National Park Service
U.S. Department of the Interior

Kennesaw Mountain National Battlefield Park
Kennesaw, Georgia

Kennesaw Mountain National Battlefield Park
Assessment of Management of Kennesaw Mountain Drive and Bus Shuttle Service




Source: U.S. Department of Transportation, Federal Transit Administration. Alternative Transportation in the Parks and Public Lands Program, Project Proposal for Fiscal Year 2007 Funds – Planning Project: Conduct Technical Study of Mountain Road Shuttle Bus Service. February 2007.

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

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Report notes

This report was prepared by the U.S. Department of Transportation John A. Volpe National Transportation Systems Center, in Cambridge, Massachusetts. The project team was led by David Spiller and staffed by Lindsey Morse, both of the Service Operations and Assessment Division.

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Executive Summary

Study Scope

Kennesaw Mountain National Battlefield Park (the park) is located in Georgia, west of the city of Marietta and I-75 in central Cobb County, northwest of the Atlanta metropolitan area. The park encompasses an array of historic features related to some of the heaviest fighting of the Atlanta Campaign of the Civil War but also operates as an important and popular recreational destination within the Atlanta metropolitan region. **This study focuses only on a small subsection of the park, Kennesaw Mountain and the Visitor Center**, both located in the northeast corner of the park. The purpose of this study is to assess the management of the Kennesaw Mountain Drive, which runs from the Visitor Center to the summit of Kennesaw Mountain, and assess the future of the shuttle service that operates on the road during weekends, including the possibility of operating an electric or hybrid electric vehicle. The study includes the following components:

- Existing conditions
- Review of recommendations from previous studies and public input
- Critique of previous management proposals
- Recommended design and operational strategy for management of Kennesaw Mountain Drive
- Financing and management of recommended shuttle service
- Vehicle technology assessment (limited to electric and electric hybrid)
- Recommended next steps

This study relies on data and information provided by park staff, Cobb County, previous studies, and field observations made during a site visit on May 8 and 9, 2009.

Existing Conditions and Previous Studies

Kennesaw Mountain National Battlefield Park received over 1.4 million visits in 2008 and according to available visitation data,[*] the majority of recreational visitors (over 50%) visit the Visitor Center, either to park[†] or to enter the Visitor Center. A very small number (~18,000) access the summit of Kennesaw Mountain by vehicle, allowed on weekdays only, and an even smaller number use the shuttle (~17,000). **This indicates that all other visitors to the Visitor Center (~650,000) who visit the summit of Kennesaw Mountain either walk, run, or bicycle using the road or the unpaved trail.**

Kennesaw Mountain Drive is a 2-lane, asphalt-paved roadway, approximately 20 feet wide, with 10 foot lanes, sustained grades exceeding 12% and one foot or less of shoulder for approximately 80% of its length. During the site visit, the U.S. DOT Volpe Center study team observed that the mixed use of the road was occurring in a very confined road space with potential conflicts between user types – bicycles, pedestrians and vehicles - all operating at great speed variance

[*] National Park Service Public Use Statistics Office and data provided by park staff.

[†] According to the Public Use Statistics Office, an inductive loop traffic counter is located on the exit lane of the visitor center parking area. The traffic count is reduced for the crossing of non-reportable vehicles (750 per month) and buses. The reduced traffic count is multiplied by the persons-per vehicle multiplier (PPV) of 2.1.

and with little predictability as to travel path. These observations confirm and validate earlier studies[*] that there are major safety concerns and the potential for great hazard.

When the fare for the shuttle was introduced in June 2004, ridership dropped by 25-30% and eventually settled at approximately half of its former level, without a similar change in visitation, which maintained previous levels.

Several previous studies and surveys contain recommendations for the Kennesaw Mountain shuttle and resolution of user conflicts on Kennesaw Mountain Drive, including the 2003 Engineering Study for Roads & Bridges, the 2004 Transportation Assistance Group visit, 2007 White Paper by park staff and corresponding public comments, and visitor surveys from 1990 and 2007.

Recommended Management Strategy

The U.S. DOT Volpe Center study team considered management alternatives presented to the public by the park in 2007 as well as several other possibilities and developed its own management alternative. A hierarchy of users (from most benign to least benign) has been identified based on environmental impact (i.e., noise and air emissions, fuel consumption, and visual intrusion and annoyance) and road space consumption. The hierarchy is as follows.

1. pedestrians (which include birders, walkers, joggers, and parents with strollers),
2. bicyclists,
3. bus shuttle users (with the bus replacing private vehicles assuming a 27 passenger load on a ratio of 9 to 14 depending on average vehicle occupancy), and
4. private vehicles.

Park staff have stated that any management solution must continue to allow vehicular access to the top of Kennesaw Mountain for interpretative purposes (part of the legislative purpose of the park), and must provide for visitor safety. Traffic data provided by the park and Cobb County indicate that on average 40-80 vehicles per weekday ascend and descend Kennesaw Mountain Drive. Thus exclusion of private vehicles appears to be both feasible and desirable based on environmental grounds and on the ability to shift the limited demand for vehicular access by privately-operated vehicles to an expanded shuttle system not too dissimilar or resource-intensive to that now provided on weekends and holidays. With this change, the shuttle system becomes mission critical to the provision of vehicular access to the summit for interpretive opportunities. **As a basis for a strategy to manage user conflicts and increase safe operation of the road, this study recommends that private vehicles be excluded from Kennesaw Mountain Drive and that the bus shuttle be expanded to operate seven days a week.**

In addition to exclusion of private vehicles and daily shuttle operation, it is recommended that physical improvements and space and time separation strategies be deployed, including:

- Redesign of the road cross section to consist of a vehicular channel of 14', and a pedestrian channel or domain of ~ 6 feet that is separated by a roughened stone delineation and in-road (flush) emergency lights and differentiated by a colored pavement surface;

[*] See, e.g., National Park Service, *Pre-Planning Project (PPP) Trip Report, Kennesaw Mountain National Battlefield Park.* (2004) and Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges* (2003).

- Installation of signage along the road (in both directions) advising pedestrians to move to the inside mountain edge (with appropriate arrow on signage, depending on location of sign) when the emergency use light system is activated;
- Implementation of a time-separation schedule for the shuttle and bicycles for use the vehicular channel;
- Allowance of use of the pedestrian channel or domain during park operating hours; and
- Establishment of operating protocols, described in detail later in the report, that only apply to the bus shuttle operator and park and emergency personal staff who are able to comply.

Recommended Financing and Management Strategy for the Shuttle Service

The projected operating and maintenance cost of the new service would be approximately $75,000 per year, to be funded by an entrance fee ($25 for an annual pass, $3 for a daily pass)[*], to be collected at five primary parking areas within the park, including the parking area at the Visitor Center, through the use of automated fee machines. Projected revenue, based on visitation and some assumptions about repeat and one-time visitors,[†] is more than sufficient to cover projected operating and maintenance costs (or contract cost) as well as administrative costs of the expanded shuttle service. The remaining revenue (more than 90 percent) could be used for other park programs, activities, and maintenance, including trail maintenance and interpretive programs. The entrance fee would be enforced periodically by park staff with warnings and/or tickets and a marketing campaign would help visitors understand the use of such revenue for various park programs and facilities, including the maintenance of an accessible transportation system that serves the summit.

The table below summarizes the assumptions and calculations for the costs and revenues of the current and proposed shuttle systems.

[*] The amounts of $25 and $3 are for calculation purposes only and would require a civic engagement process and approval; however, it seemed appropriate to match the fees charged at the nearest recreational area, Chattahoochee River National Recreation Area. In addition, these amounts are comparative to entrance and parking fees charged by other public land units.

[†] 50 percent of visitors were assumed to be repeat visitors who visited the park at least 100 times a year while the other 50 percent were assumed to be one-time visitors; these assumptions are very rough and need to be refined by park staff and if possible, additional data collection.

Assumptions and Calculations for Costs and Revenue of Current and Proposed Shuttle Systems

Cost Categories	Current System	Proposed System *
Assumptions		
Fuel per mile ($3 per gallon at 6 miles per gallon)	$0.50/mile	
Maintenance cost per mile	$0.50/mile	
Cost of driver	$25/hour	
Round-Trip Length	2.6 miles	
Round-Trip Travel Time	0.5 hours	
Total Number of Round Trips (1 year)*	1856	4,958
Costs		
Fuel cost	$2,413	$6,445
Maintenance cost	$2,413	$6.445
Driver cost	$23,200	$61,975
Cost of lease / purchase	$42,000 **	19,000 ***
Total Cost	**$65,200**	**$93,865**
Total Revenue (Fare / Designated Portion of Entrance Fee)	**$13,500-17,500**	**$93,865****
Difference between Cost/Revenue	**$47,500-51,700**	**$0**

Note: * Inclusive of service provided in current system; assumes standard clean diesel 30-foot transit bus
** Assuming $3,500/month x 12 months
*** Annualized cost of ownership; $200,000 x capital recovery factor of 1.15 (assuming 10% discount rate and 12 year life expectancy) divided by 12 year life expectancy
**** Total revenue from entrance fee estimated at ~$1.1 million but remainder of funds to be used for other park purposes.

Continued use of an external contract to operate the shuttle service is recommended as it has the advantage that the operator has expertise in transit and buses and has infrastructural and organizational advantages in providing maintenance, repair, storage, training, and regulatory activities. The disadvantages, such as lack of control over vehicle type and amenities, can be countered by the park's purchase of a vehicle. The history of shuttle service and recommended change in management of Kennesaw Mountain Drive both represent a permanent, long-term commitment that would be best served by buying the vehicle, which also is more cost-effective, as demonstrated in the table above.

Vehicle Assessment and Recommendations

The table below summarizes the technologies and vehicles examined in the limited, high-level survey of four manufacturers and three transit operators of electric and hybrid electric buses and compares them to the standard or default transit bus currently on the market, which uses clean diesel, as mandated by the EPA.

* For proposed system, consists of 3,120 weekday trips (10am-4pm), 441 weekend winter trips (9am to 4pm), and 1,397 weekend summer trips (9am to 6:30pm)

Summary of Vehicle Technology Characteristics from Survey

Characteristic	Electric *(Gatormoto)*	Electric *(Ebus and EVAmerica)*	Electric-Hybrid *(Ebus and EVAmerica)*	Standard *(30 foot)*
Capital cost	$18,000	$275-315,000	$160-200,000	$200,000
Operating and maintenance costs	Less than standard; $0.02 per mile and battery replacement every 3 years ($1500)	Not provided	Not provided	$0.50 per mile
Operating and maintenance issues	Less than standard; consists of checking tire pressure, monthly refilling of distilled water for the battery, and periodic replacement of battery	Not provided	Software issues, unfamiliar technology	Standard
Facility/infrastructure needs	None; plugs into regular receptacle with electric cords; comes with automated maintenance monitor	90KW Fast-Charger ($58,000)	Specialized diagnostic tools and mechanic	Standard garage and mechanic services
Performance at grade	Unknown but likely that batteries may drain quickly so would need multiple vehicles (3) to allow for recharging	Unknown; may have to be modified and multiple vehicles may be required (2) to allow for recharging	Unknown; may have to be modified	Sufficient
Noise	Quiet	Quiet	Fairly quiet but will use engine	Relatively loud
Challenges	Capacity, battery drain	Battery drain	Power, maintenance	Noise and fuel consumption

As a result of survey summarized in the table above, the U.S. DOT / Volpe Center study team identified two uncertainties in these technologies:

1) the state of the art of these technologies and classes of vehicles
2) the specific application of these technologies to the Kennesaw Mountain shuttle route, in particular the sustained grade of the road

These uncertainties may preclude the use of these technologies for this route and/or may mean increased maintenance and operations costs (despite fuel savings) and the need for specific staff and equipment. Cobb Community Transit does not currently have the expertise to work with AFVs and MARTA has been focused on CNG and propane; it currently operates 441 CNG transit vehicles, which it began to add to its service in 1995.[*]

Without being able to resolve these two uncertainties, the study team recommends the purchase of a standard 30-foot transit bus, run on clean diesel. Current ridership indicates a capacity of 15 would be sufficient to meet 75 percent of the demand, but with the possible increase in ridership

[*] MARTA Monthly. May 2009. http://notify.itsmarta.com/legacy/newsletter/2009/may.html

with the elimination of the fee and consideration of geometric constraints and scale, the study recommends a capacity of at least 20-25. Such a purchase would provide the park with a smaller, more efficient, and more comfortable bus than that provided by current and previous contractors.

To resolve the two uncertainties, the study team recommends that the park contact the manufacturers above whose vehicles most likely meet the requirements and preferences of the park, to test the vehicle on the route and to identify local maintenance support. Once it is determined that such technologies could perform on the route, the park should then undertake a vehicle selection study that includes a full market review of available vehicles and identifies specific features that the park prioritizes.

Recommended Next Steps

There are a number of next steps that could and should be taken to improve the safety and visitor experience for users of Kennesaw Mountain Drive. These steps primarily consist of applying for funding to conduct planning studies or construct/implement changes in management and beginning the necessary civic engagement and environmental process for such changes. For funding, the US DOT Volpe Center study team believes that the recommendation to run a shuttle seven days a week and exclude personal vehicles helps these projects to be more competitive because the shuttle service becomes mission critical in maintaining vehicular access while improving safety of the use of Kennesaw Mountain Drive. The design changes recommended for the road further improve safety and the visitor experience.

Recommended steps include the following:

- Entrance Fee Implementation
    a. Refine the projected revenue model based on park staff knowledge and new data collection; may also want to include an assumption for noncompliance.
    b. Submit a PMIS/TRIP implementation grant proposal for the design, engineering, siting, and acquisition required to implement a park and display meter system. At least seven AFMs would be required (one per 100 spaces), totaling $560,000 ($80,000 each). Once in place, this will allow the shuttle to be provided for free while providing a reliable, dedicated funding source for operations.
    c. Submit a proposal to the National Park Service to consider implementation of an entrance fee for Kennesaw Mountain NBP. The proposal should include initiation of the National Environmental Protection Act (NEPA) process and must include a civic engagement process, which will require 6-8 months.[*]

- Recommended management and design of Kennesaw Mountain Drive
    a. Submit a PMIS Category I or III grant proposal for the design, engineering, siting, and construction required to implement the recommended road design changes. Once in place, this will allow for the safe use of the road by the shuttle and pedestrians.

[*] Personal communication with Rich Devenney, Fee & Special Park Use Program Manager, Southeast Region, on February 2, 2010 (by phone)

- Submit a PMIS/TRIP implementation grant proposal for a new, 30-foot clean diesel vehicle. This will provide a vehicle that is more appropriately sized for Kennesaw Mountain Drive and that will have the amenities that the park is seeking in its shuttle service. The projected revenue from the recommended entrance fee would be sufficient for the recapitalization costs of the vehicle.

- Initiate the National Environmental Protection Act (NEPA) Process for the changes pursued in management of the road, road infrastructure, shuttle operations, and entrance fee implementation.

Introduction

Study Area

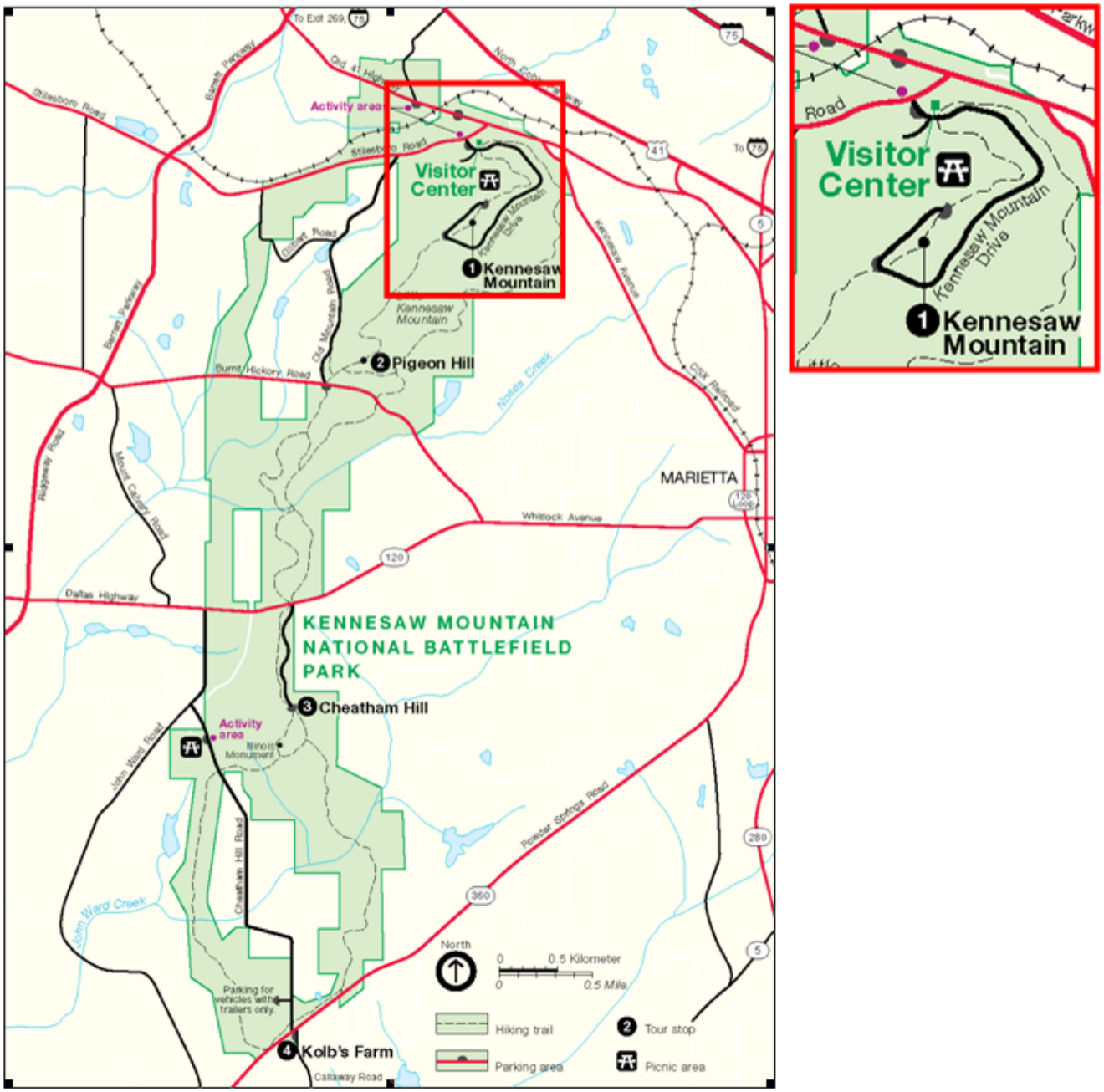
Kennesaw Mountain National Battlefield Park (the park) is located west of the city of Marietta and I-75 in central Cobb County, Georgia. Cobb County is located in the northwest Atlanta metropolitan area. The park encompasses an array of historic features related to some of the heaviest fighting of the Atlanta Campaign of the Civil War. The War Department authorized the protection of Kennesaw Mountain National Battlefield Park in 1917 and the park became a unit of the National Park System in 1933.

According to the current superintendent, the park's primary purpose is to preserve and protect its natural, cultural, and historic resources, not to provide recreation, although that has increasingly become the primary reason for visitation by local residents. The park and nearby Chattahoochee River National Recreation Area (NRA) compose about 70% of the public green space in the fast-growing Atlanta metropolitan area of 3.7 million people.[*] Unlike the NRA, the park charges no parking fees, which may help account for the extremely high recreational use. With projections of continuing population growth and few plans for the provision of additional public open space in the region, recreational demand for both NPS units will likely increase.

A map of the park with the study area outlined is shown in Figure 1; **this study focuses only on Kennesaw Mountain and the Visitor Center.** The Visitor Center provides introductory information about the park and the battles and the adjacent Kennesaw Mountain provides visitors with panoramic views of the region's important geographic features enabling a better understanding of the movement of troops and battle lines and the significant events that occurred on Kennesaw Mountain.

[*] U.S. Department of Transportation, Federal Transit Administration. *Alternative Transportation in the Parks and Public Lands Program, Project Proposal for Fiscal Year 2007 Funds – Planning Project: Conduct Technical Study of Mountain Road Shuttle Bus Service.* February 2007.

Figure 1
Map of Kennesaw Mountain National Battlefield Park with study area outlined
Source: http://www.nps.gov/kemo/index.htm



Project Background and Description

Kennesaw Mountain Drive was constructed to provide vehicular access to the top of Kennesaw Mountain so park visitors can understand its key importance during the Atlanta campaign of the Civil War. In 1973 the park implemented shuttle service on Kennesaw Mountain Drive from the Visitor Center to the top of Kennesaw Mountain on weekends and holidays during the peak season from March through November; in 2001 the service was expanded to weekends and holidays year-round due to increasing visitation. Private vehicles are not allowed on the road on the days the shuttle is operating. In June 2004 the park began to charge a fare, or transportation fee, to riders of the shuttle to help recover costs of the shuttle service.

In 1999, the park submitted a proposal to request $425,000 in Alternative Transportation Program (ATP) funding for the purchase of electric or hybrid electric bus for shuttle service to the mountain top to reduce the cost of the shuttle contract and improve air and noise pollution levels. The proposal was not funded, but in 2004 an NPS Transportation Assistance Group team visited the park to review the park's need for alternative transportation planning and an alternative fuel technology shuttle bus; the team issued a report recommending a comprehensive transportation study but did not specifically address the shuttle or issues on Kennesaw Mountain Drive.

The 1999 proposal was later submitted as a FY2006 Alternative Transportation in Parks and Public Lands (ATPPL) implementation grant to purchase a 28-passenger biodiesel hybrid bus. The NPS Washington Office considered the application premature until a technical analysis was conducted to validate the best available technology and most efficient implementation.

The following year, the park submitted a FY2007 ATTPL planning grant for $25,000 and the project was selected for funding in October 2007. The grant funded a preliminary technical study to validate the most appropriate and best available technology for a shuttle, and the most efficient and cost-effective alternative (including consideration of management and fee structure) for continuing the service into the future. The project was initiated with the U.S. Department of Transportation's Volpe National Transportation Systems Center.

As per the scope of work it was determined that the study would only focus on the feasibility of electric and electric hybrid vehicles, with emphasis on identifying any major roadblocks, and that the study would include consideration of how best to manage Kennesaw Mountain Drive before considering whether or how to optimize the current bus shuttle. Thus, this study includes the following components:

- Existing conditions
- Review of recommendations from previous studies and public input
- Critique of previous management proposals
- Recommended design and operational strategy for management of Kennesaw Mountain Drive
- Financing and management of recommended shuttle service
- Vehicle technology assessment (limited to electric and electric hybrid)
- Recommended next steps

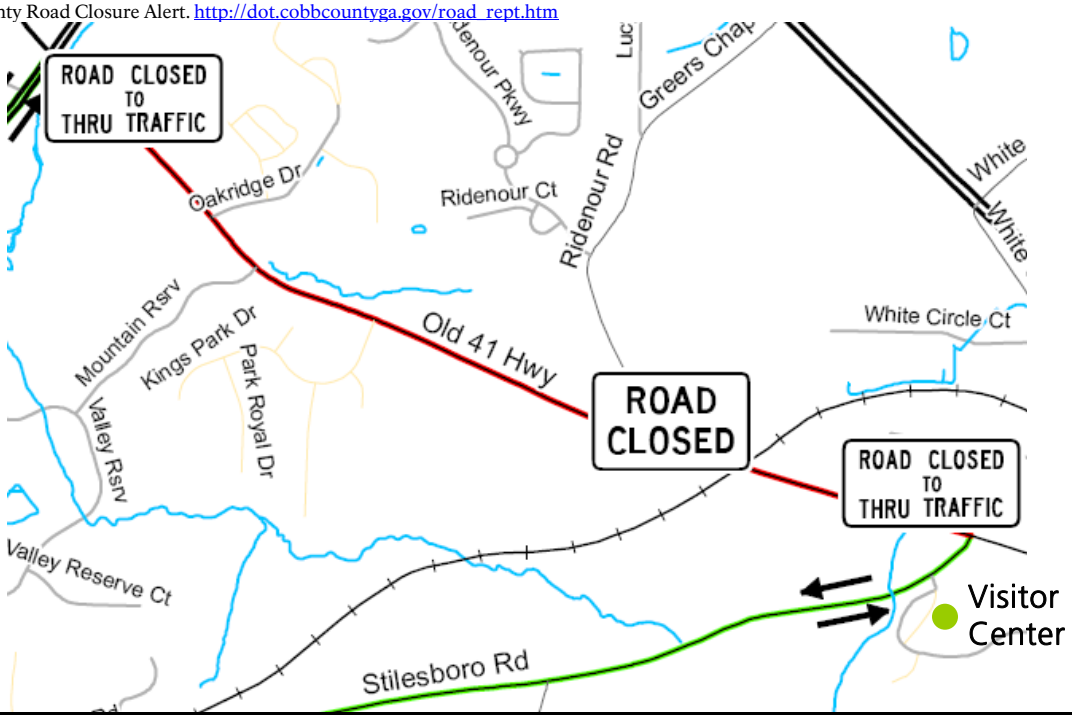
This study relies on data and information provided by park staff, Cobb County, previous studies, and field observations made during a site visit on May 8 and 9, 2009.

Relevant Ongoing Transportation Projects

There are a number of ongoing and proposed projects that address transportation within the park and are relevant to understanding the context in which this study took place. These projects include, but are not limited to:

- Starting in fall 2009, an Alternate Transportation Study will conduct transportation data collection and analysis in advance, and in support, of the upcoming update to the General Management Plan. Tasks include existing conditions, definition of existing problems, and an analysis of the opportunities and constraints faced by the park in the development of future transportation alternatives.[*]
- Replacement of CSX Rail Line bridge has resulted in the closure of Old 41 Highway from August 24, 2009 to March 11, 2010.[†] (See Figure 2).

Figure 2
Old 41 Highway Closure
Source: Cobb County Road Closure Alert. http://dot.cobbcountyga.gov/road_rept.htm



- Noon Creek Trail extension and new parking area on Old 41 Highway to serve trail and Visitor Center (see Parking section in the Existing Conditions chapter for more information)
- Trail Management Plan Environmental Assessment "to improve public safety, visitor experience and provide battlefield access and interpretive opportunities while protecting

[*] National Park Service, Kennesaw Mountain National Battlefield Park. *Scope of Services. Alternative Transportation Study.* (provided by park staff)
[†] Cobb County Road Closure Alert. http://dot.cobbcountyga.gov/road_rept.htm

cultural and natural resources"[*] is currently underway and considers five alternatives (including no action). (See Trails section in the Existing Conditions chapter for more information)

- Award of $700,000 from the American Recovery and Reinvestment Act to install a photovoltaic system on the Visitor Center that may in the future be able to be a source of electricity for electric vehicles.

[*] Planning, Environment, and Public Comment website. http://parkplanning.nps.gov/projectHome.cfm?parkID=389&projectId=22635

Existing Conditions

This section reviews and analyzes existing park management plans, traffic and visitation data, study area transportation infrastructure, shuttle operations and service characteristics, and regional transit, among other information, to provide context and document who uses Kennesaw Mountain Drive and how.

Transportation Goals of Guiding Documents

Two of the park's guiding documents, the General Management Plan (GMP) and the Centennial Strategy, directly identify transportation as important to the park's mission. Although the park's 1983 General Management Plan (GMP) was written when congestion and recreation demand pressures were far less, it does list a transportation management objective in Appendix B:

> "To facilitate leisurely, uncongested circulation of visitors within the park in ways that ensure conservation of energy and presentation of the park's natural and cultural resources."[*]

In addition, the First Annual Centennial Strategy for Kennesaw Mountain National Battlefield Park, developed in August 2007, describes a vision in which non-vehicular access to the park is improved by improving bicycle and pedestrian trails, replacing the shuttle's current vehicle with an alternative fuel vehicle, and improving parking so as to eliminate undesignated, uncontrolled parking. Recommended trail improvements included rerouting the trail to the top of Kennesaw Mountain to reduce its grade and enable it to be surfaced to make it accessible. [†]

Visitation

Kennesaw Mountain National Battlefield Park received over 1.4 million visits in 2008, making it the second-most visited national battlefield in the country, after Gettysburg National Military Park. Its visitation has been steadily increasing over time, reflecting the population growth in the vicinity. (See Figure 3).

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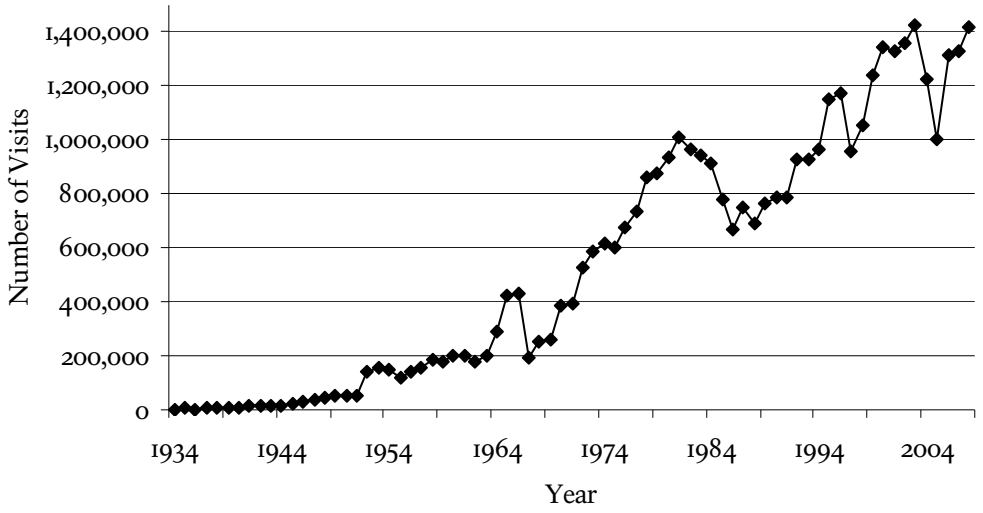
[*] *Kennesaw Mountain National Battlefield Park General Management Plan,* US Department of Interior, National Park Service, Southeast Region, 1983.

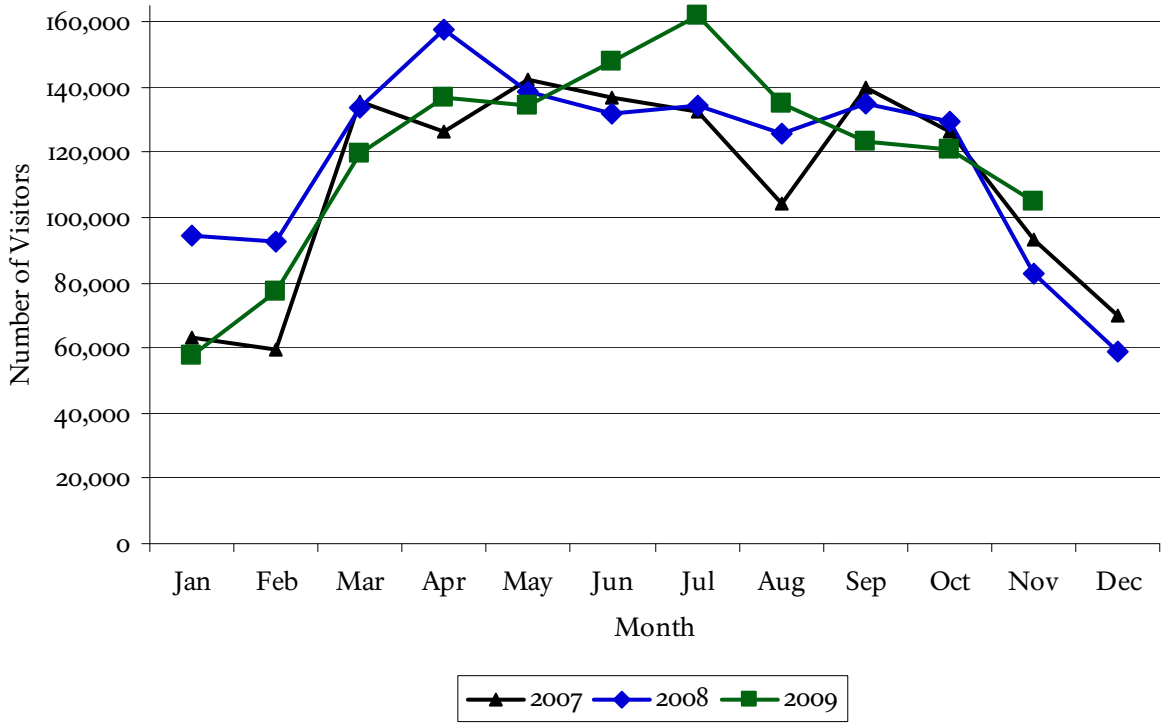
[†] National Park Service, Kennesaw Mountain National Battlefield Park. *First Annual Centennial Strategy for Kennesaw Mountain National Battlefield Park.* August 2007. (www.nps.gov/kemo)

Figure 3
Annual Recreational Visitation at Kennesaw Mountain National Battlefield Park 1934-2008
Source: National Park Service Public Use Statistics Office. http://www.nature.nps.gov/stats/



Park visitation is spread fairly evenly throughout the year, with the lowest monthly visitation occurring between November and February (see Figure 4).

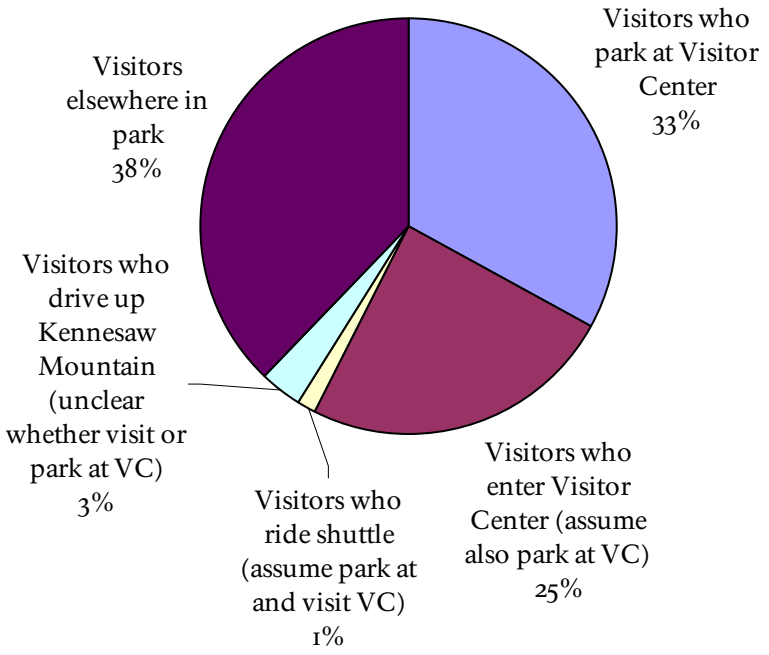
Figure 4
Monthly Recreational Visitation at Kennesaw Mountain National Battlefield Park
Source: National Park Service Public Use Statistics Office. http://www.nature.nps.gov/stats/



According to the General Management Plan (1983), more than half of the visitation occurred during spring and fall weekends, in particular Sunday afternoons.[*] This observation is consistent with a more recent study that looked at parking lot occupancy from October 2005 to March 2006; Sunday was identified as the busiest day of the week, followed by Saturday, and Sunday afternoon as the busiest period of the week.[†] In addition, park staff confirmed these trends and also reported that highest day visitation occurred on warm winter weekends. Visitation to the park is highly dependent on weather, since it is a destination for its recreational opportunities as well as for its historical significance.

According to available visitation data, the majority of recreational visitors (over 50%) visit the Visitor Center, either to park[‡] or to enter the Visitor Center. A very small percentage drive the Kennesaw Mountain Drive (weekday only) but an even smaller percentage use the shuttle. This indicates that all other visitors to the Visitor Center who visit the summit of Kennesaw Mountain either walk, run, or bicycle. Figure 5 illustrates this pattern for 2008.

Figure 5
Visitation Patterns of Kennesaw Mountain NBP Recreational Visitors (with focus on visitation to the Visitor Center (VC) and access to Kennesaw Mountain)
Source: NPS Public Use Statistics Office and KEMO staff (with assumptions)



[*] *Kennesaw Mountain National Battlefield Park General Management Plan,* US Department of Interior, National Park Service, Southeast Region, 1983.
[†] Provided by Kennesaw Mountain NBP Staff.
[‡] According to the Public Use Statistics Office, an inductive loop traffic counter is located on the exit lane of the visitor center parking area. The traffic count is reduced for the crossing of non-reportable vehicles (750 per month) and buses. The reduced traffic count is multiplied by the persons-per vehicle multiplier (PPV) of 2.1.

A tourism study[*] conducted in 1990 for Cobb County estimated that tourism brought in $700 million to the county in 1989 and that Kennesaw Mountain NBP was the most popular destination in Cobb County, with an estimated 750,000 visitors. The study included a survey of people in Cobb County and downtown Atlanta, including several hundred Cobb County residents. The survey indicated that a large percentage (estimated at 50%) of visitors to Kennesaw Mountain NBP are from outside metro Atlanta and are more likely to be interested in the historic aspects of Kennesaw, while local visitors are more likely to use the recreational opportunities the park provides. Nearly half (40%) of local visitors reported bringing visiting friends and relatives with them to the park, especially during the winter. Half of all visitors reported bringing children with them.

Kennesaw Mountain Drive

The mountain road within Kennesaw Mountain National Battlefield Park was constructed to provide vehicular access to the top of Kennesaw Mountain so park visitors can understand its key importance during the Atlanta campaign of the Civil War. The mountaintop provides a panoramic view of the region's important geographic features, revealing the strategy of Confederate and Union troop movements and battle lines during the Battle of Kennesaw Mountain. Access to the top of the mountain is considered critical to interpreting the park's significance.

The information described below came from park and shuttle staff, data provided by Cobb County Department of Transportation, and observations made during a site visit on May 8 and 9, 2009.

Roadway Geometrics

The Mountain Road is a 2-lane, asphalt-paved roadway, with sustained grades exceeding 12%. According to the 2003 Engineering Study for Roads & Bridges,[†] it is 1.7 miles long, with an average roadway width of 25 feet, consisting of 10.5 foot wide lanes and one 4-foot wide shoulder. However, site visit observations found the road to be 1.2 miles with two lanes separated by a painted solid center line, each lane approximately 10 feet plus or minus several inches. There are no continuous paved shoulders on either side of the road and in many places no unpaved shoulders. Instead, the vertical rock face of the mountain lies adjacent to the paved inside edge of the road, and on the outside edge there is often a drop-off with no guardrails or clear space for recovery. These field observations confirm park observations that the road is approximately 20 feet wide, with 10 foot lanes, and approximately 80% of the 1.5 mile mountain road has less than 1 foot of shoulder.

Also according to the 2003 Engineering Study for Roads & Bridges, the road has a 5-inch asphalt pavement on a 6-inch crusted stone base; in December 2001, a 1.5-inch asphalt overlay was placed on the roadway as part of a rehabilitation project. During the project site visit in May 2009, the U.S. DOT/Volpe Center study team observed cracks in the pavement edge on the

[*] Cobb Historic Tourism Study. Prepared for The Cobb Historic Tourism Committee by Montgomery Research Consultants, Inc. June 1990.

[†] Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges.* June 2003. Prepared for The National Park Service Southeast Region. (provided by park)

drop-off side of the road, most likely due in part to lack of a paved shoulder and uniform thickness of the pavement. This road condition may be important to monitor and consider in future management and design decisions for the road.

The previous operator described the Mountain Road as narrow, winding, with several blind spots, but with improved surface condition with a recent paving. The park reports that the road has nine blind curves and steep drop-offs. Field observation confirmed that there are several horizontal curves that have a stopping sight distance (SSD) that exceeds the sight distance (at least for bicycles on the down grade).

Management

Visitors access the summit of Kennesaw Mountain either by personal vehicle, shuttle, bicycle, or foot but allowed uses of the road vary between the week and weekend, as shown by Table 1.

Table 1
Allowed Uses of Kennesaw Mountain Drive for Weekdays and Weekends

	Weekdays	Weekends
Allowed Uses	• Personal Vehicles • Pedestrians • Bicyclists	• Shuttle • Pedestrians

According to the FY2007 ATPPL application, and confirmed by the current superintendent and current visitation data, approximately 700,000 (50%) of the park's 1.4 million annual visitors stop at the Visitor Center and presumably travel to the top of Kennesaw Mountain. According to 2008 data, [*] approximately 40,000 visitors accessed the summit in private vehicles, 15,000 by shuttle bus, and the remainder (more than 600,000) by foot or bicycle via the trail or mountain road (see Figure 5 above).

Pedestrian Use

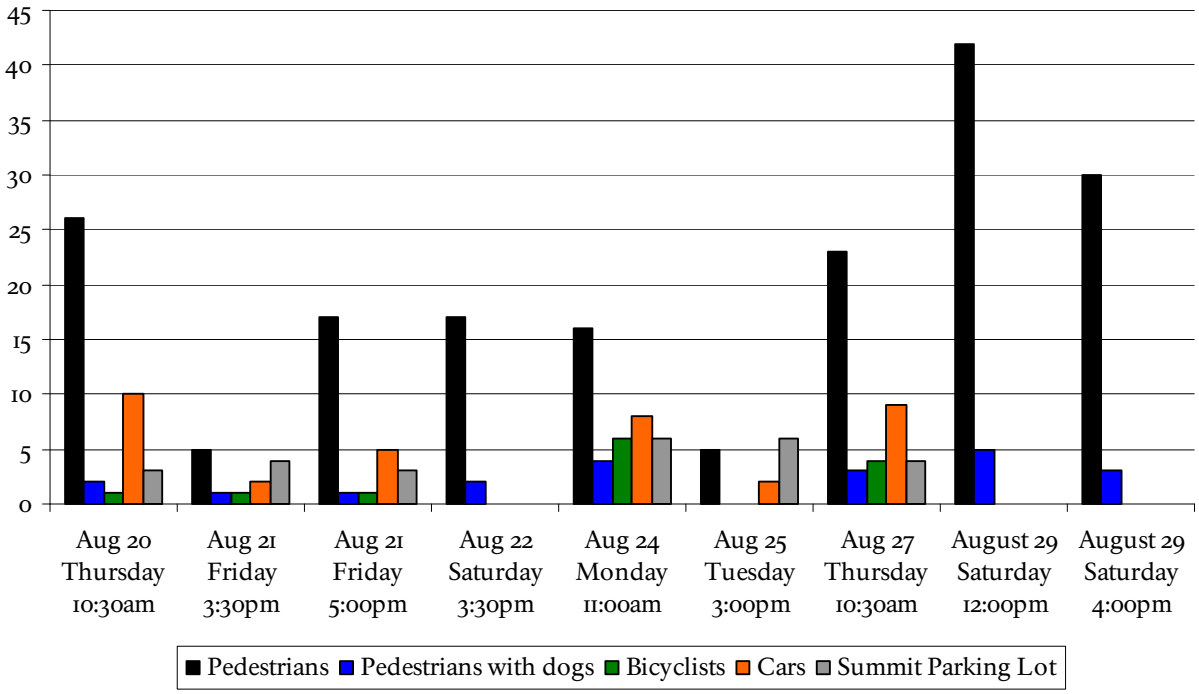
Although there is trail access to the top of Kennesaw Mountain, joggers, walkers (many with baby strollers), and birders use the paved surface of the mountain road to access the top of the mountain. During the site visit, the U.S. DOT Volpe Center study team observed that pedestrians on Kennesaw Mountain Drive used the complete right of way and essentially used and considered the paved road as a pedestrian trail. The previous shuttle operator reported that, on average, there were usually 75-100 pedestrians on the road during the weekend shuttle operation, with 140 on peak weekends and only 20-30 on days with bad weather. He gave the opinion that visitors prefer the paved road to the non-paved trail because of the paved surface, width of right of way, and better visibility and views. [†]

During the site visit in May 2009, the U.S. DOT Volpe Center study team rode the 9:30am shuttle. On the way down, the team noted 50 pedestrians on the road, including five with strollers, and an additional 6 on the trail.

[*] National Park Service Public Use Statistics Office and data provided by park staff.
[†] Personal communication, with Steve White, previous shuttle operator, on November 20, 2008 (by phone)

The park provided several counts for different users of the Kennesaw Mountain Drive from August 20-29, 2009. Although limited, the data does provide a small sample of use of Kennesaw Mountain Drive and confirms high weekend use but also weekday morning use by pedestrians. Note that because car and bicycle use is not allowed on weekends there are no counts for those categories on the Saturdays and Sundays below.

Figure 6
Counts for Use of Kennesaw Mountain Drive, August 20-29
Source: KEMO staff



Bicyclist Use

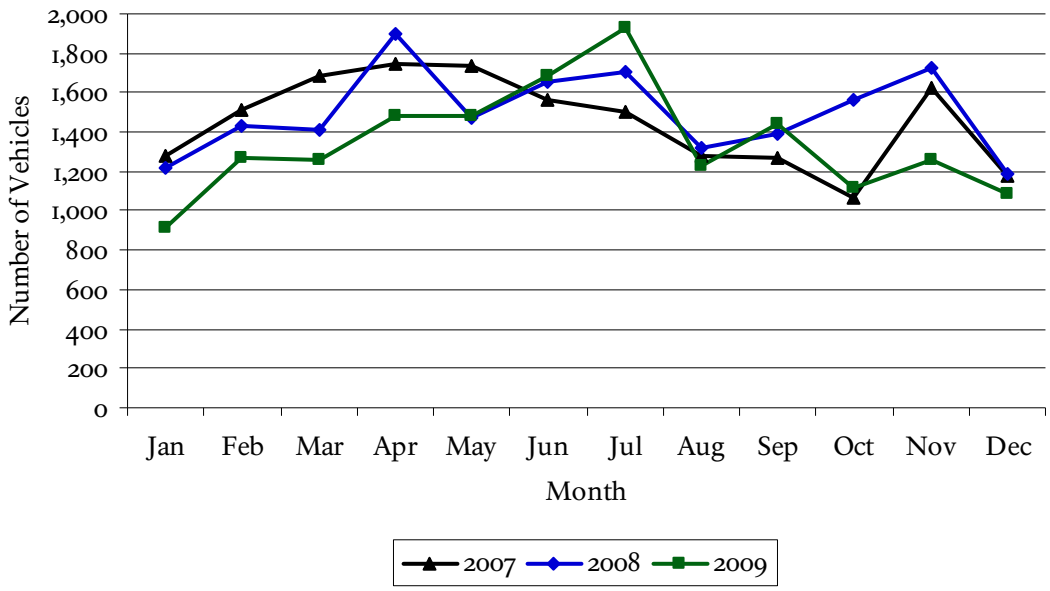
As mentioned above, bicycles are allowed during the weekday anytime. The road has sustained grades exceeding 12, meaning that only experienced, competitive bicyclists are using the road. During the site visit, the U.S. DOT Volpe Center study team observed bicyclists at speeds estimated to be 25-30 mph on the down grades.

Automobile Traffic

The park collects traffic count data for Kennesaw Mountain Drive using a pneumatic tube counter at the entrance to the road and, after subtracting 750 per month to adjust for non-reportable vehicles (such as official park vehicles), reports them to the NPS Public Use Statistics Office. [*] Table 7 shows monthly traffic counts for 2007-2009.

[*] The pre-2005 data has been disputed by a former Superintendent due to a combination of factors, including a broken counter. However, park staff communicated to the study team that any problems with the counts had been corrected. In addition, the data used for the study (2007-2009) is consistent from year to year.

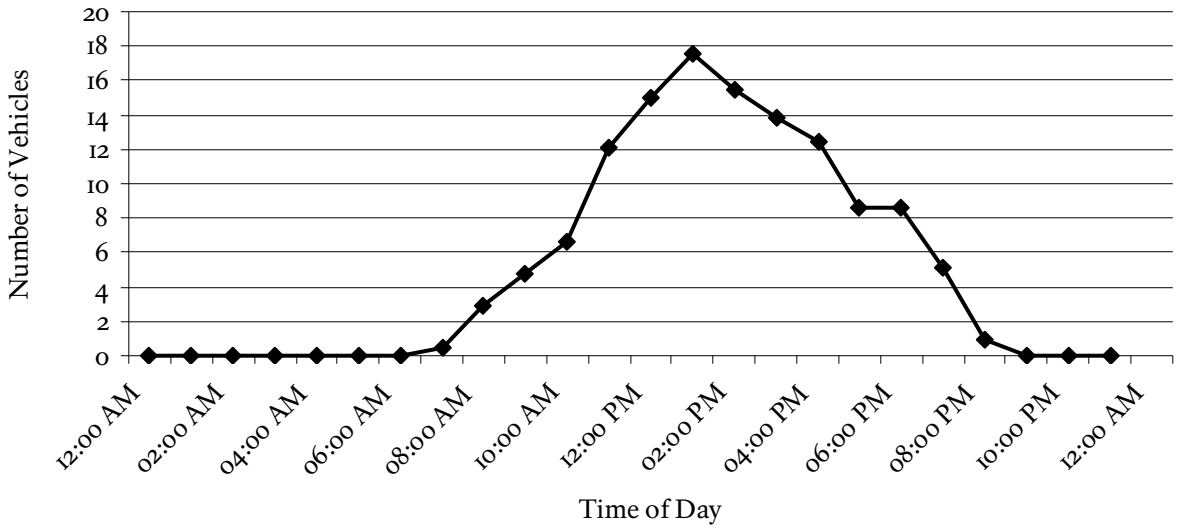
Figure 7
Traffic Data for Kennesaw Mountain Drive
Source: National Park Service Public Use Statistics Office. http://www.nature.nps.gov/stats/



From July 21 to August 25, 2009, the Cobb County Department of Transportation collected speed and count data for Kennesaw Mountain Drive. The graphs below show the average number of vehicles by hour and by speed for the 25 weekdays during which information was collected. Only weekdays are shown because personal vehicles are only allowed during the week and the focus of this inquiry is on personal vehicle use and safety. Conclusions from this data are limited by the small sample size. On average, 124 vehicles used Kennesaw Mountain Drive per weekday during this time period; this corresponds to 2,480 vehicles per month. This is higher than the data shown above, but the Cobb County data does not control for park vehicles.

The Cobb County data indicates that vehicles accessed the Kennesaw Mountain Drive from 8am to 8pm, with the peak traffic flow occurring between 11am and 5pm, with a vehicle starting up the mountain on average every three to six minutes (see Figure 8).

Figure 8
Average Number of Vehicles by Hour (Up mountain, weekday)
Source: Cobb County, July 21-August 25, 2009



14% of vehicles traveling up Kennesaw Mountain Drive during the week, when personal vehicles are allowed, exceeded the speed limit of 25 miles per hour while 21% exceeded it on the way down (see Figures 9 and 10).

Figure 9
Average Number of Vehicles Traveling at Various Speeds Up Kennesaw Mountain Drive (25 weekdays, 2009)
Source: Cobb County

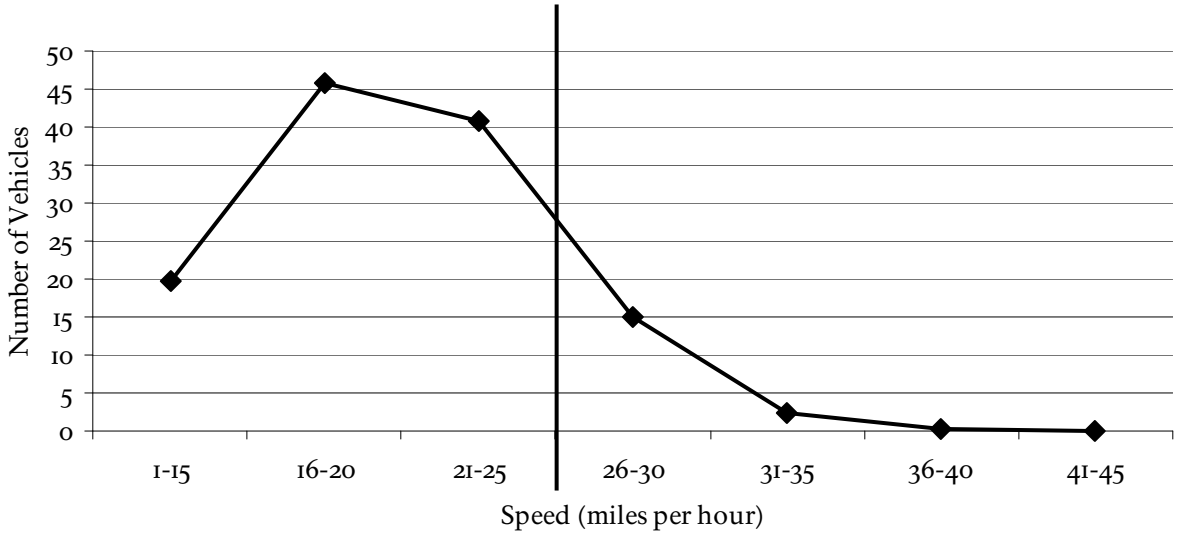
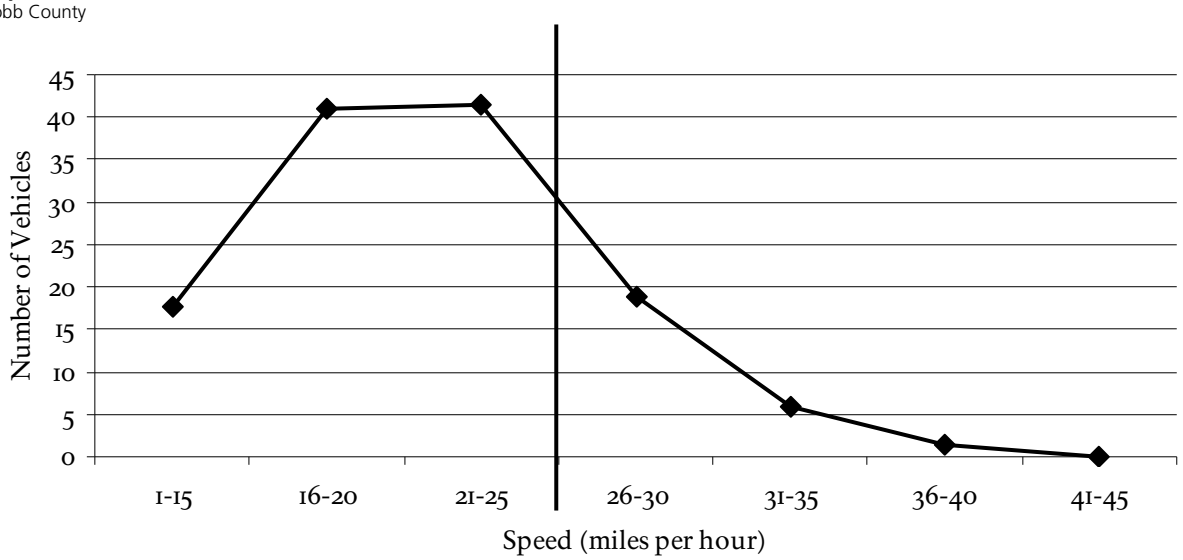


Figure 10: Average Number of Vehicles Traveling at Various Speeds Down the Kennesaw Mountain Drive (25 weekdays, 2009)
Source: Cobb County



The data also included 10 weekend days, with an average of 20 vehicles per day, slightly higher than the 18 expected shuttle runs, but this is most likely due to official park vehicle traffic. On average, 1% of the vehicles on the weekend exceeded the speed limit while driving up Kennesaw Mountain Drive, while 6.5% exceeded the speed limit on the way down.

Conflicts

A common theme covered by several documents and studies is the conflict between recreational use, non-recreational use (through traffic), and the historic mission of the park. This tension has direct implications for the Kennesaw Mountain Drive and shuttle on Kennesaw Mountain, in particular the tension between pedestrian users of the road and the shuttle. During the site visit, the U.S. DOT Volpe Center study team observed that the mixed use of the road was occurring in a very confined road space with potential conflicts between user types – bicycles, pedestrians and vehicles - all operating at great speed variance and with little predictability as to travel path. These observations confirm and validate earlier studies[*] that there are major safety concerns and the potential for great hazard.

The park's 1983 GMP identifies the main tension as being between local visitors seeking recreation and out-of-town visitors seeking historic enjoyment. As mentioned in the Introduction, the park represents a large proportion of available public open space in the Atlanta metropolitan region and, thus, is in high demand for recreational use. In addition, according to park staff, the park is surrounded by approximately 32 housing divisions that have direct walking access to the park's trails.

A 2007 article by the University of Georgia Warnell School of Forestry and Natural Resources also recognizes the conflicts between the different recreational uses and the NPS mission to protect the historic resources.[†] It reviews the temporary permit program for organized running teams that the park instituted in October 2006 in response to overcrowding of both trails and parking lots. The program required all organized running groups to apply for a Special Use Permit which specified the day(s) of week, time period, parking location, and staging area for the group. The permit also required attendance at a presentation on trail etiquette and required the use of buses, vans, or carpools.

The high recreational use throughout the park also includes Kennesaw Mountain Drive. As reported above, a number of pedestrians and joggers use the road during the weekends when the shuttle is running as well as during the week, when personal vehicles are allowed on Kennesaw Mountain Drive. According to the previous operator, park staff, and site visit observations, pedestrians do not obey the rules of the road in terms of walking single file or in pairs and keeping to the side of the road. The previous shuttle operator provided several pictures of pedestrians using the road while the shuttle bus was operating (see Figures 11 and 12 below). The previous operator also reported some, infrequent cases of an unauthorized vehicle on the road (either motorized or a bicycle) and of park staff use of the road. In the past, drivers of the shuttle bus were given radios to communicate with park staff about these occurrences; currently, cell phones are used instead.

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[*] See, e.g., National Park Service, Alternative Transportation Program. *Pre-Planning Project (PPP) Trip Report, Kennesaw Mountain National Battlefield Park.* Draft, September, 2004. Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges.* June 2003. Prepared for The National Park Service Southeast Region. (provided by park)

[†] Strack, Julie A. & Craig A. Miller. *Running Uphill: Urbanization, Conflict, and Visitor Use and Kennesaw Mountain National Battlefield Park.* Proceedings of the 2007 Northeastern Recreation Research Symposium. http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs-p-23papers/07strack-p23.pdf

Figure 11
Pedestrians using Kennesaw Mountain Drive while shuttle bus is in service.
Source: Steve White

Figure 12
Pedestrians jogging in the middle Kennesaw Mountain Drive while shuttle is in service.
Source: Steve White

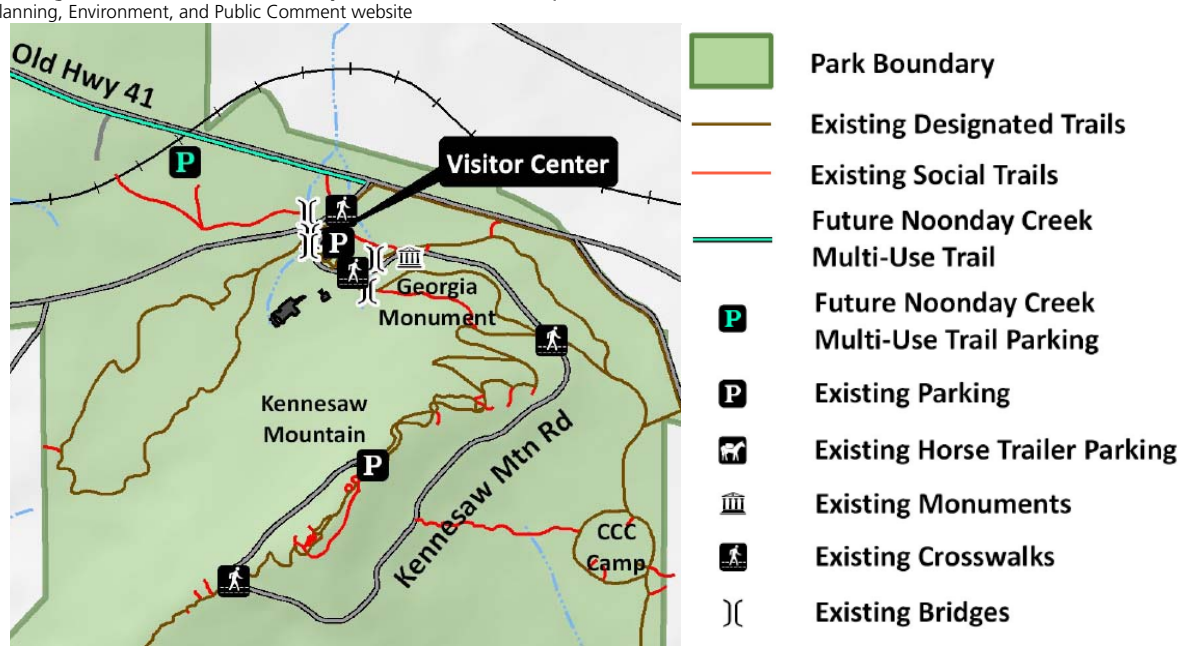
Kennesaw Mountain Trail

The Kennesaw Mountain Trail runs from the Visitor Center to the summit of Kennesaw Mountain, paralleling Kennesaw Mountain Drive for most of the way and rejoining it at the Summit parking area, where it continues to the summit. It is approximately one mile in length. It is the most popular of the park trails and intended to provide access to the summit, similar to Kennesaw Mountain Drive.

The trail is steep and rocky throughout and is not handicap or stroller accessible; according to the park, grades exceed 22%. Proposals have been made to redesign and reroute the trail to achieve a grade of less than 10% and widen and smoothen the trail surface to accommodate the variety of visitors that wish to access the mountain summit.[*] Park staff believe that improvements to the existing trail would be damaging to the adjacent resources. Recently the park, in collaboration with the Kennesaw Mountain Trail Club, a nonprofit that helps the park manage and keep up the trails within the park, developed a flatter, easier route for the first 1000 feet. This is now regarded as the official route, and the original route (shown in red in Figure 13) has been proposed to be re-vegetated under the pending Trail Management Plan.

[*] Kennesaw Mountain Trail Club. Earthworks. Volume 3, Issue 6, October 2009. http://www.kennesawmountaintrailclub.org/documents/Earthworks_Oct09_000.pdf

Figure 13
Trail Management Plan Preliminary Alternative 1 Map
Source: Planning, Environment, and Public Comment website



Shuttle Service

In 1973 the park implemented shuttle service on Kennesaw Mountain Drive, from the visitor center to the top of Kennesaw Mountain, on weekends and holidays during the peak season from March through November. In 2001 this service was expanded to weekends and holidays year-round due to increasing visitation. In June 2004 the park initiated a transportation fee to help recover costs for the shuttle contract. The fee is $2 for adults 12 years and over, $1 for children ages 6-11, and free for children under age 6. From November 2008 to May 2009, there was no shuttle bus operating due to difficulties with the contract.

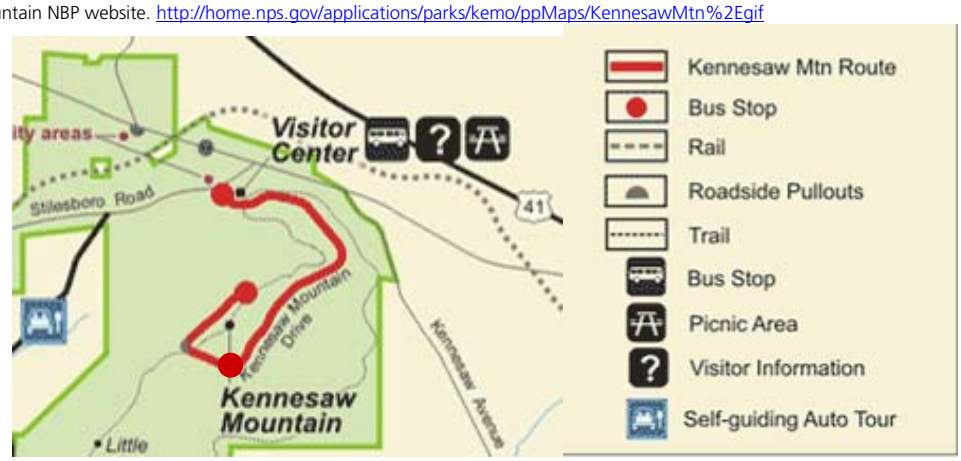
Schedule

The shuttle currently operates on the weekends and major holidays from 9:30am to either 5pm during standard time (November to March) or 6pm during daylight saving time (March to November). It runs twice an hour and thus completes 18 trips per day during March to November and 16 trips per day during November to March. The bus is the only vehicle allowed on the road during this time; neither cars nor bicycles are allowed during shuttle operation.

Route

The bus follows a one and one-quarter mile route up Kennesaw Mountain Drive with three stops: the Visitor's Center at the bottom; the viewing platform at the top; and an on-demand stop, three-quarters of the way up the mountain, where the trail intersects with the road (See Figure 14). With operating speeds of 15-20 mph, the route takes 15 minutes round-trip (7-8 up, 6-7 minutes down). Under the current and previous operator, drivers do not have a scheduled meal break but use the 15 minutes between runs to eat and use the restroom facilities.

Figure 14
Kennesaw Mountain Shuttle Route
Source: Kennesaw Mountain NBP website. http://home.nps.gov/applications/parks/kemo/ppMaps/KennesawMtn%2Egif



Operating Speeds

The posted speed on Kennesaw Mountain Drive is 25 mph but the shuttle usually operates at 15-20 mph due to the vehicle constraints due to the grade and load and due to the need to navigate alongside other users.

Vehicle

The previous shuttle operator owned and used a Thomas-built school bus retrofitted with a wheelchair lift on the side in the rear and with a stated capacity of 48 but effective capacity of 35. The park reported issues with the vehicle's size in terms of its ability to negotiate the turn-around in the parking lot at the top of the mountain and reported that the fumes and noise adversely affected park resources and visitor experience.

The current operator is using a 40-foot diesel transit bus that is ADA accessible. On the first day of service, which coincided with the site visit, the current operator used a 45-foot motor coach, as the contract specified a minimum capacity of 44. The vehicle had a tight fit through the gates, hit the curbs when turning around in the summit parking lot, and raised concerns about noise and visibility of pedestrians on the road. It was determined to be inappropriate by park staff, the shuttle operator, and the U.S. DOT Volpe Center study team.

Contract

The previous shuttle operator, who owns and manages several buses and bus services in the region, was the contract recipient for the shuttle service for over 20 years. The most recent 5-year contract with this operator started in September 2007 but the operator stopped the service in September 2008 due to conflicts over management and operations of Kennesaw Mountain Drive and the shuttle. A temporary contract for six weeks was issued after the operator stopped providing service but the temporary contract had to be ended prematurely because of administrative funding issues. The bidding process for a new, permanent contract began in December 2008 and the contract was awarded in May 2009.

The contact specifies that the vehicle must have a capacity of 44. The contract lacks a non-idling clause as well as requirement for video/audio capability.

Storage, Fueling, and Maintenance

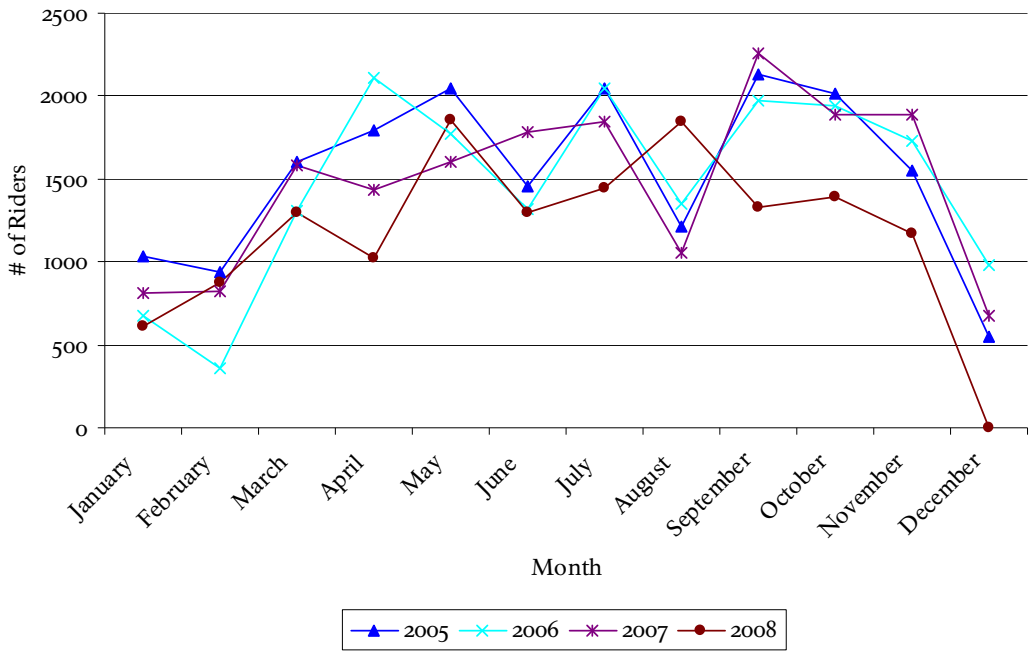
Under the previous operator, the bus was stored outside next to the park's maintenance facility, received light maintenance from that facility and heavy maintenance from the owner's shop in Rome, GA, which is 40-50 miles from the park. Gas was obtained from one of several gas stations within a mile of the park.

Under the current operator, the bus is stored and maintained in Austell, GA, about 15 miles or 30 minutes away. The current operator leases vehicles for a variety of services across the country including relocation for the U.S. Department of Housing and Urban Development, charter services, and airport runs for hotels.

Ridership*

From 2005-2007, annual ridership was 17,000-18,000; ridership for 2008 was significantly lower but service was inconsistently offered beginning in September, with no service offered in December. Ridership over the four years appears to be fairly consistent and level between March and November (1500-2000 passengers per month) with peaks occurring in April/May, July/August, and September/October. The fluctuations between months are due to variation in number of weekend and holiday days that fall within each month (ranging from eight to eleven) as well as seasonal and weather factors. (See Figure 15).

Figure 15
Monthly Ridership Patterns
Source: Data provided by NPS staff.

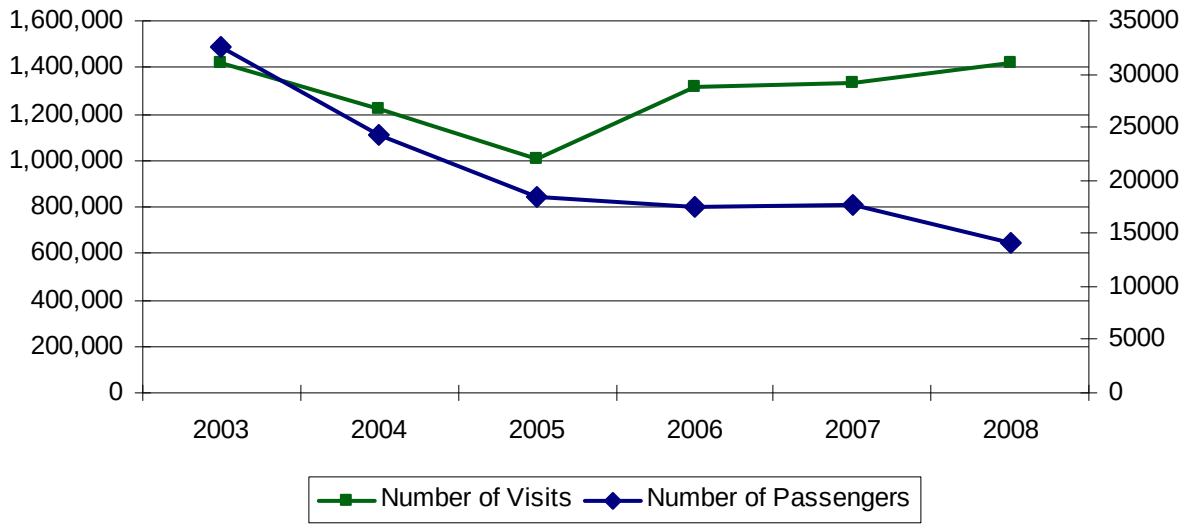


* Available data on ridership varied in level of detail by year; monthly ridership data was available from 2003-2008; daily from 2007-2008; and by one-way trip for July 2009. Ridership by one-way trip provides the best information in terms of determining demand and vehicle capacity needs over the day. Average ridership per trip will be analyzed in more depth in the Vehicle Technology Assessment chapter.

Historically, ridership experienced a significant decrease after the implementation of a fee in June 2004. According to former superintendent Dan Brown, the shuttle's ridership had been about 33,000 - 40,000 per year until the park started charging a fee in June 2004. Then it dropped to 16,000-17,000 per year. The previous operator similarly reported that the passenger load changed after a fee was instituted; when the service had been free, the bus was usually full; after the fee, the bus usually had 15-20 passengers per run and only filled up on peak weekends. These reported changes were confirmed by ridership data provided by the park. Ridership dropped significantly, by 25-30 percent, in June 2004 and stayed at reduced levels through 2005 and beyond. (See Figure 16). Visitation also decreased in 2004 and 2005 but then increased without similar increases in ridership; for example, in 2008 visitation returned to 2003 levels but ridership did not. (See Figure 17).

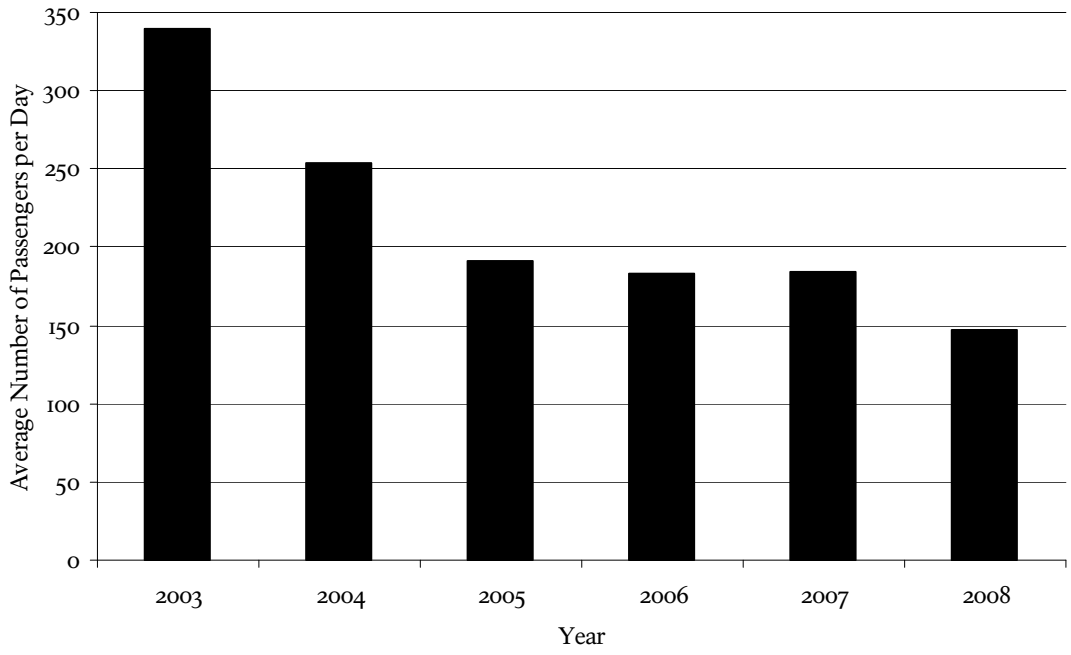
Figure 16
Change in Ridership Before and After Fee Implementation
Source: KEMO staff

Figure 17
Ridership and Visitation 2003-2008
Source: Data provided by NPS staff.



Along with monthly and annual ridership drop, average daily ridership has also declined, as evident in Figure 18.

Figure 18
Decline in Average Daily Ridership
Source: Data provided by NPS staff.



Operations Costs

The contract to operate the shuttle service costs approximately $75,000/year, which includes the cost of the vehicle.

Operating costs are estimated at approximately $28,000 per year, based on the assumptions outlined below.[*] Fee collection, vehicle acquisition and storage, and administrative costs are not included. The previous operator reported that insurance was the major cost for the operations, though gas prices had become more substantial with the nationwide increase in prices in 2008.

Table 2
Annual Operations & Maintenance Assumptions and Costs

Cost Categories	Assumptions	Costs
Fuel per mile ($3 per gallon at 6 miles per gallon)	$0.50/mile	$2,413
Maintenance cost per mile	$0.50/mile	$2,413
Cost of driver	$25/hour	$23,200
Round-Trip Length	2.6 miles	-
Round-Trip Travel Time	0.5 hours	-
Number of Round Trips (1 year)	1856	-
Total	**-**	**$28,026**

Funding

Funding for the shuttle is provided out of general operating funds for the park, supplemented by fares.

Fare Recovery Ratio

As mentioned above, the implementation of a fee decreased ridership by 50%. Estimated revenues from the fee, based on the current ridership, range from $13,500-17,500 per year (25-35% recovery) depending on the mix of users. Dan Brown, former Park Superintendent, reported a similar figure of 30% fare-recovery in 2005 and in the FY2006 ATPPL application.[†‡]

Parking

This section describes the parking areas within the study area and their use.

Parking Areas

The four existing parking areas within the study area are:

- the Visitor Center Parking Area, with spaces for 86 cars and 3 oversized vehicles;
- the Mountain Drive pull-off, with spaces for 6 vehicles;

[*] Adapted from assumptions presented in FY07 ATPPL application (U.S. Department of Transportation, Federal Transit Administration. Alternative Transportation in the Parks and Public Lands Program, Project Proposal for Fiscal Year 2007 Funds – Planning Project: Conduct Technical Study of Mountain Road Shuttle Bus Service. February 2007.)

[†] Email from Dan Brown (former KEMO Superintendent) to Micky Blackwell, member of the Marietta Trolley Advisory Committee, on 9-19-2005.

[‡] U.S. Department of Transportation, Federal Transit Administration. *Alternative Transportation in the Parks and Public Lands Program, Project Proposal for Fiscal Year 2007 Funds – Planning Project: Conduct Technical Study of Mountain Road Shuttle Bus Service.* February 2007.

- the Upper Summit Parking Area, with spaces for 27 cars (including one ADA spot); and
- the shoulder of Old Highway 41, with space for approximately 300 vehicles.

In addition, a new parking area, located along Old 41 Highway, is under preliminary design and construction.[*] Its purpose is to replace parking along the Old 41 Highway shoulder, which has been deemed unsafe, and serve as both overflow parking for the Visitor Center parking, which often fills, as well as parking for the proposed six-mile extension of the Noonday Creek Trail. The plan is to construct an 8-to-10 foot paved trail on the south side of Old Highway 41, separated from the roadway by a 2 to 5 foot grass strip, curb, and gutter, and construct a new curb and gutter on the north side, thus eliminating unsafe parking on both sides of the road and providing safe pedestrian and bicycle access along the road. Visitors who park in the new parking area would be able to use the trail to access the Visitor Center.

Figures 19-23 below provide visual information on the existing parking areas as well as the proposed new parking area.

Figure 19
Visitor Center Parking Area
Source: Google Maps

[*] National Park Service, Kennesaw Mountain National Battlefield Park. *Draft Environmental Assessment for Noonday Creek Multi-Use Trail, Phase 1* (Provided by park staff).

Figure 20
Scenic Overlook Parking
Source: Google Maps

Figure 21
Old Highway 41 Shoulder Parking
Source: NPS Staff

Figure 22
Proposed Noonday Creek Trail and new parking area
Source: Google Maps

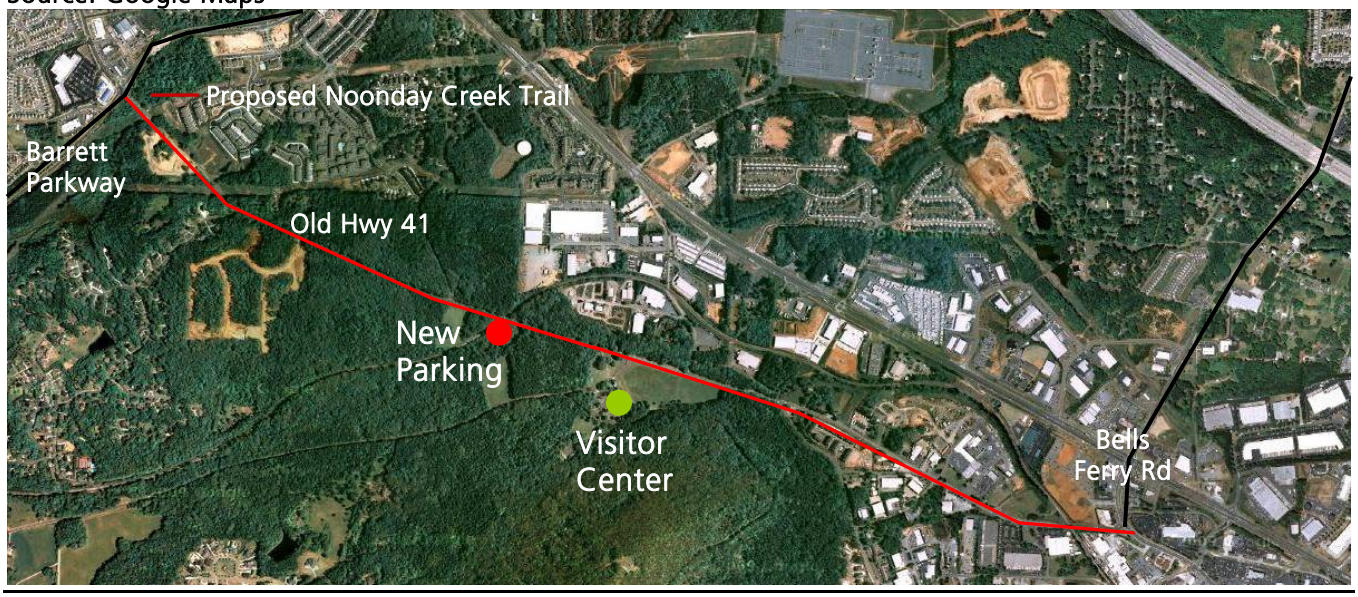


Figure 23
Kennesaw Mountain Summit Parking Area
Source: Google Maps

The previous shuttle operator, park staff, and the 2003 Engineering Study for Roads & Bridges reported that the Summit parking area has a clearance issue for buses of a certain length due to the configuration of the sidewalk and median and the circulating road radius, thus making it difficult for such buses to negotiate. The park claims that the school bus previously used for the shuttle service was too large to safely negotiate the turn-around. Its length caused the bus to overhang the narrow sidewalk that borders the parking area and driving lanes, posing a danger to pedestrians. The 2003 Engineering Study reported that the park had received an operational complaint about the upper summit parking area, on Kennesaw Mountain Drive, from a tour bus driver. According to the driver, there is an inadequate radius to allow his bus to traverse the

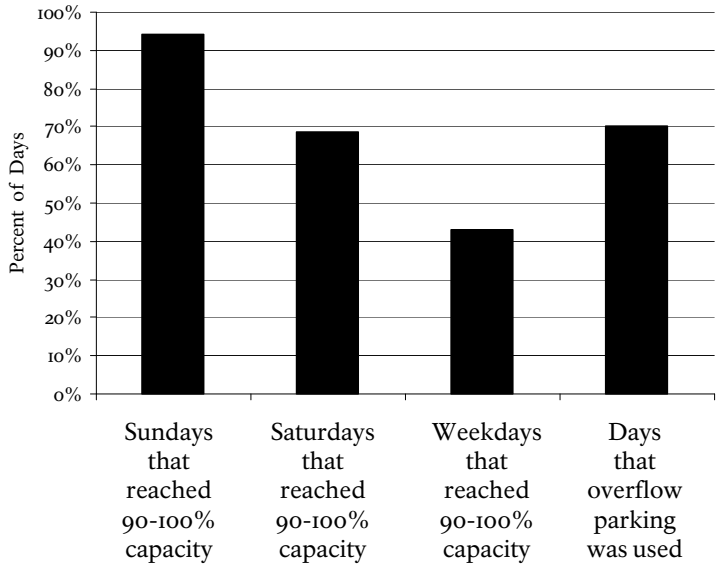
loop properly. The overhang of his bus extended into the sidewalk area, hence causing a hazard to pedestrians. The narrow width of the sidewalk between the roadway and the protective barrier at the overlook prevents visitors on the sidewalk from stepping out the way. Consequently, the driver had to stop and back up each time he entered the parking area. This is a perceived hazard due to the large numbers of children in the parking area.[*]

Parking Use

Data and previous study findings on the use, or occupancy patterns, of the parking areas are limited but indicate that the Visitor Center has insufficient parking during peak use periods, namely weekends throughout the year when there is good weather.[†] The shortage of parking has resulted in the roadside parking along Old 41 Highway mentioned above. The limited parking at the Summit parking area on Kennesaw Mountain was one of several reasons why the shuttle service was implemented on weekends.

The park conducted a survey of the occupancy of the main parking areas throughout the park from October 19, 2005, to March 7, 2006, with an additional two days recorded in April 2006.[‡] The survey included the Visitor Center parking facility but not the Kennesaw Mountain Summit parking area. Figure 24 shows the occupancy patterns observed for the Visitor Center parking area.

Figure 24
Occupancy Patterns for Visitor Center Parking Area
Source: 2005-2006 Parking Survey Summary (Kennesaw Mountain NBP staff).



[*] Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges.* June 2003. Prepared for The National Park Service Southeast Region. (provided by park)
[†] Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges.* June 2003. Prepared for The National Park Service Southeast Region. (provided by park)
[‡] Information provided by the park.

The following conclusions were made from the survey:

- The Visitor Center parking facility was identified as the busiest parking facility.
- Sunday was identified as the busiest day of the week, followed by Saturday, and Sunday afternoon as the busiest period of the week
- On weekdays, the highest capacities were recorded during late afternoon and early evening hours, followed by mid-day (lunch) hours and early morning hours
- Visitation is largely weather dependent. The busiest days during this survey period were warm fair weather days in January.

Transit

Cobb County is served by a public transit system and is also home to a private, interpretive trolley tour service that runs out of Marietta.

Cobb County's public transit system, Cobb Community Transit (CCT), began in 1989 and currently operates 14 local and 5 express routes operated by 95 buses and 15 paratransit vehicles,[*] serving Marietta, Kennesaw, Smyrna, and other local towns, with interconnections and connections to downtown Atlanta. The service is owned by Cobb County and operated by a third-party transit provider. In 2005, there were 3.7 million passenger boardings; the Cobb County 2030 Transportation Plan estimated that in 2008, ridership was 4.3 million with 15,000 daily passenger boardings.[†] All CCT buses are equipped with front-loaded bicycle racks. According to Cobb County, two bus routes (40 and 45) provide access to Kennesaw Mountain NBP trails.[‡] However, currently, the closest bus stop to Kennesaw Mountain NBP's Visitor Center is 1.5 miles away at Cobb Parkway and Bells Ferry Road and is a stop on Routes 40 and 45, which serve connect Kennesaw and Marietta.[§] Cobb Community Transit has no current plans to extend its routes. There has been preliminary, conceptual discussion of a circulator that would serve the park but there are questions about financial feasibility and ridership.

The historic Marietta Trolley Co. provides a one-hour tour of several historic sites, including historic houses, cemeteries, and the Kennesaw Mountain NBP Visitor Center, where it pulls into the parking lot and departs without letting people disembark. The tour operates twice a day Thursday and Friday and three times on Saturday and Sunday. The cost is $12-20. The $120,000 trolley is outfitted with a wheelchair lift, windows that open, 30 oak bench seats with black iron supports, a wooden ceiling and brass poles.[**]

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[*] Cobb County 2030 Comprehensive Transportation Plan. Cobb County Department of Transportation. February 27, 2008. http://dot.cobbcountyga.gov/ctp/index.htm

[†] Cobb County 2030 Comprehensive Transportation Plan. Cobb County Department of Transportation. February 27, 2008. http://dot.cobbcountyga.gov/ctp/index.htm

[‡] Cobb County Department of Transportation: Cobb County Trail System/Directory. http://dot.cobbcountyga.gov/trail-system.htm

[§] Cobb County Department of Transportation: Cobb Community Transit Route Schedules. http://dot.cobbcountyga.gov/cct/route-schedules.htm

[**] Historic Marietta Trolley Co. website, http://www.mariettatrolley.com/trolley.html, and Cauley, H. M. Tourist trolley debuts in Marietta Square. Journal Constitution. April 3, 2008. http://www.ajc.com/search/content/metro/cobb/stories/2008/04/02/trolley_marietta_0403.html

Previous Study Recommendations and Public Input

This section reviews and analyzes previous studies and surveys that contain recommendations for the Kennesaw Mountain shuttle and resolution of user conflicts on Kennesaw Mountain Drive. Studies include the 2003 Engineering Study for Roads & Bridges, the 2004 Transportation Assistance Group visit, 2007 White Paper by park staff and corresponding public comments, and visitor surveys from 1990 and 2007. Studies are presented chronologically with the focus on those elements most relevant to this study's purpose of understanding of users and conflicts between users of Kennesaw Mountain Drive and identifying options to best manage the road and bus shuttle in the future.

1990 Survey

The Cobb Historic Tourism Study included a visitor survey that collected some comments about transportation in and around Kennesaw Mountain that included requests to keep the mountain trail open for longer hours, to add more parking, and to not close the road to vehicles to the top of the mountain.[*]

2003 Engineering Study

In 2003, the Federal Highway Administration's Office of Federal Lands Highway Eastern Division conducted an engineering study for the park. It suggested the following improvements:[†]

- "Share the Road" signs
- Traffic calming devices
- Upgrade existing hiking trail into a multi-use facility (but existing grade/mountain topography may make this impossible)
- Parallel boardwalk and trail to roadway
- Ban pedestrians and cyclists
- Reconfiguration of the Upper Mountain parking lot to improve safety.
- Development of a new parking area at the Old US Highway 41 Activity Area to address safety concerns.

Many of these were reconsidered and retained or dismissed in 2007 by the park, as will be described below. A new parking area along Old 41 Highway is under preliminary design and construction and some new signage has been installed but none of the other improvements have been implemented.

2004 TAG

An NPS Transportation Assistance Group team visited the park in June 2004 to review the park's need for alternative transportation planning and an alternative fuel technology shuttle bus and completed a report in November 2004.[‡] The team included staff from the NPS

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[*] Cobb Historic Tourism Study. Prepared for The Cobb Historic Tourism Committee. Montgomery Research Consultants, Inc. June 1990.

[†] Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges.* June 2003. Prepared for The National Park Service Southeast Region. (provided by park)

[‡] U.S. Department of Transportation, Federal Transit Administration. *Alternative Transportation in the Parks and Public Lands Program, Project Proposal for Fiscal Year 2007 Funds – Planning Project: Conduct Technical Study of Mountain Road Shuttle Bus Service.* February 2007.

Washington Office, NPS Southeast Regional Office, NPS Denver Service Center, Federal Highway Administration, Federal Transit Administration, and US DOT Volpe Center. The group and the report took a broad view of transportation in the park, identifying transportation issues and proposing possible next steps, but did not focus in detail on the Kennesaw Mountain Drive or shuttle issue except for the following one-sentence recommendation: "Initiate dialogue with Cobb County Transit (CCT) to explore short-term partnership opportunities for provision of weekend transit service to top of mountain in lieu of current park contract with private operator."

The report concluded that the park is in need of significant changes to its vehicular, pedestrian, and bicycle transportation infrastructure due to numerous safety, efficiency, and connectivity challenges. For example, it determined that virtually all park vehicular transportation infrastructure is operating beyond capacity, including parking areas and roadways often at Level of Service E and F; it is important to note that most of these roads are commuter through-roads that do not serve the park directly. The report ultimately recommended that the park apply for a number of Alternative Transportation Program (ATP) funding grants with priority given to a comprehensive park transportation study to be incorporated into the GMP development process.

2007 NPS White Paper and Public Comments

In response to the increasing user conflicts on Kennesaw Mountain Drive, the park held two public meetings in 2007, one in January and one in March. The purpose of the meetings was to address critical safety issues involving the mixed use of Kennesaw Mountain Drive by pedestrians, bicyclists, motorists, and the shuttle. Alternatives being considered by the park were presented at the March meeting and represented a consolidation of concepts proposed by previous studies, park staff, and park visitors. There was a 30-day public comment period following the March meeting; the park reported receiving nearly 200 comments. During the public process, the park installed additional signs instructing pedestrians to use the proper side of the road, increased ranger patrol to enforce and educate visitors on the rules of the road, encouraged pedestrian use of the trail, and issued citations to bicyclists and motorists exceeding the posted speed limit.[*]

Proposed Alternatives

The four alternatives proposed by the park in 2007 consisted of:

- Alternative 1 - Improve Foot Trail for Accessibility. Kennesaw Mountain Drive will be closed to pedestrian use; road will be open to private vehicles including bicycles except weekends and holidays, when the shuttle will operate.
- Alternative 2 - Expand Shuttle Service. Shuttle bus service will operate 9:00 a.m. to 5:00 p.m. daily year round, every 30 minutes Monday through Friday, and potentially every 20 minutes on weekends and holidays as needed to meet demand. The park is considering implementing an entrance fee; if that occurs, the shuttle fee would be incorporated into the entrance fee and there would not be a separate fee to ride the shuttle bus. For pedestrians, the outside 4 feet of Kennesaw Mountain Drive would serve

[*] Strack, Julie A. & Craig A. Miller. *Running Uphill: Urbanization, Conflict, and Visitor Use and Kennesaw Mountain National Battlefield Park.* Proceedings of the 2007 Northeastern Recreation Research Symposium. http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs-p-23papers/07strack-p23.pdf

as a sidewalk at all times. The remaining road surface would be shared by park and emergency vehicles, and the shuttle. The road would also be open to bicycles from 5:00 p.m. to 7:30 p.m. daily (weekdays and weekends) during daylight savings time. The road would be closed to private motor vehicles at all times.

- Alternative #3 – Schedule User Groups. The following schedule of access and closures will be in effect:
    - Daily, 7:30-10:00 a.m. – Kennesaw Mountain Drive closed to private vehicles including bicycles; open to pedestrians.
    - Monday – Friday, after 10:00 a.m. – Kennesaw Mountain Drive closed to pedestrians. Road open to private vehicles including bicycles 10:00 a.m. – 5:30 p.m. EST (7:30 p.m. EDT).
    - Weekends & Holidays, 10:00 a.m. – 6:00 p.m. EST (8:00 p.m. EDT) – Kennesaw Mountain Drive closed to private vehicles including bicycles, open to pedestrians. Shuttle bus in operation 10:00 a.m. – 5:00 p.m. EST (6:00 p.m. EDT).
- Alternative #4 – Combine Elements of Alternatives #1-3
    - Under this alternative, the foot trail would be improved for accessibility. The road would be open to pedestrian use from 7:30-10:00 a.m. After 10:00 a.m. the road will be closed to pedestrians and all foot traffic redirected to the foot trail. The shuttle bus service would be expanded to operate 10:00 a.m. to 5:00 p.m. daily year round. The road would be closed to private vehicles, but would be open to bicycles daily from 10:00 a.m. – 5:30 p.m. EST (7:30 p.m. EDT).

For all alternatives, pedestrian use of the road would require pedestrians to abide by laws governing pedestrian use of roadways, i.e. walk on the road shoulder where it exists, and walk to the far outside of the pavement where no road shoulder exists.

Alternatives considered but dismissed included:

- Mark a pedestrian lane on the existing road surface. (Not enough space on roadway).
- Construct a sidewalk adjoining the road. (Not enough space on roadway and cost and resource prohibitive to add space).
- Reduce speed limit and allow continued mixed use. (Speed limit determined to be appropriate).
- Install traffic calming devices and allow continued mixed use. (Traffic calming devices determined to be inappropriate and cause safety issues due to the 12% grade).
- Increase enforcement efforts and allow continued mixed use. (Existing staffing level does not allow for enforcement necessary for success).
- Pave the road shoulder and allow continued mixed use.

Public Comments

The park received 178 written comments in response to the proposed Kennesaw Mountain Drive management alternatives presented above. A variety of perspectives were represented, with many informative comments about the use of the road, common conflicts, and possible solutions. Common themes of comments included:

- *No change necessary.*
- *Road behavior.* Quite a few comments noted the unpredictable nature of pedestrian movements on the Road, as well as their accompaniment by dogs, strollers, and children. Understanding the right of way and rules of the road was also noted as an important

source of confusion and conflict on Kennesaw Mountain Drive. Solutions included improved signage, physical infrastructure changes, and enforcement. Speeding by bicyclists and motorists is a source of concern for pedestrians.

- *Fair access.* Several comments noted the need for a national park to accommodate all modes of access and to provide each user group with an opportunity to access the resource provided by Kennesaw Mountain Drive. For example, some comments indicated a demand for bicycle access during the weekend, at least for some amount of time. Others, however, thought that the mode used by the majority of visitors should have priority.
- *Road closure to certain groups.* There were comments in support of closing the road to private vehicles, closing the road to bicycles, closing the road to both, and closing the road to pedestrians
- *Road vs. the trail.* Several comments suggested improving the trail up Kennesaw Mountain to encourage visitors to use it instead of Kennesaw Mountain Drive. However, a good number of comments noted that most people would continue to prefer the road regardless of changes made to the trail. Reasons given included the following:
    - Safety for individual visitor
    - Access to bird habitat
    - Paved surface (in particular for mobility-impaired visitors and those with strollers)
    - Views

2007 Survey

To complement the white paper and public process described above, the University of Georgia Warnell School of Forestry and Natural Resources conducted an intercept survey of over 1,000 visitors from February to September of 2007[*] to gauge visitor attitudes and preferences for management of Kennesaw Mountain Drive. Unfortunately, the survey report did not include a description of the sample, in terms of hometown, age, frequency of visitation to the park, and which mode they used to access the top of Kennesaw Mountain. The Superintendent at the time had reason to believe that the survey disproportionally represented those who preferred to walk up the mountain, rather than bicyclists and drivers, thereby possibly skewing the results. According to the survey, most visitors (65 percent) felt the road should have open access to all users regardless of type of use (e.g., pedestrians, cyclists, motor vehicles) and that other road users did not interfere with their enjoyment of the park (81 percent).[†] Of the three management scenarios included in the survey, the most popular (38 percent) prohibited personal vehicles and provided daily shuttle service; the second-most popular (31 percent) improved the off-road trail and restricted the road to motor vehicles and bicycles; the least popular (14 percent) set temporal separation of uses. Half (50 percent) of visitors indicated they would be willing to pay an annual entrance pass of $20 per vehicle, while far fewer supported a $5 (9 percent) or $10 (5 percent) daily fee; over a third (36 percent) did not support the implementation of any fee. The survey did not present options in which the shuttle service was discontinued.

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[*] Miller, Craig A., & Julie A. Strack. Warnell School of Forestry and Natural Resources, The University of Georgia. *Visitor Attitudes and Preferences For Management of Kennesaw Mountain National Battlefield Park*. 2008. (Provided by park staff).

[†] Similarly, a majority of visitors (65%) disagreed that too many different activities were allowed on the road and a majority (58%) agreed that there was enough room on the road for all types of activities.

Critique of White Paper Recommendations

This section provides brief critiques of Alternatives 2 and 3 from the 2007 White Paper described in the previous section. These critiques provide the basis for the recommended management strategy presented in the next section.

Critique of Alternative 2 – Expand Shuttle Service

Alternative 2 is presented verbatim below because the critique presented in this section makes very specific references to the details of the alternative.

> Under this alternative, the shuttle bus service will operate 9:00 a.m. to 5:00 p.m. daily year- round. The shuttle will operate every 30 minutes Monday through Friday. Frequency may increase to every 20 minutes on weekends and holidays as needed to meet demand. The Park has requested funding for a technical study (our study) to evaluate the best vehicle for this service in terms of size, technology, and method of acquisition, and will pursue those recommendations as appropriate and dependent upon available funds. The current shuttle fee is $2/adults and $1/children per day. The park is considering implementing an entrance fee. The shuttle fee would be incorporated into the entrance fee and there would not be a separate fee to ride the shuttle bus.
>
> Pedestrians – The road would be restriped and flexiposts installed to designate the outside 4 feet of road pavement to serve as a sidewalk. Pedestrian traffic would be required to stay within this designated walkway at all times, including weekends and holidays.
>
> Vehicles – The road would be closed to private motor vehicles and a motorized gate installed at the road entrance to preclude illegal access. All visitors desiring to be transported to the top of the mountain by vehicle would be required to use the shuttle bus. The remaining 16 ft. of road surface would be shared by park and emergency vehicles as necessary, requiring careful communication and coordination with the shuttle bus driver to avoid head-on collisions. The road would be open to bicycles from 5:00 p.m. to 7:30 p.m. daily (weekdays and weekends) during daylight savings time. Bicycles would share the remaining 16 ft. of road surface with park and emergency vehicles.

During the May 2009 site visit, Superintendent Stanley Bond essentially echoed this alternative and concept as his preferred 'vision' for how to manage the road.

Several issues, however, present themselves:

- Despite the fact that vehicles require substantially more road space per unit than do pedestrians, data on usage of the road to access the summit indicate the following : ~18,000 using private operating vehicles, ~ 17,000 using the bus shuttle, and ~ 650,000 on foot or bicycle.[*] Therefore confinement of this volume of pedestrians in such a confined

[*] Based on 2008 NPS visitation data for Mountain Road and Visitor Center traffic counts (NPS Public Use Statistics Office) and 2008 NPS shuttle ridership data (provided by park).

space is likely to be neither workable, nor seen as equitable. The 4' cross section is not wide enough for two friends to stroll their babies together (as opposed to single file).

- Although the delineation between the pedestrian domain and the vehicular domain uses flexiposts, any vertical obstruction on the narrow roadway – given the grades and descending speeds of bicyclists – poses a severe risk to bicyclists. Either the bicyclist if hit directly by the flexipost (essentially whip lashed at 30 mph) may lose control and be propelled under his momentum to vault over the drop-off (only 4' to the edge), or else the flexipost may get caught in the bicyclist's wheel, causing the bicyclist to collide with other users.
- The road would be open to bicycles from 5:00 p.m. to 7:30 p.m. daily (weekdays and weekends) during daylight savings time. Bicycles would share the remaining 16 ft. of road surface with park and emergency vehicles. While a shared bicycle –vehicle lane according to AASHTO design standards is 14 feet (desirable as opposed to minimum conditions)*; this presumes single-directional flow of both vehicles and bicycles. The 16' cross section proposed here must entertain the possibility of two-way flow of both vehicles (park and emergency vehicles) and bicycles. This places descending bicyclists on the steep down grades (at 30 mph or greater) in a potential head-on collision posture with ascending park and emergency vehicles (at 25 mph or greater), for a closing speed of greater than 50 mph. Not only is this counter to all bicycle facility design standards, there is little maneuvering space for the bicyclist to avoid collision with other users as well.
- Any bus shuttle frequency of service less than 30 minutes (e.g., the proposed 20-minute frequency) will require additional vehicles to meet the schedule.

Critique of Alternative 3 and Space- and Time-Separation Strategies

There are generally two types of options to resolve incompatible user uses and conflicts: space separation and time separation. Park staff has clearly indicated that enforcement of either is not feasible with staff constraints. Due to site location, road geometrics that limit sight lines, and environmental and historic preservation imperatives, space separation by widening the Kennesaw Mountain Drive cross section is not likely to be either feasible or acceptable.

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* See National Park Service, Alternative Transportation Program. *Pre-Planning Project (PPP) Trip Report, Kennesaw Mountain National Battlefield Park.* Draft, September, 2004.
Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges.* June 2003. Prepared for The National Park Service Southeast Region. (provided by park)

Recommended Design and Operational Strategy for Management of Kennesaw Mountain Drive

This section recommends a management strategy for Kennesaw Mountain Drive, including shuttle operations, and a design modification of the road itself to improve use and safety.

A hierarchy of users (from most benign to least benign) has been identified based on environmental impact (i.e., noise and air emissions, fuel consumption, and visual intrusion and annoyance) and road space consumption. The hierarchy is as follows.

5. pedestrians (which include birders, walkers, joggers, and parents with strollers),
6. bicyclists,
7. bus shuttle users (with the bus replacing private vehicles assuming a 27 passenger load on a ratio of 9 to 14 depending on average vehicle occupancy), and
8. private vehicles.

Park staff have stated that any management solution must continue to allow vehicular access to the top of Kennesaw Mountain for interpretative purposes (part of the legislative purpose of the park), and must provide for visitor safety. Traffic data provided by the park and Cobb County indicate that on average 40-80 vehicles per weekday ascend and descend Kennesaw Mountain Drive. Thus exclusion of private vehicles appears to be both feasible and desirable based on environmental grounds and on the ability to shift the limited demand for vehicular access by privately-operated vehicles to an expanded shuttle system not too dissimilar or resource intensive to that now provided on weekends and holidays. With this change, the shuttle system becomes mission critical to the provision of vehicular access to the summit for interpretive opportunities. **As a basis for a strategy to manage user conflicts and increase safe operation of the road, this study recommends that private vehicles be excluded from Kennesaw Mountain Drive and that the bus shuttle be expanded to operate seven days a week.**

Management of the other user conflicts – pedestrians, bicyclists, and the shuttle – in a safe manner is however complex. Although AASHTO and state bicycle facility design guides articulate a preferred path width for a multi-use path of 10', equivalent to the outside lane on Kennesaw Mountain Drive, this standard does NOT apply here due to the sustained length of down grade, speed variance between bicyclists and pedestrians (including birders who are often stationary for long periods of time with no or little situational awareness of other users), and the sizeable volume of pedestrians. Although not designed as a shared-use path, acknowledging its use as such under accepted AASHTO and state bicycle facility design standards would necessitate a cross section width of 14' or greater*. This, however, would preclude vehicular

* See, e.g., Vermont Pedestrian and Bicycle Facility Planning and Design Manual, December 2002, Chapter 5, p.5-13; and Florida Bicycle Facilities Planning and Design Handbook, April 2000, Section 5.5.2: Under certain conditions it may be necessary or desirable to increase the width of a shared use path to up to 22 feet (6.6 m). Examples include:

- substantial bicycle volume
- probable shared use with joggers, in-line skaters and other pedestrians
- use by large maintenance vehicles
- steep grades
- sharp curves
- places where bicyclists will be likely to ride two abreast.
- Wide paths may benefit by designating separate sections for use by "wheels and heels."

access and use of the narrow road cross section by the bus shuttle. So it is essential that bicyclists use the same vehicular channel as the bus shuttle; thus, the alternative must encompass a space-separation strategy that separates bicyclists on the road from pedestrian users.

But because of the narrow cross section of the road (and insufficient width to incorporate a wide lane in each direction – necessitating a 28' cross section), the two-way directional flow of bicycles requires imposition of a time-separation strategy so that shared use of the vehicle channel by both bicycles and the bus shuttle is NOT concurrent. This is a requirement in order to avoid placing bicycles in a potential head-on collision posture.

Finally, the alternative must allow access by park staff vehicles on an intermittent basis and emergency vehicles on an as needed basis (relatively rare event).

Addressing all of these requirements while resolving the issues inherent in Alternative 2, the US DOT Volpe Center concept or alternative - which modifies Alternative 2 ("Expand Bus Shuttle") and incorporates an element of Alternative 3 ("Schedule User Groups) of the White Paper – consists of the following design and operational elements:

- Redesign the road cross section to consist of a vehicular channel of 14', and a pedestrian channel or domain of ~ 6 feet. (see Figure 25)*
- Differentiate the pedestrian channel from the vehicular channel by tinting the pavement surface an earth-tone or brown (see Figure 25)
- Remove the existing centerline pavement marking, and install a ~ 6" width granite curbing or stone longitudinal delineation between the vehicular and pedestrian channels, but flush with the road surface. The surface of the stone delineation should be roughened to maximize skid resistance. (see Figure 26)
- Along with installation of the longitudinal delineation would be a subsurface conduit carrying power (tied into the Solar Power system on the Visitor's Center) to a series of in-road (flush) emergency use lights in between segments of each stone slab at a spacing every 100 feet to the summit. (see Figure 26)
- Signage along the road (in both directions) advising pedestrians to move to the inside mountain edge (with appropriate arrow on signage, depending on location of sign) when the emergency use light system is activated
- Usage of the vehicular channel would be as follows:
    - M-F 7:00 AM – 9: 30 AM Bicycles (two-way flow)
    - M-F 9:30 AM – 10:00 AM Clearance Time (No vehicles)
    - M-F 10:00 AM – 4:00 PM Bus Shuttle (Single-lane two-way operation)
    - M-F 4:00 PM – 4:30 PM Clearance Time (No vehicles)
    - M-F 4:30 PM – 7: 00 PM (Day light Savings) Bicycles

* Vehicles were assigned to the inside lane because of concerns about the pavement edge on the outside lane. During the project site visit in May 2009, the U.S. DOT/Volpe Center study team observed cracks in the pavement edge on the drop-off side of the road, most likely due in part to lack of a paved shoulder and uniform thickness of the pavement. This road condition raises the possibility that heavy vehicles (cars, but also the bus) may not have sufficient foundation support to preclude a cataclysmic pavement failure (i.e., crumbling of the roadway) resulting in the fall of the vehicle over the mountain edge.

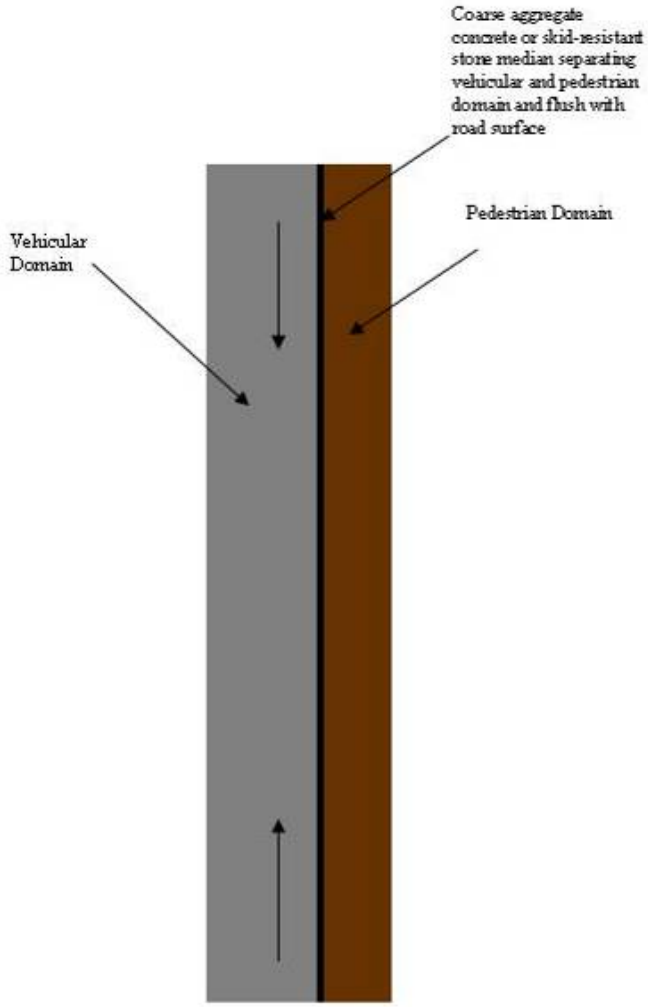
    - Weekends and Holidays, 9:00 AM – 4:00 PM (Winter) 6:30 PM (Summer) Bus Shuttle
- Usage of the pedestrian channel or domain would be as follows: All Days, All Hours
- Establish three operating protocols (that only apply to the Bus Shuttle operator and park and emergency personal staff who are able to comply):

1. Operating Protocol 1: Formalize a written procedure for the Bus Shuttle Operator on driving the vehicular channel in a single –lane operation up and down the road when pedestrians are in and crossing the vehicular channel (Note: While this concept provides an exclusive pedestrian domain no assumption is made that all pedestrians will adhere to the space allocated to them. Some will still wander and use the whole road cross section, and bus drivers need to adhere to a safe protocol, i.e., to slow to establish eye contact while the pedestrian moves to the side, or in the event the pedestrian is not cognizant of the presence of the bus, to hold the bus stationary until the pedestrian passes and clears the bus.)

2. Operating Protocol 2: For routine intermittent access and patrol by park rangers, park staff will use a Segway Personal Transporter, which has a small footprint and cross section, within the vehicular channel, with coordination and communication with the Bus Shuttle Operator when access by the park is within the time slot that the bus shuttle operates)

3. Operating Protocol 3: When park staff need to use a vehicle for access to points on Kennesaw Mountain Drive, or when emergency vehicles (park or local governmental agency) require such access, the park will activate the emergency use light system (activating flashing lights up the length of the road). Park vehicles and/or emergency vehicles will then straddle the stone delineation (using 3.5' from the pedestrian channel and 3.5' from the vehicular channel – a cross sectional width of 7', equivalent to the width of the vehicle) up or down the road – a narrow 'virtual' lane for park and emergency vehicle access. This still leaves ~ 10.5' vehicular channel width for the two-way flow of bicycles or the bus shuttle operation dependent on the time slot – and separated from the park and emergency vehicle 'virtual' lane. Bicycles are NOT placed in a potential head-on collision posture within the same lane. (Note: Emergency vehicles are commonly use to riding the middle of the road along the centerline during highly congested urban conditions).

Figure 25
Schematic Plan – US DOT Volpe Center Concept
Source: US DOT Volpe Center



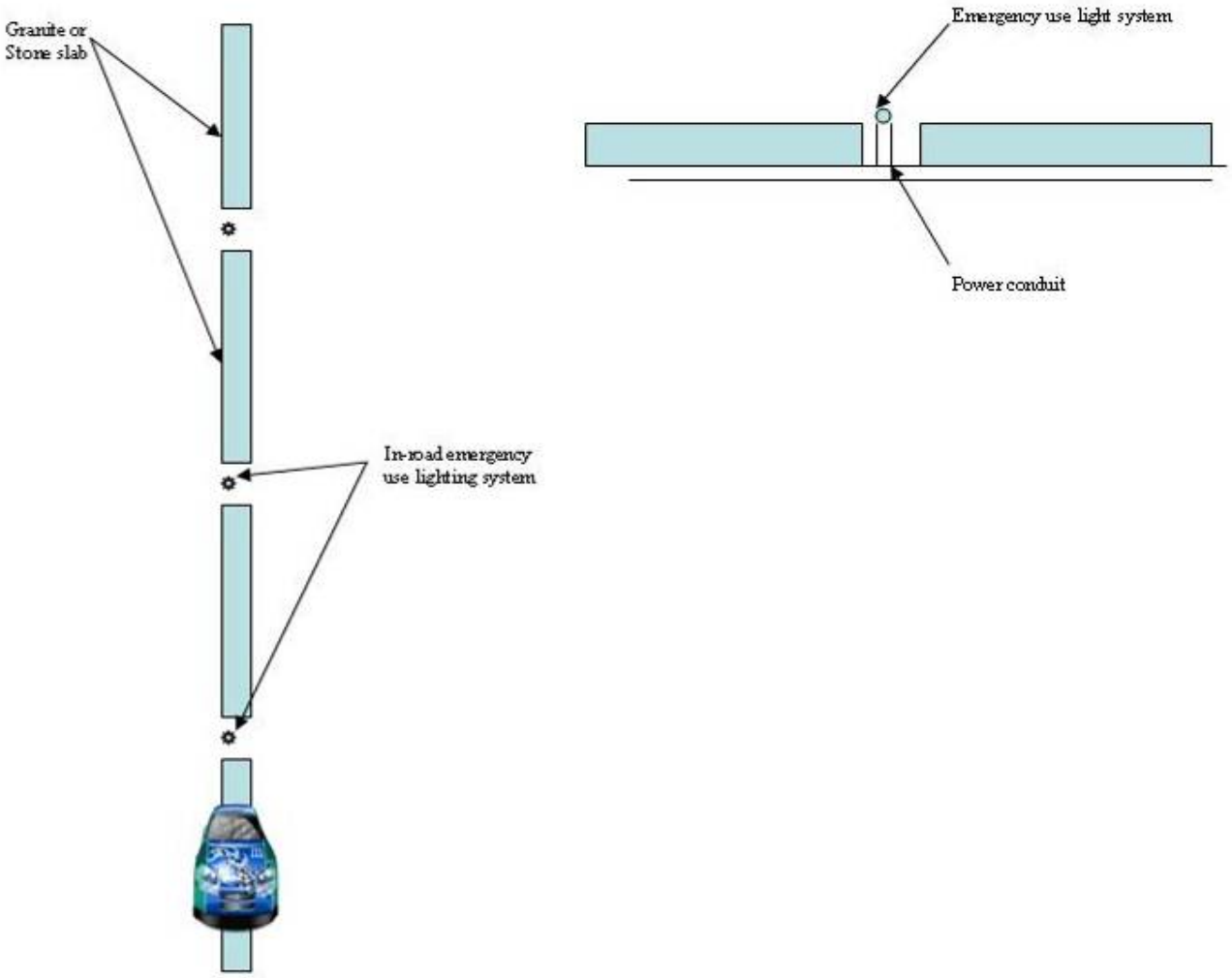
Time-separation strategy:

Two-way bicycle usage of vehicular domain 7:00 AM – 9: 30 AM M-F, and 4:30 PM –Sunset M-F

Single-lane bus shuttle operation 10:00 AM-4:OO PM M-F

Single-lane bus shuttle operation Weekends and Holidays, 9:00 AM- 6:30 PM

Figure 26
Section Schematic: Longitudinal Delineator between Vehicular Channel and Pedestrian Channel
Source: US DOT Volpe Center



Financing and Management of Recommended Shuttle Service

This section presents the following information:

- Projected cost of recommendation shuttle service
- Proposed method of revenue collection in terms of fees, technology, and revenues
- Recommended management of shuttle service in terms of contract, lease or purchase, and partners

Projected cost

The projected annual operations and maintenance cost of the recommended shuttle service, based on the assumptions below, is estimated to be $75,000. This would vary depending on hours of operation and does not include administrative, enforcement, and fee collection costs; however, as described below, these could be kept at a minimum.

Table 3
Projected Annual Operations and Maintenance Assumptions and Costs

Cost Categories	Assumptions	Estimated Costs
Fuel per mile ($3 per gallon at 6 miles per gallon)	$0.50/mile	$6,445
Maintenance cost per mile	$0.50/mile	$6.445
Cost of driver	$25/hour	$61,975
Number of miles (Round-Trip)	2.6	
Length of Round Trip	0.5 hours	
Total Round Trips*	4,958	
Total Cost		$74,865

Proposed Method of Revenue Collection

This section reviews possible methods of revenue collection, including fees and technology, and estimates projected revenue. The study, based on consultation with NPS staff,† recommends implementing an entrance fee, to be collected at five primary parking areas within the park, including the parking area at the Visitor Center, through the use of automated fee machines.

Fee Options

There are three primary options for fee collection at National Parks: parking fee; transportation fee; and an entrance fee. Based on an assessment of each option, described below, an entrance fee that is collected at the primary parking lots within the park is recommended.

The park currently charges a transportation fee for users of the shuttle and revenues from that fee cover approximately 30-35% of the cost of the shuttle; thus the fee would have to be increased substantially to cover the full cost of the expanded shuttle service. Charging a fee for any service usually decreases demand for, or use of, that service. When Kennesaw Mountain NBP instituted a charge for the shuttle system, ridership dropped by approximately 50%.‡

*Consists of 3,120 weekday trips (10am-4pm), 441 weekend winter trips (9am to 4pm), and 1,397 weekend summer trips (9am to 6:30pm)

† Personal communication with Rich Devenney, Fee & Special Park Use Program Manager, Southeast Region, on February 2, 2010 (by phone)

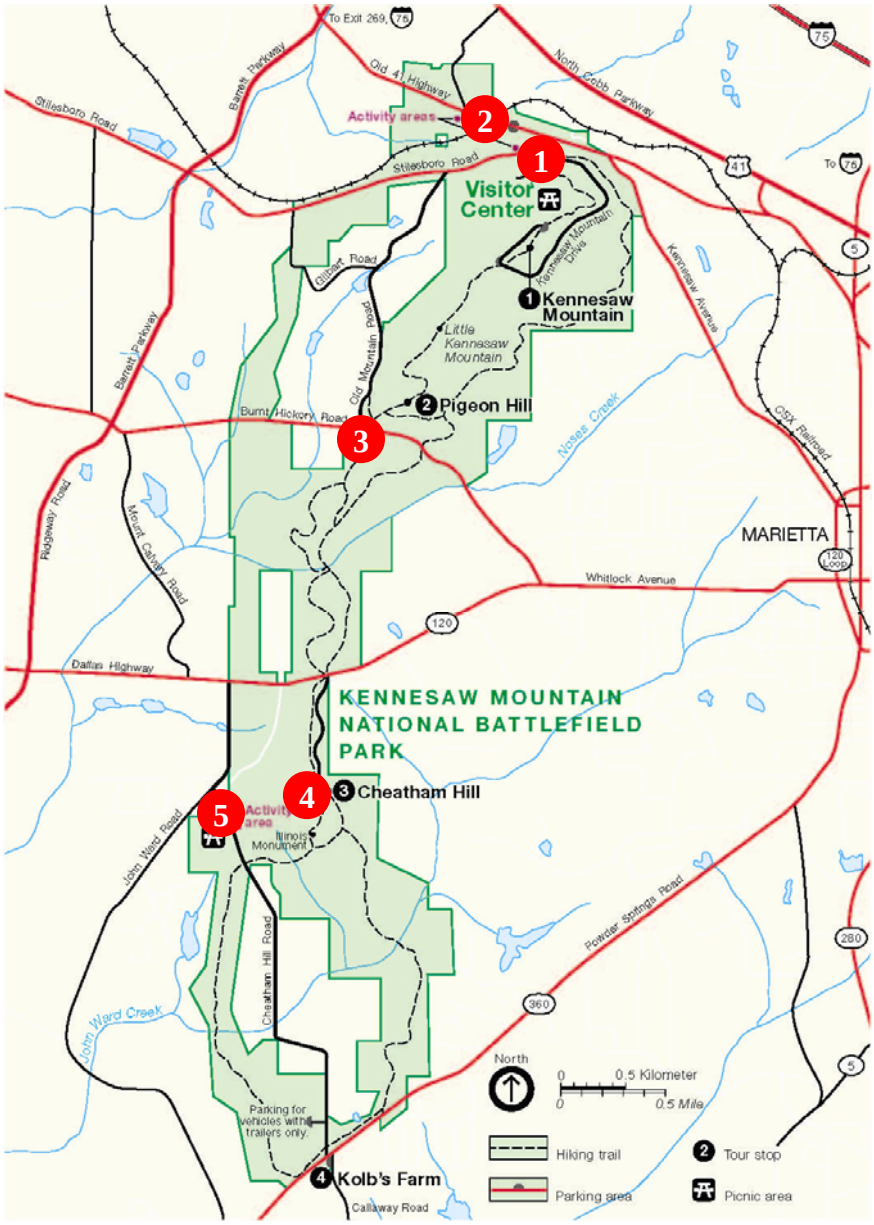
‡ Based on monthly shuttle ridership data provided by park.

Under the recommended management strategy, the shuttle would become the only vehicular access option to access the summit and as such, there is some concern that charging for it would be negatively received by the public. However, the percent of visitors that have shown preference for vehicular access has historically been quite low. A free shuttle would result in loss of revenues from fares and would only be possible if another source of funding was identified.

The FY2006 ATPPL application states that a new entrance fee will include a transportation fee to support the shuttle service. Such a fee has been used successfully in other parks that have a couple distinct, staffed access points, but only to cover a portion of transit service costs. Because of the porous nature of the park's boundaries, including through roads carrying commuter traffic, and multiple entrance points to the park and its road and trail system, Kennesaw Mountain NBP can not institute a cost-effective entrance fee system unless tied directly to parking. A selective parking fee for the Visitor Center and overflow lot, solely to fund the shuttle, is not currently politically feasible[*] so such a parking fee would have to be implemented throughout the park as an entrance fee and its revenues would have to be used for other activities. Chattahoochee River National Recreation Area, located approximately fifteen miles east of Kennesaw Mountain NBP, charges an entrance fee administrated at several parking locations and revenues used for a variety of park activities. The five largest of Kennesaw Mountain NBP's parking areas, two of which – the Visitor Center parking area and the parking area at Old 41 Highway, currently under construction – are located in the study area, provide an opportunity for such an entrance fee (see Figure 27).

[*] Personal communication with Rich Devenney, Fee & Special Park Use Program Manager, Southeast Region, on February 2, 2010 (by phone)

Figure 27
Map of Five Main Parking Areas
Source: NPS



Key	Parking Area	Capacity
1	Visitor Center	84
2	New parking area (to replace Visitor Center overflow / parking along Old Highway 41)	250-300
3	Cheatham Hill/Illinois Monument	44
4	Burnt Hickory Road/Pigeon Hill	36
5	Cheatham Hill Road Activity Area	24

The study recommends the implementation of an entrance fee at these five parking facilities to support the shuttle. The technology by which such a system could be implemented and the

analysis of projected revenue from this system are both presented below and demonstrate how such a system would be able to cover all operations and maintenance costs of the recommended shuttle service.

Technology

There are four main options for collection of fees in parking areas: voluntary lock-box; regular parking meters; parking gate either staffed or with credit or card or proximity capability; and pay and display meters, also known as automated fee machines (AFMs), which replace multiple meters. The voluntary lock-box requires people to have cash and exact change, would require emptying, and would also be susceptible to vandalism and theft; regular parking meters have similar problems. A voluntary lock-box may be appropriate for targeting pedestrians and bicyclists who do not drive to the park and want to contribute an unspecified donation. A parking gate would have substantial initial capital costs and operating costs, require reconfiguration of the parking area, cause traffic backups due to transaction time, and also would rely on a technology that is not yet commonplace in the U.S. In addition, it may cause negative perception of the park. A pay-and-display honor system would allow the visitor to use one or two common meters per parking area to purchase a pass with quarters or credit card. The pass can then be displayed on the vehicle's dashboard, and to be checked randomly by park staff with reminders and, if necessary, tickets. The system could even offer different types of passes (daily, weekly, annual) to offer some flexibility and to recognize different types of visitors. This system would require the purchase of one or two meters per parking area, limited maintenance and enforcement, and would have a low impact on the visitor's visual experience and perception of the park. An example of a pay and display meter from Cambridge, MA is shown in Figure 28. Marketing of the entrance fee would be important but could be tied directly to the provision of a mandated and accessible transit system. The pass system could allow for some creativity and visitor participation in the design of the pass.

The study recommends the use of AFMs for collection of the proposed entrance fee at the five primary parking areas within Kennesaw Mountain NBP. The Chattahoochee River National Recreational Area, located fifteen miles east of Kennasaw Mountain NBP, charges an entrance fee of $3 that is collected using AFMs at parking areas. The AFMs each cost $80,000 to install, including wiring, full enclosure, and the machines ($30-35,000 each). The full enclosure has become necessary because of issues with break-ins. Kennesaw Mountain NBP would most likely need at least five AFMs (one for each parking area) but, assuming at least one AFM is necessary per 100 spaces, the new large parking area (capacity of 250-300) would require three, for a total cost of $560,000 (7 x $80,000 each).

Figure 28
Cambridge, MA Pay & Display Meter
Source: City of Cambridge. http://www.cambridgema.gov/traffic/luke.cfm

Projected revenue stream

To determine projected revenue stream, the ideal methodology would be to estimate the number of vehicles over a given period of time that will park in the five primary parking areas and what percentage of vehicles are repeat visitors as opposed to one-time visitors. However, data is not available to support such an estimate. Therefore, several assumptions will be made using overall visitation in 2008 and observed visitation patterns to develop a rough estimate.[*] In 2008, the park experienced 1.4 million visits. Of those, we assume half (50 percent) were repeat visits by individuals who visit the park at least 100 times a year.[†]

Category	Data/Assumption
Total number of visits (2008)	1.4 million
Assumed repeat visits (50%)	700,000
Assumed repeat vehicle visits (assuming 2.1 visitors per vehicle)	333,333
Assumed frequency of repeat visits	100
Number of repeat vehicles	3,333
Revenue from repeat vehicles ($25/vehicle)	**$83,333**
Assumed one-time visits	700,000
Assumed one-time vehicle visits (assuming 2.1 visitors per vehicle)	333,333
Revenue from one-time vehicles ($3/vehicle)	**$1,000,000**
Total Revenue	**$1,083,333**

[*] This model would need to be refined by the park and by future data collection.

[†] The 50 percent is based on the Cobb Historic Tourism Study (1990); the 100 visits a year is based on anecdotal reports (from park staff and various documents such as the 2007 Strack & Miller article) that many local visitors use the park as their primary recreational facility and thus approximately two visits a week could be a realistic assumption.

The amounts of $25 and $3 are for calculation purposes only and would require a civic engagement process and approval; however, it seemed appropriate to match the fees charged at the nearest recreational area, Chattahoochee River National Recreation Area. In addition, these amounts are comparative to entrance and parking fees charged by other public land units.

Of the total projected revenue, less than a tenth would be needed for administrative and operations and maintenance costs of the new shuttle system (and/or the contract that includes such costs). The remaining amount could be used for other park programs, activities, and maintenance, including trail maintenance and interpretive programs.

Management

External vs. In-house Contract

The park has historically used an external contract to provide the bus and operate the service. The advantages of this is that the operator has expertise in transit and buses and has infrastructural and organizational advantages in providing maintenance, repair, storage, training, and regulatory activities. The disadvantages include a lack of direct control over particular operational practices and the separation of the service from the park; however, both of these aspects could be countered by careful contract specifications and the placement of volunteer or permanent interpretive staff on the bus. The lack of control includes the type of bus; alternative fuel vehicles are not yet very commonly available from transit contractors. The park does have access to capital funding that could purchase an alternative fuel vehicle. However, the advantages for having an external contractor operate the vehicle lead the study to recommend that the shuttle continue to be operated in this way.

Lease vs. Rent

If the park does decide to directly obtain its own vehicle rather than have a contractor supply it, its choices are to lease or buy. However, leasing is not a good option since the history of shuttle service and recommended change in management of Kennesaw Mountain Drive both represent a permanent, long-term commitment that makes the shuttle mission critical to the park's legislative purpose. Buying the vehicle would also be more cost-effective; for example, if a bus were purchased for $200,000 with a 12-year life-span, its cost assuming capitalization would be approximately $219,000[*] and leasing an equivalent vehicle for $3500 per month would surpass the purchase cost in five and a quarter years ($210,000/($3500*12 months). Buying a vehicle would require higher upfront costs but would free the park from any lease commitments and would allow the park to sell the vehicle at any time. Leasing is most appropriate in situations in which a shuttle service is being pilot tested and a permanent service is uncertain.

[*] $200,000 x capital recovery factor of 1.15 (assuming 10% discount rate and 12 year life expectancy) divided by 12 year life expectancy

Potential Partners

The 2004 Transportation Assistance Group recommended partnering with Cobb County to use the Cobb Community Transit vehicles not used on the weekends; however, since the recommendation is to extend the service to daily, this scenario is no longer relevant. However, Cobb Community Transit could provide maintenance support and potentially short-term vehicle borrowing. The other source of maintenance support and short-term replacement could be the Metropolitan Atlanta Rapid Transit Authority (MARTA); however, support available for electric and electric hybrid vehicles will be discussed in the next chapter.

Former Kennesaw Mountain NBP Superintendent John Sissel discussed a regional shuttle with the towns of Marietta and Kennesaw, mainly to serve overflow parking on weekends. In 2005, the town of Marietta considered the feasibility of a trolley service that would provide service to a number of tourist attractions, including potentially Kennesaw Mountain NBP. The park responded with cautions about the schedule, length and number of destinations for the proposed route, the fact that the visitors coming to Kennesaw for recreation would be unlikely to take a trolley, and importance of understanding the impact of pricing. However, the park also admitted that a shuttle to satellite parking is likely to become necessary when the park eventually eliminates overflow parking along the road shoulders for safety and aesthetic concerns.[*] The town of Marietta got a trolley in April 2008 but as an interpretive, tourism service rather than transportation and as mentioned previously, it stops at the Visitor Center but does not allow passengers to disembark.

The ongoing park-wide Alternative Transportation Study may recommend regional transit connections to the Park, including serving satellite parking areas.

[*] Email from Dan Brown (former KEMO Superintendent) to Micky Blackwell, member of the Marietta Trolley Advisory Committee, on 9-19-2005.

Vehicle Technology Assessment and Recommendation

This section presents the following information:

- Introduction of alternative fuel vehicles (AFVs);
- Assessment and recommendation of a minimum capacity for the shuttle;
- Documentation of a high-level survey of three transit operators and four manufacturers of electric and electric-hybrid vehicles; and
- Comparison and recommendation on the feasibility of these technologies for the Kennesaw Mountain shuttle.

Alternative Fuel Vehicles

The staff of Kennesaw Mountain NBP have expressed a strong desire for an alternative fueled vehicle (AFV), which is consistent with the National Park Service policy of using AFVs whenever possible. The use of AFVs is often in the best interest of the parks as they reduce vehicle emissions and air pollution; in the case of Kennesaw Mountain NBP, the park is located in Cobb County, which is within the Atlanta metropolitan area air-quality non-attainment area.[*] The FY06 ATPPL application requested a diesel electric hybrid or biodiesel AFV. The primary alternative to AFVs is the standard transit bus, the current model of which uses ultra-low sulfur diesel as required by the EPA and therefore falls under the category of "clean diesel."

This study examines the feasibility of electric and electric hybrid vehicles only. Other AFV fuel options include ethanol, methanol, hydrogen, compressed natural gas (CNG), propane, and biodiesel. Currently, no domestic bus manufacturer is producing commercial methanol or ethanol propelled products. Hydrogen technology is still in relative infancy and is cost-prohibitive. According to research done by the US DOT Volpe Center for Zion National Park and North Cascades National Park, Detroit Diesel, Caterpillar and Cummins are all exiting the market for medium duty propane engines. This is an argument against going forward with propane vehicles at park units because of the lack of manufacturing support, advances in technology, or availability of replacement parts for the long-term. However, clean diesel and/or bio-diesel is a low-risk strategy, and now with the use of ultra-low sulfur diesel (mandated by law), can provide substantial emission benefits. A private source of CNG (Cobb Electric Membership Corporation) is located five miles from Kennesaw Mountain NBP and biodiesel can be purchased from the SA White Oil Company, seven miles away.[†]

Feasibility of alternative fuel at any given site depends on a number of factors, including:

- site location and weather;
- fuel source availability and proximity;
- site-specific infrastructure needs (e.g., fuel storage tank and dispensing system);
- capability of park staff, contracting staff, and/or local mechanics to operate and maintain vehicles;
- route characteristics, such as grade and length; and
- vehicle characteristics, such as capacity and amenities.

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[*] Federal Highway Administration Environment Air Quality Conformity. http://www.fhwa.dot.gov/environment/conformity/nonattain/pm25pages/pages/ga_atlanta.htm

[†] US DOE's Alternative Fuels & Advanced Vehicles Data Center. http://www.afdc.energy.gov/afdc/stations/find_station.php

Capacity

To determine necessary shuttle capacity, ridership data by one-way trips are necessary. This data was only available for July 2009; data for previous years was only available by month or day but was also analyzed (see Table 4) and does show that the average ridership dropped by 50 percent due to the introduction of the fare.

Table 4
Average, Variation, and Maximum Passengers per Trip (Data estimated from Monthly Ridership 2003-2006 and Daily Ridership 2007-2008)
Source: Data provided by park staff and analyzed by the US DOT Volpe Center

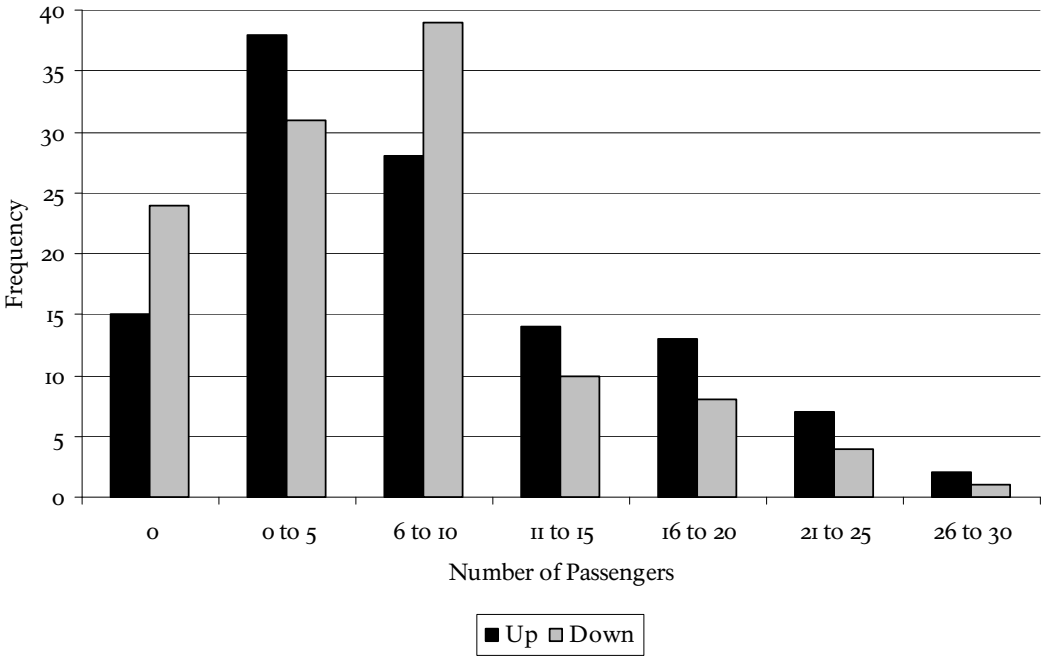
Year	Average Passengers per Trip	Variation	Maximum	Fare Status
2003	10	3	13	No fare
2004	7	2	9	Fare introduced
2005	5	2	7	Fare in place
2006	5	2	7	
2007	5	1	6	
2008	5	1	6	

Note: low ridership days due to inclement weather excluded when possible

The average ridership for July 2009 was eight with a standard deviation (or variation) of 7.[*] Figure 29 shows the pattern of ridership loads for this time period. According to this month's patterns, a 15-passenger vehicle would offer sufficient capacity for over 75% of the up trips and nearly 90% of the down trips. A 25-passenger vehicle would offer sufficient capacity for 98% and 99%, respectively. [†]

[*] The one day with rain was not included in the analysis.
[†]Note, this was a limited sample and happened to be taken from the month of highest visitation for 2009 and a month of unusually high visitation historically (see Figure 4 in Existing Conditions).

Figure 29
Ridership Patterns for July 2009
Source: Data provided by park staff and analyzed by the US DOT Volpe Center



If the shuttle service were made fare-free, ridership could potentially double and return to pre-fare levels. If the data above is doubled, a 30-passenger vehicle would be necessary to achieve sufficient capacity for 75% of the up and 90% of the down trips, and a 40- or 50-passenger vehicle would be necessary to satisfy the remaining demand. However, given the lack of data, the geometric constraints of the road and turn-around at the summit, and the scale of the road, with its use by pedestrians, it is recommended that the necessary future minimum capacity be 25-30.*

* It should be noted that this capacity is assuming a 30-minute frequency and the use of one bus.

Manufacturer and Operator Survey

The study team successfully contacted four hybrid electric and electric manufacturers (Ebus, Azure Dynamics, GatorMoto, and EVAmerica), in addition to several others that did not return communications, and three operators. This section does not represent an extensive market survey or vehicle decision process but is instead intended to present a sample of manufacturers and operators and identify advantages and disadvantages of operating hybrid electric or electric AFVs at Kennesaw Mountain NBP. Other major manufacturers of electric and hybrid electric transit vehicles are IC Bus, El Dorado, and NewFlyer. Contact information and detailed specifications for each manufacturer and operator are included in the Appendix.

The study team prepared a list of questions for both the manufacturers and operators that focused on vehicle specifications, vehicle use, performance on grade and operating and maintenance experience. A summary of the information gathered is provided in the conclusion while information provided by the manufacturer and operators is provided in the sections below.

Ebus

Ebus is a hybrid electric, fast-charge electric, and fuel cell bus and trolley manufacturer that has existed since 1998 and is currently based out of Downey, California. However, it owns a plant in Chattanooga, Tennessee, less than two hours from Kennesaw Mountain NBP, and still has two service staff at that location who could visit the park upon request. The Ebus product line is summarized in Table 5 below; all vehicles are powered by an electric traction motor that powers the rear axle instead of an internal combustion engine and can accommodate one tie-down wheelchair and are low-floor with flip-over ramps but do not have lifts. Ebus is currently working on fast-charge technology that would allow full-size (30 or 40 foot) transit buses to go ten miles per charge with five-minute charges. In speaking to the manufacturer, it is possible that the electric or hybrid electric vehicle would need to be modified to handle the grade effectively but this would need to be determined by either doing a demonstration on-site or identifying a similar route to test in California.

Table 5
Ebus Vehicle Information

Vehicle	Length (ft)	Capacity	Cost (not including shipping/taxes)	Range (miles)	Charge Time (minutes)	Grade
Fast-Charge Electric Bus or Trolley	22	22	$295,000 (bus) or $315,000 (trolley) (plus $58,000 for 90KW Fast-Charger)	45	30	Up to 18%
Hybrid-Electric Bus or trolley (HD-5 propane or low-sulfur diesel)	22	22	$325,000 (bus) or $335,000 (trolley)	150-250	Not applicable	Up to 18%

Ebus vehicles have been deployed in several places throughout the U.S. The Santa Barbara Metropolitan Transit District has an Ebus fleet of twenty electric buses that is has used for short downtown and waterfront shuttle routes since 2000. New Haven, CT, received four Ebus electric trolley replicas in 2002.

Sevierville, TN, a gateway community to the Great Smoky Mountains National Park, was identified by the manufacturer as the closest operator to Kennesaw Mountain NBP with a good-sized fleet of Ebus trolleys. The Town's fleet is operated by Fun Time Trolley but owned and maintained by the Town. The fleet consists of eight 22-foot hybrid electric trolleys that use propane with a small auxiliary diesel fuel tank. Four of the trolleys were bought new in 2003 for approximately $300,000 each while the other four were bought used from Knoxville in 2004. Seven of the trolleys are active in service while the eighth trolley has been used for parts. The trolleys operate on a fixed route that is six miles one-way, with numerous stops on request, and runs 16 hours a day, from 8:30am to midnight. The route is fairly flat but from experience on some local hills, the operator did not think the trolleys would handle grade well. The ancillary charger for the vehicles can charge two vehicles at a time.

The operator reported several operating and maintenance problems. The first three years of operating the trolleys was very problematic, with much effort required to keep the vehicles on the road, and an average roll-out rate of 20% (two of the eight vehicles). The problems have lessened as the maintenance staff has gained familiarity and experience with the vehicles. The Town has devoted a full-time mechanic, who spent time at Ebus in California for training, to the fleet. As noted above, one of the eight vehicles has been designated as a parts supply, in part because of the frequent problems but also in part because all parts have to come from Ebus so there is often some type of delay. The operator acknowledged that success with AFVs is highly dependent on finding a capable mechanic to support the fleet. One problem that remains is the vehicles' dislike for cold weather; in winter evenings, the vehicles start having problems and have to be replaced. The operator also uses propane buses which also have problems, mainly due to underpowered engines and filter issues.

Azure Dynamics

Azure Dynamics is a manufacturer of electric and hybrid electric drive technology headquartered in Detroit, MI, with offices in Boston, MA, and Vancouver and Toronto, Canada. Azure Dynamics produces two gasoline-powered hybrid electric cutaway vehicles of interest for Kennesaw Mountain NBP: the mid-sized CitiBus and smaller Balance. The CitiBus has a wheelchair lift in the right rear of the vehicle and offers flexible seating configurations. Both the CitiBus and the Balance have completed the Altoona 200,000-mile, seven-year durability test and meets the requirements for most Federal and State stimulus programs.

Azure Dynamics has technicians who are available by phone but also travel to sites of deployment for assistance and for initial introductory training to the operator's preferred service provider. In regard to grade performance, the Altoona test indicates the vehicle will lose one mph when starting from a stop on 16% grade but does not indicate what speeds could be sustained or impact of momentum gained before entering the grade. The manufacturer would like to visit the site with one of its demonstration vehicles to determine the actual performance on the route.

Table 6
Azure Dynamics Vehicle Information

Vehicle	Length (ft)	Capacity	Cost (not including shipping/taxes)	Grade
CitiBus (Hybrid Electric – gas)	25, 26, or 27	8 to 24 depending on size and number of wheelchairs	On GSA schedule ($160-200,000)	16.7% according to Altoona report
Balance (Hybrid Electric – gas	13 (shuttle bus) or 14 (cutaway)	14	$100-115,000	15.4% according to Altoona report

Figure 30
CitiBus
Source: Azure Dynamics website (www.azuredynamics.com)

Azure Dynamics has partnered with a GSA supplier, Colonial Equipment, to fulfill several AFV replacement bids funded by the American Recovery and Reinvestment Act (ARRA) and has generally experienced an escalation in distribution of its vehicles over the past year. For example, Howard County, MD, has bought eight CitiBuses with ARRA funding* and several municipalities in Kentucky have purchased Balance vehicles with ARRA funding. This summer, Azure Dynamics won bids and received orders for CitiBuses from the College of Staten Island and the University of Fairfield and for Balance vehicles from the Clermont Transportation

* Electric Drive Transportation Association. Azure Dynamics Announces Eight CitiBus Sales to Hard County, MD. http://www.electricdrive.org/index.php?ht=display/ReleaseDetails/i/14190

Connection in Ohio, among others.[*] The CitiBus has previously been deployed to the Smithsonian Institution in Washington, DC, (2008) and the United States Air Force Academy in Fort Collins, CO (2008).

Rabbit Transit, located in York, PA, received ten CitiBuses in February 2009 for $200,000 each, through an issued RFP. The operator uses the CitiBuses for paratransit service only, though it recognizes a fixed route would have more environmental benefits because of frequent stops and lower speed. The CitiBuses run 12 hours a day and run approximately 170 miles per day. The routes are fairly flat but the operator has not experienced any performance issues on grades. The CitiBuses are 25 feet with a capacity of 16 passengers and one wheelchair. However, the arrangement can be changed to have up to four wheelchairs and 8 passengers. The entry-way steps are steeper than standard paratransit vehicles, but the operator was able to request an additional extra handle to be installed and no complaints have been received.

Rabbit Transit has received positive feedback on the ride quality and has had good experience with maintenance, with costs lower than conventional vehicles and service provided by own maintenance staff. Initially, the vehicles had a lot of software issues, such as a lag in the transitioning between electric and gasoline motors and steering and breaking response, but most of those issues have been resolved. Rabbit Transit reports that Azure Dynamics has been one of the best vendors it has worked with, offering a high level of service and quick response, arriving on site to address problems within 12 hours.

GatorMoto

GatorMoto is a manufacturer of low-speed electric vehicles, motor scooters, and racing go karts headquartered in Gainesville, FL. It produces several small electric vehicles of various capacities but the largest one, a 15-passenger Electro Transport Buddy, would be the most likely candidate for Kennesaw Mountain NBP. It is powered by a 72V 5kw motor that can achieve speeds of up to 30 mph. Federal regulation mandates that such vehicles with over six passengers must seek a waiver from local DMV or police department to operate on public roads but GatorMoto has stated that its operators have not had problems with this requirement.

The vehicle does not have a lift or ramp but is low floor, and accommodations may be able to be made to make it accessible.

Table 7
GatorMoto Vehicle Information

Vehicle	Length (ft)	Capacity	Cost (not including shipping/taxes)	Range (miles)	Charge Time	Grade
Electro Transport Buddy 15p LE	16.8′	15	$17,997 (more for soft enclosure addition)	50	6 hours if drained; on-board smart charger can be used at breaks	20% (maintain speed of 20 mph)

[*] Azure Dynamics press releases. http://www.azuredynamics.com/

The vehicle does have a solar panel roof option.

The manufacturer states that the vehicle has very low maintenance requirements, at $0.02 per mile, consisting of checking tire pressure, monthly refilling of distilled water for the battery, and replacement of the battery every three years (at a cost of $1500).The vehicles are designed not to need a specialized repair center and are equipped with Curtis controller that identifies problems to the operator, who in turn can contact GatorMoto for telephone support.

Figure 31
Electro Transport Buddy
Source: GatorMoto website (www.gatormoto.com)

GatorMoto vehicles are deployed in several places throughout the U.S. For example, the Clinton Presidential Library has two. Portofino Island Resort, located ten miles south of Pensacola, FL, on the coast near Gulf Island National Seashore, offers visitors with accommodations, dining, spa treatment, and scheduled activities. The Resort owns and operates two 15-passenger Electro Transport Buddy vehicles, purchased in 2007 and 2008, and is planning on purchasing a third soon. The vehicles are used to shuttle visitors around the resort and serve a 1.5 mile round-trip loop. They operate at a maximum speed of 30 mph, and the Resort has not used them on public roads. The service begins at 8am and runs until 5 or 6pm. However, the vehicle batteries are usually drained by 2pm; the third vehicle will allow the Resort to run two vehicles while the third is charging. The operator did express concern about grade because of the possible drain on the batteries. Charging takes six hours and no special equipment is necessary other than electrical cords to plug in to a regular receptacle. There are sixteen batteries total. The Resort would have added the solar panel roof option but it has a height restriction for its garage and the panel would have added three inches to the roofline.

The operator reported that the vehicles are easy to run and drive and are dependable. They are popular among passengers. Maintenance is very low, less than gas-powered vehicle, and both

vehicles still have their original batteries. There was an initial problem with the clutch but it has been fixed. GatorMoto has an on-call technician who is very responsive. All parts must come from GatorMoto, which in turn gets parts from overseas, so there is often a delay (6-8 weeks for cosmetic parts). However, GatorMoto just built a new warehouse so it may start stocking more parts.

EVAmerica

EVAmerica was founded in 2006 by Albert E. Curtis III to focus on the design, development, and manufacturing of electric and hybrid-electric medium- to heavy-duty vehicles. The company is headquartered just south of Chattanooga, TN. The company offers several standard vehicles, including both electric and hybrid-electric (shown below). The shuttles accommodate one wheelchair while the buses accommodate two. EVAmerica is very willing and interested in working with Kennesaw Mountain NBP to identify which vehicle meets the park's needs; their initial assessment was that the diesel hybrid may be most appropriate given the strain that such a grade would have on batteries. The study was not able to interview any current operators of EVAmerica vehicles.

Table 8
EVAmerica Vehicle Information

Vehicle	Length (ft)	Capacity	Cost	Range (miles)	Charge Time (minutes)	Grade
Eco-shuttle (Electric)	22	18-22	Not provided	60-80	1 mi/minute	12%
EV70 and EV70i (with inductive power transfer) (Electric)	22	18-22		70-90		
Eco-shuttle (Hybrid-Electric) (diesel)	22	18-22		250	1 mi/minute	12%
EV20h and EV70h (Hybrid-Electric) (diesel)	22	18-22		N/A	N/A	
Eco-Bus (Electric)	30	27		180	1 mi/minute	12%
Eco-Bus (Hybrid-Electric) (Diesel)	30	27		250	1 mi/minute	12%

Conclusion

Table 9 summarizes the technologies and vehicles examined in the limited, high-level survey documented above and compares them to the standard or default transit bus currently on the market, which uses clean diesel, as mandated by the EPA.

Table 9
Summary of Vehicle Technology Characteristics from Survey

Characteristic	Electric *(Gatormoto)*	Electric *(Ebus and EVAmerica)*	Electric-Hybrid *(Ebus and EVAmerica)*	Standard *(30 foot)*
Capital cost	$18,000	$275-315,000	$160-200,000	$200,000
Operating and maintenance costs	Less than standard; $0.02 per mile and battery replacement every 3 years ($1500)	Not provided	Not provided	$0.50 per mile*
Operating and maintenance issues	Less than standard; consists of checking tire pressure, monthly refilling of distilled water for the battery, and periodic replacement of battery	Not provided	Software issues, unfamiliar technology	Standard
Facility/infrastructure needs	None; plugs into regular receptacle with electric cords; comes with automated maintenance monitor	90KW Fast-Charger ($58,000)	Specialized diagnostic tools and mechanic	Standard garage and mechanic services
Performance at grade	Unknown but likely that batteries may drain quickly so would need multiple vehicles (3) to allow for recharging	Unknown; may have to be modified and multiple vehicles may be required (2) to allow for recharging	Unknown; may have to be modified	Sufficient
Noise	Quiet	Quiet	Fairly quiet but will use engine	Relatively loud
Challenges	Capacity, battery drain	Battery drain	Power, maintenance	Noise and fuel consumption

As a result of the limited, high-level survey of the four manufacturers and three transit operators of electric and electric hybrid buses described above, the U.S. DOT / Volpe Center study team identified two uncertainties in these technologies:

3) the state of the art of these technologies and classes of vehicles
4) the specific application of these technologies to the Kennesaw Mountain shuttle route, in particular the sustained grade of the road

These uncertainties may preclude the use of these technologies for this route and/or may mean increased maintenance and operations costs (despite fuel savings) and the need for specific staff and equipment. Cobb Community Transit does not currently have the expertise to work with

* Same assumption used in calculation of operations and maintenance costs of Kennesaw Mountain NBP shuttle throughout the report; originally from FY07 ATPPL application but verified from comparing to several existing transit system costs.

AFVs and MARTA has been focused on CNG and propane; it currently operates 441 CNG transit vehicles, which it began to add to its service in 1995.[*]

Without being able to resolve these two uncertainties, the study team recommends the purchase of a standard 30-foot transit bus, run on clean diesel. Such a purchase would provide the park with a smaller, more efficient, and more comfortable bus than that provided by current and previous contractors.

To resolve the two uncertainties, the study team recommends that the park contact the manufacturers above whose vehicles most likely meet the requirements and preferences of the park, to test the vehicle on the route and to identify local maintenance support. Once it is determined that such technologies could perform on the route, the park should then undertake a vehicle selection study that includes a full market review of available vehicles and identifies specific features that the park prioritizes.

The default procurement process for federal agencies is to purchase vehicles through AutoChoice, a program of the General Services Administration (GSA). AutoChoice contains buses that meet federal vehicle standards. Should the park choose to procure a bus not offered through the GSA, it may do so with a waiver from the GSA. However, GSA waivers are *not* required for parks to purchase certain exempt vehicles such as tactical vehicles, experimental vehicles, prototype vehicles, used vehicles, or vehicles equipped with after-market converted engines for use with alternative fuels.

[*] MARTA Monthly. May 2009. http://notify.itsmarta.com/legacy/newsletter/2009/may.html

Recommended Next Steps

There are a number of next steps that could and should be taken to improve the safety and visitor experience for users of Kennesaw Mountain Drive. These steps primarily consist of applying for funding to conduct planning studies or construct/implement changes in management and beginning the necessary civic engagement and environmental process for such changes. For funding, the US DOT Volpe Center study team believes that the recommendation to run a shuttle seven days a week and exclude personal vehicles helps these projects to be more competitive because the shuttle service becomes mission critical in maintaining vehicular access while improving safety of the use of Kennesaw Mountain Drive. The design changes recommended for the road further improve safety and the visitor experience.

Recommended steps include the following:

- Entrance Fee Implementation
    a. Refine the projected revenue model based on park staff knowledge and new data collection; may also want to include an assumption for noncompliance.
    b. Submit a PMIS/TRIP implementation grant proposal for the design, engineering, siting, and acquisition required to implement a park and display meter system. At least seven AFMs would be required (one per 100 spaces), totaling $560,000 ($80,000 each). Once in place, this will allow the shuttle to be provided for free while providing a reliable, dedicated funding source for operations.
    c. Submit a proposal to the National Park Service to consider implementation of an entrance fee for Kennesaw Mountain NBP. The proposal should include initiation of the National Environmental Protection Act (NEPA) process and must include a civic engagement process, which will require 6-8 months.[*]

- Recommended management and design of Kennesaw Mountain Drive
    a. Submit a PMIS Category I or III grant proposal for the design, engineering, siting, and construction required to implement the recommended road design changes. Once in place, this will allow for the safe use of the road by the shuttle and pedestrians.

- Submit a PMIS/TRIP implementation grant proposal for a new, 30-foot clean diesel vehicle. This will provide a vehicle that is more appropriately sized for Kennesaw Mountain Drive and that will have the amenities that the park is seeking in its shuttle service. The projected revenue from the recommended entrance fee would be sufficient for the recapitalization costs of the vehicle.

- Initiate the National Environmental Protection Act (NEPA) Process for the changes pursued in management of the road, road infrastructure, shuttle operations, and entrance fee implementation.

[*] Personal communication with Rich Devenney, Fee & Special Park Use Program Manager, Southeast Region, on February 2, 2010 (by phone)

References

American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Development of Bicycle Facilities.* 1991.

Azure Dynamics press releases. http://www.azuredynamics.com/

Cauley, H. M. Tourist trolley debuts in Marietta Square. Journal Constitution. April 3, 2008. http://www.ajc.com/search/content/metro/cobb/stories/2008/04/02/trolley_marietta_0403.html

Cobb County Transportation. Cobb County 2030 Comprehensive Transportation Plan. February 27, 2008. http://dot.cobbcountyga.gov/ctp/index.htm

Cobb County Transportation. Cobb County Road Closure Alert. http://dot.cobbcountyga.gov/road_rept.htm

Cobb Historic Tourism Study. Prepared for The Cobb Historic Tourism Committee. By Montgomery Research Consultants, Inc. June 1990.

Electric Drive Transportation Association. Azure Dynamics Announces Eight CitiBus Sales to Hard County, MD. http://www.electricdrive.org/index.php?ht=display/ReleaseDetails/i/14190

Federal Highway Administration Environment Air Quality Conformity. http://www.fhwa.dot.gov/environment/conformity/nonattain/pm25pages/pages/ga_atlanta.htm

Federal Highway Administration, Office of Federal Lands Highway Eastern Division. *Kennesaw Mountain National Battlefield Park, Georgia: Engineering Study for Roads & Bridges.* June 2003. Prepared for The National Park Service Southeast Region. (provided by park)

Florida Department of Transportation. Florida Bicycle Facilities Planning and Design Handbook. April 2000. http://www.dot.state.fl.us/safety/ped_bike/ped_bike_standards.shtm#Florida%20Bike%20Handbook

Historic Marietta Trolley Co. website, http://www.mariettatrolley.com/trolley.html

Kennesaw Mountain Trail Club. Earthworks. Volume 3, Issue 6, October 2009. http://www.kennesawmountaintrailclub.org/documents/Earthworks_Oct09_000.pdf

Miller, Craig A., & Julie A. Strack. Warnell School of Forestry and Natural Resources, The University of Georgia. *Visitor Attitudes and Preferences For Management of Kennesaw Mountain National Battlefield Park*. 2008. (Provided by park staff).

National Park Service, Alternative Transportation Program. *Pre-Planning Project (PPP) Trip Report, Kennesaw Mountain National Battlefield Park.* Draft, September, 2004.

National Park Service: Kennesaw Mountain National Battlefield Park. *Draft Environmental Assessment for Noonday Creek Multi-Use Trail, Phase 1.* (Provided by park staff).

National Park Service, Kennesaw Mountain National Battlefield Park. *First Annual Centennial Strategy for Kennesaw Mountain National Battlefield Park.* August 2007. (www.nps.gov/kemo)

National Park Service, Kennesaw Mountain National Battlefield Park. *General Management Plan,* US Department of Interior, National Park Service, Southeast Region, 1983.

National Park Service, Kennesaw Mountain National Battlefield Park. *Mountain Road Alternatives.* http://www.nps.gov/kemo/parkmgmt/publicinvolvement.htm

National Park Service, Kennesaw Mountain National Battlefield Park. *Mountain Road Safety Issue Addressed.* News Release 4/5/07. http://www.nps.gov/kemo/parknews/mountain-road-saftey-issue-addressed.htm

National Park Service, Kennesaw Mountain National Battlefield Park. *Scope of Services. Alternative Transportation Study.* (provided by park staff)

National Park Service, Planning, Environment, and Public Comment website. http://parkplanning.nps.gov/projectHome.cfm?parkID=389&projectId=22635

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

Queensland, Australia, Government: Transport. *Reducing Conflict between Bicycle Riders and Pedestrians.* June 2006. http://www.transport.qld.gov.au/resources/file/eb6907443415dd9/C2_Reducing_conflict_between_bicycle_riders_and_pedestrians.pdf

Pedestrian and Bicycle Information Center. *Shared-Use Path Design Details.* http://www.bicyclinginfo.org/engineering/paths-details.cfm. Accessed on 5/11/09

State of Vermont Agency of Transportation. *Pedestrian and Bicycle Facility Planning and Design Manual.* December 2002. http://www.aot.state.vt.us/Progdev/Documents/LTF/FinalPedestrianAndBicycleFacility/PedestrianandBicycleFacilityDesignManual.pdf

Strack, Julie A. & Craig A. Miller. *Running Uphill: Urbanization, Conflict, and Visitor Use and Kennesaw Mountain National Battlefield Park.* Proceedings of the 2007 Northeastern Recreation Research Symposium. http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs-p-23papers/07strack-p23.pdf

U.S. Department of Energy, Alternative Fuels & Advanced Vehicles Data Center. http://www.afdc.energy.gov/afdc/stations/find_station.php

U.S. Department of Transportation, Federal Transit Administration. *Alternative Transportation in the Parks and Public Lands Program, Project Proposal for Fiscal Year 2007 Funds – Planning Project: Conduct Technical Study of Mountain Road Shuttle Bus Service.* February 2007.

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14. ABSTRACT

The purpose of this study is to assess the management of the Kennesaw Mountain Drive, which runs from the Visitor Center to the summit of Kennesaw Mountain, and assess the future of the shuttle service that operates on the road during weekends, including the possibility of operating an electric or hybrid electric vehicle. The study includes the following components: existing conditions, review of recommendations from previous studies and public input, critique of previous management proposals, recommended design and operational strategy for management of Kennesaw Mountain Drive, financing and management of recommended shuttle service, vehicle technology assessment (limited to electric and electric hybrid), and recommended next steps.

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