2010 Annual Revenue	Annual Revenue Adjusted
Vehicle/Individual Pass (709)	83.1%	\$298,949	\$299,027
Harpers Ferry NPS (704P)	2.3%	\$8,119	\$8,119
IA Annual (741)	7.5%	\$26,809	\$26,809
IA Senior (713)	3.5%	\$12,456	\$12,456
Commercial Tour Fee (711)	3.7%	\$13,200	\$13,200
Total Revenue			\$359,611

Source: ATS
Proforma

FY 2010

Vehicle Types	FY 2010	% of Vehicles	Fee by Vehicle Type	Weighted Fee
# of cars	69245	98.8%	\$6	\$5.98
# of single visitors (by foot or by bike)	820	1.2%	\$4	
# mini buses	3	3.3%	\$60	\$147.07
# tour buses	89	96.7%	\$150	

Pass Revenues	Annual Revenue Adjusted	Fee by Pass Type	Number of Paying Vehicles by Pass	Number of Paying Vehicles	% of Paying Vehicles
Entrance fee (vehicle pass)	\$299,027	\$6.0	50033	49447	0.74
Entrance fee (individual pass)				586	0.71
Harpers Ferry NPS (704P)	\$8,119	\$25.0	325	325	
IA Annual (741)	\$26,809	\$80.0	335	335	
IA Senior (713)	\$12,456	\$10.0	1246	1246	
Entrance fee (mini-bus, Commercial pass)	\$13,200	\$147.07	90	3	0.98
Entrance fee (tour bus, Commercial pass)				87	0.98
Total	\$359,611				

Total Visitors	2010	2011	2012	2013	2014
# of cars	69245	69937	70637	71343	72057
# of single visitors (by foot or by bike)	820	828	836	845	853
# mini buses	3	3	3	3	3
# tour buses	89	90	91	92	93
Assumed Visitation growth rate		1%	1%	1%	1%

Paying Vehicles

# of cars	51353	51866	52385	52909	53438
# of single visitors (by foot or by bike)	586	591	597	603	609
# mini buses	3	3	3	3	3
# tour buses	87	88	89	89	90

Assumptions

persons per car	3	3	3	3	3
Persons per mini bus	25	25	25	25	25
persons per tour bus	50	50	50	50	50

Paying Visitors

# of visitors in vehicles	154059	155599	157155	158727	160314
# of single visitors (by foot or by bike)	586	591	597	603	609
# mini buses	73	74	75	75	76
# tour buses	4341	4385	4429	4473	4518
Total	159059	160650	162256	163879	165517

Appendix C

C. Dwell Time and Bus Capacity Calculations

Dwell time is the amount of time a bus spends for alighting and boarding passengers at transit stops. (1) Many factors can influence dwell time, however for this study only passenger demand and loading for the existing route (VC to BH to LT) is used. The formula used to compute dwell time (t_d) is:

Where

t_d = dwell time (s),
 P_a = alighting passengers per bus through busiest door (p),
 t_a = passenger alighting time (s/p),
 P_b = boarding passengers per bus through busiest door (p),
 t_b = passenger boarding time (s/p), and
 t_{oc} = door opening and closing time (s).

For conventional bus with two doors

$$t_a = 0.9s/p$$

$$t_b = 1.2s/p$$

$$t_{oc} = 4s \text{ (Typical value 2s to 5sec)}$$

$$P_a = P_b = 22 \text{ (taking the average passenger per bus during a maximum visitation month)}$$

$$t_d = 22 \times 0.9 + 22 \times 1.2 + 4 = 50s$$

For conventional bus with one door

$$t_a = 1.7s/p$$

$$t_b = 2s/p$$

$$t_{oc} = 4s \text{ (Typical value 2s to 5sec)}$$

$$P_a = P_b = 12 \text{ (assuming passenger volume equals bus capacity)}$$

$$t_d = 12 \times 1.7 + 12 \times 2.0 + 4 = 48s$$

Based on these calculations the dwell times for 37pax and 12pax buses are 50s and 48s. However, since dwell times usually show high variability and for convenience of further calculations the dwell times are rounded to 1 minute.

Appendix D

D. Data Collection Sheet

Traffic Count Sheet

Date

Time

Collected By

Comment

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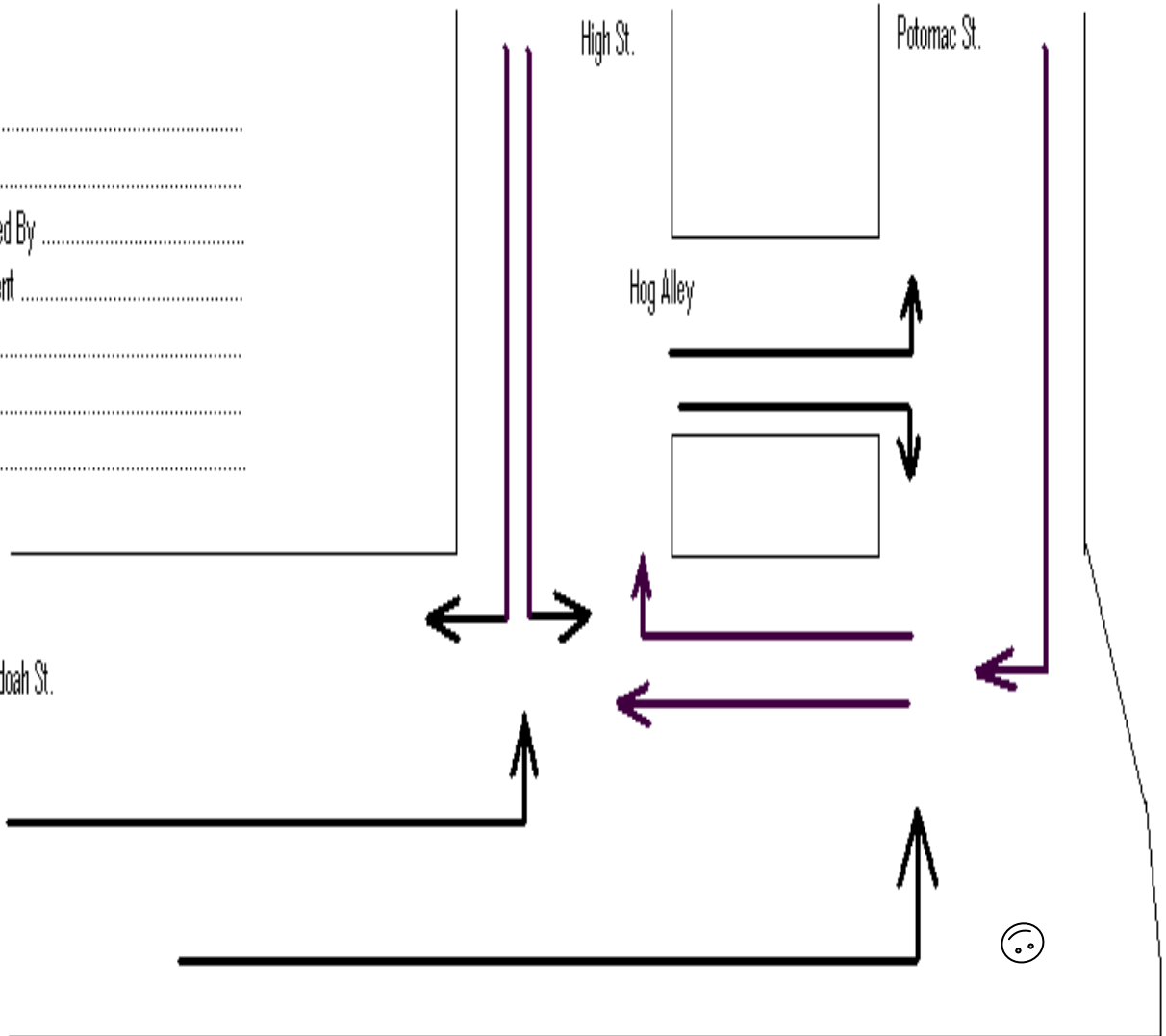
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Shenandoah St.

High St.

Potomac St.

Hog Alley



Appendix E

Educational Tour Data Collection Sheet

Date	Group Name/School	Grade Level	Number of Buses	Type of Buses	No of Students	Arrival Time	Departure Time	Comments

General Questions

Are there any educational tour groups that use the park's transit system?

What criteria do you use to assign dates, arrival and departure times for each educational tour group?

Which days are not allowed for educational tour? Why?

Appendix F

E. Public comment Summary

Synopsis of 35 Written Comments						
37 Different Comment Categories (Boxes)						
12	14	8	16	11	19	80
wants Route 9 Bike trail connection WW <i>bike</i>	wants boater/river access allow for Private WW <i>river</i>	wants A1Stadt Hill to KOA Trail & Bike route (KOA, Cliffside, Customs trails) WW, P <i>bike / hike</i>	wants Bus thru Towns w/stops WWW, PPP, E <i>bus</i>	wants Camp Hill Alt 4 turn around W, E, S <i>bus</i>	wants Mt Bike Routes on MF, SHR, JRF (Park Neg) W, P <i>bike</i>	total comment on modes 19
wants Blue Ridge Acres trail to AT river W <i>hike</i>	wants Shen River Hiking Trail trail LT to Bull Falls WW, S <i>hike</i>	wants Quality Sidewalks Camp Hill to LT W <i>hike</i>	Against Buses thru Towns (Neg) W, P, E, S <i>bus</i>	wants 340 Underpass/Old Bakerton Road W, S <i>bike / hike</i>	wants Fees to be Increased for ATS W, E <i>bus</i>	13
wants Small Bus thru towns WW <i>bus</i>	wants Bike Loop to LT W <i>bike</i>	wants Horse Trails SHR N & S W <i>horse</i>	wants Improve BB staircase to ramp W <i>bike / hike</i>	wants Bus Stop @ 340 Parking Lot for Paddlers W <i>river</i>	wants Bike Trail and River Access Potomac St Extended PPPP, PP <i>bike / hike / river</i>	12
wants Murphy Farm River Access PPPP,P <i>river</i>	wants Park Commercial river Access allowed for Private boaters too PPPP,P <i>river</i>	wants Additional River Take Outs on MD & VA Potomac River P <i>river</i>	wants Hard Parking @ Dam 3 for Bikes and boats P <i>bike / river</i>	wants Improve take-out parking Potomac Wayside (3 spaces) P <i>river</i>	wants Improved 340 & Millville intersechn w/ light to get access to battlefields with bike lanes PPPP, S <i>bike / hike</i>	18
wants Extra Bus charges to SHR-N & S P <i>bus</i>	wants Use Buses thru town on Trial basis (1-2yrs) P, E <i>bus</i>	wants Combination Route 5 P <i>bus</i>	wants Loop Route 1 P <i>bus</i>	wants Camp Hill Alt Turn Around 1 P, S, E <i>bus</i>	Against One Way Traffic Flow (Neg) P, S <i>bike / bus</i>	10
wants Segway Rentals in Town P <i>segway</i>	wants Virginius Island Bike Route (Park Neg) P <i>bike</i>	wants Zip Line thru tree cuts from BH to LBH P <i>zip line</i>	wants Bus Route Combo 1 W,E <i>bus</i>	wants Bus Route Combo 3 E <i>bus</i>	wants Hiking Trail from Mather to Cemetery for Bikes too E <i>bike / hike</i>	7
COMMENT LEGEND W = number of Writen comments 18 Oct P = number of PEPC comments 21 Oct-Nov3 E = number of Email comments Oct 21-Nov 3 S = number of Sticky note comments 18 Oct		COMMENTERS INFO 1 Clifton, VA Resident 5 Town Resident / Elec Officials 3 River Riders (HF & ShepTwn) 5 Mason Dixon Canoe Cruisers (WV and MD) 2 Charles Town Residents		Against paving green space Camp Hill turn around (Neg) S <i>bus</i>		1
				Total Different Comments		80
Bus Mode Comments 14	Bike Mode Comments 12	Hiking Mode Comments 9	River Mode Comments 8	Other Comments 3		46
Total Bus Comments 31	Total Bike Comments 15.5	Total Hiking Comments 13	Total River Comments 17.5	Other Comments 3		80 Total Combined Comments
38.75%	19.38%	16.25%	21.88%	3.75% (Segway, Horse Trails, Zip Lines)		100.00%
6 Negative Bus comment	4 Negative Bike comments	zero neg comments	zero neg comments			

Compiled by Steve Lowe

Appendix G