

National Park Service

National Park Service
U.S. Department of the Interior



Transit Feasibility Study Guilford Courthouse National Military Park GUCO PMIS #104678

February 2009



Acknowledgements

National Park Service

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Project Description

Guilford Courthouse National Military Park (NMP) is evaluating the feasibility of a transit system to improve safety and connectivity, and enhance park interpretative opportunities. The adjacency of Tannenbaum Park, Greensboro Country Park, Jaycee Park, and the Natural Science Center and Zoo to the park provides a potential opportunity to expand the park experience, creating a partnership-based “green zone” that is traffic-free and promotes healthy community activities.

Site managers at Guilford Courthouse, Greenboro County Parks and Recreation and other local partners see transit as a way to improve management of their transportation systems, alongside other anticipated improvements:

- Safety and Avoidance of User Conflicts
- Connectivity to Adjacent/Nearby Cultural, Science, and Recreation Sites
- Visitor Experience and Interpretive Opportunities
- Restore Battlefield Landscape
- Economic Benefits to the City of Greensboro (by increasing visitor stays in the area.)

Based on discussions with park management, park partners and on-site observations during July 2008, there are two feasible options for the pilot expansion of the transit system. Option I is a single integrated transit route on a consolidated one-loop road configuration. Option II is two transit routes with common transfer stop on a two-loop road configuration consisting of Guilford Courthouse-Tannenbaum and Jaycee-Country Park-Natural Science Center. At least initially, the expanded transit system would operate during the summer season.

This study is intended to be a broad overview of the transit feasibility at Guilford Courthouse NMP. The study will discuss the project background and context, and outline the two options for transit service. A detailed evaluation of costs and benefits, in addition to supporting technical information, would be part of the next step in the planning process.

Project Background and Context

Guilford Courthouse NMP is a 220-acre site owned and operated by the National Park Service. Located in northwestern Greensboro, North Carolina, the park is approximately six miles northwest of the downtown business district. Famous for the 1781 Battle of Guilford Court House, the park was created by Congress in 1917 to “preserve for historical and professional military study one of the most memorable battles of the Revolutionary War...” (1997 General Management Plan).

Park Visitation

Guilford Courthouse NMP is a well-visited site, with a high percentage of local visitors. Although park visitation has varied over the past ten years, with a decline since 2001, park staff expects visitation to continue at or above current levels. Local demand for recreational use of the park is rising; visitor counts by the park show a sizeable number of “walk-ins” (roughly 75,000 per year).

Guilford Courthouse Recreational Visits: 1998 – 2007

(NPS Public Use Statistics)

1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
753,943	740,024	822,948	858,125	762,412	530,756	277,484	497,193	486,162	445,752

Two distinctive groups of visitors come to the park, each with a different pattern of use and transportation needs (non-recreational visitors - such as commuters on Old Battleground Road – are not included in this analysis).

- Historic-oriented visitors seek historic and interpretive experiences related to the Revolutionary War. They are geographically diverse and from national, international, and regional locations. These visitors typically arrive at the park by car, begin their visit at the Visitor Center, and then drive the Park Loop Road.

These visitors constitute the primary ‘target’ market for the interpretative transit service.

A preliminary indicator of park transit ridership for this group can be estimated by the number of visits to the Visitor Center (a sample of monthly visitation during the summer season is shown below)

- Visitor Center visits: total in June over 5 years (2004-2008) – 17,397
- Visitor Center visitors: 5-year annual June average – 3,479
- Visitor Center visitors: 5-year daily average in June – 116 per day
- Visitor Center Peak Hour use (@20%) – roughly 23 visitors

(source: *NPS Public Use Statistics*)

- Recreation-oriented visitors come to the park primarily for recreation and enjoyment of the park landscape. These visitors are typically local, and usually choose to walk, jog or bike the Park Loop Road. They may arrive with or without a car, and use Old Battleground Road vs. Battleground Avenue as their primary auto access point. Their visit does not typically begin at the Visitor Center. *This group of visitors may use the transit system in some more limited fashion, riding it to/from parking to reach a specific recreation destination (vs. riding the system in its entirety).*

Guilford Courthouse NMP conducted their most recent visitor survey in August-September 1994, to prepare for the General Management Plan update. At that time, the most popular activity (56%) was to walk or jog the Park Loop Road, and the majority of park visitors:

- lived within five miles of the park (70%)
- arrived by automobile (60%)
- visited in the summer (88%)
- averaged 2.2 visits per week
- favored Saturday to use the facility (68%), and
- remained in the park an average of 1.75 hours per visit.

The most frequently identified visitor concerns were all transportation-related:

- traffic volumes

- traffic at the two crossings of the Park Loop Road with Old Battleground Road, and
- traffic and noise on Old Battleground Road.

On-site observations by the Volpe Center in July 2008 confirm that these activity and visitor use profiles are probably still accurate.

Park Transportation Conditions

Transportation within the park is primarily focused along the Park Loop Road (shown in red on Figure 1), with numerous trails connecting portions of the Park Loop Road. Two regional roads bisect the park: Old Battleground Road (a local commuter route) and the paved Greensboro Greenway trail. Most visitors access the park via automobile from New Garden Road or from Old Battleground Road. Parking is available at the Visitor Center, and off the east side of Old Battleground Road just north of the Park Loop Road.

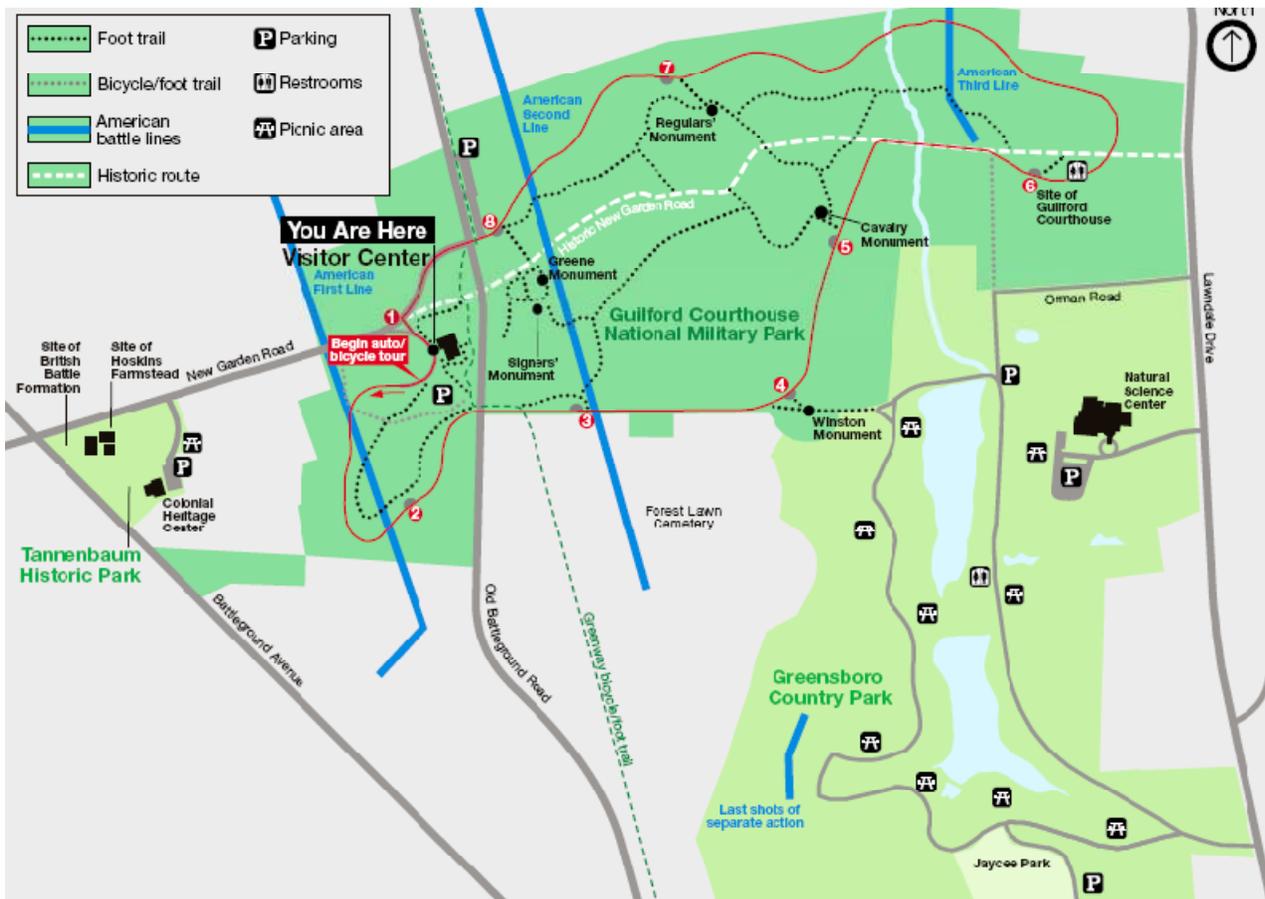


Figure 1: Existing Transportation Conditions

Park Loop Road

Circulation within the park is primarily along the two and one-quarter mile Park Loop Road. Beginning at the Visitor Center and continuing through the park, the Park Loop Road features an eight-stop historic tour that takes approximately one hour to complete. The road is a multi-modal, one-way (counter-

clockwise) facility, with separate lanes for motorized and non-motorized users. Most visitors use the Park Loop Road for recreational purposes, with cars, walkers, joggers, and bicyclists sharing the road. Although striping separates motorized and non-motorized users, non-motorized users do not always stay in their lane. Shared use of the road, coupled with limited sight distance for motorists due to curvature and grade, results in frequent user conflicts and safety concerns.

A portion of the Park Loop Road between the western property line and Old Battleground Road is the same as New Garden Road.

Old Battleground Road

This local commuter route carries roughly 12,000 average daily trips and bisects the Park Loop Road twice at-grade. According to the Greensboro DOT traffic engineer, the intersection of New Garden Road and Old Battleground Road meets traffic signal warrants. The intersection of Holt Avenue/Park Loop Road and Old Battleground Road does not meet either signal warrants or multi-stop sign warrants.

Guilford Courthouse NMP has identified the closure of Old Battleground Road through the park as a top priority. A Greensboro traffic engineer indicated at the July 2008 meeting that the closure of Old Battleground Road is not a part of the regional transportation plan, nor is it programmed into the Transportation Improvement Program. Closure of Old Battleground Road through the park would require the addition of one lane in each direction on New Garden Road and on Battleground Avenue to maintain regional traffic flow.

Interpretive Transit - Pilot

An experimental 'pilot service' serving Guilford Courthouse NMP started in 2008; the adjacent Country Park features a public tram service on weekends and holidays.

Once per day on Saturday and Sunday (during peak season), the park offers a ranger-led interpretive tour. The tour uses the tram vehicle owned by the Greensboro Parks and Recreation Department. This 50-person capacity tram has no handicap access or air conditioning, but informal feedback to the rangers has been very positive. The tour is typically about half full.



Adjacent to the park, Greensboro Parks and Recreation Department operates a public tram service on weekends and holidays within Greensboro Country Park. This service has been running for over five years, and is generally halfway full. This is an on-demand system, with pick-up-drop-off upon request.

These existing services offer the possibility of longer-term changes to the operation of the transportation system (including the closure of the Park Loop Road to vehicles) in the area, opened possibilities to improve connectivity and internal circulation, and improve the visitor experience.

Figure 2: Pilot Interpretive Tram Service, 2008

With the total visitation base for the partnership (Tannenbaum Park, Greensboro Country Park, Jaycee Park, and the Natural Science Center and Zoo) at 1,697,161 visitors annually, there is also an opportunity to greatly increase ridership, and provide service to the park's recreational as well as historical visitors. If 5-10% of the total visitation base uses transit, annual ridership could be between 84,858 and 169,716.

Proposed Transportation Conditions

Along with the provision of a transit service, the park is considering a number of small changes which would affect the on-site circulation, and the ability to move easily between the park and adjacent/nearby lands.

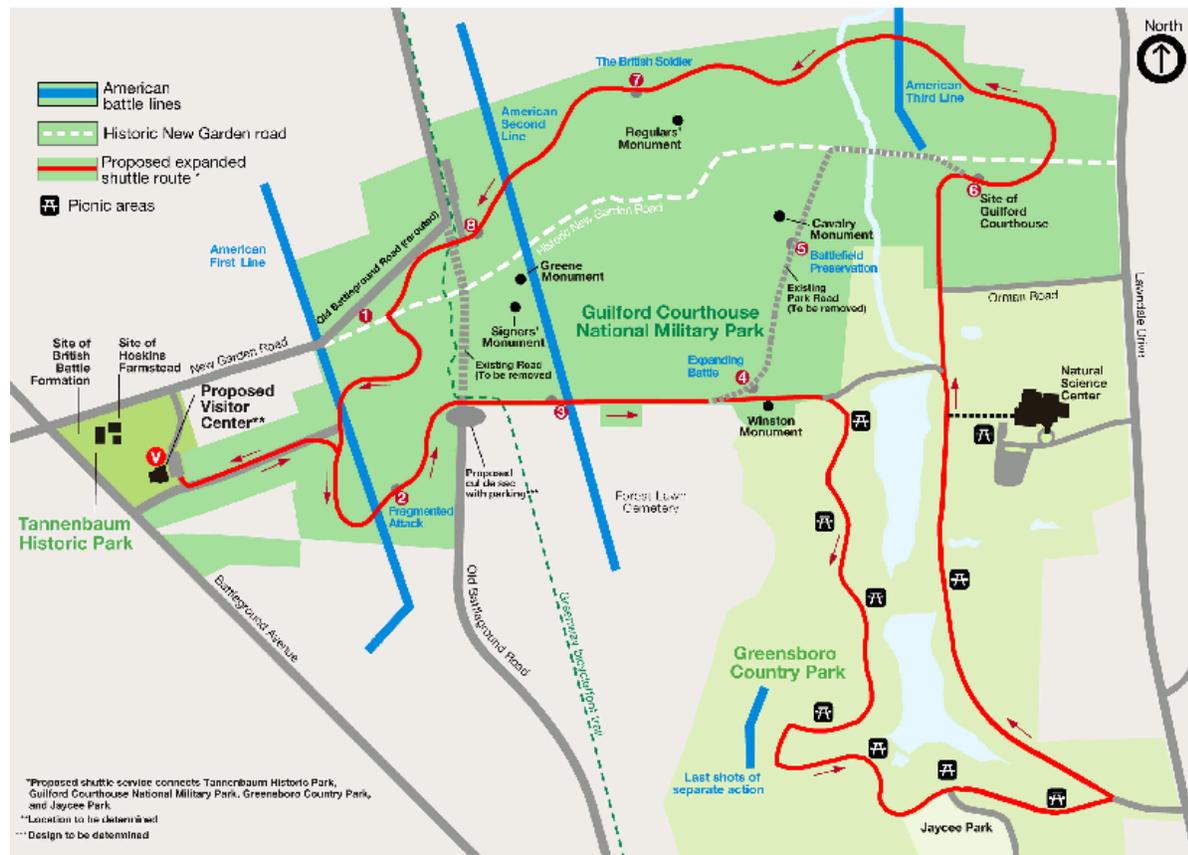


Figure 3: Proposed Conditions (showing proposed visitor center and Option I transit service)

- Relocating the Visitor Center to lands and facilities which would be acquired in the Tannenbaum Historic Park (the existing Visitor Center would be retained but used for other purposes)
- Removing the portion of the Park Loop Road that directly connects Winston Monument with the Site of the Guilford Courthouse (see dashed grey line in Figure 2)
- Change the management of the road segment just east of the Natural Science Center, or remove it
- Remove bollards and gates that separate the park and Greensboro Country Park.

Analysis: Transportation Opportunities for the Future

An analysis of existing transportation conditions at Guilford Courthouse NMP provides a compelling case to rethink the management of the park transportation, and explore opportunities to better integrate roads and trails with adjacent and nearby recreational destinations to reduce congestion and user conflicts. Park transportation management could respond to a growing number of changing situations and opportunities, including:

- Growing recreational/non-motorized use on the Park Loop Road has caused a corresponding rise in user conflicts and congestion between cars, pedestrians/joggers and cyclists. To manage this situation, the park is considering closing the Park Loop Road to vehicles on a temporary or seasonal basis.
- Closing Old Battleground Road north and south of the park's borders continues to be a top park priority. Commuter traffic, high speeds and congestion negatively affect the park's ability to manage a cohesive historic landscape. The intersection of New Garden Road and Old Battleground Road meets traffic signal warrants, however, installation of traffic signals would be incongruent with a Revolutionary War landscape.
- Continuing visitor concerns about traffic volumes, traffic at the two crossings of the Park Loop Road with Old Battleground Road, and traffic and noise on Old Battleground Road negatively affect the visitor experience.
- Changing and distinctive transportation needs of historic-oriented and recreation-oriented visitor groups means that the park must provide an environment for both visitor groups that is appropriate to the Battlefield landscape, safe and welcoming.
- Growing partnership opportunities due to rising recreational demand in northwestern Greensboro means that park staff and adjacent/nearby recreation partners share an interest in improving traffic safety and parking management, reducing user conflicts, and offering alternative transportation experiences.

Use of a transit system, with related traffic management improvements such as road modifications, signage and ITS, would either partially or fully resolve concerns regarding safety and user conflicts. It would also improve connectivity and circulation to and within several adjacent public recreational lands, allowing visitors to have a seamless transportation experience.

Regional Transportation Context

Guilford Courthouse National Military Park is adjacent to or near a number of favorite local recreation destinations in northwestern Greensboro, including:

- Tannenbaum Historic Park
- Greensboro Country Park
- Greensboro Natural Science Center and Zoo
- Jaycee Park, and
- City of Greensboro Ballfields

These regional recreational lands offer abundant opportunities for community gatherings, education, recreation, and outdoor activities. Rising demand for recreation at all these sites has caused transportation management challenges for partners similar to those that Guilford Courthouse NMP is experiencing: increasing traffic, noise and user conflicts.

Based on a brief analysis of regional transportation, recreation and land use plans in the Greensboro area (Appendix B), there are a number of transportation-related opportunities and challenges for park to monitor over the next 10-20 years. Some of these opportunities and challenges may influence the route, connectivity and design of the proposed transit system.

Opportunities

- Increase multi-modal connectivity between the park and nearby recreational lands.
- Increase multi-modal connectivity between the park and the proposed new multi-use development area (“Activity Center”) planned for the ½ mile diameter around New Garden Road/Battleground Avenue
- Link the Visitor Center to public transit, via the planned regional expansion of local transit service east of New Garden Road/Battleground Avenue), which would link the park to Downtown Greensboro via transit.
- Engage recreation-oriented visitors in the historical elements of the park landscape, and use the proposed transit system as one way to expand interpretive opportunities.
- Participate in the regional transportation and land use planning process to promote awareness of the park purpose and significance, and identify potential partnership opportunities.
- Use the proposed transit system to provide a unique visitor experience for historic-oriented visitors by using on-board interpretation.
- Promote a “healthy communities” perspective for local partners
- Encourage a balance between regional recreational access and improved visitor experience with preservation of the park landscape and resources.

Challenges

- Monitor construction of I-840 beltway and the potential for additional traffic and congestion on Battleground Avenue and New Garden Road.
- Monitor the development of the multi-use “Activity Center” near Battleground Avenue/New Garden Road, which could produce an intense development pattern that may alter the character of the park gateway entrance area.
- Monitor average daily trips and traffic patterns on Old Battleground Road for related transportation impacts (such as noise, congestion and delays at the two intersections with the Park Loop Road).
- Work with both the City of Greensboro and the Greensboro Metropolitan Planning Organization to evaluate the impacts of closing Old Battleground Road.

Feasibility and Design

This section provides a preliminary technical assessment of the proposed transit system at Guilford Courthouse NMP. The analysis is based on a broad review of the park’s General Management Plan, Administrative History, Cultural Landscape Report, discussions with park staff and partners, and limited on-site data collection and observations. Some on-site observations were also made of the transportation systems of adjacent parks (Greensboro Country Park, Tannenbaum Historical Park and Jaycee Park) and the nearby Natural Science Center.

The focus of the feasibility assessment was in providing greater connectivity between the park and adjacent/nearby public recreational lands, physical changes that would be needed to the area (road

modifications and signage) and assessing initial costs. An exploration of potential ridership is a next step for the partnership.

Planning and Design Issues

Representatives from the park, park partners and the Volpe National Transportation Systems Center met in July 2008 to discuss basic parameters for a proposed transit system (see Attachment A for the agenda), including season span, days of week and hours per day, and a limited set of interpretative tours for the transit system.

At the meeting, the partners reviewed similar services already in operation. The current tram within Greensboro Country Park, which operates between April-October, from 11:00 AM-6:00 PM on weekends and holidays, was initiated to reduce traffic congestion and associated visitor conflicts.

There was a consensus that the proposed transit system operate with a scheduled frequency that would build ridership, and create convenient connections and enhance visitation among multiple sites, yielding longer duration visits. Guilford Courthouse NMP, Tannenbaum Historical Park and the Natural Science Center and Zoo operate between 9:00 AM – 5:00 PM. However, activities within Jaycee Park and Greensboro Country Park occur from dawn to dusk, or at peak summer time 9:00 AM – 9:00 PM.

Based on the meeting consensus, a park transit system should have the following initial parameters:

- Season: 6 months (May-October)
- Days of week: contingent on route structure options
- Hours per day: contingent on route structure options
- Scheduled service: minimum of 2 transit vehicle runs per hour of operation (30 minute frequency)

These initial parameters served as the basis for examining and evaluating the feasibility of the transit system in the remainder of this study.

Preliminary Transit Options (2)

For this preliminary analysis, two options for the transit system appear to be feasible (shown in Figures 4 and 5). Both options imply minor changes in the road circulation system, to soften the boundaries between the park and surrounding recreational sites, and other minor changes to support the transit service, increase safety and reduce user conflicts.

- Option I is a single integrated transit route on a consolidated/interjurisdictional one-loop road. This concept was developed in collaboration with Guilford Courthouse NMP and its partners at the July 2008 workshop.
- Option II is two transit routes, with a common transfer stop on a two-loop road configuration Guilford Courthouse-Tannenbaum and Jaycee-Country Park-Natural Science Center. The second option was also presented at the workshop, and is further elaborated for this study. The timing data collected on-site for traversing each loop road supports the proposed frequency of service and vehicle fleet size calculations.

Option I: Single Integrated Transit Route on Consolidated One-Loop Road Configuration (Figure 4)

- Single integrated transit route with 15 stops serving and connecting the five sites

- Some consolidation of stops (over existing tram operation) to service multiple shelters within Country Park

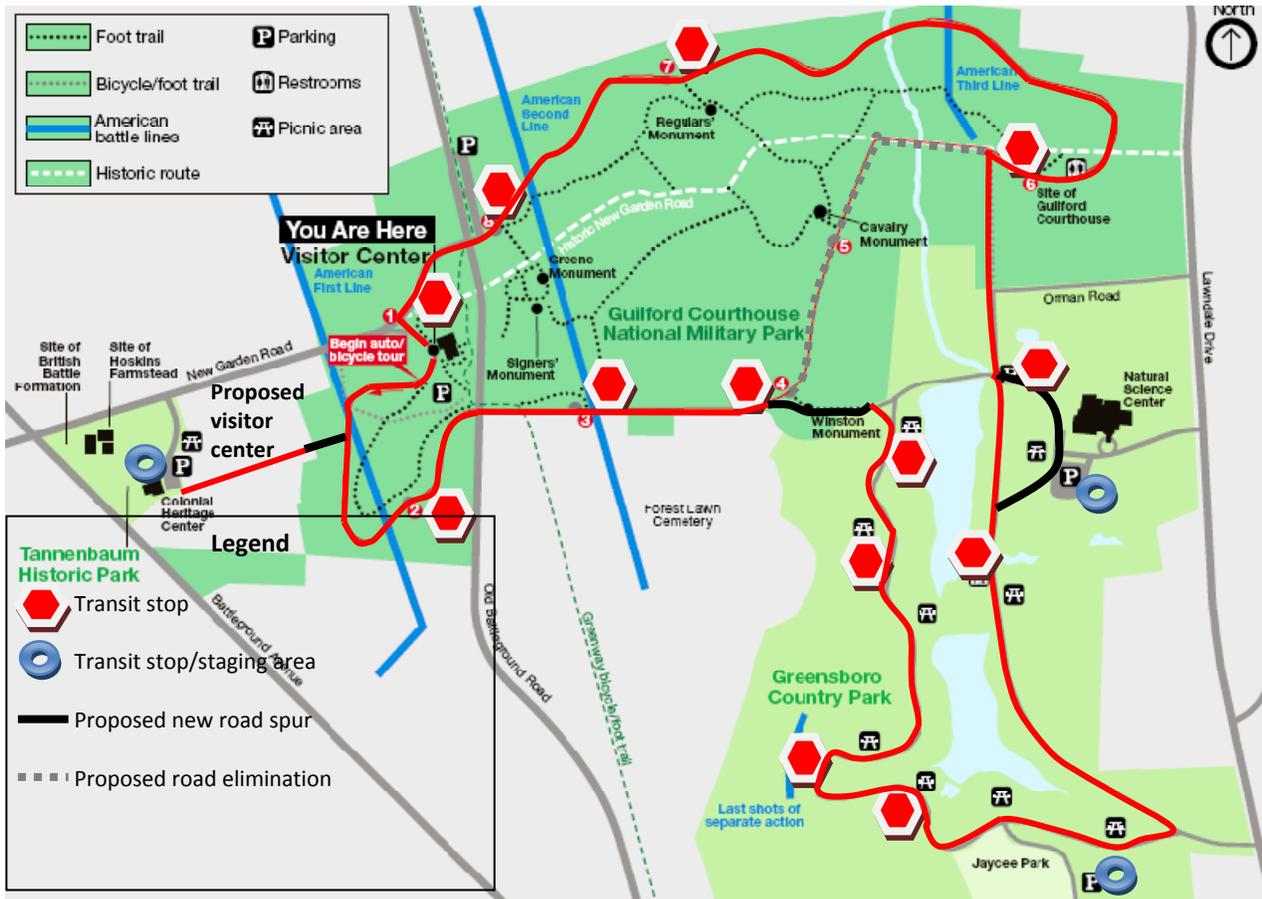


Figure 4: Option I, Single Route (with existing Visitors Center)

- Route is approximately 5 miles, with travel time equal to 20 minutes, 3 minute dwell time at the three staging stop/turnaround areas, and up to 20-second dwell time at the 12 interior stops – supporting a 30 minute frequency.
- Vehicle Requirements: 2 transit vehicles, one transit vehicle to provide the internal circulator service (30-minute frequency during the hours of operation each day), the other transit vehicle used to provide a single interpretative tour during the hours of 10:00 AM-11:00 AM and 2:00 PM- 3:00 PM (see service plan), operating concurrently with the internal circulator transit service
- Interpretative Tour transit vehicle provides backup to internal circulator transit vehicle when not in service
- Vehicle Type: hybrid-electric or electric bus (22' or 31') for the interpretative tour, and hybrid-electric or electric tram (power unit and 1- 2 trailer units) for the internal circulator service (existing gas-powered tram could be used in the interim)
- Service Plan: Season: May-October (6 months)
 - 7 days, 9:00 AM-5:00 PM, 30-minute internal circulator service (2 runs per hour)
 - 7 days, 10:00 AM -11:00 AM, and 2:00 PM – 3:00 PM – a single interpretative tour concurrent with the internal circulator service ('overlay' service)

- Closure of consolidated loop road to private vehicles during transit season: This may be critical for Guilford Courthouse NMP to protect resources and visitor experience of the Battlefield, and to prevent use of country park as an entry point for cut-through traffic via Park Loop road to New Garden Road and points north on Battlefield Avenue.

Figure 5: Option II, Two Routes (red and blue) Note: transit stops on blue route not yet identified

- Mitigation and Agreements: actuated control by passage of the transit vehicle (i.e., lowering and raising) of a bollard at the intersection of Old Battleground Road and Holt Avenue (Tour Route) to prevent private vehicles from turning onto the tour road

Option II: Two Transit Route/Two Road Loop Configuration (Figure 5)

- Guilford Courthouse NMP-Tannenbaum Route and Greensboro Country Park Route (connecting to Jaycee Park and Natural Science Center)
- Common Transfer Point
- Routes are approximately equal in length and would support 20-minute frequency of service
- Vehicle Requirements: 2 transit vehicles (each a 'backup' to the other; see service plan)

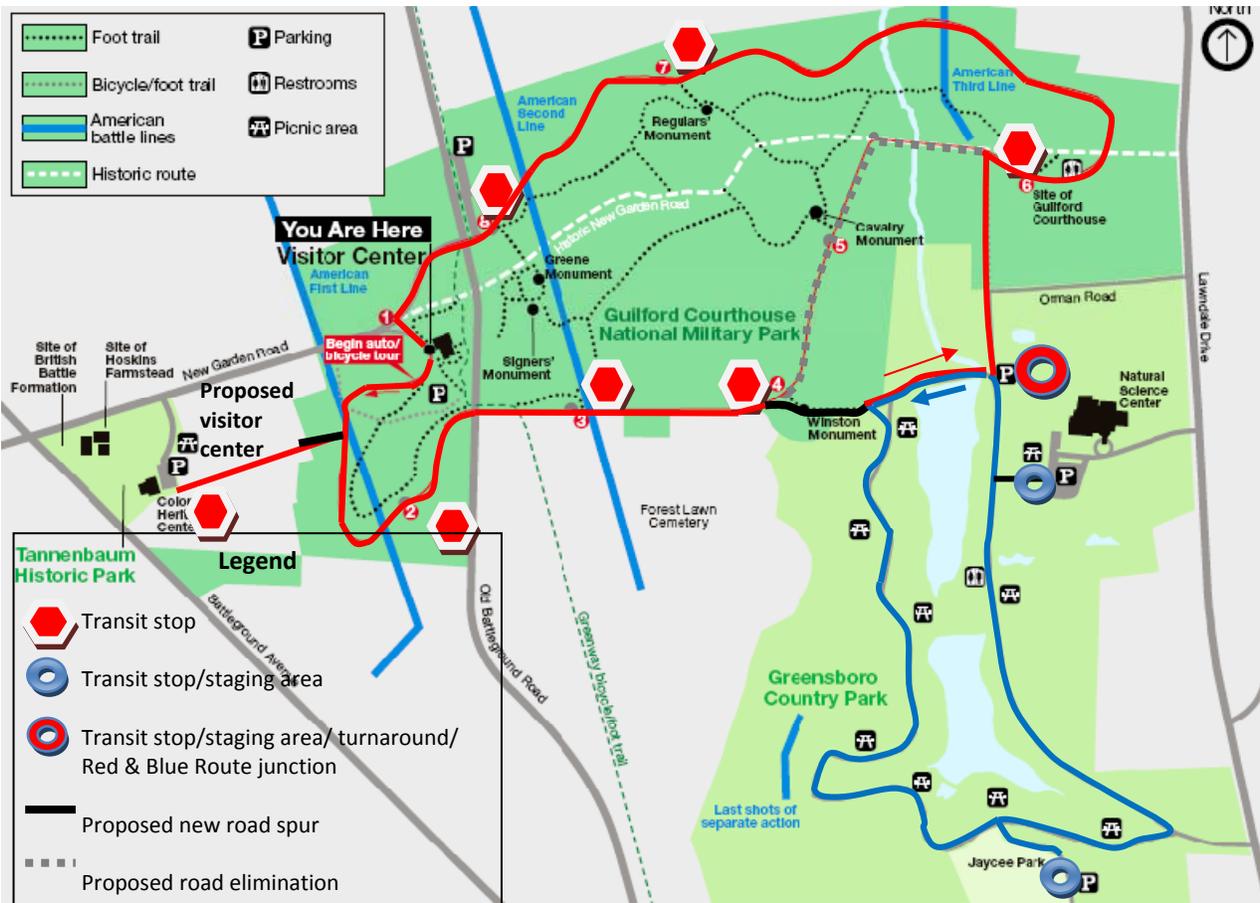


Figure 5: Option II, Two Routes (red and blue) Note: transit stops on blue route not yet identified

- Vehicle Type: Hybrid-electric or Electric bus (22' or 31') for Guilford Courthouse NMP-Tannenbaum Route & Hybrid-electric or Electric Tram (power unit, with 1 or 2 trailer units) for Greensboro Country Park Route (existing gas-powered tram could be used in the interim)
- Service Plan: Season: May-October (6 months)
 - Guilford Courthouse NMP-Tannenbaum Route: 7 days, 9:00 AM – 5:00 PM, internal park circulation at 20 minute frequency, 10:00 AM – 11:00 AM, and 1:00 PM-2:00 PM: 2 interpretative tours at 30 minutes each
 - Greensboro Country Park Route: Saturday and Sunday only, 9:00 AM – 9:00 PM at 20-minute frequency; service to Natural Science Center ends at 5:00 PM; during the hours on Saturday and Sunday for the interpretative tours, the Greensboro Country Park Route could follow the Integrated Transit route (Option I) to provide internal circulator service (at 30-minute frequency) on the Park Loop Road
- Service adjusts to an Integrated Route structure on weekends at 30 minute frequency of service when one of the two vehicles is unavailable – during weekday, other vehicles serve as a backup to the Guilford Courthouse NMP-Tannenbaum Route
- Close the loop roads to private vehicle traffic: both loop roads closed Saturday and Sunday; Park Loop Road closed five days of week during transit shuttle season. Country Park Loop road maintains same traffic management policies and circulation pattern as baseline (i.e., open to private vehicles during the week to 5:00 PM)
- Add new traffic control signage ('Yield to transit vehicle', or 'Left turn only when clear') or a transit vehicle actuated traffic signal control. These devices would hold private vehicles at the far side of the earthen dam road segment, before turning left to manage single lane two-way traffic operations safely. Actuated control of the transit vehicle passage (i.e., raising and lowering of bollards placed after passage of Winston Monument into Country Park Loop Road, and after the intersection with Orman Road) would prevent entry of private vehicles onto Park Loop Road during weekdays.

Road Modifications/OtherConstruction to Facilitate Transit

Both Option I and Option II would require multiple but minor road infrastructure modifications to connect the Park Loop Road with the Country Park loop road, and provide adequate transit vehicle turnarounds. Improvements are needed inside and outside the park.

Staging areas where visitors can park and transfer to the proposed transit system would be at¹:

- Jaycee Park parking lots
- Orman Road parking facility (at Country Park)
- Natural Science Center and Zoo parking facility (off of Lawndale Drive)
- Guilford Courthouse NMP Visitor Center parking facility
- Colonial Heritage Center proposed New Visitor Center

Proposed improvements for each of the staging areas by option are as follows (if no option is specified, the proposed improvement would be the same in both Option I and II). Those facilities that would require expansion, modification or removal are listed below.

¹ Consensus of Guilford Courthouse NMP and its partners, confirmed by the site reconnaissance as the best site locations for access off of the urban road network to the transit system, and for physical layout to accommodate parking, and transit operations.

Orman Road Parking Facility – No modifications necessary but there would be a change in circulation, requiring visitors to walk from their cars to the common access point stop (Option II) or to the nearest transit stop on the integrated transit route (Option I).

Traffic Signals - Greensboro would be willing to work with the park to install traffic signals at Old Battleground Road/Park Loop Road, which would facilitate the safe movement of the transit vehicle from the park tour road across the intersection.

ITS - an Intelligent Transportation System (ITS) consisting of in-pavement lights could be triggered to flash by the presence of a transit vehicle on the approach to the Old Battleground Road/Park Loop Road intersection. Use of in-pavement flashing lights (used to indicate pedestrian crossings, and signage warning of a transit vehicle crossing) are both likely to increase the yielding behavior of motorists at the intersection when a transit vehicle is attempting to cross the intersection. However, the transit vehicle driver would be responsible for assuring that a safe crossing gap is available before entering the intersection.

Natural Science Center and Zoo – under both Options I and II, a new road segment spur (paving the existing gravel segment) and transit vehicle stop (for passenger boarding and alighting), and transit vehicle turnaround (landscaped central island and circular road turnaround).

Guilford Courthouse NMP existing Visitor Center – No modifications necessary.

Guilford Courthouse New Visitor Center (proposed) – expand parking facility (roughly double existing parking capacity at Tannenbaum Colonial Heritage Center); build a transit shelter and passenger boarding/alighting stop and transit vehicle turnaround on the backside of the expanded parking lot. Access should be from New Garden Road (vs. Green Acre Lane) for safety, which will also allow a one-way vehicular traffic circulation pattern for visitors entering, parking and exiting the parking facility. Visitors, having parked their vehicles, can then move as pedestrians to the backside of the parking facility where the transit stop and turnaround are sited (off of Green Acre Lane).

Green Acre Lane – add a small spur to connect to the tour loop road (critical to success of either option)

Winston Monument – add a new road segment using the Old Winston Monument Circle alignment (critical to success of either option).

Partnerships

Representatives from Guilford Courthouse NMP and other adjacent/nearby recreational sites met in July 2008 to explore opportunities to work together to further common goals, including improved transportation system management. The primary focus of the meeting was to explore the feasibility of a transit system to provide direct connections between the park and the partner sites. All the partners at the meeting expressed support for the transit system concept and agreed informally to continue evaluating this concept.

Each of the partners brings a unique perspective and purpose to the partnership discussions and activities. To continue their work together, members of the partnership may need to formalize their

agreements in writing, to identify specifically which agencies will be responsible for what tasks. Legal issues that may impact transportation operations should also be explored in such an agreement. For example, Guilford Courthouse NMP and Greensboro Parks and Recreation may need an interagency agreement to permit contra-flow use of earthen dam road segment of Country Park Loop road by the park transit vehicle.

Guilford Courthouse NMP’s role in the partnership could include: writing a grant for vehicle acquisition (if FTA funds are not a viable source), underwriting additional planning and design work (including engineering design of the missing road segments and transit vehicle turnarounds), marketing and branding, outreach (including media materials), and providing interpretative rangers for the interpretative tours.

Based on their operating experience, the Natural Science Center and Zoo has a tremendous capacity to raise funds, and could be very successful at collecting underwriters for the operations and maintenance costs of the service.

Welcoming the Greensboro Transit Authority into the partnership discussions will be vital to the success of the transit system, since they have both the organizational and technical capability – including a maintenance facility with excess capacity – to maintain vehicles. They could also assist in securing Federal Transit Administration (FTA) grant funds for vehicle acquisition (serving as a grantee). Greensboro County Parks and Recreational Department could potentially operate and manage the new transit system (perhaps under ‘contract’ to Greensboro Transit Authority, although both are departments in the City of Greensboro), since they have been operating the existing tram system for many years. They also have the capability to hire and train staff at a very reasonable unit cost (labor-hour) – data provided by Steve Branson indicate a direct labor-hour cost of the existing tram service of \$9.34 – and also have the physical capacity for on-site storage of the vehicles for light maintenance and daily servicing and safety checks.

Cost Estimates

Rough cost estimates for both Option I and Option II are presented in the following tables. In the short-term, the existing gas-powered tram (owned and operated by Greensboro Park and Recreation) could serve as one of the two vehicles so that only one additional vehicle must be acquired (lease or purchase). Option I is slightly less expensive than Option II.

Option I Cost Estimates		
Category	Description	Cost
Capital Costs	2 electric-powered vehicles @ \$300,000	\$600,000
	1 charger station @ \$58,000	\$58,000
	Road infrastructure estimate (i.e., missing road segments, and transit vehicle turnarounds)	\$100,000- \$150,000

	ITS system (automated bollard)	\$30,000-\$50,000
		Option 1 Capital Costs = \$788,000 - \$858,000
Operational and Maintenance Costs (including recapitalization of the vehicle fleet)	Fully loaded (including overhead and benefits) unit labor cost (based on Greensboro County Parks and Recreation labor rate for existing tram operation) - ~\$20 per vehicle-hour	
	Annualization of vehicle fleet costs (based on capital recovery factor = 0.12, costs allocated to six-months operation only) – ~ \$44 per vehicle-hour	
	Assume annual maintenance cost equivalent to 5 percent of capital costs - ~ \$18 per vehicle-hour	
	Total sustainable operational and maintenance cost per vehicle-hour - ~\$ 82 per vehicle-hour	
		Option I Operational and Maintenance Cost on a sustainable basis (70 vehicle-hours per week x 26 weeks x \$82 per vehicle-hour) =~\$149, 240
Option II Cost Estimates		
Category	Description	Cost
Capital Costs	2 electric-powered vehicles @ \$300,000	\$600,000
	1 charger station @ \$58,000	\$58,000
	Road infrastructure estimate (i.e., missing road segments, and transit vehicle turnarounds)	\$100,000- \$150,000
	ITS system (e.g. traffic signal control and automated bollard)	\$110,000 - \$150,000

Option II Capital Costs =	
\$868,000 - \$958,000	
Operational and Maintenance Costs (including recapitalization of the vehicle fleet)	Fully loaded (including overhead and benefits) unit labor cost (based on Greensboro County Parks and Recreation labor rate for existing tram operation) - ~\$20 per vehicle-hour
	Annualization of vehicle fleet costs (based on capital recovery factor = 0.12, costs allocated to 6-months operation) – ~ \$44 per vehicle-hour
	Total sustainable operational and maintenance cost per vehicle-hour ~\$ 82 per vehicle-hour
	Option II Operational and Maintenance Cost on a sustainable basis – 80 vehicle-hours per week x 26 weeks x \$82 per vehicle-hour = ~\$170,560

Recommendations

Both Option I and Option II appear to be technically feasible. The planning team recommends a three-phase approach to planning and implementation of transit service at Guilford Courthouse NMP and adjacent lands.

Phase A: Project Exploration and Partnership-Building (2008-2009) (underway)

Phase A would consist largely of further feasibility discussions between existing and potential partners to investigate roles, responsibilities, areas of expertise and capacity. Partners would continue to explore general pros and cons of the two transit system options, and consider whether or not to acquire to professional planning services for Phase B.

Welcoming the Greensboro Transit Authority to the partnership discussions soon will be key to the success of the system.

The role of Guilford Courthouse NMP in the partnership could include: vehicle acquisition, underwriting planning and design, applying for grants, marketing and branding of the service, and providing interpretative rangers for the interpretative tours. Exploring lessons learned from other National Park Service transit systems would be beneficial prior to the commencement of Phase B.

Phase B: Concept Refinement and Identification of Partnership Roles (2009-2010)

Partners should consider acquiring planning expertise to assist them in selecting a preferred alternative (Option I or II, or a combination), pilot operational requirements, season of operation, ridership (not explored in Phase A; will be a critical to establish system viability and cost-effectiveness), vehicle selection, public involvement, marketing/branding and infrastructure improvements, and the development of a final cost estimate. The park may wish to seek grant funds to provide technical expertise for this phase.

Guilford Courthouse NMP would conduct an Environmental Assessment for the transit system operations and related improvements, and all partners could participate in the public involvement process.

Following the refined technical analysis and environmental compliance, the partners would identify which agencies would be responsible for what components during implementation, including: vehicle selection/ acquisition, operations, maintenance, financial contributions (one-time and on-going), infrastructure modifications, etc. Partners would likely need a signed agreement before implementing the transit system.

Phase C: Implementation of the New/Integrated Transit System (2010-2011)

Once the planning and park compliance work has been completed, the proposed transit system can proceed toward implementation. Funding, vehicle acquisition, design and construction of infrastructure, and selecting an operator (if a partnership member cannot be found for this work) for the system will be the final tasks.

To build support and increase the project feasibility, the 'founding' partners should discuss the project with Chattanooga Transit Authority (CATA), E-Bus (California manufacturer) and/or other agencies/companies as early as possible about leasing one or two electric-powered buses for the 'pilot' service. If leasing is not possible, then the park could write a grant request for vehicle acquisition. A plan for disposal of the pilot vehicle should be developed in advance, in case the pilot service demonstrates that a Guilford Courthouse NMP transit system is not viable.

Guilford Courthouse NMP could also seek Public Lands Highway Discretionary and Category V (Intelligent Transportation System) funding for both the road infrastructure missing links (and transit vehicle turnarounds) and the necessary supporting ITS systems (e.g., traffic signal control on single-lane segment, and automated bollard systems) for transit systems operations.

Appendix A

Guilford Courthouse National Military Park, Transit Feasibility Meeting with Partners: 7/25/08

- | | |
|-------------------|---|
| 1:00 PM -1:30 PM | Why have a transit system? <ul style="list-style-type: none">• Vision and goals for a transit system, and what each hopes to gain (or problems solved)• Identification of other visitor management options• Exploration of the “No-Build” Option |
| 1:30 PM – 2:00 PM | Basic parameters for design of a transit system <ul style="list-style-type: none">• Discussion of visitation patterns (with provision of supporting data)• Target markets for use of transit system• Discussion re: quantitative demand estimates, vehicle capacity requirements, and average peak season day hourly passenger flow-rate for transit system• Consensus on season span, days of week, hours per day, scheduled service versus limited set of interpretative tour runs• Closing Park Loop Road – Critical or Not Critical to Success of Transit System? |
| 2:00 PM – 3:00 PM | Route structure and stop locations <ul style="list-style-type: none">• Map exercise: Partners lay out routing of transit service and where stops should be• Discuss rationale for stop locations• Discussion of ‘staging area’ stops where visitors can park their vehicles and transfer to the transit service• US DOT/Volpe Center presents alternative transit routing structure (two transit routes with common transfer stop, and two-loop road circulation pattern) and operational concept, with complementary road design modification to facilitate two-loop circulation pattern• Discussion (high-level) of physical design modifications at ‘staging’ area stops to facilitate efficient and safe access and circulation of vehicles (including transit vehicles), and visitor transfers |
| 3:15 PM – 3:30 PM | Transit vehicle design preferences |
| 3:30 PM -4:30 PM | Road infrastructure modifications to facilitate transit service <ul style="list-style-type: none">• Discuss missing road links (e.g., length, what needs to be built, rough cost estimate) to connect Park Loop and Country Park Loop roads, and connections to ‘staging area’ stops/parking facilities• Discuss status of plans to remove segment of Old Battleground Road from Guilford Courthouse NMP, and reroute northern segment to New Garden Road• Discuss status of I-840 interchange with Old Battleground Road, and implications for Guilford Courthouse NMP and for feasibility of transit service if plans to remove and reroute Old Battleground Road are no longer an option |
| 4:30 PM – 5:00 PM | Organizational arrangements and financial support for transit service <ul style="list-style-type: none">• Discuss site location options for garaging and maintenance of transit vehicles• Discuss pros and cons of organizational arrangements for managing, operating and maintaining transit service• Discuss equitable cost-sharing options for a financially sustainable transit service• Discuss attitude towards User charges or fees for the service as an off-set revenue source |

Appendix B

Analysis of Regional Transportation and Land Use Plans Near Guilford Courthouse National Military Park

REGIONAL ROADS

The Greensboro Urban Area Metropolitan Planning Organization adopted the Greensboro Urban Area Thoroughfare Plan in 2006. This plan shows park gateways Highway 220/Battleground Avenue and New Garden Road (the park's primary access corridors) as arterials. Old Battleground Road, a local commuter road used by local visitors for park access, is not shown on the plan.

The future interchange planned at Battleground Avenue and I-840 likely means that more traffic will be coming to the area west of the park.

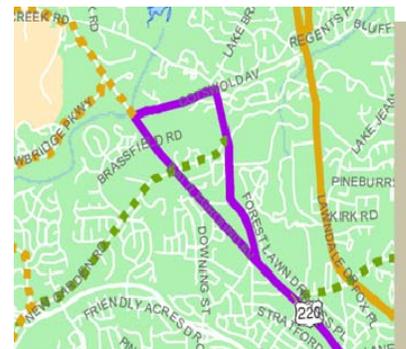


Excerpt from the Thoroughfare Plan 2006 (red shows major arterials, green shows minor)

TRANSIT

The Greensboro Transit Authority provides service to the intersection of Battleground Avenue/New Garden Road near the entrance to Tannenbaum Historic Park, about 1/2 mile east of the park Visitor Center. Transit access in this area is fair, however, no direct service is available to the park.

An eastern extension of the transit system along New Garden Road is proposed by the transit authority in the next 10 years. If this extension goes to the Visitor Center, it could potentially connect to a park shuttle system and strongly enhance multi-modal recreational access, and provide a stronger link between the downtown area, the and nearby recreational opportunities.



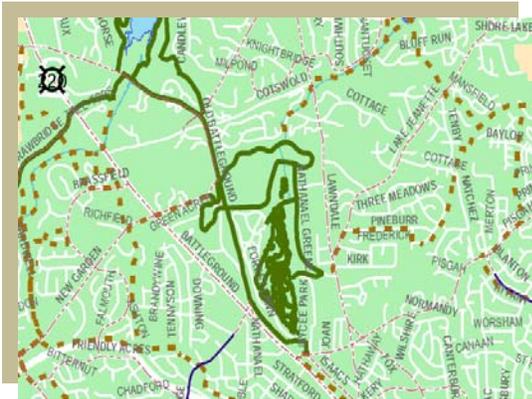
Excerpt from the 2035 Long Range Transportation Plan. Existing transit is shown in purple; hatched routes are planned.

BICYCLE

The Regional Bike Plan, from the Greensboro Urban Area Comprehensive Transportation Plan 2007, shows good bicycle connectivity in this area. The park and nearby recreational sites have access to regional bicycle trails via the north-south Greenway trail (which parallels Old Battleground Road). The Greenway passes through the park and intersects the Park Loop Road twice.

PEDESTRIAN

The Pedestrian Plan from the Greensboro Urban Area Comprehensive Transportation Plan 2007 shows a fine-grained pedestrian network with good connectivity to the the park and adjacent/nearby recreational sites.



Excerpt from the Greensboro Regional Bike Plan. Green lines indicate existing off-road trails, dashed red lines are future off-road trails



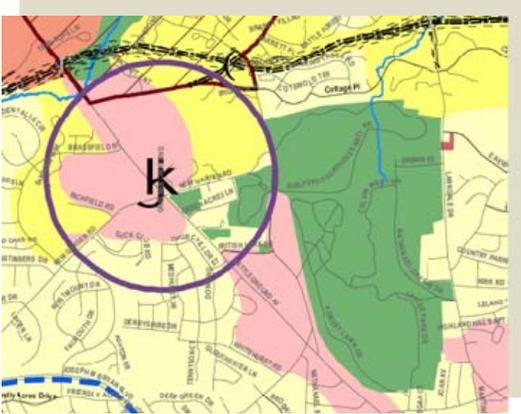
Excerpt from Greensboro Pedestrian Plan. Green lines show existing facilities, red shows existing facilities that need improvement.

LAND USE

According to the Greensboro Connections 2025 Comprehensive Plan, the favored quarters of growth within the City of Greensboro are away from the park, and northwestern Greensboro is identified as an area of stable land use.

Land use near the park will continue to be primarily low density residential, with some new mixed use commercial along the Battleground Avenue corridor. Recreation and open space will continue to be major land uses in the area near the park.

The City of Greensboro has zoned ½ mile radius around the Battleground Avenue/New Garden Road intersection as an "Activity Center" for compact, mixed-uses with pedestrian and transit linkages. The eastern portion of the park (east of Battleground Road) and Tannenbaum Historical Park both fall within this area.



Excerpt from the Greensboro Connections 2025 Comprehensive Plan; the proposed Activity Center is circled.

Appendix C

On-Site Measurements and Observations by the Volpe National Transportation Systems Center

Limited data were collected on-site in July 2008, a summary follows.

Travel time to complete Park Loop Road: 9 minutes

Travel time to complete Tannenbaum Historical Park Loop: 2-3 minutes

Travel time to complete Country Park Loop Road: 10 minutes

One-hour flow rate for vehicles, pedestrians and bicycles at tour stop 4 (Expanding Battle) on Park Loop Road:
(weather conditions good; 11:05 AM – 12:05 PM, 7/25/08)

Vehicles – 23 (3 vehicles park ranger, official duty)

Pedestrians – 29 (1 pedestrian parked at wayside and then walked; most pedestrians walking dogs)

Bicycles – 5

Parking at tour stop 4 – 7

Occupancy of parking at start of data collection – 1

Occupancy of parking at end of data collection – 6

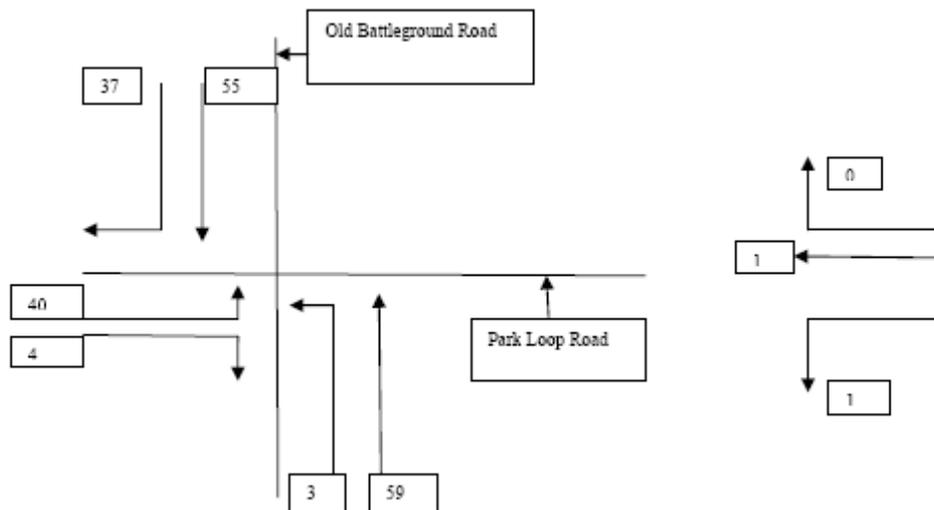
Capacity of parking at tour stop 4 – 8 parking spaces + 1 HC space

Travel time of tram vehicle run within Greensboro Country Park – 9 minutes (Note: driver indicated cycle time between 9-15 minutes dependant on the number of stops)

Travel time of 'pilot' transit run (using the Country Park tram) providing an interpretative tour on the combined Park Loop and Country Loop roads – 37 minutes (Note: several minutes dedicated to opening and closing gates that link the two road loops)

Observe and measure 15-minute turning volume counts at intersection of Park Loop Road and Old Battleground Road in the vicinity of tour stop 8 (weather conditions: good; start time 12:15 PM):

See Figure 1 below.



Appendix C (cont)

On-site data observations by the Volpe National Transportation Systems Center in July 2008 and discussions with park staff and partners confirms the following transportation conditions in and near the park:

- Visitor attractions with separate access points could feasibly be linked via an internal transit shuttle system operating on non-public use roads, and provide convenience for historic-oriented visitors, and relief of traffic on local public roads.
- Connecting Guilford Courthouse NMP with Tannenbaum Park, Greensboro Country Park and the Natural Science Center and Zoo would expand opportunities for visitors to see more than one site (when a physical connection was established between Country Park and the Natural Science Center, people were seen walking between the two sites).
- Potential use of the Jaycee Park parking lots, and the Greensboro Country Park Orman Road parking facility to serve the overflow parking needs of the Natural Science Center (which is growing in attendance at a rapid rate), which would be better served by using limited site acreage to expand its exhibits than to expand its parking capacity. To use these other peripheral sites as parking overflows for the Natural Science Center and Zoo requires quick and frequent transit shuttle service.
- Extensive use of both Park Loop Road and Country Park Loop Road by walkers, joggers and bicyclists. Walkers, joggers and bicyclists do not always use the non-motorized lane on Park Loop Road, and often are in conflict with vehicular traffic.
- Restricting use of Park Loop Road to transit vehicles would reduce conflicts between motorized and non-motorized vehicles. Before Country Park Loop Road was closed to vehicular traffic on the weekends, Greensboro Park and recreational staff noted that level-of-service along the Country Park Loop Road was at LOS F (i.e., bumper-to-bumper cruising).
- Restricting vehicular traffic on both park loop roads places a legal obligation under the Americans with Disabilities Act (ADA) of 1990 to provide equivalent service for those unable to enjoy these resources via walking, jogging or bicycling. Essentially, a policy to restrict private vehicular traffic makes it necessary to provide an alternative transit system for access to sites and internal circulation.
- New interpretive opportunities would be available with a transit system (such as on-board interpretation), and a reconfiguration of the road system would better protect and restore the historic integrity of the Battlefield.

Appendix D

Transit Vehicle Design Preferences

Five vehicle types were presented for discussion at the July 2008 workshop, but only two (both electric-powered) excited the park and its partners. These are illustrated below.



A number of factors argue for electric-powered vehicles as a potentially good choice for the proposed transit system:

- Paved roads
- No long steep sustainable grades on either loop road (i.e., power requirements would not be excessive)
- Route lengths are short, and the accumulated mileage per transit vehicle would be within the range for current battery technology
- Opportunity to recharge vehicles at night
- Reduced noise and air toxic emissions would be highly compatible with natural setting and enhance visitor experience

Appendix E

Transit System Demand, Vehicle Capacity, Hourly Flow-Rate & Service Frequency Estimates

Transit system quantitative demand estimates, vehicle capacity requirements, average peak season day hourly passenger flow-rate, and required transit hourly frequency of service are contingent on whether Option I transit route structure or Option II transit route structure is implemented. The following three tables present these calculations for Option I and Option II respectively.

Option I Transit Route Structure

Quantitative average peak-season day demand estimate ¹	Vehicle capacity requirement ²	Average peak-season day hourly passenger flow rate ³	Transit hourly frequency of service ⁴
399	25	50	30 minute frequency
587	40	74	30 minute frequency
1059	72 (tram, 1 power unit, 2 trailers)	133	30 minute frequency ⁵

Notes: 1. Calculated as the sum of the daily peak-season average number of visitors committed to interpretation of the NMP, and the number of visitors who are likely to visit multiple sites based on the interchange rate of 3, 5 and 10 percent respectively

2. Calculated as typical available vehicle unit capacity that just exceeds the ratio of the average peak-season day hourly passenger flow rate to the number of transit runs based on the transit hourly frequency of service (number of transit runs per hour equals 60 minutes/ transit hourly frequency of service)

3. Calculated as the average peak-season day demand estimate divided by the number of hours of service (8 hours)

4. Calculated as the ratio of the average peak-season day hourly passenger flow rate to the vehicle capacity requirement; the calculations are iterative in that the product of the vehicle capacity requirement and the number of transit runs operated per hour (based on assumed frequency of service) must equal or exceed the average peak-season day hourly passenger flow rate to achieve a demand-supply balance.

5. Alternatively, one would have to operate at a 15-minute transit frequency using a typical 40- passenger transit vehicle to achieve a demand-supply balance based on the average peak-season day hourly passenger flow rate

Option II Transit Route Structure: Guilford Courthouse NMP-Tannenbaum Route

Quantitative average peak-season day demand estimate ¹	Vehicle capacity requirement ²	Average peak-season day hourly passenger flow rate ³	Transit hourly frequency of service ⁴
145	25	18	30 minute frequency
198	25	25	30 minute frequency
442	25	56	20 minute frequency

Notes: 1. Calculation is the sum of the daily peak-season average (5-year) number of visitors at the Visitor Center (116) and a fraction of the number of users on the Jaycee-Country Park-Natural Science Center route who wish to interchange at the common access point to visit Guilford Courthouse and Tannenbaum Parks, the fraction equivalent to the same assumed interchange rates (i.e., 3, 5 and 10 percent representing low, medium and high scenarios)

2. Calculated as typical available vehicle unit capacity that just exceeds the ratio of the average peak-season day hourly passenger flow rate to the number of transit runs based on the transit hourly frequency of service (number of transit runs per hour equals 60 minutes/ transit hourly frequency of service)

3. Calculated as the average peak-season day demand estimate divided by the number of hours of service (8 hours)

4. Calculated as the ratio of the average peak-season day hourly passenger flow rate to the vehicle capacity requirement; the calculations are iterative in that the product of the vehicle capacity requirement and the number of transit runs operated per hour (based on assumed frequency of service) must equal or exceed the average peak-season day hourly passenger flow rate to achieve a demand-supply balance.

Option II Transit Route Structure: Jaycee Park-Country Park-Natural Science Center Route

Quantitative average peak-season day demand estimate ¹	Vehicle capacity requirement ²	Average peak-season day hourly passenger flow rate ³	Transit hourly frequency of service ⁴
973	44 (tram, 1 power unit + 1 trailer)	122	20 minute frequency
1638	72 (tram, 1 power unit + 2 trailers)	205	20 minute frequency
3276	72 (tram, 1 power unit + 2 trailers)	410	10 minute frequency

Notes: 1. Calculated as the sum of the number of visitors who are likely to visit more than one site connected by the Jaycee Park-Country Park-Natural Science Center route, and the percent of visitors on the Guilford Courthouse NMP-Tannenbaum Park route who are likely to interchange at the common access point to the Jaycee Park-Country Park-Natural Science Center route, assuming the same interchange rates (i.e., 3, 5 and 10 percent corresponding to low, medium and high rate scenarios).

2. Calculated as typical available vehicle unit capacity that just exceeds the ratio of the average peak-season day hourly passenger flow rate to the number of transit runs based on the transit hourly frequency of service (number of transit runs per hour equals 60 minutes/ transit hourly frequency of service)

3. Calculated as the average peak-season day demand estimate divided by the number of hours of service (8 hours)

4. Calculated as the ratio of the average peak-season day hourly passenger flow rate to the vehicle capacity requirement; the calculations are iterative in that the product of the vehicle capacity requirement and the number of transit runs operated per hour (based on assumed frequency of service) must equal or exceed the average peak-season day hourly passenger flow rate to achieve a demand-supply balance.