4.2 DETAILED SCREENING CRITERIA

The transportation options, as described in subsection 4.1, were evaluated and ranked according to more refined screening criteria, with the goal of identifying a list of feasible options. These options are expected to be carried forward by the National Park Service for a potential environmental compliance and planning process which is not in the scope of this study. The criteria used for detailed screening is presented in Table 4-1.

Some of the criteria in the table, including safety improvements, parking availability, and changes in delay and congestion, were also used for initial screening. However, the objective of initial screening is to simply determine whether an option would "pass," be "neutral" to, or "fail" a criterion; while the detailed screening uses more quantitative measures (on a scale of 0 to 10) and weighting factors so that options can be ranked from high to low based on their measurement on the weighted criteria.

Table 4-1: Detailed Screening Criteria

Category	Criteria	Measure/Unit	Effects/ Impacts	Weighting Factor	Sub Total
General Impacts to Park Resources, Visitor Experience, and Management	Reduction in vehicle miles traveled (VMT)	VMT	Direct	7%	60%
	Reduction in vehicle emissions	tons, cubic feet	Indirect and Cumulative	10%	
	Footprint for additional transportation infrastructure	square feet	Direct and Cumulative	10%	
	Changes in delay and congestion	0-10 with 10 being best		7%	
	Parking availability	0-10 with 10 being best		7%	
	Safety improvement	0-10 with 10 being best		7%	
	Convenience and comfort	0-10 with 10 being best		7%	
	General impacts to park staff and management	0-10 with 10 being best		5%	
Financial Feasibility	Total Cost of Ownership	US Dollars		18%	40%
	Revenue	US Dollars		10%	
	Funding Sources and Cost Sharing	0-10 with 10 being best		12%	

Source: URS Corporation.

Notes: Estimated values (measures/units) of each criterion will be converted proportionally to a rating score of 0-10 (0 being the worst, 10 being the best) before multiplying an assigned weighting factor.

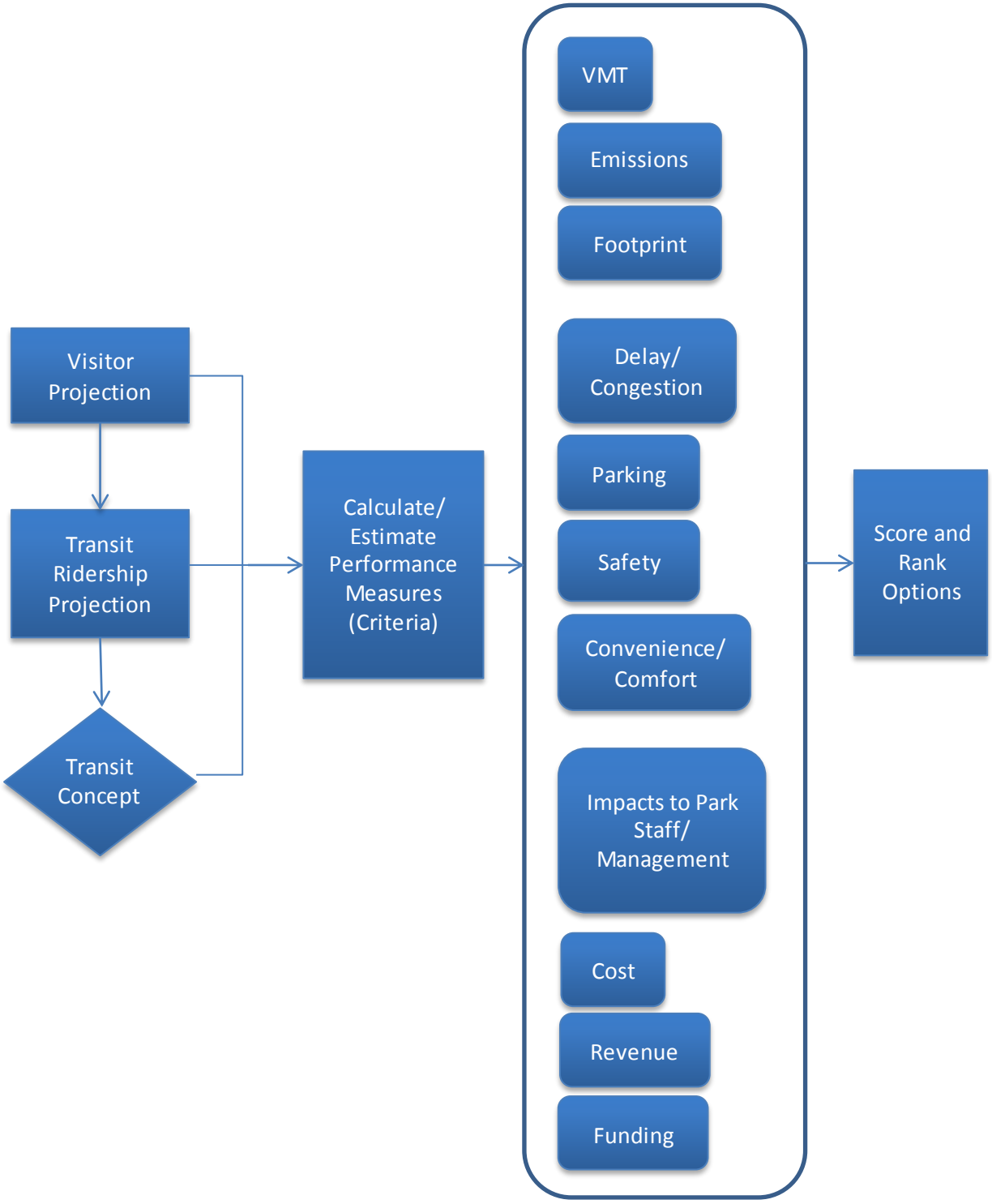
The total of weighting factors of all criteria is 100%.

The following discussions are intended to assist readers in understanding how these criteria were applied:

1. Each of the 11 criteria listed in Table 4-1 can be considered as a "performance measure" for the corresponding impact category. For instance, reduction in Vehicle Miles Traveled (VMT) is a performance measure for general impacts to natural and cultural resources, while total cost of ownership is a performance measure for financial feasibility.
2. Three criteria – reduction in VMT, reduction in emissions, and footprint increase – collectively measure the extent of general impacts to natural and cultural resources. All these criteria are quantitative measures that can be calculated for each transportation option.
3. Four criteria – change in delay and congestion, parking availability, safety improvement, and convenience and comfort – collectively measure the general impacts to visitor experience. These are used as qualitative measures and were estimated, using a scale 0-10 (a higher score represents less impact), for each transportation option.
4. The criterion "General impacts to park staff and management" is used to consider how each transportation option would affect park management, in terms of staffing, budget, maintenance, operation, enforcement, etc. on a scale 0-10.
5. Three criteria – total cost of ownership, revenue, and funding sources and cost sharing – collectively measure the financial feasibility of each transportation option. Costs and revenue are both quantitative measures and were calculated for each transportation option. The third criterion, funding sources/availability and cost sharing opportunities, is a qualitative measure and was estimated for each option.
6. For quantitative criteria, such as reduction in VMT, each option was scored at a scale 0-10 with 10 being best (i.e., least impact). For qualitative criteria, such as safety improvement, the numerical assessment (0-10) of each option automatically transferred into a score of 0-10.
7. For each criterion, one of the seven transportation options (Option I to VI-B) would score zero while another option would score 10. In other words, both ends of the score spectrum (0-10) would be assigned to a transportation option.
8. After each transportation option is assigned a score (0-10) on all 11 criteria, the 11 scores of the option would be weighted using their corresponding weighting factors (in percentage), resulting a single weighted score.
9. Each criterion has a weighting factor, expressed as percentage, which represents the relative importance of the criterion – compared with other criteria – in scoring the transportation options. These weighting factors were discussed during the Evaluation of Options Workshop, held at the park on May 7, 2012, and agreed upon by workshop participants.

The flow chart in Figure 4-10 illustrates major steps of the detailed screening process. Following subsections of this section describe each major step, estimated or calculated performance measures (screening criteria), and how these performance measures were used to score and rank the seven options.

Figure 4-10: Detailed Screening Process



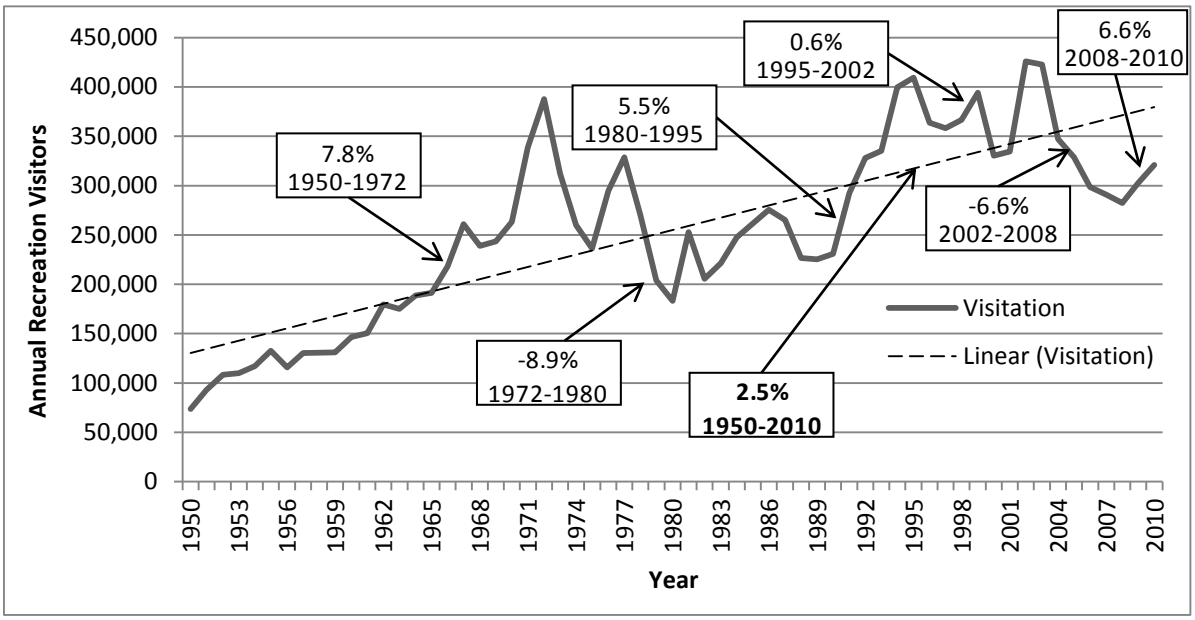
Source: URS Corporation.

4.3 VISITOR PROJECTION

The Existing Conditions Memorandum (Appendix A) evaluated visitation trends in terms of annual, monthly, and daily (Design Day) visitation and traffic circulation patterns in the park. However, this ATFS needs to account for future conditions as well, typical for similar planning studies. Therefore the existing data must be projected to estimate future conditions. Since a regional or area travel/visitor demand forecasting model does not exist for many national parks, including Little Bighorn Battlefield National Monument, projections are typically performed by factoring existing visitor data by a long-term annual visitation growth rate.

Since recreation visits to the park are discretionary and may not have been planned well in advance – most of the visitors come off I-90 for a relative short stay at the park while on their way to elsewhere, determining the appropriate growth rate for visitor projections can be difficult. Short-term events such as rising and falling gas prices and weather can cause substantial variations in visitation. Therefore, it is important to consider annual visitation variations over a long period. Federal Transit Administration (FTA) suggests that a minimum of past ten years need to be evaluated while projecting future visitor volumes for Federal Land Management Areas (FLMA)[13]. Figure 4-11 revisits historical visitor volumes to the park presented in the Existing Conditions Memorandum (Appendix A).

Figure 4-11: Annual Recreation Visitors 1950-2010



Source: NPS Public Use Statistics Office. Data Compiled by URS Corporation.

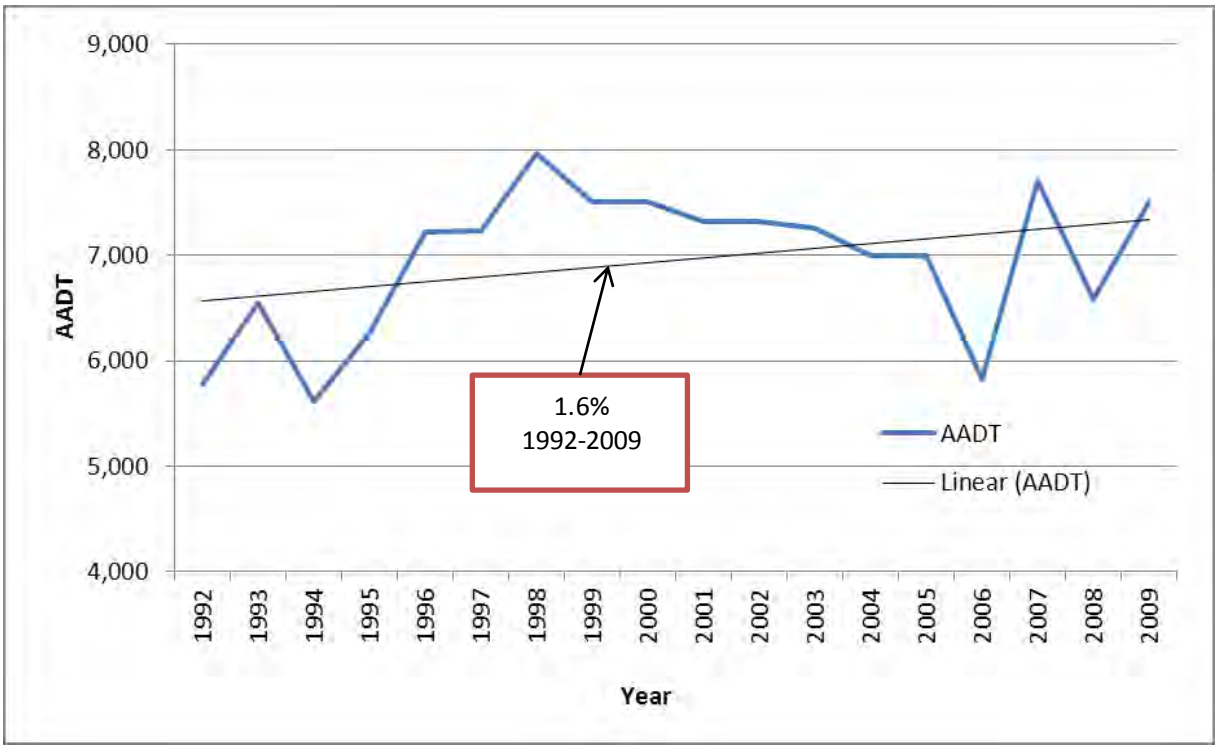
Recreation visitation to Little Bighorn Battlefield National Monument experienced significant fluctuations over the last six decades, as shown in Figure 4-11. From 1950 to 1972, visitation increased by over four times, or 7.8% per year; between 1972 and 1980, visitation fell by almost 9% a year; from 1980 to 1995, visitation on average increased by 5.5% a year and then stayed relatively stable until 2002, although there had been large spikes in between these years; between 2002 and

13 Transportation Planning Process for Transit in Federal Land Management Areas, Volume Three: Methods to Define the Transit Need. Federal Transit Administration. April 2008.

2008, visitation fell by an average 6.6% a year. Recently, annual visitors have been increasing again over the past three years (2008-2010) by approximately 6.6% a year. Overall, visitation has increased by approximately 2.5% a year over the past six decades. It should be noted that this average growth rate is a result of a linear regression of the last six decades, which accounted for the fluctuation of year-by-year visitation.

Since most visitors come to the park via I-90, it is worthwhile to explore the relationship between visitation to the park and traffic volumes on I-90. The study team analyzed historical traffic volumes on I-90 mainline, collected by Montana Department of Transportation (MDOT) at the Crow Agency Interchange area[14], as supplemental data for visitor growth rate analysis. Figure 4-12 displays traffic volume fluctuations on I-90 over the 18-year period between 1992 and 2009. The average traffic growth rate on I-90 is approximately 1.6% per year between 1992 and 2009.

Figure 4-12: Traffic Volumes on I-90



Source: Montana Department of Transportation.

Notes: AADT – Annual average daily traffic. Traffic counter located on I-90 at Mile Post 509 + 0.231.

Considering long-term visitor growth (2.5% a year from 1950 to 2010) and traffic growth on I-90 (1992-2009), as well as consultation with park staff concerning recent visitation trend, the study team decided to use a growth rate of 1.0% per year for visitation projections. Future year visitor projection was then performed by factoring this annual growth rate to 2010 annual visitors, as displayed in Table 4-2.

From 2010 to 2030, annual park visitors are estimated to increase from 321,000 to approximately 392,000, a 22% growth over the next 20 years. It should be noted that the projected annual visitation

14. *Traffic Data Collection and Analysis*, Montana Department of Transportation, webpage: http://www.mdt.mt.gov/publications/datastats/traffic_maps.shtml. Website accessed January 2011.

in year 2030 is still substantially lower than the park's historically highest annual visitation, which was close to 426,000 visitors in 2002.

The total number of vehicles that enter the park per year was calculated using estimated number of recreation visitors and factors suggested by the NPS Public Use Statistics Office[15], as follows:

*(Annual Total Vehicles) = (Annual Recreation Visitors) / (0.99*2.6)*

Where 0.99 = percentage of recreation vehicles, 2.6 = persons per vehicle multiplier

Table 4-2: Estimated Future Annual Visitation

Year	Recreational Visitors	Total Vehicles
2012	327,410	127,200
2013	330,680	128,470
2014	333,990	129,760
2015	337,330	131,050
2016	340,700	132,360
2017	344,110	133,690
2018	347,550	135,020
2019	351,030	136,370
2020	354,540	137,740
2021	358,080	139,120
2022	361,660	140,510
2023	365,280	141,910
2024	368,930	143,330
2025	372,620	144,760
2026	376,350	146,210
2027	380,110	147,670
2028	383,910	149,150
2029	387,750	150,640
2030	391,630	152,150

Source: NPS Public Use Statistics Office. URS Corporation.

15. *Public Use Counting and Reporting Instructions*, Little Bighorn Battlefield National Monument. NPS Public Use Statistics Office, January 1994

4.4 TRANSIT RIDERSHIP PROJECTION

As discussed previously, three transit options (Option V, VI-A, and VI-B) moved past the initial screening to this detailed screening process. The potential success of a transit option largely depends on how many visitors will be attracted to use the transit system. Although there are several common models available for forecasting transit ridership for discretionary (voluntary) urban transit systems, these methods may not be applicable to a potential transit system in the park since park visitors typically have different motivations for riding transit than urban commuters.

A relatively simple method to determine transit ridership is application of a "transit trip generation rate," which reflects the proportion of estimated transit riders to the total visitors[8]. To determine such a rate for FLMAs, the FTA sponsored a survey of existing transit systems in FLMAs. All surveyed transit programs happen to serve NPS sites, with three mandatory systems and seven voluntary systems. Table 4-3 summarizes service characteristics and ridership information for each of these programs. As shown in the table, one-way passenger trips per recreation visitor for voluntary transit programs vary widely from as low as 0.06 at Cape Cod to 0.80 at Yosemite. Further analysis of the data indicated that frequent service, congested roads, and lack of parking at Yosemite National Park make transit an attractive alternative to private vehicles[8].

Table 4-3: FLMA One-Way Passenger Trips per Recreation Visitor

(**Reproduced** from *Transportation Planning Process for Transit in Federal Land Management Areas, Volume Three: Methods to Define the Transit Need*. Federal Transit Administration. April 2008.)

	FLMA	Service Period		Service Time		Service Headway		Passenger Trips per Recreation Visitor
		Start Date	End Date	Start	End	Peak	Low	
Mandatory	Inyo National Forest/Devils Postpile National Monument	29-Jun	1-Oct	7:15 AM	8:30 PM	20 min	45 min	1.78
	Harpers Ferry National Historical Park	Year-Round		8:00 AM	6:00 PM - 7:00 PM	15 min		1.39
	Zion National Park	25-Mar	30-Oct	5:30 AM	11:30 PM	6 min	30 min	1.29
Discretionary	Acadia National Park	23-Jun	11-Oct	6:30 AM	Midnight	15 min	60 min	0.21
	Bryce Canyon National Park	27-May	18-Sep	9:00 AM	6:00 PM	12 min		0.40
	Cape Cod National Seashore (Provincetown)	Memorial Day Weekend	Columbus Day Weekend	6:00 AM	Midnight	20 min		0.06
	Denali National Park (Front Co. Shuttles)	Mid May	Mid Sept	5:30 AM	11:00 PM	30 min	120 min	0.08
	Grand Canyon National Park (Village Route)	Year-Round		1 hour before sunrise	9:00 PM 11:00PM	15 min	30 min	0.43
	Rocky Mountain National Park	17-Jun	2-Oct	7:00 AM	8:00 PM	10 min		0.14
	Yosemite National Park	Year-Round		7:00 AM	10:00 PM	6 min	30 min	0.80

Notes: FLMA – Federal Land Management Area. Min – minute.

One-way passenger trips per recreation visitor for mandatory transit programs range from 1.29 to 1.78. Note that for mandatory transit programs, even though each rider would typically make at least two one-way trips by transit, the number of passenger trips per recreation visitor is less than two because all transit services exempt certain types of visitors, such as overnight campers and disabled visitors.

Based on analysis of the survey data and other data sources, the FTA suggested the following equation to be a "rule of thumb" transit trip generation rate for voluntary transit programs at FLMAs:

Equation 4-1 Transit Trip Generation Rates on FLMAs

$$(Number\ of\ One\ Way\ Transit\ Passenger\ Trips) = 0.45 \times (Recreation\ Visitors)$$

It should be noted that many transit programs in Table 4-3 do not cover the entire park – visitors have no other choice but to use private vehicles when they explore other parts of the park not covered by the transit route(s). Higher transit trip generation rate may be anticipated if a transit program provides services to all or most of the park.

The study team adopted Equation 4-1 to forecast ridership for the three transit options (V, VI-A, and VI-B), as well as for the transit service element of Option III – GMP One-way Tour Loop, with the following considerations:

1. For Option III – GMP One-way Tour Loop via I-90 Frontage Road, the number of one-way passenger trips per recreation visitor is assumed to be 0.38, lower than in Equation 4-1 since the one-way tour loop is expected to have low traffic congestion, if any. Furthermore, because transit service in Option III operates along the one-way tour loop which is approximately 14.5 miles, visitors who only intend to go to the visitor center would mostly choose to use their own vehicles for a 1-mile drive.
2. For Option V – Seasonal Transit to Visitor Center, the transit system would mostly serve visitors who only intend to visit the Custer Battlefield unit. Therefore, transit ridership is expected to be relatively low in comparison with other transit options/component. Accordingly, the number of one-way passenger trips per recreation visitor is assumed to be 0.3.
3. For Options VI-A – Seasonal Transit to Reno-Benteen Battlefield, the number of one-way passenger trips per recreation visitor is assumed to be 0.40, slightly lower than in Equation 4-1. This option provides visitors the opportunity to tour through the entire battlefield and would also attract visitors who only intend to visit the Custer Battlefield unit.

   It should be noted that in comparison with Option III, Option VI-A is expected to have slightly higher ridership since it could be attractive to visitors who only intend to go to the visitor center, while the transit system in Option III would be less attractive to the same group of visitors.
4. For Options VI-B – Peak Days Transit to Reno-Benteen Battlefield, the number of one-way passenger trips per recreation visitor is assumed to be 0.60. The rational for this higher value includes:
   a. This option provides visitors with opportunities to visit the visitor center area and tour the battlefield.

b. During the peak days when the transit system is in operation, parking shortage and road congestion in the park are at the highest level of the year, and therefore transit would be more attractive to visitors as an alternative transportation mode.

Table 4-4 summarizes the above estimates of transit ridership factors, in terms of transit riders and transit passenger trips per recreation visitor for all three transit options (Options III, V, VI-A, and VI-B). There are notable differences between the two terms "One-way Passenger Trips per Recreation Visitor" and "Transit Riders per Recreation Visitor":

1. The number of one-way passenger trips per recreation visitor accounts for boarding and alighting activities of transit passengers.
2. The number of transit riders per recreation visitor simply measures the percentage of visitors who would use the transit service, regardless of boarding and alighting activities.
3. For instance, assuming one out of a total of four recreation visitors used the transit service, the number of transit riders per recreation visitor would be 0.25 (1/4). Assuming this rider first got off the bus at the visitor center for a short visit, stepped onto another bus, then got off at Reno-Benteen, and eventually boarded a bus to exit the park. The resulting number of one-way passenger trips per recreation visitor was 0.75 (1x3/4).

Table 4-4: Transit Riders and Passenger Trips per Recreation Visitor

	Option III: Seasonal Transit on One-way Loop	Option V: Seasonal Transit to Visitor Center	Option VI-A: Seasonal Transit to Reno-Benteen	Option VI-B: Peak Days Transit to Reno-Benteen
One-way Passenger Trips/Recreation Visitor	0.38	0.30	0.40	0.60
Transit Riders/Recreation Visitor	0.17	0.13	0.18	0.27

Source: URS Corporation.

Notes: Each transit rider is estimated to make an average 2.25 passenger trips riding transit. This value (2.25) is based on the Intermountain Region Long Range Transportation Plan, Baseline Conditions Report – Draft, National Park Service, 2011.

The Existing Conditions Memorandum identified the three summer months (June, July, and August) as representing the peak season of visitation to the park, witnessing approximately 68% of annual recreation visitors. May and September are the shoulder season, which combined with the peak season to account for 87% of annual recreation visitors.

As described in subsection 4.1, Options III, V, and VI-A would offer transit service to visitors from Memorial Day through Labor Day; while Option VI-B would operate transit service only during 10-15 peak visitation days. Accordingly, transit ridership projections for each of the four transportation options of the future years were performed using ridership factors (Table 4-4) and forecasted recreation visitors (Table 4-2). As a result, forecasted annual transit riders are illustrated in Table 4-5.

Table 4-5: Forecasted Annual Transit Riders for Year 2020

	Annual Recreation Visitors	Transit Riders[1]	Reduction in Private Vehicles[2]
Option III - Seasonal Transit on One-way Loop	354,540	33,190	12,900
Option V - Seasonal Transit to Visitor Center	354,540	26,210	10,180
Option VI-A - Seasonal Transit to Reno-Benteen	354,540	34,940	13,580
Option VI-B - Peak Days Transit to Reno-Benteen[3]	354,540	6,430	2,470

Source: URS Corporation.

Notes: (1) Visitors that enter the park via transit vehicles

(2) Reduction of private vehicles entering the park

(3) Option VI-B is assumed to offer transit service for 15 peak visitation days in 2020

(4) Both transit riders and Reduction in Private Vehicles are calculated based on the number of recreation visitors and vehicles during the time periods when transit service is available, not the total annual visitors or vehicles

4.5 TRANSIT CONCEPTS

Visitor and transit ridership projections, as described previously, establish visitation data of future conditions that will be used to estimate performance measures (screening criteria) for all options. In addition, the transit options/concepts need to be further refined with necessary components before their performance measures (screening criteria) can be calculated and/or estimated with relative accuracy. This subsection describes refined concepts, built upon descriptions of options in subsection 4.1, of the following transit concepts:

- Option III: the GMP option with a seasonal transit service on the one-way tour loop
- Option V: a seasonal transit service from offsite staging/parking to the visitor center
- Option VI-A: a seasonal transit service from offsite staging/parking to Reno-Benteen
- Option VI-B: a peak days/special events transit service form offsite staging/parking to Reno-Benteen

Transit Route

All transit options will have a single route starting from the staging area, presumably at the junction of U.S. Highway 212 (US 212) and Montana State Highway 342 (MT 342, or park access road).

For Option III, the transit route will follow the one-way tour loop via the I-90 frontage road, proceed to Reno's first skirmish line at Garryowen, and then cross under I-90 to arrive at Reno's Crossing. The route would then follow a new one-way road from Reno's crossing, extend southeast along the west side of the Little Bighorn River and up to Reno Creek, enter the existing Reno-Benteen Battlefield from the south, connect with the existing tour road, and proceed over the tour road to Last Stand Hill. From Last Stand Hill, transit vehicles would then continue to the existing visitor center area, exit the park via the current entrance station, and arrive at the staging area. This loop route is approximately 14.5 miles long.

For Option V, the transit route would be simply a round trip between the offsite staging/parking and the visitor center via MT 342, of approximately 2.1 miles in round trip distance.

For Options VI-A and VI-B, the transit route would continue on MT 342 through the entrance station, visitor center area, tour road, and the Reno-Benteen parking lot/turnaround area. After turning around, transit vehicles would follow the same route, in the opposite direction, back to the staging area. The round-trip distance is approximately 11.8 miles.

For each transit concept, there would be a single staging/launching area, simplifying transit information for visitors and utilizing staff and transit vehicles more efficiently.

Annual/Daily Span of Service

For Options III, V, and VI-A, the transit service would operate from Memorial Day to Labor Day. For Option VI-B, the transit service would only operate during the peak days. The number of peak days to have transit service may vary from year to year dependent on visitation. As the purpose of the transit service under Option VI-B is to relieve traffic congestion and parking shortage during days when these problems are most severe, generally it should be offered for 10 to 15 days during the summer season. Special events that should be included in the transit service period include the park's anniversary (June 25), Memorial Day, the Sturgis Motorcycle Rally, and one or more days

immediately prior to and after these events. For the purpose of evaluating options, a 15-day transit service period is assumed for Option VI-B.

Table 4-6 displays the 15 peak visitation days in 2010. It should also be noted that these 15 days spread out through the summer season, which may make it more difficult for the park and a concession contractor to schedule and operate the transit service.

Table 4-6: 15-Day Peak Visitation in 2010

Ranking	Entering Vehicles	Date	Special Event
1	993	6/25/2010	Anniversary
2	756	6/26/2010	One Day After Anniversary
3	750	8/8/2010	Sturgis Motorcycle Rally
4	693	8/9/2010	Sturgis Motorcycle Rally
5	692	6/27/2010	Two Days After Anniversary
6	663	7/18/2010	
7	660	7/21/2010	
8	658	7/22/2010	
9	647	8/11/2010	Sturgis Motorcycle Rally
10	643	7/20/2010	
11	638	7/17/2010	
12	637	8/10/2010	Sturgis Motorcycle Rally
13	636	8/24/2010	
14	634	6/24/2010	
15	632	5/31/2010	Memorial Day
Total	**10,332**		

Source: Existing Traffic and Parking Conditions and Implications for Transportation Alternatives: Little Bighorn Battlefield National Monument, Jonathan Upchurch, December 16, 2010

On each day during the transit operating period, the first shuttle would leave the staging area at 9:00 a.m., and the last shuttle would leave the staging area at 5:00 p.m. Visitors coming before 9:00 a.m. or after 5:00 p.m. would need to use their own vehicles to access the park.

It should be noted that from Memorial Day to July 31st, the park opens at 8:00 a.m. and closes at 9:00 p.m. From August 1st to Labor Day, the park opens at 8:00 a.m. and closes at 8:00 p.m.

Transit Facilities

Due to compliance requirements and the latest policies regarding capital improvement strategies, building any additional infrastructure in the park to support a transit system is unlikely. Therefore, if a transit option is selected for the park, all transit facilities described in this subsection, except for transit stops, would need to be located outside the park boundary and would not be owned by National Park Service.

As discussed previously, a potentially feasible location for the staging/launching area would be adjacent to the junction of US 212 and MT 342. The staging area would include sufficient parking spaces, varying among the transit options/concepts, for both regular size and oversized vehicles. The parking area would need to accommodate towed-vehicle decoupling and drop-off. A ticket/operation office could be located in or close to the staging area, as well as maintenance/storage facilities, washing area, and a fueling station.

Since the transit system of the various transportation options evaluated in this study would only operate during the peak visitation season or peak days, it is possible that the transit system would share an existing local maintenance facility with a local business or agency, therefore avoiding the capital costs of building a separate maintenance facility. Similarly, the transit system could use local fueling stations within a few miles without having to build its own fueling station.

Besides an offsite staging/launching area, three transit stops would be located along the entire route, including the visitor center, Last Stand Hill, and Reno-Benteen parking/turnaround area. Each transit stop would have a bench and appropriate signage. Optional amenities may include a trash can at each stop. Option V would use only the visitor center stop.

The park would own and maintain the transit stops located in the park. Preferably, the park should contract via concession with a national, regional, or local transit provider who would be responsible for transit facilities outside the park. Ownership of the outside transit facilities would need to be determined among the concession contractor, land owner(s), local businesses adjacent to the staging area, and other stakeholders. Some other national parks, such as Bryce Canyon National Park, has been using this type of partnership with a transit provider and local communities to provide transit services for visitors and effectively reduced the costs of having to own all transit facilities.

Transit Vehicles

Transit vehicle types are dependent on estimated ridership (passenger trips or transit riders) and closely related to expected service frequency/headway. For each transit concept, it is determined that the entire transit fleet should consist of 15-seat passenger vans (no standees). This determination is based on forecasted ridership for a bus lifecycle of 12 years.

A 15-seat Van

For analysis purposes, year 2020 was assumed to be the middle year of the bus lifecycle and was used to estimate performance measures (criteria) of transit options.

All transit vehicles should have a low floor to provide relative convenience for boarding and alighting and to reduce loading/unloading times. If possible, they should be equipped with wheelchair tie-downs and lifts.

An in-vehicle interpretation program should be implemented to the transit system. This interpretation could be a series of pre-recorded audio tours that the shuttle operator plays to the passengers during the tour, or have the shuttle operator directly as the narrator/interpreter.

Other common transit vehicles that have been used at national parks include 30- to 40-seat shuttle buses as well as 50-seat tour buses, varying from 30-feet to 60-feet in length. These larger transit vehicles are determined as not needed at the park based on forecasted ridership. In addition, until road conditions are improved in the park, larger buses cannot be used on the existing park roads as the tour road cannot handle the weight and width of these buses.

40-seat Bus

30-seat Bus

Service Frequency/Headway

Service frequency is determined based on monthly and daily ridership projections, and varies among the transit options. For the purpose of evaluating options, the frequency/headway distribution as displayed in Table 4-7 is estimated using forecasted ridership of year 2020.

Table 4-7: Transit Service Headway and Vehicle Capacity

	Peak (9 a.m.- 3 p.m.) Headway (minute)	Off-peak (3 p.m.- 5 p.m.) Headway (minute)
Option III	15	30
Option V	20	30
Option VI-A	15	25
Option VI-B	10	20

Source: URS Corporation.

Dwell Time and Travel Time

As described previously in subsection "Transit Route", the round-trip distance is approximately 14.5 miles for Option III, 2.1 miles for Option V, and 11.8 miles for Options VI-A and VI-B. The average speed, excluding stops, is assumed to be 29 miles per hour, slightly lower than a presumable speed limit of 30 miles per hour.

For all transit options, shuttle vehicles, would stop at each designated transit stop for loading and unloading. The dwell time at the offsite staging area, visitor center, and Reno-Benteen turnaround area is assumed to be five minutes each to accommodate loading, unloading, and recovery time when necessary; and two minutes at the Last Stand Hill transit stop. The round-trip travel time is estimated to be approximately 60 minutes for Option III, 18 minutes for Option V, and 50 minutes for Options VI-A and VI-B.

4.6 GENERAL IMPACTS TO NATURAL AND CULTURAL RESOURCES

Three criteria listed in Table 4-1 fall into the category of general effects or impacts to cultural and natural resources: VMT, vehicle emissions, and footprint for additional transportation infrastructure. Each of these criteria would have a direct or indirect effect or cumulative impact upon the extant cultural and natural resources. For cultural resources, e*ffect* is defined at 36 CFR 800.16(i) as an alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register of Historic Places (NRHP). A *historic property* is defined at 36 CFR 800.16(l)(1) as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP. The National Environmental Policy Act (NEPA) defines *direct effects* as those that are caused by the action and occur at the same time and place (40 CFR § 1508.8). *Indirect effects* are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR § 1508.8). *Cumulative impact* results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

This subsection describes methods to calculate and/or estimate each of the criteria for all options, and summarizes how each option fares in each criterion on scores at the scale from zero to ten.

Vehicle Miles of Travel

For the purpose of evaluating options, forecasted annual visitors, vehicles, and transit ridership of year 2020 were used to estimate VMT for all options. The determination of round trip distance for various scenarios is described below.

- For all options, the round trip for a visitor who only intends to go to the existing visitor center area, either using a private vehicle or riding transit, is considered as starting from the junction of US 212 and MT 342, continuing on MT 342 to the visitor center. The length of such a round trip is approximately 2.1 miles. Approximately 45% of total visitors are in this category
- For all options except Option III (One-Way Loop via I-90 Frontage Road, or the GMP Option), the round trip for a visitor who intends to tour the battlefield, either using a private vehicle or riding transit, is considered as starting from the junction of US 212 and MT 342, continuing on MT 342 and then Tour Road, turning around at the Reno-Benteen parking lot, and arriving back at the staging area. As previously discussed, the length of such a round trip is approximately 11.8 miles. For the GMP option, this trip would follow the entirety of the one-way tour loop, a distance of 14.5 miles. Approximately 55% of total visitors would tour through the battlefield

Because the seven transportation options (I to VI-B) have different vehicle mixes, the number of vehicle trips need to be estimated accordingly. Two of the three construction options (I and II) and

the no-build option (IV) would have the same number of vehicle trips, as there is no transit available to divert from private vehicles. The GMP option (III) and the three transit options (V, VI-A, and VI-B) would have reduced vehicle trips compared with the other options, as on average each transit vehicle trip would carry more passengers than a private vehicle trip. However, vehicle trips vary significantly among these transit options including the GMP option, as each of the transit program would attract a different number of recreation visitors to ride the transit.

Table 4-8 summarizes results from calculating VMT and corresponding scores (0-10) for the seven options. Note that both private vehicle trips and transit trips refer to round trips.

Table 4-8: VMT Calculations and Scores for Year 2020

Option[1]	I	II	III [2]	IV	V	VI-A	VI-B
Miles per round trip to Reno-Benteen	11.78	11.78	14.52	11.78	11.78	11.78	11.78
Miles per round trip to visitor center	2.08	2.08	2.08	2.08	2.08	2.08	2.08
Private Vehicles to visitor center (thousand) [3]	138	138	62	138	128	124	135
Private Vehicles on tour road (thousand)	76	76	63	76	70	68	73
Bus trips	0	0	2,760	0	2,760	3,404	660
Annual VMT (thousand)	1,021	1,021	1,081	1,021	952	961	1,000
VMT Score (1-10)	**5**	**5**	**0**	**5**	**10**	**9**	**6**

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen

(2) For GMP option, it is assumed that 45% of visitors would drive from the new visitor contact station to Custer Battlefield, and the other 55% would take the one-way loop either via their own vehicles or via transit.

(3) For GMP option, these include private vehicles that only get to the visitor center but not the tour road. For other options, these include all private vehicles entering the park.

All options are scored, at a scale from zero to 10, against their respective VMT estimations using the following equation (results are rounded to integers):

VMT score of Option N = (maximal VMT of all options – VMT of Option N) X 10 / (maximal VMT of all options – minimal VMT of all options)

It should be noted that the above equation would result in a score of 10 (the highest score possible) for the option with the lowest total VMT – the lowest impact, and a score of zero (the lowest score possible) for the option with the highest total VMT – the most adverse impact. The other options would have an interpolated score between zero and ten.

The VMT scores are directly correlated with the direct effects and impacts upon cultural and natural resources. The heavier transit vehicles could, over time, adversely affect/impact buried cultural resources, soils, and vegetation along the roadways.

Vehicle Emissions

The study team considered four motorized vehicle emission types, including hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO_X), and carbon dioxide (CO_2). Emission rates for passenger cars and light trucks (including passenger vans) are from US Environmental Protection Agency (EPA) highway vehicle emission factor models[16]. Fuel economy is estimated at 21.5 miles per gallon (mpg) for passenger cars and 17.2 mpg for light trucks[17]. Emission rates for oversized vehicles are estimated by extrapolating rates for regular size vehicles, using an estimated fuel economy of oversized vehicles at nine miles per gallon. Other input for calculating vehicle emissions include annual VMT of year 2020 and vehicle mixes of each option.

Table 4-9 displays average emission rates of the three considered vehicle types (passenger cars, light trucks, and oversized vehicles). In order to estimate vehicle mixes, it is assumed that of all private vehicles, excluding oversized vehicles, passenger cars account for 65% and light trucks account for 35%.

Table 4-9: Emission Rates

	Oversized vehicle	Light Truck	Passenger Car
Emission Rates			
Hydrocarbons (g/mi)	6.71	3.51	2.80
Carbon Monoxide (g/mi)	52.97	27.70	20.90
Oxides of Nitrogen (g/mi)	3.46	1.81	1.39
Carbon Dioxide (lbs./mi)	2.20	1.15	0.92

Source: US Environmental Protection Agency, URS Corporation.

Notes: g/mi = grams per mile.
lbs. /mi = pounds per mile.

16. *Emission Facts: Average Annual Emissions and Fuel Consumptions for Passenger Cars and Light Trucks*. US Environmental Protection Agency, April 2000.
17. *Transportation Energy Data Book: Edition 19*. Prepared for US Department of Energy, prepared by Oak Ridge National Laboratory, September 1999.

Table 4-10 summarizes results from calculating vehicle emissions and scores for all options. The method of calculating the score (on a scale of zero to 10) of emissions for each option is similar to that of VMT.

Table 4-10: Vehicle Emissions and Scores of Options for Year 2020

Option[1]	I	II	III	IV	V	VI-A	VI-B
Emission Type	Annual Emission (pounds)						
Hydrocarbons	8,100	8,100	8,800	8,100	7,600	7,400	8,000
Carbon Monoxide	62,400	62,400	68,300	62,400	58,400	57,100	61,500
Oxides of Nitrogen	4,100	4,100	4,500	4,100	3,800	3,800	4,000
Carbon Dioxide	1,203,200	1,203,200	1,315,300	1,203,200	1,126,900	1,100,200	1,186,000
Emission Score	**5**	**5**	**0**	**5**	**9**	**10**	**6**

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen

Option VI-A - Seasonal Transit from Offsite Staging/Parking to Reno-Benteen scores the highest (10) due to its deepest reduction in all emission types. On the other end, Option III - GMP Option scores the lowest (zero) since it requires the longest distance of a round trip which results in the highest amount of emissions.

Vehicle emissions, especially with increased VMT and larger transit vehicles, would have an indirect effect on the viewshed, which is a significant aspect of the park's interpretive function, by introducing particulates in the air and reducing visibility. These emissions would also have indirect and cumulative impacts on local vegetation and wildlife.

Footprint for Additional Transportation Infrastructure

Footprint considered in this study includes increased pavement areas due to new or widened road, new or expanded parking spaces (on and off site), and other transportation facilities such as transit stops and bus maintenance/storage building(s). The measured footprint increases for each option are relative quantities compared to the No-Build option, which does not increase the footprint. The current parking demand indicates there is not a shortage of parking spaces at the Reno-Benteen site. Therefore some of the options, as discussed in the following paragraphs, do not include new parking for the current Reno-Benteen parking lot. However if visitation continues to grow, there is a potential for footprint increase due to new parking being added at the site.

For Option I – Repairing Tour Road and Reconfiguring Parking, the increased footprint results from the minor widening of the tour road of approximately 5.25 miles long, from 18 feet wide to 20 feet wide.

For Option II – 4R Project, the increased footprint results from widening (from 18 to 24 feet wide) the tour road of approximately 5.25 miles long and expanding parking lots in the visitor center area and Reno-Benteen Battlefield. According to the Environmental Assessment / Assessment of Effect – Rehabilitate Tour Road (Little Bighorn Battlefield National Monument, 2005), the 4R project would

add a total of 20 spaces at the visitor center parking lots including six regular, two handicapped, four motorcycle, and eight oversized vehicle parking spaces; and a total of 14 parking spaces at the Reno-Benteen parking lot including five regular and nine oversized vehicle parking spaces. On average each new parking stall is estimated to add 350 square feet of new pavement[18], including access lanes and landscaping.

For Option III – the GMP Option, the increased footprint mainly comes from a new road connecting the proposed new visitor station at Garryowen (assumed to be 2.5 miles with a typical width of 12 feet), a new parking lot at the new visitor contact station/shuttle staging area (approximately 170 parking spaces needed at this parking lot), and additional parking spaces (about 30) needed at Reno-Crossing site where the one-way road starts.

As discussed earlier, Option IV – Management Improvements would not cause footprint increase or decrease.

For transit options V – Seasonal Transit to Visitor Center and VI-A – Seasonal Transit to Reno-Benteen, the increased footprint are a result of required parking lot(s) at an offsite staging area (170 parking spaces), a maintenance/storage facility, operation management/ ticket office, and transit stop amenities. In addition, the increased footprint by repairing the tour road also needs to be accounted for each of these two options.

For transit option VI-B – Peak Days Transit to Reno-Benteen, the increased footprint are a result of required parking lot(s) at an offsite staging area (170 parking spaces). The relatively few days of transit operation do not warrant other separate transit facilities such as maintenance and washing area. The parking spaces for the temporary use do not need to be paved. The existing business parking lots close to Highway 212 and 342, such as the casino parking lot, may be utilized if an agreement can be reached with the parking lot owners. Nevertheless, the potential footprint increase, in case a new parking area has to be established, is accounted for in this study.

Table 4-11 summarizes footprint calculations and resulting scores for all seven transportation options. The method of calculating scores for increased footprints is similar to that for VMT and emissions.

18. *Transportation Cost and Benefit Analysis II - Parking Costs*. Victoria Transport Policy Institute (www.vtpi.org), 2011

Table 4-11: Increased Footprints and Scores of Options

Option[1] / Footprint[2]	I	II	III	IV	V	VI-A	VI-B
Widened/New Road (acres)	1.27	3.82	6.36	0.00	1.27	1.27	0.00
Expanded/New Parking (acres)	0.00	0.27	1.45	0.00	1.32	1.32	1.32
Total Footprint Increase (acres)	1.27	4.09	7.81	0.00	2.60	2.60	1.32
Footprint Score	**8**	**5**	**0**	**10**	**7**	**7**	**8**

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen
(2) Footprint for the transit options include parking, transit vehicle maintenance/storage, management/ticket office, and transit stop amenities.

The option with lowest amount of increased footprint – the no-build – scores 10 while the option with the highest amount of increased footprint – the GMP Option – scores zero. Scores for other options were then interpolated. Option I (the 4R Project) scored low at five due to the widened Tour Road at a significant length.

Creating new roads, widening existing roads, and expanding parking lots in the park would have direct effects on any cultural resources, known or undiscovered, immediately adjacent to those roads and parking lots. Likewise, adjacent soils and vegetation would be directed affected by these increased roads and expanded parking lots.

4.7 GENERAL IMPACTS TO VISITOR EXPERIENCE

The retelling of the battle of Little Bighorn requires balancing conflicting viewpoints, history, perspectives, and cultures to give a complete picture of the events and the times. So too, the interpretation of the Battlefield National Monument must be balanced with the need to preserve the place itself while at the same time allowing the public to experience, view, and understand what happened here so long ago.

In achieving this balance, there will inevitably be compromises, conflicts, and trade-offs. Accommodating increasing visitors for summer events as well as throughout the year will predictably encroach on the park's resources. Improving the facilities needed for travel, parking, viewing, and exploring the battleground, as well as visitor safety and comfort, is necessary to improve the visitor experience.

The following checklist contains goals for consideration when making changes designed to enhance the visitor experience of the historical events that took place at this park. Clearly, not all of these goals can be achieved as there are inherent conflicts between them and the need to preserve the battlefield. Rather, the checklist is a tool to use as a framework for discussion about both broad and specific ideas for improving visitor experience. It is intended to help decision makers be both thoughtful and deliberate about the benefits and consequences associated with the choices they make.

Overview

The land is largely open prairie with few trees. Therefore, whatever is added to, or a part of the landscape – even temporarily - can be seen for a long distance. This includes monuments, interpretive signage, traveling vehicles, roads, and parking lots. The haunting beauty of the battleground largely depends on maintaining the large, open feeling with minimal interruption. The design imperative is, therefore, to maintain the uninterrupted rolling plains and big sky to the degree possible.

Land Use

- Minimize disturbance to the battleground and its adjacent monuments, cemeteries, and other important components.
- Design buildings to be low and neutrally adorned or painted. Likewise, consider the impact of interpretive signage and its placement.
- Allow public access to the various areas within the park where important events occurred, overall views of the battleground can be seen, and specific monuments are located.
- Do not allow large parking lots to overwhelm the sites within the park.
- Maintain as much of the existing prairie grounds as practicable while also providing for visitor activities, transportation, interpretation, comfort, and safety.

Roadways

- Consider the placement of new roadways in relation to viewscapes and ridge lines. Avoid silhouetting traffic against the sky if possible.
- If a narrow cross-section is desired or maintained on existing roadways, provide pull-outs along the way so that disabled traffic can move out of the traffic lanes. The placement of these should be made so that their visual impact is minimized.

Public Transportation

- If public transit is implemented throughout the year, consider minimal shade structures for shuttle stops, as well as clear signage.
- If public transit is implemented only for special events or short periods of time, consider temporary shade structures for waiting passengers.

Views

- Determine viewsheds from important places within the battlefield site and try to minimize disturbing the landscape within that view shed, especially at ridgelines.

Interpretation

- Consider practical ways to minimize the intrusion of interpretive signage, such as placing it low to the ground.
- Use websites, recorded tours, or other non-invasive means of providing interpretation without signage.
- Explore other interpretive organizational methods other than the sequential incidents during the battle. For example, organize the tour by starting with the people involved or an

explanation of the cultures that clashed. Because the location of the entrance and the place where the battle began are at two ends of the park separated by several miles of non-park land, organizing by time is inherently problematic.

Facilities

- Provide bathrooms within easy distance of major sites. For example, at a minimum, in both the north and south portions of the park.
- Provide places for rest, perhaps made from local stone, along the interpretive trail.
- Provide water within easy distance of major sites.

Finally, in the preliminary design phase of any physical project, create a process that screens for unintended consequences or secondary effects associated with making changes to the park.

Performance Criteria Applied to Visitor Experience

As listed in Table 4-1, the following four performance criteria were considered in the category of general impacts to visitor experience:

- Changes in delay and congestion
- Parking availability
- Safety improvement
- Convenience and comfort

Scores on each of the above criteria for options were determined based a qualitative assessment of each option, in comparison with the no-build option. Detailed analysis of traffic operation, parking operation, and safety is beyond the scope of this feasibility study.

Delay and Congestion

Assessment of delay and congestion in this subsection is relative to the no-build option.

For Option I - Repairing the Tour Road and Reconfiguring Parking, congestion on the tour road and parking lots is expected to be relieved in the short term. However, since this option neither increases parking spaces nor offers a transit service, delay and congestion are expected to exist during some peak days and could deteriorate if the number of visitors increases.

For Option II - Widening the Existing Tour Road and Expanding Parking, or the 4R Project, congestion at parking lots, particularly at the visitor center area, is expected to be substantially mitigated due to increased parking spaces and reconfigured circulation patterns. Similarly, the widened tour road would provide sufficient pavement width for oversized vehicles to meet and pass each other, and therefore effectively reduce local congestion and consequent delay, which have mainly been the result from presence of oversized vehicles on the narrow tour road.

For Option III - One-Way Loop via I-90 Frontage Road, or the GMP Option, the one-way loop road would eliminate the need for vehicles running in opposite directions to pass each other, and therefore effectively address congestion and delay issues on the tour road. Assuming the parking area at the new visitor contact station will provide sufficient parking spaces for both regular size and oversized vehicles, parking congestion would also be mitigated. Furthermore, this option offers a seasonal transit service which is expected to substantially help manage visitation and reduce delay and congestion. Due to the increased trip length of this one-way loop road, passing lanes and additional pullouts may need to be included in the GMP Option.

If a construction project is designed to accommodate short-term to mid-term visitor demand, as is the case for many FLMAs, future visitor demand higher than the projections could trigger the need for additional improvements, which could be very costly. The inherent difficulties in visitor projections for most FMLAs certainly aggravate this situation, which would remain a prominent issue for the construction options without transit service.

By providing public transportation that would move visitors more efficiently and in larger groups, the transit options (V, VI-A, and VI-B) are expected to effectively mitigate or eliminate congestion and consequent delays at the parking areas in the park and on the tour road, although to various extents. Compared with no-build and the construction options, with exception of Option III, which does offer seasonal transit service, transit options would reduce the total number of vehicles entering the park and on the tour road, and therefore help reduce delay and congestion.

Parking Availability

Option II - the 4R Project and Option III – the GMP Option would provide sufficient parking spaces for short-term demand. The GMP would have the largest number of new parking spaces of all options and offer a transit service which would reduce parking demand in the park.

The three transit options (V, VI-A, VI-B) are expected to be relatively flexible and efficient in addressing long-term parking issues, though to various extents. All transit options are expected to provide sufficient parking at the offsite staging area and reduce parking demand in the park. However, none of these transit options would increase parking spaces in the park.

Safety Improvement

The three construction options (I, II, and III) would improve visitor safety to various extents, in relation to their capabilities of mitigating vehicle/pedestrian conflicts in the parking areas and on tour road. The three transit options (V, VI-A, and VI-B) offer safety benefits by reducing the number of vehicles in the park. Option IV – Management Improvements is expected to moderately improve safety by redistributing visitors/vehicles away from "hot spot" areas.

Convenience and Comfort

All options would provide relative convenience and comfort to visitors to various extents. Because the 10-15 peak visitation days are spread throughout the summer season, some of which are around certain special events (such as the park's anniversary), while others are not (a few days in mid-July 2010 ranked in top 10), visitors could easily be confused and frustrated over which days have a transit service and how to use the transit when it is offered.

The GMP option is scored the highest (10) since the one-way tour loop provides an opportunity for visitors to tour the battlefield in the correct chronological order, eliminates conflicts of vehicles passing each other, and offers a voluntary transit service.

The 4R project would make it easier for visitors to find a parking space and drive on the tour road with less conflicts, congestion, and delay compared with the no-build option. Options V and VI-A provide opportunities for visitors who prefer not to drive their own vehicles while experiencing the park. Option VI-B provides similar benefits during the peak days; however, it could also cause confusion and frustration with regard to bus scheduling and availability, which would negatively affect visitors' convenience and comfort.

The comfort level of riding a transit vehicle is typically higher than that of driving. For transit options, it is crucial to make the transit information readily available to all visitors and to provide frequent services (short headways) so that visitors do not have to wait long for the buses/vans.

Table 4-12 presents scores on criteria for general impacts to visitor experience, resulting from qualitative assessment of each option against the criteria. For each criterion, the option providing the lowest quality scores zero, while the option with highest quality scores 10. Other options score between zero and 10.

Table 4-12: Impacts on Visitor Experience – Scores

Option / Impact	I	II	III	IV	V	VI-A	VI-B
Delay & Congestion	0	7	10	3	5	8	6
Parking Availability	0	7	10	4	6	8	5
Safety Improvement	0	8	10	5	4	7	6
Convenience & Comfort	4	8	10	2	5	6	0

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen

4.8 GENERAL IMPACTS TO PARK STAFF/MANAGEMENT

Scores of options on general impacts to parks staff/management are based upon qualitative assessment of anticipated impacts, in comparison with the no-build option. Table 4-13 presents impact assessment and reasoning of scores in terms of pros and cons, as well as resulting scores of all options.

Table 4-13: Impacts to Park Staff/Management and Scores

Option	Pros	Cons	Score
I	In short-term, reduces requirements for park staff to direct traffic and respond to emergency situations in parking areas and on the tour road.	Does not address long term parking shortage issues that would require park staff to redistribute parking during peak days	2
II	Reduces requirements for park staff to direct traffic and respond to emergency situations in parking areas and on the tour road. Realignment and pavement improvements effectively mitigate deferred maintenance	Widened road and expanded parking require more staff resource and budget to maintain	10
III	Reduces requirements for park staff to direct traffic and respond to emergency situations in parking areas and on the tour road.	The longer road increases workload for maintenance. The seasonal transit service would require park staff to manage transit contract and marketing	8
IV	Helps reduce the need for park staff to direct traffic and parking	Does not address delayed maintenance of transportation assets	6
V	Reduces requirements for park staff to direct traffic and respond to emergency situations in the visitor center parking lots, due to fewer vehicles in the park.	Requires park staff to manage transit contract and marketing.	4
VI-A	Reduces requirements for park staff to direct traffic and respond to emergency situations in the parking lots or on the tour road, due to fewer vehicles in the park.	Requires park staff to manage transit contract and marketing.	3
VI-B	Reduces requirements for park staff to direct traffic and respond to emergency situations in the parking lots or on the tour road, due to fewer vehicles in the park during peak days.	Requires park staff to manage transit contract and marketing. Likely causes confusion of park staff over which days transit should operate. Requires more time for preparation and mobilization.	0

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen.

4.9 FINANCIAL ANALYSIS

As shown in Table 4-1 on page 56, three performance measures (criteria) – total cost of ownership, revenue, and funding resources/cost sharing – are included in the category of financial feasibility. This section presents the financial analysis methods and process resulting in estimated values (costs and revenues), qualitative assessment (funding sources/cost sharing), and scores for the seven options.

Total Cost of Ownership

The study team estimated lifecycle cost of ownership, including capital, operation, and maintenance over a 12-year span. The 12-year span is applied to all options to be consistent with the *Bus Lifecycle Cost Model for Federal Land Management Agencies*[19] which is adopted for this ATFS for transit cost estimates.

It should be noted that costs of ownership for each option would continue to accrue beyond the first 12-year lifecycle, including recapitalization of transit fleets, continued operating and maintenance costs, depreciation of transportation infrastructure, etc. However, these continued costs are expected to be proportional to the first 12-year lifecycle. Therefore, for options evaluation purpose, it is not necessary to account for the costs beyond the 12-year lifecycle.

As previously discussed in section 4.5 – Transit Concepts, it was assumed that a transit system for the park would seasonally rent or otherwise share an existing local maintenance facility to avoid the capital costs of building a separate maintenance facility. Therefore, a total leasing fee of $75,000 over the 12-year lifecycle – approximately 10 percent of the construction costs – is assumed for the transit system to use an existing maintenance facility. An exception is Option VI-B – Peak Days Transit, for which a maintenance facility was not accounted for in the cost estimate since the system would only operate during 10-15 days a year and local maintenance may not be needed.

An engineer cost estimate, using the Montana Department of Transportation Average Prices Catalog[20], was performed for Option I – Repairing the Tour Road and Reconfigure Parking, Option II – Widening the Tour Road and Expanding Parking (the 4R Project), Option III – One-way Tour Loop via I-90 Frontage Road (the GMP Option), and the construction components (repairing the tour road and new parking) for Options V and VI-A, respectively. The estimating methods follow the guidelines of the *NPS Cost Estimating Requirements Handbook*, specifically *Class C Construction Cost Estimates for Feasibility Studies (Least Detailed)*. Itemized cost elements that need conceptual design components were generalized to a higher level so that reasonable assumptions can be made. Cost estimate of transit options and concepts was performed using the *2011 Bus Lifecycle Cost Model for Federal Land Management Agencies.*

Due to very limited conceptual information on these options available to the study team, these cost estimates are considered as "order of magnitude" and rely heavily on engineering judgment. Cost estimating with relative accuracy cannot be achieved until conceptual design and engineering drawings are developed, which is beyond the scope of this ATFS. Table 4-14 describes some of the mark-up and add-on factors that are required for Class C Cost Estimates.

Results from cost estimates are summarized in Tables 4-15 to 4-22.

19. *Bus Lifecycle Cost Model for Federal Land Management Agencies*, prepared for US Department of Transportation, prepared by John A. Volpe National Transportation Systems Center, 2011.

20. *Average Prices Catalog: Metric and English*, Montana Department of Transportation, Contract Plans Bureau, January 2011 to June 2011 Edition.

Table 4-14: Mark-up and Add-ons for Class C Cost Estimate

Mark-up/Add-on	Value	Description
Location Factor:	0.00%	Montana DOT average price catalog accounts for the location of the project in Montana.
Remoteness Factor:	7.00%	Site is approximately 70 miles from closest commercial center (Billings). State highway and Freeway access to site.
Wage Rate Factor:	0.00%	Montana DOT average price catalog accounts for wage rates based on Davis Bacon Act
State & Local Taxes:	0.00%	Crow Agency, MT has 0.0% sales tax. There is no sales tax in the State of Montana, and no documented localized sales taxes in Crow Agency.
Design Contingency:	30.00% or 10.00%	Maximum suggested percentage for conceptual plans. Current conceptual plans are very general in detail requiring an increased contingency percentage. Includes drainage, traffic control and signing/striping. Since Option II – the 4R project – has been designed, it should no longer be considered as a conceptual plan. Accordingly, a design contingency of 10% was applied for Option II in this study.
Standard General Conditions:	10.00%	A mid-range percentage was selected from the suggested 4-20% range to account for multiple remote worksites to be coordinated.
Government General Conditions:	5.00%	Half of the standard general conditions to account for the increased administrative and quality requirement of the NPS.
Historic Preservation Factor:	2.00%	Construction will take place in a historic district - no impact to historic structures is anticipated at this time.
Contractor Overhead:	0.00%	Contractor overhead is included in the average unit costs calculated by the Montana DOT.
Contractor Profit:	0.00%	Contractor profit is included in the average unit costs calculated by the Montana DOT.
Bonds and Permits:	2.50%	2 percent bonds and 0.5 percent permit costs anticipated.
Contracting Method Adjustment:	10.00%	Competitive Negotiation of Construction is anticipated; however, other methods may be used.
Construction Management Adjustment:	8.00%	Estimate for construction management activities of the project. Has been requested on other feasibility level estimates.
Washington contingency:	10.00%	Estimate for possible Washington office involvement. Has been requested on other feasibility level estimates.
Annual Inflation Escalation Factor:	5.00%	Estimated annual inflation rate for construction activities in Montana.
Time Until Project Midpoint (Months)	39	December 2014 is estimated as the midpoint of the construction efforts. Added additional 12 months for unit prices from 2011.
12-year Maintenance Estimate	N/A	To provide consistent estimates with ATS options: a 12 year maintenance estimate was established. Average annual cost was assumed to be $10,000/mile, increasing 5% annually thru year 12.

Source: National Park Service and Montana Department of Transportation. Data compiled by URS Corporation.

Table 4-15: Summary of Lifecycle Cost Estimation – Option I

(Part 1: PROJECT COST SUMMARY)

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Option 1 - Repair Existing Road	1	VALUE	$1,672,112	$1,672,112
2	Not Used	1	VALUE	$0	$0
3	Not Used	1	VALUE	$0	$0
4	Not Used	1	VALUE	$0	$0
5	Not Used	1	VALUE	$0	$0
6	Not Used	1	VALUE	$0	$0
7	Not Used	1	VALUE	$0	$0
8	Not Used	1	VALUE	$0	$0
9	Not Used	1	VALUE	$0	$0
10	Not Used	1	VALUE	$0	$0
11	Not Used	1	VALUE	$0	$0
12	Not Used	1	VALUE	$0	$0
13	Not Used	1	VALUE	$0	$0
14	Not Used	1	VALUE	$0	$0
15	Not Used	1	VALUE	$0	$0
16	Not Used	1	VALUE	$0	$0
17	Not Used	1	VALUE	$0	$0
18	Not Used	1	VALUE	$0	$0
	Subtotal Direct Construction Costs				**$1,672,112**
	Value of Government Furnished Property (GFP) Included in Direct Cost (see footnote)*				**$0**
				Direct Cost Subtotal without GFP	**$1,672,112**
	Published Location Factor	0.00%			$0
	Remoteness Factor	7.00%			$117,048
	Federal Wage Rate Factor	0.00%			$0
	State & Local Taxes (Applied to 50% of Direct Cost)	0.00%			$0
	Design Contingency	30.00%			$501,633
	Total Direct Construction Costs				**$2,290,793**
	Standard General Conditions	10.00%			$229,079
	Government General Conditions	5.00%			$114,540
	Historic Preservation Factor	2.00%			$45,816
	Subtotal NET Construction Cost				**$2,680,228**
	Overhead	0.00%			$0
	Profit	0.00%			$0
	Estimated NET Construction Cost				**$2,680,228**
	Bonds & Permits	2.50%			**$67,006**
	Contracting Method Adjustment	10.00%			$268,022.75
	CM Costs	8.00%			$214,418.20
	Washington Contingency	10.00%			$268,023
	Inflation Escalation	39	Months	5.00%	$601,015
	Total Estimated NET Cost of Construction				**$4,098,712**
	12-Year Maintenance Estimate	5.2	Miles		**$827,687**
	Total Estimated NET Cost of Construction and Maintenance				**$4,926,399**

* GFP costs are only used when the Government pre-purchases items, or provides other materials out of Government inventory, to be installed by contractor. Adjustments and Markup on GFP only include Inflation Escalation; No other adjustment factors or O&P markup have been applied.

Table 4-15: Summary of Lifecycle Cost Estimation – Option I
(Part 2: LINE ITEM COST SUMMARY)

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
	SITE PREPARATION					Removed 1' of existing
202020140	Remove Bituminous Pavement	10830	SQYD	$ 2.08	$22,526	asphalt for clean
203020100	Excavation - Unclassified	1560	CY	$ 4.16	$6,490	construction line and
					$0	15% for deficiency
					$0	reconstruction
	SUBTOTAL SITE PREPARATION	**1**	**VALUE**	**$ 29,016.00**	**$29,016**	

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
	SITE IMPROVEMENTS					6" HMA over 6" ABC
301020340	Crushed Aggregate Course	2850	CY	$ 18.62	$53,067	Bridge assumed to be
401020022	Commercial Mix - PG 64-28	5550	TON	$ 81.83	$454,157	300' long in total and 26'
552010302	Class B Bridge Deck Repair	870	SQYD	$ 1,305.60	$1,135,872	wide
					$0	Consistent 20 width of
					$0	construction (increased
						2' in ave width)
	SUBTOTAL SITE IMPROVEMENTS	**1**	**VALUE**	**$ 1,643,095.50**	**$1,643,096**	

TOTAL COST -	**Option 1 - Repair Existing Road**	**1**	**VALUE**	**$ 1,672,111.50**	**$1,672,112**	

Table 4-16: Summary Lifecycle Cost Estimation – Option II

(Part 1: PROJECT COST SUMMARY)

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Option 2 - 4R Project	1	VALUE	$4,074,421	$4,074,421
2	Not Used	1	VALUE	$0	$0
3	Not Used	1	VALUE	$0	$0
4	Not Used	1	VALUE	$0	$0
5	Not Used	1	VALUE	$0	$0
6	Not Used	1	VALUE	$0	$0
7	Not Used	1	VALUE	$0	$0
8	Not Used	1	VALUE	$0	$0
9	Not Used	1	VALUE	$0	$0
10	Not Used	1	VALUE	$0	$0
11	Not Used	1	VALUE	$0	$0
12	Not Used	1	VALUE	$0	$0
13	Not Used	1	VALUE	$0	$0
14	Not Used	1	VALUE	$0	$0
15	Not Used	1	VALUE	$0	$0
16	Not Used	1	VALUE	$0	$0
17	Not Used	1	VALUE	$0	$0
18	Not Used	1	VALUE	$0	$0
	Subtotal Direct Construction Costs				**$4,074,421**
	Value of Government Furnished Property (GFP) Included in Direct Cost (see footnote)*				**$0**
				Direct Cost Subtotal without GFP	**$4,074,421**
	Published Location Factor	0.00%			$0
	Remoteness Factor	7.00%			$285,209
	Federal Wage Rate Factor	0.00%			$0
	State & Local Taxes (Applied to 50% of Direct Cost)	0.00%			$0
	Design Contingency	10.00%			$407,442
	Total Direct Construction Costs				**$4,767,073**
	Standard General Conditions	10.00%			$476,707
	Government General Conditions	5.00%			$238,354
	Historic Preservation Factor	2.00%			$95,341
	Subtotal NET Construction Cost				**$5,577,475**
	Overhead	0.00%			$0
	Profit	0.00%			$0
	Estimated NET Construction Cost				**$5,577,475**
	Bonds & Permits	2.50%			**$139,437**
	Contracting Method Adjustment	10.00%			$557,747.50
	CM Costs	8.00%			$446,198.00
	Washington Contingency	10.00%			$557,748
	Inflation Escalation	39	Months	5.00%	$1,250,695
	Total Estimated NET Cost of Construction				**$8,529,300**
	12-Year Maintenance Estimate	5.2	Miles		**$827,687**
	Total Estimated NET Cost of Construction and Maintenance				**$9,356,987**

* GFP costs are only used when the Government pre-purchases items, or provides other materials out of Government inventory, to be installed by contractor. Adjustments and Markup on GFP only include Inflation Escalation; No other adjustment factors or O&P markup have been applied.

Table 4-16: Summary Lifecycle Cost Estimation – Option II

(Part 2: LINE ITEM COST SUMMARY)

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
	SITE PREPARATION					Remove all existing pavement and sub grade
202020140	Remove Bituminous Pavement	60410	SQYD	$ 2.08	$125,653	
203020100	Excavation - Unclassified	12100	CY	$ 4.16	$50,336	
207010300	Foundation Material	12100	CY	$ 24.23	$293,183	
					$0	
					$0	
	SUBTOTAL SITE PREPARATION	**1**	**VALUE**	**$ 469,171.80**	**$469,172**	

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
	SITE IMPROVEMENTS					6" HMA over 6" ABC Bridges assumed to be 300' long in total and 26' wide Consistent 24 width of construction. Construct all new pavement
301020340	Crushed Aggregate Course	13430	CY	$ 18.62	$250,067	
401020022	Commercial Mix - PG 64-28	26290	TON	$ 81.83	$2,151,311	
552010302	Class B Bridge Deck Repair	870	SQYD	$ 1,305.60	$1,135,872	
Lump Sum Est.	Parking Lot Expansion	34	spaces	$ 2,000.00	$68,000	
					$0	
	SUBTOTAL SITE IMPROVEMENTS	**1**	**VALUE**	**$ 3,605,249.30**	**$3,605,249**	

TOTAL COST -	**Option 2 - 4R Project**	**1**	**VALUE**	**$ 4,074,421.10**	**$4,074,421**	

Table 4-17: Summary of Lifecycle Cost Estimation – Option III (Excluding Transit Costs)

(Part 1: PROJECT COST SUMMARY)

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Option 3 - GMP One-way Loop	1	VALUE	$6,377,717	$6,377,717
2	Not Used	1	VALUE	$0	$0
3	Not Used	1	VALUE	$0	$0
4	Not Used	1	VALUE	$0	$0
5	Not Used	1	VALUE	$0	$0
6	Not Used	1	VALUE	$0	$0
7	Not Used	1	VALUE	$0	$0
8	Not Used	1	VALUE	$0	$0
9	Not Used	1	VALUE	$0	$0
10	Not Used	1	VALUE	$0	$0
11	Not Used	1	VALUE	$0	$0
12	Not Used	1	VALUE	$0	$0
13	Not Used	1	VALUE	$0	$0
14	Not Used	1	VALUE	$0	$0
15	Not Used	1	VALUE	$0	$0
16	Not Used	1	VALUE	$0	$0
17	Not Used	1	VALUE	$0	$0
18	Not Used	1	VALUE	$0	$0
	Subtotal Direct Construction Costs				**$6,377,717**
	Value of Government Furnished Property (GFP) Included in Direct Cost (see footnote)*				**$0**
				Direct Cost Subtotal without GFP	**$6,377,717**
	Published Location Factor	0.00%			$0
	Remoteness Factor	7.00%			$446,440
	Federal Wage Rate Factor	0.00%			$0
	State & Local Taxes (Applied to 50% of Direct Cost)	0.00%			$0
	Design Contingency	30.00%			$1,913,315
	Total Direct Construction Costs				**$8,737,472**
	Standard General Conditions	10.00%			$873,747
	Government General Conditions	5.00%			$436,874
	Historic Preservation Factor	2.00%			$174,749
	Subtotal NET Construction Cost				**$10,222,842**
	Overhead	0.00%			$0
	Profit	0.00%			$0
	Estimated NET Construction Cost				**$10,222,842**
	Bonds & Permits	2.50%			**$255,571**
	Contracting Method Adjustment	10.00%			$1,022,284.18
	CM Costs	8.00%			$817,827.34
	Washington Contingency	10.00%			$1,022,284
	Inflation Escalation	39	Months	5.00%	$2,292,373
	Total Estimated NET Cost of Construction				**$15,633,182**
	12-Year Maintenance Estimate	7.7	Miles		**$1,225,629**
	Total Estimated NET Cost of Construction and Maintenance				**$16,858,811**

* GFP costs are only used when the Government pre-purchases items, or provides other materials out of Government inventory, to be installed by contractor. Adjustments and Markup on GFP only include Inflation Escalation; No other adjustment factors or O&P markup have been applied.

Table 4-17: Summary of Lifecycle Cost Estimation – Option III (Excluding Transit Costs)

(Part 2: LINE ITEM COST SUMMARY)

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
	SITE PREPARATION					Removed 1' of existing
202020140	Remove Bituminous Pavement (Tour Road)	10830	SQYD	$ 2.08	$22,526	asphalt for clean
203020100	Excavation - Unclassified (Tour Road)	1560	CY	$ 4.16	$6,490	construction line and
201130005	Clearing and Grubbing (New Road)	5.3	AC	$ 2,150.00	$11,395	15% for deficiency
203020100	Excavation - Unclassified (New Road)	2590	CY	$ 4.16	$10,774	reconstruction on
202020140	Remove Bituminous Pavement (Access Road)	2090	SQYD	$ 2.08	$4,347	existing Tour Road and
203020100	Excavation - Unclassified (Access Road)	300	CY	$ 4.16	$1,248	access road
					$0	Constructed new 2.2
					$0	mile, 12' wide road
					$0	
	SUBTOTAL SITE PREPARATION	**1**	**VALUE**	**$ 56,780.60**	**$56,781**	

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
	SITE IMPROVEMENTS					6" HMA over 6" ABC for
301020340	Crushed Aggregate Course (Tour Road)	2850	CY	$ 18.62	$53,067	all roads.
401020022	Commercial Mix - PG 64-28 (Tour Road)	5550	TON	$ 81.83	$454,157	Tour Road bridges
552010302	Class B Bridge Deck Repair (Tour Road)	870	SQYD	$ 1,305.60	$1,135,872	assumed to be 300' long
301020340	Crushed Aggregate Course (Access Road)	550	CY	$ 18.62	$10,241	in total and 26' wide
401020022	Commercial Mix - PG 64-28 (Access Road)	1070	TON	$ 81.83	$87,558	Consistent 20' width of
207010300	Foundation Material	2590	CY	$ 24.23	$62,756	construction (increased
301020340	Crushed Aggregate Course (New Road)	2590	CY	$ 18.62	$48,226	2' in ave width) for tour
401020022	Commercial Mix - PG 64-28 (New Road)	5060	TON	$ 81.83	$414,060	road and access road.
Lump Sum	New Bridge	16000	SQFT	$ 250.00	$4,000,000	New Road 12' wide, new
Lump Sum	Entrance Station Parking	20	Space	$ 2,000.00	$40,000	bridge 1000' x 16'
Lump Sum	Entrance Fee Booth	1	Each	$ 15,000.00	$15,000	
					$0	
	SUBTOTAL SITE IMPROVEMENTS	**1**	**VALUE**	**$ 6,320,935.90**	**$6,320,936**	

TOTAL COST -	**Option 3 - GMP One-way Loop**	**1**	**VALUE**	**$ 6,377,716.50**	**$6,377,717**	

Table 4-18: Summary of Lifecycle Cost Estimation – Option IV

(Part 1: PROJECT COST SUMMARY)

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Option 4 - ITS/Management Improvements	1	VALUE	$216,597	$216,597
2	Not Used	1	VALUE	$0	$0
3	Not Used	1	VALUE	$0	$0
4	Not Used	1	VALUE	$0	$0
5	Not Used	1	VALUE	$0	$0
6	Not Used	1	VALUE	$0	$0
7	Not Used	1	VALUE	$0	$0
8	Not Used	1	VALUE	$0	$0
9	Not Used	1	VALUE	$0	$0
10	Not Used	1	VALUE	$0	$0
11	Not Used	1	VALUE	$0	$0
12	Not Used	1	VALUE	$0	$0
13	Not Used	1	VALUE	$0	$0
14	Not Used	1	VALUE	$0	$0
15	Not Used	1	VALUE	$0	$0
16	Not Used	1	VALUE	$0	$0
17	Not Used	1	VALUE	$0	$0
18	Not Used	1	VALUE	$0	$0
	Subtotal Direct Construction Costs				**$216,597**
	Value of Government Furnished Property (GFP) Included in Direct Cost (see footnote)*				**$0**
				Direct Cost Subtotal without GFP	**$216,597**
	Published Location Factor	0.00%			$0
	Remoteness Factor	7.00%			$15,162
	Federal Wage Rate Factor	0.00%			$0
	State & Local Taxes (Applied to 50% of Direct Cost)	0.00%			$0
	Design Contingency	30.00%			$64,979
	Total Direct Construction Costs				**$296,738**
	Standard General Conditions	10.00%			$29,674
	Government General Conditions	5.00%			$14,837
	Historic Preservation Factor	2.00%			$5,935
	Subtotal NET Construction Cost				**$347,184**
	Overhead	0.00%			$0
	Profit	0.00%			$0
	Estimated NET Construction Cost				**$347,184**
	Bonds & Permits	2.50%			**$8,680**
	Contracting Method Adjustment	10.00%			$34,718.37
	CM Costs	8.00%			$27,774.69
	Washington Contingency	10.00%			$34,718
	Inflation Escalation	39	Months	5.00%	$77,853
	Total Estimated NET Cost of Construction				**$530,927**

* GFP costs are only used when the Government pre-purchases items, or provides other materials out of Government inventory, to be installed by contractor. Adjustments and Markup on GFP only include Inflation Escalation; No other adjustment factors or O&P markup have been applied.

Table 4-18: Summary of Lifecycle Cost Estimation – Option IV

(Part 2: LINE ITEM COST SUMMARY)

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
SITE PREPARATION						
					$0	
					$0	
					$0	
					$0	
SUBTOTAL SITE PREPARATION		1	VALUE	$ -	$0	

MDT Item Number	Description	Quantity	Unit	Cost/Unit	Total Cost	Remarks
SITE IMPROVEMENTS						2 Permanent ITS Signs on I-90, 1 Permanent ITS Sign at Entrance. Additional Signing of restrictions/information (20 - 9 sf signs)
619010075	Signs-Alum Refl Sheet (I)	180	SQFT	$ 25.54	$4,597	
FHWA RITA database	Large Dynamic Message Sign (Permanent)	2	Each	$ 75,000.00	$150,000	
FHWA RITA database	Medium Dynamic Message Sign (Permanent)	1	Each	$ 45,000.00	$45,000	
619010724	Frang Sign Post BKWY-S5 X 10	20	Each	$ 850.00	$17,000	
					$0	
SUBTOTAL SITE IMPROVEMENTS		1	VALUE	$ 216,597.20	$216,597	

TOTAL COST -	Option 4 - ITS/Management Improvements	1	VALUE	$ 216,597.20	$216,597	

Table 4-19: Summary of Lifecycle Cost Estimation - Option III (Transit Component)

Cost Summary

Which worksheet did you use? Detailed Schedule

Annual O&M costs	**$177,922**
Bus type	Full-size passenger van
Number of buses	5
VMT per fleet	40,424
VHT per fleet	2,784
Driver costs per fleet	$125,280
Fuel cost per mile	$0.43
Fuel costs (per fleet)	$17,324
Maintenance cost per mile	$0.75
Maintenence cost (per fleet)	$30,318
Overhaul mileage trigger	150,000
Engine overhaul cost	$15,000
Transmission overhaul cost	$10,000
Battery replacement (hybrid)	$0
Marketing costs	$5,000
Inflation rate	3.3%

Year one costs	**$255,000**
Purchase cost	$150,000
Startup costs	$15,000
Maintenance facility	$75,000
Fueling station	$0
Bus stops and shelters	$15,000

Costs per year

Year	*O&M*	*Miles per bus*	*Engine overhaul*	*Transmission overhaul*	*Battery replacement*	*Total costs per year*	*Cumulative costs*
Year 1 O&M	*$177,922*	*8,085*				*$177,922*	
Year 1	$432,922	8,085			$0	$432,922	$432,922
Year 2	$183,794	16,169	$0	$0	$0	$183,794	$616,716
Year 3	$189,859	24,254	$0	$0	$0	$189,859	$806,575
Year 4	$196,124	32,339	$0	$0	$0	$196,124	$1,002,699
Year 5	$202,596	40,424	$0	$0	$0	$202,596	$1,205,295
Year 6	$209,282	48,508	$0	$0	$0	$209,282	$1,414,577
Year 7	$216,188	56,593	$0	$0	$0	$216,188	$1,630,765
Year 8	$223,322	64,678	$0	$0	$0	$223,322	$1,854,088
Year 9	$230,692	72,763	$0	$0	$0	$230,692	$2,084,780
Year 10	$238,305	80,847	$0	$0	$0	$238,305	$2,323,085
Year 11	$246,169	88,932	$0	$0	$0	$246,169	$2,569,254
Year 12	$254,293	97,017	$0	$0	$0	$254,293	$2,823,546

Table 4-20: Summary of Lifecycle Cost Estimation – Option V

Cost Summary

Which worksheet did you use? Detailed Schedule

Annual O&M costs	**$40,221**
Bus type	Full-size passenger van
Number of buses	2
VMT per fleet	4,593
VHT per fleet	662
Driver costs per fleet	$29,808
Fuel cost per mile	$0.43
Fuel costs (per fleet)	$1,968
Maintenance cost per mile	$0.75
Maintenence cost (per fleet)	$3,444
Overhaul mileage trigger	150,000
Engine overhaul cost	$15,000
Transmission overhaul cost	$10,000
Battery replacement (hybrid)	$0
Marketing costs	$5,000
Inflation rate	3.3%

Year one costs	**$165,000**
Purchase cost	$60,000
Startup costs	$15,000
Maintenance facility	$75,000
Fueling station	$0
Bus stops and shelters	$15,000

Costs per year

Year	*O&M*	*Miles per bus*	*Engine overhaul*	*Transmission overhaul*	*Battery replacement*	*Total costs per year*	*Cumulative costs*
Year 1 O&M	*$40,221*	*2,296*				*$40,221*	
Year 1	$205,221	2,296			$0	$205,221	$205,221
Year 2	$41,548	4,593	$0	$0	$0	$41,548	$246,769
Year 3	$42,919	6,889	$0	$0	$0	$42,919	$289,688
Year 4	$44,335	9,185	$0	$0	$0	$44,335	$334,023
Year 5	$45,799	11,482	$0	$0	$0	$45,799	$379,822
Year 6	$47,310	13,778	$0	$0	$0	$47,310	$427,132
Year 7	$48,871	16,074	$0	$0	$0	$48,871	$476,003
Year 8	$50,484	18,371	$0	$0	$0	$50,484	$526,487
Year 9	$52,150	20,667	$0	$0	$0	$52,150	$578,637
Year 10	$53,871	22,963	$0	$0	$0	$53,871	$632,507
Year 11	$55,648	25,260	$0	$0	$0	$55,648	$688,156
Year 12	$57,485	27,556	$0	$0	$0	$57,485	$745,641

Table 4-21: Summary of Lifecycle Cost Estimation – Option VI-A

Cost Summary

Which worksheet did you use? Detailed Schedule

Annual O&M costs	**$152,985**
Bus type	Full-size passenger van
Number of buses	5
VMT per fleet	33,926
VHT per fleet	2,400
Driver costs per fleet	$108,000
Fuel cost per mile	$0.43
Fuel costs (per fleet)	$14,540
Maintenance cost per mile	$0.75
Maintenence cost (per fleet)	$25,445
Overhaul mileage trigger	150,000
Engine overhaul cost	$15,000
Transmission overhaul cost	$10,000
Battery replacement (hybrid)	$0
Marketing costs	$5,000
Inflation rate	3.3%

Year one costs	**$255,000**
Purchase cost	$150,000
Startup costs	$15,000
Maintenance facility	$75,000
Fueling station	$0
Bus stops and shelters	$15,000

Costs per year

Year	*O&M*	*Miles per bus*	*Engine overhaul*	*Transmission overhaul*	*Battery replacement*	*Total costs per year*	*Cumulative costs*
Year 1 O&M	*$152,985*	*6,785*				*$152,985*	
Year 1	$407,985	6,785			$0	$407,985	$407,985
Year 2	$158,033	13,571	$0	$0	$0	$158,033	$566,018
Year 3	$163,248	20,356	$0	$0	$0	$163,248	$729,266
Year 4	$168,635	27,141	$0	$0	$0	$168,635	$897,902
Year 5	$174,200	33,926	$0	$0	$0	$174,200	$1,072,102
Year 6	$179,949	40,712	$0	$0	$0	$179,949	$1,252,051
Year 7	$185,887	47,497	$0	$0	$0	$185,887	$1,437,938
Year 8	$192,022	54,282	$0	$0	$0	$192,022	$1,629,960
Year 9	$198,358	61,068	$0	$0	$0	$198,358	$1,828,318
Year 10	$204,904	67,853	$0	$0	$0	$204,904	$2,033,223
Year 11	$211,666	74,638	$0	$0	$0	$211,666	$2,244,889
Year 12	$218,651	81,423	$0	$0	$0	$218,651	$2,463,540

Table 4-22: Summary of Lifecycle Cost Estimation – Option VI-B

Cost Summary

Which worksheet did you use? Detailed Schedule

Annual O&M costs	**$38,913**
Bus type	Full-size passenger van
Number of buses	6
VMT per fleet	7,775
VHT per fleet	550
Driver costs per fleet	$24,750
Fuel cost per mile	$0.43
Fuel costs (per fleet)	$3,332
Maintenance cost per mile	$0.75
Maintenence cost (per fleet)	$5,831
Overhaul mileage trigger	150,000
Engine overhaul cost	$15,000
Transmission overhaul cost	$10,000
Battery replacement (hybrid)	$0
Marketing costs	$5,000
Inflation rate	3.3%

Year one costs	**$210,000**
Purchase cost	$180,000
Startup costs	$15,000
Maintenance facility	$0
Fueling station	$0
Bus stops and shelters	$15,000

Costs per year							
Year	*O&M*	*Miles per bus*	*Engine overhaul*	*Transmission overhaul*	*Battery replacement*	*Total costs per year*	*Cumulative costs*
Year 1 O&M	*$38,913*	*1,296*				*$38,913*	
Year 1	$248,913	1,296			$0	$248,913	$248,913
Year 2	$40,197	2,592	$0	$0	$0	$40,197	$289,110
Year 3	$41,524	3,887	$0	$0	$0	$41,524	$330,634
Year 4	$42,894	5,183	$0	$0	$0	$42,894	$373,528
Year 5	$44,310	6,479	$0	$0	$0	$44,310	$417,838
Year 6	$45,772	7,775	$0	$0	$0	$45,772	$463,610
Year 7	$47,282	9,071	$0	$0	$0	$47,282	$510,892
Year 8	$48,843	10,366	$0	$0	$0	$48,843	$559,735
Year 9	$50,454	11,662	$0	$0	$0	$50,454	$610,189
Year 10	$52,119	12,958	$0	$0	$0	$52,119	$662,308
Year 11	$53,839	14,254	$0	$0	$0	$53,839	$716,148
Year 12	$55,616	15,550	$0	$0	$0	$55,616	$771,764

Table 4-23 presents cost estimation results and scores for all options. The option with the lowest total costs scores 10 while the option with the highest total costs scores zero. Other options were then interpolated to have their scores assigned.

Table 4-23: Summary of Cost Estimations and Scores

Option[1]	I	II	III	IV	V	VI-A	VI-B
Lifecycle Costs[2]	$3,940K-$5,910K	$7,490K-$11,230K	$15,750K-$23,620K	$430K - $640K	$4,540K - $6,810K	$5,910K - $8,870K	$620K - $930K
Score	**7**	**4**	**0**	**10**	**9**	**8**	**10**

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen

(2) The range of costs were estimated to be between -20% and +20% of calculated costs

Revenue

Revenue generated by each option, beyond the current park funding, was considered for the purpose of evaluating options. The following considerations were applied in this evaluation:

1. For construction options which improve the tour road and/or parking, such as Options I and II, the resulting improvements have the potential to attract more paid visitors to the park, and therefore bring in more revenue through sales of entrance tickets/passes. However, the additional revenue cannot be quantified
2. For the transit options and the GMP option which has a transit component, the study team assumed a transportation fee would be added on top of the current entrance fee to fund the transit programs. It should be noted that adding a transportation fee to the entrance fee requires action by Congress
3. The park currently charges an entrance fee of $10 per vehicle or $5 per individual for those who enter the park on foot or riding motorcycles or bicycles into the park. For the transit program to break even by the end of a 12-year lifecycle, i.e., to have revenue (generated from a transportation fee) equal to the transit costs, a transportation fee needs to be added on top of the current entrance fee. The amount of the transportation fee varies among the transportation options which have a transit system

   Table 4-24 illustrates the break-even transportation fee for transit options/component
4. Scores of options should consider the potential sources of additional revenue, potential amount of additional revenue, and the possibility of a transportation fee being approved. If a higher transportation fee is required to fund the transit program, chances are less that the congress would approve such a fee

Table 4-24: Transportation Fee Needed for Lifecycle Break-even

Option[1]	III	V	VI-A	VI-B
Transit Costs[2]	$2,823,500	$745,600	$2,463,500	$771,800
Break-even Transportation Fee per Vehicle[3]	$5.40	$1.50	$4.70	$1.50
Break-even Transportation Fee per Visitor[3]	$2.10	$0.60	$1.80	$0.60
Average Annual Paid Vehicles[4]	43,400	43,400	43,400	43,400
Average Annual Paid Visitors[4]	113,000	113,000	113,000	113,000

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen.

(2) Transit costs are caused directly by a transit system, as summarized in Tables 4-19 to 4-22.

(3) A break-even transportation fee would generate cumulative revenue equal to transit costs by the end of the 12th year. According to NPS Public Use Statistics Office, on average one vehicle entering the park carries 2.6 visitors.

(4) It is assumed that 32% of total visitors would pay the entrance fee plus a transportation fee, which is the same as the current percentage of paid visitors.

Table 4-25 presents scores for all options on revenue, based on the analysis as summarized above.

Table 4-25: Revenue Estimations and Scores

Option[1]	I	II	III	IV	V	VI-A	VI-B
Revenue Score	**3**	**7**	**10**	**0**	**6**	**5**	**8**

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen.

Funding Sources and Cost Sharing

Generally, funding sources for both construction projects and alternative transportation programs are limited at national parks. However, construction projects can be funded as capital improvement program (CIP) funds are allocated at the national and regional level. The 4R project was initially funded before the construction was indefinitely postponed.

For the transit options, funding can potentially be provided by multiple sources. Operating and maintenance costs can be funded at least partially by the transportation fee added on top of the entrance fee. If a break-even amount of transportation fee is approved and most visitors are willing to pay a higher entrance fee than the current price, the total capital, operation, and maintenance costs can be funded by the transportation fee. In other words, the transit options would be financially sustainable.

In addition, corporate sponsorship, such as LL Bean's support of the Island Explorer transit program in Acadia National Park, may provide capital funding for a transit system in the park. Partnership

with communities and agencies such as Montana Department of Transportation, Crow Nation Transit, and Crow Agency may also help identify potential funding sources. In comparison, funding for the construction options and the Management Improvements option is likely to be limited to regular park funding.

When the park contracts with a transportation agency, such as Crow Nation Transit, or a private transit provider to develop and operate a transit program, the partners could share operating and maintenance costs, which would reduce financial risks and potentially reduce total costs for the park.

Option IV – Management Improvements – does not include construction projects, incurs the lowest cost, and is the easiest to implement. Therefore, it is assigned the highest score of 10.

Option I – Repair the Tour Road and Reconfigure Parking – consists of minor construction, has relatively low costs, and does not substantially increase maintenance cost. Funding for this option is relatively easier to obtain than most of the other options and does not require a congressional act. Therefore, it is assigned the second highest score of nine. The GMP option would incur by far the highest capital costs, and it is unlikely to be fully funded in the near future. Therefore it is assigned the lowest score zero. Although the 4R project would incur the second highest construction cost, it would effectively mitigate delayed maintenance of the tour road and parking lots. Since it was initially funded, the 4R project is likely to secure the funding again. Therefore, Option II is assigned a relatively high score of eight. The transit options V, VI-A, and VI-B each consists of a transit system for which it would be relatively difficult to secure initial capital funding. Therefore, the three transit options are assigned relatively low scores.

Table 4-26 presents scores for all options on funding sources and cost sharing, based on the analysis as summarized above. Input from the Evaluation of Options Workshop, held at the park on May 7, 2012, provided the preliminary scores, which were later evaluated and adjusted.

Table 4-26: Scores on Funding Sources and Cost Sharing

Option	I	II	III	IV	V	VI-A	VI-B
Score	9	8	0	10	3	4	5

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen

4.10 DETAILED SCREENING RESULTS

Table 4-27 summarizes the score results from analyzing the transportation options against all detailed screening criteria and presents the overall weighted score of each option. Transit Option VI-A – Seasonal Transit from Offsite Staging/Parking to Reno-Benteen – scores the highest at 6.6, followed by Option II – Widen the Tour Road and Expand Parking (4R Project) – at 6.5. Option III – One-way Tour Loop via I-90 Frontage Road – scores the lowest at 4.2.

Table 4-27: Detailed Screening Results – Score Matrix

Options	I	II	III	IV	V	VI-A	VI-B	Weighting Factor
Vehicle miles traveled (VMT)	5	5	0	5	10	9	6	7%
Vehicle emissions	5	5	0	5	9	10	6	10%
Footprint	8	5	0	10	7	7	8	10%
Delay and congestion	0	7	10	3	5	8	6	7%
Parking availability	0	7	10	4	6	8	5	7%
Safety improvement	0	8	10	5	4	7	6	7%
Convenience and comfort	4	8	10	2	5	6	0	7%
General impacts to park staff/ management	2	10	8	6	4	3	0	5%
Total Cost of Ownership	8	5	0	10	7	6	9	18%
Revenue	3	7	10	0	6	5	8	10%
Funding Sources and Cost Sharing	9	8	0	10	3	4	5	12%
Weighted Score	**4.8**	**6.5**	**4.2**	**6.1**	**6.1**	**6.6**	**6.1**	**100%**

Source: URS Corporation.

Notes: (1) Options I to VI-B: I - Repair the Tour Road and Reconfigure Parking; II - Widen the Tour Road and Expand Parking (4R Project); III - One-Way Loop Tour via the I-90 Frontage Road, Including a Seasonal Transit Service; IV - Management Improvements; V - Seasonal Transit Service from Offsite Staging/Parking to Visitor Center; VI-A - Seasonal Transit Service from Offsite Staging/Parking to Reno-Benteen; VI-B - Peak Days/Special Events Transit Service from Offsite Staging/Parking to Reno-Benteen

4.11 FURTHER CONSIDERATION: FUEL TYPES FOR TRANSIT VEHICLES

This alternative transportation feasibility study considered a range of possible fuel types for use in transit vehicles in the park, including conventional diesel, renewable and non-renewable alternative fuels, hybrid-electric propulsion, and battery electric propulsion. The advantages and disadvantages of the various fuels are briefly highlighted in Table 4-28.

Table 4-28: Fuel Types

Fuel	Advantages	Disadvantages
Diesel	▪ Readily available ▪ Industry standard for transit vehicles ▪ Diesel engines are efficient; they operate at high compression ratios and convert a large percentage of the fuel's available energy into usable work	▪ Air pollution ▪ Prices are affected by unpredictable forces in worldwide energy markets
Biodiesel	▪ Domestically and organically produced from renewable or recycled resources ▪ Biodegradable, nontoxic, and essentially free of sulfur and aromatics ▪ Produces less particulate, smoke, hydrocarbons, and carbon monoxide emissions than conventional petrodiesel ▪ Only alternative fuel to have fully completed the health effects testing requirements under the Clean Air Act ▪ Can be used without modifying existing diesel vehicles and produces similar engine performance ▪ Can use the standard storage and handling procedures already in place for petrodiesel	▪ Historically, has been more expensive than petrodiesel ▪ Nearest distributor is at the northeast entrance to Yellowstone National Park, 131 miles away
Ethanol	▪ Domestically and organically produced ▪ Nontoxic, water soluble, and biodegradable ▪ E85 (85% ethanol blended with 15% gasoline) is appropriate for light-duty vehicles; E95 (95% ethanol blended with 5 percent diesel) can be used as a replacement for diesel fuel ▪ High octane rating, results in increased engine efficiency and performance ▪ Substantially lower tailpipe emissions, burns cleaner, and produces less carbon dioxide	▪ Lower energy content than gasoline – about a third more ethanol is required to travel the same distance as on gasoline ▪ Requires certain engine adjustments or a fuel flexible vehicle (FFV) ▪ E85 has historically had comparable costs to gasoline as a result of government subsidies ▪ E95 has historically been more expensive than petrodiesel ▪ According to e85refueling.com, one distributor of E85 is located in Sheridan, WY, about 65 miles from Little Bighorn Battlefield NM; no E95 distributors were readily identified
Natural Gas	▪ Generally emits fewer overall regulated emissions than their diesel or gasoline counterparts, particularly with respect to particulate matter ▪ CNG is primarily used in light- and medium-duty vehicles as an alternative to	▪ A non-renewable fuel source, made from a mixture of hydrocarbons (mainly methane) extracted from underground reserves ▪ Requires vehicle conversion; CNG buses cost about $25,000 to $50,000 more than a conventional diesel bus

Fuel	Advantages	Disadvantages
	gasoline; LNG is primarily used as an alternative to diesel to operate heavy-duty vehicles ▪ Historically costs substantially less than gasoline or diesel per gallon equivalent; At 25 cents per gallon savings, the typical CNG bus could pay for itself in just a little more than 3 years	▪ Although there are many refueling stations throughout the country, they are mostly built for and used by individual vehicle fleets; new natural gas vehicle fleets can install their own refueling station or explore the possibility of sharing an existing facility ▪ According to a U.S. Department of Energy database, there is a CNG distributor in Billings, MT, about 52 miles from Little Bighorn Battlefield NM
Propane/Liquefied Petroleum Gas (LPG)	▪ Emissions of hydrocarbons, carbon monoxide, and nitrogen oxide are well within EPA standards, and may offer some improvements over conventional fuels ▪ A special blend of propane, HD-5, has been developed for vehicular use which has a higher octane rating than gasoline ▪ Cost has historically been substantially less expensive than gasoline and diesel per gallon equivalents	▪ A non-renewable fuel source which primarily consists of propane and butane and is produced as part of natural gas processing and crude oil refining ▪ HD-5 has less energy content, getting about 12-15% fewer miles per gallon ▪ Requires vehicle conversion ▪ The majority of propane providers are retail operations who supply propane for a variety of purposes; most fleet users install their own infrastructure (storage tanks, meters, and dispensers) and propane is then delivered to these facilities by truck
Methanol	▪ M85 (85% methanol and 15% gasoline) is primarily used as an alternative fuel in light-duty vehicles; M100 (pure methanol) works best in heavy-duty vehicles	▪ A fuel source made from non-renewable natural gas or coal (although it can also be derived from renewable resources containing carbon) ▪ As a volatile organic compound (VOC), methanol can contribute to the formation of photochemical smog ▪ Because of the lower energy content, vehicles will have a reduced range compared to conventional fuel ▪ Fueling infrastructure is primarily limited to private facilities supporting individual fleets ▪ Price is subject to volatility based on the fluctuation in demand for its other uses ▪
Hybrid Electric	▪ Propulsion system combines on-board electric storage with a power unit that may be fueled from any of the conventional or alternative fuels ▪ Improved vehicle performance and reduced fuel consumption and emissions without compromising the range of the vehicle ▪ Reduction in fuel consumption results in cost savings	▪ Maintenance personnel and drivers will require proper training for safety and optimal vehicle operation ▪ Required infrastructure potentially includes battery charging infrastructure and access to a refueling station ▪ The cost of a hybrid vehicle is generally more expensive than a conventional vehicle
Battery Electric	▪ Does not use a fuel source, instead relying on stored energy to power the vehicle. ▪ Zero tailpipe emissions (emissions	▪ Substantially smaller driving range than conventional vehicles ▪ Can be substantially more expensive than conventional vehicles

Fuel	Advantages	Disadvantages
	associated with powering the vehicle are displaced to the power plant) ▪ Daily cost of operating an electric vehicle is based on the cost of electricity	▪ Maintenance personnel and drivers will require proper training for safety and optimal vehicle operation
Hydrogen	▪ Can be derived from renewable or non-renewable sources (water, biomass, renewable fuels, fossil fuels, and any other material rich in hydrogen) ▪ If hydrogen is stored on board in a fuel cell, then the only measurable emission is water vapor; if burned in an internal combustion engine, then small amounts of NOx and other products may be emitted	▪ Use is currently limited to experimental or prototype vehicles, either in fuel cell applications or modified internal combustion engines ▪ Has a lower energy density than natural gas and conventional fuels, requiring larger fuel storage capacities in vehicles, which adds weight or reduces cargo or passenger capacity ▪ Current high cost associated with producing hydrogen ▪ Current lack of a national infrastructure

Sources:

Federal Transit Administration, Transportation Planning Process for Transit in Federal Land Management Areas, Volume III: Methods to Define the Transit Need, April 2008.

Clean Air Trust, http://www.cleanairtrust.org.

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

Growth Energy, E85 & Flex Fuel Station Finder, http://www.e85fuel.com.

U.S. Environmental Protection Agency, http://www.epa.gov/chemfact/s_methan.txt.

U.S. Department of Energy, Clean Cities Fact Sheet, "Natural Gas Buses: Separating Myth from Fact," May 2000, http://www.kaapeli.fi/~tep/projektit/liikenteen_biopolttoaineet/CNGbuses_MythvsFact.pdf.

An important consideration when evaluating alternative fuels is proximity to a fuel source or distributor and the cost of supplying fuel to the fleet of transit vehicles. Given the location of Little Bighorn Battlefield National Monument, far from a major metropolitan area, there are fewer practical options for supplying alternative fuels to a possible transit fleet. The park's proximity to various fuel suppliers is summarized in Table 4-29. In some cases, such as biodiesel and ethanol, the nearest supplier is more than 100 miles away, a distance that presents potential logistical and cost challenges.

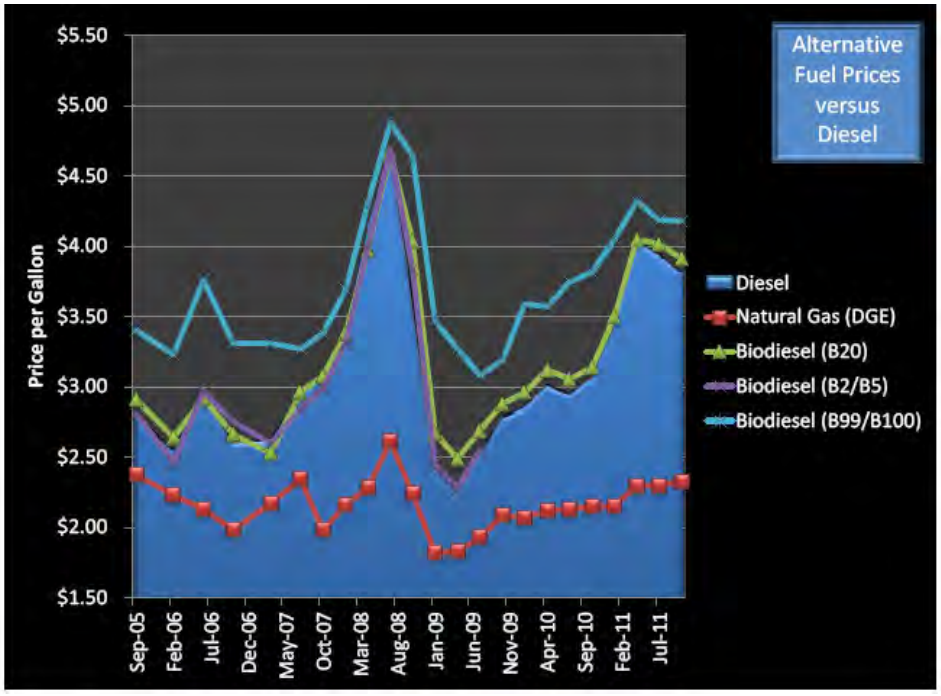
Table 4-29: Distances to Alternative Fuel Distributors

Fuel	Distance	Distributor
Propane/Liquefied Petroleum Gas (LPG)	51.2 Miles	U-Haul 1145 Main St Billings MT 59105 Phone: 406-248-7162 Access: Public
Compressed Natural Gas (CNG)	51.8 Miles	Montana-Dakota Utilities Co 408 N 18th St Billings MT 59101 Phone: 701-224-5807 Access: Public- card key at all times
Ethanol (E85)	65 Miles	Farmers Co-op Oil 117 North Scott Sheridan, WY 82801 Phone: 877-660-3050 Full Service Hours: M-F 7-6, Sat. 8-12
Biodiesel (B20 and above)	131 Miles	Yellowstone National Park - Northeast Entrance Yellowstone National Park MT 82190 Access: Private access only
Ethanol (E85)	164.2 Miles	Yellowstone National Park - Mammoth Hot Springs Park headquarters Yellowstone National Park WY 82190 Access: Private access only

Sources:
U.S. Department of Energy, Alternative Fuels & Advanced Vehicles Data Center, http://www.afdc.energy.gov/afdc/locator/stations.
Growth Energy, E85 & Flex Fuel Station Finder, http://www.e85fuel.com.

If a transit option is chosen for the park and an alternative fuel is used to run the transit fleet, it is likely that new local fueling infrastructure will be required to support the fleet. Depending on the fuel selected, the initial capital cost of the fueling infrastructure can be offset by the savings realized by using a lower-cost fuel. For example, the U.S. Department of Energy's October 2011 Alternative Fuel Price Report showed a considerable price differential between various fuels. According to the report, CNG had a lower price than diesel for all regions of the country, with the largest difference ($2.19 per diesel gallon equivalent) being in the Rocky Mountain region. As illustrated in the following graph from the report, the prices of other alternative fuels were found to be closer to, or slightly higher than, conventional diesel.

Figure 4-13: Alternative Fuel Prices versus Diesel (National Average)



U.S. Department of Energy, Clean Cities Alternative Fuel Price Report, October 2011, http://www.afdc.energy.gov/afdc/price_report.html

Given the large fuel price differential between natural gas and conventional diesel, many transit providers in the U.S. have converted their vehicles to run on CNG, and natural gas buses represent a significant and growing percentage of new bus orders. However, these buses are most often part of a large fleet. A recent analysis for the National Renewable Energy Laboratory concluded that the profitability of small transit fleets running on CNG tends to be marginal and drops precipitously if the number of transit vehicles drops below 30.[21] Although CNG has many attractive benefits – long-term cost-effectiveness, more-consistent operational costs, increased energy security, reduced greenhouse gas emissions, reduced local air pollution, and reduced noise pollution – it requires careful analysis and detailed scoping of numerous aspects of the fleet and refueling station in order to determine whether a potential transit project such as Little Bighorn Battlefield National Monument would be more cost-effective than conventional diesel.

21. Johnson, Caley. "Business Case for Compressed Natural Gas in Municipal Fleets" National Renewable Energy Laboratory, NREL/TP-7A2-47919, June 2010: http://www.afdc.energy.gov/afdc/pdfs/47919.pdf

5. SUMMARY OF STUDY RESULTS

Results from this alternative transportation feasibility study are summarized below.

1. The initial set of 13 transportation options encompasses a broad range of alternative transportation improvement measures, including roadway improvements, parking reconfiguration/ expansion, intelligent transportation system (ITS) tools, travel demand management (TDM), transit programs, and other alternative transportation improvements.
2. The initial screening of the 13 options, using a set of criteria derived from established goals and objectives for this study, eliminated eight of them from further consideration and carried the other five to the next step of the study for further refinement, development, and detailed evaluation.
3. The refined transportation options (following initial screening) include three construction options, one no-build option focused on management improvements, and three transit options, which were variations of a Voluntary Transit option analyzed in initial screening.
4. The detailed screening resulted in the seven options being ranked on a scale of zero to 10, using a set of weighted criteria.
5. Transit option VI-A – Seasonal Transit from Offsite Staging/Parking to Reno-Benteen – scored the highest among all seven transportation options. This option is more likely to meet the goals and objectives and help fulfill park mission.
6. Option II – Widening Tour Road and Expanding Parking – scores the second highest and closely behind Option VI-A. This option is promising in mitigating traffic congestion, roadway safety, and parking shortage issues in both short- and long-term.
7. Option IV – Management Improvements, Option V – Seasonal Transit from Offsite Staging/Parking to Visitor Center, and Option VI-B – Peak Days Transit from Offsite Staging/Parking to Reno-Benteen score the same as the third highest.

   Option IV offers many benefits, such as low costs, ease of implementation, effectiveness in enhancing visitor experience in the short term, and low impacts; however, it is not expected to provide substantial relief to parking shortage and road congestion issues, particularly in the long term. Considerations should be given to implement this option as a short-term solution, or as the first phase for other more comprehensive and higher cost options.

   Option V would be attractive to visitors who only intend to visit the Custer Battlefield Unit and account for approximately 45-50% of all existing visitors. It could effectively mitigate parking shortage in the visitor center area.

   Option VI-B can be implemented as a three- to five-year pilot program, or as the first phase of a more comprehensive transit program, such as Option VI-A. It could also serve as a special events management strategy for other options that do not have a transit program, such as Option I and II.
8. Although Option I – Repairing Tour Road and Parking Reconfiguration – scores relatively low, it could serve as an essential component for other options to function well, including Options III, V, and VI-A.
9. Although Option III (the GMP option) scores the lowest among the seven options, it does offer long-term solutions to transportation problems in the park and remains the long-term plan. The National Park Service will continue to work on securing funding to implement the GMP at the park.

Agency Statement

Document Number: 381/100910

As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environment and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.